|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | Engineering Specification | | | | | | | | |
| PART NAME | | | | | | | | PART NUMBER | | | | | |
| Blind Spot Monitoring System and Cross Traffic Alert Functional Specification | | | | | | | | **BLIS CTA DAT2p1 FS AA** | | | | | |
|  | | LET | | FR | REVISIONS | | | | DR | CK | REFERENCE: | | |
| AA | |  | |  | Initial Revision for DAT2.1 based on P702 Spec | | | |  |  | Updated from ML3T-14C689-AD Rev3 | | |
|  | |  |  |  | PREPARED/APPROVED BY | | |
|  | |  |  |  | KSNARSKI, ENASSER1, MCROSB12 | | |
|  | |  |  | | | |  |  | CHECKED BY | | DETAILED BY |
|  | |  |  | | | |  |  | BLIS FMC D&R Team | |  |
|  | |  |  | | | |  |  | CONCURRENCE/APPROVAL | | |
|  | |  | |  |  | | | |  |  | SIGNATURES | | |
|  | |  |  | | | |  |  | Design Engineering Supervisor | | |
|  | |  |  | | | |  |  | Eddie Abinoja | | |
|  | | | |  |  | Design Engineering Management | | |
|  | |  | |  |  | | | |  |  | Steve Schondorf | | |
|  | |  | |  |  | | | |  |  | Manufacturing Engrg. | | |
|  | |  | |  |  | | | |  |  |  | | |
|  | |  | |  |  | | | |  |  | Quality Control | | |
|  | |  | |  |  | | | |  |  |  | | |
|  | |  | |  |  | | | |  |  | Purchasing | | |
|  | |  | |  |  | | | |  |  | Veloris Alexander | | |
|  | |  | |  |  | | | |  |  | Supplier Quality Assistance | | |
|  | |  | |  |  | | | |  |  |  | | |
|  | |  | |  |  | | | |  |  |  | | |
|  | |  | |  |  | | | |  |  |  | | |
|  | |  | |  |  | | | |  |  |  | | |
| FRAME |  | | | OF | |  | REV | | Date: | | | | |

Ford Motor Company

Global DAT2.1 Side Feature

Specification

* Blind Spot Information System (BLIS)
* BLIS for Trailer Tow (BTT)
* (Rear) Cross Traffic Alert (CTA)
* Rear Cross Traffic Braking (RCTB)

Date: 24Sep2020

BLIS CTA DAT2p1 FS AA

Retain record copy in accordance with CRM Schedule 27.01: V + 10 Years

**Ford Motor Company Confidential and Proprietary**

Disclosure of the information contained in any portion of this document is not permitted without expressed written consent of a duly authorized representative of Ford Motor Company, Dearborn, Michigan, USA

Contents

[1 Document Overview 6](#_Toc51844677)

[1.1 Purpose & Scope 6](#_Toc51844678)

[1.2 Related Documents 7](#_Toc51844679)

[1.2.1 Related Documents Table 7](#_Toc51844680)

[1.3 PDL Impacts and Vehicle Requirements 8](#_Toc51844681)

[1.4 MFALs 11](#_Toc51844682)

[1.5 Document Conventions 13](#_Toc51844683)

[2 Feature Descriptions 14](#_Toc51844684)

[2.1.1 BLIS Feature Description 14](#_Toc51844685)

[2.1.2 CTA Feature Description 16](#_Toc51844686)

[2.1.3 BLIS with Trailer Tow (BTT) Feature Description 16](#_Toc51844687)

[2.1.4 Rear Cross Traffic Braking Feature Description 17](#_Toc51844688)

[2.1.5 RESERVED 18](#_Toc51844689)

[2.1.6 RESERVED 18](#_Toc51844690)

[2.1.7 Feature Terminology 18](#_Toc51844691)

[2.2 System Overview 20](#_Toc51844692)

[2.2.1 Major System Components 20](#_Toc51844693)

[2.2.2 RESERVED 21](#_Toc51844694)

[2.2.3 MS CAN Signal Summary 21](#_Toc51844695)

[2.3 BLIS CTA HMI Requirements 21](#_Toc51844696)

[2.3.1 System Indication 21](#_Toc51844697)

[2.3.2 Display Location 21](#_Toc51844698)

[2.3.3 Display 21](#_Toc51844699)

[2.3.4 RESERVED 22](#_Toc51844700)

[2.3.5 BLIS CTA Auxiliary Displays 22](#_Toc51844701)

[2.4 Software Classification Level 22](#_Toc51844702)

[3 SIDE RADAR SYSTEM VEHICLE CONFIGURATION and INTERFACE 22](#_Toc51844703)

[3.1 M2 M3 Vehicle configuration 22](#_Toc51844704)

[3.2 Calibration Parameters 24](#_Toc51844705)

[3.2.1 Global Parameter File 24](#_Toc51844706)

[3.2.2 Configuration for Global Region 25](#_Toc51844707)

[3.2.3 Configuration LH/RH Drive and HMI 25](#_Toc51844708)

[3.2.4 Configuration BLIS and CTA 26](#_Toc51844709)

[3.2.5 RESERVE 26](#_Toc51844710)

[3.2.6 Configuration Transmission 26](#_Toc51844711)

[3.2.7 Configuration Trailer Tow Module 27](#_Toc51844712)

[3.2.8 Configuration AutoPark (AP) Feature Configuration 27](#_Toc51844713)

[3.2.9 Reserved 27](#_Toc51844714)

[3.2.10 Configuration SWS (Turn\_Signal) 28](#_Toc51844715)

[3.2.11 Configuration BTT 28](#_Toc51844716)

[3.2.12 Configuration RCTB 28](#_Toc51844717)

[3.2.13 Reserved 29](#_Toc51844718)

[3.2.14 Reserved 30](#_Toc51844719)

[3.2.15 Module Configuration Enable\_Disable Plausability Check Handling 30](#_Toc51844720)

[3.3 Side Feature operation with engine Start/Stop 30](#_Toc51844721)

[3.4 Side Feature Power Up, Initialization, Modes of Operation 31](#_Toc51844722)

[3.4.1 Side Feature Initialization 31](#_Toc51844723)

[3.4.2 Side Features Modes of Operation 40](#_Toc51844724)

[3.5 Side Features Enable/Disable and On/Off Interface 41](#_Toc51844725)

[3.5.1 Enable/Disable Feature Dependencies 42](#_Toc51844726)

[3.5.2 Feature Cluster Interface 43](#_Toc51844727)

[3.5.3 Base Feature On/Off 44](#_Toc51844728)

[3.5.4 BTT Feature On/Off 45](#_Toc51844729)

[3.5.5 RESERVE 47](#_Toc51844730)

[3.5.6 Rear Cross Traffic Braking RCTB/RBA Feature On/Off 47](#_Toc51844731)

[3.5.7 Reserved 48](#_Toc51844732)

[3.6 RESERVED 48](#_Toc51844733)

[3.7 Side Features INPUT / OUTPUT PROCESSING 48](#_Toc51844734)

[3.7.1 Vehicle Network Input Processing 48](#_Toc51844735)

[3.7.2 BLIS CTA Arbitration Model 81](#_Toc51844736)

[3.7.3 SOD Generated CAN Signal Setups 83](#_Toc51844737)

[3.7.4 BLIS/CTA CAN Signal Setup for AutoPark 84](#_Toc51844738)

[3.7.5 ~~SOD Anti-Theft~~ - Reserved 84](#_Toc51844739)

[3.7.6 BLIS System Alert Reporting 85](#_Toc51844740)

[3.7.7 CTA System Alert Reporting 87](#_Toc51844741)

[3.7.8 BLIS/CTA ON/OFF Flash Processing 87](#_Toc51844742)

[3.7.9 RESERVED 88](#_Toc51844743)

[3.7.10 Fault Processing 88](#_Toc51844744)

[3.7.11 RCTB Behavior 98](#_Toc51844745)

[3.7.12 RESERVE ~~BLIS and LCWA LED Arbitration~~ 103](#_Toc51844746)

[4 Side Feature Performance Requirements 104](#_Toc51844747)

[4.1 Platform Flexibility 104](#_Toc51844748)

[4.2 Performance to ISO Standard NP17387 104](#_Toc51844749)

[4.3 FMC BLIS Performance Requirements (Not Contained In ISO NP17387) 108](#_Toc51844750)

[4.3.1 BLIS – Vehicle Speed 108](#_Toc51844751)

[4.3.2 BLIS – False Alarm Rate and Missed Target Rate 110](#_Toc51844752)

[4.3.3 BLIS Target Tracking with/without BTT 111](#_Toc51844753)

[4.3.4 BTT Performance Requirements 112](#_Toc51844754)

[4.4 SOD Feature Environmental Performance 117](#_Toc51844755)

[4.4.1 Side Radar Sensor Blockage Response 117](#_Toc51844756)

[4.4.2 Performance in Various Environmental Conditions 119](#_Toc51844757)

[4.5 CTA Functional Performance 120](#_Toc51844758)

[4.6 RCTB Functional Performance 125](#_Toc51844759)

[4.6.1 RCTB Real World Usage Profile (RWUP) and Backing Rate 127](#_Toc51844760)

[4.7 CTA and RCTB Parallel Parking Performance with moving targets 132](#_Toc51844761)

[**4.7.1 Defining real world usage profile for parallel parking** 132](#_Toc51844762)

[**4.7.2 CTA False Alert Rate (FAR) for Parallel Parking for moving targets** 132](#_Toc51844763)

[4.8 RESERVE 133](#_Toc51844764)

[4.9 RESERVE 133](#_Toc51844765)

[4.10 RESERVED Functional Performance 133](#_Toc51844766)

[4.11 RESERVED Functional Performance 133](#_Toc51844767)

[4.12 Governmental Restrictions and Regulations 133](#_Toc51844768)

[5 Outside Rearview Mirror (OSRVM) / Alert Indicator Requirements 134](#_Toc51844769)

[5.1 Display Location 134](#_Toc51844770)

[5.2 Display 134](#_Toc51844771)

[5.2.1 Alert Indicator Electrical Requirements 134](#_Toc51844772)

[6 RESERVE 135](#_Toc51844773)

[7 BLIS CTA BTT - instrument cluster interface or APIM 136](#_Toc51844774)

[**7.1** **Side Feature and CLUSTER CAN Signals** 137](#_Toc51844775)

[**7.2** **Vehicle Ignition States and Right/Left Signal Filtering** 140](#_Toc51844776)

[**7.3** **CLUSTER ON / OFF / DISABLE INTERFACE** 142](#_Toc51844777)

[**7.3.1** **POWER UP and INITIALIZATION** 142](#_Toc51844778)

[**7.3.2** **DISABLE/ENABLE and ON/OFF OPERATION OF BLIS, CTA, and BTT** 143](#_Toc51844779)

[**7.4** **CLUSTER CTA CHIME ALERT** 145](#_Toc51844780)

[**7.5** **BTT Cluster Feature Operation** 148](#_Toc51844781)

[**7.6** **BLIS, CTA, and BTT MESSAGE CENTER MESSAGES** 149](#_Toc51844782)

[**7.7** **CLUSTER BLIS and CTA FAULT STRATAGY** 153](#_Toc51844783)

[8 BLIS/CTA Door Module Interface 154](#_Toc51844784)

[8.1 LH / RH DRIVE CONFIGURATION 154](#_Toc51844785)

[8.2 BLIS – DCU LED ON/OFF COMMUNICATION 154](#_Toc51844786)

[8.3 CAN SIGNAL TIMING and FAULT PROCESSING 156](#_Toc51844787)

[9 RESERVE 160](#_Toc51844788)

[10 RESERVE 160](#_Toc51844789)

[11 Diagnostics 160](#_Toc51844790)

[12 Configurable GLOBAL Parameters 160](#_Toc51844791)

[13 Requirements/Specification Traceability 160](#_Toc51844792)

[13.1 Functional Specification SDS Traceability 160](#_Toc51844793)

[13.2 Functional Specification Requirements Traceability 160](#_Toc51844794)

[14 Appendix A: Revision History/Change Log 162](#_Toc51844795)

[15 APPENDIX B: Methodology & Data Flow Diagrams 162](#_Toc51844796)

[15.1 Requirements Representations 163](#_Toc51844797)

[15.2 State Transition Table/Diagram Notation 163](#_Toc51844798)

[15.3 Assumed Interface to NVRAM Manager 165](#_Toc51844799)

[16 APPENDIX C: Data Dictionary 166](#_Toc51844800)

[16.1 Data Dictionary: SOD Internal Signals (“isig\_”) 166](#_Toc51844801)

[16.2 Data Dictionary: CAN Signals Sent by SOD features (ADAS ECU) 168](#_Toc51844802)

[16.3 Data Dictionary: CAN Signals Received by SOD features (ADAS ECU) 169](#_Toc51844803)

# Document Overview

## Purpose & Scope

The requirements detailed in this functional specification meet the applicable SDS requirements as stated in the SOW. Section 13 discusses the requirements compliance traceability from for this FS.

This specification defines the 2022MY DAT2.1 global functional requirements for the rear radar features listed below. These features use the LH and RH rear side radar sensors, previously referred to as SOD sensors.

Blind Spot Information System (BLIS)

Cross Traffic Alert system (CTA)

BLIS with Trailer Tow (BTT)

Rear Cross Traffic Braking (RCTB)

BLIS for 5th Wheel and Gooseneck (BTT5G)

Global specifications mean that FNA (Ford North America), FOE (Ford of Europe), APA (Ford Asia Pacific) and FSA (Ford South America) shall use one software package with minimal differences. Any differences must be approved by FMC management and implemented via programmable parameter.

The 2021MY FS-ML3T-14C689-AE was used as a base for this 21MY FS.

Note that Ford Netcom uses the acronym SOD for BLIS CAN signal prefixes. However, within this document SOD (Side Obtacle Detect) aslo refers to BLIS and CTA.

This document will be reviewed for record retention disposal in 2028

Conflict of Documentation

If you find a conflict in documentation contact the FS authors.

## Related Documents

Additional documents that are part of this FS are listed within this section.

### Related Documents Table

SDS/ARL and OTHER documents are available upon request if unattainable by supplier. SOW documents are found in the Statement of Work package. Supplemental Requirements Documents are part of this Functional Specification. Supplemental Requirements Document file name will end in a suffix Ax which is the revision level of this FS. Items in bold are directly related to the system design.

|  |  |
| --- | --- |
| R: 1.2.1.1 | The supplier shall meet the specifications listed in the table below. |

Table 1.2.1-1: Applicable Specifications

| **Item** | **Title** | **Control Number** |
| --- | --- | --- |
| **FS Supplemental Requirement Documents** | | |
| 1 | Global Parameter Specification BLIS CTA RCTB M2 M3 Parameters DAT2p1 Ax | AA |
| 2 | **BLIS CTA BTT RCTB Block Diagram DAT2** | Sep 2020 |
| 3 | **Cluster BLIS CTA Interface truth table\_2020MY Rev1** | 2020MY Rev. 1 |
| 4 | **Specification BLIS CTA RCTB Section 11 Diagnostics Ax** | AA |
| 5 | **Side Feature Mode Chart DAT2\_1** | **Rev1 17Apr20** |
| 6 | **SDS\_Summary\_Ax** | 2015cy eSOW agreement |
| 7 | **DAT\_BLIS\_CTA\_Master\_ARL** | Rev.6\_23June2017 |
| 8 | **FunctionSpecification\_BTT5G\_Vxx** | Rev 6 |

## PDL Impacts and Vehicle Requirements

Table 1.3-1 below lists the Product Direction Letter (PDL) entries and considerations that need to be made for inclusion of the BLIS and CTA feature.

Table 1.3-1 : PDL Entries by CPSC for BLIS and CTA

|  |  |  |  |
| --- | --- | --- | --- |
| **CPSC** | **Features and Options / Word Assumptions** | **Text** | **Comment** |
| 13.01.01 | Cluster | Cluster / Message Center w/ BLIS and CTA software | CTA add |
| 01.19.02 / 01.01.04 | Packaging space and attachment points | Rear Plastic Fascia / Sheet Metal | Including stone shielding |
|  | Nonmetallic paints | Metallic Paints |  |
|  | BLIS CTA CGEA MS\_CAN signals | Network Impact | Netcom refers to the system as SOD |
| 01.09.02 | BSMS Mirrors | OSRVM |  |
| 18.00.00 | BSMS connectors LH/RH | Harness Impact |  |
| 17.04.07 | Sensor required | Ambient Light Sensor/Autolamps |  |
| 14.02.01 | Central Load Dump Required | Alternator |  |
| N/A | CTA requires chime generator and speaker for audible alert | Cluster – Audio w/ CTA chime software | 2010 MYs used RPA |
| (optional) | TBM with 7-pin trailer connector. | Trailer Brake Module is necessary for max BTT performance | When BTT is packaged w/ 7 pin trlr connector |
| (optional) | TLM with 4-pin trailer connector. | Trailer Lighting Module is necessary for max BTT performance | When BTT is packaged w/ 4 pin trlr connector |
| 11.02.06 | Steering Wheel Angle | For Vehicle Turn radius calculation | From PSCM or ABS | |
| 06.09.01 | Yaw Rate sensor | For Vehicle Turn radius calculation |  | |
|  | Wheel Rotation Front Right sensor | For Vehicle Turn radius calculation | WhlRotatFr\_No\_Cnt | |

Table 1.3-2 below lists the Product Direction Letter (PDL) entries and considerations in addition to Table 1.2-1 that need to be added for BTT. Note that TLM is no longer optional.

Table 1.3‑2a : PDL Entries by CPSC for BTT

|  |  |  |  |
| --- | --- | --- | --- |
| **CPSC** | **Features and Options / Word Assumptions** | **Text** | **Comment** |
| 13.01.01 | Cluster or SYNC4.x | Cluster / SYNC4.x w/ BLIS with Trailer Tow (4.2inch min display) | BTT added |
|  | BTT CGEA MS\_CAN signals | Network Impact | Netcom refers to the system as SOD |
| Required for 4 and 7-pin connector vehicles | TBM with 7-pin trailer connector. | Trailer Brake Module is necessary for BTT performance | When BTT is packaged w/ 7 pin trlr connector |
| 11.02.06 | Steering Wheel Angle | For Vehicle Turn radius calculation | From PSCM or ABS | |
| 06.09.01 | Yaw Rate sensor | For Vehicle Turn radius calculation |  | |
|  | Wheel Rotation Front Right sensor | For Vehicle Turn radius calculation | WhlRotatFr\_No\_Cnt | |
| Required for 4-pin connector only vehicles | TLM with 4-pin trailer connector. | Trailer Lighting Module is necessary for BTT performance | When BTT is packaged w/ 4 pin trlr connector |

Table 1.3‑2b : PDL Entries by CPSC for BTT5G

|  |  |  |  |
| --- | --- | --- | --- |
| **CPSC** | **Features and Options / Word Assumptions** | **Text** | **Comment** |
| 13.01.01 | Cluster and SYNC4.x | Cluster / SYNC4.x w/ BLIS with Trailer Tow and BTT5G | BTT and BTT5G added |
|  | BTT FNV3 CAN signals | Network Impact | Netcom refers to the system as SOD |
|  | BTT5G FNV3 CAN signals | Network Impact |  |
| Required 7/12-pin connectors vehicles | ITRM with 7/12-pin trailer connector. | Trailer Module is necessary for BTT5G performance |  |
| 11.02.06 | Steering Wheel Angle | For Vehicle Turn radius calculation | From PSCM or ABS | |
| 06.09.01 | Yaw Rate sensor | For Vehicle Turn radius calculation |  | |
|  | Wheel Rotation Front Right sensor | For Vehicle Turn radius calculation | WhlRotatFr\_No\_Cnt | |
|  | Aftermarket Radars | Customer installed radars on 5th wheel or gooseneck trailer |  | |
|  | Trailer TPMS module (TTPMS) | Customer installed tire pressure module on trailer | MS2 CAN termination node | |
| 19.04.02 | BTT | BLIS with Trailer Tow | Required for BTT5G function | |

Table 1.3-3 must include base PDL requirements from Table 1.3-1.

Table 1.3‑3 : PDL Entries by CPSC for Boundary Alert

|  |  |  |  |
| --- | --- | --- | --- |
| **CPSC** | **Features and Options / Word Assumptions** | **Text** | **Comment** |
|  |  |  |  |
| Police Units Only |  |  |  |
| 13.01.01 | Cluster | Only clusters versions that support BA feature. | Boundary Alert Menus and Radar Map added. BA Chime added. |
| 01.19.02 / 01.01.04 | Packaging space and attachment points | Rear Plastic Fascia / Sheet Metal | Same requirements as BLIS/CTA |
|  | Nonmetallic paints | Metallic Paints avoid. Must be tested and approved. | Same as BLIS/CTA |
|  | BLIS CTA CGEA MS\_CAN signals | Network Impact.  New messages developed. Boundary Alert Left/Right (Balrr) (Balrl) | Netcom refers to the system as SOD |
|  | BCM Body Control Module | Software support for Boundary Alert. Door lock control |  |
|  | DCU Door Control Units (DDM/PDM) | Software support for Boundary Alert. Window control. |  |
|  | APIM or any other unit that acts as the Rear Video Dispay RVD | Software support for Boundary Alert. Rear camera display. |  |

Table 1.3-4 must include base PDL requirements from Table 1.3-1.

Table 1.3‑4 : PDL Entries by CPSC for RSTB / RBA

|  |  |  |  |
| --- | --- | --- | --- |
| **CPSC** | **Features and Options / Word Assumptions** | **Text** | **Comment** |
| 06.09.01 | ABS | Provideds the braking for the feature. |  |
|  | RCTB CGEA MS\_CAN signals | Network Impact | Netcom refers to the system as SOD |
| 13.13.05 | IPMB or PAM module | Master of RBA (Camera). Controls HMI settings and warnings with the Insturment Cluster. | Note that SOD will not allow RBA unless CTA is present and enabled. |
| 11.02.06 | Electronic power steering module | Provides Steering Angle Sensor signals |  |
| 06.09.01 | Bi-directional wheel speed sensors | Needed to detect that the host is actually reversing. |  |
| 11.02.06 | Steering Wheel Angle | For Vehicle Turn radius calculation | From PSCM or ABS |
| 06.09.01 | Yaw Rate sensor | For Vehicle Turn radius calculation |  |
|  | Wheel Rotation Front Right sensor | For Vehicle Turn radius calculation | WhlRotatFr\_No\_Cnt |

## MFALs

The following table describes the manufacturing feature codes associated with side radar features. Individual MFAL notes have been added (29Apr2019).

|  |  |
| --- | --- |
| **MFAL** | **Description** |
| **HLLAA** | **Less** **BLIS** |
| **HLLAC** | **BLIS**  (note - Should only be used for BLIS LESS CTA. This was our original MFAL for BLIS (which included CTA) but then FOC came along and launched a BLIS LESS CTA program; this caused HLLAD to be generated.) |
| **HLLAD** | BLIS 2 (**BLIS+CTA**)  (note - This is the standard two feature base BLIS/CTA system. VRR is integrated into BLIS - VRR is NOT a stand-a-lone feature but an enhancement.) |
| **HLLAE** | **BLIS+CTA Radar Direct LED**  Used ONLY for programs with both direct connect AND CAN connect LEDs.  Note: This MFAL was set up by a past program to indicate SOD direct connect LED. SOD does not need an MFAL to set up direct connect; it uses the VSCS global parameter. HLLAE and HLLAF would be used ONLY for programs that have both direct connect and CAN connect. |
| **HLLAF** | **BLIS+CTA Radar CAN LED**  Used ONLY for programs with both direct connect AND CAN connect LEDs.  Note: This MFAL was set up by a past program to indicate SOD direct connect LED. SOD does not need an MFAL to set up direct connect; it uses the VSCS global parameter. HLLAE and HLLAF would be used ONLY for programs that have both direct connect and CAN connect. |
| **HLLAG** | **BLIS+CTA with Trailering BTT**  (note - informs Cluster, SYNC3, SYNC4 to configure for full BTT. BTT is part of the full trailer feature package.) |
| **HLLAH** | **BLIS+CTA+ BTTLITE**  (note - informs Cluster, SYNC3, SYNC4 to configure for BTTLITE (BTT-only). BTTLITE is stand-a-lone and is NOT part of the full trailer feature package.) |
| **HNYAA** | Less Reverse Brake Assist (RBA) (see Note 2) |
| **HNYAB** | **Reverse Brake Assist (RBA**)  :Note Includes RCTB. It combines Camera braking, radar braking and ultrasonic braking. |
| **HNYAC** | **Rear Cross traffic Braking**  Also known as CwB (Cta with Braking). This for RCTB LESS RBA- Radar only braking, no camera or Ultrasonic braking. |
| **HNSAA** | Less Auto Parking System |
| **HNSAB** | Auto Parking System ( See Note 1) |
| **HNSAC** | Advanced Auto Parking System ( See Note 1) |
| **HNVAB** | Alarm System Perimeter (Boundary Alert) |
| **AATAT/ ATTAX** | Trailering feature sets that include BTT5G |

NOTE 1 – n/a

Note 2 – Used for RCTB and RBA (Radar and/or Camera based rear braking)

## Document Conventions

Flow Chart

Detailed software flow chart and requirement conventions can be found in APPENDIX A. Note that less detailed flow charts, those describing a function rather than actual software, are also utilized in this specification.

Global Parameters

The term Global Parameter is a variable that shall be programmed in to the LH and RH Side Radars via Method II programming. All global parameters are in blue in this specification. The global parameters shall feed the Part II which feeds the VSCS which feeds the Ford Assembly Plant EOL programming.

**CAN signal**

Medium speed CAN signals are referenced throughout this specification and are highlighted in **BOLD**. An example is **CtaSnsRight\_D\_Stat**. Most ADAS CAN signals have a right and a left signal indicating the source of either Side radar L or Side radar R. For simplicity sake, when referencing the LH and RH complimentary CAN signals, **SodLeft\_D\_Stat** and **SodRight\_D\_Stat** for example, the paragraph or requirement will reference both simultaneously by replacing 'Right' and 'Left' with an 'X'; **SodX\_D\_Stat**.

**Internal signals**

Internal signals are those used in this specification in order to better explain a process or requirement. It is not required that the supplier software use these internal signal names unless specifically stated. Internal signals are called out with a prefix **isig\_** and the name is bolded; example **isig\_Ignition\_Stable**.

**DAT2 Internal Signals**

These are CAN signals that due to the integration of moudles into the ADAS ECU have been converted to internal signals. These new internal signals will retain their 20MY CAN signal names with the suffix **\_Intern** added on: example **ApaClk\_T\_Stat** CAN signal becomes **ApaClk\_T\_Stat\_Intern**.

**State Machines**

The behavior of the SW is partly described in state machines. Following a drawing all states are listed as separate requirements with a description and the action to be taken, when the SW is in the state. Further all transitions are listed in an additional table where the “from” and “to” states are defined as well as the triggers that cause the transition.

# Feature Descriptions

The Rear Side Features as discussed in this DAT2.1 document are paired radar sensors mounted near the rear corners of the vehicle and viewing to the sides and rear of the vehicle. These sensors feed radar information to a central controller called the ADAS\_ECU. The ADAS\_ECU controls several Advanced Driver Assistance features, described in this specification and associated documents including; Blind Spot Monitoring System (BLIS), Rear Cross Traffic Alert (CTA), Cross Traffic Alert with Braking (CTAwB), BLIS for Trailer Tow (BTT), BLIS for Trailer Tow 5th wheel and Gooseneck (BTT5G), and Bounday Alert (BA). The Side radars also support additional features that are primarily controlled by other modules such as: Advanced Park Aid Fusion (APAF) and Lane Change Warning Assist (LCWA).

### BLIS Feature Description

BLIS is a convenience feature that aids the driver in assessing whether a vehicle is in or will be entering an area to either side of the vehicle extending rearward from the outside mirrors to a minimum approximately 5 meters beyond the bumper. This area is referred to as the detection zone. The feature is designed to alert on targets entering the detection zone from either the rear, side, or front of the detection zone. The rear range of the zone from the radar depends on zone entry of the target.

1. When the target vehicle is overtaking the subject vehicle the rear range of the detection zone will be a function of target speed with a minimum rear range of approximately 5 meters. This is referred to as a variable rear range.
2. When the subject vehicle is overtaking the target vehicle, or the target is entering from the side the rear range of the detection zone will be a fixed range of approximately 5 meters.

The Secondary Warning System (SWS) is a subset of BLIS. The SWS feature aids the driver in assessing whether a vehicle is in or is entering the detection zone (shown below) during a lane change maneuver where the turn indicator is used. When the turn signal is active, and a target is detected the corresponding BLIS alert indicator will flash.



Figure 0‑1 Basic Blind Spot Monitoring System functional strategy.

The alert is in the form of an amber LED located in each of the outside rearview mirrors (OSRVM) or optionally, but not preferred, in the A pillar trim or sail plane trim.





US SOW Right Icon

ISO Symbol to be placed in the mirror

Figure 0‑2 Location of Blind Spot Monitoring System alert in the side mirrors.

The feature is not intended to be a replacement for driver visual confirmation via side and rear view mirrors and physically turning to check the detection zones.



min

Rear bumper line

variable

*Figure 0‑3 Illustration of variable rear range*

### CTA Feature Description

CTA is a convenience feature that aids the driver in assessing whether a vehicle is approaching from either the left or right while reversing out of a parking area or backing out on to a road. This area is referred to as the CTA detection zone. The feature is designed such that an alert is conveyed to the driver only when a vehicle, referred to as the target vehicle, is approaching the subject vehicle. The subject vehicle must be in reverse, either stationary or backing up, and the target vehicle is moving towards the subject vehicle (see figure below). With an approaching CTA target, the BLIS OSRVM alert indicator will flash, the message center will indicate from which direction the target is approaching, and an audible chime will occur. Rear Park Aid alerts supersede CTA alerts.



### BLIS with Trailer Tow (BTT) Feature Description

The standard BLIS feature as described in section 2.1.1 is turned off when a trailer is attached to the vehicle. BLIS with Trailer Tow (BTT) will enable BLIS to operate using an adjustable blind zone area that covers the blind zone of the vehicle plus trailer. When BTT is active BLIS variable rear range is deactivated. BTT is the same convenience feature as BLIS but with an extended blind zone (see figure below). To the customer this BTT feature will behave as the BLIS feature but with longer rear range.

BTT will automatically activate when either the trailer module sends a CAN signal indicating that a trailer is attached or for towing systems without a trailer module automatically detect an attached trailer using radar returns.



### Rear Cross Traffic Braking Feature Description

RCTB is an enhanced driver assistance system beyond cross traffic alert.

RCTB can be packged with or without digital cameras to form the Reverse Brake Assist package.

An algorithm will detect rear approaching targets and alert the driver of targets in the 1st lane of traffic whose Time To Collision (TTC) meets a specific threshold. If the driver does not respond to the CTA alert and the vehicle keeps moving backwards, RCTB request a brake intervention from the ABS system to stop the host vehicle motion immediately. Driver actions, such as application of the accelerator pedal, will override the brake intervention. RCTB is a subset of CTA. RCTB cannot operate if CTA is turned off or faulted. RCTB functions at low host speeds and detects vehicles approaching at speeds above 8km/h and below 60km/h

.

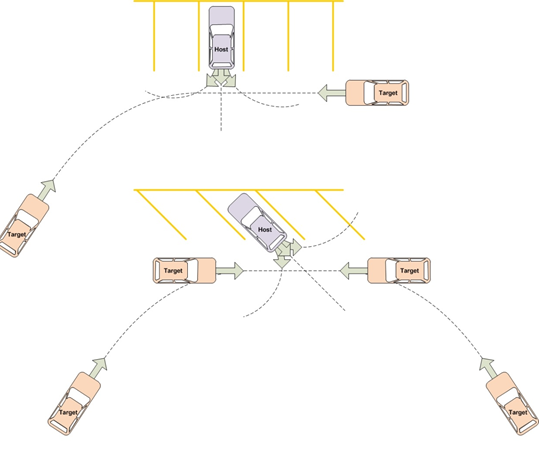


Figure 2.1.4‑1 Example of (RCTB) Scenarios.

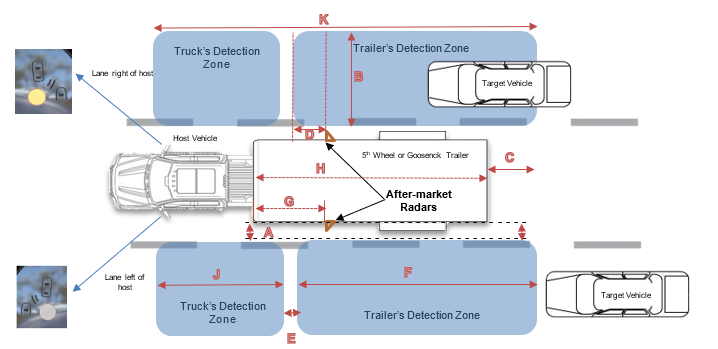
### BLIS with Trailer Tow for 5th Wheel and Gooseneck (BTT5G)

BTT5G delivers the same experience as BTT when a fifth wheel or gooseneck type of trailer is attached to the vehicle. BTT5G will enable BLIS to operate using an adjustable blind zone area that covers the blind zone of the vehicle plus trailer, where the trailer blind zone is covered using the aftermarket radars. BTT5G will be utilizing both the aftermarket blind spot radars on vehicle CAN and the vehicle radars. The alerts from both radar sets will be arbitrated to deliver a seamless customer experience, using the same alert indicators as the BLIS system.

BTT5G will automatically activate after the trailer and the aftermarket ECU modules are connected. Trailer setup procedure is required for the customer to input trailer type, measurements, and confirm that the aftermarket radars are installed.

In this specification, BTT5G is considered part of BTT. BTT5G does not exist outside of the BTT feature.

For measurement values for the lettered distances below, see BTT5G feature document.



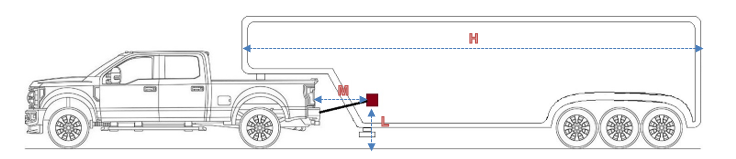


Figure 2.1.5‑1 BTT5G Detection Areas



Figure 2.1.5‑2 BTT5G Front Lower Trailer Face (Zone J limit)

### RESERVED

### Feature Terminology

Listed below are some of the BLIS and CTA specific terms and definitions that are be used in this specification.

|  |  |
| --- | --- |
| **Term** | **Definition** |
| A/D | Analog to Digital convertor |
| ACTIVE/ INACTIVE | To be active means that the feature is able to warn the customer. To be inactive the system warning is inhibited. The words ACTIVE and INACTIVE are used throughout this specification. |
| BCM | Body Control Module |
| Blind Zone (BZ) | BLIS area to the sides of the host vehicle where the system detects target vehicles (ISO NP17387, Sections 3.3, 3.4, 3.11 and 4.1). |
| BLIS | Blind Spot Information System refers to the blind spot feature only; it does not include Cross Traffic Alert. |
| BLIS CTA | This refers to the entire BLIS CTA system. |
| Blocked | Blockage shall be defined as the state in which the Miss Target Rate (MTR) is below the value specified within these requirements. |
| BTT | Blind Spot Information System (BLIS) with Trailer Tow feature. This is BLIS with extended trailer tow capability added. |
| BTT5G | BLIS with Trailer Tow for 5th wheel and Gooseneck trailers. Utilizes aftermarket trailer radar units to extend coverage zones for 5th wheel or gooseneck trailers. |
| CAN | Controller Area Network |
| CGEA | Common Global Electrical Architecture |
| Cmd | Command |
| CTA | Cross Traffic Alert feature only; less BLIS. |
| CtaX | X means Left and Right Text . I.e. CtaLeft\_D\_Stat and CtaRight\_D\_stat |
| CUSTOMER | The driver of the vehicle. |
| DCU | Door Control Unit; for vehicles equipped with door modules that drive the OSRVM LED. |
| DD | Data Dictionary |
| DDCU | Driver Door Control Unit; the door module located on the driver side of the vehicle. Note for LH drive vehicles this will be the LH door module. For RH side vehicles this will be the RH door module. |
| DID | Data Identifier |
| DISABLED | The system is permanently turned OFF via method II programming regardless of a new key cycle. Alerts are not provided. The customer cannot turn the system ON. |
| DTC | Diagnostic Trouble Code |
| ECU | Electronic Control Unit |
| EEPROM | Electrically Erasable Programmable Read Only Memory |
| EESE | Electrical/Electronic Systems Engineering |
| ENABLED | The system is functional and can respond to ON and OFF commands. |
| EOL | End Of Line |
| ESC | Electronic Stability Control |
| Ev | Event |
| FAR | False Alert Rate. The number of alerts over a specific amount of time in which no target is present. This value can be expressed in percent of false alarms. |
| FBWR | FALSE BLOCKAGE WARNING RATE - The number of BLOCKED warnings that occur when the system is not blocked. |
| FNOS | Ford Network Operating System |
| GWM | Gateway Module |
| Host Vehicle | The vehicle that contains the Blind Spot Modules. |
| HS-CAN | High Speed – Controller Area Network |
| HS-CAN | High Speed Controller Area Network |
| IC | Instrument Cluster |
| Infrastructure | Any object other than a target or subject vehicle (e.g. trees, road signs, guard rails, etc.) |
| Initial State | Upon reset this is the value that the data flow is to take until a new value can be obtained. |
| Initial Value | Upon reset this is the value that the data flow is to take until a new value can be obtained. |
| IPMB | Image Procecssing Camera - Module Type B |
| ISO | International Standards Organization |
| L R | The letters 'L' and 'R' or 'LH' and 'RH' are shorthand for LEFT and RIGHT. When used as a suffix it refers to the physical side or physical module side (ie. SODL, SODR) |
| MERGE | (MERGE) When a target enters the adjacent lane from the side of the blind zone. Any target entering the blind zone other than a PFR or STAG. |
| MS\_CAN Signal | An MS\_CAN message may contain one or more signals. |
| MS-CAN | Medium Speed – Controller Area Network |
| MS-CAN | Medium Speed Controller Area Network |
| MTR | Missed Target Rate. The number of targets over a specific amount of time in which the driver was not alerted to. This value can be expressed in percent of missed targets. |
| N/A | Not Applicable |
| NM | Network Management |
| NOS | Network Operating System/Software/Strategy |
| NVM | Non-Volatile Memory |
| OFF | While ENABLED, the customer can turn the system OFF, no alerts provided, during a single key cycle. After a key cycle the system defaults to ON. |
| ON | While ENABLED, the system is fully functional providing alerts. |
| OSRVM | Outside Rearview Mirror |
| PAM | Park Assist Module |
| Parameter | A software variable that is common with FNA and FoE. These variables are either programmable at the supplier manufacturers facility and some are programmable at FMC assembly plant EOL. In this specification, a parameter is highlighted in blue. |
| PFR | (Pass From Rear) When a target overtakes the host vehicle in the adjacent lane. Also defined by ISO NP17387. |
| PDCU | Passenger Door Control Unit; the door module located on the passenger side of the vehicle. Note for LH drive vehicles this will be the RH door module. For RH side vehicles this will be the LH door module. |
| PID | Parameter Identification, replaced with DID |
| PPA | Perpendicular Parking Assist |
| RBA | Rear/Reverse Brake Assist |
| RCTB | Rear Cross Traffic Braking |
| Relative Velocity | Target approach velocity relative to the subject vehicle in kph. |
| Reset | To force the state machine to a known condition. Each state machine may have an independent reset condition not defined in the software requirements. This independent condition shall not conflict with the module software requirements. |
| RCS | Radar Cross Section |
| SAPP | Semi-automatice parallel parking |
| SOD | Side Obstacle Detect refers to the module which contains both the BLIS and CTA features (ADAS ECU for DAT2.x). When used within a CAN signal name (ie. SodSnsRight\_D\_Stat) it refers to a BLIS CAN signal as opposed to a CTA CAN signal. |
| SodX | X indicates Left (L) and Right (R) text. For example, SodX\_D\_Stat means SodLeft\_D\_Stat and SodRight\_D\_Stat. |
| STAGNATION | (STAG) When the host overtakes a target in the adjacent lane. Also defined by ISO MP17387. |
| SWDL | Software Download |
| SWS | Secondary Warning System |
| TAP | Threat Assessment Processing |
| Target Vehicle | Any ISO specified target (ISO NP17387, Sections 3.2 and 5.2.1). |
| TRM | Trailer Module (same as TLM) |
| TTC | Time to collision (between a target and the host vehicle) |
| UB | Update Bit |
| Volatile | Changes during run-time, program execution (RAM) |
| VQM | Voltage Quality Module; The VQM generates clean power in Start/Stop vehicles. The abbreviation VQM is used within to mean normal vehicle power, as in a non Start/Stop vehicle. |
| VRR | (Variable Rear Range) The rear range distance from the bumper at which the BLIS alert goes on for targets over taking the host vehicle is variable. |

## System Overview

### Major System Components

**Side Radar Sensors SRR**: In the DAT2 architecture, the Side Feature radars are relatively “dumb” sensing devices only and do not control the Side feature. Feature control is moved to a central controller called the ADAS ECU in this document. This document has been converted from prior generation specificaitons to form a DAT2.0 compliant version. Some legacy nomenclature from the prior stand-alone SOD architecture might be found in DAT2.0 intial versions.

The Side radar sensors are produced generaly and each Side radar will be identified as a Left or Right side sensor after it is connected to its wiring harness in the vehicle. The specification of that strategy is not covered in this feature level specification.

**ADAS ECU**: The ADAS ECU can be configured to drive the mirror LED alert directly via hardwire or to drive the mirror LED alert via the door modules or a combination of both. Configuration parameters control the type of LED drive control to be used. The ADAS is also configurable for LH or RH side drive vehicles, automatic or manual transmission, and vehicle VIN number. This configuration data is received at Ford Assembly Plant EOL configuration and is controlled by the ADAS ECU VSCS.

BLIS Indicators: The BLIS alert indicators are integrated in to the LH and RH OSRVM glass. The ADAS ECU controls these alert indicators directly via single wire or via CAN bus signals to the DCU. Configuration parameters set the LED drive type (hardwire or DCU) and whether the vehicle is a LH or RH drive.

DCU: The Door Control Units (DCUs) are used in some vehicle architectures. DCU is a generic name for either door module. There can be a Driver Door Module (DDM) and a Passenger Door Module (PDM). Note that the DCU CAN node IDs swap LH and RH sides depending on the type of drive vehicle it is (Left Hand/Right Hand drive).

IPC: The Side Radar features communicate status information via ADAS to the Cluster message center and receives customer on/off commands from the Cluster message center.

CTA sends alert information to the Cluster so that the Cluster can activate the appropriate Message Center messages and activate the Audio system CTA chime. Vehicle information is obtained by the ADAS system such as transmission information, vehicle speed, etc.

BTT interfaces with the Cluster for trailer information. BTT wil use Trailer Brake Module and Trailer Lighting Module connect status if available.

RCTB interfaces with the ABS module and requests brake interventions through a CAN message. The ABS provides its status also over CAN. The driver is informed of a brake intervention through the instrument cluster from the RBA model. RCTB utilizes the steering wheel angle from the PSCM and yaw rate from the RCM as well as wheel direction signals from ABS. ADAS will interface with the RBA central controller and other components such as parking sensors and/or rear camera that will provide the ADAS with environmental data to improve algorithm predictions of target paths. The RCTB Central Controller is the IPMB, which is responsible for monitoring brake requests, and handles all RBA HMI.

The Park Aid Module (PAM) or IPMB informs CTA and BLIS when it is in autopark mode. CTA, RCTB, and BLIS are turned off during an Autopark maneuver.

The Side radar have a feature for police vehicles only, called Boundary Alert, also known as Police Perimeter Alarm. It is activated via a physical on/off switch that is hardwired to the cluster. The ADAS is the master of Boundary Alert.

The trailer aftermarket radars provide detections over CAN for the BTT5G feature, extending the detection zone of the SRRs for large trailer applications. Trailer aftermarket radars interface with the ADAS module, SYNC4, and cluster.

### RESERVED

### MS CAN Signal Summary

|  |  |
| --- | --- |
| R: 2.2.3.1 | The ADAS shall support internal (isig\_) and CAN signals as defined in the Data Dictionary, in appendix C, and in the Boundary Alert specification. |

## BLIS CTA HMI Requirements

### System Indication

ADAS ECU will support one hardwire output for the purpose of alerting the customer of an object in the blind spot area (HMI Indicator) if configured for hardwire. Otherwise the HMI indicator will be controlled via CAN signals from ADAS by the LH or RH DCU.

This same output will be used for alerting the customer of sensor blockage and may be used to indicate CTA alerts.

The indicator will be dimmable via PWM. PWM dimming levels will be configurable to accommodate differing requirements for interior and exterior HMI. There will be two dimming levels; one for night and one for day. The parameter that controls the PWM duty cycles are ALERT\_INDICATOR\_DUTY\_CYCLE\_DAY and ALERT\_INDICATOR\_DUTY\_CYCLE\_NIGHT.

The BLIS and/or CTA visual indicators may also be displayed in an auxiliary display such as a center stack camera display or a Heads-Up-Display. There is no specific HMI requirement mandating these auxiliary displays other than for purposes of HMI customer convenience. The BLIS primary display is the OSRVM LED and the CTA primary display is the audible chime.

RCTB does not have its own chime nor does it activate the HMI indicator, because CTA is already activating the chime and HMI indicator during a brake intervention.

Beginning with MY22 U55X MCA, the Ford arbitrator model will handle the Alerts for BLIS/CTA/LWCA/CEA.

### Display Location

Ford ergonomics recommends that the symbol be displayed on the exterior mirror surface or in the mirror housing. The desire is to keep these symbols as far away from the driver's direct line of sight as possible so that a nuisance situation is not created. It is believed that if the display is located inside the vehicle on or near the A-pillar that we may incur TGWs for nuisance. The approach should follow the mental model applied by our drivers' in that they will look towards their mirror when attempting to gain information regarding their blind spot.

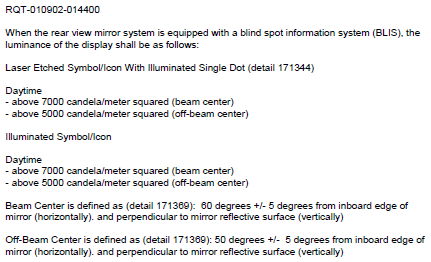
### Display

The ISO symbol should be used for this feature and be mirror imaged for the driver's side as compared to the passenger's side. Thus, ensuring a correct interpretation of the relationship between the customer's vehicle compared to an obstacle in the blind spot.

|  |  |
| --- | --- |
| US SOW Left Icon | US SOW Right Icon |
| Figure 0‑3 Left Hand Side ISO symbol | Figure 0‑4 Right Hand Side ISO symbol |

Color – Amber

The following is the daytime illumination as specified by FMC Mirror Group:



Based on measurement made of a sample of our 6mm indicator mirror at 10% PWM, the nighttime luminance at beam center is approx. 850 cd/m2.

|  |  |
| --- | --- |
| R: 2.3.3 | The ADAS module shall be designed to drive the OSRVM LED circuit with a programmable PWM duty cycle, specified later in this FS, with a max load currents as specified in the OSRVM Device Transmittal. |

### RESERVED

### BLIS CTA Auxiliary Displays

For customer convenience, FMC may request auxiliary displays for BLIS or CTA alerts. Although the auxiliary display will become part of the ADAS system the module producing the auxiliary display is not governed by the rear side radar functional specification. The 2.3.5 requirements are for auxiliary display checks during ADAS DV testing.

|  |  |
| --- | --- |
| R: 2.3.5.1 | An auxiliary display is defined as a module producing a side feature indicator other than the BLIS OSRVM LED or CTA audible alert and requires no added interface software in the ADAS. The Auxiliary module will simply use existing ADAS CAN signals to operate the auxiliary display.  Note – the Cluster and Door Modules are not auxiliary displays. |
| R: 2.3.5.2 | Auxiliary displays, such as a center stack rear view camera or head up display, will function per the auxiliary module function specification. Side feature DV responsibility for auxiliary displays will be minimized to only verify the auxiliary display is active / inactive in accordance to the side feature alert. Specific details of operation of the auxiliary display will be the responsibility of the auxiliary module D&R. |

## Software Classification Level

The Side Feature software is Functional Classification level B. Reference EY-0091 requirement.

**.**

# SIDE RADAR SYSTEM VEHICLE CONFIGURATION and INTERFACE

## M2 M3 Vehicle configuration

## 

BLIS CTA Vehicle Configuration

The ADAS ECU will be configured for vehicle specific Side radar features (mfals). The Side radar features must also be configured for various vehicle build parameters (transmission type, with or without door modules, etc). Table 3.2-1 lists both types of configurable parameters.

**Table 3.2-1 Global Parameters for Configuration**

|  |  |  |
| --- | --- | --- |
| Vehicle Global Parameter | Definition | Data |
| REGION  Not a specific parameter but rather a set of columns in the global parameter file | Specific market veh is sold in | A column in the global parameter file for each region. In the VSCS, each region will have a default value column. Thus the EOL will download the set of global parameter default values based on each region. |
| SYS\_CONFIG\_DCU | Hardwire HMI - Door module configuration | Indicates if the vehicle uses door module(s) and/or hardwired ADAS ECU to drive the HMI LED s |
| SYS\_CONFIG\_LHRHDRIVE | LH or RH drive vehicle | Vehicle is LH or RH drive. Allows Side Radar L and Side Radar R to set up Driver Door Module and Passenger Door Module CAN ID |
| SYS\_CONFIG\_TRANS | Transmission type | Automatic or manual transmission. Determines which transmission CAN signal will be used and sets up PRNDL processing |
| SYS\_CONFIG\_TOWTLM | TLM module | Trailer Light module available. If available the TLM CAN signal will be read and processed. |
| SYS\_CONFIG\_TOWTBM | TBM Module | Trailer Brake module available. If available the TBM CAN signal will be read and processed. |
| AP\_ENABLE\_DISABLE | Autopark configuration | Defines the autopark features. BLIS and/or CTA turn off for various modes of each autopark feature |
| BTT\_ENABLE\_DISABLE | BLIS with Trailer Tow feature | Enables /disables the BTT feature. This config is independent of the \_TOW config. |
| BTT5G\_ENABLE\_DISABLE | BLIS for 5th wheel and gooseneck trailers | Enables/disables the BTT5G feature. |
| RbaEnable\_Cfg | Disable/Enable Rear Cross Traffic Braking (RCTB) or Reverse brake assist | RBA  RPAwBRK  DISABLED  **CTAwBrk**  Rear Cross Braking is enabled ONLY if RbaEnable\_Cfg = (RBA or **CTAwBrk)** |
| SYS\_CONFIG\_wheel\_base | Wheel base of the vehicle, needed to use the steering angle | 1-10,000 mm. Used by RCTB to calculate the turn radius |
| SYS\_CONFIG\_steering\_ratio | Steering ratio of the vehicle, needed to use the steering angle | Used by RCTB to detect park maneuvers with small turn radius. |
| SYS\_CONFIG\_FrontRear\_direction\_sensors | Axle that carries bi-directional wheel speed sensors | Used by RCTB, 0: Front, 1: Rear |

## Calibration Parameters

### Global Parameter File

|  |  |
| --- | --- |
| R: 3.2.1.1 | Reserve |
| **R: 3.2.1.2** | Reserve |
| **R: 3.2.1.3** | Any parameters not listed in Table 3.2.1-1 shall be set to the default values listed in the Global Parameter File for NA region. Global Parameter File is a separate document that lists all the calibration parameters used in this document. |
| **R: 3.2.1.4** | This specification uses a set of variable names for Method 2 confguration that the supplier shall map one-to-one to the DAT2 Diagnsotic and VSCS specification, per Table 3.2.1-2 below. The table lists the paramters used in this specification and the equivalent configuration parameter name in the DAT2 Diagnostic Specificatoin document and the ADAS ECU part II spec. |
| **R: 3.2.1.5** | BLIS, CTA, RCTB, and BTT functionlatiy described in this specification is based upon the rear corner radar sensors. Using front corner radars to improve performance is allowed but is not a requirement. The features shall continute to function regardless of the presense of the front radars and regardless of the fault status of front radars. |

Table 3.2.1-2 Side radar features Configuration Parameter Names mapping to Part II Specification

|  |  |
| --- | --- |
| **BLIS BTT CTA CTB Spec/Algo Parameter Used in this Document** | **Equivalent Part II paramter** |
| BTT\_Enable\_Disable | ModuleFeatureCfg\_BTT |
| BTT5G\_Enable\_Disable | ModuleFeatureCfg\_BTT5G |
| AP\_ENABLE\_DISABLE | ModuleFeatureCfg\_APA |
| Sys Config DCU | FeatureCfg\_BLIS\_Left\_DCU\_Cfg & FeatureCfg\_BLIS\_Right\_DCU\_Cfg |
| Sys Config LHRHDRIVE | VehicleCfg\_SteWhlSide |
| Sys Config TOWTLM | VehicleCfg\_TrlrLghtModulePresent |
| Sys Config TOWTBM | VehicleCfg\_TrlrBrkModulePresent |
| Sys Config TRANS | VehicleCfg\_TransmissionType |
| BLIS\_Enable\_Disable | ModuleFeatureCfg\_BLIS |
| CTA\_Enable\_Disable | ModuleFeatureCfg\_CTA |
| RbaEnable\_CFG | ModuleFeatureCfg\_RBA |
| Wheel\_base | VehicleCfg\_Wheelbase |
| Steering\_ratio | VehicleCfg\_SteeringRatio |
| FrontRear\_direction\_sensors | VehicleCfg\_WhlSensorAxle |

### Configuration for Global Region

Various global parameters will be set automatically based on the market region of the vehicle. The Global Parameter File (Section 12) lists the setting changes under the GLOBAL REGION columns in the parameter file.

|  |  |
| --- | --- |
| R: 3.2.2.1 | The global parameter values will vary as specified in the Global Parameter File, Global Region columns. These values shall be fed to the ADAS ECU at EOL. The default region is FNA REGION 1. |

### Configuration LH/RH Drive and HMI

The SYS\_CONFIG\_DCU and SYS\_CONFIG\_LHRHDRIVE global parameters will be used to establish the HMI drive setup (hardwire / door module) and, if door module(s) are present, the door module CAN Message. For LH Drive vehicles the left radar alerts will communicate with the DDCU and the right radar alerts will communicate with the PDCU. For RH drive vehicles the left radar will communicate with the PDCU and the right radar will communicate with the DDCU.

Detailed Side radar to DCU interface can be found in section 8. For reference, the driver side DCU MSCAN signal to ADAS is BLISLEDStatDriverSide (message 0x332 MSCAN) and the passenger side DCU MSCAN signal to ADAS is BLISLEDStatPassSide (0x333 MSCAN).

|  |  |
| --- | --- |
| R: 3.2.3.1 | When both left and right radars are set to hardwire, the FETS shall drive the HMI LED and the associated CAN signals, SodAlrtX\_D\_Stat, CtaAlrtX\_D\_Stat, and CtaAlrtX2\_D\_Stat shall reflect the current HMI LED hardwire signal.  Note CTAAlrtX\_D\_Stat and CtaAlrtX2\_D\_Stat work together but with different purpose.  CTAAlrtX\_D\_Stat drives the LED via the door module (when equipped) and is read by other modules to indicate a CTA alert in any CTA zone.  CtaAlrtX2\_D\_Stat is read by the Cluster to drive the CTA chimes |
| **R: 3.2.3.2** | When SYS\_CONFIG\_DCU indicates a DDCU and a PDCU setting, ADAS shall read SYS\_CONFIG\_LHRHDRIVE to determine which side of the vehicle the door modules are associated to.  For LH drive vehicles the ADAS ECU’s LH CAN signals will automatically set up communication for DDCU via MSCAN Message 0x332 and the ADAS ECU’s RH CAN signals will set up communication for the PDCU via MSCAN Message 0x333.  For RH drive vehicles the RH radar will automatically set up communication for the DDCU via MSCAN Message 0x332 and the LH radar will set up communication for the PDCU CAN via MSCAN Message 0x333. |
| **R: 3.2.3.3** | When SYS\_CONFIG\_DCU indicates a DDCU or PDCU but not both are used, the ADAS shall read SYS\_CONFIG\_LHRHDRIVE to determine which side of the vehicle the module is associated to.  The radar with the DCU shall set up its HMI with the appropriate MSCAN Message while the radar with no DCU shall set up its HMI for hardwire. |
| **R: 3.2.3.4** | When left and right radar alerts are set up for a DCU the hardwire output will be continuously held to module ground voltage thus turning it OFF. |

### Configuration BLIS and CTA

BLIS and CTA are the base algorithms in that all other Side features will run using either BLIS or CTA target tracking.

|  |  |
| --- | --- |
| R: 3.2.4.1 | The BLIS ON/OFF state shall be written to nonvolatile memory to become the BLIS on/off setting for the next key cycle. This last remembered state shall be referred to as internal signal **isig\_BLIS\_Last\_Rem**. The values of **isig\_BLIS\_Last\_Rem** are ON and OFF. |
| R: 3.2.4.2 | BLIS enable/disable state shall be set by the global parameter BLIS\_ENABLE\_DISABLE. When BLIS\_ENABLE\_DISABLE -> ENABLE **isig\_BLIS\_Last\_Rem** defaults to ON  Thereafter, BLIS Enable/Disable shall be available to Service via Method II. |
| R: 3.2.4.3 | RESERVED |
| R: 3.2.4.4 | CTA enable/disable state shall be set by the global parameter CTA\_ENABLE\_DISABLE. |
| R: 3.2.4.5 | The CTA is a DEFAULT ON feature. After ignition power up, CTA shall be set to ON. |
| R: 3.2.4.6 | Post module configuration, the cluster / SYNC CTA ON/OFF will command the CTA state via CAN signal **Cta\_D\_Rq**.  Three seconds after Power Up the cluster / SYNC will be capable setting the CTA ON/OFF via CAN signal **Cta\_D\_Rq** as specified in section 3.5. |
| R: 3.2.4.7 | CTA Enable/Disable shall be available to Service via Method II. |

### RESERVE

### Configuration Transmission

|  |  |
| --- | --- |
| R: 3.2.5.1 | If the SYS\_CONFIG\_TRANS is set to automatic, the BLIS/CTA/RCTB shall use the CAN signal **GearLvrPos\_D\_Actl** to read PRNDL data and ignore **GearRvrse\_D\_Actl.**  If the SYS\_CONFIG\_TRANS is set to manual, the BLIS/CTA/RCTB shall use the CAN signal **GearRvrse\_D\_Actl** to read PRNDL data and ignore **GearLvrPos\_D\_Actl.** |

### 

### Configuration Trailer Tow Module

The vehicle may be equipped with or without a trailer light module (TLM) and/or trailer brake module (TBM). TLM will generate the CAN signal **TrlrLampCnnct\_B\_Actl**. TBM will generate the CAN signal **TrlrBrkActCnnct\_B\_Actl**. When a trailer is connected to the customer's vehicle and BTT\_ENABLE\_DISABLE is DISABLED the BLIS and CTA features will be turned off as specified in section 3.7.1.5. If BTT\_ENABLE\_DISABLE is ENABLED, BLIS will remain on and CTA may be turned off.

|  |  |
| --- | --- |
| R: 3.2.7.1 | If SYS\_CONFIG\_TOWTLM is TRUE then the ADAS change to BLIS/CTA/RCTB shall read CAN signal **TrlrLampCnnct\_B\_Actl.**  If SYS\_CONFIG\_TOWTLM is FALSE then the ADAS shall ignore CAN signal **TrlrLampCnnct\_B\_Actl.** |
| R: 3.2.7.2 | If SYS\_CONFIG\_TOWTBM is TRUE then the ADAS shall read CAN signal **TrlrBrkActCnnct\_B\_Actl.**  If SYS\_CONFIG\_TOWTBM is FALSE then the ADAS will ignore CAN signal **TrlrBrkActCnnct\_B\_Actl.** |
| R: 3.2.7.3 | ADAS shall read Sys\_Config\_TOWTLM and Sys\_Config\_TOWTBM and set internal signal **isig\_TTM\_Cfg** as specified in Table 3.2.7-1. **isig\_TTM\_Cfg** shall be used by BTT for trailer processing. Note that **isig\_TTM\_Cfg** is not an NVM internal signal. |

Table 3.2.7-1 Definition of **isig\_TTM\_Cfg**

|  |  |  |  |
| --- | --- | --- | --- |
| INPUTS | | OUTPUT |  |
| Sys\_Config\_TOWTLM | Sys\_Config\_TOWTBM | isig\_TTM\_Cfg | SOD to use trailer CAN signals |
| FALSE | FALSE | 0x0 | none |
| FALSE | TRUE | 0x1 | **TrlrBrkActCnnct\_B\_Actl** |
| TRUE | FALSE | 0x2 | **TrlrLampCnnct\_B\_Actl** |
| TRUE | TRUE | 0x3 | **TrlrBrkActCnnct\_B\_Actl**  **TrlrLampCnnct\_B\_Actl** |

### Configuration AutoPark (AP) Feature Configuration

The vehicle may be equipped with or without autopark (AP).

The AP feature will reside in the ADAS and requires autopark sensors.

|  |  |
| --- | --- |
| R: 3.2.8.1 | Reserve |
| R: 3.2.8.2 | If AP\_ENABLE\_DISABLE = ENABLE then ADAS shall configure to read and process the AP signal **ApaMde\_D\_Stat\_Intern**.  If AP\_ENABLE\_DISABLE = DISABLE then ADAS shall ignore **ApaMde\_D\_Stat\_Intern**.  Note: Enable means values *other than 0x00* (for example 0x1: SAP, 0x2 FAP, 0x3: rePA etc.) |
| R: 3.2.8.3 | Reserve |

### Reserved

### Configuration SWS (Turn\_Signal)

Secondary Warning Signal SWS is a BLIS subfeature. BLIS can be enabled with SWS enabled or disabled. The design intent is to have SWS enabled when BLIS is enabled. Note that there may be regional differences where SWS will be disabled for BLIS enabled.

|  |  |
| --- | --- |
| R: 3.2.10.1 | For BLIS ENABLED (**SodX\_D\_Stat** NOT set to DISABLE), the TURN\_SIGNAL can be set to ENABLE or DISABLE. |

### Configuration BTT

The vehicle may be enabled with or without the BTT feature. When disabled the BTT feature is permanently OFF and transparent to the customer. When enabled the BTT feature will function along with the BLIS feature; if the BLIS feature is turned OFF or DISABLED then so will the BTT feature.

**Note**: As of November 2018, Sync4 (**APIM** CAN Node) will transmit it as **Btt\_L\_Actl2**. This means that the ADAS ECU will use **Btt\_L\_Actl2 instead of Btt\_L\_Actl throught this whole specification. Spec has been updated to reflect his change**

|  |  |
| --- | --- |
| R: 3.2.11.1 | If BTT\_ENABLE\_DISABLE is (DISABLED) FALSE, then SODX shall ignore the Cluster CAN signal **Btt\_L\_Actl2** and set the SOD CAN signals to  **BttX\_D\_Stat** =0x6, DISABLE  **BttX\_D\_RqDrv** = 0x1, No Request  And set the BTT last remembered state settings to  **isig\_BTT\_Last\_Rem** = 0x3, DISABLE  **isig\_TFLAG\_Last\_Rem** = 0x0, FALSE  If BTT\_ENABLE\_DISABLE is (ENABLED) TRUE then SODX shall read the Cluster CAN signal **Btt\_L\_Actl2** and initialize the BTT CAN signals to  **BttX\_D\_Stat** = 0x0 NOT DETERMINED  **BttX\_D\_RqDrv** = 0x1, No Request  And initialize the BTT last remembered state settings to  **isig\_BTT\_Last\_Rem** = 0x2, ON  **isig\_TFLAG\_Last\_Rem** = 0x0, FALSE  The SOD module is shipped to the Ford Assembly Plants as DISABLED. It can only be enabled during a SOD module configuration. |
| R: 3.2.11.2 | If BTT5G\_ENABLE\_DISABLE is (ENABLED) TRUE, then ADAS shall read the APIM CAN signal **Btt\_L2\_Actl2**, as well as aftermarket radar signals **SodAltLeft\_D2\_StatAft** and **SodAltRight\_D2\_StatAft**.  If BTT5G\_ENABLE\_DISABLE is (DISABLED) FALSE, then the ADAS shall ignore **Btt\_L2\_Actl2**, **SodAltLeft\_D2\_StatAft,** and **SodAltRight\_D2\_StatAft.** |

### Configuration RCTB

RCTB (Rear Cross Traffic Braking (or Reverse Brake Assist) is a CTA subfeature. CTA can be enabled with RCTB enabled or disabled. Note that there may be regional differences or vehicle build options where RCTB will be disabled for CTA enabled.

|  |  |
| --- | --- |
| R: 3.2.12.1 | For CTA ENABLED (**CtaX\_D\_Stat** NOT set to DISABLE), the RbaEnable\_Cfg can be set to ENABLE or DISABLE. For CTA DISABLED (**CtaX\_D\_Stat** = DISABLE), the RbaEnable\_Cfg is permitted to be set to RBA or **CTAwBrk**, but RCTB shall not send any braking requests nor request CTA chime. |
| R: 3.2.12.1.1 | RBA\_Enable\_Cfg is for RCTB only.  It’s mapped to RBA Config “ModuleFeatureCfg\_RBA”.  When ModuleFeatureCfg\_RBA is either = (RBA or CTAwBrk) thenset RbaEnable\_Cfg = Enable ;  Else RBA\_Enable\_Cfg = Disabled for RCTB. |
| R: 3.2.12.2 | If RbaEnable\_Cfg = (RBA or CTAwBrk**)**, then RCTB shall read the configuration parameters listed below    RCTB\_Brake\_denied\_time  RCTB\_MAX\_BRAKE\_TIME  RCTB\_MIN\_BRAKE\_TIME  RCTB\_TTC  RCTB\_rear\_range\_low  RCTB\_rear\_range\_high  RCTB\_no\_intervention\_range  RCTB\_Upper\_Angle\_Limit  RCTB\_Lower\_Angle\_Limit  Wheel\_base  Steering\_ratio  FrontRear\_direction\_sensors  RCTB\_Max\_Reverse\_Speed  RCTB\_Min\_Reverse\_Speed  RCTB\_ZoneX\_Front\_Rng  RCTB\_MIN\_ABORT\_SPEED  RCTB\_Min\_Standby\_Time  SelfSteerGradient  Additionally, ADAS shall read the CAN signals for RCTB processing:  **CtaBrk\_D\_Stat,**  **WhlDirFl\_D\_Actl,**  **WhlDirFr\_D\_Actl,**  **WhlDirRl\_D\_Actl,**  **WhlDirRr\_D\_Actl**,  **StePinComp\_An\_Est**  **RbaSys\_D\_stat\_Intern**  **Rba\_D\_Stat\_Intern** |
| R: 3.2.12.3 | If RbaEnable\_Cfg <> (RBA or **CTAwBrk)**, the SOD shall ignore the CAN signals listed above and set the SOD RCTB output CAN signals as follows:  **CtaXBrkDecel\_B\_Rq** = DISABLED  **CtaXBrkEnbl\_B\_Rq** = DISABLED  **RbaCtaX\_D\_Stat\_Intern =** DISABLED |
| R: 3.2.12.4 | The global parameter FrontRear\_direction\_sensors defines from which axle to use the wheel direction as shown in Table 3.2.12-1.  Note: in a vehicle usually only the non-driven axle is equipped with bi-directional wheel speed sensors. |
| R: 3.2.12.5 | The global parameter steering\_ratio defines the steering ratio of the steering system. wheel\_base (vehicle wheel base), will be used in conjunction with the steering wheel CAN signal **StePinComp\_An\_Est** (or **SteWhlComp\_An\_Est**) to determine the reverse vehicle dynamics as specified in section 3.7.1.12. |

Table 3.2.12-1 Definition of **WhlDirXl\_D\_Actl**  and **WhlDirXr\_D\_Actl**

|  |  |  |
| --- | --- | --- |
| \_FrontRear\_direction\_sensors | Wheel Direction CAN Signals Used | |
| 0: Front | WhlDirFl\_D\_Actl | WhlDirFr\_D\_Actl |
| 1: Rear | WhlDirRl\_D\_Actl | WhlDirRr\_D\_Actl |

### Reserved

### Reserved

### Module Configuration Enable\_Disable Plausability Check Handling

BLIS and CTA are base features. All other rear side radar features use portions of the based features. Therefore, there will be some interdependencies built within software to inhibit certain configuration combinations. Post EOL enable/disable feature requirements can be found in section 3.5.

|  |  |
| --- | --- |
| R: 3.2.15.1 | For enable/disable dependencies refer to Mode Chart section 3.4.2. |
| R: 3.2.15.2 | This requirement applies when \*\_Enable\_Disable configuration parameters are sent in more than one DID.  The setting the \*\_ENABLE\_DISABLE values during actual module configuration (FD60 = 1) will be in any order. The check for proper hierarchy of feature configuration shall occur at the end of module configuration but before FD60 transitions to 0. |
| R: 3.2.15.3 | If the hierarchy of \*\_Enable\_Disable configuration meets the above requirments then FD60 shall be allowed to transition to 0. |
| R: 3.2.15.4 | For FD60 = 0, if a configuration change is made rerun the \*\_Enable\_Disable configuration check in this section. |

## Side Feature operation with engine Start/Stop

The BLIS and CTA features will function per this specification when powered by Start/Stop power (unconditioned RUN/START subject to zero speed restarting). Stop/Start power has a variation from 16 to 7 Vdc as seen at the vehicle battery; the 7 Vdc is associated with a Stop/Start re-crank event. The Stop/Start vehicle feature allows the engine to be turned off for zero and near zero drive events.

Stop/Start power voltage drops occur during a Stop/Start stop event and start event. The CAN signal **ElPw\_D\_Stat** indicates the mode of Start/Stop and thus the start and stop events. When the customer first starts the engine the Stop/Start is active, but a stop event will not occur until after a vehicle speed threshold is reached. A stop event for manual transmission vehicles can occur for vehicle speeds of 4 kph or less and for automatic transmissions of 0.5 kph or less. A preceding start event will occur when the customer releases the brake or the transmission in placed in REVERSE (auto or manual). If during a stop event the transmission is placed in to REVERSE and the brake is pressed the start event will occur within 200 msec. If the transmission is placed in REVERSE and the brake is not depressed the customer will be notified to press. Stop/Start will wait up to 15 sec for the customer press the brake. Else the customer will need to start the engine. The actual vehicle ignition switch state will not change during a Start/Stop start event or start event. The ignition switch only changes during a customer initiated start or stop.

RCTB may stall the engine in the case of a manual transmission vehicle. For warm engines the stall recovery feature will start the engine again, once the clutch is pressed.

The ADAS module will be required to remain in operation for all Start/Stop voltages as described within the requirements below.

|  |  |
| --- | --- |
| R: 3.3.1 | RESERVED |
| R: 3.3.2 | The BLIS and CTA features will function per this specification when functioning on Start/Stop power. The Stop/Start power assumes the voltage range as defined in StartStop\_Voltage\_Curve\_Specification FS-0000-00001-AB rev2 plus an additional voltage drop of 1.0 Vdc.  The stop/start CAN **ElPw\_D\_Stat** signal is available for supplier usage but it is not required by this functional specification. Handling of this CAN signal will be designed by the supplier and the handling method must be approved by FMC Side Radar Feature Core Team. |

## Side Feature Power Up, Initialization, Modes of Operation

Section 3.4 describes initialization of side features at normal power up (ignition key RUN/START power and at running reset power up for a configured module. Normal power up will be referred to as ‘power up’ and running reset power up will be referred to as ‘running reset.’ Upon initialization BLIS/CTA system modes of operation are established based on system settings.

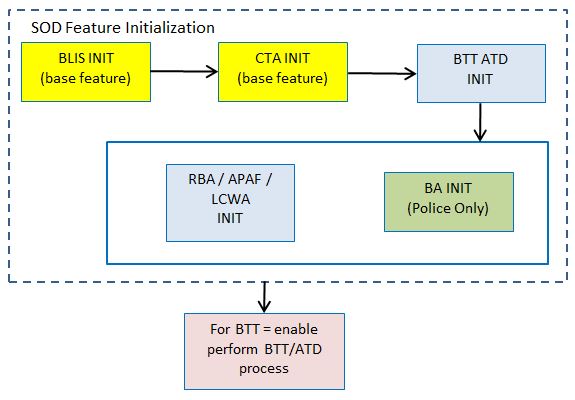
Initialization includes uP boot up, ADAS ECU internal initialization, self-test functions, CAN bus initialization, bulb prove-out initialization, and initial setting of feature ON/OFF settings.

### Side Feature Initialization

Figure 3.4.1-1 shows the sequence of Side feature initialization after uP boot up. BLIS and CTA features are base features and must initialize first. Then the features RCTB, and APA-F will occur in any order.

Upon initialization of the features, feature CAN signals reflect the ON/OFF ENABLE/DISABLE states of each feature for less trailer status. At power up post initialization, BTT processing must occur (if enabled) to detect trailer present. If a trailer is present BTT will modify the feature CAN signals appropriately. Note – by definition BTT processing is the BTT feature and not part of initialization but rather a BLIS mode.

Figure 3.4.1-1 Overview of Feature Initialization:



|  |  |
| --- | --- |
| R: 3.4.1.1 | The Side features shall be initialized in the following order:   1. BLIS then CTA 2. BTT 3. RCTB, APA\_F, BA (any order) 4. Exit initialization and if BTT is enabled activate BTT processing |

#### Running Reset

NOTE – Modules that meet SDS EC-0043, Power Drop Out, are not required to have a running reset power drop software; section 3.4.1 would not apply. For all other modules this section applies.

A running reset will be defined as a power drop out which causes the ADAS ECU uP to reset during normal engine running conditions as specified in EC-0043.

|  |  |
| --- | --- |
| **R:3.4.1.1.1** | The ADAS ECU shall contain logic to sense that a running reset has occurred.  A recommended method to do so is:  After ADAS ECU power up:  Read the vehicle speed CAN signals **Veh\_V\_ActEng** and **VehVActEng\_D\_Qf** defined in section 3.7.1.3.  If **VehVActEng\_D\_Qf** = 0 | 1, update the internal signal **isig\_RunningReset** = FALSE & exit running reset processing. *Note – If the QF indicates an unstable vehicle speed (0 | 1) it can be assumed that the event is a key ignition power up and not a running reset.*  If **VehVActEng\_D\_Qf** = 2 | 3, read **isig\_Veh\_Speed**.  If  **isig\_Veh\_Speed** >= 15 kph / update **isig\_RunningReset** = TRUE and increment  running reset DID counter.  Else / update **isig\_RunningReset** = FALSE.  Exit Running Reset state.  *Note – if vehicle speed is > 15 kph, it is assumed a running reset has occurred. PRNDL information should not be considered since a PRNDL approach will not work for manual transmission.*  *An alternative approach may be used by the supplier but must be reviewed and approved by SOD Core and Ford Software Groups.* |
| **R: 3.4.1.1.2** | Upon detection that a running reset has occurred the IPMA\_ADAS shall increment a running reset DID counter defined in R: 9.4, bulb proveout shall be inhibited per Bulb Prove-Out state diagram, and **isig\_Ignition\_Stable** shall be set to TRUE excluding the 1000 msec settling time as defined in section 3.7.1.1. |
| **R: 3.4.1.1.3** | Running Reset DID counters shall count running resets regardless of the **SodX\_D\_Stat** or **CtaX\_D\_Stat** state of the module (regardless if the feature is ON/OFF/enabled/disabled). |

#### Power Up Initialization: Hardware, BLIS, CTA, and Bulb Proveout

This section contains the initialization requirements for hardware, BLIS, CTA, and Bulb Proveout.

ADAS ECU will govern its ON/OFF state for CTA and BLIS at initialization and inform the the Cluster of its state at power up. During initialization Side Features will ignore Cluster On/Off state change commands. This behavior is necessary because Cluster does not retain last remembered states of features. BLIS and CTA features can be independently set to ON or OFF and independently set to ENABLE or DISABLE.

***IMPORTANT DEFINITION:*** *Within this specification there is a difference between the words ON/OFF and ENABLE/DISABLE.*

*ON/OFF – this is a customer commanded operation or directed by another module. Each feature’s ON/OFF is either default ON at power up or Last Remembered.*

*ENABLE/DISABLE – This is a Method II setting that enables or disabled a feature.*

|  |  |  |
| --- | --- | --- |
| **Reqmnt #** | State change | **Requirement** |
| **R: 3.4.1.2.1** | n/a | The hardware, Side determination, BLIS, and CTA power up initialization is defined in State Diagram 3.4.1.2 – 1. |
| **R: 3.4.1.2.2** | n/a | At key cycle power up initialization the ADAS shall not accept the **Sod\_D\_Rq** and **Cta\_D\_Rq** CAN signal values sent from the cluster for the first 2000 milliseconds after powering up the ADAS ECU. . This is required because the Cluster does not store BLIS nor CTA ON/OFF states in NVM but relies on the ADAS ECU to retain this information. Refer to section 3.5.2 On/Off processing for Cluster interface details. |
| **R: 3.4.1.2.3** | State 1 | At ADAS ECU RUN/STARTboot up.   1. Based on LH / RH Drive vehicle global parameter SYS\_CONFIG\_LHRHDRIVE the DDCU and PDCU CAN node IDs shall be set up as detailed in section 3.2.3.   *Note – Node IDs are required prior to CAN initialization in State 2.* |
| **R: 3.4.1.2.4** | 1->2.1 | State 1 complete. |
| **R: 3.4.1.2.5** | State 2 | ADAS shall initialize CAN communication per Netcom requirements within 250 msec. Feature ON/OFF settings may be re-adjusted during individual feature initialization. This is because Side feature specific initialization will require CAN data from other modules that may not be settled until after the vehicle CAN initialization phase.  ADAS shall load internal signals (**isig**) from vehicle CAN signals, configurations, and internal last remembered flags. |
| **R: 3.4.1.2.6** | 2->3.1 | State 2 complete. |
| **R: 3.4.1.2.7** | State 3 | Perform Running Reset processing as detailed in section 3.4.1.1. |
| **R: 3.4.1.2.8** | 3->4.1 | State 3 complete. |
| **R: 3.4.1.2.9** | 3->7.1 | BLIS DISABLED |
| **R: 3.4.1.2.10** | 3->5.1 | BLIS off |
| **R: 3.4.1.2.11** | 3->6.1 | BLIS on |
| **R: 3.4.1.2.12** | 5->6.1 | My Key (refer to section 3.7.1.10 for MyKey processing)  If **isig\_My\_Key** = TRUE then BLIS = ON |
| **R: 3.4.1.2.13** | 6->5.1 | Trailer processing for BTT disabled (refer to section 3.7.1.5.1 for Trailer Tow processing)  Trailer connect detected for BTT = DISABLED. |
| **R: 3.4.1.2.14** | 4->8.1 | Upon completion of power up initialization of BLIS, proceed to CTA power up initialization. |
| **R: 3.4.1.2.15** | 4->10.1 | CTA disable |
| **R: 3.4.1.2.16** | 4->9.1 | CTA on. CTA shall default to ON at power up less running reset. For a running reset CTA shall be set per the Cluster commanded CAN signal **CTA\_D\_Rq**. |
| **R: 3.4.1.2.17** | 9->11.1 | Trailer processing for BTT disabled (refer to section 3.7.1.5.1 for Trailer Tow processing).  Trailer connect detected for BTT = DISABLED. |
| **R: 3.4.1.2.18** | 4->11.1 | CTA shall resume to the OFF state upon a running reset and the Cluster commanded CAN signal **CTAX\_D\_Rq** = OFF. |
| **R: 3.4.1.2.19** | 8->12 | Go to BTT initialization. It is necessary to initialize BTT next because at power up a BTT process must take place and the output of the BTT process can influence feature initialization. |
| **R: 3.4.1.2.19.1** |  | **CTA shall be functional no later than 1000ms after power on reset** |
| **R: 3.4.1.2.19.2** |  | After a running reset, CTA shall follow **Cta\_D\_Rq** for OFF or ON state. If **Cta\_D\_Rq** is not on or off (i.e. Unkown or no selection made) then CTA shall default to ON (provided CTA is ENABLED is Method II). |

Figure 3.4.1.2-1: Hardware/BLIS/CTA Initialization State Diagram



Bulb Prove-Out State Diagram:

|  |  |  |
| --- | --- | --- |
| **R: 3.4.1.2.20** | Reset->90.1 | Reset |
| **R: 3.4.1.2.21** | 90->91.1 |  |
| **R: 3.4.1.2.22** | 90->92.1 | Manual transmission BPO enable |
| **R: 3.4.1.2.23** | 90->fault | Exit upon DTC |
| **R: 3.4.1.2.24** | 90->92.2 | Automatic transmission BPO enable |
| **R: 3.4.1.2.25** | State 92 | Initiate BPO. LED illumination shall be at daytime illumination. Set **SodAlrtX\_D\_Stat** = Bulb Prove Out.  If SYS\_CONFIG\_DCU = 00 illuminate the hardwire LED to ON. |
| **R: 3.4.1.2.26** | 92->93.1 | BPO outputs are active for 3 +/- 0.25 seconds. If the SOD is configured for DCU then the hardwire bulb prove-out shall not be activated; only the CAN signal. The DCUs (section 8) shall illuminate the LED for 3 +/- 0.25 seconds upon the receipt of **SodAlrtX\_D\_Stat** transition to bulb prove-out regardless of how long **SodAlrtX\_D\_Stat** is set equal to bulb prove-out.  A timer does not appear in the state diagram. This is because BPO is initiated only and other processes shall not be on hold during the 3 sec bulb prove-out. |
| **R: 3.4.1.2.27** | State 93 | For SYS\_CONFIG\_DCU = 00, ADAS shall perform the LED ON self-test diagnostics portion.  For SYS\_CONFIG\_DCU = 01, Passenger Side shall perform the LED ON self-test diagnostics portion. Passenger side SOD is a function of SYS\_CONFIG\_LHRHDRIVE. The driver side LED diagnostics shall be performed by the DCU per section 8.  For SYS\_CONFIG\_DCU = 10, Driver Side shall perform the LED ON self-test diagnostics portion. Driver side SOD is a function of SYS\_CONFIG\_LHRHDRIVE.  The passenger side LED diagnostics shall be performed by the DCU per section 8.  For SYS\_CONFIG\_DCU = 11, both LED diagnostics shall be run by the DCUs. DCUs run LED test so SOD exits BPO.  Exit the BPO routine and continue processing. |
| **R: 3.4.1.2.28** | Post State 93 | When the 3 second BPO timer expires, **SodAlrtX\_D\_Stat** = OFF and thereafter set the CAN message according to BLIS alert status. |

Figure 3.4.1.2-2: Bulb prove-out State Diagram:



#### BTT Initialization

BTT will be initialized after BLIS and CTA are initialized but prior ot the initialization of all other features. This is necessary because BTT initialization can impact the initialization of other features.

If the vehicle is equipped with BTT then BTT will be enabled at the Ford Assembly Plant. When enabled, BTT will be on when BLIS is on.

|  |  |  |
| --- | --- | --- |
| Req # | State Change | **Requirement** |
| R: 3.4.1.3.1 | n/a | BTT shall follow the BLIS ON/OFF Cluster CAN signal command **Sod\_D\_Rq**. However, at power up **Sod\_D\_Rq** is ignored until the 3 second bulb prove out timer is complete. This process is explained in detail in section 3.5.2 Feature Cluster Interface.  The Cluster BLIS/BTT ON/OFF command **Sod\_D\_Rq** is not used in BTT initialization. |
| R: 3.4.1.3.2 | n/a | BTT shall examine internal signals **isig\_BTT\_Last\_Rem, isig\_BTT\_Temp\_Rem,** **isig\_BLIS\_Last\_Rem, isig\_TBM, isig\_TLM**, and BTT configurations to initially set **BttX\_D\_Stat.** |
| R: 3.4.1.3.3 | n/a | The BTT ON/OFF state shall be written to nonvolatile memory to become the BTT on/off setting for the next key cycle. This last remembered state will be referred to as internal signal **isig\_BTT\_Last\_Rem**. The **isig\_BTT\_Last\_Rem** shall contain one of the states:  00 – OFF  01 – OFF TEMP  10 – ON  11 – DISABLE |
| R: 3.4.1.3.4 | n/a | If the MyKey CAN signal **IgnKeyType\_D\_Actl** is TRUE, BLIS is forced to ON and BTT shall also be forced to an ON state unless BTT was DISABLED. While **IgnKeyType\_D\_Actl** = TRUE BTT shall use a non NVM BTT last remembered variable **isig\_BTT\_Temp\_Rem** in place of **isig\_BTT\_Last\_Rem** for that key cycle. **Isig\_BTT\_Last\_Rem** shall remain untouched from the previous key cycle. Values for **isig\_BTT\_Temp\_Rem** are:  00 – *not used*  01 – OFF TEMP  10 – ON  11 –DISABLE  For MyKey TRUE, **isig\_BTT\_Last\_Rem** shall map to **isig\_BTT\_Temp\_Rem** per Table 3.4.2-1.  *Note: On the next key cycle, BTT will use* ***isig\_BTT\_Last\_Rem*** *pending the* ***IgnKeyType\_D\_Actl*** *state is FALSE.* |
| R: 3.4.1.3.5 | 11->13.1 | BTT disabled. |
| R: 3.4.1.3.6 | 11->14.1 | For BTT enabled, BTT shall initially set **BTTX\_D\_Stat** = Not Determined and read internal signals BLIS and BTT last remembered states. |
| R: 3.4.1.3.7 | 14->15.1 | BTT OFF state. |
| R: 3.4.1.3.8 | 15->16.1 | During initialization only MyKey shall cause BTT to exit the BTT off state. Refer to R:3.4.1.3.4 for details |
| R: 3.4.1.3.9 | 14->16.1 | Enter BTT ON initialization. |
| R: 3.4.1.3.10 | 16->17.1 | **Isig\_BTT\_Last\_Rem** = OFF TEMP. |
| R: 3.4.1.3.11 | 16->18.1 | Trailer Connected. During initialization trailer connect shall be determined by isig\_TRAILER |
| R: 3.4.1.3.12 | 16->19.1 | Trailer Not Connect. Trailer not connect status shall be determined from isig\_TRAILER. |
| R: 3.4.1.3.13 | 16->20 | With the deletion of Auto Trailer Detect state 20 is no longer used. |
| R; 3.4.1.3.14 | State 12 EXIT | BTT Init Exit. BTT will not do a request for trailer data at BTT initialization. Initialization will continue. |

Table 4.3.2-1 isig\_BTT\_Last\_Rem Maping to isig\_BTT\_Temp\_Rem

|  |  |  |
| --- | --- | --- |
| isig\_BTT\_Last\_Rem | isig\_BTT\_Temp\_Rem | Description |
| OFF | ON | MyKey forces BTT = ON |
| OFF TEMP | OFF TEMP | Post BTT initialization with MyKey TRUE isig\_BTT\_Temp\_Rem will equal OFF TEMP per BTT initialization. |
| ON | ON | 1 to 1 map |
| DISABLE | DISABLE | 1 to 1 map |



#### BA Boundary Alert Initialization

|  |  |
| --- | --- |
| R: 3.4.1.4.1 | The Boundary Alert feature shall be initialized after BTT initialization. For specific intiization requirements reference the Boundary Alert Functional Requirements Specification. |

#### RCTB Initialization

When CTA is ON, RCTB ON/OFF state is determined by monitoring the Rba\_D\_Stat\_Intern CAN signal from the IPMB module.

The ADAS sends its RBA model output on CAN via RbaCtaX\_D\_Stat

|  |  |  |
| --- | --- | --- |
| R: 3.4.1.5.1 | 30 | During power up, SOD Shall initialize RBA after BTT initialization is complete. |
| R: 3.4.1.5.2 | ->31.1 | RCTB initializes to ON |
| R: 3.4.1.5.3 | ->33.1 | RCTB OFF (including trailer tow off) |
| R: 3.4.1.5.4 | ->32.1 | RCTB Disabled |
| R: 3.4.1.5.6 |  | RCTB shall be functional no later than 1000ms after power on reset (Key on cycle) |

Figure 3.4.1.5-1: RCTB (RBA) Power up Initialiazation State Diagram:

### Side Features Modes of Operation

After power up initialization the system will establish the proper modes of operation.

For this section reference the attachment DAT2.1 SIDE FEATURE MODE CHART. The MODE column below references the numbers in the attachment. Note that the DAT2.1 SIDE FEATURE MODE CHART is not a state diagram.

|  |  |  |
| --- | --- | --- |
| Req Number | MODE | Requirements |
| R.3.4.2.5 | 1  1.1  1.4 | When power up initialization is complete, ADAS shall enter CTA STANDBY and if RCTB is enabled ADAS shall enter RCTB STANDBY, CTA and RCTB shall function in parallel. |
| R.3.4.2.6 | 1.1 to 1.2 | CTA enters NOT REPORTING if CTA is ENABLED, and the system isn’t FAULTED or BLOCKED. RCTB shall equal STANDBY for CTA = STANDBY | NOT REPORTING |
| R.3.4.2.7 | 1.2 to 1.3 | When the **isig\_Transmission\_Status** transitions to REVERSE and DVR\_SELECT\_STAT = OK the system shall enter CTA REPORTING by a delay time equal to the global parameter REVERSE\_DEBOUNCE\_TIME ms after the transition to REVERSE. |
| R.3.4.2.8 | 1.3 to 1.2 | Transition back to CTA NOT REPORTING. |
| R.3.4.2.9 | 1.2 to 1.1  1.3 to 1.1 | Transitions which force CTA STANDBY. |
| R.3.4.2.10 | 1.4 to 1.5 | When the **isig\_Transmission\_Status** transitions to REVERSE & DVR\_SELECT\_STAT = OK & **isig\_Vehicle\_Direction** = REVERSE and other RCTB factors are set & CTA submode = REPORTING the system shall enter RCTB REPORTING.  For detailed RCTB transition parameters see section 3.7.11.  RCTB REPORTING runs parallel with CTA REPORTING but CTA REPORTING can run with RCTB = STANDBY. |
| R.3.4.2.11 | 1.3.1 to 1.4 | RCTB REPORTING shall transition to RCTB STANDBY when  CTA mode exits CTA REPORTING or per the RCTB mode processing described in section 3.7.11. |
| R.3.4.2.12 | 1 | For modes (CTA NOT REPORTING | (CTA NOT REPORTING & RCTB STANDBY)) & CTA REPORTING which includes RCTB REPORTING, CTA and RCTB targets shall be processed for threats. Target alerting is allowed in CTA REPORTING and RCTB REPORTING only. |
| R.3.4.2.13 | 1 to 2, 4, 6 | For **isig\_Transmission\_Status** = DRIVE CTA and RCTB shall remain in NOT REPORTING until the forward speed of global parameter CTA\_TO\_BSM\_TRANSITION\_SPEED has been reached.  BLIS STANDBY submode is entered. If APAF is enabled the system shall enter APA-F mode also. BLIS and APA-F, and LCWA function in parallel. |
| R.3.4.2.14 | 2.1 to 2.2 | For BLIS enabled and on, ADAS shall transition to BLIS NOT REPORTING |
| R.3.4.2.15 | 2.1 to 2.2 to 2.3  2.3 to 2.2 | BLIS transitions through NOT REPORT to REPORTING for BLIS = ON and NOT BLOCKED and the vehicle speed reaches the global parameter MinSpeed Threshold Hysteresis Upper. BLIS shall transition back to NOT REPORTING based on the minimum speed threshold MinSpeed Threshold Hysteresis Lower.  MinSpeed Threshold Hysteresis Upper and MinSpeed Threshold Hysteresis Lower form a hysteresis about a speed threshold for activating BLIS alerting. |
| R.3.4.2.16 | 2.3 to 2.1  2.2 to 2.1  3 to 2.1 | Transitions to STANDBY |
| R.3.4.2.17 | 1 | For modes BLIS NOT REPORTING, BLIS REPORTING, and BTT, BLIS targets shall be processed for threats. Target alerting is allowed in BLIS REPORTING only. |
| R.3.4.2.18 | 2.3.1 to 2.3.2 | Blockage processing occurs in both BLIS NOT REPORTING and REPORTING submodes. When blocked BLIS is NOT REPORTING but continues to process to search for unblocked. |
| R.3.4.2.19 | 2 to 1 | BLIS mode exit. |
| R.3.4.2.20 | 3 | If BTT is ENABLED, BTT trailer detection modes of operation shall be defined per BTT Processing, section 3.5. BTT mode runs parallel to BLIS mode and certain BTT attributes also run parallel to CTA.  *Note – Although the base algo for BTT is BLIS, BTT trailer detection features and logic determination function outside of BLIS.* |
| R.3.4.2.21 | * 1. to 5   2. to 5 | BA shall function independent of CTA enable/sidable status. |
| R.3.4.2.22 | 5 to 1,2 | Exit BA. |
| R.3.4.2.23 |  | Transitions between initialization complete and any mode transitions shall settle within 600msec. |
| R.3.4.2.24 |  | ADAS shall transmit the CAN signal **SodinnrX\_D\_Stat** and **CtainnrX\_D\_Stat** as defined in Tables 3.4.2-1 and 3.4.2-2. This CAN signal shall be used for engineering test and system diagnostics. |

Table 3.4.2-1 SodinnrX\_D\_Stat Signal Description

|  |  |  |
| --- | --- | --- |
| SodinnrX\_D\_Stat\_Intern | VALUE | Definition |
| BLIS Initializing | 0x0 | The system is initializing during system power up |
| **BLIS System Standby** | 0x1 | Submode 2.1 |
| **BLIS Not Reporting** | 0x2 | Submode 2.2 |
| **BLIS Reporting** | 0x3 | Submode 2.3 |

Table 3.4.2-2 CtainnrX\_D\_Stat Signal Description

|  |  |  |
| --- | --- | --- |
| SodinnrX\_D\_Stat\_Intern | VALUE | Definition |
| CTA Initializing | 0x0 | The system is initializing during system power up |
| **CTA System Standby** | 0x1 | Submode 1.1 |
| **CTA Not Reporting** | 0x2 | Submode 1.2 |
| **CTA Reporting** | 0x3 | Submode 1.3 |

## Side Features Enable/Disable and On/Off Interface

This section describes post module configuration ENABLE/DISABLE relationships, post power up ON/OFF relationships of the following Side features, and the HMI control: BLIS, CTA, BTT, RCTB.

The HMI controller of the Enable/Disable states is Method II programing which is primarily covered in the configuration section 3.2. There is an exception for BTT.

The Center Stack Display is the primary HMI controller of the ON/OFF states of BLIS and CTA. BLIS and CTA are base features. Disabling or turning base features ON or OFF will impact other features. The Cluster – BLIS/CTA interface is defined in this section. The detailed Cluster interface defined for Driver Information is in section 7.

### Enable/Disable Feature Dependencies

|  |  |
| --- | --- |
| R: 3.5.1.1 | BLIS is the base feature for BTT.  When BTT\_ENABLE\_DISABLE = ENABLE and BLIS\_ENABLE\_DISABLE is set to DISABLE, BTT shall go into STANDBY MODE and BTT\_ENABLE\_DISABLE status shall remain unchanged.  BTT shall resume normal operation when BLIS\_ENABLE\_DISABLE is set back to ENABLED and BTT\_ENABLE\_DISABLE = ENABLE  The ADAS ECU shall not reject Method II configuration nor send a negative response code if BLIS\_ENABLE\_DISABLE = DISABLE and BTT\_ENABLE\_DISABLE = ENABLE |
| R: 3.5.1.2 | Reserved |
| R: 3.5.1.3 | CTA is the base feature for RCTB  When RbaEnable\_Cfg = (RBA or **CTAwBrk)** and CTA\_ENABLE\_DISABLE is set to DISABLE, then RCTB shall go into STANDBY MODE and Shall NOT Request Braking. RbaEnable\_Cfg status shall remain unchanged.  RCTB (RBA) shall resume normal operation when CTA\_ENABLE\_DISABLE is set back to ENABLED and RbaEnable\_Cfg = (RBA or **CTAwBrk)**  The ADAS ECU shall not reject Method II configuration and shall not send a negative response code if CTA\_ENABLE\_DISABLE = DISABLE and RbaEnable\_Cfg = (RBA or **CTAwBrk)** |
| R: 3.5.1.4 | RESERVED |
| R: 3.5.1.5 | RESERVED |
| R: 3.5.1.6 | RESERVED |
| R: 3.5.1.7 | When a feature is DISABLED that feature shall ignore any CAN signal that has the ability to modify the ON/OFF state of that feature. |
| R: 3.5.1.8 | ***BLIS Disable CAN Signals***  When BLIS\_ENABLE\_DISABLE = DISABLE, BLIS shall set the CAN signal **SodX\_D\_Stat** = DISABLED, **SodAlrtX\_D\_Stat** = LAMP OFF, and BLIS shall not activate the LED. |
| R: 3.5.1.9 | ***BLIS Enable CAN Signals***  When BLIS\_ENABLE\_DISABLE -> ENABLE, BLIS shall set the CAN signal **SodX\_D\_Stat** = ON, and**SodAlrtX\_D\_Stat** = OFF. If configured for hardwire LED then the SODX shall keep the hardwire LED OFF.  Then perform the BLIS power up initialization in section 3.4 then set **SodX\_D\_Stat** = **Sod\_D\_Rq** |
| R: 3.5.1.10 | ***BTT Disable CAN Signals***  When BTT\_ENABLE\_DISABLE = DISABLE | (BTT\_ENABLE\_DISABLE = ENABLE & BLIS\_ENABLE\_DISABLE -> DISABLE), associated BTT CAN signals and internal signals shall be set as follows:  **BttX\_D\_Stat** = DISABLE  **BttX\_D\_RqDrv** = NO REQUEST  **isig\_BTT\_Last\_Rem** = DISABLE  **isig\_BTT\_Temp\_Rem** = DISABLE  **isig\_TFLAG\_Last\_Rem** = FALSE  *Note: For BTT enabled and BLIS changes to disable, BTT will follow BLIS via BTT CAN signals and appear to be disabled.* |
| R: 3.5.1.11 | ***BTT Enable CAN Signals***  When (BLIS\_ENABLE\_DISABLE -> ENABLED & BTT\_ENABLE\_DISABLE = ENABLE) | ( BTT\_ENABLE\_DISABLE -> ENABLED & BLIS\_ENABLE\_DISABLE = ENABLE) BTT shall assume the ON state and set the following CAN signal and internal signal values as follows:  **BttX\_D\_Stat** = NOT DETERMINED  **BttX\_D\_RqDrv** = NO REQUEST  **isig\_BTT\_Last\_Rem** = ON  **isig\_BTT\_Temp\_Rem** = ON  **isig\_TFLAG\_Last\_Rem** = FALSE  Next perform the BTT power up initialization in section 3.4.1.3.  Next set **BttX\_D\_Stat** per R:3.5.4.1.  Next go through the BTT process in section 3.7.1.5.4. |
| R: 3.5.1.12 | ***Reserve*** |
| R: 3.5.1.13 | ***Reserve*** |
| R: 3.5.1.14 | Reserve |
| R: 3.5.1.15 | Reserve |
| R: 3.5.1.16 | ***CTA Disable CAN Signals***  When CTA\_ENABLE\_DISABLE = DISABLE, Side radarX shall set the CAN signal as follows:  **CtaX\_D\_Stat** = DISABLED  **CtaAlrtX\_D\_Stat** = OFF  **CtaAlrt2X\_D\_Stat** = OFF |
| R: 3.5.1.17 | ***CTA Enable CAN Signals***  When CTA\_ENABLE\_DISABLE -> ENABLE, ADAS shall set the CAN signal as follows:  **CtaX\_D\_Stat** = ON  **CtaAlrtX\_D\_Stat** = OFF  **CtaAlrt2X\_D\_Stat** = OFF  Then perform the CTA power up initialization in section 3.4 then set **CtaX\_D\_Stat** = **Cta\_D\_Rq** |
| R: 3.5.1.18 | ***RCTB Disable CAN Signals***  When RbaEnable\_Cfg-> DISABLED | RPAwBRK, ADAS shall set the CAN signal as follows:  **CtaXBrkDecel\_B\_Rq** = DISABLE  **CtaXBrkEnbl\_B\_Rq** = DISABLE  And the internal signal:  **RbaCtaX\_D\_Stat\_Intern =** DISABLE |
| R: 3.5.1.19 | ***RCTB Enable CAN Signals***  When RbaEnable\_Cfg ~~->~~ = (RBA or **CTAwBrk)**, ADAS will set the CAN signal as follows:  **CtaXBrkDecel\_B\_Rq** = DISABLE , temporarily  **CtaXBrkEnbl\_B\_Rq** = DISABLE , tomporarily    And the internal signal:  **RbaCtaX\_D\_Stat\_Intern** =ON  Then go through RCTB initialization process to determine the final status of **CtaXBrkDecel\_B\_Rq** and **CtaXBrkEnbl\_B\_Rq**. |
| R: 3.5.1.20 | BTT is the base feature for BTT5G.  BTT5G\_ENABLE\_DISABLE can only be set to ENABLE whend BTT\_ENABLE\_DISABLE is set to ENABLE.  If BTT5G is ENABLE and BTT transitions to OFF or DISABLE, BTT5G signals shall not be processed.  The ADAS ECU shall not reject Method II configuration nor send a negative response code if BTT\_ENABLE\_DISABLE = DISABLE and BTT5G\_ENABLE\_DISABLE = ENABLE. |

### Feature Cluster Interface

This section defines the Cluster CAN interface from the ADAS ECU perspective. The detailed Cluster BLIS/CTA interface for the Cluster is in section 7.

|  |  |
| --- | --- |
| **R: 3.5.2.1** | The Cluster HMI shall be capable of turning the base features BLIS and CTA ON or OFF using the cluster message center. The ON/OFF Cluster CAN signals that control BLIS and CTA are **Sod\_D\_Rq** and **Cta\_D\_Rq**. SODX shall read CAN signals **Sod\_D\_Rq** and **Cta\_D\_Rq**. |
| **R: 3.5.2.2** | For a key cycle power up ADAS shall ignore Cluster ON/OFF command signals **Sod\_D\_Rq** and **Cta\_D\_Rq** until after the 3 second Bulb Prove-Out timer. Three seconds after Power Up **Isig\_BLIS\_Last\_Rem** shall be modifiable by Cluster command **Sod\_D\_Rq** as specified in within this section.  BLIS/CTA shall not ignore Cluster ON/OFF CAN signals for a running reset as specified in section 3.4.  *Note: The Cluster does not retain Side feature ON/OFF settings over a key cycle but uses the Side features to set up the Cluster feature status menus at power up initialization. The Cluster will set up BLIS and CTA via CAN signals* ***SodX\_D\_Stat*** *and* ***CtaX\_D\_Stat*** |
| **R: 3.5.2.3** | BLIS/CTA shall handle the **Sod\_D\_Rq** = UNKNOWN and **Cta\_D\_Rq** = UNKNOWN as follows:  At key cycle power up and post initialization **Sod\_D\_Rq** = UNKNOWN and **Cta\_D\_Rq** = UNKNOWN and remain at these values until the customer causes an ON/OFF command transition via the message center for that specific feature. After a customer induced ON/OFF transition the Cluster **Sod\_D\_Rq** and/or **Cta\_D\_Rq** CAN signals will be set to ON or OFF. After that the **Sod\_D\_Rq** and/or **Cta\_D\_Rq** state shall indicate ON/OFF for the remainder of the key cycle.  *Note: For example, at power up ADAS sends* ***SodX\_D\_Stat*** *= ON but the Cluster will keep* ***Sod\_D\_Rq*** *= UNKNOWN. Then the customer turns BLIS to OFF. The Cluster will set* ***Sod\_D\_Rq*** *= OFF. From then on* ***Sod\_D\_Rq*** *will reflect the actual state of BLIS regardless the source of the BLIS ON/OFF command.*  *Note: For* ***Sod\_D\_Rq*** *and* ***Cta\_D\_Rq*** *UNKNOWN is equivalent to their .dbc file states NoDataExist (0x2) or Unused (0x3).* |
| **R: 3.5.2.4** | When the **Sod\_D\_Rq** or **Cta\_D\_Rq** signal is received by BLIS or CTA initiating an ON or OFF transition, the SODX shall respond with a confirmation of system state change via **SodX\_D\_Stat** or **CtaX\_D\_Stat** CAN signals. These CAN signals shall reflect the actual ON/OFF setting of the feature and not simply a command echo.  *Note – If a BLIS fault is detected see ON/OFF behavior in the Fault Processing section; requirements 3.7.10.11 and 3.7.10.12.* |
| **R: 3.5.2.5** | While **SodX\_D\_Stat** = TRAILER TOW OFF | DISABLE, SODX shall ignore **Sod\_D\_Rq** state change commands. |
| **R: 3.5.2.6** | While **CtaX\_D\_Stat** = TRAILER TOW OFF | DISABLE, SODX shall ignore **CtaX\_D\_Rq** state change commands. |
| **R: 3.5.2.7** | If **Sod\_D\_Rq** becomes missing, BLIS shall default to ON, **SODX\_D\_Stat** = ON, and proceed with normal operation. No BLIS fault shall be indicated (see Fault Processing section 3.7.10). |
| **R: 3.5.2.8** | If the **Cta\_D\_Rq** becomes missing, CTA shall default to ON and proceed with normal operation. No CTA fault shall be indicated (see Fault Processing section 3.7.10). |

### Base Feature On/Off

Base features BLIS and CTA ON/OFF control are specified within. These requirements assume BLIS and CTA are enabled and at post initialization.

|  |  |
| --- | --- |
| **R: 3.5.3.1** | When BLIS is OFF, **SodAlrtX\_D\_Stat** = OFF and if configured for HMI LED hardwire the hardwire LED shall not be activated for BLIS alerts.  When BLIS is ON, BLIS Alerts are allowed via **SodAlrtX\_D\_Stat** and LED hardwire. |
| **R: 3.5.3.2** | When CTA is OFF, **CtaAlrtX\_D\_Stat** and **CtaAlrtX2\_D\_Stat** shall equal OFF (0x0).  When CTA is ON, CTA alerts are allowed via **CtaAlrtX\_D\_Stat** = ON (02) and **CtaAlrtX2\_D\_Stat = AlertZone1 (0x1).** |
| **R: 3.5.3.3** | The BLIS or CTA feature shall be capable of being turned ON and OFF regardless of which mode the ADAS is in.  *Note: For example, if the ADAS is in CTA mode and the ADAS receives a* ***Sod\_D\_Rq*** *commanded state change (this is a BLIS feature on/off change), the ADAS will comply and set* ***SodX\_D\_Stat*** *appropriately.* |
| **R: 3.5.3.4** | For (**isig\_MY\_KEY** = FALSE & **isig\_TTM\_Cfg** = 0) | ( **isig\_TTM\_Cfg** <> 0 & **TrlrLampCnnct\_B\_Actl** & **TrlrBrkActCnnct\_B\_Actl** = NOT CONNECT)  BLIS shall be set to ON or OFF via **Sod\_D\_Rq**.  When the **Sod\_D\_Rq** signal is received by ADAS initiating an ON or OFF transition, the ADAS shall respond with a confirmation of system state change via **SodX\_D\_Stat** CAN signal. **SodX\_D\_Stat** shall reflect the actual ON/OFF setting and not simply a command echo. |
| **R: 3.5.3.5** | BLIS shall update **isig\_BLIS\_Last\_Rem** for **Sod\_D\_Rq** -> ON | **Sod\_D\_Rq** -> OFF. |
| **R: 3.5.3.6** | For (**isig\_MY\_KEY** = FALSE & **isig\_TTM\_Cfg** = 0) | ( **isig\_TTM\_Cfg** <> 0 & **TrlrLampCnnct\_B\_Actl** & **TrlrBrkActCnnct\_B\_Actl** = NOT CONNECT)  CTA shall be turned ON and OFF via the Instrument Cluster Message Center via CAN message **Cta\_D\_Rq**. When the **Cta\_D\_Rq** signal is received by ADAS initiating an ON or OFF transition, the ADAS shall respond with a confirmation of system state change via **CtaX\_D\_Stat** CAN signal. **CtaX\_D\_Stat** shall reflect the actual ON/OFF setting and not simply a command echo.  CTA is a default ON feature and defaults to ON at an ignition cycle. |
| **R: 3.5.3.7** | The Cluster shall command the BLIS ON/OFF customer command via the CAN signal **Sod\_D\_Rq**. The states are  hx0 (OFF); BLIS OFF  hx01 (BLIS ON Secondary Warning ON); BLIS ON  hx02 (BLIS ON Secondary Warning OFF); BLIS ON  hx03; unknown (no selection made)  *07Mar2019 NOTE 1:* Sod\_D\_Rq *definition for ON states was swapped in the Cluster. Originally 0x01 was unused but DI used it and did not use 0x02. This is opposite the CAN signal definition. So as to not cause a coordinated x-veh change in the cluster, the ADAS will use 0x01 and 0x02 is unused.*  *12APR2019 NOTE 2: It is OK to logically OR hx01 and hx02 for P702.* |

### 

### BTT Feature On/Off

These requirements assume BTT is enabled and at post initialization. Since BTT ON/OFF is controlled by BLIS ON/OFF section 3.5.4 is tied to section 3.5.3.

|  |  |
| --- | --- |
| **R: 3.5.4.1** | The BTT off state and on states shall follow BLIS ON/OFF. **Btt\_D\_Rq** CAN signal is no longer used. The BLIS ON/OFF status is indicated by **SodX\_D\_Stat**. The mapping between **SodX\_D\_Stat** and **BttX\_D\_Stat** is shown in table 3.5.4-1. |
| **R: 3.5.4.2** | If **SODX\_D\_Stat** -> OFF (**isig\_BLIS\_Last\_Rem** -> OFF),  **BttX\_D\_Stat** = OFF  **isig\_BTT\_Last\_Rem** = OFF  **isig\_TFLAG\_Last\_Rem** = FALSE  **BttX\_D\_RqDrv** = NO REQUEST  *Note: Setting BLIS to OFF via the Cluster menu will force BTT last remembered trailer status.* |
| **R: 3.5.4.3** | If **SodX\_D\_Stat** -> ON (**isig\_BLIS\_Last\_Rem** -> ON),  **BttX\_D\_Stat** = NOT DETERMINED  **isig\_BTT\_Last\_Rem** = ON  **isig\_TFLAG\_Last\_Rem** = FALSE  **BttX\_D\_RqDrv** = NO REQUEST  Next, BTT initialization shall be processed per section 3.4.  Next, Go through the BTT process in section 3.7.1.5.4. |
| **R: 3.5.4.4** | The **isig\_BTT\_Last\_Rem** shall be updatedas shown in Table 3.5.4-2.  The **isig\_BTT\_Last\_Rem** state of ON and OFFTEMP are actually both ON states. OFF TEMP is considered an ON state because BTT shall continue searching for trailer state change and automatically change the BTT state if a trailer is disconnected or valid trailer data is received from the Cluster.  *Note: The* ***isig\_TFLAG\_Last\_Rem*** *and* ***Btt\_L\_Actl2*** *is detailed in section 3.7.1.5.4* |
| **R: 3.5.4.5** | The BTT CAN signal **BttX\_D\_Stat** defines the actual BTT operating state as shown in Table 3.5.4-3. As depicted in column 3 of the table, the BTT feature shall run in the ON states and shall not run in the OFF or DISABLE states. |
| **R: 3.5.4.6** | If BTT5G is ENABLE and **Btt\_L2\_Actl2** is in state 0x7F, then the trailer type connected is conventional and **BTT\_L\_Actl2** shall be process for trailer length. See table 3.5.4-4. |
| **R: 3.5.4.7** | If BTT5G is ENABLE and **Btt\_L2\_Actl2** is in a valid state, then the trailer type is a 5th wheel or gooseneck and the CAN signals **Btt\_L2\_Actl2, SodAltX\_D2\_StatAft** shall be processed. See table 3.5.4-4. |
| **R: 3.5.4.8** | If BTT5G is DISABLE, only **BTT\_L\_Actl2** shall be processed. |
| **R: 3.5.4.9** | If BTT5G is ENABLE, **Btt\_L2\_Actl2** is in a valid state, and **SodAltX\_D2\_StatAft** signals are present, then **BTT5G\_Intern** is TRUE. |
| **R: 3.5.4.10** | If BTT5G is DISABLE or **Btt\_L2\_Actl2** is in state 0x7F, **BTT5G\_Intern** is FALSE. |
| **R: 3.5.4.11** | If BTT5G is ENABLE, **Btt\_L2\_Actl2** is in a valid state, and **SodAltX\_D2\_StatAft** signals are missing, then **BTT5G\_Intern** is FAULT. |

Table 3.5.4-1 Mapping of **SodX\_D\_Stat** ON/OFF to **BttX\_D\_Stat** ON/OFF

|  |  |  |
| --- | --- | --- |
| SodX\_D\_Stat | BttX\_D\_Stat | Definition |
| OFF | OFF | BTT is forced to OFF when BLIS is OFF |
| TRAILER TOW OFF | One of the ON states | BTT, if enabled, would have to have been ON previously to BLIS setting SodX\_D\_Stat to TRAILER TOW OFF. |
| ON | One of the ON states | BTT shall be in one of its ON states. Refer to Table 3.5.4-3. |
| DISABLE | DISABLE | BTT is forced to a temporary disable state. Section 3.5.1 for requriements. |
| - > OFF | - > OFF | BTT follows BLIS. |
| - > ON | NOT DETERMINED | R: 3.5.4.3. At the transition BTT has not yet processed its inputs. |
| ON | NOT DETERMINED | Set at initialization and for other reasons such as BLIS Fault. |

Table 3.5.4-2 Updates to **isig\_BTT\_Last\_Rem**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Inputs | | | | Output |
| BTT\_Enable\_ Disable | isig\_BLIS\_ Last\_Rem | TRAILER DATA | | isig\_BTT\_Last\_Rem |
| isig\_TFLAG\_Last\_Rem | Btt\_L\_Actl |
| DISABLE | Don’t Care | Don’t Care | Don’t Care | DISABLE |
| ->ENABLE | OFF | Don’t Care | Don’t Care | OFF |
| ENABLE | OFF | Don’t Care | Don’t Care | OFF |
| ENABLE | ON | -> 0 | Don’t Care | ON |
| ENABLE | ON | -> 1 | UNKNOWN | OFF TEMP |
| ENABLE | ON | -> 1 | Valid Length | ON |
| ENABLE | ON | -> 1 | Invalid Length | OFF TEMP |
| ENABLE | ON | 0 | Don’t Care | ON |
| ENABLE | ON | 1 | UNKNOWN / INVALID | OFF TEMP |
| ENABLE | ON | 1 | Valid Length | ON |
| ENABLE | -> ON | 0 | Don’t Care | ON |
| ENABLE | -> ON | 1 | UNKNOWN | *Not allowed* |
| ENABLE | -> ON | 1 | Valid Length | *Not allowed* |
| ENABLE | -> ON | 1 | Invalid Length | *Not allowed* |

Table 3.5.4-3 BTT states of **BttX\_D\_Stat**

|  |  |  |
| --- | --- | --- |
| BTT on/off system state | BttX\_D\_Stat  Name | Definition |
| OFF | DISABLE | Disabled per VSCS <OR> forced disabled due to BLIS going DISABLED. |
| OFF | OFF | BLISI Cluster commanded off. BTT shall halt processing until Cluster commands BLIS ON. |
| ON | CONNECT | BTT processing detected a trailer attached. |
| ON | PENDING | BTT processing is searching for a trailer. |
| ON | NOT CONNECT | BTT processing detected no trailer attached. |
| ON | OFF TEMP | Cluster trailer data is invalid <OR> BTT requested trailer data and did not receive data.  BLIS and CTA shall transition to TRAILER TOW OFF. |
| ON | NOT DETERMINED | Set at initialization and BLIS transition to enable or on. |
| ON | BTT5GFAULT | For BTT5G enabled only. Used to indicate a trailer aftermarket radar fault. |

Table 3.5.4-4 **Btt\_L\_Actl2** and **Btt\_L2\_Actl2** possible input states

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trailer TYPE** | **BTT\_L\_Actl2** | **Btt\_L2\_Actl2** | **SodAltX\_D2\_StatAft** | **BTT5G State in ADAS-SOD** |
| Conventional | Valid (3-33ft) | 0x7F – Invalid | Don’t Care | BTT5G OFF |
| Conventional | 0x7E – No Data | 0x7F – Invalid | Don’t Care | BTT5G OFF |
| 5th Wheel or Gooseneck | Don’t Care | Valid (20-50ft) | Active (01 or 02) || Standby (00) | BTT5G ON |
| 5th Wheel or Gooseneck | Don’t Care | Valid (20-50ft) | MISSING CAN || Fault (03) | BTT5G FAULT |
| 5th Wheel or Gooseneck | 0x7F - Invalid | 0x7E – No Data | Don’t Care | BTT5G OFF |
| Unknown | 0x7F - Invalid | 0x7F - Invalid | Don’t Care | BTT5G OFF |
| Unknown | 0x7E – No Data | 0x7E – No Data | Don’t Care | BTT5G OFF |

### RESERVE

### Rear Cross Traffic Braking RCTB/RBA Feature On/Off

These requirements are post initialization:

|  |  |
| --- | --- |
| **R: 3.5.6.1** | The RCTB/RBA feature is commanded to ON/OFF by the ADAS ECU via the internal signal **Rba\_D\_Stat\_Intern.** The states of **Rba\_D\_Stat\_Intern** are:  1. ON state: The system is active (reporting) and SODX RCTB braking request is possible if other vehicle and environment conditions are met and no system faults exist.  2. OFF state: The feature is not active (not reporting) and SODX RCTB braking requests are suspended.  3. Disabled State: Feature is disabled via Method II.  The states of **Rba\_D\_Stat\_Intern** shallbe used by the SOD as described in section 3.7.11. |
| **R: 3.5.6.2** | The RBA Controller (Camera)fault status is communicated to the ADAS ECU via the CAN signal **RBAsys\_D\_Stat\_Intern.**  The states of **RBAsys\_D\_Stat\_Intern shall** be used by the ADAS ECU as described in section 3.7.11. |
| **R: 3.5.6.3** | RCTB feature shall be ON when :  CTA\_ENABLE\_DISABLE = ENABLE &  RbaEnable\_Cfg = (RBA or **CTAwBrk)** &  **CtaX\_D\_Stat** = ON &  **Rba\_D\_Stat\_Intern** = ON |
| **R: 3.5.6.4** | When **Rba\_D\_Stat\_Intern** = OFF , the SOD RCTB CAN signals shall be set as follows:  **CtaXBrkDecel\_B\_Rq** = DISABLE  **CtaXBrkEnbl\_B\_Rq** = DISABLE  and the internal signal:  **RbaCtaX\_D\_Stat\_Intern** =OFF |
| **R: 3.5.6.5** | When **Rba\_D\_Stat\_Intern** = ON, the SOD RCTB CAN signals shall be set per requirement section 3.7.11. |

### Reserved

## RESERVED

## Side Features INPUT / OUTPUT PROCESSING

### Vehicle Network Input Processing

The BLIS CTA utilizes several inputs for system operation. The inputs are listed in the appendix, and any input processing, if needed, is detailed in section 3.7.1.

#### Ignition Switch

The ignition switch CAN signal is **Ignition\_Status** and is event/periodic with a periodic rate of 1000msec. Although RUN/START power initializes BLIS/CTA, the **Ignition\_Status** CAN signal determines vehicle system stabilization and is an enabler for diagnostics and bulb prove-out.

Since SOD is on RUN/START it could be assumed that **Ignition\_Status** would always be seen as equal to RUN or START. However, due to race conditions it is possible for **Ignition\_Status** to be equal to states other than RUN and START.

|  |  |
| --- | --- |
| R: 3.7.1.1.1 | Any state change of **Ignition\_Switch** will not be stable until 1000 msec after the state change. BLIS/CTA shall generate an internal signal **isig\_Ignition\_Stable** which shall be equivalent to the time **Ignition\_Status** state change is received plus 1000 msec. Until the 1000 msec has passed, **isig\_Ignition\_Stable** shall equal the last stable state. |
| **R: 3.7.1.1.2** | At BLIS/CTA initial power up, Ignition Stable shall equal the first **Ignition\_Status** CAN signal after the 1000 msec stabilization time. Prior to the 1000 msec stabilization time, **isig\_Ignition\_Stable** shall equal NOT RUN.  There is one exception where **isig\_Ignition\_Stable** becomes equal to the new **Ignition\_Switch** state less the 1000 msec stabilization time and this is for a running reset as specified in section 3.4.1. |
| **R: 3.7.1.1.3** | **Ignition\_Status** CAN signal values are listed in Table 3.7.1. The Ignition Stable shall be equal to the value specified in the table.  *Note: The* ***Ignition\_Status*** *CAN signal will not change states during a Start/Stop event.*  *Note: The* ***isig\_Ignition\_Stable*** *is used as the enabler in Fault Processing, section 3.7.1.10.* |
| **R: 3.7.1.1.4** | Reserved |
| **R: 3.7.1.1.5** | **Ignition\_Status** shall be set to missing after 5 seconds. Invalid is equivalent to missing. If Ignition\_Status is set to missing BLIS/CTA shall set Ignition Stable to NOT RUN, set an Ignition\_Status DID, and continue to operate BLIS and CTA in normal operation. Therefore, when missing/invalid assume MC\_CAN Ignition Status in table 3.7.1 is NOT RUN. |

Table 3.7.1 Ignition Stable

|  |  |  |  |
| --- | --- | --- | --- |
| INPUTS | | | OUTPUT |
| MC\_CAN Ignition\_Status | MS CAN state encoded value | + 1000 msec after transition | Isig\_Ignition\_Stable |
| Unknown | 0x0 | + 1000 | RUN |
| Off | 0x1 | + 1000 | NOT RUN |
| Accessory | 0x2 | + 1000 | NOT RUN |
| Run | 0x4 | + 1000 | RUN |
| Start | 0x8 | + 1000 | START |
| Invalid | 0x15 | + 1000 | NOT RUN |
| Missing | n/a | + 1000 | NOT RUN |

NOTE – UNKNOWN equating to isig\_Ignition\_Stable=RUN is justifiable because for BLIS/CTA to even see the CAN Ignition\_Status signal the RUN/START power circuit must be active and for the RUN/START power line to be active the Ignition MUST be in RUN/START.

#### Reserved

#### Vehicle Speed

The BLIS/CTA/RCTB features receives two vehicle speed periodic signals **Veh\_V\_Act|Eng** and **VehVAct|Eng\_Qf**. **Veh\_V\_Act|Eng** contains the actual vehicle speed data and **VehVAct|Eng\_Qf** indicates the quality of the **Veh\_V\_Act|Eng** data. The vehicle speed MS\_CAN signals shall be processed to provide an absolute value speed signal.

CAN-FD vehicle speed does not differentiate between forward vehicle speed and reverse vehicle speed. The requirements in this section define properties of the vehicle speed signal only. The following section describes the determination of forward (DRIVE) and rearward (REVERSE) determination based on both PRNDL and VEHICLE SPEED CAN-FD inputs.

Per **JIRA 11500 “DAT2 System Fault handling of Veh Speed Over Gnd”** , The DAT2.0 Tracker uses **VehOverGnd\_V\_Est** signal from ABS, which is used to calculate the heading of targets. If that vehicle speed quality factor bad the heading of the tracker will be incorrect, therefore BLIS, CTA and RCTB will go into system fault after 2 seconds of detecting a bad quality factor. The DTC is already handled by the Ford Common mode manager spec / FDIP so BLIS and CTA will not control the DTC setting. The fault recovery strategy will be followed for this signal quality factor similar to **Veh\_V\_ActEng\_D\_Qf**. Per meeting with Aptiv on March 12th 2020, it was decided that the VSE algorithm will output a quality factor signal to the BLIS/CTA diagnstoic model to be used to fault the features in case of a faulty **VehOverGnd\_V\_Est** signal being received by the VSE algorithm. The signal to be used is **Raw\_speed\_qf.** See Requirement **R: 3.7.1.3.7.**

|  |  |
| --- | --- |
| R: 3.7.1.3.1 | **Veh\_V\_ActEng** data shall be valid when **VehVActEng\_D\_Qf** is equal to decimal value 3 or 2. For **VehVActEng\_D\_Qf** equal to 0, BLIS or CTA shall enter a fault state after 3.000 seconds of receiving the value of 0 only if the invalid data causes the software to stop functioning normal (see Fault Processing section 3.7.10).  If **VehVActEng\_D\_Qf** returns to valid, the SOD shall return to normal operation per Fault Signal Recover as described in section 3.7.10.  *Note, the MS CAN periodic rate for* ***VehVActEng\_D\_Qf*** *is 50 msec so 60 consecutive incidences is equal to 3.0 sec. DCR14* |
| R: 3.7.1.3.2 | The **Veh\_V\_ActEng\_D\_Qf** can be equal to 1 (No Data Exists) at power up for up to 2 sec. During this first two seconds BLIS/CTA shall assume vehicle speed to be equal to zero. After BLIS/CTA power up and once ADAS DTC processing is enabled, if **Veh\_V\_ActEng\_D\_Qf** is 1 then BLIS/CTA shall enter a fault state after 3.000 seconds of the Qf equal to 1. *DCR14*  If **VehVActEng\_D\_Qf** returns to valid, BLIS/CTA shall return to normal operation per Fault Signal Recover as described in section 3.7.10 |
| R: 3.7.1.3.3 | RESERVED |
| R: 3.7.1.3.4 | Determination forward speeds and reverse speeds are as described in section 3.7.1.4. |
| R: 3.7.1.3.5 | If the vehicle speed signals are missing or corrupt for greater than or equal to 3.000 seconds, the BLIS/CTA system shall enter a fault state only if the missing or corrupt data causes the software to stop functioning normal (see Fault Processing section 3.7.10). *DCR14*  BLIS/CTA shall return to normal operation upon Fault Signal Recover as described in section 3.7.10. |
| R: 3.7.1.3.6 | An internal signal **isig\_Veh\_Speed** shall be used in the specification which will include FMC PowerTrain zero speed tolerance (global parameter Zero\_Speed\_Tollerance) as follows:  **isig\_Veh\_Speed** = 0.0 kph when **Veh\_V\_ActEng** <= Zero\_Speed\_Tollerance,  Else **isig\_Veh\_Speed** = **Veh\_V\_ActEng**  *Note - The Zero\_Speed\_Tollerance is defined by FMC PowerTrain.* |
| R: 3.7.1.3.7 | BLIS and CTA, and RCTB shall enter a fault state (send **SODsnsX\_D\_stat , CtaSnsX\_D\_Stat , RbaCtaX\_D\_Stat\_Intern ,** all set to faulty) after receiving the value of **VehOverGnd\_V\_Est == 0xFFFF (Unknown) or missing ; or internal signal raw\_speed\_qf == faulty** from VSE model for 2 continuous seconds.  The ADAS ECU can use the internal VSE signal **raw\_speed\_qf** instead of the CAN signal , for diagnostic purposes.  The BLIS/CTA faulty state shall occur only if the invalid speed of VSE data causes the software to stop functioning normally (see Fault Processing section 3.7.10).  BLIS warning shall occur above 10km/h in Drive Gear.  CTA warning shall occur when ADAS enters CTA mode which is Reverse Gear.  For simplicity, it is allowed that both BLIS and CTA warnings appear together in any gear if Ford agrees to this implementation.  If **VehOverGnd\_V\_Est (** or internal signal **raw\_speed\_QF )** returns to valid, BLIS and CTA CAN output (Faulty status) shall return to normal operation per Fault Signal Recovery as described in section 3.7.10.  *Note: The associated vehicle speed DTC is already handled by other LROS /Common mode manager /FDIP requirements, so the BLIS/CTA feature will not control the DTC* |



MinSpeedThresholdHysteresisUpper / MinSpeedThresholdHysteresisLower Hysteresis Diagram

#### Automatic and Manual Transmission Input Processing

The vehicle will be configured for either automatic transmission or manual transmission. The output of transmission input processing for automatic transmission will be Park, Reverse, Neutral, Drive and the output for manual transmission will be Reverse, Drive.

This automatic transmission gear select signal is **GearLvrPos\_D\_Act** and the manual transmission gear select signal is **GearRvrse\_D\_Actl**.The BLIS will be reporting when the transmission status is equal to DRIVE and CTA will be reporting when transmission status is equal to REVERSE. ADAS ECU will process the transmission CAN signal to generate the filtered internal signal **isig\_Transmission\_Status**.

Transmission State and another internally generated signal DVR\_SELECT\_STAT which sets a fault for the transmission CAN signals for automatic and manual are listed in the tables 3.7.1.4-1 and 3.7.1.4-2.

Note – It is possible to also use a Park Brake Status CAN input for manual transmission to determine manual transmission PARK. However, this is a function of customer park brake usage and cannot be considered consistent or dependable. This could possibly create different BLIS feature behavior dependence on whether the customer used park brake of not.

For automatic transmission the Transmission State is a function of vehicle speed for Transmission State DRIVE and REVERSE. A transition of the PRNDL from DRIVE to REVERSE at speeds above 25 KPH will cause the transmission to remain in DRIVE even though the **GearLvrPos\_D\_Act** = REVERSE. Once the speed drops below 25 KPH the transmission gear will enter reverse. Also, the transmission can physically transition to reverse from drive while the speed is not zero. When this happens there is a finite amount of time when the direction of the vehicle changes from forward to reverse.

For manual transmissions the only information available is that the driver has placed the shift in to REVERSE. When not in reverse the DRIVE gear is assumed. The states REVERSE and DRIVE are independent to vehicle speed.

There are no limits on the vehicle speed value for DRIVE. For REVERSE the maximum vehicle speed is 25 KPH.

|  |  |
| --- | --- |
| R: 3.7.1.4.1 | AUTO  For **GearLvrPos\_D\_Act** equal to a valid DRIVE value, all **isig\_Veh\_Speed** vehicle speed values have no limits other than those specified in the MS\_CAN signal description. |
| **R: 3.7.1.4.2** | AUTO  When **GearLvrPos\_D\_Act** transitions from DRIVE to REVERSE, the transmission\_status (listed in table 3.7.1.4-1) shall be set to REVERSE only for **isig\_Veh\_Speed** < 25 kph.  For **isig\_Veh\_Speed** >= 25 KPH during this state transition the transmission\_status shall remain in DRIVE. The transmission\_status shall enter REVERSE once **isig\_Veh\_Speed** < 25 kph. |
| **R: 3.7.1.4.3** | AUTO  When **GearLvrPos\_D\_Act** transitions from REVERSE to NEUTRAL to DRIVE, the transmission\_status (listed in table 3.7.1.4-1) shall transition to DRIVE immediately upon **GearLvrPos\_D\_Act** entering DRIVE. |
| **R: 3.7.1.4.4** | AUTO  When **GearLvrPos\_D\_Act** transitions from DRIVE to NEUTRAL to REVERSE, the transmission\_status (listed in table 3.7.1.4-1) shall transition to REVERSE immediately upon **GearLvrPos\_D\_Act** entering REVERSE. |
| **R: 3.7.1.4.5** | AUTO  When **GearLvrPos\_D\_Act** transitions from REVERSE to DRIVE without seeing a NEUTRAL, the transmission\_status (listed in table 3.7.1.4-1) shall transition to DRIVE after a 2 second time delay for **isig\_Veh\_Speed** > 4.8 KPH (3 MPH) and < 25 KPH. This requirement applies to abnormal rapid higher speed gear shifting such as that may occur in snow conditions |
| **R: 3.7.1.4.6** | MANUAL  When **GearRvrse\_D\_Actl** transitions from an inactive state to an active state, transmission status (listed in table 3.7.1.4-2) equals REVERSE immediately independent of vehicle speed. |
| **R: 3.7.1.4.7** | MANUAL  When **GearRvrse\_D\_Actl** transitions from an active state to an inactive state the transmission status (listed in table 3.7.1.4-2) shall be set to DRIVE immediately independent of vehicle speed. |
| **R: 3.7.1.4.8** | The BLIS/CTA shall generate the transmission status signals and fault detection from the MS\_CAN automatic or manual transmission signals as shown in Tables 3.7.1.4-1and 3.7.1.4-2.  For automatic transmission, system shall enter a fault state after 3.000 seconds where **GearLvrPos\_D\_Act** is equal to Undefined\_Treat\_as\_Fault, Unknown\_Position, Fault, or Missing Message. Note that the MS CAN periodic rate for **GearLvrPos\_D\_Act** is 50msec.  For manual transmission, system shall enter a fault state after 3.000 seconds where **GearRvrse\_D\_Actl** is equal to Not Used, Fault, or Missing Message. Note that the MS CAN event periodic rate for **GearLvrPos\_D\_**Act is 200msec.  The BLIS/CTA shall return to normal operation upon Fault Signal Recover as described in section 3.7.10. |
| **R: 3.7.1.4.9** | BLIS and CTA shall fault on a transmission CAN signal fault. Refer to Fault Processing section 3.7.10. |

Table 3.7.1.4 -1 Transmission Gear Table Automatic Transmission

|  |  |  |  |
| --- | --- | --- | --- |
| INPUT | | OUTPUTS | |
| MS\_CAN gear state  GearLvrPos\_D\_Act | MS CAN state encoded value | Isig\_Transmission\_ Status | DVR\_SELECT\_STAT |
| Park | 0x0 | Park | OK |
| Reverse | 0x1 | Reverse | OK |
| Neutral | 0x2 | Neutral | OK |
| Drive | 0x3 | Drive | OK |
| Sport\_DriveSport | 0x4 | Drive | OK |
| Low | 0x5 | Drive | OK |
| First | 0x6 | Drive | OK |
| Second | 0x7 | Drive | OK |
| Third | 0x8 | Drive | OK |
| Fourth | 0x9 | Drive | OK |
| Fifth | 0xA | Drive | OK |
| Sixth | 0xB | Drive | OK |
| Undefined\_Treat\_as\_Fault | 0xC | Don't Care | Fault |
| Undefined\_Treat\_as\_Fault | 0xD | Don't Care | Fault |
| Unknown\_Position | 0xE | Don't Care | Fault |
| Fault | 0xF | Don't Care | Fault |
| Missing Message | n/a | Don't Care | Fault |

Table 3.7.1.4 -2 Transmission Gear Table Manual Transmission

|  |  |  |  |
| --- | --- | --- | --- |
| INPUT | | OUTPUTS | |
| MS\_CAN gear state  GearRvrse\_D\_Actl | MS CAN state encoded value | Isig\_Transmission\_ Status | DVR\_SELECT\_STAT |
| Inactive Not Confirmed | 0x0 | Drive | OK |
| Inactive Confirmed | 0x1 | Drive | OK |
| Active Not Confirmed | 0x2 | Reverse | OK |
| Active Confirmed | 0x3 | Reverse | OK |
| Not used | 0x4 | Don't Care | Fault |
| Not used | 0x5 | Don't Care | Fault |
| Not used | 0x6 | Don't Care | Fault |
| Fault | 0x7 | Don't Care | Fault |
| Missing Message | n/a | Don't Care | Fault |

**Special Considerations for CTA transmission Input Fault Generation**

For automatic transmission only an "Unknown" state would be considered a fault condition in CTA mode requiring System Fault notification to the customer. Some vehicle lines utilize a PRNDL gear selection strategy where the GearLvrPos\_D\_Act is set to UNKNOWN if the customer slowly transitions the gear selector between states (e.g. shifting from DRIVE to REVERSE). This produces a temporary false UNKNOWN state in the CAN signal however, the actual transmission gear remains in the last gear state. This false UNKNOWN should not generate a CTA fault. Given this, the GearLvrPos\_D\_Act signal will need to be filtered so that a true UNKNOWN can be deciphered from a false UNKNOWN. This filtering will be handled within the Transmission Input Processing. This filtering will be done using the vehicle speed signal as described in the requirements below.

|  |  |
| --- | --- |
| **R: 3.7.1.4.10** | The BLIS / CTA shall generate the transmission status signals PARK, NEUTRAL, and DRIVE directly from the MS\_CAN gear state input as shown in Table 3.4.1.3-1. |
| **R: 3.7.1.4.11** | PRNDL UNKNOWN states caused by slow shifting of the PRNDL shall be inferred when **isig\_Veh\_Speed** < the global parameter CTA\_TO\_BSMTRANSITION\_SPEED. Below this threshold the module shall assume a PRNDL slow transition and retain current **isig\_Transmission\_Status**. |
| **R: 3.7.1.4.12** | Above this speed threshold CTA\_TO\_BSMTRANSITION\_SPEED, the module shall assume there is a potential for an actual PRNDL data fault and shall default the Transmission Status to DRIVE but NOT set the DRV SELECT STAT status to FAULT. Once a second speed threshold global parameter CTA\_PRNDL\_UNKNOWN\_FAULT\_SPEED is exceeded the module shall assume an actual fault and set DRV SELECT STAT to FAULT; thus, notifying the customer of a CTA fault. |
| **R: 3.7.1.4.13** | The DRIVER SELECT STAT shall reset on the next ignition key cycle. |

#### Trailer Module Processing and BTT Feature

This section is divided into the following sections:

3.7.1.5.1 Trailer Tow CAN Signal Processing

3.7.1.5.2 Trailer Tow Processing for BTT disabled and BTT enabled adjust

3.7.1.5.4 BTT Processing.

Performance requirements for BTT are in section 4. Cluster processing requirements of the BTT inputs to Cluster are in section 7.

For a BTT process overview diagram see section 3.7.1.5.4.

##### Trailer Tow CAN Signal Processing

This section describes the processing for CAN signals **TrlrLampCnnct\_B\_Actl** and/or **TrlrBrkActCnnct\_B\_Actl**.. This processing is independentof BTT; runs with BTT ENABLED or DISABLED.

|  |  |
| --- | --- |
| **R: 3.7.1.5.1.1** | If **isig\_TTM\_Cfg** <> 0x0 (meaning one or both trailer modules are present: section 3.2.7) then Trailer Tow CAN signals **TrlrLampCnnct\_B\_Actl** and/or **TrlrBrkActCnnct\_B\_Actl** shall be available for processing. |
| **R: 3.7.1.5.1.2** | The **isig\_TBM** values are:  NOT CONNECT (**TrlrBrkActCnnct\_B\_Actl** = 0x0)  CONNECT (**TrlrBrkActCnnct\_B\_Actl** = 0x1)  UNKNOWN (0x3)  FAULT (0x2)  *Note: The* ***isig\_TBM*** *and* ***isig\_TLM*** *internal signals are needed for Trailer Lighting Module and Trailer Brake Module 2.5 second time delays.*  *Note:* ***isig\_TTM*\_Cfg** *is indicative of the module configuration status and* ***isig\_TBM*** *is indicative of the CAN signal trailer connect status.* |
| **R: 3.7.1.5.1.3** | ***Setting isig\_TBM at Ignition Power Up***  At ignition power up SYS\_CONFIG\_TOWTBM shall be read.  If SYS\_CONFIG\_TOWTBM = FALSE (TBM not present) then **isig\_TBM** = NOT CONNECT  If SYS\_CONFIG\_TOWTBM = TRUE then **isig\_TBM** shall be set per TBM CAN signal filtering Figure 3.7.1.5.1-1. |
| **R: 3.7.1.5.1.4** | ***Setting isig\_TBM for NON Ignition Power Up Conditions***  For a running reset **isig\_TBM** shall be set equal **TrlrBrkActCnnct\_B\_Actl** less TBM CAN signal filtering. |
| **R: 3.7.1.5.1.5** | ***Setting isig\_TBM for NON Ignition Power Up Conditions***  When **isig\_Veh\_Speed** = 0, a trailer can be connected/disconnected and **TrlrBrkActCnnct\_B\_Actl** may change state. A state change in **TrlrBrkActCnnct\_B\_Actl** shall cause **isig\_TBM** to be set equal to **TrlrBrkActCnnct\_B\_Actl** less TBM CAN signal filtering. |
| **R: 3.7.1.5.1.6** | If **isig\_TTM\_Cfg** = 0x2 or 0x3, then the **TrlrLampCnnct\_B\_Actl** CAN signalshall be read. The values for **isig\_TLM** are:  NOT CONNECT (**TrlrLampCnnct\_B\_Actl** = 0x0)  CONNECT (**TrlrLampCnnct\_B\_Actl** = 0x1)  UNKNOWN (0x3)  FAULT (0x2)  *Note: The* ***isig\_TBM*** *and* ***isig\_TLM*** *internal signals are needed for Trailer Lighting Module and Trailer Brake Module 2.5 second time delays.*  *Note:* ***isig\_TTM*\_Cfg** *is indicative of the module configuration status and* ***isig\_TBM*** *is indicative of the CAN signal trailer connect status.* |
| **R: 3.7.1.5.1.7** | ***Setting isig\_TLM at Ignition Power Up***  At ignition power up SYS\_CONFIG\_TOWTLM shall be read.  If SYS\_CONFIG\_TOWTLM = FALSE (TLM not present) then **isig\_TLM** = NOT CONNECT.  If SYS\_CONFIG\_TOWTLM = TRUE, then isig\_TLM shall be set per TLM CAN signal filtering Figure 3.7.1.5.1-2. |
| **R: 3.7.1.5.1.8** | ***Setting isig\_TLM for NON Ignition Power Up Conditions***  For a running reset **isig\_TBM** shall be set equal **TrlrLampCnnct\_B\_Actl** less TLM CAN signal filtering. |
| **R: 3.7.1.5.1.9** | ***Setting isig\_TLM for NON Ignition Power Up Conditions***  When **isig\_Veh\_Speed** = 0, a trailer can be connected/disconnected and **TrlrLampCnnct\_B\_Actl** may change state. A state change in **TrlrLampCnnct\_B\_Actl** shall cause **isig\_TLM** to be set equal to **TrlrLampCnnct\_B\_Actl** less TLM CAN signal filtering. |
| **R: 3.7.1.5.1.10** | **TrlrLampCnnct\_B\_Actl** and **TrlrBrkActCnnct\_B\_Actl** CAN signals shall be considered missing after 8 missing/invalid consecutive messages. A DID for each CAN signal shall be set as specified in Fault Processing section 3.7.10.    If **TrlrBrkActCnnct\_B\_Actl** is missing, then **isig\_TBM** = FAULT (0x2)  If **TrlrLampCnnct\_B\_Actl** is missing ,then **isig\_TLM** = FAULT (0x2) |
| **R: 3.7.1.5.1.11** | ***Power Up Missing Message Special Case:***  In Figure 3.7.1.5.1-1 while **isig\_TBM** = UNKNOWN and Bulb Prove Out is active, if **TrlrBrkActCnnct\_B\_Actl** is missing since power up, **isig\_TBM** shall be set to NOT CONNECT after Bulb Prove Out is complete.  In Figure 3.7.1.5.1-2 while **isig\_TLM** = UNKNOWN and Bulb Prove Out is active, if **TrlrLampCnnct\_B\_Actl** is missing since power up, **isig\_TLM** shall be set to NOT CONNECT after Bulb Prove Out is complete. |
| **R: 3.7.1.5.1.12** | Trailer tow CAN signal processing shall set an internal signal **isig\_TRAILER** as shown in table 3.7.1.5.1-1. The **isig\_TRAILER** is used by BTT together with ATD. No DID is set when **isig\_TRAILER** is faulted.  Values for **isig\_TRAILER** are 0x0 not connected, 0x1 connected, 0x2 fault. |
| **R: 3.7.1.5.1.13** | The **isig\_TRAILER** is reset to NOT CONNECT at ignition power up. |
| **R: 3.7.1.5.1.14** | The **isig\_TRAILER** shall be updated for **isig\_Veh\_Speed** of =< 5 kph. The two exceptions to this are the BLIS OFF to ON special case per R:3.7.1.5.3.16 and Running Reset.  This requirement is necessary to avoid BTT transitioning states due to trailer harness or trailer connector intermittent failures. |

Figure 3.7.1.5.1-1 Ign Power Up TBM CAN Signal Filter



Figure 3.7.1.5.1-2 Ign Power Up TLM CAN Signal Filter



Table 3.7.1.5.1-1 Definition of isig\_TRAILER

|  |  |  |  |
| --- | --- | --- | --- |
| INPUTS | | | OUTPUT |
| isig\_TTM\_Cfg | isig\_TLM | isig\_TBM | isig\_TRAILER |
| 0x0 | *Don’t care* | *Don’t care* | Not Connected |
| 0x1 | *Don’t care* | Not connected | Not Connected |
| 0x1 | *Don’t care* | Connected | Connected |
| 0x1 | *Don’t care* | Fault | Fault |
| 0x1 | *Don’t care* | Unknown | Not Connected |
| 0x2 | Not connected | *Don’t care* | Not Connected |
| 0x2 | Connected | *Don’t care* | Connected |
| 0x2 | Fault | *Don’t care* | Fault |
| 0x2 | Unknown | *Don’t care* | Not Connected |
| 0x3 | Not connected | Not connected | Not connected |
| 0x3 | *Don’t care* | Connected | Connected |
| 0x3 | Connected | *Don’t care* | Connected |
| 0x3 | Not connected | Fault | Not Connected |
| 0x3 | Not connected | Unknown | Not Connected |
| 0x3 | Fault | Not connected | Not connected |
| 0x3 | Unknown | Not connected | Not connected |
| 0x3 | Fault | Fault | Fault |
| 0x3 | Unknown | Unknown | Not connected |

*NOTE – For isig\_TTM*\_Cfg *= 0x3, isig\_TRAILER reads either trailer module for a connection; both do not need to agree.*

##### BLIS and CTA Trailer Tow On/Off Processing

This section defines BLIS and CTA trailer tow off processing for the following configurations

1. Less trailer tow module(s) and less BTT
2. Trailer tow module(s) less BTT
3. BTT with or without trailer tow modules

In addition the internal signal **isig\_BTT\_TRAILER** is defined in this section.

The RCTB feature behavior is a function of BLIS, CTA, and BTT (if enabled) trailer tow off processing.

|  |  |
| --- | --- |
| **R: 3.7.1.5.2.1** | ***Reserved*** |
| **R: 3.7.1.5.2.2** | ***Trailer Modules and less BTT:***  For BTT\_ENABLE\_DISABLE = DISABLE & **isig\_TTM\_Cfg** <> 0x0  BLIS and CTA trailer tow processing shall be as shown in Table 3.7.1.5.2-1. |
| **R: 3.7.1.5.2.3** | ***Trailer Modules and less BTT:***  If BTT\_ENABLE\_DISABLE = ENABLED & **isig\_TTM\_Cfg** <> 0x0 & **BttX\_D\_Stat** = OFF  Then**, SodX\_D\_Stat** shall be set to OFF; and CTA trailer tow processing shall be as shown in Table 3.7.1.5.2-1. |
| **R: 3.7.1.5.2.4** | ***BTT with or without Trailer Modules:***  An internal BTT signal, **isig\_BTT\_TRAILER**, shall contain the trailer connect / not connect decision of the BTT feature.  The **isig\_BTT\_TRAILER** is a function of **isig\_TRAILER** and is defined in Table 3.7.1.5.2-2. |
| **R: 3.7.1.5.2.5** | ***BTT with or without Trailer Modules:***  The **isig\_BTT\_TRAILER** in Table 3.7.1.5.2-2 shall be in the state of NOT CONNECT until the connection status from **isig\_TRAILER** has been determined (**isig\_TRAILER** is UNKNOWN). |
| **R: 3.7.1.5.2.6** | ***BTT with or without TrailetModules: BTT Connect / Not Connect Decision***  The BTT feature shall determine the final trailer status for the purpose of turning ON/OFF features based on trailer connect. The trailer status is indicated by **BttX\_D\_Stat** (values defined in section 3.5.4.3) and the trailer length received form the Cluster via CAN signal **Btt\_L\_Actl2**. **Btt\_L\_Actl2** is defined in Table 3.7.1.5.2-3. |
| **R: 3.7.1.5.2.7** | ***BTT with or without Trailer Modules: BTT Connect / Not Connect Decision***  BTT shall set **BttX\_D\_Stat** based on trailer status inputs **isig\_BTT\_TRAILER** and **Btt\_L\_Actl2** per Table 3.7.1.5.2-4a. |
| **R: 3.7.1.5.2.8** | ***BTT with or without Trailer Modules: BTT Connect / Not Connect Decision***  Base features BLIS and CTA behavior and RCTB (RBA) behavior for trailer status shall be indicated by **SodX\_D\_Stat, CtaX\_D\_Stat**, per Table 3.7.5.1.2-4. For **SodX\_D\_Stat**, **CtaX\_D\_Stat**, the value TRAILER TOW OFF indicates that the feature is off for the particular trailer. |
| **R: 3.7.1.5.2.9** | For **SodX\_D\_Stat** = TRAILER TOW OFF, **isig\_BLIS\_Last\_Rem** does not change to OFF. |
| **R: 3.7.1.5.2.10** | During power up initialization **isig\_BTT\_Last\_Rem** is an input to the setting of **BttX\_D\_Stat** as specified in the BTT Initialization section 3.4.1.3. |
| **R: 3.7.1.5.2.11** | For **isig\_TRAILER** -> CONNECT, **isig\_BTT\_TRAILER** shall be set equal to **isig\_TRAILER** no later than 100msec.  *Note: this is so that* ***isig\_BTT\_trailer*** *status of connect doesn’t need to wait for ATD decision to go to Connect. This is an exception for the case of* ***isig\_Trailer*** *= Connect only.* |
| **R: 3.7.1.5.2.12** | RESERVED |
| **R: 3.7.1.5.2.13** | When BLIS or CTA are turned OFF or ON due to trailer connect (**SodX\_D\_Stat** and **CtaX\_D\_Stat** transition between TRAILER\_TOW\_OFF and ON), the Side RadarX shall not flash the HMI LED as specified in section 3.7.9. |
| **R. 3.7.1.5.2.14** | Boundary Alert shall not be logically affected by Trailer Tow feature status. Boundary Alert performance is affected by the physical presence of a trailer, as with any nearby physical obstruction in the Boundary Alert detection zone, but there is no logical connection between BTT and Boundary Alert. |
| **R. 3.7.1.5.2.15** | Reserve |
| **R: 3.7.1.5.2.16** | For LCWA feature use only:  The signal **BTT\_SystemStatus** shall be set as an ouput internal signal (see LROS) based **BttLeft\_D\_Stat** and **BttRight\_D\_Stat** as specified in Table 3.7.1.5.2-5. By default or if BttX\_D\_Stat is not available for any reason, **BTT\_SystemStatus** shall default to OFF. The LROS signal file contains the **BTT\_SystemStatus** internal signal for LCWA.  This requirement shall not intefer with normal BLIS or BTT functionality.  This spec only captures the need to pass the internal signal **BTT\_SystemStatus , and is a duplicate requirement to the LCWA specification.** Any LCWAconflicts or contradictions are to be resoleved by the LCWA specification and by the LROS specification. |
| **R: 3.7.1.5.2.17** | **Special Case: BTT for Btt\_L\_Actl2 = 1m**  When **Btt\_L\_Actl2 ≤ 1m** & **BTTX\_D\_Stat** = CONNECT ,per Table 3.7.1.5.2-4a, the rear range for a 1m target shall be set to BLIS\_REAR\_RANGE , and targets shall be processed per BLIS processing algo. VRR will be turned off per R:4.2.7.  If the supplier recommends processing targets via BTT processing algo then the supplier shall notify FMC so that the BLIS CTA Bike Rack / Cargo Rack test will be performed on BTT and BTTLITE vehicles.  Reference BLIS Bike/Cargo Rack performance R:4.3.2.4 and CTA & CTB Bike/Cargo Rack performance R:4.5.19.  CTA will function per Table 3.7.1.5.2-4a.  Cross Traffic Braking functionality will follow Table 3.7.11.3-1  *Note – This requirement is for clarification as to which processing algo to use in cases where the BLIS and BTT processing are two separate algos.* |
| **R: 3.7.1.5.2.18** | If **BTT5G** is ENABLE and **Btt\_L2\_Actl2**  is not 0x7F, BTT shall set **BttX\_D\_Stat** based on trailer status inputs **isig\_BTT\_TRAILER** and **Btt\_L2\_Actl2** per Table 3.7.1.5.2-4b. |

Table 3.7.1.5.2-1 Trailer Process for BTT Disabled and isig\_TTM\_Cfg <> 0x0

|  |  |  |
| --- | --- | --- |
| INPUT | OUTPUT | |
| Isig\_TRAILER  (TLM <OR> TBM) | BLIS stat | CTA state |
| Not Connect | operational | operational |
| Connect | Trailer Tow OFF | Trailer Tow OFF |
| FAULT | operational | Operational |

*Note: operational means normal feature operation for trailer not connected*

Table 3.7.1.5.2-2 Setting isig\_BTT\_TRAILER

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| INPUTS | | | OUTPUT |  |
| Isig\_TTM\_Cfg | Isig\_TRAILER  (TLM <OR> TBM) |  | Isig\_BTT\_TRAILER | Description |
| Not 0x0 | Not Connect |  | Not Connect |  |
| Not 0x0 | Fault |  | Not Connect | Default to Not Connect |
| Not 0x0 | Connect |  | Connect | Trailer connected |
| 0x0 | Not Connect |  | Not Connect | For 0x0 Isig\_TRAILER can only have the state of Not Connect |

Table 3.7.1.5.2-3a **Btt-L\_Actl2** Data Definition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Btt\_L\_Actl2** | | | **Definition** | **Notes** |
| **HEX (values)** | **Feet** | **Meters** |
| 09 – 6A | 3 through 33 | 0.9 through 10.0 | VALID length | Length from rear of vehicle to end of trailer. BLIS BTT will be ON. |
| 00 – 08  6B – 7D | Less than 3  Greater than 33 | Less than 0.9  Greater than 10.0 | INVALID length | Length from rear of vehicle to end of trailer. BLIS will shut OFF for trailer attached. Treat as 7F. |
| 7E | No Data Exists | No Data Exists | UNKNOWN | No length data for trailer. This can mean the customer cancelled trailer select process or chose not to enter data. Cluster does not have length data. |
| 7F | Invalid | Invalid | Invalid trailer size | Netcom defines this as FAULT. FF means that either trailer length or width or type is invalid (size is greater than allowed) |

Table 3.7.1.5.2-3b **Btt-L\_Actl3** Data Definition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Btt\_L2\_Actl2** | | | **Definition** | **Notes** |
| **HEX (values)** | **Feet** | **Meters** |
| hx0A through hx66 | 20 through 50 | 6.0 through 15.2 | VALID length | Length from rear of vehicle to end of trailer. BLIS BTT will be ON. |
| hx00 through hx09  hx67 through hx7C | Less than 20 feet  Greater than 50 | Less than 6.0  Greater than 15.2 | INVALID length | Length from rear of vehicle to end of trailer. BLIS will shut OFF for trailer attached. |
| hx7E | No Data Exists | No Data Exists | UNKNOWN | No length data for trailer. This can mean the customer cancelled trailer select process or chose not to enter data. Cluster does not have length data. |
| hx7F | Invalid | Invalid | Invalid trailer size | Netcom defines this as FAULT. FF means that either trailer length or width or type is invalid (size is greater than allowed). **Btt\_L2\_Actl2** shall be in state hx7F when Trailer TYPE is conventional. |

Table 3.7.1.5.2-4a BLIS / CTA Trailer Tow Off Processing for BTT Enabled

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| INPUTS | | | OUTPUTS | | | |
| isig\_TTM\_Cfg | Isig\_BTT\_TRAILER | Btt\_L\_Actl2 | BttX\_D\_Stat | SodX\_D\_Stat | CtaX\_D\_Stat | *Unused column* |
| NOT equal to 0x0 | NOT CONNECT | Don’t care | NOT CONNECT | ON | ON |  |
| NOT equal to 0x0 | Note 1 | Note1 | NOT DETERMINED | ON | ON |  |
| NOT equal to 0x0 | CONNECT | VALID = 1m  ($ 08 to $0C) | CONNECT | ON | ON |  |
| NOT equal to 0x0 | CONNECT | VALID > 1m | CONNECT | ON | Trailer Tow OFF |  |
| NOT equal to 0x0 | CONNECT | INVALID | OFF\_TEMP | Trailer Tow OFF | Trailer Tow OFF |  |
| NOT equal to 0x0 | CONNECT | No Data Available waiting | CONNECT  Note 2 | ON | Trailer Tow OFF |  |
| NOT equal to 0x0 | CONNECT | No Data Available  post waiting | OFF\_TEMP  Note 2 | Trailer Tow OFF | Trailer Tow OFF |  |
| 0x0 | NOT CONNECT | Don’t care | NOT CONNECT | ON | ON |  |
| 0x0 | NOT CONNECT | Don’t care | PENDING (ATD determination) | ON | ON |  |
| 0x0 | Note 1 | Note 1 | NOT DETERMINED | ON | ON |  |
| 0x0 | CONNECT | VALID = 1m | CONNECT | ON | ON |  |
| 0x0 | CONNECT | VALID > 1m | CONNECT | ON | Trailer Tow OFF |  |
| 0x0 | CONNECT | INVALID | OFF\_TEMP | Trailer Tow OFF | Trailer Tow OFF |  |
| 0x0 | CONNECT | No Data Available waiting | CONNECT  Note 2 | ON | Trailer Tow OFF |  |
| 0x0 | CONNECT | No Data Available  post waiting | OFF\_TEMP  Note 2 | Trailer Tow OFF | Trailer Tow OFF |  |

*NOTE 1 – This is an initialization state. BLIS and CTA remain ON during initialization. Refer to BTT initialization state diagram.*

*NOTE 2 – Refer to BTT Processing Section 3.7.1.5.4; Trailer Tow Off is delayed until post trailer data request.*

*NOTE – above requirements define the timing of when the decision to transition to Trailer Tow Off can be performed.*

Table 3.7.1.5.2-4b BLIS / CTA Trailer Tow Off Processing for BTT5G Enabled

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| INPUTS | | | OUTPUTS | | | |
| isig\_TTM\_Cfg | Isig\_BTT\_TRAILER | Btt\_L2\_Actl2 | BttX\_D\_Stat | SodX\_D\_Stat | CtaX\_D\_Stat | *Unused column* |
| NOT equal to 0x0 | NOT CONNECT | Don’t care | NOT CONNECT | ON | ON |  |
| NOT equal to 0x0 | Note 1 | Note1 | NOT DETERMINED | ON | ON |  |
| NOT equal to  0x0 | CONNECT | VALID | CONNECT | ON | Trailer Tow OFF |  |
| NOT equal to 0x0 | CONNECT | INVALID | OFF\_TEMP | Trailer Tow OFF | Trailer Tow OFF |  |
| NOT equal to 0x0 | CONNECT | No Data Available waiting | CONNECT  Note 2 | ON | Trailer Tow OFF |  |
| NOT equal to 0x0 | CONNECT | No Data Available  post waiting | OFF\_TEMP  Note 2 | Trailer Tow OFF | Trailer Tow OFF |  |
| 0x0 | NOT CONNECT | Don’t care | NOT CONNECT | ON | ON |  |
| 0x0 | NOT CONNECT | Don’t care | PENDING (ATD determination) | ON | ON |  |
| 0x0 | Note 1 | Note 1 | NOT DETERMINED | ON | ON |  |
| 0x0 | CONNECT | VALID | CONNECT | ON | Trailer Tow OFF |  |
| 0x0 | CONNECT | INVALID | OFF\_TEMP | Trailer Tow OFF | Trailer Tow OFF |  |
| 0x0 | CONNECT | No Data Available waiting | CONNECT  Note 2 | ON | Trailer Tow OFF |  |
| 0x0 | CONNECT | No Data Available  post waiting | OFF\_TEMP  Note 2 | Trailer Tow OFF | Trailer Tow OFF |  |
| Don’t Care | CONNECT | VALID | BTT5G FAULT (note 3) | Trailer Tow OFF | Trailer Tow OFF |  |

*NOTE 1 – This is an initialization state. BLIS and CTA remain ON during initialization. Refer to BTT initialization state diagram.*

*NOTE 2 – Refer to BTT Processing Section 3.7.1.5.4; Trailer Tow Off is delayed until post trailer data request.*

*NOTE – above requirements define the timing of when the decision to transition to Trailer Tow Off can be performed.*

*NOTE 3 – State occurs if aftermarket radar signals are missing.*

Table 3.7.1.5.2-5 BTT output signal status to LCWA feature

|  |  |  |
| --- | --- | --- |
| **Input:**  **BttX\_D\_Stat** | **Output:**  **BTT\_SystemStatus** | **LCWA function (\**See LCWA Spec)*** |
| DISABLE | DISABLE | checks for trailer with TrlrLampConnect\_B\_Actl and shuts off if trailer connected |
| OFF | OFF | checks for trailer with TrlrLampConnect\_B\_Actl and shuts off if trailer connected |
| CONNECT | CONNECT | Trailer mode |
| PENDING | *UNUSED* | *UNUSED* |
| NOT CONNECT | NOT CONNECT | LCWA will continue to function |
| TEMP OFF | TEMP OFF | LCWA will suppress and trigger a PopUp |
| NOT DETERMINED | NOT DETERMINED | Waits for BTT to go to a non-transient state, LCWA will not trigger a PopUp |

##### RESERVED

##### BTT Processing

This section describes BTT processing with BTT enabled. BTT feature performs the following operations:

* + - Trailer status determination
    - Interfaces to the Cluster / SYNC (receive trailer length or request trailer data)
    - Determine new or c/o trailer after key cycle
    - Set the length of the trailer blind zone in BLIS

###### BTT CAN SIGNAL PROCESSING

This section describes the BTT CAN signals and the processing of those CAN signals. The overall BTT process however is in section 3.7.1.5.4.2.

|  |  |
| --- | --- |
| **R: 3.7.1.5.4.1.1** | After bulb proveout (section 3.4.2), the Cluster / SYNC can command BTT to turn ON or OFF via CAN signal **SodX\_D\_Stat** section 3.5.4. When **SodX\_D\_Stat** transitions BTT to OFF, **BttX\_D\_Stat** shall be set to OFF and SOD shall not perform BTT processing **isig\_TFLAG\_LAST\_REM** = FALSE, and **isig\_BTT\_LAST\_REM** = OFF. |
| **R: 3.7.1.5.4.1.2** | When **SodX\_D\_Stat** transitions from OFF to ON, BTT will process according to R:3.5.4. |
| **R: 3.7.1.5.4.1.3** | The Cluster / SYNC will send BTT trailer data via CAN signal **Btt\_L\_Actl2**. The size of this data is 7 bits. **Btt\_L\_Actl2** is defined in Table 3.7.1.5.2-3a.  **Btt\_L\_Actl2** is stored in the Cluster / SYNC NVM and thus carried over a key cycle. The Cluster may continuously send the last selected trailer data but BTT shall use the **Btt\_L\_Actl2** value only when a trailer is detected.  **Reading Btt\_L\_Actl2 CAN Signal:** When **isig\_BTT\_TRAILER** -> CONNECT, ADAS shall read the next to **Btt\_L\_Actl2** CAN signals; ignor the first read and store the second read CAN signal. This does not apply for other state transitions of **isig\_BTT\_TRAILER**. *(DCR 055)*  Therefore, the OUTPUTS of Table 3.7.1.5.2-4a shall not be set until the second read of **Btt\_L\_Actl2** CAN signal value for **isig\_BTT\_TRAILER** -> CONNECT.  At vehicle configuration **Btt\_L\_Actl2** shall equal NO DATA EXISTS (hx7E). |
| **R: 3.7.1.5.4.1.4** | ADAS shall request trailer data by transmitting the CAN request **BttX\_D\_RqDrv** to the Cluster. **BttX\_D\_RqDrv** values are:  0x01 NO REQUEST  0x02 REQUEST  There are six cases for **BttX\_D\_RqDvr** processing listed in R:3.7.1.5.4.1.4.1 through R:3.7.1.5.4.1.4.6 below. |
| **R: 3.7.1.5.4.1.4.1** | **Case 1: NO TRIALER DETECTED**  For **BTT\_TRAILER** = NOT CONNECT, **BttX\_D\_RqDvr** = NO REQUEST. The Cluster / SYNC will set **Btt\_L\_Actl2** and **Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) according to the trailer set up by the customer; if deselected then the value will behx7E NO DATA EXISTS. BTT shall ignore **Btt\_L\_Actl2** and **Btt\_L2\_Actl2** for **BTT\_TRAILER** = NO CONNECT. |
| **R: 3.7.1.5.4.1.4.2** | **Case 2: NEW TRAILER DETECTED WITH NO DATA AVAILABLE**  When BTT detects a trailer attached and the trailer was previously not connected (described in BTT Processing section 3.7.1.5.4.2; see **isig\_TGLAG\_LAST\_REM**)and **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) = NO DATA EXISTS, BTT shall set **BttX\_D\_RqDvr** = REQUEST. Then wait for the Cluster / SYNC to respond via a **Btt\_L\_Actl2 or Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) update (described in R:3.7.1.5.4.1.5). In this case **Btt\_L\_Actl2** is a response to **BttX\_D\_RqDrv**. |
| **R: 3.7.1.5.4.1.4.3** | **Case 3 NEW TRAILER DETECTED WITH VALID DATA**  When BTT detects a trailer attached and the trailer was previously not connected (described in BTT Processing section 3.7.1.5.4.2; see **isig\_TGLAG\_LAST\_REM**)and **Btt\_L\_Actl2** o**r Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) contains VALID data, **BttX\_D\_RqDvr** = NO REQUEST. The **Btt\_L\_Actl2** o**r Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) valid data will be used by BTT or BTT5G. See table 3.5.4-4 for activation conditions based on **Btt\_L\_Actl2** and **Btt\_L2\_Actl2** states. |
| **R: 3.7.1.5.4.1.4.4** | **Case 4 CARRY OVER TRAILER DETECTED**  When BTT detects a trailer attached after ignition cycle and a trailer was previously connected at the previous ignition on state (described in BTT Processing section 3.7.1.5.4.2; see **isig\_TGLAG\_LAST\_REM**), **BttX\_D\_RqDvr** = NO REQUEST. In this case BTT had already performed any request for data when the current carry over trailer was new. BTT shall make one request per trailer.  *Note: This is to avoid multiple trailer data requests for the same trailer causing customer annoyance. However, BTT will continue to process* ***Btt\_L\_Actl2*** *and* ***Btt\_L2\_Actl2*** *changes and is described later.* |
| **R: 3.7.1.5.4.1.4.5** | **Case 5 BLIS(BTT) OFF to ON TRANSITION**  Refer to R: 3.7.1.5.3.16. Typically, a BTT process run begins for **isig\_Veh\_Speed** = 0 kph since this is when a trailer gets attached/unattached. However, BLIS can be turned from OFF to ON (thus BTT from OFF to ON) independent of vehicle speed. For this case BTT is activated regardless of vehicle speed. |
| **R: 3.7.1.5.4.1.4.6** | **Case 6 TRAIELR IS INVALID 0x7F**  When a **Btt\_L\_Actl2** = hx7F (Invalid) or **Btt\_L2\_Actl2** = hx7F (Invalid) (if **BTT5G\_Intern** = TRUE)**, BttX\_D\_RqDvr** = NO REQUEST regardless if this is a new or carry over trailer. h7xF is the case where the customer has selected a trailer that is not conventional, greater than 8.5 feet wide at the front, and/or longer than 33 feet from the ball hitch. |
| **R: 3.7.1.5.4.1.5** | Other than Case 5, a BTT trailer data request is only done for a new trailer (**isig\_TFLAG\_LAST\_REM** transitions from not connect to connect) and trailer data is NO DATA EXISTS. Thus, the customer is asked only once for trailer data. |
| **R: 3.7.1.5.4.1.6** | When **BttX\_D\_RqDrv** -> REQUEST, BTT shall wait for **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) state change from hx7E to a non hx7E value or until **isig\_Veh\_Speed** > global parameter MaxBTTVehSpdCfg. If **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) remains at hx7E then BTT shall process the trailer with the value NO DATA EXISTS.  *Note –The MaxBTTVehSpdCfg must be set to allow for low speed forward and revers maneuvers and then back to 0 kph. Therefore, MaxBTTVehSpdCfg will never be set below 24 kph.* |
| **R: 3.7.1.5.4.1.7** | **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if BTT5G is ENABLED)  CAN signal shall be set to missing if the signal is missing after 16 consecutive periodic signals. Refer to fault processing section 3.7.10. When missing and **isig\_BTT\_TRAILER** = CONNECT, BTT shall use the last **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if BTT5G is ENABLED) value read from CAN.  If the last **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** if BTT5G is ENABLED) was 7E and **isig\_TFLAG\_LAST\_REM** is FALSE (Indicating a new trailer is attached) BTT shall not send a request for data but process the trailer connect as 7E.  If **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if BTT5G is ENABLED) is missing at SOD power up then BTT shall process for **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if BTT5G is ENABLED) = NO DATA EXISTS and regardless of the isig\_TFLAG\_LAST\_REM, BTT shall not send a request for data but process the trailer connect as a 7E carry-over trailer.  Missing **Btt\_L\_Actl2** and **Btt\_L2\_Actl2** shall set a DID fault counter; no DTC shall be set. |
| **R: 3.7.1.5.4.1.8** | When **isig\_TFLAG\_LAST\_REM** transitions from FALSE to TRUE (new trailer attached)and **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) is NO DATA EXISTS**, BttX\_D\_RqDrv** shall transition to REQUEST.  Once **BttX\_D\_RqDrv** = REQUEST, **BttX\_D\_RqDrv** shall transition to NO REQUEST only when **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** transitions from NO DATA EXISTS to a valid trailer value, invalid trailer, or **isig\_Veh\_Speed** > MaxBTTVehSpdCfg . |
| **R: 3.7.1.5.4.1.9** | BTT shall transmit via CAN signal **BttX\_D\_Stat** the status of BTT as defined in Table 3.7.1.5.4.1-1. |
| **R: 3.7.1.5.4.1.10** | **BttX\_D\_Stat** = DISABLE when BTT\_ENABLE\_DISABLE is unconfigured or when **SodX\_D\_Stat** = 0x3 (DISABLE). Note from section 3.4.2 **BttX\_D\_Stat** = DISABLE at power up if **isig\_BTT\_LAST\_REM** = DISABLE.  The Cluster BTT setup is defined in section 7. |
| **R: 3.7.1.5.4.1.11** | **BttX\_D\_Stat** = OFF when commanded by the Cluster via **SodX\_D\_Stat** = OFF. SOD shall halt BTT processing until the Cluster commands a **SodX\_D\_Stat** <> OFF. Per from section 3.4.2 if **isig\_BTT\_LAST\_REM** = OFF at power up BttX\_D\_Stat = OFF. |
| **R: 3.7.1.5.4.1.12** | **BttX\_D\_Stat** = CONNECT when BTT has completed the process of trailer detection and **isig\_BTT\_TRAILER** = CONNECT. This indicates to the Cluster that BTT has determined a trailer is attached. |
| **R: 3.7.1.5.4.1.13** | **BttX\_D\_Stat** = NOT CONNECT when BTT has completed the process of trailer detection and **isig\_BTT\_TRAILER** = NOT CONNECT. This indicates to the Cluster that BTT has determined a trailer is not attached. |
| **R: 3.7.1.5.4.1.14** | **BttX\_D\_Stat** = PENDING is an UNUSED state as of DAT2.1 |
| **R: 3.7.1.5.4.1.15** | RESERVED |
| **R: 3.7.1.5.4.1.16** | **BttX\_D\_Stat** is equal to NOT DETERMINED during power up initialization, **SodX\_D\_Stat** transitions from OFF to ON, or during times when **BttX\_D\_Stat** states are waiting to be determined. |
| **R: 3.7.1.5.4.1.17** | **BttX\_D\_Stat** = OFF TEMP for the following cases   1. **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) returns INVALID trailer data hx7F 2. BTT requests trailer data (**BttX\_D\_RqDrv** = REQUEST) and the Cluster response is **Btt\_L\_Actl2** or **Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) = NO DATA AVAILABLE.   OFF TEMP is treated as a BTT ON state in that BTT shall still process for trailer connect when the input conditions to do so are correct.  When **BttX\_D\_Stat** is set to OFF TEMP, the next time the conditions are correct for BTT to activate trailer search processing, BTT shall keep **BttX\_D\_Stat** = OFF TEMP and shall not set **BttX\_D\_Stat** to PENDING or NOT DETERMINED. **BttX\_D\_Stat** can exit OFF\_TEMP only after BTT has determined trailer connect / not connect such that an OFF\_TEMP state no longer exists.  *Note: This requirement is to stop Cluster HMI message flicker which would occur if* ***BttX\_D\_Stat*** *sequenced through the various states in an attempt to exit and OFF\_TEMP condition.* |
| **R: 3.7.1.5.4.1.18** | SYNC will send BTT5g trailer data via CAN signal **Btt\_L2\_Actl2**. The size of this data is 7 bits. **Btt\_L2\_Actl2** is defined in Table 3.7.1.5.2-3b.  **Reading Btt\_L2\_Actl2 CAN Signal:** When **isig\_BTT\_TRAILER** -> CONNECT, ADAS shall read the next to **Btt\_L2\_Actl2** CAN signals; ignore the first read and store the second read CAN signal. This does not apply for other state transitions of **isig\_BTT\_TRAILER**.  Therefore, the OUTPUTS of Table 3.7.1.5.2-4 shall not be set until the second read of **Btt\_L2\_Actl2** CAN signal value for **isig\_BTT\_TRAILER** -> CONNECT.  At vehicle configuration **Btt\_L2\_Actl2** shall equal NO DATA EXISTS (hx7E). |
| **R: 3.7.1.5.4.1.19** | **BttX\_D\_Stat** = BTT5G FAULT is used if BTT5G is ENABLED. Refer to section 3.7.10 for detailed description. |
| **R: 3.7.1.5.4.1.20** | The potential values of **SodAltX\_D\_StatAft** are:   * Standby (0x0) * Active: No object detected (0x1) * Active: Object detected (0x2) * Fault (0x4) |

Table 3.7.1.5.4.1-1 BttX\_D\_Stat States

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| INPUT | | | INPUT | ACTION |
| BttX\_D\_ Stat | Binary Value | Definition | Btt\_L\_Actl2 | BttX\_D\_RqDrv  states available |
| DISABLE | 0x06 | BTT is disabled via Part II / III | Don’t care | NO REQUEST |
| OFF | 0x05 | Cluster commanded off .BTT shall halt processing until Cluster commands ON | Don’t care | NO REQUEST |
| Connected | 0x01 | Cluster commanded on. BTT has detected a trailer attached. | UNKNOWN  (hx7E) | REQUEST or  NO REQUEST |
| Connected | 0x01 | Cluster commanded on. BTT has detected a trailer attached. | Not hx7E | NO REQUEST |
| Pending | 0x02 | UNUSED | Don’t care | NO REQUEST |
| Not Connected | 0x03 | Cluster commanded on. BTT has determined no trailer attached. | Don’t care | NO REQUEST |
| OFF TEMP | 0x04 | Cluster commanded on. Trailer data is invalid from Cluster <OR> BTT requested trailer data and did not recieve data prior to VSS changing to greater than VSS Threshold value (extended wait period). | Don’t care | NO REQUEST |
| NOT DETERMINED | 0x00 | Used during BTT initialization only. A default setting while BTT is initializing. | Don’t care | NO REQUEST |
| BTT5G Fault | 0x07 | BTT5G Fault detected. Cluster to show fault message. | Don’t care | NO REQUEST |

###### BTT Core Processing

This section defines the BTT process for BTT enabled and SodX\_D\_Stat is ON.

|  |  |
| --- | --- |
| **R: 3.7.1.5.4.2.1** | The BTT feature shall determine if a trailer is attached, interface with the Cluster / SYNC to obtain trailer data, request trailer data from the Cluster / SYNC if it not available, determine if the trailer connected is new trailer connect or carry-over, and set the BLIS blind zone in accordace to the trailer. The BTT algo shall process targets in accordance to the trailer blind zone. If BTT5G is ENABLE, BTT shall also determine if the trailer is conventional or 5th wheel or gooseneck to process **BTT\_L\_Actl2** or **Btt\_L2\_Actl2**.  BTT trailer determination is done via **isig\_BTT\_TRAILER**. When equal to CONNECT BTT shall use trailer data for TRAILER\_TOW\_OFF feature settings and blind zone settings. |
| **R: 3.7.1.5.4.2.2** | For **isig\_BTT\_TRAILER** = CONNECT, the primary inputs for BTT output determination shall be **Btt\_L\_Actl2** (trailer data) and **Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE), and **isig\_TFLAG\_Last\_Rem** (new or c/o trailer). |
| **R: 3.7.1.5.4.2.3** | BTT process shall be activate when:   1. Upon a module power up (ignition cycle) 2. isig\_Veh\_Speed = 0 3. **SodX\_D\_Stat** transition from OFF to ON independent of vehicle speed |
| **R: 3.7.1.5.4.2.4** | The output of the BTT process is **isig\_BTT\_TRAILER** (which is also used as an input together with trailer data), **BttX\_D\_Stat**, and the blind zone setting. |
| **R: 3.7.1.5.4.2.5** | A flag shall be written to nonvolatile memory which indicates whether a trailer was attached the last time BTT was activated including the last key cycle: internal signal **isig\_TFLAG\_Last\_Rem**. The values of **isig\_TFLAG\_Last\_Rem** shall be  TRUE (trailer previously connected, (0x1))  FALSE (trailer not previously connected, (0x0))  The **isig\_TFLAG\_Last\_Rem** = FALSE when **BTT\_ENABLE\_DISABLE** = DISABLE | **SodX\_D\_Stat** -> OFF per section 3.5.4. |
| **R: 3.7.1.5.4.2.6** | RESERVED |
| **R: 3.7.1.5.4.2.7** | When first activated, BTT shall evaluate **isig\_TRAILER** to determine if a trailer is attached via TLM and/or TBM. |
| **R: 3.7.1.5.4.2.8** | BTT shall then derive **isig\_BTT\_TRAILER** (Table 3.7.1.5.2.-2). |
| **R: 3.7.1.5.4.2.9** | If **isig\_BTT\_TRAILER** = NOT CONNECT, BTT shall set **BttX\_D\_Stat** = NO CONNECT and terminate. |
| **R: 3.7.1.5.4.2.10** | If **isig\_BTT\_TRAILER** = CONNECT, shall read **Btt\_L\_Actl2 and Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) to determine which action to take. |
| **R: 3.7.1.5.4.2.10.1** | ***VALID TRAILER:***  If **Btt\_L\_Actl2** **or Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) is a VALID TRAILER, BTT shall perform TRAILER TOW OFF processing (Table 3.7.1.5.2-4a), set **BttX\_D\_Stat** = CONNECT (Table 3.7.1.5.4-1), set **isig\_TFLAG\_Last\_Rem** = TRUE, and adjust the Blind Zone to trailer. BTT shall remain active. |
| **R: 3.7.1.5.4.2.10.2** | ***INVALID TRAILER:***  If **Btt\_L\_Actl2 or Btt\_L2\_Actl2** (if **BTT5G\_Intern** = TRUE) is a INVALID TRAILER, BTT shall perform TRAILER TOW OFF processing (Table 3.7.1.5.2-4a for **BTT5G\_Intern** = FALSE, Table 3.7.1.5.2-4b for **BTT5G\_Intern** = TRUE), set **BttX\_D\_Stat** = TEMP OFF (Table 3.7.1.5.4-1), and set **isig\_TFLAG\_Last\_Rem** = TRUE. BTT shall remain active.  *Note: OFF TEMP is actually an ON state of BTT. OFF TEMP state can only occur with trailer connected.* |
| **R: 3.7.1.5.4.2.10.3** | ***NO DATA EXISTS:***  If **Btt\_L\_Actl2** = NO DATA EXISTS or **Btt\_L2\_Actl2** = NO DATA EXISTS (if **BTT5G\_Intern** = TRUE), BTT shall read **isig\_TFLAG\_Last\_Rem**.  For **isig\_TFLAG\_Last\_Rem** = TRUE (c/o trailer), BTT shall perform TRAILER TOW OFF processing (Table 3.7.1.5.2-4a), set **BttX\_D\_Stat** = TEMP OFF (Table 3.7.1.5.4-1), and set **isig\_TFLAG\_Last\_Rem** = TRUE.  For **isig\_TFLAG\_Last\_Rem** = FALSE (new trailer), BTT shall request trailer data from the cluster / SYNC via **BttX\_D\_RqDvr** = REQUEST and process the request per requirement R:3.7.1.5.4.1.4 and sub requirements R:3.7.1.5.4.1.4.1 through R:3.7.1.5.4.1.4.6.   1. If the request response is a VALID trailer, then BTT shall process per R:3.7.1.5.4.2.10.1. 2. If the request response is a INVALID trailer then BTT shall process per R:3.7.1.5.4.2.10.2. 3. c) If the request response is a NO DATA EXISTS then BTT shall perform TRAILER TOW OFF processing (Table 3.7.1.5.2-4a) and set **BttX\_D\_Stat** = TEMP OFF (Table 3.7.1.5.4-1). BTT shall then set **isig\_TFLAG\_Last\_Rem** = TRUE. 4. d) BTT shall remain active.   *Note: Per R:3.7.1.5.4.1.4 (BttX\_D\_RqDvr) BTT requests cusomter data only once for a new trailer and no data exists.* |
| **R: 3.7.1.5.4.2.11** | ***BTT System Settings and Rear Range:***  For **isig\_BTT\_TRAILER** = CONNECT & **Btt\_L\_Actl2** = (valid values) BTT shall adjust the BLIS rear range per R:4.3.4.2. Rear range of BTT is from the rear bumper of host. |
| **R: 3.7.1.5.4.2.12** | ***Btt\_L\_Actl2 Customer Changes for BTT active:***  When a trailer is connected (**BttX\_D\_Stat** = (CONNECT | TEMP OFF)) BTT remains active. BTT shall continually monitor **Btt\_L\_Actl2** for value changes. If **Btt\_L\_Actl2** changes then BTT shall process the new value and perform TRAILER TOW OFF processing (Table 3.7.1.5.2-4a), set **BttX\_D\_Stat** (Table 3.7.1.5.4-1), and adjust the Blind Zone to trailer if applicable. Since BTT processes **Btt\_L\_Actl2** value changes during trailer connect, **isig\_TFLAG\_Last\_Rem** does not change for value changes; the trailer is always carry-over.  *Note - The Cluster / SYNC allows the customer to update trailer select information for* ***isig\_Veh\_Speed*** *=< 5 kph.* |
| **R: 3.7.1.5.4.2.13** | ***Isig\_BTT\_Last\_Rem Updating:***  **isig\_BTT\_Last\_Rem** is set per Table 3.5.4-2. BTT shall update **isig\_BTT\_Last\_Rem** just prior to updating **BttX\_D\_Stat** within the BTT process. |
| **R: 3.7.1.5.4.2.14** | ***Isig\_BTT\_Last\_Rem Updating:***  For customer changes made during BTT active (**Btt\_L\_Actl2**) or BTT5G active (**Btt\_L2\_Actl2**) (if **BTT5G\_Intern** = TRUE), **isig\_BTT\_Last\_Rem** shall be updated per table 3.7.1.5.4.2-1. |
| **R: 3.7.1.5.4.2.15** | ***BTT5G System Settings and Rear Range:***  If **BTT5G\_Intern** = TRUE, for **isig\_BTT\_TRAILER** = CONNECT, BTT shall adjust the BLIS rear range per R:4.3.5.2. |
| **R: 3.7.1.5.4.2.16** | If **BTT5G\_Intern** = TRUE, active detections from aftermarket radars shall be included in the rear range (when **SodAltLeft\_D2\_StatAft** or **SodAltRight\_D2\_StatAft** arestate 02 (active – object detection)). |
| **R: 3.7.1.5.4.2.17** | ***Btt\_L2\_Actl2 Customer Changes for BTT5G active:***  If **BTT5G\_Intern** = TRUE, when a trailer is connected (**BttX\_D\_Stat** = (CONNECT | TEMP OFF)) and BTT5G is on, BTT5G shall continually monitor **Btt\_L2\_Actl2** for value changes. Since BTT processes **Btt\_L2\_Actl2** value changes during trailer connect, **isig\_TFLAG\_Last\_Rem** does not change for value changes; the trailer is always carry-over.  *Note - The Cluster / SYNC allows the customer to update trailer select information for* ***isig\_Veh\_Speed*** *=< 5 kph.* |

Table 3.7.1.5.4.2-1 **Btt\_L\_Actl2**Changes for **isig\_BTT\_Last\_Rem** setting

|  |  |  |
| --- | --- | --- |
| Btt\_L\_Actl2 transitions | | UPDATE  Isig\_BTT\_Last\_Rem |
| From | To |
| Valid length 1 | Valid length 2 | NO |
| Valid length | Invalid length | YES |
| Valid length | NO DATA EXISTS | YES |
| Invalid length | Valid length | YES |
| Invalid length | NO DATA EXISTS | NO |
| NO DATA EXISTS | Invalid length | NO |
| NO DATA EXISTS | Valid Length | YES |
| Btt\_L2\_Actl2 transitions | | UPDATE  Isig\_BTT\_Last\_Rem |
| From | To |
| Valid length 1 | Valid length 2 | NO |
| Valid length | Invalid length | YES |
| Valid length | NO DATA EXISTS | YES |
| Invalid length | Valid length | YES |
| Invalid length | NO DATA EXISTS | NO |
| NO DATA EXISTS | Invalid length | NO |
| NO DATA EXISTS | Valid Length | YES |

#### Turn Signal (Secondary Warning Signal) Processing

The BLIS feature shall incorporate Secondary Warning Signal (SWS). The SWS feature shall operate off of the turn signal CAN signal **TurnLghtSwitch\_D\_Stat**.

|  |  |
| --- | --- |
| R: 3.7.1.6.1 | When in BLIS mode, the CAN signal TurnLghtSwitch\_D\_Stat indicates a LH or RH turn in process and the BLIS SodAlrtX\_D\_Stat (and HMI LED hardwire, depending on the vehicle configuration) is equal to LAMP ON, the SodAlrtX\_D\_Stat (and HMI LED hardwire) shall change to FLASH.  The values of **TurnLghtSwitch\_D\_Stat** CAN signal are:  00 – off  01 – left  10 – right  11 – unused  Unused state shall be equal to off.  The interrelation between BLIS and SWS is shown in table 3.7.1.6-1. |
| **R: 3.7.1.6.2** | SWS flash shall be defined as a 50% ON/OFF duty cycle at frequency that is derived by as described in section 8.2 – R:8.2.6 (Door Module Interface).  The global parameter SWS\_FLASH\_PERIODOFFSET is the offset from the 0.125 seconds (refer to 8.2.6) with a resolution of 0.0003  SWS\_FLASH\_PERIODOFFSET parameter is specified in the Global Parameter List. When SWS\_FLASH\_PERIODOFFSET = 7Fhex the signal is read as invalid data by the DCU (Door module).  *NOTE that TURN\_SIGNAL global parameter sets the SWS feature to ENABLE or DISABLE (R: 2.3.4.1).* |
| **R: 3.7.1.6.3** | For both Hardwire LED and DCU controlled LED the CAN signal **SodWarn\_x\_Prd\_Rq** shall be set to:  **SodWarn\_x\_Prd\_Rq =** SWS\_FLASH\_PERIODOFFSET \* 0.3  For Side features configured for Hardwire, the ADAS shall flash the HMI LED at the calculated frequency (refer to section 8.2.6), set the CAN signal **SodAlrtX\_D\_Stat** = FLASH, and set the **SodWarn\_x\_Prd\_Rq ,** as defined above, within 50msec of receiving a **TurnLghtSwitch\_D\_Stat** state change to Left or Right.  For Side features configuration for DCU, the ADAS shall only set the CAN signal **SodAlrtX\_D\_Stat** = FLASH and set the **SodWarn\_x\_Prd\_Rq** as defined above within 50msec of receiving a **TurnLghtSwitch\_D\_Stat** state change to Left or Right. The HMI shall be set to OFF.  **If BTT5G\_Intern** is TRUE, and **SodAltX\_D2\_StatAft**  is Active With Detection, the output signal to the Ford arbitrator shall be FLASH, within 50msec of receiving a **TurnLghtSwitch\_D\_Stat** state change to Left or Right. See table 3.7.3.3-2. |
| **R: 3.7.1.6.4** | RESERVED |
| **R: 3.7.1.6.5** | For Side features configured for HMI hardwire – while flashing the LED during an SWS event **TurnLghtSwitch\_D\_Stat** state changes from Left (Right) to OFF and then LED is in the ON state, the ADAS shall complete the ON cycle. This behavior is detailed in section 8. |
| **R: 3.7.1.6.6** | The LED brightness during a SWS event shall be equivalent to the current BLIS day or night brightness setting. |
| **R: 3.7.1.6.7** | If **TurnLghtSwitch\_D\_Stat** transitions form Left to Right without going to Off, the SODL shall treat this as a LH turn signal off condition and RH turn signal on condition.  If **TurnLghtSwitch\_D\_Stat** transitions form Right to Left without going to Off, the SODR shall treat this as a RH turn signal off condition LH turn signal on condition. |
| **R: 3.7.1.6.8** | Because the customer can function the turn signal switch for very short periods of time during a lane change, a global parameter SWS\_Minimum\_Flash\_Time will define the minimum time that the ADAS will set **SodAlrtX\_D\_Stat** = FLASH when **TurnLghtSwitch\_D\_Stat** transitions to ON.  NOTE: The **TurnLghtSwitch\_D\_Stat** is ON for as long as the turn signal is supposed to be active. The steering column module cancelled the CAN signal to OFF when Lane Change Flashes are complete, the steering wheel turns through the vehicle turn, or when the ignition goes to OFF.  **If BTT5G\_Intern** is TRUE, and **SodAltX\_D2\_StatAft**  is Active With Detection, the output signal to the Ford arbitrator shall be FLASH for the minimum time as defined by SWS\_Minimum\_Flash\_Time. |
| **R: 3.7.1.6.9** | **TurnLghtSwitch\_D\_Stat** shall be set to missing/invalid if the signal is missing/invalid after 8 consecutive periodic signals. Refer to fault processing section 3.7.10. When missing/invalid the ADAS shall assume the **TurnLghtSwitch\_D\_Stat** is OFF. |

Table 3.7.1.61-1 Secondary Warning Activation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | INPUT | | | OUTPUT | |
| Requirement | BLIS ALERT  LH | BLIS ALERT  RH | TurnLghtSwitch\_D\_Stat | Vehicle in Blind Zone | |
| LH Alert | RH Alert |
| R: 3.7.1.6.1 | NOT ACTIVE | NOT ACTIVE | OFF | Off | Off |
| R: 3.7.1.6.2 | NOT ACTIVE | ACTIVE | OFF | Off | Solid On |
| **R: 3.7.1.6.3** | ACTIVE | NOT ACTIVE | OFF | Solid On | Off |
| **R: 3.7.1.6.4** | ACTIVE | ACTIVE | OFF | Solid On | Solid On |
| **R: 3.7.1.6.5** | NOT ACTIVE | NOT ACTIVE | LEFT | Off | Off |
| **R: 3.7.1.6.6** | NOT ACTIVE | ACTIVE | LEFT | Off | Solid On |
| **R: 3.7.1.6.7** | ACTIVE | NOT ACTIVE | LEFT | SWS Flash | Off |
| **R: 3.7.1.6.8** | ACTIVE | ACTIVE | LEFT | SWS Flash | Solid On |
| **R: 3.7.1.6.9** | NOT ACTIVE | NOT ACTIVE | RIGHT | Off | Off |
| **R: 3.7.1.6.10** | NOT ACTIVE | ACTIVE | RIGHT | Off | SWS Flash |
| **R: 3.7.1.6.11** | ACTIVE | NOT ACTIVE | RIGHT | Solid On | Off |
| **R: 3.7.1.6.12** | ACTIVE | ACTIVE | RIGHT | Solid On | SWS Flash |

#### AutoHitch Interaction

|  |  |
| --- | --- |
| R: 3.7.1.7.1 | The ADAS ECU internal signal **AutoHitch\_Mode** shall be read. When **AutoHitch\_Mode** = 0x1 (TRUE) AutoHitch feature is active and CTA and RCTB alerting shall be inhibited. When **AutoHitch\_Mode** = 0x0 (FALSE) AutoHitch feature is inactive and CTA and RCTB shall function as specified within. |

#### DCU Status Message Processing

If configured for DCU then ADAS will process the appropriate DCU status message **BlisLED\_Stat\_Driver\_Side** and **BlisLED\_Stat\_Pass\_Side** as specified is the section 8; BLIS CTA Door Module Interface.

Note: These two signals will be received by the LED arbitrator starting in DAT 2.1. The arbitrator will set the appropriate DTC’s for LED status mismatch with DCU.

#### RESERVE

#### MyKey Processing

The MyKey signal is read during Bulb Prove-Out only as described in section 3.4. MyKey processing generates an internal signal **isig\_My\_Key**.

|  |  |
| --- | --- |
| R: 3.7.1.10.1 | At power up, the internal signal **isig\_My\_Key** is set to FALSE. |
| **R: 3.7.1.10.2** | The ADAS shall read the MyKey CAN signal **IgnKeyType\_D\_Actl** commencing at power up. Thus, for a running reset My Key can be reread without having to store the value to nonvolatile memory. If the signal is missing initially, the ADAS shall make a total of eight attempts to read the signal. At the first valid read of **IgnKeyType\_D\_Actl** within the eight read attempts, ADAS shall set **isig\_My\_Key** in accordance to Table 3.7.1.10. |
| **R: 3.7.1.10.3** | If **IgnKeyType\_D\_Actl** is equal to 0x0, ADAS shall wait an additional 5 seconds to see if **IgnKeyType\_D\_Actl** changes to another state. If at the end of 5 seconds **IgnKeyType\_D\_Actl** remains equal to 0x0 then no further reading of **IgnKeyType\_D\_Actl** is done and **isig\_My\_Key** is FALSE for the remainder of the key cycle. |
| **R: 3.7.1.10.4** | When **isig\_My\_Key** is TRUE, the ADAS shall set **isig\_My\_Key** = TRUE for the duration of the ignition cycle; thus, no further reads are needed for the **IgnKeyType\_D\_Actl** signal. This is because if the vehicle is started with a MyKey then the ignition will need to recycle before it becomes a NOT MyKey. |
| **R: 3.7.1.10.5** | When **isig\_My\_Key** is TRUE, the ADAS shall set both BLIS and CTA to ON as shown in table 3.7.1.10. Both **SodX\_D\_Stat** and **CtaX\_D\_Stat** shall be set to ON regardless of the ADAS mode (BLIS mode or CTA mode). |
| **R: 3.7.1.10.6** | When **isig\_My\_Key** is FALSE, the ADAS shall set **isig\_My\_Key** = FALSE for the duration of the ignition cycle; thus, no further reads are needed for the **IgnKeyType\_D\_Actl** signal. This is because if the vehicle is started with a MyKey then the ignition will need to recycle before it becomes a NOT MyKey. |
| **R: 3.7.1.10.7** | The **IgnKeyType\_D\_Actl** shall be set to missing after 8 consecutive missing messages. If missing, BLIS and CTA shall assume standard key. A MyKey missing message DID shall be set as defined in section 3.7.10 Fault Processing. |
| **R: 3.7.1.10.8** | BLIS shall not write a MyKey forced ON state change to Last Remembered memory. |
| **R: 3.7.1.10.9** | When **isig\_My\_Key** = TRUE and the **BttX\_D\_Stat** = OFF BTT shall be forced to ON for the remainder of the key cycle. However, **isig\_BTT\_Last\_Rem** shall not be changed. During this forced on key cycle BTT shall ignore any request from Cluster to turn OFF via **Sod\_D\_Rq**. Refer to R:3.4.2.11 for detailed BTT processing during a MyKey event. The **isig\_TFLAG\_Last\_Rem** is still updated per BTT processing when **isig\_My\_Key** = TRUE |

Table 3.7.1.10 - 1 Development of Internal Signal My\_Key

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| INPUT | | | OUTPUT | |
| IgnKeyType\_D\_Actl | MS CAN state encoded value | Isig\_My\_Key | CtaX\_D\_Stat | SodX\_D\_Stat |
| Key Read in Progress | 0x0 | FALSE | No state change | No state change |
| Key in ignition standard key | 0x1 | FALSE | No state change | No state change |
| Key in ignition My Key | 0x2 | TRUE | ON | ON |
| Key Not Prgrm Read Failure | 0x3 | FALSE | No state change | No state change |
| Not Used | 0x4 – 0xC | FALSE | No state change | No state change |
| Unknown | 0xD | FASLE | No state change | No state change |
| Invalid | 0xF | FALSE | No state change | No state change |
| Missing | n/a | FALSE | No state change | No state change |

Note – No state change means assume the existing state

Note² - in the case of a MyKey being used, RCTB (RBA) will NOT follow CTA ON/OFF setting.

#### Alert LED Illumination Diming Process

This sub-section is an internal Ford HMI manager requirement due to LED arbitrator design.

Illumination Dimming is achieved using two network input signals, **Parklamp\_Status** and **Litval** CAN signals. **Litval** provides information regarding ambient light via the vehicle light sensor. **Parklamp\_Status** provides information regarding the status of the park lamps. For more information regarding **Parklamp\_Status** and **Litval** and illumination processing, refer to the Vehicle Interior Illumination Dimming Subsystem Specification, ES-9L3T-1A278-Ax.

**Parklamp\_Status** is an ON/OFF toggle that tells when the park lamps have been energized.

**Litval** values range from 0 (full nighttime) to 5 (daytime). Values of 4 and 5 equate to daytime and values of 3 through 0 equate to night time.

This two signal strategy is being utilized so that the alert LED will be set for Daytime Brightness during daytime/twilight ambient lighting conditions regardless of whether the park lamps are on. Vehicles less a Sun Load sensor do not comply with this FS PDL requirements (see section 1.2). If, however, Side feature is added to a program less Sun Load sensor then see the FMC work-around-requirement R:3.7.1.11.9.

|  |  |
| --- | --- |
| R: 3.7.1.11.1 | Side feature shall utilize the CAN signals **Parklamp\_Status** and **Litva**l to set an internal signal **isig\_Day\_Night\_Set** as defined in table 3.7.1.11-1. |
| **R: 3.7.1.11.2** | RESERVED |
| **R: 3.7.1.11.3** | The HMI LED drive signal is a PWM voltage signal with a 120 Hz frequency and voltage states of zero and 12 Vdc. For details on OSRVM LED circuit submit an email request to FNA BLIS D&R engineering. |
| **R: 3.7.1.11.4** | Internal signal **isig\_Day\_Night\_Set** shall be compared to system states to determine the actual LED PWM illumination intensity, **Side\_Detect\_X\_Illum,** as defined in table 3.7.1.11-2. **Side\_Detect\_Illum** CAN signal define the percent ON time duty cycle of the PWM signal. **Side\_Detect\_Illum** daytime value shall be equal to the global parameter ALERT\_INDICATOR\_DUTY\_CYCLE\_DAY (referred to as FULL brightness) and **Side\_Detect\_Illum** nighttime value shall be equal to the global parameter ALERT\_INDICATOR\_DUTY\_CYCLE\_NIGHT (referred to as DIM brightness). |
| **R: 3.7.1.11.5** | When ADAS activates the HMI LED via CAN signals **SodAlrtX\_D\_Stat** (LAMP ON or FLASH), **CtaAlrtX\_D\_Stat =** ON, or **CtaAlrtX\_D\_Stat** ≠ OFF, ADAS shall command the illumination intensity of the HMI LED by transmitting the CAN signal **Side\_Detect\_X\_Illum**. |
| **R: 3.7.1.11.6** | When Side feature is configured for Hardware HMI and ADAS activates the HMI LED via CAN signals **SodAlrtX\_D\_Stat,** ADAS shall command the illumination intensity of the hardwire HMI LED with a PWM duty cycle equal to ALERT\_INDICATOR\_DUTY\_CYCLE\_DAY for daytime illumination and ALERT\_INDICATOR\_DUTY\_CYCLE\_NIGHT for nighttime illumination.  *Note: illumination for CTA alert is defined in R: 3.7.7.3.* |
| **R: 3.7.1.11.7** | When Side feature is unconfigured **Side\_Detect\_X\_Illum** shall be set toALERT\_INDICATOR\_DUTY\_CYCLE\_DAY. |
| **R: 3.7.1.11.8** | When ADAS commands the HMI LED to flash twice for Cluster commanded ON/OFF transitions per section 3.7.9, **Side\_Detect\_X\_Illum** shall be equal to internal signal **isig\_Day\_Night\_Set**. |
| **R: 3.7.1.11.9** | ***Ford D&R Application Engineer Requirement only***  If FMC engineering decides to launch Side features on a vehicle less SUNLOAD sensor, the vehicle specific global parameter ALERT\_INDICATOR\_DUTY\_CYCLE\_NIGHT must be set equal to ALERT\_INDICATOR\_DUTY\_CYCLE\_DAY (typically set at 95% duty cycle).  *Note – This requirement is necessary since a vehicle with less Sun Load sensor may default the CAN signal value for LITVAL equal to a 0x0 which is a nighttime value. In addition, this requirement must be tested by the D&R application engineer.* |

Table 3.7.1.11-1 Internal Signal isig\_Day\_Night\_Set Decision Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| INPUTS | |  |  |  |
| Parklamp\_Status | Litval |  | isig\_Day\_Night\_Set | Description |
| Don't Care | INVALID |  | DAY | Unknown ambient level turn on full |
| Don't Care | UNKNOWN |  | DAY |
| OFF | < 4 |  | DAY | Night with park lamps off |
| OFF | >= 4 |  | DAY | Day with park lamps off |
| ON | < 4 |  | NIGHT | Night with park lamps on |
| ON | >= 4 |  | DAY | Day with park lamps on |
| UNKNOWN | < 4 |  | DAY | Unknown park lamp status |
| UNKNOWN | >= 4 |  | DAY |
| INVALID | < 4 |  | DAY |
| INVALID | >= 4 |  | DAY |
| Missing | Don't Care |  | DAY |  |
| Don't Care | Missing |  | DAY |  |
| Missing | Missing |  | DAY | Missing FNOS message |

Table 3.7.1.11-2 HMI LED Signal for System States

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| INPUTS | | | | | |  | OUTPUT |
| isig\_Day\_Night\_Set | Active  Alert | Bulb Prove-Out | System Fault |  | Blockage |  | HMI PWM  Side\_Detect\_X\_Illum |
| DAY | ON | No | no |  | no |  | FULL |
| NIGHT | ON | No | no |  | no |  | DIM |
| DAY | don't care | YES | don't care |  | don't care |  | 20% |
| NIGHT | don't care | YES | don't care |  | don't care |  | 20% |
| DAY | don't care | No | YES |  | don't care |  | FULL |
| NIGHT | don't care | No | YES |  | don't care |  | DIM |
| DAY |  | No | no |  | YES |  | FULL |
| NIGHT |  | No | no |  | YES |  | DIM |

#### Vehicle Turn Radius

Vehicle turn radius shall be used for RCTB (RBA) and are recommended to be used for other features for the purpose of optimizing MTR and FAR.

|  |  |
| --- | --- |
| **R: 3.7.1.12.1** | The vehicle dynamics CAN signals available for the SOD shall be as follows:  **VehYaw\_W\_Actl**  **WhlRotatFr\_No\_Cnt**  **StePinComp\_An\_Est** or **SteWhlComp\_An\_Est**  Vehicle dynamics CAN signals shall be used by the supplier to optimize the MTR and FAR performance for the RCTB (RBA) feature as specified in R:3.7.1.12.9 and may be used by the supplier to optimize MTR and FAR performance for BLIS, CTA, BA, BTT, and ATD.  For example, vehicle dynamics may be used by BLIS with VRR and BTT to determine road curvature. It may be used by ATD to determine host to trailer angle changes. It may be used by CTA to determine parking angle. Specific uses shall be reviewed and approved by Ford.  All vehicles will have **VehYaw\_W\_Actl**, **WhlRotatFr\_No\_Cnt** and (**StePinComp\_An\_Est** or **SteWhlComp\_An\_Est**). |
| **R: 3.7.1.12.2** | The **VehYaw\_W\_Actl** is in degrees per second. If **VehYaw\_W\_Actl** = NO DATA EXIST or FAULTY or is missing for 4 seconds, a fault counter DID shall be set. If **VehYaw\_W\_Actl** recovers then ADAS may again use it. Also refer to section 3.7.10 Fault Processing. |
| **R: 3.7.1.12.3** | Vehicles shall have one of two steering wheel CAN signals **StePinComp\_An\_Est** (from the PSCM) or **SteWhlComp\_An\_Est** (from the ABS) but never both. The CAN signals are identical other than source and signal name.  At ADAS power-up and initialization the ADAS shall search for **StePinComp\_An\_Est** and **SteWhlComp\_An\_Est** to determine which signal is available. Once established that CAN signal and it’s associated QF signal shall be used for the entire key cycle. |
| **R: 3.7.1.12.4** | For reference purposes let  **SteXComp\_An\_Est** = **StePinComp\_An\_Est** | **SteWhlComp\_An\_Est**  **SteXComp\_An\_Est\_QF** = **StePinComp\_An\_Est\_QF** | **SteWhlComp\_An\_Est\_QF**  The values for **SteXComp\_An\_Est\_QF** in Table 3.7.1.12-1. If **SteXComp\_An\_Est\_QF** <> OK | DEGRADED or **SteXComp\_An\_Est** is missing for 4 seconds, a fault counter DID shall be set. If **SteXComp\_An\_Est\_QF** -> OK | DEGRADED or **SteXComp\_An\_Est** recovers then ADAS may again use it. Also refer to section 3.7.10 Fault Processing.  *Note:* ***SteXComp\_An\_Est*** *polarity shall be checked per program by the supplier.* |
| **R: 3.7.1.12.5** | To calculate the turn radius using **SteXComp\_An\_Est** the wheel base and steering ratio shall be used. These values are listed in the global parameters Wheel\_Base and Steering\_Ratio. |
| **R: 3.7.1.12.6** | The **WhlRotatFr\_No\_Cnt** shall be used together with the Yaw Rate for vehicle turn radius computations. If **WhlRotatFr\_No\_Cnt** is missing for 4 seconds, a fault counter DID shall be set. If **WhlRotatFr\_No\_Cnt** recovers then ADAS may again use it. Also refer to section 3.7.10 Fault Processing. |
| **R: 3.7.1.12.7** | It is recommended that the supplier use steering wheel angle data at low speeds for vehicle dynamics, and use the Yaw and Wheel Rotation for turn radius at higher speeds. This is because the Yaw measurement is noising at low speeds. The transition between ‘low’ and high’ speed is in the range of 20 to 35 kph. The strategy selected by the supplier shall be reviewed and approved by Ford. |
| **R: 3.7.1.12.8** | Vehicle dynamics calculations shall be done from the inputs available under various fault conditions as specified in Table 3.7.1.12-2.  The table supersedes R: 3.7.1.12.6. For example, if **SteXComp\_An\_Est** CAN signal goes missing, the supplier shall use Yaw data for low speed vehicle dynamics calculations.  Note – Per section 3.7.10 (Fault Processing) the loss of vehicle dynamics, in part or all, does not cause a feature to fail; only a DID is set. The logic is that Yaw and steering can be backups to each other, and if both are lost the vehicle will have bigger issues than Side feature false alerts. |
| **R: 3.7.1.12.9** | The internal signal **isig\_Turn\_Radius\_Status** shall be used for test purposes and shall indicate which of the sets of turn radius inputs are being processed by the software as shown in Table 3.7.1.12-2. |
| **R: 3.7.1.12.10** | For RCTB (RBA) the Vehicle turn radius shall be used by a supplier to avoid false interventions when backing into the first lane with vehicles approaching in the 2nd lane. It shall also be used to suppress false interventions when doing parallel or perpendicular park in maneuvers. See the diagram below. |
| **R: 3.7.1.12.11** | For RCTB (RBA) the global parameters RCTB\_UpperAngleLimit and RCTB\_LowerAngleLimit may be ignored when suppressing interventions based on turn radius.Intervention suppression based on turn radius must be reviewed and approved by FMC. |

Scenarios described in R: 3.7.1.12.10

|  |  |
| --- | --- |
|  |  |
| 2nd lane targets | Parallel park in |
|  | |
| Perpendicular park in | |

Table 3.7.1.12-1

|  |  |  |
| --- | --- | --- |
| **CAN Signal** | **Hex Value** | **Definition** |
| VehYaw\_W\_Actl | 0x0 through 0xFFFD | -6.5 to 6.6066 Rads/sec |
| 0xFFFE | No Data Exists |
| 0xFFFF | Faulty |
| WhlRotatFr\_No\_Cnt |  | Wheel Speed |
| SteXComp\_An\_Est |  | Steering Angle in degree. Resolution: 0.1° |
| SteXComp\_An\_Est\_QF |  | Quality Factor:  Faulty: PSCAM has detected a fault  No\_Data\_Exists:  temporarily no data available  Degraded: Residual error < 25°  OK: Residual error < 5° |

Table 3.7.1.12-2: BLIS and RCTB turn radius signal usage

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| VehYaw\_W\_Actl | WhlRotatFr\_No\_Cnt | SteXComp\_ An\_Est\_QF | isig\_turn\_radius\_status | Signal to calculate turn radius | Feature Behavior |
| OK | OK | OK | 0x0 | Supplier defined |  |
| OK | missing | OK | Degraded | 0x1 | SteXComp\_An\_Est | If Yaw rate is not available, features shall function even if only coarse turn radius data exists |
| missing | OK | OK | Degraded | 0x2 | SteXComp\_An\_Est | If Yaw rate is not available, features shall function even if only coarse turn radius data exists |
| OK | OK | Fault | Missing/invalid | NoDataExists | Degraded | 0x3 | VehYaw\_W\_Actl | If Steering data is degraded or unavailable, but Yaw rate is available, use Yaw rate only. |
| Fault/Missing/invalid | Don’t Care | NoDataExists OR Faulty/Missing/Invalid | 0x4 | n/a | Features shall function less turn radius data. |
| Don’t Care | missing | NoDataExists OR Faulty/Missing/Invalid | 0x4 | n/a | Features shall function less turn radius data. |

#### RESERVED

#### Wheel Direction Signals

RCTB uses the wheel direction signals from ABS to determine if the vehicle is moving in the reverse direction for both automatic and manual transmissions. The internal signal isig\_Vehicle\_Direction is derived out of these CAN signals.

Note: RCTB becomes active only after isig\_transmission\_staus equals REVERSE. The wheel direction then is used to detect that the car is moving, and a brake request is possible.

The wheel direction is needed to detect motion and make sure the vehicle is really moving rearward. Note that a manual transmission vehicle may roll forward downhill with the reverse gear engaged and the clutch depressed.

|  |  |
| --- | --- |
| **R: 3.7.1.14.1** | The internal signal **isig\_Vehicle\_Direction** is defined by logical combination of the wheel direction CAN signals **WhlDirXl\_D\_Actl** and **WhlDirXr\_D\_Actl** as specified in table 3.7.1.14–1, where X refers to either the front or rear wheel configuration as specified in Table 3.2.13-1.  The states for **isig\_Vehicle\_Direction** are:  0x0: not reversing  0x1: reversing  0x2: fault |
| **R: 3.7.1.14.2** | If the vehicle is configured for manual transmission, RCTB shall enter a fault state after 5.000 seconds where WhlDirXl\_D\_Actl and WhlDirXr\_D\_Actl are equal to Failed or Missing/Invalid Message. See in Table 3.7.1.14-1. |
| **R: 3.7.1.14.3** | If the vehicle is configured for automatic transmission missing or faulty wheel speed sensors shall not trigger a DTC. Instead set a DID and attempt to process isig\_Vehicle\_Direction per Table 3.7.1.14-2 (backup logic). |

Table 3.7.1.14-1 isig\_Vehicle\_Direction definition

|  |  |  |  |
| --- | --- | --- | --- |
| WhlDirXl\_D\_Actl | WhlDirXr\_D\_Actl | isig\_Vehicle\_Direction | |
| Manual | Automatic |
| Backward | Don’t care | Reversing | |
| Don’t care | Backward | Reversing | |
| Forward | Not Backward | not reversing | |
| Not Backward | Forward |
| Unknown | Not Backward |
| Not Backward | Unknown |
| Fault or missing/invalid | Fault or missing/invalid | Fault (after 5 seconds) 1 | See Table 3.7.1.14-2 |

1: Note this is an exception from R: 3.7.10.125

Table 3.7.1.14-2: isig\_Vehicle\_Direction definition (automatic trans backup logic)

|  |  |  |
| --- | --- | --- |
| isig\_Transmission\_Status | Isig\_Veh\_Speed | isig\_Vehicle\_Direction |
| Reverse | > 0 kph | Reversing |
| Reverse | = 0 | Not reversing |
| Not Reverse | Don’t care |

*Note – in case the signals for PRNDL or vehicle speed are faulty/missing/invalid, CTA will fault and RCTB will be unavailable. Therefore, there is no need to handle faults of these signals separately for RCTB.*

### BLIS CTA Arbitration Model

This section documents the effect of CEA Arbitration on BLIS and CTA algorithms and Ford’s HMI Model. Each requirement is designated as supplier or internal Ford requirement.

|  |  |
| --- | --- |
| **R: 3.7.2.1** | Ford Internal requirement:  The Arbitration of BLIS LED request from BLIS, CTA, LCWA and CEA will be handled by Ford HMI Manager Model and the requirement is captured in LROS spec. |
| **R: 3.7.2.2** | Supplier requirement (Algorithm to HMI model inerrnal signal Tx/Rx)  The BLIS CTA models shall follow the mapping in table 3.7.2-1 to generate and to process the appropriate internal signals transmitted to the Arbitrator model and received from the COP/CST and sent to CAN. |
| **R: 3.7.2.3** | Internal Requirement (Hardwired OSRVM LEDs)  Supplier shall process the following internal signals received from Ford HMI Manager LED driver (to be used by supplier) to trigger LED ON/OFF/Flashing.  **HMI\_BLISLEDAlertLeft\_D\_Stat** (0x0 – Off, 0x1 – On, 0x2 – BLIS Flash, 0x3 – CTA Alert,  0x4 – Bulb\_Proveout; Note that Default = Off)  **HMI\_BLISLEDAlertRight\_D\_Stat** (0x0 – Off, 0x1 – On, 0x2 – BLIS Flash, 0x3 – CTA Alert, 0x4 – Bulb\_Proveout; Note that Default = Off) |
| **R: 3.7.2.4** | Supplier Requirement (LED Illumination)  Supplier shall use the following signals, sent by the Ford HMI Model, to control the illumination level of hardwired LEDs  **HMI\_SideDetectLeft\_Illum** (0-100% PWM)  **HMI\_SideDetectRight\_Illum** (0-100% PWM) |
| **R: 3.7.2.5** | Ford Internal requirement:   * HMI Manager will send out following CAN Signals to DCU via COP and CST which have LED illumination intensity values in terms of % PWM   + **HMI\_Side\_Detect\_L\_Illum (from HMI) -> Side\_Detect\_L\_Illum \_COP (from COP) -> Side\_Detect\_L\_Illum (from CST) -> Aptiv COM Stack**   + **HMI\_Side\_Detect\_R\_Illum (from HMI) -> Side\_Detect\_R\_Illum \_COP (from COP) -> Side\_Detect\_R\_Illum (from CST) -> Aptiv COM Stack** * HMI Manager will follow the requirements currently specified in SOD specification for implementing LED illumination strategy * Following CAN signals will be used by HMI Manager to calculate the LED illumination intensity and they will be processed through CST, CIP and FHP.   + **Parklamp\_Status\_CIP (From CST) -> CIP\_Parklamp\_Status (From CIP) -> HMI Manager**   + **Litval\_CIP (From CST) -> CIP\_Litval (From CIP) -> HMI Manager** * FHP will need to provide message 0x3B3 comm status via following signal which will be used by HMI Manager to calculate the LED illumination intensity in case of missing above signals   + **Msg\_0x3B3\_ComStat** |
| **R: 3.7.2.6** | Supplier requirement:  The following flags shall be communicated from Supplier LED Diagnostics code to common function FIDP model for the HW LED fault status to arbitrate with DCU LED status (per LROS requriements)   * **HWLEDStatLeft** (0x0 – Off, 0x1 – On, 0x2 - Fault; Default = Off) * **HWLEDStatRight** (0x0 – Off, 0x1 – On, 0x2 - Fault; Default = Off) |
| **R: 3.7.2.7** | Ford Internal requirement (LED mismatch DTCs with Door module status)  The FHP Model will receive following signals from CST and will process the validity check as well as message comm status for the two BLIS LED Status signals received from DCU   * + **BLISLEDStatDriverSide\_CIP**   + **BLISLEDStatPassSide\_CIP**   + **Msg\_0x332\_RxStat**   FHP Model will send following signals to FIDP model as results of processing the validity check and message comm status   * + **BLISLEDStatDriverSide\_ValSts**   + **BLISLEDStatPassSide\_ValSts**   + **Msg\_0x332\_ComFlt**   FIDP Model will use above signals along with BLIS LED status signals received from DCU and LED command signals from HMI Manager to set DTCs.  FIDP model will receive following Hardwire LED status flags from supplier diagnostics code.   * + **HWLEDStatLeft** (0x0 – Off, 0x1 – On, 0x2 - Fault; Default = Off)   + **HWLEDStatRight** (0x0 – Off, 0x1 – On, 0x2 - Fault; Default = Off)   FIDP will set a DTC flag or DTC flags if a mismatch is found between commanded value and feedback value.  FDIP will arbitrate, using M2 configuration for LED (i.e. Hardwire LED or DCU LED), between the Hardwire LED status signals (**HWLEDStatLeft** & **HWLEDStatRight)** and DCU LED status signals (**BlisLEDStatDriverSide\_CIP & BlisLEDStatPassSide\_CIP)** and generate and communicate following LED status flags to Features for their internal failsafe action:   * + **SODLEDStatLeft** (0x0 – No Fault, 0x1 – Fault)   + **SODLEDStatRight** (0x0 – No Fault, 0x1 – Fault) |
|  |  |

**Table 3.7.2-1 BLIS CTA Arbitrator Signal Mapping**

|  |  |  |  |
| --- | --- | --- | --- |
| **Initial output from BLIS CTA Models to Ford Arbitrator** | **From Arbitrator to COP** | **From COP to CST/Supplier Code** | HMI Manager to DCU via COP and CST |
| BLIS\_SodAlrtLeft\_D\_Stat | HMI\_SodAlrtLeft\_D\_Stat | SodAlrtLeft\_D\_Stat\_COP | SodAlrtLeft\_D\_Stat |
| BLIS\_SodAlrtRight\_D\_Stat | HMI\_SodAlrtRight\_D\_Stat | SodAlrtRight\_D\_Stat\_COP | SodAlrtRight\_D\_Stat |
| CTA\_CtaAlrtLeft\_D\_Stat | HMI\_CtaAlrtLeft\_D\_Stat | CtaAlrtLeft\_D\_Stat\_COP | CtaAlrtLeft\_D\_Stat |
| CTA\_CtaAlrRight\_D\_Stat | HMI\_CtaAlrRight\_D\_Stat | CtaAlrRight\_D\_Stat\_COP | CtaAlrRight\_D\_Stat |
| CTA\_CtaAlrtLeft2\_D\_Stat | HMI\_CtaAlrtLeft2\_D\_Stat | CtaAlrtLeft2\_D\_Stat\_COP | CtaAlrtLeft2\_D\_Stat |
| CTA\_CtaAlrRight2\_D\_Stat | HMI\_CtaAlrRight2\_D\_Stat | CtaAlrRight2\_D\_Stat\_COP | CtaAlrRight2\_D\_Stat |

### SOD Generated CAN Signal Setups

This section shall define special SOD CAN signal relationships.

#### CAN Signal Setup for SodDetctX\_D\_Stat

The **SodDetctX\_D\_Stat** will be used by other systems within the vehicle. It is a reflection of current BLIS status. It does not reflect CTA status.

|  |  |
| --- | --- |
| **R: 3.7.3.1.1** | The **SodDetctX\_D\_Stat** CAN signal content is shown in Table 3.7.3.1.1. This CAN signal shall be equal to specific ADAS CAN signals as indicated. |

**Table 3.7.3.1.1 SodDetctX\_D\_Stat Definition**

|  |  |  |
| --- | --- | --- |
| **SodDetctX\_D\_Stat** | **VALUE** | **Equal To:** |
| Alert On | 0x1 | SodAlrtX\_D\_Stat = LAMP ON |
| Flash On | 0x2 | SodAlrtX\_D\_Stat = FLASH |
| Sensor Fault | 0x3 | SodSnsX\_D\_Stat = FAULT |
| Sensor Blocked | 0x4 | SodSnsX\_D\_Stat = BLOCKED |
| Clear | 0x0 | None of the above conditions are true or Side Feature is in CTA mode. |

#### CtaAlrtX2\_D\_Stat and CtaAlrtX\_D\_Stat CAN Signal Relationship

|  |  |
| --- | --- |
| **R: 3.7.3.2.1** | The states of **CtaAlrtX2\_D\_Stat** and **CtaAlrtX\_D\_Stat** are shown in Table 3.7.3.2-1. This table defines the ON / OFF relationship between the two CAN signals. **CtaAlrtX2\_D\_Stat** and **CtaAlrtX\_D\_Stat** state setting shall be done within the same uP cycle. |

Table 3.7.3.2-1 CtaAlrtX2\_D\_Stat and CtaAlrtX\_D\_Stat

|  |  |  |  |
| --- | --- | --- | --- |
| CtaAlrtX2\_D\_Stat | | CtaAlrtX\_D\_Stat | |
| Definition | Value | Definition | Value |
| OFF | 0x0 | OFF | 0x0 |
| Alert Zone 1 | 0x1 | ON | 0x1 |

#### SodAlrtX\_D\_Stat CAN Signal

|  |  |
| --- | --- |
| **R: 3.7.3.1.1** | For **BTT5G\_Intern** FALSE, **SodAlrtX\_D\_Stat** CAN signal content is shown in Table 3.7.3.3-1. |
| **R: 3.7.3.1.2** | If **BTT5G\_Intern** TRUE and BLIS is ON, **SodAltX\_D2\_StatAft** is processed, signal content is shown in 3.7.3.3-2. |

**Table 3.7.3.3-1: SodAlrtX\_D\_Stat**

|  |  |
| --- | --- |
| Isig\_BLIS\_Alert\_Left | SodAlrtLeft\_D\_Stat |
| LAMP OFF | 0x0 – LAMP OFF |
| LAMP ON | 0x1 – LAMP ON |
| FLASH | 0x2 - FLASH |
| BULB PROVEOUT | 0x3 – BULB PROVEOUT |

|  |  |
| --- | --- |
| Isig\_BLIS\_Alert\_Right | SodAlrtRight\_D\_Stat |
| LAMP OFF | 0x0 – LAMP OFF |
| LAMP ON | 0x1 – LAMP ON |
| FLASH | 0x2 - FLASH |
| BULB PROVEOUT | 0x3 – BULB PROVEOUT |

**Table 3.7.3.3-2: SodAlrtX\_D\_Stat (BTT5G\_Intern** TRUE and BLIS ON)

|  |  |  |
| --- | --- | --- |
| Isig\_BLIS\_Alert\_Left | SodAltLeft\_D2\_StatAft | SodAlrtLeft\_D\_Stat (Output) |
| LAMP OFF | Standby | 0x0 – LAMP OFF |
| LAMP OFF | Active No Detection | 0x0 – LAMP OFF |
| LAMP OFF | Active With Detection | 0x1 – LAMP ON |
| LAMP OFF | Fault | 0x0 – LAMP OFF |
| LAMP ON | Standby | 0x1 – LAMP ON |
| LAMP ON | Active No Detection | 0x1 – LAMP ON |
| LAMP ON | Active With Detection | 0x1 – LAMP ON |
| LAMP ON | Fault | 0x0 – LAMP OFF |
| FLASH | Don’t Care | 0x2 - FLASH |
| Don’t Care | Active With Detection & Left turn signal active (see requirement 3.7.1.6.3) | 0x2 - FLASH |
| BULB PROVEOUT | Don’t Care | 0x3 – BULB PROVEOUT |

|  |  |  |
| --- | --- | --- |
| Isig\_BLIS\_Alert\_Right | SodAltRight\_D2\_StatAft | SodAlrtRight\_D\_Stat (output) |
| LAMP OFF | Standby | 0x0 – LAMP OFF |
| LAMP OFF | Active No Detection | 0x0 – LAMP OFF |
| LAMP OFF | Active With Detection | 0x1 – LAMP ON |
| LAMP OFF | Fault | 0x0 – LAMP OFF |
| LAMP ON | Standby | 0x1 – LAMP ON |
| LAMP ON | Active No Detection | 0x1 – LAMP ON |
| LAMP ON | Active With Detection | 0x1 – LAMP ON |
| LAMP ON | Fault | 0x0 – LAMP OFF |
| FLASH | Don’t Care | 0x2 - FLASH |
| Don’t Care | Active With Detection & Right turn signal active (see requirement 3.7.1.6.3) | 0x2 - FLASH |
| BULB PROVEOUT | Don’t Care | 0x3 – BULB PROVEOUT |

### BLIS/CTA CAN Signal Setup for AutoPark

This section defines BLIS/CTA feature CAN signal structure for AutoPark.

#### BLIS/CTA CAN Signal Setup for AutoPark

When AutoPark is configured to ENABLE, the customer activation of autopark will cause BLIS, BTT, CTA, and RCTB to inhibit alerting.

|  |  |
| --- | --- |
| **R: 3.7.4.1.1** | The AutoPark module will indicate the AP system mode (Park Manouver) via CAN signal **ApaMde\_D\_Stat\_Intern**. When **ApaMde\_D\_Stat\_Intern** = NULL | OFF, autopark is inactive. When **ApaMde\_D\_Stat\_Intern** <> NULL | OFF an autopark maneuver is active. |
| **R: 3.7.4.1.2** | An internal signal **isig\_AutoPark** shall equal ACTIVE or INACTIVE as follows:  If (**ApaMde\_D\_Stat\_Intern** <> NULL | OFF) & **isig\_TRAILER** & **isig\_ATD\_TRAILER** = NOT CONNECT)  Then **isig\_AutoPark** = ACTIVE  Else **isig\_AutoPark** = INACTIVE |
| **R: 3.7.4.1.3** | RESERVED |
| **R: 3.7.4.1.4** | When **isig\_AutoPark** = ACTIVE for BLIS mode, BLIS shall enter NOT REPORTING mode thus inhibiting BLIS alerts. BLIS CAN signals shall be set as follows:   * **SodX\_D\_Stat** (no state change) * **SodSnsX\_D\_Stat** (no state change) * **SodAlrtX\_D\_Stat** = OFF |
| **R: 3.7.4.1.5** | When **isig\_AutoPark** = ACTIVE for CTA mode, CTA shall enter NOT REPORTING mode thus inhibiting CTA alerts. RCTB if enabled shall inhibit braking requests.  CTA and RCTB CAN signals shall be set as follows:   * **CtaAlrtX\_D\_Stat = OFF** * **CtaXBrkDecel\_B\_Rq** = Disable   *Note:* ***RbaCta\_D\_Stat\_Intern*** *shall be unchanged during CTA/RCTB suppression to avoid RBA model faults.* |
| **R: 3.7.4.1.6** | Reserve |
| **R: 3.7.4.1.7** | If **SodSnsX\_D\_Stat** = BLOCKED, ignore **ApaMde\_D\_Stat\_Intern**. An active autopark shall not inhibit a blockage indication. |
| **R: 3.7.4.1.8** | If **Apa\_Mde\_D\_Stat** goes missing after 3 seconds, BLIS/CTA shall set **isig\_AutoPark** = INACTIVE and set a DID. The AP CAN signal can recover during an ignition cycle as described in the CAN recovery process defined in section 3.7.10 Fault Processing. Once missing a DID shall be set per section 3.7.10. |

*Note - This does not mean that these features will be turned to OFF but rather enter their NOT REPORTING mode. For example, if AP active and the vehicle inputs are such that ADAS algorithm is in BLIS mode, BLIS and BTT will remain in NOT REPORTING mode.If the vehicle inputs are such that ADAS algorithm is in CTA mode, CTA will remain in NOT REPORTING mode and RCTB will remain in STANDBY.*

#### RESERVED

### Reserved

### BLIS System Alert Reporting

When the Side Feature enters BLIS mode and the system is in System Reporting, the system actively begins reporting on target detections. As long as the system reporting conditions continue to be met and the vehicle speed and vehicle transmission maintain the BLIS mode target detections will be alerted to the customer. When these conditions exist the BLIS alert is defined as ACTIVE; a state in which an alert can be turned ON or OFF depending on target qualifications.

This section specifies the alert reporting methodology. Section 4 specifies the performance requirements for alert reporting.

BLIS will report on all ISO defined targets that enter the Blind Zone, as described in section 4, for stagnating targets, pass from rear targets, and merging targets.

Note – for the requirements below ON/FLASH refers to the two on states for **SodAlrtX\_D\_Stat**; ON or FLASH.

|  |  |
| --- | --- |
| **R: 3.7.6.1** | When a target is detected and meets the criteria to alert, an internal signal **isig\_Alert\_Stat** will be set to TRUE. When **isig\_Alert\_Stat** is TRUE and the forward vehicle speed exceeds the speed threshold, defined by global parameters Minimum Speed Threshold Hysteresis Upper and Minimum Speed Threshold Hysteresis Lower, the internal signal **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** shall turn ON.  **Isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** shall set the corresponding LH/RH CAN signal **SodAlrtX\_D\_Stat** to LAMP ON, LAMP OFF, or FLASH and, if configured for HMI Hardwire, cause the ADAS to drive the LED hardwire to ON, OFF, or FLASH.  If **BTT5G\_Intern** is TRUE, the aftermarket radar signals are also inputs to **SodAlrtX\_D\_Stat** state, see section 3.7.3.3. |
| **R: 3.7.6.2** | For **SodAlrtX\_D\_Stat** equal to FLASH, FLASH action is described in section 3.7.1.6 – Secondary Warning Processing. |
| **R: 3.7.6.3** | If a target is detected and **isig\_Alert\_Stat** = TRUE but the vehicle is below speed threshold, **isig\_BLIS\_Alert\_Left** and **isig\_BLIS\_Alert\_Right** shall be OFF. Once vehicle speed reaches threshold **isig\_BLIS\_Alert\_Left** and/or **isig\_BLIS\_Alert\_Right** shall go to ON/FLASH as long as the target remains. |
| **R: 3.7.6.4** | For **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** equal to ON/FLASH, a specific target shall not be lost if vehicle speed drops momentarily below threshold as long as the target remains detected. For example, If a target is detected and **isig\_BLIS\_Alert** is ON/FLASH (thus the vehicle speed is above threshold) and the vehicle speed drops below threshold for a time then back above threshold, the **isig\_Alert\_Stat** shall remain TRUE regardless of threshold and **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** shall go OFF while below threshold and return to ON/FLASH once above threshold. |
| **R: 3.7.6.5** | For **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** equal to OFF but **isig\_Alert\_Stat** = TRUE, a specific target shall not be lost once vehicle speed reaches threshold as long as the target remains detected. Once threshold is reached **isig\_BLIS\_Alert** shall go to ON/FLASH. For example, If a target is detected at a stop light **isig\_Veh\_Speed** is at 0 kph thus **isig\_Alert\_Stat** = TRUE but **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** = OFF (assume threshold is > 0 kph). When the host vehicle moves forward and reaches threshold **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** shall go to ON/FLASH as long as **isig\_Alert\_Stat** = TRUE. |
| **R: 3.7.6.6** | The global parameter Alert\_On\_Min\_Time shall define the minimum time that **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** will be ON/FLASH once it has transitioned to ON/FLASH.  If **isig\_Alert\_Stat** time is less than Alert\_On\_Min\_Time:  **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** time = Alert\_On\_Min\_Time  If **isig\_Alert\_Stat** time is equal to or greater than Alert\_On\_Min\_Time then  **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** time = **isig\_Alert\_Stat** time |
| **R: 3.7.6.7** | When multiple targets are detected on the same side (LH or RH) in series (one target detected, then the next, then the next…) such that **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** turns off between targets but for a time less than Alert\_On\_Min\_Time, Alert\_On\_Min\_Time shall be reset for each target. |

#### RESERVED

#### Target Stagnation Reporting

Stagnation applies to targets entering the blind zone from the front; the host vehicle is over taking the target vehicle. Stagnation implies that the target remains in the blind zone for some time prior to **Isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** equal to ON/FLASH.

|  |  |
| --- | --- |
| R: 3.7.6.2.1 | For stagnation only, a stagnated target is defined as being in the blind zone when the rear of the target is aligned with the Side radar module location (near the rear of the object vehicle). This is referred to as Stagnation Time Zero. |
| R: 3.7.6.2.2 | The point in time that a stagnating target is within the ISO blind zone or has reached the SOD module location will be referred to as stagnation time zero. This is the point in which the BLIS alerts on the stagnating target. At stagnation time zero **isig\_Alert\_Stat** shall be TRUE. The **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** shall transition to ON/FLASH by global parameter delay time Stagnation\_Delay such that    **isig\_BLIS\_Alert\_Left** or **isig\_BLIS\_Alert\_Right** time **= isig\_Alert\_Stat** time + Stagnation\_Delay  Note that typical values of Stagnation\_Delay are 0, 1, 2, and 3 seconds. |

### CTA System Alert Reporting

When the Side Feature enters CTA mode and the system is in System Reporting, the system actively begins reporting on target detections. As long as the System Reporting conditions continue to be met and the vehicle speed and vehicle transmission maintain the CTA mode target detections will be alerted to the customer. When these conditions exist the CTA alert is defined as ACTIVE; a state in which an alert can be turned ON or OFF depending on target qualifications.

CTA alert reporting is done by flashing the exterior mirror LED and initiating a chime along with a message center message. The OSRVM LED alert is performed by direct drive of the LED with the associated CAN signal **CtaAlrtX\_D\_Stat**. The chime and message center message activation is performed by the CAN signal **CtaAlrtX2\_D\_Stat**. The **CtaAlrtX\_D\_Stat** and **CtaAlrtX2\_D\_Stat** CAN signals are related.

This section specifies the alert reporting methodology. Section 4 specifies the performance requirements for alert reporting.

CTA will report on all ISO defined targets as described in section 4; CTA performance.

|  |  |
| --- | --- |
| **R: 3.7.7.1** | CTA alert shall be active as long as the vehicle reverse speed is below the CTA\_MAX\_REVERSE\_SPEED global parameter. |
| **R: 3.7.7.2** | When a target is detected and CTA is in Reporting mode and CTA alert is active the CAN signals **CtaAlrtX\_D\_Stat** and **CtaAlrtX2\_D\_Stat** shall be set to ON. The **CtaAlrtX2\_D\_Stat** and **CtaAlrtX\_D\_Stat** CAN signal shall be sent in the same CAN message.  **CtaAlrtX\_D\_Stat** will be used by the Door Control Modules, when present, to control the OSRVM LED illumination during a CTA alert. **CtaAlrtX2\_D\_Stat** will be used by the Cluster to issue the CTA chime.  The **CtaAlrtX\_D\_Stat** ON/OFF CAN signal state change and **CtaAlrtX2\_D\_Stat** OFF /(not off) CAN signal state shall occur within the same cycle time of the CTA algorithm and shall not exceed 80 msec. Note that the two CAN signals reside in the same CAN message. |
| **R: 3.7.7.3** | The Hardwire HMI (when configured for Hardwire HMI) output shall be used to indicate a CTA alert and is in addition to the CAN CTA alert (discussed in the next requirement). When the CTA alert is ON the HMI shall flash as follows:  ON/OFF signal with a period of 1 second with the ON duty cycle at 50%. For CTA HMI flash the LED intensity shall be set to the global parameter ALERT\_INDICATOR\_DUTY\_CYCLE\_DAY regardless of ambient light conditions.  The HMI CTA flash shall be true as long as **CtaAlrtX\_D\_Stat is equal to ON. If CtaAlrtX\_D\_Stat** transitions to OFF during the HMI flash ON duty cycle, the HMI flash ON duty cycle shall complete prior to extinguishing the flash warning |
| **R: 3.7.7.4** | For **isig\_Transmission\_Status** = REVERSE, when a CTA alert is triggered the CAN signals **CtaAlrtX\_D\_Stat** = ON and **CtaAlrtX2\_D\_Stat** = ALERT ZONE 1 shall remain equal to ON as long as the target is detected but not less than a minimum time defined by the global parameter CTA\_Alert\_Hold\_On\_Time. When **isig\_Transmission\_Status** exits the REVERSE state the CTA alert CAN signals, **CtaAlrtX\_D\_Stat** and **CtaAlrtX2\_D\_Stat**, shall immediately go to OFF (no alert). This global parameter CTA\_Alert\_Hold\_On\_Time only applies to Alert Zone 1 targets. |
| **R: 3.7.7.5** | Typically, a CTA alert will be issued prior to an RCTB brake request. However, there may be instances where the radar detects an RCTB target without a prior CTA alert.  A target, which causes an RCTB brake request prior to a CTA alert, shall force a CTA alert. |

### BLIS/CTA ON/OFF Flash Processing

Below are some specific requirements for BLIS and CTA transitions between OFF and ON via the Cluster command, My Key, or Trailer Tow commands.

|  |  |
| --- | --- |
| **R: 3.7.8.1** | When the Cluster commands the BLIS to transition from ON to OFF or from OFF to ON, the ADAS ECU shall command the LED, via CAN and Hardwire HMI (if configured for Hardwire HMI) to flash twice ON at a frequency of 0.5 HZ 50% duty cycle.  This is for customer command feedback to the customer commanded ON/OFF.  This is true regardless of which mode the ADAS ECU is in (BLIS or CTA). |
| **R: 3.7.8.2** | When the Cluster commands the CTA to transition from ON to OFF or from OFF to ON, the ADAS ECU shall command the LED, via CAN and Hardwire HMI (if configured for Hardwire HMI) to flash twice ON at a frequency of 0.5 HZ 50% duty cycle.  This is for customer command feedback to the customer commanded ON/OFF.  This is true regardless of which mode the ADAS ECU is in (BLIS or CTA).  This is true if the BLIS is ON and is alerting on a target when the Cluster commands a BLIS OFF.  This is true if the CTA is ON and is alerting on a target when the Cluster commands a CTA OFF. |
| **R: 3.7.8.3** | When a Trailer Tow Module commands the ADAS ECU (both BLIS and CTA) to transition from ON to OFF or from OFF to ON and BTT is DISABLED or OFF the ADAS ECU shall not issue a flash command to the HMI LED. |
| **R: 3.7.8.4** | ADAS ECU shall not command the LED to flash twice when commanded from OFF to ON due to an **isig\_My\_Key** equal TRUE. |
| **R: 3.7.8.5** | ADAS ECU shall not command the LED to flash twice when commanded from OFF to ON or ON to OFF due to an AutoPark inhibit / permit transitions. |
| **R: 3.7.8.6** | RESERVED |

### RESERVED

### Fault Processing

This section pertains to generic fault processing for all faults. Also described is the fault HMI to the customer. Many other sections in this specification refer to this Fault Processing section. There are five fault tables in this section: BLIS, CTA, RCTB and BTT. BTT is separated from BLIS and CTA since it can operate in either mode.

|  |  |
| --- | --- |
| **R: 3.7.10.1** | BLIS faults (per table 3.7.10-1 below) shall be reported when in BLIS mode for submodes NOT REPORTING or REPORTING (reference section 3.4.2 SOD Modes of Operation).  BLIS faults shall not be reported for BLIS mode OFF, TRAILER TOW OFF, and DISABLE. |
| **R: 3.7.10.2** | CTA and RCTB faults (per table 3.7.10-1 below) shall be reported when in CTA mode for submodes NOT REPORTING or REPORTING (reference section 3.4.2 Modes of Operation  CTA and RCTB faults shall not be reported for CTA mode OFF, TRAILER TOW OFF, and DISABLE. |
| **R: 3.7.10.3** | If **SodSnsX\_D\_Stat** = System\_Failure the LED shall not be activated.  *Note: The reason for this is that the IPC contains a fault tell-tale, and Illuminating the OSRVM LED would be redundant.*  *Note: The OSRVM LED (CAN signals and Hardwire HMI) shall remain OFF during a BLIS fault state* |
| **R: 3.7.10.4** | If **CtaSnsX\_D\_Stat** = System\_Failure the LED shall not be activated.  *Note: Although there is no IPC telltale for CTA or RCTB, the LED is not a primary warning for CTA or RCTB. The IPC customer messages are considered the primary warning for CTA and RCTB*  *Note: The OSRVM LED (CAN signals and Hardwire HMI) shall remain OFF during a CTA or RCTB fault state.* |
| **R: 3.7.10.5** | BLIS CAN signal fault reporting shall be inhibited when **SodX\_D\_Stat** = DISABLE or OFF or TRAILER TOW OFF.  *Note: Inhibited for this requirement means that; no CAN signal fault processing, DTC setting or DID setting, nor reporting of faults will take place.* |
| **R: 3.7.10.6** | CTA CAN signal fault reporting shall be inhibited when **CtaX\_D\_Stat** = DISABLE or OFF or TRAILER TOW OFF.  *Note: Inhibited for this requirement means that; no CAN signal fault reporting, DTC setting or DID setting, nor reporting of faults will take place.* |
| **Notes only** | Note: There are no specific BTT faults that will set a DTC.  Note: There is a possible Cluster missing signal **Btt\_L\_Actl2**.  Note: For missing/invalid **Btt\_L\_Actl2** refer to R:3.7.1.5.4.1.6.  Note: DIDs will be set per table 3.7.10-3.  Note: BTT DIDs will not be set when **BttX\_D\_Stat** = DISABLE or OFF. |
| **R: 3.7.10.7** | RESERVE |
| **R: 3.7.10.8** | For CAN signal faults, no fault processing will take place until 3.000 seconds after power up and **isig\_Ignition\_Stable** = RUN or NOT RUN. This supersedes The Software SOW ECU Software Requirements.DOC, requirement number 0043.  *Note: Reason is that Side features, particularly CTA, are needed quickly by the customer. The standard ECU uses a longer time for this.* |
| **R: 3.7.10.9** | No fault processing or DTC setting or DID reporting of faults shall take place while the internal signal **isig\_Ignition\_Stable** is equal to START, refer to section 3.7.1.1 Ignition Switch |
| **R: 3.7.10.10.1** | When [Vehicle Speed CAN signals are missing or invalid] or [**DVR\_SELECT\_STAT** = FAULT] / then a BLIS fault will be reported to the Cluster regardless of which mode the ADAS ECU is in except for conditions stated in R: 3.7.10.5.  *Note – The BLIS fault declaration in any mode is needed because once vehicle speed or PRNDL CAN data goes missing/invalid, ADAS ECU will not be able to enter BLIS mode from CTA mode.* |
| **R: 3.7.10.10.2** | When [**DVR\_SELECT\_STAT** = FAULT] or [Vehicle Speed CAN signals are missing or invalid] / then a CTA fault shall be reported to the Cluster regardless of which mode the ADAS ECU is in except for conditions stated in 3.7.10.6. The ADAS ECU shall then enter BLIS mode. Refer to section 3.7.1.4 Automatic and Manual Trasmission Input Processing  *Note – This special case is needed because once the transmission CAN data or vehicle speed CAN data goes missing/invalid, ADAS mode selection is no longer possible.* |
| **R: 3.7.10.10.3** | If BLIS sets a DTC and is in fault mode (**SodSnsX\_D\_Stat** = FAULT) and BTT was in an ON state, BTT shall exit and stop functioning and set BTT CAN signals as listed below and shall ignore cluster CAN signals **Sod\_D\_Rq** and **Btt\_L\_Actl2**.  **BttX\_D\_Stat** = NOT DETERMINED  **BttX\_D\_RqDrv** = NO REQUEST  If BTT was in an OFF state when the fault occurred then BTT shall not change.  If BLIS recovers from the fault during a key cycle BTT shall reinitialize immediately if **isig\_BTT\_Last\_Rem** = ON. Re-initialization shall occur regardless of vehicle speed per R:3.7.1.5.3.16.  *Note – BLIS will set a fault based on missing/invalid vehicle speed (which BTT depends on to function). It is not necessary for BTT to also set a DTC for missing/invalid vehicle speed also.* |
| **R: 3.7.10.11** | When a BLIS fault shall be reported by setting **SodSnsL(R)\_D\_Stat** = FAULT - BLIS shall lock the existing **SodL(R)\_D\_Stat** state and ignore all further BLIS ON/OFF MSCAN requests regardless of the requesting source (Trailer Tow, MyKey, Cluster, or personalization). This locked condition shall remain until **SodSnsL(R)\_D\_Stat** <> FAULT.  When the RH(LH) radar has faulted and the LH(RH) radar has not faulted, BLIS feature shall continue to function via the non faulted radar and ignore all further BLIS ON/OFF MSCAN commands.  *Note: that* ***SodX\_D\_Stat*** *must be ON to report the fault*. |
| **R: 3.7.10.12** | A CTA fault shall be reported by setting **CtaSnsL(R)\_D\_Stat** = FAULT. When **CtaSnsL(R)\_D\_Stat** = FAULT / Then the **CtaAlrtL(R)\_D\_Stat** shall be set to LAMP OFF.  When **CtaSnsL(R)\_D\_Stat** = FAULT / Then CTA shall lock the existing **CtaL(R)\_D\_Stat** state and ignore all further CTA ON/OFF MSCAN requests regardless of the requesting source (Trailer Tow, MyKey, Cluster, or personalization). This locked condition shall remain until **CtaSnsL(R)\_D\_Stat** is not equal to FAULT.  When the RH(LH) radar has faulted and the LH(RH) radar has not faulted, CTA feature shall continue to function via the non faulted radar and ignore all further CTA ON/OFF MSCAN commands. |
| **R: 3.7.10.12.1** | For RCTB specific faults, CTA shall not be faulted. |
| **R: 3.7.10.12.2** | If CTA is faulted, RCTB is also faulted. See Section 3.7.11. |
| **R:3.7.10.12.3** | If a feature is disabled or turned off, the ADAS shall not report faults for that feature. |
| **R:3.7.10.12.4** | The ADAS ECU shall ignore Cluster or SYNC feature commands while a feature is faulted. Therefore, the customer shall not be able to change the state of a feature (on, off, or settings) when the feature is in fault mode. |
| **R: 3.7.10.13** | ***CAN Fault Signal Recovery***  Background/Fault Setting: When a Side feature DTC is set due to a missing/invalid CAN signal, module reported fault state or LED hard-wire fault state (Signal[x]) the DTC shall set the BLIS and/or CTA to fault mode.  If Signal[x] recovers during a key cycle the BLIS and/or CTA feature shall recover to normal operating mode. This process is referred to as Fault Signal Recovery.  Fault Signal Recovery for Signal[x] which can cause a DTC consists of three phases:   1. NORMAL –Signal[x] is not missing/invalid long enough to cause a DTC. 2. FAULT –Signal[x] has been faulted for 3 seconds which causes a DTC to occur as specified in R: 3.7.10.16. The FAULT state shall be held as long as the fault condition exists but not less than the minimum time defined by global parameter FAULT\_TIME\_CFG seconds. 3. RECOVERY – A set time in which the faulted Signal[x] must be NOT missing/invalid as defined by global parameter RECOVERY\_TIME\_CFG seconds.   While the CAN signal is in the FAULT or RECOVERY mode, **SodSnsL(R)\_D\_Stat** = FAULT and/or **CtaSnsL(R)\_D\_Stat** = FAULT.  *Note: Once a missing message condtion is set – the feature will not fully recover until a minimum of FAULT\_TIME\_CFG + RECOVERY\_TIME\_CFG.* |
| **R: 3.7.10.14** | ***CAN Fault Signal Recovery***  Refer to Figure 3.7.10-1 for this requirement.  Once a Signal[x] goes faulted such that a DTC is set, the BLIS and/or CTA shall enter the FAULT state at time T0. At T0 a FAULT counter shall begin counting. When the FAULT counter = FAULT\_TIME\_CFG the ADAS ECU shall determine if it is again operating normal (not faulted). If Signal [x] is normal when read, a RECOVERY timer shall begin counting at time Tr.  If the RECOVERY timer becomes equal to RECOVERY\_TIME\_CFG. Without a single instance of a fault, Signal[x] shall be considered NORMAL and the ADAS shall exist the FAULT state.  (Resetting the Fault Timer): If during the RECOVERY timer an instance of Signal[x] becomes invalid~~,~~ the Signal[x] shall immediately enter the FAULT state and begin the FAULT counter at T0 and the BLIS and/or CTA shall reenter remain faulted;the process repeats.  When a DTC fault is recovered, the DTC shall be placed in history. |
| **R: 3.7.10.15** | ***CAN Fault Signal Recovery***  For CAN signals that go missing/invalid or module fault states that do NOT cause a DTC but only a DID, CAN Signal Recovery process does not apply. For CAN signals that go missing/invalid for the CAN signal specific missing message count and cause only a DID to be set, the ADAS shall continue to function using the individual CAN signal default values in section 3.7.1. Once these CAN signals recover the ADAS shall begin using the new valid CAN signal values.  Fault recovery does not apply to a Side radar internal fault U3000. U3000 faults shall hold for the remainder of the key cycle. |
| **R: 3.7.10.16** | Missing message count shall be equal to 3000 msec for all periodic received CAN signals that cause DTCs to occur per tables 3.7.10-1 and 3.7.10-2.  A timer shall be used to count to 3000 msec. If the CAN signal becomes valid (not missing/invalid) the timer shall reset. For intermittent missing/invalid CAN signals that are missing/invalid for less than three seconds the ADAS shall continue to operate using the available valid CAN data.  Missing message count shall be 8 for CAN signals that only cause DIDs to increment unless otherwise specified for a specific signal. |
| **R: 3.7.10.17** | Reserved |
| **R: 3.7.10.18** | All Fault Counters contained in DID shall record the number of occurrences of the specific fault and the count shall reset only upon receiving a DTC CLEAR diagnostics command. The counters shall be the length of one byte (counter upper bound of 255, with no roll-over). |
| **R: 3.7.10.19** | Entering self-test shall not cause any DTC clearing. |
| **R: 3.7.10.20** | DTC aging life shall be 86 key cycles. On the 86th key cycle the DTC shall be cleared from history, assuming it has not reoccurred during this counter period. |
| **R: 3.7.10.21** | Upon receiving a DTC CLEAR diagnostics command, all OnDemand DTCs clear immediately. No additional steps shall be necessary to clear DTCs. The **SodSnsX\_D\_Stat** and **CtaSnsX\_D\_Stat** shall clear upon a DTC clear. |
| **R: 3.7.10.22** | Tables 3.7.10-1, -2, -3,and -4 specify QF and missing message DIDs and DTCs. DID setting for Vehicle Turn Radius CAN signals and their associated QFs (listed below) and their combinations are as specified in section 3.7.1.12.  **VehYaw\_W\_Actl**  **WhlRotatFr\_No\_Cnt**  **StePinComp\_An\_Est**  **StePinComp\_An\_Est\_QF**  **SteWhlComp\_An\_Est**  **SteWhlComp\_An\_Est\_QF**  Note: *The rule for setting a DTC is: If the missing or invalid message causes the BLIS and/or CTA feature to no longer function / then a DTC will be set. If the missing or invalid message does not cause the BLIS and/or CTA feature to no longer function, a DTC shall be not set This rule is used to develop the DTC requirement in the tables.* *The only exception to this rule is the DCU to ADAS interface.* |
| **R: 3.7.10.23** | Upon on-demand self-test diagnostic command (ODST Service 31 Routine 0202), the ADAS module shall perform a self-test and then report all on-demand DTCs. For direct HMI drive only, the bulb may be turned on for ODST. Note: A bulb prove-out for the sake of a visual check is not necessary. All continuous DTCs flagged prior to the time self test starts shall also be reported out. The on-demand self-test shall take less than 10 sec. |
| **R: 3.7.10.24** | ADAS – DCU Mismatch (Invalid):  The ADAS module shall check the DCU LED status CAN signals **BLISLEDStatDriverSide** and **BLISLEDStatPassSide** at the DCU status signal periodic rate.  The ADAS shall contain a DDCU and a PDCU mismatch counter. The counter will clear at module power up (key cycle). This counter shall increment for each BLIS or CTA alert mismatch detected whether it be a T1 or T2 mismatch as specified in R:8.3.5. Thus the mismatches need not be sequential. Once the mismatch counter reaches 12 counts a DCU Mismatch DTC shall be set and the ADAS shall set both **SodSnsX\_D\_Stat** and **CtaSnsX\_D\_Stat** FAULT.  This requirement does not apply to Bulb Proveout per R:8.3.5.  For example, a ADAS commands a BLIS alert and the DCU does not respond with an LED ON confirmation within T1; counter increments to one. One DCU periodic rate later the DCU LED status is still OFF; counter increments to two. At the next DCU periodic rate the DCU LED status is ON. Several minutes later ADAS issues a CTA alert and the DCU alert status responds with an LED ON within T1. ADAS commands the CTA alert OFF and at T2 the DCU alert status remains ON; counter increments to three. For the next three DCU periodic intervals the DCU maintains the alert ON status; counter is now at six. On the next periodic sample DCU alert status is OFF; counter remains at six. |
| **R: 3.7.10.25** | For the purpose of engineering fault diagnosis and system analysis, any internal signal “isig” shall have an associated engineering DID to read status or value. |
| **R: 3.7.10.26** | If BTT5G is ENABLED, if **Btt\_L2\_Actl2** is missing or invalid, refer to R:3.7.1.5.4.1.6. |
| **R: 3.7.10.27** | If BTT5G is ENABLED and **Btt\_L2\_Actl2** is valid:   * If **SodAltRight\_D2\_StatAft** = FAULTY or is missing for 3 seconds, **BttRight\_D\_Stat** shall be to (hx07) BTT5G FAULT. BTT shall stop functioning and a DTC set (see table 3.7.10-3). * If **SodAltLeft\_D2\_StatAft** = FAULTY or is missing for 3 seconds, **BttLeft\_D\_Stat** shall be to (hx07) BTT5G FAULT. BTT shall stop functioning and a DTC set (see table 3.7.10-3). |

Figure 3.7.10‑1 SOD Fault Signal Recovery

Valid data

…

…

…

Fault\_Time\_Cfg

Recovery\_Time\_Cfg

Signal[x] invalid for

3 sec DTC timer

T0

Tr

**Table 3.7.10‑1** BLIS HMI Warning and Fault Setting Table (SodX\_D\_Stat = ON)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Rqmt. No.** | **Signal** | **Fault condition** |  | **SodSnsX\_D\_Stat**  **(Output CAN signal Warning Status to HMI)** | **Side\_Detect\_ Fault \_State** | **Diagnostics**  **Reports** |
| Note: For the purpose of Table 3.7.10-X The term DID refers to fault counters contained in a DID.  The Warning Maturation and Dematuration Criteria and detailed in the “Chapter 11 Rear Feature Diagnostic” File | | | | | | |
| **R: 3.7.10.24** | n/a | Module not configured |  | CLEAR |  | DID / DTC |
| **R: 3.7.10.25** | Ignition\_Status | Unknown |  | CLEAR |  | DID |
| **R: 3.7.10.26** |  |  |  |  |  |
| **R: 3.7.10.27** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.28** | Sod\_D\_Rq | Unknown (0x2 or 0x3) |  | CLEAR | Sensor\_Clear |  |
| **R: 3.7.10.29** | Vehicle Speed  Veh\_V\_ActlEng |  |  |  |  |  |
| **R: 3.7.10.30** |  |  |  |  |  |
| **R: 3.7.10.31** | **Missing** |  | **FAULT** |  | DID DTC |
| **R: 3.7.10.32** | Vehicle Speed  VehVActlEng\_D\_Qf  (see Note 1) | 03 or 02 hex |  | CLEAR |  |  |
| **R: 3.7.10.33** | **00 or 01 hex** |  | **FAULT** | \*section 3.7.1.3 | DID DTC |
| **R: 3.7.10.34** | **Missing** |  | **FAULT** |  | Set DID/DTC |
| **R: 3.7.10.35** | Transmission  Internal signal DVR\_SELECT\_STAT |  |  |  |  |  |
| **R: 3.7.10.36** |  |  |  |  |  |
| **R: 3.7.10.37** | **FAULT** |  | **FAULT** |  | DID DTC |
| **R: 3.7.10.38** | Trailer Tow  TrlrLampCnnct\_B\_Actl |  |  |  |  |  |
| **R: 3.7.10.39** |  |  |  |  |  |
| **R: 3.7.10.40** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.41** | **VehOverGnd\_V\_Est *OR***  **Raw\_speed\_qf** | **Faulty** |  | **FAULT** | \*section 3.7.1.3 | DID / DTC |
| **R: 3.7.10.42** | **Missing** |  | **FAULT** | \*section 3.7.1.3 | DID/DTC |
| **R: 3.7.10.43** |  |  |  |  |  |
| **R: 3.7.10.44** | Reserved |  |  |  |  |  |
| **R: 3.7.10.45** |  |  |  |  |  |
| **R: 3.7.10.46** |  |  |  |  |  |
| **R: 3.7.10.47** | Dvr Pass Door Modules  BLISLEDStat\_X\_Side | **ON/OFF mismatch (Invalid)** |  | **FAULT** | R:3.7.10.23.2 | DID DTC |
| **R: 3.7.10.48** | **DCU fault** |  | **FAULT** | \*section 8.3 | DID |
| **R: 3.7.10.49** | **Missing** |  | **FAULT** | \*section 8.3 | DID DTC |
| **RESERVE** |  |  |  |  |  |  |
| **RESERVE** |  |  |  |  |  |
| **RESERVE** |  |  |  |  |  |
| **R: 3.7.10.53** | My Key  IgnKeyType\_D\_Actl | Unknown |  | CLEAR |  | DID |
| **R: 3.7.10.54** |  |  |  |  |  |
| **R: 3.7.10.55** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.56** | Parklamp\_Status | Unknown |  | CLEAR |  | DID |
| **R: 3.7.10.57** |  |  |  |  |  |
| **R: 3.7.10.58** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.59** | Litval | Unknown |  | CLEAR |  | DID |
| **R: 3.7.10.60** |  |  |  |  |  |
| **R: 3.7.10.61** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.62** | Secondary Warning  TurnLghtSwitch\_D\_Stat |  |  |  |  |  |
| **R: 3.7.10.63** |  |  |  |  |  |
| **R: 3.7.10.64** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.65** | Reserved |  |  |  |  |  |
| **R: 3.7.10.66** |  |  |  |  |  |
| **R: 3.7.10.67** |  |  |  |  |  |
| **R: 3.7.10.68** | Reserved |  |  |  |  |  |
| **R: 3.7.10.69** |  |  |  |  |  |
| **R: 3.7.10.70** | Rear SRRs | Missing |  | **FAULT** |  | DTC DID |
| **R: 3.7.10.71** | Hardwired LED Output  (NOTE 2) | **Short to Ground** |  | **FAULT** |  | DTC DID |
| **R: 3.7.10.72** | **Short to Battery** |  | **FAULT** |  | DTC DID |
| **R: 3.7.10.73** | **Open** |  | **FAULT** |  | DTC DID |

Note 1 – 01hex DTC/DID applies after 2 sec wait power up as specified in R:3.7.1.3.2

Table 3.7.10‑2 CTA Warning Status to HMI and Fault Setting Table (CtaX\_D\_Stat = ON)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Rqmt. No.** | **Signal** | **Fault Condition** |  | **CtaSnsX\_D\_Stat**  **(Output CAN signal Warning Status to HMI)** | **Side\_Detect\_ Fault \_State** | **Diagnostics**  **Reports** |
| **R: 3.7.10.74** | n/a | Module not configured |  | CLEAR |  | DID / DTC |
| **R: 3.7.10.75** | Ignition\_Status | Unknown |  | CLEAR |  | DID |
| **R: 3.7.10.76** |  |  |  |  |  |
| **R: 3.7.10.77** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.78** | Cta\_D\_Rq | Unknown (0x2 or 0x3) |  | CLEAR | Sensor\_Clear |  |
| **R: 3.7.10.79** | Vehicle Speed  Veh\_V\_ActlEng |  |  |  |  |  |
| **R: 3.7.10.80** |  |  |  |  |  |
| **R: 3.7.10.81** | **Missing** |  | **FAULT** |  | DID DTC |
| **R: 3.7.10.82** | Vehicle Speed  VehVActlEng\_D\_Qf | 03 or 02 hex |  | CLEAR |  |  |
| **R: 3.7.10.83** | **00 or 01 hex** |  | **FAULT** | \*section 3.7.1.3 | DID DTC |
| **R: 3.7.10.84** | **Missing** |  | **FAULT** |  | DID DTC |
| **R: 3.7.10.85** | Transmission  Internal signal DVR\_SELECT\_STAT |  |  |  |  |  |
| **R: 3.7.10.86** |  |  |  |  |  |
| **R: 3.7.10.87** | **FAULT** |  | **FAULT** |  | DID DTC |
| **R: 3.7.10.88** | Trailer Tow  TrlrLampCnnct\_B\_Actl |  |  |  |  |  |
| **R: 3.7.10.89** |  |  |  |  |  |
| **R: 3.7.10.90** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.91** | Turn Signal  TurnLghtSwitch\_D\_Stat | n/a |  | CLEAR |  | none |
| **R: 3.7.10.92** | n/a |  | CLEAR |  | none |
| **R: 3.7.10.93** | n/a |  | CLEAR |  | none |
| **R: 3.7.10.94** | **VehOvrGnd\_V\_Est *OR***  **Raw\_speed\_qf** | **Faulty** |  | **FAULT** | \*section 3.7.1.3 | DID / DTC |
| **R: 3.7.10.95** | **Missing** |  | **FAULT** | \*section 3.7.1.3 | DID/DTC |
| **R: 3.7.10.96** |  |  |  |  |  |
| **R: 3.7.10.97** | Dvr Pass Door Modules  BLISLEDStat\_X\_Side | **ON/OFF mismatch (Invalid)** |  | **FAULT** | R:3.7.10.23.2 | DID DTC |
| **R: 3.7.10.98** | **DCU fault** |  | **FAULT** | \*section 8.3 | DID |
| **R: 3.7.10.99** | **Missing** |  | **FAULT** | \*section 8.3 | DID DTC |
| **R: 3.7.10.100** | RESERVED |  |  |  |  |  |
| **R: 3.7.10.101** |  |  |  |  |  |
| **R: 3.7.10.102** |  |  |  |  |  |
| **R: 3.7.10.103** | My Key  IgnKeyType\_D\_Actl | Unknown |  | CLEAR |  | DID |
| **R: 3.7.10.104** |  |  |  |  |  |
| **R: 3.7.10.105** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.106** | Parklamp\_Status | Unknown |  | CLEAR |  | DID |
| **R: 3.7.10.107** |  |  |  |  |  |
| **R: 3.7.10.108** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.109** | Litval | Unknown |  | CLEAR |  | DID |
| **R: 3.7.10.110** |  |  |  |  |  |
| **R: 3.7.10.111** | Missing |  | CLEAR |  | DID |
| **R: 3.7.10.112** | Secondary Warning  TurnLghtSwitch\_D\_Stat | n/a |  | CLEAR |  | none |
| **R: 3.7.10.113** | n/a |  | CLEAR |  | none |
| **R: 3.7.10.114** | n/a |  | CLEAR |  | none |
| **R: 3.7.10.115** | Reserved |  |  |  |  |  |
| **R: 3.7.10.116** |  |  |  |  |  |
| **R: 3.7.10.117** |  |  |  |  |  |
| **R: 3.7.10.118** | Reserved |  |  |  |  |  |
| **R: 3.7.10.119** |  |  |  |  |  |
| **R: 3.7.10.120** | Rear SRRs | Missing |  | **FAULT** |  | DTC DID |
| **R: 3.7.10.121** | Hardwired LED Output  (NOTE 1) | **Short to Ground** |  | **FAULT** |  | DTC DID |
| **R: 3.7.10.122** | **Short to Battery** |  | **FAULT** |  | DTC DID |
| **R: 3.7.10.123** | **Open** |  | **FAULT** |  | DTC DID |

NOTE 2 - Evaluated when Hardwire HMI output is enabled.

Table 3.7.10-3 BTT Fault Setting Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rqmt. No.** | **Signal** | **Fault Condition** |  | **BttX\_D\_Stat** | **Diagnostics**  **Reports** |
| **R: 3.7.10.124.1** | Btt\_L\_Actl2 | n/a |  | n/a | n/a |
| **R: 3.7.10.124.2** |  |  |  |  |
| **R: 3.7.10.124.3** | Missing |  | OFF TEMP | DID |
| **R: 3.7.10.124.4** | TrlrLampCnnct\_B\_Actl | MIssing |  |  | DID |
| **R: 3.7.10.124.5** | TrlrBrkActCnnct\_B\_Actl | Missing |  |  | DID |
| **R: 3.7.10.124.6** | Btt\_L2\_Actl2 | Missing |  | n/a | n/a |
| **R: 3.7.10.124.7** | SodAltRight\_D2\_StatAft | Missing or FAULTY |  | BTT5G FAULT | DTC |
| **R: 3.7.10.124.8** | SodAltLeft\_D2\_StatAft | Missing or FAULTY |  | BTT5G FAULT | DTC |

|  |  |
| --- | --- |
| R: 3.7.10.125 | RCTB Faults , must be tracked by internal signal **isig\_rctb\_fault ,** andshall be triggered as required by the following tables 3.7.10-4 and 3.7.1.12-1 and 3.7.1.12-2 . |
| R: 3.7.10.126 | RCTB faults shall only be reported after the trigger for the fault is present for 3.000 seconds. An exception is the DTC for the wheel direction signals as defined in Table 3.7.1.14-1. |
| R: 3.7.10.127 | ***FMC applications engineer requirement:***  DIDs as defined in Table 3.7.10-4 need to be read by the service tools. The service manual shall include a customer symptom of RCTB increased false braking. The service action will be to check for these DIDs. Review exact procedures with Rear Feature core engineering. |

Table 3.7.10‑4 RCTB Fault Setting Table when (Rba\_D\_Stat\_Intern = ON)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rqmt. No.** | **Signal** | **Fault Condition** |  | **isig\_rctb\_fault**  **(Ouput signal to the RBA Model)** | **Diagnostics**  **Reports** |
| **R: 3.7.10.125.1** | Both Wheel direction  (Manual trans) | **Failed** |  | **FAULT** | DID / DTC |
| **R: 3.7.10.125.2** | **Reserved** |
| **R: 3.7.10.125.3** | **Missing** |
| **R: 3.7.10.125.4** | Both Wheel Direction  (Auto trans) | Failed |  | Refer to **R: 3.7.1.14.11** | DID |
| **R: 3.7.10.125.5** | Reserved |
| **R: 3.7.10.125.6** | Missing |
| **R: 3.7.10.125.7** | CtaBrk\_D\_Stat | Denied |  |  | DID |
| **R: 3.7.10.125.8** | CtaBrk\_D\_Stat | **Missing** |  | **FAULT** | DID / DTC |
| **R: 3.7.10.125.9** | **Isig\_brake\_timeout (rising edge)** | Isig\_Brake\_Timer > RCTB\_MAX\_BRAKE\_TIME |  | CLEAR | DID  (note 1) |
| **R: 3.7.10.125.10** | **CtaYBrkEnbl\_B\_Rq**  (note 2) | **Missing** |  | **FAULT** | DID / DTC |
| **R: 3.7.10.125.11** | **CtaYBrkEnbl\_B\_Rq<> CtaXBrkEnbl\_B\_Rq** | **No match for 3 seconds** |  | **FAULT** | DID / DTC |

*Note 1 - that ABS may not be reacting, if the reversing speed is too high or the other SOD has not opened the IF. Therefore a DTC should not be set immediately. The DID is to have means to diagnose such cases.*

*Note 2 - that a “Y” is deliberately used to indicate that the requirement is valid for both SODL and SODR.*

### RCTB Behavior

The following section describes the configuration of reverse braking assist in ADAS~~,~~ the state machine for the brake interface and the handling of the interface to the IPMB.

#### RCTB Global Parameters

This section specifies RCTB related configuration. Refer to **Figure 4.6-1** for the associated diagram.

|  |  |
| --- | --- |
| R: 3.7.11.1.1 | The global parameters RCTB\_REAR\_RANGE\_LOW, RCTB\_REAR\_RANGE\_HIGH, RCTB\_ZoneX\_Front\_Rng and RCTB\_NO\_INTERVENTION\_RANGE defines the rear ranges for RCTB. |
| R: 3.7.11.1.2 | The global parameter RCTB\_UPPER\_ANGLE\_LIMIT defines the maximum approach angle for a target to be counted as valid for RCTB. |
| R: 3.7.11.1.3 | The global parameter RCTB\_LOWER\_ANGLE\_LIMIT defines the minimum approach angle for a target to be counted as valid for RCTB.. |
| R: 3.7.11.1.4 | The global parameter RCTB\_TTC defines the time to crossing at which RCTBshall request a brake intervention. SW shall not allow RCTB\_TTC to be greater than the global parameter CTA\_TTC\_Zone1. |
| R: 3.7.11.1.5 | The global parameter RCTB\_Brake\_denied\_time defines a delay time that RCTB waits until the SW takes action on **CtaBrk\_D\_Stat** changing to “denied”. |
| R: 3.7.11.1.6 | RCTB\_MIN\_Brake\_Time and RCTB\_Max\_Brake\_Time are global parameters defining the minimum and maximum time the system shall request a brake intervention.  Note: RCTB\_MIN\_Brake\_Time must be set to less than RCTB\_Max\_Brake\_Time. |
| R: 3.7.11.1.7 | RCTB\_Max\_Reverse\_Speed defines the maximum Speed up to where RCTB may request brake interventions. |
| R: 3.7.11.1.8 | RCTB\_MIN\_Standby\_Time defines the minimum time the system shall remain in standby after a brake intervention as defined in **R: 3.7.11.2.4.8.** |

#### RCTB Brake Interface

The following requirements define how RCTB in ADAS interfaces the brake system.

|  |  |
| --- | --- |
| R: 3.7.11.2.1 | **CtaBrk\_D\_Stat** is received from the ABS system. It has the following states:  0x0: Closed: The brake system is not actively braking or the interface has not been enabled yet by RCTB.  0x1: Opened: not used  0x2: Active: the brake system is executing a brake intervention or holding the vehicle in standstill after a brake intervention.  0x3: Denied: The brake system cannot support a brake intervention. Note: The interface may be denied for short periods during power up or during ESC events. See R: 3.7.11.2.2 |
| R: 3.7.11.2.2 | **CtaBrk\_D\_Stat** shall be filtered to feed the internal signal **isig\_RCTB\_brake\_denied**.  At power up **isig\_RCTB\_brake\_denied** is initialized to NOT DENIED.  When **CtaBrk\_D\_Stat** is not equal to DENIED, **isig\_RCTB\_brake\_denied** is set to NOT DENIED.  When **CtaBrk\_D\_Stat** changes to DENIED **isig\_RCTB\_brake\_denied** shall transition to DENIED only after **CtaBrk\_D\_Stat** has been received equal to DENIED for RCTB\_Brake\_denied\_time seconds. (default: 5 second) |
| R: 3.7.11.2.3 | CtaBrk\_D\_Stat shall be set to missing/invalid, if the signal is missing/invalid after 3.000 seconds. When missing/invalid, RCTB shall fault and a DTC shall be set. Refer to section 3.7.10. |
| R: 3.7.11.2.4 | Figure 3.7.11.2-1 shows the state machine for the RCTB interface.  Table 3.7.11.2-1 defines the CAN outputs for the individual states  Table 3.7.11.2-2 defines the trigger conditions that initiates state changes |
| R: 3.7.11.2.5 | **CtaXBrkEnbl\_B\_Rq** is generated by ADAS. The signal is used to enable (open) the brake interface in ABS. Its values are: 0: disable and 1: enable.  ABS will only accept brake requests, if both Left and Right signals have opened the interface through **CtaXBrkEnbl\_B\_Rq.**  Note: If only one side enables the brake interface, ABS will simply not accept brake interventions from the enabling side. |
| R: 3.7.11.2.6 | **CtaXBrkDecel\_B\_Rq** is generated by IPMA\_ADAS. The signal requests the ABS system to stop the vehicle. |
| R: 3.7.11.2.7 | **Isig\_RCTB\_Target\_detected** is an internal signal which indicates, if the RCTB algorithm has detected a valid RCTB target.  0: false (no RCTB target detected)  1: true (RCTB target detected) |
| R: 3.7.11.2.8 | **isig\_Brake\_Timer** is an internal timer used to monitor the time after a brake intervention has been requested. There is a maximum time the brakes may be activated by RCTB. There also is a minimum time that a brake request needs to be activated. See R: 3.7.11.1.6 |
| R: 3.7.11.2.9 | **Isig\_brake\_timeout** is an internal signal which indicates if a brake request has timed out.  0: false (not timed out)  1: true (timed out) |



Figure 3.7.11.2-1: Brake interface state machine

Table 3.7.11.2-1: Brake Interface States

|  |  |  |  |
| --- | --- | --- | --- |
| **Req.** | **State** | **Description** | **Action** |
| **R: 3.7.11.2.4.1** | Fault | RCTB has a fault | For Setting **RbaCtaX\_D\_Stat\_Intern = fault** 3.7.10‑4 3.7.1.12-1 and 3.7.1.12-2  Set **CtaXBrkDecel\_B\_Rq** = 0  Set **CtaXBrkEnbl\_B\_Rq** = 0 |
| **R: 3.7.11.2.4.2** | Standby (RCTB not reporting) | This is the startup state. RCTB stays in here, if the transmission in not in reverse or RBA is not activated by driver or is unavailable.  RCTB may still use the radar to monitor the environment  This includes any case like blocked, CTA OFF/trailer OFF etc. | At Entry:   * Restart Standby\_Timer   Set **CtaXBrkDecel\_B\_Rq** = 0  Set **CtaXBrkEnbl\_B\_Rq** = 0  If **isig\_Brake\_Timer** >= RCTB\_Max\_Brake\_Time (  **isig\_brake\_timeout** = true  **isig\_brake\_timer** = 0  stop **isig\_brake\_timer**  )  At Exit:   * Stop **Standby\_Timer** |
| **R: 3.7.11.2.4.3** | RCTB Active Mode Initiated | In this state the radar searches for oncoming targets and is ready toBrake, if the host is reversing , RBA is activated by the driver, RCTB is available in all modules, and an RCTB target is present. | Set **CtaXBrkDecel\_B\_Rq** = 0  Set **CtaXBrkEnbl\_B\_Rq** = 1  stop **isig\_brake\_timer**  isig\_brake\_timer = 0 |
| **R: 3.7.11.2.4.4** | Request Braking | The host is reversing and a RCTB target is present. A brake request is sent, but not confirmed yet by ABS | At Entry:   * Start **isig\_Brake\_Timer** * **isig\_brake\_timeout** = false   Set **CtaXBrkDecel\_B\_Rq** = 1  Set **CtaXBrkEnbl\_B\_Rq** = 1 |
| **R: 3.7.11.2.4.5** | Decelerating | The brake request is confirmed by ABS. The host is decelerating | Set **CtaXBrkDecel\_B\_Rq** = 1  Set **CtaXBrkEnbl\_B\_Rq** = 1 |

Table 3.7.11.2-2: Transitions between Brake Interface states

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Req.** | **Transition** | **From** | **To** | **Trigger Condition** |
| **R: 3.7.11.2.4.6** | F1 | Not fault | Fault | see Tables 3.7.10‑4 and and 3.7.1.12-1 and 3.7.1.12-2  (CTA\_ SnsX\_D\_Stat **RbaCtaX\_D\_Stat\_Intern**  = Fault set by CTA or RCTB) |
| **R: 3.7.11.2.4.7** | F2 | Fault | Standby | see Tables 3.7.10‑4 and and 3.7.1.12-1 and 3.7.1.12-2 |
| **R: 3.7.11.2.4.8** | S1 | Standby | RCTB Active Mode Initiated | **isig\_Transmission\_Status** = reverse &  Standby\_Timer >= RCTB\_Min\_Standby\_Time &  CtaSnsX\_D\_Stat = clear &  **CtaX\_D\_Stat** = on &  **Rba\_D\_Stat\_Intern** = ON &  **RbaSys\_D\_Stat\_Intern** = Available |
| **R: 3.7.11.2.4.9** | R1 | RCTB Active Mode Initiated | Request Braking | **isig\_RCTB\_Target\_detected** = True &  **isig\_Veh\_Speed** >= RCTB\_Min\_Reverse\_Speed &  **isig\_Vehicle\_Direction** = reversing &  **isig\_Veh\_Speed** < RCTB\_Max\_Reverse\_Speed &  **isig\_Transmission\_Status** = reverse  Note: this transition triggers a brake request in **R: 3.7.11.2.4.4**, setting CtaXBrkDecel\_B\_Rq = 1 |
| **R: 3.7.11.2.4.10** | R2 | RCTB Active Mode Initiated | Standby | **isig\_Transmission\_Status** <> reverse |  CtaSnsX\_D\_Stat = blocked |  CtaX\_D\_Stat <> on |  **Rba\_D\_Stat\_Intern** <> ON |  RbaSys\_D\_Stat\_Intern <> Available |
| **R: 3.7.11.2.4.11** | B1 | Request Braking | Decelerating | **isig\_RCTB\_Target\_detected** = True &  **CtaBrk\_D\_Stat** = Active &  **isig\_Transmission\_Status** = reverse  & **isig\_Brake\_Timer** < RCTB\_Max\_Brake\_Time |
| **R: 3.7.11.2.4.12** | B2 | Request Braking | RCTB Active Mode Initiated | **[isig\_Vehicle\_Direction** <> reversing |  **(isig\_RCTB\_Target\_detected** = False  & **isig\_Brake\_Timer** > RCTB\_MIN\_Brake\_Time)]  & **isig\_Transmission\_Status** = reverse  & **isig\_Brake\_Timer** < RCTB\_Max\_Brake\_Time |
| **R: 3.7.11.2.4.13** | B3 | Request Braking | Standby | **isig\_Transmission\_Status** <> reverse |  **isig\_Brake\_Timer** >= RCTB\_Max\_Brake\_Time |  CtaSnsX\_D\_Stat = blocked |  **CtaX\_D\_Stat** <> on |  **Rba\_D\_Stat\_Intern** <> ON |  **RBASys\_D\_Stat\_Intern** <> Available |
| **R: 3.7.11.2.4.14** | D1 | Decelerating | Standby | **CtaBrk\_D\_Stat** = Closed |  **isig\_Transmission\_Status** <> reverse |  CtaSnsX\_D\_Stat = blocked |  CtaX\_D\_Stat <> on |  Rba\_D\_Stat\_Intern <> ON |  RbaSys\_D\_Stat\_Intern <> Available |
| **R: 3.7.11.2.4.15** | D2 | Decelerating | RCTB Active Mode Initiated | **isig\_RCTB\_Target\_detected**  = False &  **isig\_Brake\_Timer** > RCTB\_MIN\_Brake\_Time &  **isig\_Veh\_Speed** >= RCTB\_Min\_Abort\_Speed &  **CtaBrk\_D\_Stat** <> Closed &  **isig\_Transmission\_Status** = reverse |

#### RCTB Activation States

The following table shows how ADAS sets it’s **RbaCtaX\_D\_Stat\_Intern** signal based on the inputs from the IPMB, BTT, CTA, internal Fault Status obtained from Table 3.7.10‑4 RCTB Fault Setting Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Input | | | | Ouput |
|  | **Rba\_D\_Stat\_Intern** | ***Isig\_rba\_fault*** | **CtaX\_D\_Stat** | **CtaSnsX\_D\_Stat** | **RbaCtaX\_D\_Stat\_Intern** |
| **R: 3.7.11.3.1** | ON | CLEAR | ON | CLEAR | ON |
| **R: 3.7.11.3.2** | ON | CLEAR | Trailer Tow OFF | CLEAR | Trailer Tow Off |
| **R: 3.7.11.3.3** | ON | FAULT | ON | CLEAR | FAULT |
| **R: 3.7.11.3.4** | ON | CLEAR | ON | FAULT | BLOCKED | FAULT |
| **R: 3.7.11.3.5** | - | - | - | - | - |
| **R: 3.7.11.3.6** | OFF | Don’t Care | Don’t care | Don’t Care | OFF |
| **R: 3.7.11.3.7** | DISABLED | Don’t Care | Don’t care | Don’t Care | OFF |

Table 3.7.11.3-1

### RESERVE

#### RESERVE

|  |  |
| --- | --- |
| **R: 3.7.12.1.1** | RESERVE |
| **R: 3.7.12.1.2** | RESERVE |
| **R: 3.7.12.1.3** | RESERVE |

# Side Feature Performance Requirements

The supplier owns the algorithms that set BLIS, BTT, and CTA performance. The requirements in section 4 pertain only to performance requirements that are perceived by the customer.

## Platform Flexibility

The system will function across vehicle platforms using one software part number for each electrical architecture. The requirements in section 4.1 assume a single supplier.

|  |  |
| --- | --- |
| **R: 4.1.1** | Side feature shall function across vehicle platforms with only global parameter differences given that the platforms use the same electrical architecture. The goal is that one software part number shall be used per vehicle architecture. |
| **R: 4.1.2** | Side feature shall function per this specification for all vehicle road heights per each vehicle program. |
| **R: 4.1.3** | Side feature shall function per this specification for all vehicle payloads per each vehicle program. |
| **R: 4.1.4** | Feature performance shall be designed to function for all global regions. Any regional differences shall be controlled through the global parameters. |

## Performance to ISO Standard NP17387

The BLIS will comply with the ISO Standard NP17387 performance requirements as listed in Table 4.2. Exceptions to this standard are noted in the requirements below.

|  |  |
| --- | --- |
| **R: 4.2.1** | The system shall meet the functional requirements and test conditions for a Type I LCDA system (Blind Spot Warning) as detailed in ISO Standard NP17387 – Lane Change Decision Aid Systems (ISO/TC204/WG14/N40.29-30Mar2005 or latest/published). Applicable NP17387 sections are listed in table 4.3-32 below. |
| **R: 4.2.2** | ***Rear Range Definition: Stagnation***  *Note – performance parameters may be modified per global region.*  The BLIS rear range alert capability shall be defined as the distance from the center of the rear bumper as packaged in the vehicle to the closest point of the approaching target along the X axis of the radar vehicle.  For host overtaking target (stagnation) and merge scenarios the minimum rear range alert OFF distance for the alert zone shall be defined by the global parameter BLIS\_Rear\_Range + any supplier required hysteresis +/- 0.5 m. The supplier hysterises shall be reviewed and approved with Ford. |
| **R: 4.2.3** | ***Rear Range Definition: Pass From Rear (PRF)***  For target overtaking host (pass from rear) scenarios the rear range alert distance shall be defined by the subjects speed x BLIS\_VarRearRange\_TTC with a minimum rear range alert distance is equal to BLIS\_Rear\_Range. This shall be true for all radar vehicle speed above the BLIS vehicle speed threshold.  Per ARL 24, the ALERT ON for the BLIS\_Rear\_Range shall be:  72% of pfr detections = BLIS\_Rear\_Range (+/- 0.5m)  25% of pfr detections between BLIS\_Rear\_Range and 3m  3% of pfr detections < 3m  The pass/fail criteria for BLIS\_VarRearRange\_TTC shall be:  90% = TTC +/- 0.25(seconds)  10% = TTC +/- 0.5(seconds)  This requirement is for constant delta speed testing.  *Example:*  *Let ‘d’ be the alert rear range distance of a PFR target, Vdelta be the delta speed between the overtaking target and the host. Then the Vdelta that causes the alert at d = 7m is*  *7 / (BLIS\_VarRearRange\_TTC) = 2.8m/s for a 2.5 second TTC*  *The Vdelta that causes an alert at d = BLIS\_VarRearRange\_Max = 15m is*  *15 / (BLIS\_VarRearRange\_TTC) = 6m/s for a 2.5 second TTC*  *Thus for PFR targets with a Vdelta ≤ 2.8 m/s shall alert at a distance of 7 +/- 0.5 m. and PRF targets with a Vdelta ≥ 6 m/s shall alert at a distance of 15 +/- 0.5m, and PRF targets with 2.8 < Vdelta < 15 shall alert at a distance d = Vdelta / (BLIS\_VarRearRange\_TTC).*  *Note – this* +/- 0.5m *tolerance is needed to prevent the rear range to extend out significantly to meet the overall requirement.*  Any results less than those specified in this requirement will be evaluated for Conditional Pass or Failure. |
| **R: 4.2.4** | ***PFR (Pass from Rear) Variable Rear Range (VRR)***  The BLIS variable rear range for PFR targets, **isig\_BLIS\_VarRearRange,** shall be defined by the global parameters BLIS\_VarRearRange\_TTC and BLIS\_VarRearRange\_Max. The BLIS system shall alert on PFR targets using variable rear range when the target in the adjacent lane will cross the rear bumper line within less than BLIS\_VarRearRange\_TTC seconds <AND> the target is closer than BLIS\_VarRearRange\_Max meters.  The global parameter BLIS\_VarRearRange\_Max value will be selected based on sensor capability for azimuth packaging angle range.  *Note - A PFR target’s TTC and distance will be continuously calculated to determine the alert time of a target and whether to use the minimum rear range BLIS\_Rear\_Range or to set the variable rear range* ***isig\_BLIS\_VarRearRange****. This is required to satisfy host to target variable PFR variable speeds.* |
| **R: 4.2.5** | ***PFR Variable Rear Range Hysteresis: Variable Delta Speed Tgts***  For targets whose delta speed is changing there shall be a time hysteresis for the BLIS\_VarRearRange\_TTC defined by global parameter BLIS\_VarRearRange\_TTC\_Hysterisis such that the actual VRR TTC is  BLIS\_VarRearRange\_TTC +/- BLIS\_VarRearRange\_TTC\_Hysterisis  The SOD software shall not allow BLIS\_VarRearRange\_TTC\_Hysterisis to be greater than BLIS\_VarRearRange\_TTC. If form the VSCS file the BLIS\_VarRearRange\_TTC\_Hysterisis value is ever equal to or greater than BLIS\_VarRearRange\_TTC, SOD shall automatically default BLIS\_VarRearRange\_TTC\_Hysterisis to  BLIS\_VarRearRange\_TTC – 0.1  Note – the hysteresis applies to variable delta speed between the host and target whereas the alert distance tolerance of +/- 0.75m in R:4.2.2 applies to constant delta speeds. |
| **R: 4.2.6** | ***VRR Minimum Speed***  VRR shall become active when **isig\_Veh\_Speed** => the global parameter BLIS\_VarRearRange\_ActiveSpeed. A fixed hysteresis of 4 kph shall be applied to speeds that vary about the value of BLIS\_VarRearRange\_ActiveSpeed. When VRR is inactive, PFR targets shall alert at the rear range of BLIS\_Rear\_Range. |
| **R: 4.2.7** | ***VRR and BTT***  If**Isig\_BTT\_TRAILER** = CONNECT then VRR is turned OFF and does not apply. |
| **R: 4.2.8** | ***Side Range Definition: BLIS Global Performance Parameters (ARL)***  *Note – performance parameters may be modified per global region.*  The BLIS Blind Zone side range (distance from the module to the side; equivalent to ISO 17387 figure 10 distance between JL and EG) will be defined by the global parameter BLIS\_Side\_Range. This parameter defines the furthest distance in which if a target is present shall generate a BLIS alert. |
| **R: 4.2.9** | ***VRR Performance on Curved Roads***  VRR shall meet the BLIS MTR and FAR requirements as specified for both straight and curved roads. The extended rear range on curved roads will cause some degree of overlap onto the same lane and the lane that is two lanes over (refer to figure 4.2). These overlaps can cause false target alerting. VRR shall use the vehicle yaw rate (refer to section 3.7.1.12) to calculate the vehicle turn to eliminate these types of falses.  The technique to eliminate these types of falses produced by curved roads shall be determined by the supplier. However, the VRR TTC alert will not change due to curved roads. The system will be designed for a minimum curve road radius found on a road with a speed limit of 35mph (55 kph) road of 150m. |
| **R: 4.2.10** | ***Merge into Variable Rear Range (VRR)***  For a target that merges into the BLIS VRR zone with a high enough delta speed so as to trigger a VRR alert, the radar may require a target acquision dwell time prior to establishing a target. Therefore, the PFR VRR requirements shall apply after an allowable radar dwell time. The radar dwell time shall be determined from the time any point of the target enters the zone minus the alert time less the TTC.  The target dwell time shall be agreed to by Ford and the supplier but should not be greater than 1.5 seconds. |

Table 0 ISO Standard NP17387 Requirements

|  |  |  |  |
| --- | --- | --- | --- |
| RQMNT | Section | Description | Comments |
| **R: 4.2.1.1** | 3 | Definitions |  |
| **R: 4.2.1.2** | 4.1 | Coverage Zone Classification |  |
| **R: 4.2.1.3** | 4.1.1 | Type I Systems |  |
| **R: 4.2.1.4** | 5.1 | LCDAS State Diagram |  |
| **R: 4.2.1.5** | 5.1.1 | LCDAS Inactive State |  |
| **R: 4.2.1.6** | 5.1.2 | Activation Criteria |  |
| **R: 4.2.1.7** | 5.1.2.1 | Continuous Activation |  |
| **R: 4.2.1.8** | 5.1.2.2 | Manual Switch Activation |  |
| **R: 4.2.1.9** | 5.1.2.4 | Subject Vehicle Speed Activation | For speed threshold see FordNA requirements section 4.4.2 |
| **R: 4.2.1.10** | 5.1.3 | LCDAS Active State |  |
| **R: 4.2.1.11** | 5.1.3.1 | Non-Warning State |  |
| **R: 4.2.1.12** | 5.1.3.2 | Warning State |  |
| **R: 4.2.1.13** | 5.1.3.2.1 | Warning Level 1 State |  |
| **R: 4.2.1.14** | 5.2 | System Performance | FMC Rear Range Requirement 4.3.2 supersedes the Line B requirement of this section. |
| **R: 4.2.1.15** | 5.2.1 | Minimum Detectable Target Vehicle |  |
| **R: 4.2.1.16** | 5.2.2 | Requirements for the Blind Spot Warning Function | Includes all 5.2.2 subsections.  Includes subsection 5.2.2.2 – Optional Blind Spot Warning Suppression  Note – any deviations to this ISO requirement shall be submitted in writing for approval. |
| **R: 4.2.1.17** | 5.2.5 | System Response Time |  |
| **R: 4.2.1.18** | 5.3 | User Interface | Includes all 5.3 subsections. |
| **R: 4.2.1.19** | 5.4 | Operation with Trailers |  |
| **R: 4.2.1.20** | 5.5 | Self-Test Requirements |  |
| **R: 4.2.1.21** | 6.1 | Test Target Vehicle |  |
| **R: 4.2.1.22** | 6.1.2 | Test Target Vehicle for RADAR-Based Systems |  |
| **R: 4.2.1.23** | 6.3 | Blind Spot Warning Test Requirements | This section shall supplement the FMC BLIS Test Procedures for Score Card and DOE testing. |
| **R: 4.2.1.24** | 7.3 | ANNEX C – Rationale Behind the Blind Spot Warning Requirements |  |
| **R: 4.2.1.25** | 7.4 | ANNEX D - Blind Spot Warning Example Cases |  |

**Figure 4.2 Same Lane and Two Lane Out Targets**



*Note: The figure shows only one side, the other side is a mirrored version of the Figure. A vehicle in the adjacent lane but far back must still be detected (Vehicle surrounded in red). To make VRR inactive in city driving BLIS\_VarRearRange\_ActiveSpeed is going to be set to 60 kph*

## FMC BLIS Performance Requirements (Not Contained In ISO NP17387)

This section contains FMC performance requirements for BLIS that are not contained in the ISO NP17387

Section 4.3 requirements are for BLIS less BTT unless otherwise stated.

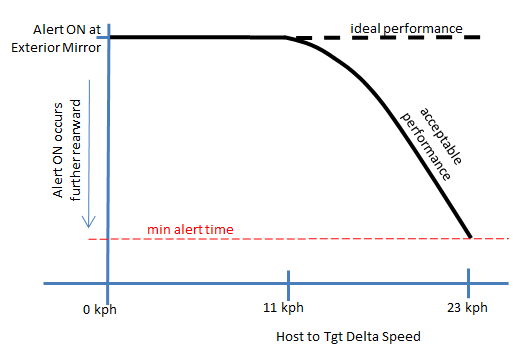
### BLIS – Vehicle Speed

|  |  |
| --- | --- |
| **R: 4.3.1.1** | **Host Vehicle Speed Range:** The BLIS performance shall perform at all vehicle speeds down to the minimum speed defined by R:3.7.6.1. However, target tracking must be capable down to **isig\_Veh\_Speed** = 0 kph. There is no upper speed limit. This is also true for BLIS alerts with BTT on and trailer attached.  *Note: The purpose of this requirement is to require the BLIS to continue tracking moving BLIS targets when the host is below the minimum BLIS alert speed (R:3.7.6.1). This will allow the BLIS not to lose track of a target when momentarily stopping at a stop sign or stop light.* |
| **R: 4.3.1.2** | **Target Vehicle Speed Range:** The minimum delta target speed in which the BLIS will process shall be 0 kph. This is also true for BLIS alerts with BTT on and trailer attached. |
| **R: 4.3.1.3** | Host Vehicle to Target Vehicle delta speed range for PFR targets shall be 0 to +35 kph (9.72 m/s). |
| **R: 4.3.1.4** | The host vehicle to target vehicle delta speed range for stagnation shall be 0 to – 23 kph (7 m/s). This value is based on an evaluation of both a small car with a blind zone total length of 5m and a club cab F250 truck with a blind zone total length of 10m using a BLIS rear range of 5m and a zero stagnation delay: refer to Figure 4.3.1-1. Figure 4.3.1-1 shows the amount of time the target will be within the blind zone vs. delta speed. For larger vehicles stagnation must alert on higher delta speeds than 3 m/s else the alert will appear as a miss or inconsistent behavior while the target is still in the blind zone.  Therefore, stagnation alert ON performance shall perform according to Figure 4.3.1-2 such that there shall exist no set delta speed cut-off for stagnation but rather a smooth degredation in alert ON time: for delta speeds of greater than 3 m/s the target may begin to alert ruther back than at the exterior mirror.  The alert ON and OFF time for the vehicles blind zone shall meet stagnation MTR requirement R: 4.3.2.5.  *Note: A late stagnation alert is considered a miss.*  *Note: This requirement is based on a min 1 sec alert time.* |

Firgure 4.3.1-1 Target presents in Blind Zone

Time in the 5m or 10m zone

Firgure 4.3.1-2 BLIS Stag Performance Chart



### BLIS – False Alarm Rate and Missed Target Rate

**False Alert Rate**

|  |  |
| --- | --- |
| **R: 4.3.2.1** | The BLIS FAR shall be no greater than 1% when measured for a minimum of 600 targets (300 targets per side) and over a minimum distance of 400km. Target trajectories include pass from rear, stagnation, and merge.  A false alert is defined as an alert that is triggered on a non ISO target.  Note – due to the physics of the radar system there may exist 'known' false alerts. Known falses are those that are repeatable and caused by a specific non ISO object. Known false alerts may not contribute to the false alert rate depending on the type of target and frequency of the false. Classifying a false alert as a known false will be at the discretion of FMC. |
| **R: 4.3.2.2** | The FAR shall be calculated as follows:  FAR = (# of falses) / (# of detections + # of misses + # of falses) |
| **R: 4.3.2.3** | A value of kilometers per False shall also be calculated as (km driven / (# of falses). The km per false alert shall not be less than 26. |
| **R: 4.3.2.4** | **BLIS Performance with Bike/Cargo Rack**  BLIS performance may be degraded due to a loaded Bike or Cargo rack attached. The system will be performance tested to determine if an Owner Manual note is required. This is not a pass/fail test. |

**Missed Target Rate**

|  |  |
| --- | --- |
| **R: 4.3.2.5** | The BLIS MTR shall be as specified in Table 4.3.2-1 when measured for a minimum of 600 targets (300 targets per side) and 400 km drive minimum distance. The system is to be designed to meet the PASS value. If greater than the PASS value but less than or equal to the CONDITIONAL PASS value the system is considered pass with the condition that the supplier will correct the algorithm to meet the PASS value. Values greater than the CONDITIONAL PASS value will be considered a FAIL.  Note – due to the physics of the radar system there may exist 'known' missed targets. Known missed targets are those that are repeatable and caused by specific scenarios. Known missed targets may not contribute to the MTR depending on the type of target and frequency of the MTR. Classifying an MTR as a known MTR will be at the discretion of FMC. |
| **R: 4.3.2.6** | The MTR shall be calculated as follows:  MTR = (# of misses) / (# of detections + # of misses) |

**BLIS Availability**

|  |  |
| --- | --- |
| R: 4.3.2.7 | The BLIS shall be available for 100% or the time over 2000 km travel distance without faults caused by system reset due to vehicle voltage drop outs per EC-0043. The system shall be recoverable from system resets caused by voltage drop outs. |

Table 4.3.2-1 MTR Percent

|  |  |  |
| --- | --- | --- |
| Tgt Trajectory | Pass | Conditional Pass |
| Pass From Rear | 1% | 2% |
| Stagnation | 3% | 5% |
| Merge | 4% | 8% |

Note – These numbers are based on competitor test data and FMC requirements.

### BLIS Target Tracking with/without BTT

Section 4.3.3 apply to both BLIS without BTT and with BTT ON and trailer attached.

|  |  |
| --- | --- |
| R: 4.3.3.1 | Once a target is alerted to the customer, the alert shall not drop out nor temporarily drop out then reappear. Such an alert will be considered a missed alert. |
| **R: 4.3.3.2** | Targets shall be detected and the driver alerted so long as the target moves in to the BZ from any direction: pass from rear, merge from any angle, and stagnation. |
| **R: 4.3.3.3** | Multiple targets in series, a caravan type of arrangement, shall be detected and the customer alerted. It is permissible to treat closely packed caravan of targets as a single target. |
| **R: 4.3.3.4** | BLIS shall not be designed intentionally to trigger on bicycles. |
| **R: 4.3.3.5** | A BLIS shall alert on ISO targets; any motorized licensed vehicle. An ISO target is defined by ISO Standard NP17387. |
| **R: 4.3.3.6** | BLIS shall alert per specification regardless of the surrounding target density. In other words, in heavy traffic BLIS shall continue to track targets in the BZ without adjacent target interference. |

### BTT Performance Requirements

BTT is BLIS with an extended rear range where the extended rear range is adjusted to the trailer length data received from the Cluster. However, the BTT BLIS performance requirements, with extended rear range are slightly different than BLIS with BTT OFF/DISABLED. These requirements pertain to BTT ON and a trailer attached.

#### BTT Trailer Types and Size Restriction

The BTT requirements in section 4.3.4 apply to all trailers defined within this section.

|  |  |
| --- | --- |
| R: 4.3.4.1.1 | The performance requirements apply to all trailers that do not fall in to the class of 5th wheel trailers and gooseneck trailers. Included are flat bed trailers with and without loads. |
| **R: 4.3.4.1.2** | The maximum width of any trailer as measured at the front of the trailer shall be 8.5 feet (2.6m). Trailer width is defined as the width of the front of the trailer.  For example, an 8 foot (2.4m) enclosed box trailer shall have a width of 8 feet (2.4m) at the front of the trailer box but the trailer wheels located in the middle of the trailer will be extended beyond 8 feet (2.4m). It is only the front of the trailer where the width is of interest. |
| **R: 4.3.4.1.3** | The Trailer Length shall be defined as the distance from the host vehicle trailer ball to the rear of the trailer, d’. The maximum d’ shall be not greater than 10m. Refer to the figure in section 2.1.3. |

#### BTT Blind Zone Area Definition

|  |  |
| --- | --- |
| R: 4.3.4.2.1 | The standard Blind Zone area (less BTT) as depicted in the figure in section 2.1.3 is noted by the blue dotted area.  The BTT Blind Zone is from the exterior mirror to approximately 3m rear of the trailer. The rear range of the BTT blind zone shall never be less than the global parameter BLIS\_Rear\_Range; this is important in the case of small trailers. The lateral distance of the blind zone 0.5 +/-0.35 m from the host vehicle/trailer body to the global parameter BLIS\_Side\_Range.  A supplier algorithm may deviate in lateral distance for large trailers where visible line-of-sight from the sensor to the target is limited. |
| **R: 4.3.4.2.2** | The rear range alert capability behind the trailer shall be defined as the distance from the radar sensor as packaged in the vehicle with the closest point of the approaching target along the X axis of the radar vehicle. The minimum rear range alert distance shall be as specified below using a sample size of 60 pass from rear targets per side for **isig\_Veh\_Speed** => 50 kph. This shall be true for all radar vehicle speed above the BLIS vehicle speed threshold.  70% greater than or equal to 2m but not greater than 4m.  30% between 0m and 2m  Any results less than those specified in this requirements shall be evaluated for Conditional Pass or Failure. |

#### BLIS with BTT – False Alert Rate and Missed Target Rate

|  |  |
| --- | --- |
| **R: 4.3.4.3.1** | The BLIS with BTT FAR shall be no greater than 3% when measured for a minimum of 240 targets (120 targets per side). Target trajectories include pass from rear, stagnation, and merge. A FAR up to 5% is considered a conditional pass on trailers wider than 2.2m and longer than 6m. A false alert is defined as an alert that is triggered on a non ISO target.  False alerts that occur for 1 second or less shall be considered as a known false alert and shall be excluded as a false alert. This is possible as long as the occurrence of such false alerts is not greater than 16.1 km/false (10 miles/false).  This requirement shall be tested across a range of different trailers. If a specific type of trailer causes a FAR outside this requirement, FMC and supplier shall determine if an owner’s manual notification is required or an improvement can be made.  *Note: The CAE requirements are relaxed because history shows that CAE FAR rusults are 6 times greater than realworld testing.* |
| **R: 4.3.4.3.2** | The FAR shall be calculated as follows:  FAR = (# of falses) / (# of detections + # of misses + # of falses) |
| **R: 4.3.4.3.3** | A value of kilometers per False shall also be calculated as (km driven / (# of falses). The km per false alert shall not be less than 14. |

**Missed Target Rate**

|  |  |
| --- | --- |
| **R: 4.3.4.3.4** | The BLIS with BTT MTR shall be as specified in Table 4.3.4.3-1 when measured for a minimum of 240 targets (120 targets per side) and 200 km drive minimum distance. The system is to be designed to meet the PASS value. If greater than the PASS value but less than or equal to the CONDITIONAL PASS value the system is considered pass with the condition that the supplier will correct the algorithm to meet the PASS value. Values greater than the CONDITIONAL PASS value will be considered a FAIL. |
| **R: 4.3.4.3.5** | The MTR shall be calculated as follows:  MTR = (# of misses) / (# of detections + # of misses) |

Table 4.3.4.3-1 MTR Percent

|  |  |  |
| --- | --- | --- |
| Tgt Trajectory | Pass | Conditional Pass |
| Pass From Rear | 2% | 4% |
| Stagnation | 3% | 5% |
| Merge | 5% | 10% |

#### BLIS with BTT – FAR MTR Test Requirements

|  |  |
| --- | --- |
| **R: 4.3.4.4.1** | For algorithm development of BTT the number of different trailers test must be adequate to show that the BLIS with BTT requirements shall be met in general. The trailer types to be tested will be agreed upon by FMC and the supplier but shall include the types listed below. Note the trailer lengths are measured from the ball hitch to the rear of the trailer.   1. Enclosed box trailers: small (4x6 ft), medium (8x greater than 16 ft), and maximum (8.5 x 33 ft). V-nose, round-nose, and square nose shall be evaluated. 2. Flatbed trailer with and without load (min 7x14 ft) 3. Utility trailer of length ≥ 16 with and without a load 4. ~~Reserved~~ 5. V-nose boat/ski trailer with and without boat/ski 6. Snowmobile clamshell trailer |
| **R: 4.3.4.4.2** | For actual program DV testing the trailers to be used are  6x12’ utility  8.5x20’ flatbed car hauler  8.5x30’ V-nose box  8x14’ round nose box (w/ exterior wheels)  8.5x14’ snowmobile clamshell  8x16’ jet ski trailer / V-haul boat trailer (loaded and empty)  8.5x20’ flat nose box |

#### RESERVED

#### BLIS / BTT Merge Target Timing

This section defines the merge timing for BLIS, VRR, LCWA zones, and BTT. The following diagram describes the merge terms used in this section.



|  |  |
| --- | --- |
| **R: 4.3.4.6.1** | ***BLIS Merge:***  For all outside merges, the alert shall occur within 300 msec of the target (Target 2) touching the BLIS zone lateral distance BLIS\_Side\_Range.  For all inside merge, the alert shall occur within 300 msec from time t0. Time t0 shall be when the front width of the target (Target 1) is completely in the zone. |
| **R: 4.3.4.2.2** | ***BLIS VRR Merge:***  For both inside and outside merges and merge & swerve, the alert shall occur according to the VRR TTC requirement R:4.2.3 from time t0 plus the maxmum radar dwell time as specified in R: 4.2.10. Time t0 shall be when the front width of the target (Target 1 or Target 2) is completely in the zone. |
| **R: 4.3.4.6.3** | ***BTT Merge:***  For both inside and outside merges and merge & swerve, the alert shall occur according to the BTT section 4.3.4.3 from time t0 plus a maxmum radar dwell time as listed below. Time t0 shall be when the front width of the target (Target 1 or Target2) is completely in the zone.  For a PASS the dwell time is not greater than 1 second.  For a CONDITIONAL PASS the dwell time is greater than 1 second but less than 5 seconds. |
| **R: 4.3.4.6.4** | ***RESERVE*** |
| **R: 4.3.4.6.6** | ***RESERVE*** |
| **R: 4.3.4.6.7** | All merges shall be tested in a controlled environment with a maximum merge rate of 1.3 m/sec.  Higher merge rates will occur in realworld testing. The software shall not implement a cutoff filter for higher merge rates > 1.3 m/sec but rather performance alert degredation shall be allowed. |

*Note 01Mar2019: Section 4.3.4.6 was written post 20MY SW release. FMC understands that section 4.3.4.6 requirements for BLIS, BTT, VRR have been met by 20MY SW release and does not need to be retested. LCWA requirements must still be tested.*

#### BLIS / BTT Alert Off

The Alert Off definitions apply to sedan type target vehicles and do not apply to target vehicles towing a trailer or semi-truck targets.

|  |  |
| --- | --- |
| **R: 4.3.4.7.1** | ***BLIS:***  The alert shall turn OFF once the target exits the zone with the following tolerance:  For STAG and MERGE  -0.5m to 0.0m for 3%  0.0m to +1.0m for 87%  +1.0 to 1.4m for 10%  For PFR  +/- 1.0m for 100%  This applies to PFR, Stagnation, and Merge for a sample size of 60 samples per each maneuver and samples proportionally taken from the LH and RH radars. |
| **R: 4.3.4.7.2** | ***BLIS VRR:***  While the target is in the VRR zone the alert ON is a function of TTC for PFR and STAG with tolerances specified in the VRR TTC requriements. For exiting a merge the alert OFF will occur:  -0.5m to 0.0m for 3%  0.0m to +1.0m for 87%  +1.0 to 1.4m for 10%  This is for a sample size of 20 samples proportionately taken from the LH and RH radars. |
| **R: 4.3.4.7.3** | ***BTT:***  The alert shall go OFF once the target exits the zone with the following tolerance:  For MERGE  -0.5m to 0.0m for 3%  0.0m to +1.0m for 87%  +1.0 to 1.4m for 10%  For PFR  +/- 1.0m for 100%  For STAG  0 to 2.5 from the BTT rear range requirement R: 4.3.4.2.1.  This applies to PFR, Stagnation, and Merge for a sample size of 60 samples per each maneuver and samples proportionally taken from the LH and RH radars.  *Note 1: For triler towing it is better to have a larger stagnation OFF distance for driver comfort.* |
| **R: 4.3.4.7.4** | RESERVED |
| **R: 4.3.4.7.5** | Degredation from the OFF time requirements shall be reviewed for acceptance by FMC. |

*Note 01Mar2019: Section 4.3.4.7 was written post 20MY SW release. FMC understands that section 4.3.4.7 requirements for BLIS, BTT, VRR have been met by 20MY SW release and does not need to be retested. LCWA requirements must still be tested.*

### BTT5G Performance Requirements

BTT5G utilizes aftermarket trailer radars mounted on the 5th wheel or gooseneck trailer with the 2 coverage zones extending to the trailer length data received from the Cluster. These requirements pertain to BTT5G ON and a trailer attached and setup in the vehicle HMI.

|  |  |
| --- | --- |
| R: 4.3.5.1 | The BTT5G feature shall not impact performance of carryover BLIS, BTT, or any other feature carried over from DAT202, 203, or 204. BTT5G shall have its own dedicated Simulink model such that the existing BLIS and BTT models are left intact. |

#### BTT5G Trailer Types and Size Restriction

The BTT requirements in section 4.3.5 apply to all trailers defined within this section.

|  |  |
| --- | --- |
| R: 4.3.5.1.1 | The performance requirements apply to 5th wheel trailers and gooseneck trailers. Conventional trailers covered under the BTT feature, section 4.3.4. |
| **R: 4.3.5.1.2** | The maximum width of any 5th wheel or gooseneck trailer as measured at the area rearward from the rear vehicle bumper shall be 8.5 feet (2.6m). |
| **R: 4.3.5.1.3** | The Trailer Length shall be defined as the distance from the 5th wheel hitch to the rear of the trailer, d’. The maximum d’ shall be not greater than 50ft. Refer to figure 2.1.5‑1. |

#### BTT5G Blind Zone Area Definition

|  |  |
| --- | --- |
| R: 4.3.5.2.1 | The BTT5G Blind Zone area is depicted in figure 2.1.5-1, noted by the blue area.  The complete BTT5G Blind Zone extends from the exterior mirror to rear of the trailer. The lateral distance of the blind zone 0.5 +/-0.35 m from the host vehicle/trailer body to the global parameter BLIS\_Side\_Range.  A supplier algorithm may deviate in lateral distance for large trailers where visible line-of-sight from the sensor to the target is limited. |
| **R: 4.3.5.2.2** | While BTT5G is on, the detection area of the BLIS vehicle rear corner radars shall be reduced rearward to the front lower trailer face (see figure 2.1.5-2) of the 5th wheel/gooseneck trailer, as shown in figure 2.1.5‑1 area J. |
| **R: 4.3.5.2.3** | The detection area of the aftermarket trailer radars shall cover 2.1.5‑1 area F, this area is controlled by the afermarket radars via trailer length data from Sync. |
| **R: 4.3.5.2.4** | The trailer radar placement location may have variation as it is placed by the customer, the detection areas of the BLIS radars and aftermarket radars may include a gap as depicted in 2.1.5‑1 area E, or an overlap in detection areas. |
| **R: 4.3.5.2.5** | While BTT5G is on, the BLIS system notifications shall not drop out while a vehicle is passing or merging in the detection zones if a gap or overlap in radar detection ranges exists. |

#### BTT5G – False Alert Rate and Missed Target Rate

Targets are the same as the BTT requirements in section 4.3.4.3.

#### BTT5G – FAR MTR Test Requirements

|  |  |
| --- | --- |
| **R: 4.3.4.4.1** | For algorithm development of BTT5G the number of different trailers test must be adequate to show that the requirements shall be met in general. The trailer types to be tested will be agreed upon by FMC and the supplier but shall include the types listed below. Note the trailer lengths are measured from 5th wheel hitch to the rear of the trailer.   1. 5th wheel trailer of up to 50ft length and 8.5ft width 2. Gooseneck trailer of up to 50ft length and 8.5ft width |
| **R: 4.3.4.4.2** | For actual program DV testing the trailers to be used are:   1. 5th Wheel (Box and RV) 2. Gooseneck boxed 3. Gooseneck Flatbed     Specific trailers to be tested to be included in reference document FunctionSpecification\_BTT5G\_Vxx. |

#### BTT5G Merge Target Timing

Targets are the same as the BTT requirements in section 4.3.4.6.

#### BTT5G Alert Off

Targets are the same as the BTT requirements in section 4.3.4.7.

## SOD Feature Environmental Performance

**Overview:** The side features features described in this specification are expected to function without degradation of performance over the defined environmental conditions (temperature, humidity etc.) for the overall ADAS. However, special considerations are given to conditions of precipitation and the buildup of foreign materials directly in front of the rear SRR sensors.

The functional performance of the side features described in this specification can be impacted by radar signal attenuation caused by contamination (dirt, mud, trapped water, water sheeting, snow ice etc.) on the sensor transmit/receive surface, on the design surfaces in the signal path or trapped between these areas. Signal attenutation may also occur from active precipitation, road splash or other atmospheric conditions. Signal attenuation from environmental conditions is inherent to the physics of the radar signals employed and must be accounted for.

### Side Radar Sensor Blockage Response

Side Radar feature performance is considered degraded, referred to as “blocked”, when a Side radar feature Missed Target Rate (MTR) is increase due signal attenuation and reduced target detection capability. Where applicable, a ‘late target’ will be considered as a ‘missed target’ for Side radar feature blockage test purposes.

Based on FMC blockage testing and experience, a partially blocked Side radar sensor does not normaly exist in real world conditions because the smooth vertical surfaces of the rear fascia and tail-lamp assemblies rarely get partially covered with contaminants. Therefore, partial blockage will not be considered in Side radar feature blockage testing.

|  |  |
| --- | --- |
| **R: 4.4.1** | If the ADAS ECU determines that the Side radar sensor performance have become degraded due to environmental conditions, such that any Side radar feature performance is degraded, the ADAS ECU shall notify all Side radar features of the “Side radar sensor blocked” condition, by setting **isig\_blocked = BLOCKED.**  *Note: All Side radar features will consider the blocked condition equally; no partial Side radar functionaly is planned.* |
| **R: 4.4.2** | Upon determining a Side radar sensor blocked condition, the ADAS ECU shall notify the Cluster via CAN by setting (xxxxxxxxxxxxx = xxxx)  *Note: The Cluster will notify the customer via a BLOCKED warning message via the Message Center as defined in section 7* |
| **R: 4.4.3** | Upon determining a Side radar sensor blocked condition, the ADAS ECU shall activate the Alert LEDs as defined by the associated global parameters for the duration of the blocked condition. |

#### Blockage Requirement Definitions

False Blockage Warning Rate (FBWR)

The number of BLOCKED warnings that occur when the system is not blocked as measured over a specified hour period for half of the hours of non open terrain driving and half of the hours of open terrain driving.

Open Terrain

Open Terrain is near zero target density in an open flat plan area with less that 1vehicle per 120 seconds and no infrastructure.

#### Side Radar Feature Blockage Requirements

|  |  |
| --- | --- |
| **R: 4.4.1.2.1** | The Side radar Feature Blockage Detection methods shall be reviewed and approved by Ford Side radar engineering. |
| **R: 4.4.1.2.2** | The Side radar Feature Blockage Deteciton system shall be configurable ON/OFF via supplier configuration parameter(s). |
| **R: 4.4.1.2.3** | The Side radar Feature Blockage Detection method may utilize windshield wiper status information. |
| **R: 4.4.1.2.4** | If wiper status information is used for Side radar feature blockage detection, the system should have a configurable hysteresis control method to manage intermittent wiper usage. |
| **R: 4.4.1.2.5** | For the purpose of engineering test and development, the Side Radar feature blockage detection system shall have available engineering DID parameter(s) that provide real-time visibility on the status and performance of the blockage system. |
| **R: 4.4.1.2.6** | Reserved |
| **R: 4.4.1.2.7** | Reserved |
| **R: 4.4.1.2.8** | The Side Radar Feature Blockage Detection system may utilize vehicle speed information |
| **R: 4.4.1.2.9** | When a blocked condition is determined for either Left or Right side radar sensor, both side radar sensors shall be considered blocked. |
| **R: 4.4.1.2.10** | Reserved |
| **R: 4.4.1.2.11** | When the Side Radar Sensors are determined to be blocked, the following CAN signals shall be set within 200msec:   * **SodSnsX\_D\_Stat** = BLOCKED * **SodInnr\_D\_Stat** = REPORTING * **SodAlrtX\_D\_Stat** = LAMP ON * **SodDetct\_D\_Stat** = SENSOR BLOCKED   *Note that R: 4.4.1.2.19 defines the CTA CAN signals for BLOCKED state. Also note that the* ***SodAlrtX\_D\_Stat*** *will be set to ON and for both BLIS and CTA mode.* ***CtaAlrtX\_D\_Stat*** *and* ***CtaAlrtX2\_D\_Stat*** *cannot be used for LED illumination for blockage because it will trigger a CTA alert and the LED will continuously flash*. |
| **R: 4.4.1.2.12** | Reserved |
| **R: 4.4.1.2.13** | Because the Cluster does not filter multiple reporting of blockage and to keep the Cluster from writing multiple blockage messages, once the ADAS ECU sets **SodSnsX\_D\_Stat** to BLOCKED, **SodSnsX\_D\_Stat** shall remain set to BLOCKED until the SOD sensors become unblocked regardless of operational mode. |
| **R: 4.4.1.2.14** | Reserved |
| **R: 4.4.1.2.15** | Reserved |
| **R: 4.4.1.2.16** | A SOD Feature BLOCKED state shall reset to UNBLOCKED upon a key cycle. |
| **R: 4.4.1.2.17** | The SOD Feature Blockage detection system shall be tested per the FMC Blockage Performance Test Plan. The results shall be reviewed and approved by Ford SOD engineering. |
| **R: 4.4.1.2.18** | SOD Feature Blockage detection may be disabled when BTT is enabled and a trailer is detected. |
| **R: 4.4.1.2.19** | Review this seems risk to delete, involves the cluster….  NOTE that blockage determination may not be able to be accomplished in CTA mode.  A blocked state determined in BLIS mode shall carry in to the CTA mode if blocked and the system transitions in to CTA mode. If this occurs upon entering in to CTA mode and the transmission state is REVERSE SODX will set the CAN signal **CtaSnsX\_D\_Stat** = BLOCKED within 200 msec of entering the CTA mode, **CtaAlrtX\_D\_Stat** = OFF, **CtaAlrtX2\_D\_Stat** = OFF, and the **SodAlrtX\_D\_Stat** will remain equal to ON. If configured for hardwire HMI LED then the hardwired HMI LED be set to ON.  Because the Cluster does not filter multiple reporting of blockage and to keep the Cluster from writing multiple blockage messages, once the ADAS sets **CtaSnsX\_D\_Stat** to BLOCKED, **CtaSnsX\_D\_Stat** will remain set to BLOCKED until the ADAS in BLIS mode determines the system is no longer blocked regardless of which mode, BLIS or CTA, or transmission status the system is in thereafter. |
| **R: 4.4.1.2.20** | The Side Radar Feature Blockage Detection system shall be capable of being disabled via method II programming via the global parameter BLOCKED ENABLED. When disabled via method II, blockage shall remain disabled until enabled via method II. |
| **R: 4.4.1.2.21** | If the the Side Radar Feature blockage state is BLOCKED and any fault is subsequently detected in the Side radar sensing system, the BLOCKED condition shall be cleared and the FAULT state shall be indicated for the faulted component and all blockage detection shall be inhibited.  *Note: This is intended to avoid masking or confusing an actual fault condition with a blockage condition.* |
| **R: 4.4.1.2.22** | If the Side Radar Feature Blockage detection system utilizes any inputs from other vehicle systems, such as wiper status, and enginerng DID(s) shall be available to force override the input state for testing purposes.  *Note: For example, the ability to override the wiper status, can allow testing to be performed without the vehicle wipers running.* |
| **R: 4.4.1.2.23** | For the Side Radar feature the FBWR shall not exceed 1 over a four hour drive period in a non-open terrain environment. |
| **R: 4.4.1.2.24** | For the Side Radar feature the FBWR shall not exceed 1 over a four hour drive period in an open terrain environment. |
| **R: 4.4.1.2.25** | The accumulated lifetime number of Side Radar sensor blockage events shall be stored, per Side Radar sensor, up to a minimum of 32k events per sensor, and retrievable via engineering DID. |
| **R: 4.4.1.2.26** | Reserved |
| **R: 4.4.1.2.27** | While in the BLOCKED state, the cluster, via customer input to the message center, can command either BLIS and/or CTA to OFF. The ADAS ECU must obey the cluster OFF command as specified even when in the blocked state.  If the SOD is in the blocked state and the customer turns the CTA to OFF then later to ON, the CTA feature shall obey the command, but the blockage state shall not be impacted.  If the Side Radar sensors are in the blocked state and the customer subsequency turns the BLIS to OFF then back to ON, the BLIS feature shall obey the ON/OFF command but the blockage state shall reset to UNBLOCKED (as though a key cycle was performed). CTA blockage state shall also reset to UNBLOCKED. |

### Performance in Various Environmental Conditions

The BLIS and CTA will operate without functional degradation in statistically significant environmental conditions as indicated in the requirements table below and the Real World User Profile up to the point of Blockage.

|  |  |
| --- | --- |
| **R: 4.4.2.1** | The System shall operate with ice on the fascia in front of the radome. Ice buildup will be done per requirements in CETP 01.11-L-401 |
| **R: 4.4.2.2** | The system will operate with any of the following natural materials built up of the fascia in front of the radome:   1. dry or damp salt spray 2. dry dust 3. dry or wet mud 4. light to heavy rainfall 5. road water spry caused by adjacent vehicles 6. water sheeting along the fascia 7. normal dirt build up due to vehicle not being washed 8. snow fall and road snow spray caused by adjacent vehicles 9. Snowy environments and snow covered infrastructure. |

## CTA Functional Performance

There are two applications for CTA: reversals out of a parking lot where target speeds are typically less than 32 kph (20 mph) and reversals on to a road where target speeds may range between 32 kph (20 mph) to above 60 kph (37.5 mph) or more.

CTA will alert on targets approaching from the left or right when the radar vehicle is reversing out of a parking space or on to a road.

CTA target speeds range from a specified minimum target speed up to 60 kph (37.5 mph).

Since the requirement specified the time to collision (TTC) and applies to all target speeds, the alert range of the higher speed targets can appear to be more demanding. For example, for a TTC of 2.5 a CTA target at 32 kph equates to a range 22 meters (8.9m/s) where a target at 60 kph equates to a range of 42 meters (16.7m/s). However, with a TTC tolerance of +0.5 / - 1.0 sec, the lower speed target (32 kph) range is 26m max and the higher speed target (60 kph) range is 25m min. Therefore, there does not have to be a linear relationship between target speeds and maximum range detection for all target speeds.

The CTA targets will consist of both BLIS ISO targets and bicycles; both traveling above a minimum target speed. This minimum target speed is specified within so that a pedestrian walking at a normal walking speed will not cause an alert. Pedestrian alerts are seen as nuisance alerts.

The CTA targets of interest in a parking lot are located anywhere traveling in the parking lot lane. CTA targets of interest when reversing on to a road are located in the bicycle lane and 1st lane.

|  |  |
| --- | --- |
| **R: 4.5.1** | CTA shall meet the performance requirements as specified in this section for **isig\_Veh\_Speed** of 0 kph to the global parameter CTA\_Maximum\_Reverse\_Speed without performance degradation (this does not imply that CTA will not be operational at greater host velocities). (ARL) |
| **R: 4.5.2** | CTA will meet the performance requirements as specified in this section for targets whose speeds range from the minimum target speed defined by the Global Parameter CTA\_Minimum\_Tgt\_Speed to 60 kph. This requirement does not mean that CTA will not process targets greater than 60 kph but that the algorithm will be tested under a controlled environment up to 60 kph. In real-world testing targets may travel as high as 75 kph. Cta targets with speeds greater than 60 kph are considered MAY ALERTS. MAY ALERTS above 60 kph are defined as targets with reduced TTC performance or no alert. An environment where targets are greater than 75 kph indicates reversals on to freeways which is not the intent of CTA.  The minimum target speed is used to filter out alerts on pedestrians. |
| **R: 4.5.3** | CTA targets are defined as BLIS ISO targets and bicycles. Bicycles are defined as a standard two wheel non-motorized pedal bike having a metal frame and an adult riding the bike. The CTA feature will function for host parking angles of 90 degree parking, 60/120 degree parking and 45/135 degree parking for both straight and curved bicycle paths.  *Note: Since bicycle speeds are relatively small the degree of road curvature will have negligible impact on MTR due to short range alerting. Bicycle test procedure shall be modified such that non-linear bike path will be changed to curved bike path.* |
| **R: 4.5.4** | ***Host Parking Angles:***  CTA performance will be met for host parking angles as listed in table 4.5.1.-1. There are three parking scenarios that are considered each with their own parking angle requirements:   1. Parking Lot – an area reserved for vehicle parking which the customer backs out into a parking isle. 2. Road Side Parking – Parking spaces alongside a road which the customer backs out onto a public road. 3. Bicycle – Typically this refers to a designated bicycle lane between road side parking and a road. However, bicycle targets may drive on a road or in a parking isle without a designated path.   CTA will perform for host Parking Lot angles of 90, 60 /120, and 45 / 135 degrees. The parking lot angles 120 and 135 performance however will be relaxed since these are unordinary target approaches.  CTA will perform for bicycles for host parking angles of 90, 60 /120, and 45 / 135 degrees. Performance is not reduced for bicycle detection for any parking angle.  CTA will perform for host Road Side Parking angles as specified in the table below. The 120 and 135 target approaches for 1st lane are illegal and for second lane target detection is unwanted. |
| **R: 4.5.5** | The CTA system will show no degradation in performance due to parking lot traffic density, stationary vehicle density, nor due to road traffic density. |
| **R: 4.5.6** | ***Road Side Parking (ARL)***  Figure 4.5.1-1 depicts the CTA alertzone (in red) having a time to collision of TTCz1 that is equal to the global parameter CTA\_TTC\_Zone1. The figure represents a host vehicle parked at 90 degree parking with its rear most point at the zero line. Immediately behind the host is the bike lane of 1m width followed by Lane 1, Lane 2, Lane 3 of 3.2m widths. The 90, 60, and 45 degree dashed lines are the possible host parking angles.  The RED zone is defined by targets in the Bicycle lane and Lane 1 whose time to collision is less than or equal to TTCz1. RED zone targets are MUST ALERT targets corresponding to ALERT ZONE 1.  CTA will alert on targets that travel on an intersecting path with the rear path of the host vehicle. There intersection area is defined by the area behind the host vehicle with a rear range (R1) where R1 is defined by global parameter CTA\_Zone1\_Rear\_Rng.  The design concept is to have CTA\_Zone1\_Rear\_Rng to alert on targets in the first lane and 1m bike path target detection only.  For MTR test acceptance refer to the bell curve defined in CTA ARL 54 and 58. |
| **R: 4.5.7** | ***Road Side Parking (ARL)***  The CTA front range coverage, Rf in Figure 4.5.1-1, will be used to control the CTA forward range gating. The CTA front range will be defined by the global parameter CTA\_ZoneX\_Front\_Rng.  The CTA\_ZoneX\_Front\_Rng will be selected to minimize alerts of targets passing in front of the host while in CTA reporting mode while minimizing outside curve road performance. Front alerts are special false alerts. An acceptable front FAR is <= 10%. |
| **R: 4.5.8** | ***Road Side Parking (ARL)***  The RED zone in Figure 4.5.1-1 will be independent of the host parking angle; 90, 60, and 45 degree. Therefore, the RED zone is based on target trajectory and not host parking angle. |
| **R: 4.5.9** | ***Road Side Parking (ARL)***  Targets with intersecting trajectories outside of the RED zone intersecting area will not cause a CTA alert.  There may exist special scenarios where an alert may occur in the 2nd lane; these are false alerts. 2nd lane false alerts greater than 0 but less than 5% will be considered a Conditional Pass. The 3rd lane FAR will be 0.1%.  *Note – Known false alerts shall be reviewed with the supplier and FMC for exclusion from FAR.* |
| **R: 4.5.10** | ***Road Side Parking (ARL)***  For a host moving in reverse, refer to Figure 4.5.1-1, the MUST ALERT zone (red zone) will move with the host. |
| **R: 4.5.11** | ***Road Side Parking***  The supplier will incorporate algorithms to learn the environment so as to meet the MTR and FAR requirements for bike lane, 1st lane, 2nd and nth lane targets. The algorithms will be reviewed and approved by Ford. At a minimum, two algorithms are recommended for incorporation by FMC as listed below. Approval for not incorporating these two algorithms must be approved by SOD Core.   1. Road Curve Learning Algorithm   The CTA algorithm will incorporate a Lane Curvature Learning Routine which will determine the road curvature. The learning routine will be used to meet the 1st lane and bike lane MTR and 2nd lane FAR.  The supplier will design this routine. Typically, the approach is to use target trajectories over time. While a learning routine is in learning mode, up to two 2nd lane target FARs will be allowed but there will be no compromise the 1st lane MTR nor 1st lane TTC. The learning algorithm shall not be designed to permit initial 1st lane misses at startup.   1. Parking Angle Learning Algorithm   The CTA algorithm will incorporate a Parking Angle routine which will determine the host vehicle parking angle of 90 deg (perpendicular to the road), 60 deg, or 45 deg. |
| **R: 4.5.12** | ***Road Side Parking and Parking Lot (ARL)***  The CTA TTC, defined by global parameter CTA\_TTC\_Zone1, shall have a tolerance of +/- 20% for 95% of the targets. This shall be measured for all targets with a speed range of 5 kph to 60 kph where the target is approaching at 3 second distance from the host in a controlled environment. Five % of the CTA TTCs may be outside of the +/- 20% tolerance but never less than 1.0 seconds.  *Note: a CTA TTC < 1 sec shall be considered a missed target.*  This requirement will be tested in a controlled environment. In real-world operation the TTC becomes a function of environment and target trajectories as well as target speed. In real-world the TTC should not be less than 1 sec for 60 kph targets given that the environment and target trajectory allow for sufficient processing time. |
| **R: 4.5.13** | ***Road Side and Parking Lot Determination Routine***  The CTA algorithm will determine if the host is parked in a Parking Lot or is parked road side by evaluating the target speeds.  If any target cluster has a speed of >= the global parameter CTA\_Prk\_Rd\_Threshold the CTA algorithm will set a **isig\_CTA\_SCENARIO** DID = ROAD. Else the **isig\_CTA\_SCENARIO** DID = PARKLOT.  The supplier shall be permitted to offer an alternativemethod for road-parking determination. An alternative method shall be reviewed and approved by FMC. |
| **R: 4.5.14** | ***Parking Lot (ARL)***  Figure 4.5.1-2 depicts the CTA Parking Lot. For worse case parking isle widths X = 8m and Y = 9m, where Xypical is the distance between parking lane width markings and Y is a typical distance between parks cars in a parking lot where X equals 8m. If CTA\_Zone1\_Rear\_Rng is used to define the target to host intersecting area in a parking lot, then targets traveling in the center of the isle or further out from the host vehicle will not cause a CTA alert. The customer perception will be that the system is missing targets. Therefore:  When **isig\_CTA\_SCENARIO** = PARKLOT  R2 (fig. 4.5.1-2) = CTA\_Zone1\_Rear\_Rng + CTA\_Delta\_Rear\_Rng  Where CTA\_Delta\_Rear\_Rng is a global parameter that extends CTA\_Zone1\_Rear\_Rng |
| **R: 4.5.15** | ***Parking Lot (ARL)***  The use cases in which the CTA will function is detailed in PS-DS7T-14C689 R15 through R23. |
| **R: 4.5.16** | ***Road Side Parking and Parking Lot (ARL)***  CTA Missed Target Rate (MTR) is as defined in Table 4.5.1-1. These MTR values apply to host moving and stationary.  MTR will be calculated as follows:  MTR = Total missed alerts / (Total detections + Total missed alerts) for a sample size of not less than 120 events. ARL  A missed target is defined as either no alert for a must alert target or a late alert where the alert TTC is < 1.3 seconds. |
| **R: 4.5.17** | ***Road Side Parking and Parking Lot (ARL)***  The CTA FAR will not exceed 1% false alert for a minimum of 120 events.  A CTA false alert is defined as an alert for a non-CTA target (e.g. stationary objects such as parked vehicles or infrastructure). There exists CTA scenarios in which RF reflections of moving objects can cause a false alert. These alerts are typically found in host blocked conditions or for specific environments. These false alerts are referred to as KNOWN False Alerts. Depending on each individual situation and frequency, 'known' false alerts may not contribute to the CTA False Alert Rate (FAR). Classifying a false alert as a ‘known’ false will be at the discretion of FMC. Known false alerts occure with targets present. Known false alerts are not allowed for sensor fusion systems or with no targets within the CTA area.  The FAR will be calculated as follows:  FAR = Total false alerts / (Total detections + total missed alerts + Total false alerts) ARL |
| **R: 4.5.18** | Once a target is alerted to the customer, the alert will not drop out nor temporarily drop out then reappear. Such an alert will be considered a missed alert. |
| **R: 4.5.19** | **CTA & RCTB Performance with Bike/Cargo Rack**  CTA and/or CwB performance may be degraded due to a loaded Bike or Cargo rack attached. The system will be performance tested to determine if an Owner Manual note is required. This is not a pass/fail test. |

**Figure 4.5.1-1 ROAD SIDE PARKING Zone 1 Scenario**



Note that R1 is perpendicular to the road.

**Figure 4.5.1-2 PARKING LOT Scenario**



**Table 4.5.1-1 CTA Parking Angles and MTR**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| PARKING ANGLE | ROAD TYPE | PARKING LOT | | BICYCLE | | ROAD SIDE 1st lane | |
|  |  | MTR pass | MTR conditional pass | MTR pass | MTR conditional pass | MTR pass | MTR conditional pass |
| 90 | straight | 1% | <= 3% | 1% | <= 3% | 1% | <= 2% |
| 90 | Inside curve | --- | --- | 1%  (Note 3) | <= 3% | 1% | <= 2% |
| 90 | Outside curve | --- | --- | 1% | <= 3% | 1% | <= 2% |
| 60 | straight | 1% | <= 3% | 1% | <= 3% | 1% | <= 2% |
| 60 | Inside curve | --- | --- | 1%  (Note 3) | <= 3% | 1% | <= 2% |
| 60 | Outside curve | --- | --- | 1% | <= 3% | 1% | <= 2% |
| 120 | straight | 4% | <= 7% | 1% | <= 3% | --- | --- |
| 120 | Inside curve | --- | --- | --- | --- | --- | --- |
| 120 | Outside curve | --- | --- | 1% | <= 3% | --- | --- |
| 45 | straight | 2% | < = 5% | 2% | < = 5% | 1% | <= 2% |
| 45 | Inside curve | --- | --- | 2%  (Note 3) | < = 5% | --- | --- |
| 45 | Outside curve | --- | --- | 2% | < = 5% | --- | --- |
| 135 | straight | 4% | <= 7% | 4% | <= 7% | --- | --- |
| 135 | Inside curve | --- | --- | --- | --- | --- | --- |
| 135 | Outside curve | --- | --- | 4% | <= 7% | --- | --- |

Note: a ‘---‘ indicates the scenario is not tested

Note: See ARL 54 for 2nd and 3rd lane hit rate test acceptance.

Note 3 – MTR applies to open field of view testing.

## RCTB Functional Performance

RCTB is active for speeds greater than 0 up to RCTB\_Max\_Reverse\_Speed . It does not work above RCTB\_Max\_Reverse\_Speed. The targets that are valid for CTA are also valid for RCTB.

|  |  |
| --- | --- |
| **R: 4.6.1** | RCTB will be ready to request brake interventions when the vehicle is in **isig\_Transmission\_Status** = REVERSE. See section 3.7.11. |
| **R: 4.6.2** | RCTB shall meet the performance requirements as specified in this section for **isig\_Veh\_Speed** ~~host~~ greater than 0kph up to the global parameter RCTB\_Max\_Reverse\_Speed without performance degradation. (ARL) |
| **R: 4.6.3** | RCTB must not request any brake interventions for **isig\_Veh\_Speed** > RCTB\_Max\_Reverse\_Speed |
| **R: 4.6.4** | The RCTB system shall be capable of identifying and warning on a target traveling at 2.3 m/sec (8.2 kph) up to 16.7 m/sec (60 kph) with a tolerance of +/- 0.6 m/sec. RCTB will meet the performance requirements within for targets within this speed range (this does not imply that CTA will not be operational at greater target velocities). (ARL)  *Note: It is assumed that targets travelling below 2.3 m/sec do not represent a significant threat to the host. This value was derived for CTA from experimental testing and engineering evaluation.* |
| **R: 4.6.5** | RCTB targets are defined as BLIS ISO targets and bicycles. Bicycles are defined as a standard two wheel non-motorized pedal bike having a steel or aluminum frame and an adult riding the bike. |
| **R: 4.6.6** | The RCTB system will show no degradation in performance due to parking lot traffic density or stationary vehicle density, nor due to road traffic density. |
| **R: 4.6.7** | For the definition of the RCTB\_TTC see Figure 4.5.1-1 in the CTA performance section. The value of RCTB\_TTC must be smaller than CTA\_TTC\_Zone1 |
| **R: 4.6.8** | A TTC value for detected targets will have a tolerance of +/- 10% of RCTB\_TTC for 75% of the targets, and +/- 20% of RCTB\_TTC for 20% of the targets.  5% of the targets may have a TTC of between 0.8 x RCTB\_TTC and 0.3 seconds.  Missed targets as listed in Table 4.6-1 are not counted in this statistic.  This is measured for using a sample size of 360 targets in the intervention zone.  The acceptance of any other result outside of these tolerances will be at the discretion of FMC taking into account the system response. |
| **R: 4.6.9** | The RCTB feature will function for targets approaching in angles between RCTB\_LOWER\_ANGLE\_LIMIT and RCTB\_UPPER\_ANGLE\_LIMIT, see **Figure 4.6-1** |
| **R: 4.6.10** | The RCTB Rear Range is a function of the **isig\_Veh\_Speed**.  For ~~V~~~~\_host~~ **isig\_Veh\_Speed** = 0 , set RCTB’s rear range to RCTB\_rear\_range\_low  For ~~V~~~~\_host~~ **isig\_Veh\_Speed** = RCTB\_Max\_Reverse\_Speed set RCTB\_rear\_range as follows: RCTB\_rear\_range\_HIGH  For 0 < V\_host < RCTB\_Max\_Reverse\_Speed RCTB rear range is equal to  RCTB\_rear\_range\_low  +  (RCTB\_rear\_range\_High – RCTB\_rear\_range\_low) \* V\_host / RCTB\_Max\_Reverse\_Speed |
| **R: 4.6.11** | RCTB Missed Target Rate (MTR) is as defined in Table 4.6-1.  MTR will be calculated as follows:  MTR = Total missed alerts / (Total detections + Total missed alerts) for a sample size of not less than 120 events. ARL  Angles in Table 4.6-1, which are outside of RCTB\_LOWER\_ANGLE\_LIMIT and RCTB\_UPPER\_ANGLE\_LIMIT will not be tested. Also see **R: 3.7.1.12.7.** |
| **R: 4.6.12** | The RCTB False Intervention Rate (FIR) must be below 0.1%. False interventions are any interventions that occur:   1. Without a target approaching Inside of the must or may intervention zone. 2. In a scenario defined in the RCTB black list (R 4.6.14) |
| **R: 4.6.13** | No interventions are expected for Targets passing further away than the RCTB rear range (as defined in R: 4.6.10) from the host, but less than RCTB\_No\_intervention\_range. Given the nature of radar systems up to 10% interventions are accepted within that range (may intervention). The acceptance of any other result outside of these tolerances will be at the discretion of FMC.  May interventions must be reviewed and an improvement plan has to be created. |
| **R: 4.6.14** | The Blacklist test procedure defines FIR scenareos. The RCTB shall meet these scenarios. |
| **R: 4.6.15** | RCTB shall not request braking if **isig\_Veh\_Speed** < RCTB\_Min\_Reverse\_Speed. |

1: The statemachine according to section 3.7.11 suppresses any interventions in standstill or when moving forward

**Table 4.6-1 RCTB** **MTR Open Field of View (DOE only)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parking angle** | **Straight road**  **PASS** | **Straight road**  **Conditional Pass** | **Curved road**  **PASS** (note 2) | **Curved road Conditional Pass** (Note2) |
| **90** | 2% | <= 5% | 5% | <= 8% |
| **60** | 2% | <= 5% | 5% | <= 8% |
| **45** | 5% | <= 8% | - | - |
| **120** Bicycles | 5% | <= 8% | 10% | <= 13% |
| **135** Bicycles | 5% | <= 8% | 10% | <= 13% |
| **120** VEHICLE  *(Note 1 and note 2)* | INFO ONLY | INFO ONLY | - | - |
| ***135*** *VEHICLE*  *(Note 1)* | INFO ONLY | INFO ONLY | - | - |

*Note1: The MTR is allowed to be reduced/degraded for 120 and 135 parking angles because the vehicle test sample size is very low for DOE and real world testing. In addition these parking angles portray a target illegal maneuver. Collect 120 data during the DOE for informational purposes.*

*Note2: The Curved road percentages are subject to change to lower values based on actual testing results.*

**Figure 4.6-1 RCTB** **Design** **Parameters**



### RCTB Real World Usage Profile (RWUP) and Backing Rate

#### Defining Real World Usage Profile:

Backing and parking experiences are highly varied based on customer region (state or region of the country or world), locale (urban, suburban, rural), home, work locations and other factors. Therefore, the fraction of parking events in any particular parking scenario can vary widely from customer to customer even within the same household or neighborhood. Customers living or working in a densely populated urban area may have a higher incidence of parking deck and narrow parking spot widths while a customer living or working in a suburban location may see more open lot experiences with ample parking widths. Customers living or working in rural areas may have few or no daily parking lot experiences. Given this variability, the profiles depicted below are an attempt to represent percents of the aggregate population but are unlikely to represent an "average" or individual customer. Studies of actual percents of parking scenarios are not available and therefore the percents below are either inferred from other data or based on engineering judgment. The final results are used for directional purposes only.

The profile is split into two major areas. These two areas contain independent percentage distributions. The first area assigns a distribution to the type of parking or backing event (parking lot, garage, angled, etc.). The second area assigns a distribution to the environment in which the backing maneuver takes place (traffic levels, road surface, road incline, etc.). The combination of these two distributions are anticipated to provide a guide for real world testing of the RBA system which are representative of a broad scope of possible customer experiences. The intent is that any testing would cover scenarios in each area at the percentages indicated. For example:

1. It would be expected that 16% of the real world test scenarios would be [Perpendicular Back Out](#Perpendicular_Back_Out_Percent) scenarios in an Open Parking Lot. *See Table 4.6.1.1-1*
2. It would be expected that 3% of the real world test scenarios would include backing with some [Overhanging](#Overhanging_Foliage_Percent) foliage in the path of the host vehicle. *See Table 4.6.2.1-2*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category** | | | **% of Total** | **Illustration** |
| Open Parking Log | | | 45 |  |
|  | Within Parking Lot | | 32 |  |
|  | Angled Back In | 0.2 |
| Angled Back Out | 8 |
| Perpendicular Back In | 4 |
| Perpendicular Back Out | 16 |
| Parallel | 2 |
| Backing in Lot | 2 |
| Into/From Roadway | | 14 |
|  | Angled Back In | 0.1 |
| Angled Back Out | 5 |
| Perpendicular Back In | 1 |
| Perpendicular Back Out | 3 |
| Parallel | 5 |
|  |  |
| Parking Structure | | | 15 |  |
|  | Angled Back In | | 0.1 |  |
| Angled Back Out | | 3 |
| Perpendicular Back In | | 2 |
| Perpendicular Back Out | | 8 |
| Parallel | | 1 |
| Backing in Lot | | 1 |
|  | |  |
| Driveway | | | 25 |  |
|  | Back In | | 8 |  |
| Back Out | | 18 |
|  | |  |

Table 4.6.1.1-1: Real world distribution of parking/backing events

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category** | | **% of Total** | **Illustration** | |
| Garage | | 10 |  | |
|  | Back In | 3 |  | |
| Back Out | 7 |
|  |  |
| **Category** | | | | **% of Total** |
| Other | | | | 5 |
|  | Backing to/from Curved Roads | | | -- |
| Backing near fence | | | -- |
| Backing in construction zone | | | -- |
| Backing near parking islands | | | -- |
| Backing at ATM/Drive thru | | | -- |
| Backing to gas pumps | | | -- |
| Backing near snow banks | | | -- |
| Backing in snow storm/rain | | | -- |
| Backing with fast temp differential | | | -- |
| Backing in high temp | | | -- |
| Backing in low temp | | | -- |
| Backing with salt film covered sensors | | | -- |
| Backing near operating street lamps | | | -- |
| Backing in complete darkness (just vehicle reverse lighting) | | | -- |
| Backing near other vehicles with ultrasonic sensors active | | | -- |
| Backing near other ultrasonic noise sources | | | -- |
| Backing to stop and go traffic | | | -- |
| Backing with varied road surfaces (Gravel, grass, dirt, shoulder, transitions) | | | -- |
| Scenario collection at night | | | -- |

Table 4.6.1.1-1: Real world distribution of parking/backing events – Continued…

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | **Foliage** | **% of Total** | **Illustration** | | None | 91 |  | | Adjacent | 3 |  | | Overhanging | 3 |  | | In-path | 3 |  | | | | | |  | |  |  | | --- | --- | | **Traffic** | **% of Total** | | None | 30 | | Light | 40 | | Moderate | 20 | | Heavy | 10 |  |  |  | | --- | --- | | **Surface** | **% of Total** | | Blacktop | 30 | | Concrete | 30 | | Rough Pavement | 10 | | Grass | 5 | | Dirt | 10 | | Curb | 10 | | Gravel | 5 | |
| **Incline** | **% of Total** | **Illustration** |
| Level | 90 |  |
| Back Up Incline | 1 |  |
| Back Down Incline | 1 |  |
| Back Out of Incline | 1 |  |
| Back Into Decline | 1 |  |
| Next to Decline | 1 |  |
| Next to Incline | 1 |  |
| Parallel at Trough | 1 |  |
| Parallel at Crest | 1 |  |

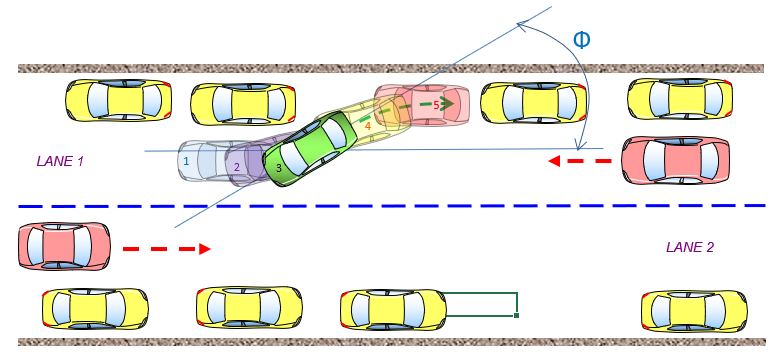
Table 4.6.1.1-2: Real world distribution of parking/backing environment

## CTA and RCTB Parallel Parking Performance with moving targets

**4.7.1 Defining real world usage profile for parallel parking**

Parallel parking is a method of parking a vehicle parallel to the road, in line with other parked vehicles. Parallel parking usually requires initially driving slightly past the parking space, parallel to the parked vehicle in front of that space, keeping a safe distance, then followed by reversing into that space. Subsequent position adjustment may require the use of forward and reverse gear and steering angle. During a parallel parking manuever, which includes dynamic and/or static host, it is desired that CTA (Cross Traffic Alert) alerts, on the vehicle side where targets pass (e.g in Figure 4.7-1 the left-hand side of the host vehicle), are kept to a minimum. CTA Alerts could be considered a nuisance to the driver, therefore CTA alerts and False CTA alerts (FAR) should be tested for parallel parking scenarios. See Figure 4.7-1 for Parallel Parking Scenario and Table 4.7-1 Parallel parking angles and expected CTA performance.

**Figure 4.7-1 Parallel Parking** **Scenario**



**Table 4.7-1: Parallel parking angles and expected CTA performance**



**4.7.2 CTA False Alert Rate (FAR) for Parallel Parking for moving targets**

These requirements are to define the CTA FAR and RCTB false braking performance when host vehicle is doing a parallel parking maneuver **with** targets present. CTA Real World Scorecard is to be used to determine the FAR.

|  |  |
| --- | --- |
| **R: 4.7.2.1** | Host parking angle 45 - 35 degrees for **Lane 1 targets**: CTA false alerts during a parallel parking maneuver **with** moving targets in the surrounding environment could be considered “May Alerts” and will be present at this angle range but the alerts should go away as host parking angle decreases.  Host parking angle 45 - 35 degrees for **Lane 2 targets**: CTA false alerts during a parallel parking maneuver **with** moving targets in the surrounding environment are considered as front crossing alerts and shall not be greater than the overall CTA FAR of 5%, with a conditional pass at no greater than 10%.  Host parking angle 35 - 0 degrees for **Lane 1 and Lane 2 targets**: CTA false alerts during a parallel parking maneuver **with** moving targets in the surrounding environment shall be no greater than the overall CTA FAR of 5%, with a conditional pass at no greater than 10%.  The FAR **with** moving targets will be calculated as follows (considering the number of targets as specified in the Attachment 4, Parallel Park worksheet:  FAR = (FA from Lane 1 + FA from Lane 2) / Total events  *Note: It is assumed that targets travelling below 2.3 m/sec do not represent a significant threat to the host. This value was derived for CTA from experimental testing and engineering evaluation.* |
| **R: 4.7.2.2** | RCTB false braking during a parallel parking maneuver **with** moving targets in the surrounding environment shall not be permitted.  RCTB shall not request any brake interventions during a parallel parking maneuver. Any RCTB braking during testing shall meet the False Intervention Rate (FIR) per 4.6.12, or would be considered a FAIL. No conditional PASS allowed. |
| **R: 4.7.2.3** | No CTA Alerts shall be allowed for any Lane 2 targets as referred to in Figure 4.7-1 (aka ‘front crossing targets). |

## RESERVE

## RESERVE

## RESERVED Functional Performance

## RESERVED Functional Performance

## Governmental Restrictions and Regulations

|  |  |
| --- | --- |
| R: 4.12.1 | The Blind Spot Monitoring System utilizes radar technology that must adhere to the regulations governing the particular frequency bands utilized in the system. The system will require certification in all applicable markets per vehicle program. |

# Outside Rearview Mirror (OSRVM) / Alert Indicator Requirements

## Display Location

Ford ergonomics recommends that the symbol be displayed on the exterior mirror surface or in the mirror housing. The desire is to keep these symbols as far away from the driver's direct line of sight as possible so that a nuisance situation is not created. Placement on the mirror surface or mirror housing should be a far outboard as possible.

## Display

|  |  |  |
| --- | --- | --- |
| R: 5.2.1 | The ISO symbol, as shown below or most current, should be used for this feature. | |
| US SOW Left Icon | US SOW Right Icon |
| Figure 0‑5 Left side ISO symbol | Figure 0‑6 Right side ISO symbol |
| **R: 5.2.2** | The symbol will be mirror imaged for the driver's side as compared to the passenger's side, thus ensuring a correct interpretation of the relationship between the customer's vehicle compared to an obstacle in their blind spot. | |
| **R: 5.2.3** | The symbol may be illuminated or etched in the glass. If the symbol is not illuminated, an illumination scheme such as an LED in close proximity to the symbol can be used but must be approved by Ford Ergonomics and Ford Engineering | |
| **R: 5.2.4** | Symbol illumination or LED should be Amber. | |

### Alert Indicator Electrical Requirements

|  |  |
| --- | --- |
| R: 5.2.5 | The Alert LED may share a ground with other mirror electrical components, but will a have separate high side input from the BSMS module. |
| R: 5.2.6 | Ford SDS mirror requirements OM-0017, OM-0031, OM-0033, OM-0169, OM-0195 and OM-0197 must be met. (NOTE: Other mirror specifications may also need to be met per mirror engineering.) |
| R: 5.2.7 | Any state and/or federal regulations must be met. |
| R: 5.2.8 | Ford SDS electrical requirements must be met (see table below). |
| R: 5.2.9 | If the connector to the HMI LED in the mirror is in the OSRVM housing, the connector will be sealed. |

Table 0‑1 Exterior Mirror Electrical SDS Requirements Pertaining to the LED Circuit

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Rqmt. No.** | **ELCOMP SDS** |  | **Rqmt. No.** | **EMC SDS** |  | **Rqmt. No.** | **CONN SDS** |
| M: 0.1 | EC-0058 |  | M: 0.2 | 09-0411 |  | M: 0.3 | EL-0075 |
| M: 0.4 | EC-0062 |  | M: 0.5 | 09-0414 |  | M: 0.6 | EL-0165 |
| M: 0.7 | EC-0064 |  | M: 0.8 | 09-0418 |  | M: 0.9 | EL-0173 |
| M: 0.10 | EC-0073 |  | M: 0.11 | 09-0419 |  |  |  |
| M: 0.12 | EC-0074 |  | M: 0.13 | 09-0422 |  |  |  |
| M: 0.14 | EC-0077 |  | M: 0.15 | 09-0426 |  | **Rqmt. No.** | **EESYS SDS** |
| M: 0.16 | EC-0078 |  | M: 0.17 | 09-0428 |  | M: 0.18 | EY-0128 |
| M: 0.19 | EC-0080 |  | M: 0.20 | 09-0432 |  |  |  |
| M: 0.21 | EC-0102 |  | M: 0.22 | 09-0466 |  |  |  |
| M: 0.23 | EC-0120 |  | M: 0.24 | 09-0467 |  | **Rqmt. No.** | **CLC-MATL SDS** |
| M: 0.25 | EC-0124 |  | M: 0.26 | 09-0468 |  | M: 0.27 | MA-0154 |
| M: 0.28 | EC-0222 |  |  |  |  |  |  |
| M: 0.29 | EC-0223 |  |  |  |  |  |  |
| M: 0.30 | EC-0238 |  | **Rqmt. No.** | **EDS SDS** |  |  |  |
| M: 0.31 | EC-0239 |  | M: 0.32 | ED-0117 |  |  |  |
| M: 0.33 | EC-0240 |  |  |  |  |  |  |
| M: 0.34 | EC-0241 |  |  |  |  |  |  |
| M: 0.35 | EC-0243 |  |  |  |  |  |  |
| M: 0.36 | EC-0245 |  |  |  |  |  |  |

# RESERVE

1. **BLIS CTA BTT - instrument cluster interface or APIM**

The Cluster is the customer HMI interface to the side feature system. The side feature system contains the feautres in Table 7-1. This HMI interface will include warnings, system ON/OFF setup, and system status. The side feature System will interface with the Cluster via CAN. The side feature System consists of a LH and RH side feature modules (refer to attachment BLISCTA\_DAT2\_System\_Diagram.doc).

|  |  |
| --- | --- |
| **R: 7.01** | The side feature features that interface with the Cluster are listed in Table 7-1. |
| **R: 7.02** | All BTT requirements listed within section 7 apply to BTTLITE unless explicitly stated differently within the requirement. For example, when the term BTT is used in a requirement and there is no separate reference to BTTLITE, the requirement applies to both BTT and BTTLITE. |

Table 7-1: Side Features

|  |  |
| --- | --- |
| **Feature** | **Description** |
| BLIS | Blind Spot - When driving foreward, alerts the driver when a vehicle is located in the LH or RH vehicle blind zone. |
| CTA | Cross Traffic Alert - When in reverse, alerts the driver of an approaching vehicle coming form the LH and RH side |
| BTT | BLIS with Trailer Tow – Extends the BLIS blind zone along the length of the trailer. |
| BTTLITE | BTT LITE is the BTT feature with a different trailer width requirement and different trailer Cluster menu. |

The Side Features MFAL coding for features is shown in Table 7-2.

Table 7-2: Side Features MFALs

|  |  |
| --- | --- |
| **MFAL** | **Description** |
| HLLAA | Less side feature module |
| HLLAC | BLIS only, less all other features |
| HLLAD | BLIS and CTA |
| HLLAF | BLIS and CTA with DCU driven LED (no impact to Cluster) |
| HLLAG | BLIS, CTA, and BTT |
| HLLAH | BLIS, CTA, and BTTLITE |

* 1. **Side Feature and CLUSTER CAN Signals**

This section defines the CAN signal structure between the Left and Right CAN signals and the Cluster for each side feature.

|  |  |
| --- | --- |
| **R: 7.1.1** | The Left and Right have identical CAN signals but are differentiated by having the word ‘Left’ or ‘Right’ in the CAN signal name. Left and Right CAN signals are classified as being either MUTUALLY EXCLUSIVE or DEPENDENT.  Mutually Exclusive CAN Signals – The left and right associated CAN signals do not need to be equal. The Cluster shall act on either the left or right CAN signal (example: CtaAlrtLeft\_D\_Stat does not need to equal CtaAlrtRight\_D\_Stat and the Cluster shall take action on either signal).  Dependent CAN Signals – The left and right associated CAN signals must be equal within an aloted filter time in order to process else the Cluster shall set the feature to fault. (example: CtaLeft\_D\_Stat = ON and CtaRight\_D\_Stat =ON within the aloted filter time for CTA feature = ON. Else CTA feature = FAULT).  SOD and Cluster CAN signals for BLIS and CTA feautres are defined in Table 7.1-1. |
| **R: 7.1.2** | Side features and Cluster CAN signals for the BTT feature is defined in Table 7.1.2. All BTT CAN signals from the Left and Right are dependent signals.  *Note – BTT CAN singals are synchronized between the Left and Right but BLIS and CTA CAN signals are not synchronized.* |

**Table 7.1-1 Side Feature Cluster CAN Signal Summary**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **To Cluster** | **From Cluster** | **Signal Definition** | **Dependent or Mutually Exclusive** | **Comments** |
|  | Sod\_D\_Rq | 0 = Off  1 = BLIS On Secondary Warning OFF  2 = BLIS ON Secondary Warning ON  3 = No Selection made(Unknown) | N/A | Customer command BLIS 0x1 and 0x2 both are ON. |
|  | Cta\_D\_Rq | 0 = Off  1 = On | NA | Customer command CTA on/off. |
| CtaAlrtLeft\_D\_Stat |  | 0 - Lamp Off  1 - Lamp On | Mutually Exclusive | LH CTA alert signal. |
| CtaAlrtRight\_D\_Stat |  | 0 - Lamp Off  1 - Lamp On | Mutually Exclusive | RH CTA alert signal. |
| CtaAlrtLeft2\_D\_Stat |  | 00 - Off  01 – Alert Zone 1  10 – Alert Zone 2  11 – Alert Zone 3 | Mutually Exclusive | LH CTA chime alert level. Alert Zone 2 & 3 are unused. |
| CtaAlrtRight2\_D\_Stat |  | 00 - Off  01 – Alert Zone 1  10 – Alert Zone 2  11 – Alert Zone 3 | Mutually Exclusive | RH CTA chime alert level. Alert Zone 2 & 3 are unused. |
| SodLeft\_D\_Stat |  | 0 - Off  1 - Trailer Tow Off  2 - On  3 - Disabled  4 – Invalid | Dependent on  SodRight\_D\_Stat | LH BLIS operational state. |
| SodRight\_D\_Stat |  | 0 - Off  1 - Trailer Tow Off  2 - On  3 - Disabled  4 – Invalid | Dependent on  SodLeft\_D\_Stat | RH BLIS operational state. |
| CtaLeft\_D\_Stat |  | 0 - Off  1 - Trailer Tow Off  2 - On  3 - Disabled  4 - Invalid | Dependent on  CtaRight\_D\_Stat | LH CTA operational state. |
| CtaRight\_D\_Stat |  | 0 - Off  1 - Trailer Tow Off  2 - On  3 - Disabled  4 - Invalid | Dependent on  CtaLeft\_D\_Stat | RH CTA operational state. |
| SodSnsLeft\_D\_Stat |  | 0 - Clear  1 - Blocked  2 - System Failure  3 - Second Warning Audio | Mutually Exclusive | LH BLIS sensor state. |
| SodSnsRight\_D\_Stat |  | 0 - Clear  1 - Blocked  2 - System Failure  3 - Second Warning Audio | Mutually Exclusive | RH BLIS sensor state. |
| CtaSnsLeft\_D\_Stat |  | 0 - Clear  1 - Blocked  2 - System Failure  3 - Invalid | Mutually Exclusive | LH CTA sensor state. |
| CtaSnsRight\_D\_Stat |  | 0 - Clear  1 - Blocked  2 - System Failure  3 - Invalid | Mutually Exclusive | RH CTA sensor state. |

**Table 7.1-2 Cluster BTT CAN Signal Summary**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **To Cluster** | **From Cluster** | **Signal Definition** | **Dependent or Mutually Exclusive** | **Comments** |
| BTTLeft\_D\_Stat |  | 0x00 –Not Determined  0x01 – Connect  0x02 – Pending  0x03 – Not Connect  0x04 – Off Temp  0x05 – Off  0x06 – Disable  0x07 – BTT5G Fault | Dependent on  BTTRight\_D\_Stat | Defined within section 7 |
| BTTRight\_D\_Stat |  | 0x00 –Not Determined  0x01 – Connect  0x02 – Pending  0x03 – Not Connect  0x04 – Off Temp  0x05 – Off  0x06 – Disable  0x07 – BTT5G Fault | Dependent on  BTTLeft\_D\_Stat | Defined within section 7 |
| BttLeft\_D\_RqDrv |  | 0x0 –NULL  0x1 – No Request  0x2 – Request Trailer Data  0x3 - Unused | Dependent on  BttRight\_D\_RqDrv | Request trailer length data |
| BttRight\_D\_RqDrv |  | 0x0 –NULL  0x1 – No Request  0x2 – Request Trailer Data  0x3 - Unused | Dependent on  BttLeft\_D\_RqDrv | Request trailer length data |
|  | Btt\_L\_Actl2 | See Table 7.1-3 | N/A | Trailer data |

**Table 7.1-3 Btt\_L\_Actl2** Definition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Btt\_L\_Actl2** | | | **Definition** | **Notes** |
| **HEX (values)** | **Feet** | **Meters** |
| hx0A through hx64 | 3 through 33 | 1 through 10.6 | VALID length | Length from rear of vehicle to end of trailer. BLIS BTT will be ON. |
| hx00 through hx09  hx65 through hx 7D | Less than 3 feet  Greater than 33 | Less than 1  Greater than 10.6 | INVALID length | Length from rear of vehicle to end of trailer. BLIS will shut OFF for trailer attached. |
| hx7E | No Data Exists | No Data Exists | UNKNOWN | No length data for trailer. This can mean the customer cancelled trailer select process or chose not to enter data. Cluster does not have length data. |
| hx7F | Invalid | Invalid | Invalid trailer size | Netcom defines this as FAULT. FF means that either trailer length or width or type is invalid (size is greater than allowed) |

Table 7.1-4 SYNC **Btt\_L2\_Actl2** Data Definition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Btt\_L2\_Actl2** | | | **Definition** | **Notes** |
| **HEX (values)** | **Feet** | **Meters** |
| hx0A through hx66 | 20 through 50 | 6.0 through 15.2 | VALID length | Length from rear of vehicle to end of trailer. BLIS BTT will be ON. |
| hx00 through hx09  hx67 through hx7C | Less than 20 feet  Greater than 50 | Less than 6.0  Greater than 15.2 | INVALID length | Length from rear of vehicle to end of trailer. BLIS will shut OFF for trailer attached. |
| hx7E | No Data Exists | No Data Exists | UNKNOWN | No length data for trailer. This can mean the customer cancelled trailer select process or chose not to enter data. Cluster does not have length data. |
| hx7F | Invalid | Invalid | Invalid trailer size/type | Netcom defines this as FAULT. FF means that either trailer length or width or type is invalid (size is greater than allowed). **Btt\_L2\_Actl2** shall be in state hx7F when Trailer TYPE is conventional |

* 1. **Vehicle Ignition States and Right/Left Signal Filtering**

The BLIS CTA system is operational in RUN/START ignition mode only. Operations between the Cluster and BLIS CTA are suspended in any other ignition state.

|  |  |
| --- | --- |
| **R: 7.2.1** | All side features are powered from RUN/START. The Cluster shall suspend operation of side feature CAN communication for IGN ≠ RUN. This includes missing message counters. |
| **R: 7.2.2** | Right and Left mutually exclusive CAN signals shall be logically ‘ORed’ by the cluster for processing. See section 7.1 for mutually exclusive definition and classification. |
| **R: 7.2.3** | Right and Left dependant signals, defined in section 7.1, require the cluster to filter the left hand and right hand like CAN signals prior to making a decision. The filtering is shown in Figures 7.2-1 and 7.2-1 |

**Examples of Dependent and Mutually Exclusive Signal Filtering**

**Examples of Filter Response processing**

To determine if the system is ON or OFF:

If (BLIS **SodLeft\_D\_Stat** = ON) **AND** (BLIS **SodRight\_D\_Stat** = ON))

Then BLIS Status = SYSTEM ON (Cluster Filtered System Status = ON)

Else BLIS Status = SYSTEM OFF(Cluster Filtered System Status = OFF)

If (CTA **CtaLeft\_D\_Stat** = ON) **AND** (CTA **CtaRight\_D\_Stat** = ON))

Then CTA Status = SYSTEM ON (Cluster Filtered System Status = ON)

Else CTA Status = SYSTEM OFF(Cluster Filtered System Status = OFF)

In some cases the AND may be an OR. Such is the case for a Sensor Fault.

If (BLIS **SodSnsLeft\_D\_Stat**) **OR** (BLIS CTA **SodSnsRight\_D\_Stat**) = FAULT

Then BLIS Status = faulted (Cluster Filtered Sensor Status = FAULT)

Enter BLIS warning message routine

If (CTAS **CtaSnsLeft\_D\_Stat**) **OR** (CTAS **CtaSnsRight\_D\_Stat**) = FAULT

Then CTAS Status = faulted (Cluster Filtered Sensor Status = FAULT)

Enter CTAS warning message routine

The cluster must coordinate messages from the LH and RH modules using two classes of timing requirements:

1. Periodic status message timing

2. Event status message timing in response to a Message Center ON/OFF command.

These timing classes are detailed in Figures 7.2-1 and 7.2-2.

**Periodic Status Message Filtering for BLIS Dependent Signals or CTA Dependent Signals**

The cluster decision is processed only after both LH and RH module responses are received. The cluster may send BLIS or a CTA ON/OFF command. Cluster then waits for a response from both the Side Radar L and Side Radar R. Prior to T1 the Side Radar L response with the \_D\_STAT state. At T1 however the Side Radar R has not processed the state change request and its \_D\_STAT state may not agree yet with Side Radar L or Side Radar R may not have responded at all. T1 is the minimum filter response time. The Cluster must wait until T2 to determine if Side Radar R responds correctly; **SODR \_D\_STAT** state is equal to **SODL \_D\_STAT** state. T2 is the worst case response time and is equal to the Side Radar X missing message timeout as specified in requirement R: 7.2.6.

*T2*

CLUSTER BLIS or CTA

ON/OFF Command

CLUSTER process decision

Right CTA or BLIS \_D\_STAT

response

Left CTA (BLIS) responds with it's ON/OFF state

Right CTA (BLIS) responds with it's ON/OFF state

CLUSTER sends ON/OFF request

T1

T1

Left CTA or BLIS \_D\_STAT

response

**Figure 7.2‑1 Periodic Status Message Timing**

**Event Status Message Filtering for BLIS Dependent Signals or CTA Dependent Signals**

This timing applies to Cluster sending an event ON/OFF command due to the customer command via the message center switch and waiting for the CTA (BLIS) response. The operation is similar that of the periodic filtering where T4 is the maximum wait time and equal to the side feature missing message timeout as specified in requirement R: 7.2.6.

T4

CLUSTER BLIS or CTA

ON/OFF Command

CLUSTER process response

Left CTA or BLIS \_D\_STAT

response

Right CTA or BLIS \_D\_STAT

response

Left CTA (BLIS) responds with it's ON/OFF state

Right CTA (BLIS) responds with it's ON/OFF state

CLUSTER sends ON/OFF request

T3

T1

**Figure 7.2‑2 Event Status Message Timing**

|  |  |
| --- | --- |
| **R: 7.2.5** | Left and Right missing message timeout (T2 and T4) shall be no greater than 2000 msec (10 times the side feature periodic message rate of 200 msec) but not less than 1600 msec. This requirement is specified by the side feature DFMEA. |
| **R: 7.2.6** | If the Left and Right mutually exclusive CAN signals do not meet the timing of R:7.2.5 the Cluster shall fail the side feature system and set a message in the message center as defined in section 7.7. |

* 1. **CLUSTER ON / OFF / DISABLE INTERFACE**

|  |  |
| --- | --- |
| **R: 7.3.1** | Sides features will initialization BLIS and CTA ON/OFF setup as specified in CLUSTER BLIS CTA INTERFACE TRUTH TABLES. The CLUSTER BLIS CTA INTERFACE TRUTH TABLES define the Cluster message center screen settings for each of the BLIS and CTA states. BTT is *not* part of this truth table. |

* + 1. **POWER UP and INITIALIZATION**

The following requirements assume the Side Features is configured and BLIS, CTA, and BTT/BTTLITE are ENABLED.

|  |  |
| --- | --- |
| **R: 7.3.1.1** | ADAS shall retain side features last remembered states from the previous ignition cycle for BLIS, CTA, and BTT. The last remembered states shall be used to initialize Cluster feature menu settings. |
| **R: 7.3.1.2** | When Ignition transitions to RUN/START after a key cycle the Cluster shall wait 4000 msec for the filtered response of the signals **SodX\_D\_Stat** , **CtaX\_D\_Stat** and **BttX\_D\_Stat**  to determine the ON/OFF state of BLIS and CTA per the CLUSTER BLIS CTA INTERFACE TRUTH TABLE attachment.  BTT/BTTLITE ON/OFF initialization shall be derived from **SodX\_D\_Stat** as specified in requirements R:7.3.2.20 and 21. |
| **R: 7.3.1.3** | If after IGN transitions to RUN//START from OFF, ACC, or START and the **SodX\_D\_Stat** and/or **CtaX\_D\_Stat** signals have not been received within the time specified in R: 7.3.1.2 the Cluster shall set the BLIS to FAULT and CTA to FAULT. See section 7.6 for Cluster fault processing of BLIS and CTA.  *Note: There is no fault messaging for BTT/BTTLITE.* |
| **R: 7.3.1.4** | If a MyKey is present and detected by ADAS, the ADAS will initialize BLIS, CTA, and BTT/BTTLITE (if enabled) to ON. |
| **R: 7.3.1.5** | If a trailer is found connected during initialization and BTT/BTTLITE is DISABLED, the ADAS will initialize BLIS and CTA per the CLUSTER BLIS CTA TRUTH TABLE attachment (also refer to section 7.3.2). |
| **R: 7.3.1.6** | If a trailer is found connected during initialization and BTT/BTTLITE is ENABLED, the ADAS will initialize BLIS and CTA per the CLUSTER BLIS CTA TRUTH TABLE attachment and there after adjust the BLIS/CTA settings post BTT processing (section 7.5). |
| **R: 7.3.1.7** | After the Cluster 4000 msec allowed SOD initialization, the BLIS shall only change between and ON state (**SodX\_D\_Stat** = TRAILER\_TOW\_OFF | ON) and **SodX\_D\_Stat** = OFF upon a Cluster commanded state change via Cluster CAN signal **Sod\_D\_Rq**.  *Note: If BTT is ENABLED, BTT/BTTLITE ON/OFF follows BLIS ON/OFF.* |
| **R: 7.3.1.8** | After the Cluster 4000 msec allowed SOD initialization, the CTA shall only change between and ON state (**CtaX\_D\_Stat** = TRAILER\_TOW\_OFF | ON) and **CtaX\_D\_Stat** = OFF upon a Cluster commanded state change via Cluster CAN signal **Cta\_D\_Rq**. |
| **R: 7.2.1.11** | The BLIS feature and BTT/BTTLITE feature will power up in the Last Remembered state form the previous keycycle. CTA will power up to ON. However, the MyKey and Trailer Tow states, detailed in the next section, can change this. |

* + 1. **DISABLE/ENABLE and ON/OFF OPERATION OF BLIS, CTA, and BTT**

|  |  |
| --- | --- |
| **R: 7.3.2.1** | When ADAS is unconfigured, the CAN signals will be set as specified in section 3.2.1. In this case the BLIS operational state will be DISABLED and the sensor state will be ON which is an illegal state for normal operation. However, this will have no impact on Cluster (Cluster will be looking to see that the LH and RH operational states agree and will not care if the sensor state is ON or OFF while disabled). |
| **R: 7.3.2.2** | If the BLIS feature is disabled via Method II programming, the BLIS feature will remain disabled until it is enabled via Method II programming. When disabled **SodX\_D\_Stat** = DISABLED and the cluster shall set the message center tables as specified CLUSTER BLIS CTA INTERFACE TRUTH TABLES.  The Active Safety Telltale shall not be activated for BLIS disabled. |
| **R: 7.3.2.3** | If the CTA feature is disabled via Method II programming, the CTA feature will remain disabled until it is enabled via Method II programming. When disabled **CtaX\_D\_Stat** = DISABLED and the cluster shall set the message center tables as specified CLUSTER BLIS CTA INTERFACE TRUTH TABLES. |
| **R: 7.3.2.4** | The BTT feature (BTT or BTTLITE) shall be configured at the Ford Assembly Plant only and cannot be enabled/disabled by the Ford Service. BTT shall be capable of being enabled only if BLIS is enabled. |
| **R: 7.3.2.5** | The ADAS module is shipped to the Ford Assembly Plant as BTT DISABLED. When the BTT is ENABLED at the Ford Plant, ADAS and Cluster must have BTT ENABLED. |
| **R: 7.3.2.6** | When BTT is DISABLED, **BttX\_D\_Stat** = DISABLED. |
| **R: 7.3.2.7** | If BLIS and BTT were enabled at the Ford Assembly Plant and BLIS is DISABLED via method II programing at a later time, ADAS will force BTT to DISABLED (**BttX\_D\_Stat** -> DISABLED) and the Cluster shall indicate BTT is not available. Upon re-enabling BLIS via method II programing, ADAS will re-enable BTT.  *Note: In this case BTT is temporarily disabled by ADAS* |

|  |  |
| --- | --- |
| **R: 7.3.2.8** | When the Ignition is in a state in which the Rear Features is not powered but the Cluster is (ie. ACC), the Cluster shall not allow the customer to modify the BLIS nor CTA feature ON/OFF state via the message center. |
| **R: 7.3.2.9** | ***BLIS Telltale:***  The BLIS feature will be an input to the Active Safety Telltale. The CTA feature will not be an input to the telltale. The Active Safety Telltale shall illuminate when  **SodX\_D\_STAT** = OFF | **SodSnsX\_D\_STAT** = FAULT | **SodSnsX\_D\_STAT** = TRAILER TOW OFF  The Telltale shall NOT be activated for **SodSnsX\_D\_STAT** = BLOCKAGE nor will the CTA or BTT features activate the BLIS telltale. |
| **R: 7.3.2.10** | The Cluster shall command the BLIS ON/OFF customer command via the CAN signal **Sod\_D\_Rq**. The states are  hx0 (OFF); ADAS turns BLIS off  hx1 (BLIS ON Secondary Warning ON); ADAS turns BLIS ON  hx2 (BLIS ON Secondary Warning OFF); ADAS turns BLIS ON  hx03; unknown (no selection made)  *07Mar2019 NOTE:* Sod\_D\_Rq *definition for ON states was swapped in the Cluster. Originally 0x01 was unused but DI used it and did not use 0x02. This is opposite the CAN signal definition. So as to not cause a coordinated x-veh change in the cluster, the ADAS will use 0x01 and 0x02 is unused.* |
| **R: 7.3.2.11** | The Cluster shall command the CTA ON/OFF customer command via the CAN signal **Cta\_D\_Rq**. The states are  hx0 (OFF); SODX turns CTA off  hx1 (ON); SODX turns CTA ON |
| **R: 7.3.2.12** | For BTT enabled, BTT ON/OFF shall follow the BLIS ON/OFF stat and thus shall follow the **Sod\_D\_Rq** command as follows:  hx0 (OFF); ADAS turns BTT OFF  hx1 (BLIS ON Secondary Warning OFF); ADAS turns BTT ON  hx2 (BLIS ON Secondary Warning ON); ADAS turns BTT ON  There shall be no BTT ON/OFF selection in the Cluster Message Center. |
| **R: 7.3.2.13** | The **Sod\_D\_Rq** and **Cta\_D\_Rq** on/off commands shall be derived from customer Cluster Message Center commands only. The Cluster shall not command SOD feature on/off state changes for any other reason. |
| **R: 7.3.2.14** | If the Cluster commands a BLIS ON/OFF state change via **Sod\_D\_Rq** and no trailer is connected and the vehicle is not in MyKey mode, Left and Right shall respond with the actual ON/OFF state of BLIS via **SodX\_D\_Stat** = the cluster commanded state within the filtered timing (section 7.2). |
| **R: 7.3.2.15** | If the Cluster commands a CTA ON/OFF state change via **Cta\_D\_Rq** and no trailer is connected and the vehicle is not in MyKey mode, Left and Right shall respond with the actual ON/OFF state of CTA via **CtaX\_D\_Stat** = the cluster commanded state within the filtered timing (section 7.2). |
| **R: 7.3.2.16** | The system shall be capable of changing the ON / OFF state of side features independent of the Cluster message center commanded on/off states for MyKey true (**IgnKeyType\_D\_Actl** = TRUE) or certain trailer connected situation.  The Cluster shall simply follow the ON / OFF direction of the BLIS and CTA per CLUSTER BLIS CTA INTERFACE TRUTH TABLES. Note the filtered response requirements apply to these ON / OFF changes. |
| **R: 7.3.2.17** | If MyKey is true, the ADAS shall turn ON all side features regardless of their previous settings. The Cluster shall not permit the customer to change the side features settings for MyKey true.  If MyKey goes to false on the next ignition cycle, ADAS will initialize with the pre MyKey settings for all NVM Last Remembered features. |
| **R: 7.3.2.18** | When ADAS determines a trailer is connected via **TrlrBrkActCnnct\_B\_Actl** or  **TrlrLampCnnct\_B\_Actl**, ADAS shall examine all trailer inputs and determine if BLIS and/or CTA will remain ON or go to TRAILER TOW OFF. This applies for ADAS with and without BTT enabled. When BLIS or CTA are turned OFF due to trailer connect the following CAN signals will be set to:  **SodX\_D\_Stat =** TRAILER TOW OFF  **CtaX\_D\_Stat =** TRAILER TOW OFF  Note – these are dependent signals so the Cluster must apply message filtering.  Upon receiving the Trailer Tow Off the Cluster shall display the Trailer Tow Off HMI to the customer. The Active Safety Telltale shall activate due to BLIS going to TRAILER TOW OFF. The Cluster shall not permit the customer to change BLIS nor CTA ON/OFF states during Trailer Tow Off state. However, BTT trailer information can be modified by the customer while BLIS/CTA is in Trailer Tow Off (refer to section 7.5 BTT Cluster Operation) |
| **R: 7.3.2.19** | In the event that MyKey is True and a Trailer Tow Off event occurs, Trailer Tow Off shall take precedence over MyKey. |
| **R: 7.3.2.20** | ***BTT ON/OFF:***  For BTT ENABLED, BTT ON/OFF shall follow the BLIS ON/OFF state; there shall not be a separate customer BTT on/off control in the Cluster Message Center.  When **Sod\_D\_Rq -> OFF**, the ADAS responds with **SodX\_D\_Stat** = OFF & **BttX\_D\_Stat** = OFF. |
| **R: 7.3.2.21** | ***BTT ON/OFF:***  If (**SodX\_D\_Stat** <> OFF | DISABLED) & **BttX\_D\_Stat** = ENABLE then BTT/BTTLITE shall be in an ‘ON state’ as defined in Table 7.3.2-1. |

**Table 7.3.2-1 BttX\_D\_Stat Definition**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BttX\_D\_ Stat | Binary Value | Definition | BTT On or OFF State | Trailer Connection State |
| DISABLE | 0x06 | BTT is disabled via Part II / III | OFF | n/a |
| OFF | 0x05 | Cluster commanded off via Sod\_D\_Rq. Both BLIS and BTT will be off. | OFF | No Data Available |
| Connected | 0x01 | BTT has detected a trailer attached using TLM, TBM | ON | CONNECT |
| Pending | 0x02 | UNUSED | ON | No Data Available |
| Not Connected | 0x03 | BTT has detected no trailer attached using TLM, TBM | ON | NOT CONNECT |
| OFF TEMP | 0x04 | Cluster trailer data is invalid <OR> BTT requested trailer data and did not recieve data prior to VSS changing to greater than VSS Threshold value (extended wait period). | ON | CONNECT |
| NOT DETERMINED | 0x00 | Used during BTT initialization only. A default setting while BTT is initializing. | ON | No Data Available |
| BTT5G Fault | 0x07 | BTT5G feature has detected a fault | ON | CONNECT |

* 1. **CLUSTER CTA CHIME ALERT**

The CTA feature will warn of an approaching target while the customer is reversing The Cluster will activate one of two audible warning chimes and present a message in the message center when a LH or RH CTA warning chime is active.

The CTA Chime alerting is completely independent of the RCTB feature. For example, if the CTA CAN message indicates a CTA alert the cluster will activate the CTA chime regardless of the state of the RCTB alert.

**IMPORTANT NOTE – June 2016: The dual CTA chime design is not used due to HMI issues. Only Chime 1 is used. Essentially this makes CtaX\_D\_Stat and CtaAlrtX2\_D\_Stat CAN signal perform the same action. Cluster may use either of these to CAN signals. Based on discussions with Scott Watkins, DI Core, Cluster should move to using the original CTA alert CAN signal CtaX\_D\_Stat. SOD will support both CAN signals.**

|  |  |
| --- | --- |
| **R: 7.4.1** | There shall be two CTA chimes; CHIME 1 and CHIME 2. Both CHIME 1 and CHIME 2 shall use the same bong but the repetition rates are different.  CHIME 1 repetition rate is 8 cycles per second  CHIME 2 repetition rate is 4 cycles per second  The CTA Cluster CHIME 1 and CHIME 2 shall function as outlined in CLUSTER BLIS CTA INTERFACE TRUTH TABLES. |
| **R: 7.4.2** | Cluster CTA CHIME 1 alert shall be active when **CtaLeft\_D\_Stat** or **CtaRight\_D\_Stat** = ON and shall be inactive for all other **CtaX\_D\_Stat** states and **CtaAlrtLeft2\_D\_Stat** | **CtaAlrtRight2\_D\_Stat** = CHIME 1 |
| **R: 7.4.3** | If **CtaSnsX\_D\_Stat** = BLOCKED | FAULTED | INVALID, the Cluster CTA alerts shall be inactive. Refer to fault processing section 7.6. |
| **R: 7.4.4** | The CAN signal **CtaAlrtLeft2\_D\_Stat** and **CtaAlrtRight2\_D\_Stat** shall be used to activate CHIME 1 and CHIME 2. CHIME 1 is higher priority than CHIME 2 regardless of whether the commanded chime came from Left or Right. Table 7.4-1 defines the CHIME 1 and CHIME 2 priority.  CTA alert CAN signals **CtaAlrtLeft\_D\_Stat** and **CtaALrtRight\_D\_Stat** relationship to the multizone CTA CAN signals **CtaAlrtLeft2\_D\_Stat** and **CtaAlrtRight2\_D\_Stat** are also shown in the table. This Cluster no longer needs to use **CtaAlrtLeft\_D\_Stat** and **CtaAlrtRight\_D\_Stat** but both sets of CAN signals will be supported.  If **CtaAlrtLeft2\_D\_Stat** or **CtaAlrtRight2\_D\_Stat** is set to ALERT ZONE3 then the Cluster will ignore the alert as well as the associated **CtaAlrtLeft\_D\_Stat** and **CtaALrtRight\_D\_Stat** equal ON. *Note that SODX should never send an ALERT ZONE3 alert.* |
| **R: 7.4.5** | When either Left or Right initiate an ALERT ZONE 1 or ALERT ZONE 2 alert, the appropriate chime shall begin per Table 7.4-1. The chime shall end when the initiating Left or Right sets **CtaAlrtX2\_D\_Stat** = OFF.  The CTA chime alert is independent of the RCTB message alert CAN signals **CtaBrkLeftMsgTxt\_B\_Rq** and **CtaBrkLeftMsgTxt\_B\_Rq.**  The Cluster shall display a CTA alert message in the message center as specified in R:7.7.7. |
| **R: 7.4.6** | When both Left and Right initiate ALERT ZONE 1 or ALERT ZONE 2 alerts, the appropriate chime shall begin per Table 7.4-1. If the initiating Left(R) highest priority alert ends (**CtaAlrtX2\_D\_Stat** = OFF) and Right(L) is still alerting, the Cluster shall initiate the other Right(L) alert.  The CTA chime alert is independent of the RCTB message alert CAN signals **CtaBrkLeftMsgTxt\_B\_Rq** and **CtaBrkLeftMsgTxt\_B\_Rq.**  The Cluster shall display a CTA alert message in the message center as specified in R:7.7.7. |
| **R: 7.4.7** | If the audio module utilizes radio/audio muting during RPA chime events, the same muting strategy should be utilized for CTA chime requests. |
| **R: 7.4.8** | If the Cluster also commands the RPA (Back-Up Aid) warning/chime, the RPA warning/chime shall take precedence over the CTA warning.  *Note - By nature of the CTA feature an approaching vehicle while backing up will depart from the ADAS antenna beam prior as it enters the RPA antenna beam and the CTA alert would normally change to OFF prior to the RPA detection. However, in cases where there is an object behind the vehicle in the RPA antenna beam while an approaching vehicle is detected by the CTA, the RPA warning will take precedence.* |
| **R: 7.4.9** | RESERVED – for other vehicle warning device precedence. |
| **R: 7.4.10** | RESERVED – for other vehicle warning device precedence. |
| **R: 7.4.11** | RESERVED – for other vehicle warning device precedence. |
| **R: 7.4.12** | Whether the Cluster or Audio system generates the CTA audible alert the audible alert must activate within 500 msec of receiving a **CtaAlrtX\_D\_Stat** or **CtaAlrtX2\_D\_Stat** state of ALERT ZONE 1 (01) or ALERT ZONE 2 (10). |
| **R: 7.4.13** | CTA chime arbitration shall be governed by Combined Chime Priorities for the chime arbitration strategy, which is located at : Contact Driver Information for chime arbitration strategy. Reference link https://f1.ford.com/eRoom/EESE2/EESEInteriorHarmonyGroup/0\_18c47 |
| **R: 7.4.14** | CTA chime audio tone shall be governed by Specification ES-8L8T-70275-AC : Interior Harmony Chime & Turn Signal Sound Quality for Audio Chime output requirements. |

**Table 7.4-1 CHIME 1 and CHIME 2 Priority**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CtaAlrtLeft2\_D\_Stat** | | **CtaAlrtLeft\_D\_Stat** | **CtaAlrtRight2\_D\_Stat** | | **CtaAlrtRight\_D\_Stat** | **CHIME** |
| Definition | Binary |  | Definition | Binary |  |  |
| OFF | 00 | OFF | OFF | 00 | OFF | **inhibit** |
| OFF | 00 | OFF | ALERT ZONE 1 | 01 | ON | **CHIME 1** |
| OFF | 00 | OFF | ALERT ZONE 2 | 10 | ON | **CHIME 2** |
| ALERT ZONE 1 | 01 | ON | OFF | 00 | OFF | **CHIME 1** |
| ALERT ZONE 2 | 10 | ON | OFF | 00 | OFF | **CHIME 2** |
| ALERT ZONE 1 | 01 | ON | ALERT ZONE 1 | 01 | ON | **CHIME 1** |
| ALERT ZONE 2 | 10 | ON | ALERT ZONE 1 | 01 | ON | **CHIME 1** |
| ALERT ZONE 1 | 01 | ON | ALERT ZONE 2 | 10 | ON | **CHIME 1** |
| ALERT ZONE 2 | 10 | ON | ALERT ZONE 2 | 10 | ON | **CHIME 2** |

* 1. **BTT Cluster/APIM Feature Operation**

This section describes the interface between the BTT and Cluster for the purpose of customer interface.

|  |  |
| --- | --- |
| **R: 7.5.1** | The Cluster shall read the Left and Right BTT status via CAN signal **BttX\_D\_Stat** (defined in Table 7.3.2-1). The dependent signal wait time for a proper response is no greater than 2000 msec but not less than 1600 msec.  If the correct response is not received within allowed time see section 7.7, Fault Strategy.  ***For BTT5G only:***  **BttX\_D\_Stat** state 0x07 shall indicate a BTT5G fault, prompting a message to the customer that BTT5G has faulted and BLIS deactivated. |
| **R: 7.5.2** | ***For BTT only:***  The Cluster shall be capable of inputting BTT trailer information from the customer. The information shall be TRAILER TYPE, TRAILER WIDTH, and TRAILER LENGTH. TRAILER TYPE (see R:7.5.3) and TRAILER WIDTH (see R:7.5.4) customer inputs shall determine a valid or invalid BTT trailer. TRAILER LENGTH shall be actual length data (see 7.5.5).  ***For BTTLITE only:***  The Cluster shall be capable of inputting BTT trailer information from the customer. The information will be TRAILER WIDTH then TRAILER LENGTH. |
| **R: 7.5.3** | ***For BTT only – TRAILER TYPE:***  TRAILER TYPE shall allow the customer to select between (a) Conventional, (b) Fifth Wheel, (c) Gooseneck.  If (a) is selected the Cluster shall request TRAILER WIDTH from the customer.  If (b) or (c) are selected the trailer data in BTT\_L\_Actl2 shall be set to invalid (see R:7.5.5) and the customer shall be notified that BTT does not operate with trailer types (b) nor (c).  The BTT data entry shall exit.  ***For BTT5G enabled vehicles – TRAILER TYPE:***  If (b) or (c) are selected and the SYNC detects auxiliary radars, the trailer data in **Btt\_L2\_Actl2** shall be set to the length of the trailer (see R:7.5.5).  **Btt\_L\_Actl2** shall be set to 0x7F. |
| **R: 7.5.4** | ***For BTT and BTT5G only – TRAILER WIDTH:***  TRAILER WIDTH shall ask if the trailer is equal to or less than 8.5 feet wide.  If it is less than or equal to 8.5 feet the Cluster shall request TRAILER LENGTH.  If it is not less than or equal to 8.5 feet wide the trailer data shall be set to invalid (see R:7.5.5) and the customer shall be notified that BTT does not operate with trailer widths greater than 8.5 feet.  The BTT data entry shall exit.  The metric equivalent to 8.5 feet will be 2.6m.  ***For BTTLITE only – TRAILER WIDTH:***  TRAiLER WIDTH shall ask if the trailer is equal to or less than 8.0 feet wide.  If it is less than or equal to 8.0 feet the Cluster shall request TRAILER LENGTH  If it is not less than or equal to 8.0 feet wide the trailer data shall be set to invalid (see R:7.5.5) and the customer shall be notified that BTT does not operate with trailer widths greater than 8.0 feet.  The BTT data entry shall exit.  The metric equivalent to 8.0 feet will be 2.4m.  Note – the owner manual / quick reference card will indicate how to measure the width of the trailer. It is not necessarily the widest part of the trailer. |
| **R: 7.5.5** | ***For BTT and BTTLITE – TRAILER LENGTH:***  TRIALER LENGTH shall ask the customer to enter the length of the trailer. The length is defined as the measurement from the trailer ball to the back of the trailer. The length shall be a minimum of 3 feet (1m) and increment in 3 feet (1m) increments. The length measurement is measured by the customer to the meter; tenths of a meter accuracy is not required. The maximum valid length is 33 feet (10.6m). Note that per Netcom rules the actual CAN signal **Btt\_L\_Actl2** will be transmitted in meters with a resolution of 0.1m.  If trailer TPYE or WIDTH is invalid, the Cluster shall set **Btt\_L\_Actl2** = hx7F.  If the customer enters the trailer length the Cluster shall set **Btt\_L\_Actl2** equal to the trailer length. **Btt\_L\_Actl2** is sent to ADAS in tenths of meters. Anything greater than 10m (33 feet) is invalid. For an invalid trailer length the Cluster may set **Btt\_L\_Actl2** equal to the actual length or set it tohx7F. BTT shall accept either as invalid.  While the length of a trailer has not been entered, SYNC shall set **Btt\_L\_Actl2** and **Btt\_L2\_Actl2** equal to UNKNOWN (hx7E); also referred to as NO DATA EXISTS.  ***For BTT5G enabled vehicles – TRAILER LENGTH:***  If (b) or (c) are selected for trailer type and SYNC detects auxiliary radars, the trailer data in **Btt\_L2\_Actl2** shall be set to the length of the 5th wheel or gooseneck trailer. **Btt\_L2\_Actl2** is sent to ADAS in tenths of meters. See table 7.5-1.  **Btt\_L\_Actl2** state shall be 0x7F (invalid trailer). |
| **R: 7.5.6** | The customer may change the trailer data for a specific trailer attached. BTT shall update the current attached trailer with the new data and make BLIS adjustments. |
| **R: 7.5.7** | BTT and BTT5G will use Trailer Lighting Module (TLM), Trailer Brake Module (TBM), to detect a trailer. Trailer detection via TLM or TBM will occur at vehicle speed = 0. If the trailer is not detected by either TLM or TBM can detect the trailer after the vehicle moves in DRIVE over a distance of a few meters.  BTT reports trailer connect status via **BttX\_D\_Stat** as shown in Table 7.3.2-1. |
| **R: 7.5.8** | When **BttX\_D\_Stat** transitions to CONNECT (meaning a trailer has been detected) and **Btt\_L\_Actl2** = UNKNOWN (hx7E), BTT will request the Cluster to get trailer data from the customer.  If **BttX\_D\_Stat** transitioned to CONNECT based off of TLM or TBM, the request will come prior to the customer moving the vehicle.  If **BttX\_D\_Stat** transitioned to CONNECT based off of ATD only, the request will come while the vehicle is moving. If the request occurs for vehicle speeds ≤ 5 kph the Cluster will display a message asking the customer to enter trailer data. For vehicle speeds > 5 kph the Cluster will display a message to stop the vehicle and enter trailer data.  BTT will issue a trailer data request via CAN signal **BttX\_D\_RqDrv**. |
| **R: 7.5.9** | If **BttX\_D\_Stat** transitions to CONNECT and **Btt\_L\_Actl2** <> UNKNOWN (hx7E), BTT will not request trailer data; **BttX\_D\_RqDrv** will remain at 0x1. |
| **R: 7.5.10** | When **BttX\_D\_RqDrv** transitions to REQUEST, it will remain at that state until either **Btt\_L\_Actl2** transitions from UNKNOWN to a not unknown value or the vehicle exceeds a defined maximum vehicle speed. BTT will accept an UNKNOWN as trailer data in the event no trailer data is available.  *Note – once the vehicle reaches the defined maximum speed BTT assumes that the customer is driving and has decided not to enter or select a trailer in the menu.* |
| **R: 7.5.11** | If **Btt\_L\_Actl2** and **Btt\_L2\_Actl2** indicate that the a 5th wheel or gooseneck trailer is connected with aux radars, but ADAS does not detect aux radars, then Btt\_X\_D\_Stat shall be 0x7 (BTT5G Fault). The cluster shall display the fault status to the customer. |
| **R: 7.5.12** | SYNC shall only send a valid trailer length in **Btt\_L2\_Actl2 f**f the customer sets up a 5th wheel or gooseneck trailer between 20 and 50ft, and SYNC does detects aftermarket radars. See table 7.5-1. |
| **R: 7.5.13** | For additional SYNC interface requirements, see FunctionSpecification\_BTT5G. |

Table 7.5-1: BTT\_L\_Actl2 and Btt\_L2\_Actl2 Status with Customer Input

|  |  |  |  |
| --- | --- | --- | --- |
| **Trailer TYPE** | **BTT\_L\_Actl2** | **Btt\_L2\_Actl2** | **Aux Radars Present** |
| Conventional | Valid (3-33ft) | 0x7F – Invalid (unsupported trailer type) | Don’t Care |
| Conventional | 0x7F - Invalid (less then 3ft or greater than 33ft) | 0x7F – Invalid (unsupported trailer type) | Don’t Care |
| Conventional | 0x7E – No Data | 0x7F – Invalid (unsupported trailer type) | Don’t Care |
| 5th Wheel or Gooseneck | Don’t Care | Valid (20-50ft) | TRUE |
| 5th Wheel or Gooseneck | 0x7F - Invalid (unsupported trailer type) | 0x7F - Invalid (less then 20ft or greater than 50ft) | TRUE |
| 5th Wheel or Gooseneck | 0x7F - Invalid (unsupported trailer type) | 0x7F – Invalid (no AUX radars) | FALSE |
| 5th Wheel or Gooseneck | 0x7F - Invalid (unsupported trailer type) | 0x7F – Invalid (no AUX radars) | FALSE |
| 5th Wheel or Gooseneck | 0x7F - Invalid (unsupported trailer type) | 0x7E – No Data | TRUE |
| Not Inputted | 0x7E – No Data | 0x7E – No Data | Don’t Care |

* 1. **BLIS, CTA, and BTT MESSAGE CENTER MESSAGES**

The Cluster Filtered Sensor and System signals as described in the previous sections are evaluated to determine appropriate Message Center WARNINGS, SYSTEM SETUP, and SYSTEM CHECK messages. DI will have a standard method of presenting these messages. This section will list specific requirements to specific messages as defined by agreement between various Ford object detection groups.

|  |  |
| --- | --- |
| **R: 7.6.1** | CLUSTER BLIS CTA INTERFACE TRUTH TABLES defines lists the verbiage for the WARNING, SYSTEM SETUP, and SYSTEM CHECK. Specific verbiage is outlined in this section.  CwB is not part of the truth tables because CwB follows CTA in terms of ON/OFF, FAULT, and BLOCKED. Therefore there are no special CwB ON/OFF, FAULT, and BLOCKED messages needed in the ,Cluster Message Center. |
| **R: 7.6.2** | When either the BLIS or CTA feature is disabled. The Cluster must show under SYSTEM CHECK that the system is DISABLED and use the specific word DISABLED. The BLIS or CTA SYSTEM SETUP will not be available to the customer and all BLIS or CTA warning messages will be disabled. |
| **R: 7.6.3** | When the Cluster receives a **SodSnsX\_D\_Stat** = BLOCKED, the Cluster shall set the warning message that states  Blind Spot Radar Unavailable  Clear Radar, See Manual  If the display does not permit this many characters, then two warning messages in succession will be used.  SYSTEM CHECK shall state that the system is BLOCKED and use the word BLOCKED. |
| **R: 7.6.4** | When the Cluster receives a **CtaSnsX\_D\_Stat** = BLOCKED, the Cluster will set the warning message that states  Cross Traffic Radar Unavailable  Clear Radar, See Manual  If the display does not permit this many characters, then two warning messages in succession will be used.  SYSTEM CHECK shall state that the system is BLOCKED and use the word BLOCKED. |
| **R: 7.6.5** | The BLIS Blockage warning will remain unless either cleared by the customer via the Message Center or the BLIS becomes unblocked as defined by **SodSnsX\_D\_Stat** not equal to BLOCKED. |
| **R: 7.6.6** | The CTA Blockage warning will remain unless either cleared by the customer via the Message Center or the CTA becomes unblocked as defined by **CtaSnsX\_D\_Stat** not equal to BLOCKED. |
| **R: 7.6.7** | When the Cluster receives **SodX\_D\_Stat** = Trailer\_Tow\_Off (0x1), the Cluster shall set the warning message that states  Trailer Connected  BLIS System OFF  SYSTEM CHECK shall state that BLIS is OFF.  *Note –* ***BttX\_D\_Stat*** *will go to TEMP OFF. The cause of this state is due to either invalid trailer or unknown trailer data. The timing of* ***SodX\_D\_Stat*** *= Trailer\_Tow\_Off may occur anytime up to the BTT maximum speed threshold.* |
| **R: 7.6.8** | When the Cluster receives **CtaX\_D\_Stat** = Trailer\_Tow\_Off (0x1), the Cluster shall set the warning message that states  Trailer Connected  Cross Traffic System OFF  SYSTEM CHECK shall state that Cross Traffic is OFF.  *Note –* ***BttX\_D\_Stat*** *will go to TEMP OFF. The cause of this state is due to either invalid trailer or unknown trailer data. The timing of* ***CtaX\_D\_Stat*** *= Trailer\_Tow\_Off may occur anytime up to the BTT maximum speed threshold.* |
| **R: 7.6.9** | When the Cluster receives **CtaX\_D\_Stat** = Trailer\_Tow\_Off (0x1) and **SodX\_D\_Stat** = Trailer\_Tow\_Off (0x1) the Cluster may choose to set the single warning message for both CTA and BLIS that states  Trailer Connected  Blind Spot & Cross Traffic OFF  SYSTEM CHECK shall state that Cross Traffic is OFF and Blind Spot is OFF.. |
| **R: 7.6.10** | BTT trailer status is based off of three inputs: the BLIS state via CAN signal **SodX\_D\_Stat,** the BTT trailer status via **BttX\_D\_Stat,** and the Cluster’s trailer data CAN signal **Btt\_L\_Actl2**. The Cluster shall display the BTT status menu as shown in Table 7.6-1.  *Note - When* ***SodX\_D\_Stat*** *= ON, the Cluster BTT status menus are a function of* ***Btt\_L\_Actl2*** *and* ***BttX\_D\_Stat****. When* ***SodX\_D\_Stat*** *is OFF BTT is OFF.*  *Note in the table for* ***Btt\_L\_Actl2*** *and* ***BttX\_D\_Stat*** *states (VALID, OFF TEMP) and (UNKNOWN, CONNECT) do not exist and are grayed out.* |
| **R: 7.6.10.1** | When **SodX\_D\_Stat** = DISABLE, BTT will go to disable via **BttX\_D\_Stat** = DISABLE. Actually when BLIS is set to DISABLE the cluster can internally set up BTT screens to disable if BTT was previously enabled.  When BTT is DISABLED in the Cluster via Ford EOL configuration, ADAS will also have BTT DISABLED via Ford EOL configuration and ADAS will transmit **BttX\_D\_Stat** = DISABLE (0x0). |
| **R: 7.6.10.2** | When **SodX\_D\_Stat** = OFF the cluster BTT setup menu will read BTT OFF.  *Note - The* ***CtaX\_D\_Stat*** *on/off states have no influence on BTT state or Cluster BTT menus.* |
| **R: 7.6.10.3** | When **Btt\_L\_Actl2** = INVALID, **BttX\_D\_Stat** -> OFF\_TEMP thus causing **SodX\_D\_Stat** -> TRAILER\_TOW\_OFF. BTT is unavailable for INVALID trailer. |
| **R: 7.6.10.4** | For trailer not connected, **BttX\_D\_Stat** = NOT CONNECT, the Cluster BTT setup menu will read OFF. |
| **R: 7.6.10.5** | For **Btt\_L\_Actl2** = VALID & **BttX\_D\_Stat** set to CONNECT, UNKNOWN, or PENDING the cluster BTT setup menu is a function of **Btt\_L\_Actl2** and will read BTT READY.  *Note that* ***BttX\_D\_Stat*** *UNKNOWN and PENDING are temporary states during trailer check or recheck and should will not drive the cluster to a different setup menu.* |
| **R: 7.6.10.6** | For **Btt\_L\_Actl2** = UNKNOWN and **BttX\_D\_Stat** set to OFF TEMP, UNKNOWN, or PENDING the cluster BTT setup menu is a function of **Btt\_L\_Actl2** and will read BTT NOT SET UP.  *Note that* ***BttX\_D\_Stat*** *UNKNOWN and PENDING are temporary states during trailer check or recheck and should will not drive the cluster to a different setup menu.* |
| **R: 7.6.10.7** | For **Btt\_L\_Actl2** = INVALID and **BttX\_D\_Stat** set to CONNECT, UNKNOWN, PENDING, of OFF TEMP the cluster BTT setup menu is a function of **Btt\_L\_Actl2** and will read BTT NOT AVAILABLE.  *Note that* ***BttX\_D\_Stat*** *UNKNOWN and PENDING are temporary states during trailer check or recheck and should will not drive the cluster to a different setup menu.* |
| **R: 7.6.10.8** | For BTT DISABLED per FMC EOL configuration, the Cluster shall not display BTT screens. |
| **R: 7.6.11** | When the Cluster SYNC sees a trailer connect / disconnect via the TLM or TBM modules it displays a TRIALER CONNECT and TRAILER DISCONNECT message to the customer. With BTT enabled, BTT will provide trailer connect status via **BttX\_D\_Stat** which includes TLM and TBM trailer status. For BTTLITE the TLM is currently mandatory.  *This is not a requirement.* |
| **R: 7.6.12** | The Cluster will display a CTA alert message as a function of SYNC vehicle configuration, refer to Table 7.6.2.  A CTA alert message will be displayed in the Cluster message center only when the vehicle is not configured for SYNC. Else the CTA alert will be displayed in the SYNC display. |
| **R: 7.6.13** | ***For vehicle configuration LESS SYNC:***  For an active CTA alert via **CtaAlrtLeft2\_D\_Stat** (or **CtaAlrtLeft\_D\_Stat)** |  **CtaAlrtRight2\_D\_Stat** (or **CtaAlrtRight\_D\_Stat**) Cluster will display the message in the message center  CROSS TRAFFIC ALERT  as long as **CtaAlrtX2\_D\_Stat** (**CtaAlrtX\_D\_Stat)** is indicating an alert. |
| **R: 7.6.14** | ***For vehicle configuration with SYNC:***  The Cluster will not generate a CTA alert message when **CtaAlrtLeft2\_D\_Stat** (or **CtaAlrtLeft\_D\_Stat)** |  **CtaAlrtRight2\_D\_Stat** (or **CtaAlrtRight\_D\_Stat**) becomes active; only a chime via section 7.5. |
| **R: 7.6.15** | ***If BTT5G is enabled:***  **BttX\_D\_Stat = BTT5G FAULT**, cluster will display the message in the message center:  BTT5G Fault – Please see BTT5G owner’s manual. |

**Table 7.6-1 BTT Status Menus**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Reference Requirement** | **SodX\_D\_Stat** | **Btt\_L\_Actl2** | **BttX\_D\_Stat** | **BTT STATUS MENU** |
| **R: 7.6.10.1** | DISABLE | *Don’t Care* | *Don’t Care* | Either BTT NOT AVAILABLE or do not display BTT status screen |
| **R: 7.6.10.2** | OFF | *Don’t Care* | OFF | OFF |
| **R: 7.6.10.3** | TRAILER TOW OFF | INVALID | OFF TEMP | NOT AVAILABLE |
| **R: 7.6.10.5** | ON | VALID | CONNECT | READY |
| **R: 7.6.10.4** | ON | VALID | NOT CONNECT | OFF |
| **R: 7.6.10.5** | ON | VALID | UNKNWON | READY |
| **R: 7.6.10.5** | ON | VALID | PENDING | READY |
|  | *ON* | *VALID* | *OFF TEMP* | *N/A; combination of states do not exist* |
|  | *ON* | *UNKNOWN* | *CONNECT* | *N/A; BttX\_D\_Stat will change to OFF TEMP* |
| **R: 7.6.10.4** | ON | UNKNOWN | NOT CONNECT | OFF |
| **R: 7.6.10.6** | ON | UNKNOWN | UNKNWON | NOT SET UP |
| **R: 7.6.10.6** | ON | UNKNOWN | PENDING | NOT SET UP |
| **R: 7.6.10.6** | ON | UNKNOWN | OFF TEMP | NOT SET UP |
| **R: 7.6.10.7** | ON | INVALID | CONNECT | NOT AVAILABLE |
| **R: 7.6.10.4** | ON | INVALID | NOT CONNECT | OFF |
| **R: 7.6.10.7** | ON | INVALID | UNKNWON | NOT AVAILABLE |
| **R: 7.6.10.7** | ON | INVALID | PENDING | NOT AVAILABLE |
| **R: 7.6.10.7** | ON | INVALID | OFF TEMP | NOT AVAILABLE |
|  | ON | *Don’t Care* | OFF | SOD on BTT off state does nto exist |
| **R: 7.6.10.8** | ON | *Don’t Care* | DISABLE | *BTT screens are not available* |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Reference Requirement** | **SodX\_D\_Stat** | **Btt\_L2\_Actl2** | **BttX\_D\_Stat** | **BTT STATUS MENU** |
| **R: 7.6.10.9** | ON | VALID | BTT5GFAULT | BTT5G FAULT |

**Table 7.6-2 CTA Alert Messages**

|  |  |  |
| --- | --- | --- |
| **INPUT** | | **OUTPUT** |
| **CTA Enable/Disable** | **Veh With SYNC** | **CTA messaging** |
| DISABLED | *Don’t Care* | NO |
| ENABLED | *NO* | YES |
| ENABLED | YES | NO |

* 1. **CLUSTER BLIS and CTA FAULT STRATAGY**

A BLIS or CTA feature fault can be determined by the side feature system for internal faults or by the Cluster via messaging faults.

|  |  |
| --- | --- |
| **R: 7.7.1** | CLUSTER BLIS CTA INTERFACE TRUTH TABLES defines all fault conditions for BLIS and CTA features. |
| **R: 7.7.2** | BLIS faults and CTA faults are independent from one another. These are two separate features and a fault in one feature does not proclaim a fault in the other.  There are no special ADAS initiated RCTB fault messages.  There are no special BTT fault messages. |
| **R: 7.7.3** | If **SodSnsRight\_D\_Stat** = SYSTEM FAULT | **SodSnsLeft\_D\_Stat** = SYSTEM FAULT, the Cluster shall display BLIND SPOT SYSTEM FAULT in the Message Center. |
| **R: 7.7.4** | If **CtaSnsRight\_D\_Stat** = SYSTEM FAULT | **CtaSnsLeft\_D\_Stat** = SYSTEM FAULT, the Cluster shall display BLIND SPOT SYSTEM FAULT in the Message Center. |
| **R: 7.7.5** | **SodSnsX\_D\_Stat** FAULT and INVALID is equivalent.  **CtaSnsX\_D\_Stat** FAULT and INVALID is equivalent. |
| **R: 7.7.6** | During an engine crank (Ignition equals START) the Cluster shall not monitor the SOD CAN signals for fault conditions per Ford standard practices. |
| **R: 7.7.7** | For independent CAN signals the missing timeout shall be no less than ~~5~~ 8 times the SOD periodic message rate of 200 msec but not more than 2000 msec. This requirement is specified by the BLIS DFMEA. |
| **R: 7.7.8** | For dependent CAN signals the missing message timeout is as defined in requirements R: 7.2.6. |
| **R: 7.7.9** | If **SodSnsX\_D\_Stat** and/or **CtaSnsX\_D\_Stat** equals BLOCKED and **SodSnsX\_D\_Stat** and/or **CtaSnsX\_D\_Stat** state changes to FAULT, the Cluster shall clear the BLOCKED warning message and display the FAULT warning message. |
| **R: 7.7.10** | Side Feature faults are capable of recovering dugin a key cycle. |
| **R: 7.7.11** | Only a BLIS FAULT shall cause the BLIS Telltale to illuminate per R:7.3.2.9. |
| **R: 7.7.12** | If a BLIS fault is active, the Cluster shall not permit the BLIS ON/OFF operation in SYSTEM SETUP and shall not modify the BLIS state via **Sod\_D\_Rq**. |
| **R: 7.7.13** | If a CTA fault is active, the Cluster shall not permit the CTA ON/OFF operation in SYSTEM SETUP and shall not modify the CTA state via **Cta\_D\_Rq**. |
| **R: 7.7.14** | For BTT ENABLED, if either Left or Right sets a BLIS faulted (**SodSnsLeft\_D\_Stat** = FAULT (0x2) or **SodSnsRight\_D\_Stat** = FAULT (0x2)) or if the Cluster fails BLIS due to lost comm / missing message, the Cluster shall set BTT to OFF in the BTT menus (for BTT only) and ignore BTT communication from Left and Right (for BTT and BTTLITE).  If the ADAS fault recovers, the Cluster shall update the BTT setup menus per table 7.6.1 and commence BTT communications with Left and Right. |

**7.8 Autonoumous Vehicle Chime for Cross Traffic Alerts**

|  |  |
| --- | --- |
| **R: 7.8.1** | The module responsible for cross traffic alert chime in Automated Vehices (i.e. IPC or APIM or ASPIRE) shall suppress the chime during automated driving mode. |
| **R: 7.8.2** | The module responsible for cross traffic alert chime in Automated Vehices (i.e. IPC or APIM or ASPIRE) shall process the chime if vehicle is in maual (user controlled) mode |
|  |  |
|  |  |

# BLIS/CTA Door Module Interface

The BLIS/CTA System will interface with the DCU System via CAN so as to direct the DCU system when to activate the OSRVM BLIS LEDs. The BLIS/CTA System consists of a LH and RH BLIS/CTA CAN signals from the ADAS and the DCU system consists of a LH DCU and RH DCU. The LH BLIS/CTA signals will interface with the LH DCU and the RH BLIS/CTA signals will interface with the RH DCU. This interface will function for either LH or RH drive vehicles. For LH drive vehicles the LH DCU will become the Driver Door Module (DDM) and the RH DCU will become the Passenger Door Module (PDM). For RH drive vehicles the LH DCU will become the PDM and the RH DCU will become the DDM.

The door modules are responsible for alerting on the correct side of the vehicle when configured to RH DRIVE by monitoring the corresponding BLIS/CTA CAN signals per requirements below.

The DCU and BLIS/CTA will communicate via CAN signals as defined in the supplemental requirement document BLISCTA\_DAT2\_System\_Diagram\_2021MY

Essentially, the BLIS/CTA CAN signals from the ADAS will instruct the DCU when to turn the LED ON and OFF and communicate parameter set up instruction. The CAN signals from the DCU to the ADAS will indicate LED ON/OFF status and fault status.

## LH / RH DRIVE CONFIGURATION

The DDM BLIS/CTA Status MSCAN message BLISLEDStatDriverSide (message 0x332) and PDM BLIS/CTA MSCAN message BLISLEDStatPassSide (message 0x333 are fixed.

|  |  |
| --- | --- |
| R: 8.1.1 | The LH DCU and RH DCU shall configure for LH or RH Drive Vehicle per FMC EOL configuration Method II (VSCS). Refer to section 3.1.3 for Side Radar configuration details. The Side Radar and DCU systems shall configure the CAN node IDs for proper communication with Side Radar and DCU |
| R: 8.1.2 | Prior to configuration, the Side RadarX and DCU system shall read both LH and RH IDs. |
| R: 8.1.3 | RESEREVED |

## BLIS – DCU LED ON/OFF COMMUNICATION

The DCU will activate the OSRVM LED based on the BLIS alert CAN signal **SodAlrtX\_D\_Stat**. The LED will flash for CTA alerts. The DCU will communicate LED state and LED circuit status back to the ADAS. For ADAS status signals BLOCKAGE and FAULT the ADAS will direct operation of the OSRVM LED via the CAN alert signals **SodAlrtX\_D\_Stat** thus the DCU does not need to read the BLIS/CTA sensor state signals.

|  |  |
| --- | --- |
| R: 8.2.1 | The DCU shall illuminate/extinguish the OSRVM LED within 50msec of receiving a LED state change from the ADAS. |
| **R: 8.2.2** | ADAS can communication is present for Ignition = RUN/START only. The DCU shall process ADAS commands and ADAS related routines only for Ignition = RUN/START. For Ignition NOT EQUAL to RUN/START the DCU shall terminate all ADAS related processes and hold the BLIS/CTA LED to OFF. |
| **R: 8.2.3** | The OSRVM LED circuit is shown in CD4.1 OSRVM LED DT. The LED hardwire signal is a PWM signal. The ADAS will indicate the PWM for an LED illumination via CAN signal **Side\_Detect\_x\_Illum**. |
| **R: 8.2.4** | The ADAS will not transmit an LED = ON condition during normal engine crank (Start). For Stop/Start re-start ADAS will hold the alert to LED = OFF because ADAS will not activate the LED for vehicle speeds of 0 kph; there exists a programmable speed threshold in the ADAS.  Note – this requirement is more of an FYI for the DCU. |
| **R: 8.2.5** | The DCU shall activate the OSRVM LED per CAN signal **SodAlrtx\_D\_Stat**. **SodAlrtx\_D\_Stat** values are listed in Table 8.2. |
| **R: 8.2.6** | When the **SodAlrt\_x\_D\_Stat** = FLASH the DCU shall flash the LED ON/OFF at frequency ranging between 3Hz and 4Hz inclusive. To reduce the DCU processing required, the ADAS will transmit the ON time value in msec that when added to 125 msec will equal ½ the period of the flash frequency. This CAN signal is **SodWarn\_x\_Prd\_Rq** is the period offset from 125. When commanded to flash, the DCU shall drive the LED as a 50% duty cycle at a frequency ( fon ) as follows  fon = 1 / [ 2 x ((**SodWarn\_x\_Prd\_Rq** \* 0.001**)** + 0.125)]  During the ON time of this pulse the LED PWM signal is active at a PWM value defined by **Side\_Detect\_x\_Illum.** Refer to Figure 8.2. So the maximum flash rate is 4 Hz. One half the 4 Hz period is 0.125 sec. The minimum flash rate is 3 Hz. One half the 3 Hz period is 0.167 sec. **SodWarn\_x\_Prd\_Rq i**s a 7 bits thus the resolution is (0.167 – 0.125) / 127 = 0.0003. A **SodWarn\_X\_Prd\_Rq** of 7F will be considered invalid and the DCU shall default to value of 0.014 sec (a 3.6 Hz fon ).  The brightness of the LED during ON shall be per **Side\_Detect\_x\_Illum** signal. |
| **R: 8.2.7** | While the DCU is flashing the LED for **SodAlrtX\_D\_Stat** =FLASH and the LED is ON when the **SodAlrtX\_D\_Stat** transitions to OFF, the DCU shall complete the ON period. See Figure 8.2 below. |
| **R: 8.2.8** | When the **SodAlrtX\_D\_Stat** = BULB PROVEOUT the DCM shall set the LED=ON at a 20% PWM for 3 +/- 0.25 seconds. When the DCM completes the bulb prove-out timer and the **SodAlrtX\_D\_Stat** is still equal to BULB PROVEOUT (due to system delays) the DCM shall not perform another prove out.  NOTE – It is not necessary for the ADAS to hold the **SodAlrtX\_D\_Stat** = BULB PROVEOUT for a three second time period since the DCU times the bulb proveout upon receipt of the first BULB PROVEOUT true CAN signal. See R:8.3.5. |
| **R: 8.2.9** | When the **CtaAlrtX\_D\_Stat = ON,** the DCU shall flash the LED as follows  :  ON/OFF signal period of 1 second with the ON duty cycle at 50%. For CTA HMI flash the LED intensity will be set to the global parameter ALERT\_INDICATOR\_DUTY\_CYCLE\_DAY regardless of ambient light conditions.  The HMI CTA flash will be true as long as **CtaAlrtX\_D\_Stat** is equal to ON. If **CtaAlrtX\_D\_Stat** transitions to OFF during the HMI flash ON duty cycle, the HMI flash ON duty cycle will complete prior to extinguishing the flash warning |

**Table 8.2: BLIS Alert Options (SodAlrtX\_D\_Stat)**

|  |  |  |  |
| --- | --- | --- | --- |
| SodAlrtX\_D\_Stat | Signal value | OSRVM LED State | Illumination CAN signals |
| LAMP OFF | 0x0 | OFF | none |
| LAMP ON | 0x1 | ON | **Side\_Detect\_x\_Illum** |
| FLASH | 0x2 | Flash | **Side\_Detect\_x\_Illum**  **SodWarn\_x\_Fq\_Rq** |
| BULB PROVEOUT | 0x3 | 3 sec ON | n/a |
| Missing | n/a | See next section | n/a |

Note – Missing message processing is defined in the next section.

**FIGURE 8.2 Flash ON Cycle Completion**



## CAN SIGNAL TIMING and FAULT PROCESSING

The CAN periodic messaging for the BLIS system is set so that a BLIS fault can be reported to the vehicle driver within 2 seconds; missing messaging decisions will be done within 2 seconds.

The only BLIS/CTA fault detection that the DCU will process is invalid / missing message for **SodAlrtX\_D\_Stat, Side\_Detect\_x\_Illum, SodWarn\_x\_Fq\_Rq** and LED circuit analysis.

The DCU will send out a Driver Door Module and Passenger Door Module status signals **BLISLEDStatDriverSide** and **BLISLEDStatPassSide** via CAN. The ADAS will process the DCU status signals to determine the BLIS / CTA system.

|  |  |
| --- | --- |
| R: 8.3.1 | The signal periodic rate for the ADAS alert signals is 200msec. The DCU will set the invalid / missing message counter to 8. When the counter reaches 8 the LED defaults to OFF for the remainder of the key cycle. Invalid signal is equivalent to missing.  The DCU shall not set a missing message ADAS DTC.  Note – The Cluster is also seeing this signal missing and upon a missing ADAS signal the Cluster will set a DTC, light the tell tail, and send a warning message to the cluster indicating BLIS and CTA system fault. |
| **R: 8.3.2** | After power up the DCU shall not begin counting for ADAS missing messages until ignition status is stable (typical 1000 msec after ignition state change) and the ignition is in RUN/START. Note that during a Start/Stop re-crank event the CAN bus may be down; missing messages should not be counted during this re-crank period. |
| **R: 8.3.3** | If any of the ADAS CAN signals read by the DCU go missing, the DCU shall default the LED output as shown in Table 8.3. |
| **R: 8.3.4** | The DCU shall report its status to the ADAS via CAN signals **BLISLEDStatDriverSide** and **BLISLEDStatPassSide** The contents of the signal shall include:  OSRVM LED ON  OSRVM LED OFF  LED/DCU FAULT  The LED ON/OFF status shall be the actual state of the LED and not simply the acknowledgement of the most recent ADAS command. There are two exceptions to this – when **CtaAlrtX\_D\_Stat** = ON and when **SodAlrtX\_D\_Stat** = FLASH. For   **CtaAlrtX\_D\_Stat** = ON and **SodAlrtX\_D\_Stat** = FLASH the DCU is actually flashing the LED per R: 8.2.9 but the **BLISLEDStatDriverSide** / **BLISLEDStatPassSide** LED statuswill be equal to a continuous ON state during the flashing. *Note – Prior to this fix the DCU LED status sent to the ADAS was switching on and off. Thus the ADAS would set a fault when it saw the DCU LED status off state.*  The signal shall be event/periodic with a periodic rate of 200 msec. |
| **R: 8.3.5** | The ADAS will use the **BLISLEDStat\_X\_Side** signal to verify that the LED state in the DCU is equal to the ADAS commanded value. If it is not equal within a specified time, the ADAS will set an invalid response DCU\_FAULT (refer to section 3.7.10; ADAS Fault Processing and specifically R:3.7.10.23.2), set a DCU DTC, and command the DCU to keep the LED to OFF.  There exists time delay between **SodAlrtX\_D\_Stat** and **BLISLEDStat\_X\_Side** as well as **CtaAlrtX\_D\_Stat** and **BLISLEDStat\_X\_Side** where the **BLISLEDStat\_X\_Side state** will not match the ADAS commanded state. Because of R: 8.2.7 and R: 8.2.9 this mismatch for ON to OFF transitions can be as high as 500 msec; see Figure 8.3-a. To account for these timing mismatches for an OFF to ON ADAS command, the ADAS will wait T1 msec after the command before comparing **AlrtX\_D\_Stat** = **BLISLEDStat\_X\_Side.** For timing mismatches for an ON to OFF ADAS command, the ADAS will wait T2 msec after the command before comparing **AlrtX\_D\_Stat** = **BLISLEDStat\_X\_Side.**  where T1 = 450 +/- 100 msec  T2 = 750 +/- 100 msec  A timing mismatch is defined as a DCU invalid message.  This requirement will be true for **SodAlrtX\_D\_Stat** states of ON, OFF and FLASH and **CtaAlrtX\_D\_Stat** states of ON and OFF. This requirement does not apply for **SodAlrtX\_D\_Stat** equal to BULB PROVEOUT.  The T1 and T2 timers will be reinitialized for each **SodAlrtX\_D\_Stat** and **CtaAlrtX\_D\_Stat** state transition. This is to allow for timer resets for higher speed targets. Only one timer may be active at a time. See special cases Figure 8.3-b. |
| **R: 8.3.6** | **LED Circuit Open Circuit / Short to B+ Fault Reporting:**  The DCU will monitor the OSRVM LED circuit for Short-to-B+/Open.  For a Short-to-B+/Open the fault must be true for a minimum of 500 msec prior to sending an LED FAULT to ADAS. It is recommended that the DCU use an up/down counter to count the number of short-to-B+/Opens. For each sample fault detection, the DCU shall increment the counter. For each sample of no fault detection, the counter shall decrement. Example, for sampling done every 5 msec, 100 continuous fault samples will equal 500 msec. DCU can use any time sampling that is equal to or less than 50 msec (a higher sample time would result in too few counts and is NOT recommended). Once the counter reaches the maximum count equal to 500 msec the DCU shall send the LED FAULT to the ADAS via **BLISLEDStat\_X\_Side** CAN signal and set the appropriate DTC in the DCU. |
| **R: 8.3.7** | **LED Circuit Short to Ground Fault Reporting:**  The DCU shall monitor the OSRVM LED circuit for short-to-ground per EESE specifications. Upon detection of this type of fault the DCU shall send the LED FAULT to the ADAS via **BLISLEDStat\_X\_Side** CAN signal and set the appropriate DTC in the DCU. |
| **R: 8.3.8** | **DCU Self-Test Fault Detected Reporting:**  If the DCU fails its self-test in a such a way that will interfere with the BLIS LED operation, the DCU shall send the LED FAULT to the ADAS via **BLISLEDStat\_X\_Side** CAN signal and set the appropriate DTC in the DCU. |
| **R: 8.3.9** | If the DCU LED status message goes missing or invalid for 8 counts, the ADAS will set the internal DCU\_FAULT to true, set the **SodSnsX\_D\_Stat** equal to FAULT, and set a DCU missing message DTC. |
| **R: 8.3.10** | Upon the ADAS receiving a fault form the DCU the ADAS will not set a DTC but set **SodSnsX\_D\_Stat** to fault and set the following ADAS CAN signals as follows:  **SodAlrtX\_D\_Stat** = LAMP OFF  **Side\_Detect\_x\_Illum** = don't care  **SodWarn\_x\_Fq\_Rq** = don't care  Note that the DCU shall set the DTC and not the ADAS.  The ADAS will return to normal operation upon Fault Signal Recover as described in section 3.7.10. |
| **R: 8.3.11** | DCU System Conflict: The DCU may have other systems that may need to function during a LED activation event (BLIS or CTA). Other DCU systems should not interfere with a LED activation event. DCU systems such as door ajar, seat movement, memory store, memory recall, puddle lamps, etc must not interfere with a LED activation.  The DCU team shall perform a mini DFMEA to (a) list the DCU features and (b) verify the LED does not interfere via analysis. The DCU team shall provide this list to the ADAS test engineers to validate.  *(This requirement was added because it was found that the DCU could not drive the LED during a puddle lamp activation)* |

**Table 8.3: BLIS LED missing message LED default strategies**

|  |  |  |
| --- | --- | --- |
| SODX CAN Signal Lost | DCU Default Value | Illumination CAN signals |
| **SodAlrtX\_D\_Stat** | OFF | none |
| **Side\_Detect\_x\_Illum** | 95% | **Side\_Detect\_x\_Illum** |
| **SodWarn\_x\_Fq\_Rq** | 0.014 | **Side\_Detect\_x\_Illum**  **SodWarn\_x\_Fq\_Rq** |
| **Loss of any combination of above 3 signals or all 3 signals** | OFF | none |

NOTE – The associated signals are those signals that are still available that the DCU should continue to use to drive the LED.

**Figure 8.3-a: ADAS – DCU ON/OFF Timing**



**Figure 8.3-b: Special Case Examples**

The two timing diagrams depict an alert on a rapid moving target (top) and multiple rapid moving targets.

Alert

LED Status

500ms

30 ms

550ms

Alert

LED Status

200ms

750ms

# RESERVE

# RESERVE

# Diagnostics

Refer to “BLIS/CTA FS BLIS CTA RCTB Section 11 Diagnostics Ax” supplemental file for 11.0 requirements.

# Configurable GLOBAL Parameters

The configurable parameters in this specification are detailed in the attached document SOD GLOBAL PARAMETER SPECIFICATION “BLIS CTA RCTB M2 M3 Parameters DAT2p1 Ax.XLS” The global parameter specified in this functional specification and the default settings are summarized in the file. This file is a supplement to this functional specification. The BLIS CTA modules will be shipped to the Ford assembly plants with these default values specified within the file. The global parameters in this specification will feed the IPMA\_ADAS Part II. The Part II document will be used to derive the VSCS. The VSCS is used by the Ford Assembly Plant to down load the global parameter setting to the IPMA\_ADAS

|  |  |
| --- | --- |
| R: 12.1 | As a minimum, the global parameters shall consist of those found in the supplemental requirements document BLIS CTA RCTB Global Parameter Specification BLIS CTA RCTB M2 M3 Parameters DAT2p1 Ax.XLS The parameters shall be designed to be accessible by EOL, Service, and/or Engineering as specified in the file. Each global parameter in the file is assigned its own requirement number with assigned DID/ (or NVM location in SWP2). All M3 global parameters must be accessible by A2L. |
| R: 12.2 | Any additional parameters than those specified in the supplemental requirements document Global Parameter Specification BLIS CTA RCTB M2 M3 Parameters DAT2p1 Ax.XLS will be reviewed by FMC for inclusion and assigned associability. This does not include Supplier only parameters. |

# Requirements/Specification Traceability

## Functional Specification SDS Traceability

See program specific FDVS & Subsystem DVP&R for other applicable requirements (Generic Body Module, Exterior Lighting, FMVSS/Regulatory, etc …)

|  |  |
| --- | --- |
| R: 13.1.1 | The supplier shall provide an SDS Compliance Table for the SDSs listed in section 1.2.1 indicating whether the supplier shall comply, partial comply with explanation, or does not comply to each requirement of this functional specification. |

## Functional Specification Requirements Traceability

The functional specifications requirements will be traced to a compliance matrix showing the supplier compliance for each requirement and shall be traced to a DV. The supplier is responsible for the compliance matrix and both the supplier and Ford D&R will complete the DV trace matrix.

|  |  |
| --- | --- |
| R: 13.2.1 | A compliance matrix shall be generated by the supplier indicating compliance, partial compliance with explanation, or does not comply with each requirement of this functional specification. This applies to any supplemental document to this specification and SDS requirement. |
| R: 13.2.2 | The supplier and Ford D&R shall align each functional specification requirement to its DV test. The DV test can be a vehicle level test, Ford breadboard test, supplier breadboard test, vehicle program test, etc. |

# Appendix A: Revision History/Change Log

A revision history of specification changes shall begin at FS rev AA.

| **Date** | **Revision** | **Summary of Change** | **Creator / Reviewer** |
| --- | --- | --- | --- |
| 24Sep 2020 | AA | INITIAL RELEASE for DAT2.1 based on DAT2.0 version AE.  -Added LED Arbitrator section 3.7.2,  - Removed ATD function/section,  - updated DCU BPO intensity to 20%,  - Added Parallel Parking section for CTA  - Added R: 3.4.1.2.19.2 to clarify CTA status after a running reset. | FMC BLIS/CTA CORE |
| 5 Nov 2020 | AB | Section 1   * Added BTT5G to section 1.1 * Added BTT5G functional spec to 1.2 * Section 1.3 – added CPSC entries table for BTT5G * MFAL - Added BTT5G MFAL codes and descriptions   Section 2   * 2.1.5 - Added feature description for BTT5G * 2.1.7 - Added BTT5G acronym * 2.2.1 - Added component information   Section 3   * Table 3.2.1-2 - Added BTT5G\_Enable\_Disable * New requirement 3.2.11.2 * New requirement 3.5.1.20 * Section 3.5.4 – several updates to requirements and tables.   + Added Requirements 3.5.4.6 - 3.5.4.11   + Added BTT5G Fault state to table 3.5.4-3   + Added table 3.5.4-4 * 3.7.1.5 – Several requirement and table changes   + Added requirement 3.7.1.5.2.18   + Added table 3.7.1.5.2-3b and renamed existing table to 3.7.1.5.2-3a   + Updates 3.7.1.5.2-4 to 3.7.1.5.2-4a throughout the spec and added 3.7.1.5.2-4b   + Requirement updates to section 3.7.1.5.4.1 to integrate BTT5G, added new requirements 3.7.1.5.4.1.18-20   + Added new BTT5G fault state to table 3.7.1.5.4.1-1   + Requirement updates to section 3.7.1.5.4.2 to integrate BTT5G, , added new requirements 3.7.1.5.4.2.15-17   + Added new states to table 3.7.1.5.4.2-1 * 3.7.3.3 - New section added * 3.7.6 - Updated requirements to split isig\_BLIS\_Alert into right/left, and added references to BTT5G * 3.7.10 - New requirements 3.7.10.26 and 3.7.10.27, added states to table 3.7.10-3   Section 4   * 4.3.5 – New section with new requirements   Section 7   * Table 7.1-2 added BTT5G fault states * Table 7.1-4 new table * Table 7.3.2-1 added BTT5G fault states * 7.5 – Updated requirements to integrate BTT5G, added requirements 7.5.11-7.5.13. Added table 7.5-1. * 7.6 – New requirement 7.6.15. Added state to table 7.6-1.   Section 16.1 - new internal signals isig\_BLIS\_Alert\_Left/isig\_BLIS\_Alert\_Right/BTT5G\_Intern  Section 16.3 - new input signals SodAltLeft\_D2\_StatAft, SodAltRight\_D2\_StatAft, Btt\_L2\_Actl2 | NSHARKUS / FMC BLIS/CTA CORE |
| 2 Feb 2021 | AB | Added Autonoumous Vehicle Chime for Cross Traffic Alerts  Update requirement 3.7.2.3 alert states | FMC BLIS/CTA CORE |
|  |  |  |  |
|  |  |  |  |

# APPENDIX B: Methodology & Data Flow Diagrams

The requirements in this specification are partitioned into processes with data flowing between them. This partitioning is represented in the data flow diagrams. A bubble represents each process. Arrows represent data flows, with the direction indicating the direction of the flow of information.

The context diagram shown below is presented here to illustrate the methodology and conventions used in the requirements modeling.



Figure 0‑1 Context Diagram Illustration

The Hatley-Pirbhai method is used exclusively. Control flows, CFDs, and CSPECS are NOT used. All modeling is done via data flows and DFDs. *unless otherwise specified, it is assumed that all processes are activated when the module awakes and are deactivated when the module goes to sleep*.

When the use of an event would be highly desirable, the”Ev” suffix is appended to a data flow.

All context diagrams in *Section 3, Feature Specifications,* include terminators for all data flows. Terminators can be processes or physical devices connected to the module. If the terminator is a process, such as *IGNITION STATUS,* this means that the reader must go to *the subsection for the process* to actually see the requirements for the Ignition Status process.

## Requirements Representations

Within each process, the required functionality is described in the form of text, decision tables, state transition diagrams and/or state transition tables.

Decision tables show combinational logic where Inputs are on the left side of the table and Outputs are on the right side of the table. A double vertical line separates inputs and Outputs. Each row has a unique number to allow reference to that particular requirement.

State transition diagrams and state transition tables contain four key elements: states, transitions, events, and actions. States represent a known condition with the model. Transitions represent the interaction of the states. Events represent the conditions, which must be true for a transition to be taken. Actions represent the operations that must be accomplished when a transition is taken.

State transition diagrams use the following conventions: States are represented by rectangles. Arrows represent transitions. The symbols🡒, –>, and => mean "transitions to" and represent an event occurring at a specific point in time. For example Ignition\_Status 🡒 RUN means that the ignition switch has transitioned to the RUN position. This is different than Ignition\_Status = RUN, which means that the ignition switch is in the RUN position. The events and actions for a transition are in text with the events listed before a "/" and the actions following the "/". Timers in one State Transition Diagram are independent of timers in other State Transition Diagrams.

State transition tables have the Current State, Events, Actions, Next State column format with one transition per row. Each row has a unique number to allow reference to that particular requirement.

Processing order shall be such that all inputs have been processed prior to evaluation of a given p-spec.

## State Transition Table/Diagram Notation

In state machines, some special symbols are used. All symbols used in state machines are listed below. The equality symbols (=) is explained because it is both used for comparisons and assignments.

Table 0‑1 Special Symbols used in Finite State Machines

|  |  |  |
| --- | --- | --- |
| Symbol | Event or  Action | Definition |
| <n> | Event | Requirement number n: uniquely identifies requirement #1 when transitioning between state A and state B. Every “OR” condition is assigned a unique requirement number. Example: <1> |
| = | Event | Equality: |
| <> | Event | Inequality: |
| >= | Event | Greater than or equal: |
| <= | Event | Less than or equal: |
| > | Event | Greater than: |
| < | Event | Less than: |
| -> 🡪 | Event | Transitions to: activates only on the transition from one value to the target value. Unless specified otherwise in the Finite State Machine, the state machine must look for the data transition to occur while it is in the state that has the -> as an exit condition. In modeling terms, this means that the transition flag is cleared upon entry to the state. Special care must be taken when the -> event must be evaluated as part of a logical AND operation. See Figure 0‑1 Example of Detecting a Transition. |
| & | Event | Boolean “AND”: |
| | | Event | Boolean “OR”: |
| = | Action | Assignment: |
| no event | Event | No event trigger |
| no action | Action | No action taken: |
| Mark event xyzzy | Action | Event in time: conceptual timing requirement – this action marks the event “xyzzy” on an imaginary timeline. Later referenced by Time since event…” |
| Time since event xyzzy | Event | Elapsed time: determines the amount of time that has elapsed since the last occurrence of the Mark event xyzzy |



Figure 0‑1 Example of Detecting a Transition

## Assumed Interface to NVRAM Manager

**Note:** This document assumes the following interface with an EEPROM manager. The supplier does not need to support this exact interface.

**NVRAM\_Rqst** **NULL** = do nothing

**UPDATE** = post all changes to NVRAM (going to reboot)

**STOP** = Let any current write finish – don't start another

**NVRAM\_Status** **BUSY** = NVRAM is busy, write is occurring

**NULL** = NVRAM is not busy

**DONE** = request for UPDATE or STOP has been completed

This interface is used in the Sleep/Awake feature and in the Diagnostics feature.

# APPENDIX C: Data Dictionary

## Data Dictionary: SOD Internal Signals (“isig\_”)

The initernal signals isig\_\* are defined in various sections in this speicfiation.

This table is a reference to the cumulative number of signals. The supplier of the SOD shall use the defnitions of the internal signals from the respective sections in this specification.

Table: 16.1-1

|  |  |  |
| --- | --- | --- |
| **Signal Name** | **Comments** | **Used by** |
| isig\_Alert\_Stat | Used for BLIS target detected and meets the criteria to alert |  |
| isig\_BLIS\_Alert\_Left | Whin isig\_Alert\_Stat is true, isig\_Blis\_Alert\_Left is used to  set the LH CAN signal SodAlrtX\_D\_Stat to LAMP ON, LAMP OFF, or FLASH and, if configured for HMI Hardwire, cause the SODX to drive the LED hardwire to ON, OFF, or FLASH. | BLIS |
| isig\_BLIS\_Alert\_Right | Whin isig\_Alert\_Stat is true, isig\_Blis\_Alert\_Right is used to  set the RH CAN signal SodAlrtX\_D\_Stat to LAMP ON, LAMP OFF, or FLASH and, if configured for HMI Hardwire, cause the SODX to drive the LED hardwire to ON, OFF, or FLASH. |  |
| isig\_BLIS\_Last\_Rem | Used to remember HMI input for BLIS ON/OFF state , and will set BLIS on/off setting for the next key cycle | BLIS |
| isig\_BLIS\_VarRearRange | BLIS variable rear range for PFR targets, isig\_BLIS\_VarRearRange, will be defined by the global parameters BLIS\_VarRearRange\_TTC and BLIS\_VarRearRange\_Max | BLIS |
| isig\_Blkg\_Permit | The output of the windshield wiper processing will be an internal signal isig\_Blkg\_Permit. The isig\_Blkg\_Permit will be an input to the blockage algorithm. See section 3.7.1.9 for definitions and details | BLIS |
| Isig\_brake\_timeout | Isig\_brake\_timeout is an internal signal which indicates if a brake request has timed out. See section 3.7.11 for details. | RCTB |
| isig\_Brake\_Timer | Used to monitor the time after a brake intervention has been requested. See section 3.7.11 for details. | RCTB |
| isig\_BTT\_Last\_Rem | Used to remembere the BTT on/off state for the next ignition cycle | BTT |
| isig\_BTT\_Temp\_Rem | Used to remember the BTT on/off state for the current ignition cycle when My Teen Key is present | BTT |
| isig\_BTT\_TRAILER | Used to determine final connection status of trailer, based on data from isig\_TTM\_Cfg, isig\_TRAILER, and isig\_ATD\_TRAILER | BTT |
| isig\_CTA\_SCENARIO | Used for CTA parking lot vs road situation | CTA/RCTB |
| isig\_ECVE\_C102 | Used for VIN signal comparison of CAN bus vs SOD DID | VIN |
| isig\_Ignition\_Stable | Filtered ignition status after the CAN network has stabilized. | All |
| isig\_LCWA\_flash | Indicates if SOD is flashing the LED due to an LCWA request by IPMA | LCWA |
| isig\_My\_Key | Used for determining if My Teen Key is being used or not during the ignition cycle | BLIS/CTA |
| isig\_RCTB\_fault | Used to determine if the SOD has an issue with RCTB related inputs. | RCTB |
| isig\_RCTB\_Target\_detected | Isig\_RCTB\_Target\_detected is an internal signal which indicates, if the RCTB algorithm has detected a valid RCTB target.  0: false (no RCTB target detected)  1: true (RCTB target detected) | RCTB |
| Isig\_RunningReset | Used to indicated of the SOD module to indicate if a running reset has occured | All |
| isig\_TBM | Used for processing the Trailer Brake Module CAN signals. The isig\_TBM signalis needed and Trailer Brake Module 2.5 second time delay. | BLIS/CTA  BTT |
| isig\_TFLAG\_Last\_Rem | indicates whether a trailer was attached the last time BTT was activated including the last key cycle: internal signal isig\_TFLAG\_Last\_Rem. The values of isig\_TFLAG\_Last\_Rem are  TRUE (trailer previously connected, (0x1))  FALSE (trailer not previously connected, (0x0)) | BTT |
| isig\_TLM | Used for processing the Trailer Lighting Module CAN signals. The isig\_TLM signal is needed and Trailer Brake Module 2.5 second time delay. | BLIS/CTA  BTT |
| isig\_trailer | Used to determine if a trailer is connected based on CAN data from the TLM and TBM modules. The inputs to this isig are isig\_TTM\_Cfg, isig\_TLM, and isig\_TBM. See table 3.7.1.5.1-1. The isig\_TRAILER is used by BTT together with ATD. | All |
| isig\_Transmission\_Status | The SOD will process the transmission CAN signal to generate the filtered internal signal isig\_Transmission\_Status.  This automatic transmission gear select signal is GearLvrPos\_D\_Act and the manual transmission gear select signal is GearRvrse\_D\_Actl. | All |
| isig\_TTM\_Cfg | This isig is set based on Method II configuration for TLM or TBM presense. | BLIS/CTA BTT |
| Isig\_turn\_radius\_status | Used to track SOD calculation status of turn radius | RCTB |
| isig\_Vehicle\_Direction | SOD uses wheel direction signals from ABS to determine if the vehicle is physically moving backwards while in the reverse grear for both automatic and manual transmissions. See R: 3.7.1.14.1 | CTA/RCTB |
| isig\_Wipe\_State | Used to process front wiper states (clear, intermittent, low, high) | BLIS |
| RbaCtaLeft\_D\_Stat\_Intern  RbaCtaRight\_D\_Stat\_Intern  Also kown as RbaCtaX\_D\_Stat\_Intern |  |  |
| Rba\_D\_Stat\_Intern | To turn on/off RCTB in SOD, and to provide overall system availability status from all RBA modules. | RCTB |
| RbaSys\_D\_Stat\_Intern | Faulted/Not faulted status of RBA Controller | RCTB |
| For Boundary Alert “isig\_” list, refer to Boundary Alert Functional Specification |  | BA |
| BTT5G\_Intern | Used to communicate status of BTT5G. See section 3.5.4 for requirements. | BTT |

## Data Dictionary: CAN Signals Sent by SOD features (ADAS ECU)

Table 16.2-2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CMDB Signal Name**  **(23 Character Limit)** | **Reciever ECU** | **Description** | **Size [Bits]** | **Range**  **& Resolution** | **Used for** |
| SodInnrLeft\_D\_Stat\_Intern  SodInnrRight\_D\_Stat \_Intern | GWM/ADAS | SOD internal state. | 2 | 0 – Initialization,  1 - System Standby,  2 - Not Reporting,  3 – Reporting | BLIS |
| CtaInnrLeft\_D\_Stat  CtaInnrRight\_D\_Stat | GWM/ADAS | CTA internal state | 2 | 0 – Initialization,  1 - System Standby,  2 - Not Reporting,  3 – Reporting | CTA |
| SodAlrtLeft\_D\_Stat  SodAlrtRight\_D\_Stat | DDM /GWM/PDM  DDM /GWM/PDM | Command of LED. | 2 | 0 – Lamp Off,  1 – Lamp On,  2 – Flash,  3 – Bulb Prove Out | DCU |
| CtaAlrtLeft\_D\_Stat  CtaAlrtRight\_D\_Stat | DDM /GWM/PDM  DDM /GWM/PDM | Command of LED Used by DCUs to activate LED flash | 1 | 0 – off,  1 – on | DCU |
| CtaAlrtLeft2\_D\_Stat  CtaAlrtRight2\_D\_Stat | GWM / IPC  GWM / IPC | Command of LED;  Used by Cluster to activate CTA message and chimes  Note – only off and 0x1 are used | 3 | 0x0 – off,  0x1 thru 0x4 alert levels | Cluster |
| SodDetctLeft\_D\_Stat  SodDetctRIght\_D\_Stat | GWM  GWM | Sent to LCA/LDW. | 3 | 0x0: AlertOff\_FlashOff\_SensrClr  0x1: Alert\_On  0x2: Flash\_On  0x3: Sensor\_Fault  0x4: Sensor\_Blocked |  |
| SodLeft\_D\_Stat  SodRight\_D\_Stat | GWM / ADAS /I PC | BLIS operation state. |  | 0x0: Off  0x1: Trailer\_Tow\_Off  0x2: On  0x3: Disabled | BLIS |
| SodSnsLeft\_D\_Stat  SodSnsRight\_D\_Stat | DDM/GWM/PDM/ ADAS /IPC | BLIS status. |  | 0x0: Clear  0x1: Blocked  0x2: System\_Failure | BLIS |
| CtaSnsLeft\_D\_Stat  CtaSnsRight\_D\_Stat | GWM/ SODR /IPC  GWM/ SODL /IPC | CTA status. |  | 0x0: Clear  0x1: Blocked  0x2: System\_Failure | CTA |
| CtaLeft\_D\_Stat  CtaRight\_D\_Stat | GWM SODR IPC  GWM SODL IPC | CTA operation state. |  | 0x0: Off  0x1: Trailer\_Tow\_Off  0x2: On  0x3: Disabled | CTA |
| Side\_Detect\_L\_Illum  Side\_Detect\_R\_Illum | DDM /GWM/ PDM  DDM /GWM/ PDM | LED PWM value 0 to 100%. Sent to DZMs and/or indicates the hardwire PWM signal. |  |  | LED |
| SodWarnLeft\_Prd\_Rq  SodWarnRight\_Prd\_Rq | DDM /GWM /PDM  DDM /GWM /PDM | Secondary warning flash period sent to DZMs. |  |  |  |
| BttLeft\_D\_Stat  BttRight\_D\_Stat | GWM SODR  GWM SODL | BTT state of operation |  | 0x0: NotDetermined  0x1: Connected  0x2: Pending  0x3: NotConnected  0x4: OffTemp  0x5: Off  0x6: Disabled | BTT |
| BttLeft\_D\_RqDrv  BttRight\_D\_RqDrv | GWM /SODR/ IPC  GWM /SODL/ IPC | BTT request to Cluster: 0 – NULL, 1 – no request, 2 – request trailer data, 3 - Unused |  | 0x0: Null  0x1: NoRequest  0x2: Request | BTT |
| CtaRightBrkDecel\_B\_Rq | GWM / SODL ABS / IPMB | Deceleration request from the SODR to the ABS-module |  | 0x0: disable – no brake requested  0x1: enable – brake requested | RCTB |
| CtaLeftBrkDecel\_B\_Rq | GWM / SODR ABS / IPMB | Deceleration request from the SODL to the ABS-module |  | 0x0: disable – no brake requested  0x1: enable – brake requested | RCTB |
| CtaRightBrkEnbl\_B\_Rq | GWM SODL  ABS IPMB | Request from the SODR to the ABS-module to enable/disable the CTA brake intervention interface. |  | 0x0: disable – interface to be closed  0x1: enable – interface to be opened | RCTB |
| CtaLeftBrkEnbl\_B\_Rq | GWM SODR ABS IMPB | Request from the SODL to the ABS-module to enable/disable the CTA brake intervention interface. |  | 0x0: disable – interface to be closed  0x1: enable – interface to be opened | RCTB |
| RbaCtaLeft\_D\_Stat\_Intern  RbaCtaRight\_D\_Stat\_Intern  Also kown as RbaCtaX\_D\_Stat\_Intern | GWM SODR ABS IMPB  GWM SODL ABS IPMB | RCTB (RBA) operation state in SOD |  | 00 – off,  01 – Trailer Tow off,  02 – on,  03 – Disabled  04 -- Invalid  07 --Fault | RCTB |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

## Data Dictionary: CAN Signals Received by SOD features (ADAS ECU)

Table 16.3-1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CMDB Signal Name**  **(23 Character Limit)** | **Tx ECU** | **Description** | **Size [Bits]** | **Range**  **& Resolution** | **Applies to** | **Processing Details** |
| Sod\_D\_Rq | IPC | Cluster ON/OFF command to BLIS. Unknown used for MyKey event. |  | 0 = OFF, 1 = BLIS On Secondary Warning OFF, 2 = BLIS ON Secondary Warning ON, 3 = unknown | BLIS | Cluster Interface Section 7 |
| Cta\_D\_Rq | IPC | Cluster ON/OFF command to CTA. Unknown used for MyKey event.  ON applies to activating CTA alert levels. |  | 0 = OFF, 1 = ON, 2 = NoDataExists, 3 = Unused | CTA | Cluster Interface Section 7 |
| Btt\_L\_Actl2 | APIM | Cluster trailer length data. |  | hx0A-64 is valid length, hx7E is no data / customer cancel, hx00 thru hx09, hx65 thru hx7D and hx7F is invalid trailer | BTT | Cluster Interface Section 7 |
| Ignition\_Status |  | State of ignition switch and used to determine ignition switch stable. |  |  | All | Ignition Switch Section 3.7.1.1 |
| TrlrLampCnnct\_B\_Actl |  | Trailer connect signal from the Trailer Lighting Module (TLM): Connected / not connected |  |  | All | Trailer Tow Section 3.7.1.5 |
| TrlrBrkActCnnct\_B\_Actl |  | Trailer connect signal form Trailer Brake Module (TBM); connected / not connected. |  |  | All | Trailer Tow Section 3.7.1.5 |
| GearLvrPos\_D\_Actl |  | Automatic transmission gear. PRNDL state. |  |  | All | Transmission Section 3.7.1.4 |
| GearRvrse\_D\_Actl |  | Manual transmission reverse gear status (active / not active) |  |  | All | Transmission Section 3.7.1.4 |
| Parklamp\_Status |  | Parklamp ON/OFF status. |  |  | BLIS  CTA | LED Illumination Section 3.7.1.11 |
| Litval |  | Day, levels of night, or full night. |  |  | BLIS  CTA | LED Illumination Section 3.7.1.11 |
| EIPw\_D\_Stat |  | Not required to use. Supplier use optional. |  |  | BLIS  CTA | Section 3.2 and 3.7.1.2 |
| BLISLEDStatDriverSide  BLISLEDStatPassSide |  | DCU status of LED alert. |  |  | BLIS  CTA  RCTB  LCWA | Sections 4.7.1.8 and 8.0 |
|  |  |  |  |  |  |  |
| TurnLghtSwtch\_D\_Stat |  | Turn signal status used for Secondary Warning |  |  | BLIS  LCWA | SWS Section 4.7.1.6 |
| IgnKeyType\_D\_Actl |  | MyKey feature. |  |  |  |  |
| Veh\_V\_ActlEng |  | Vehicle speed. |  |  | All | Vehicle Speed Section 3.7.1.3 |
| VehVActlEng\_D\_Qf |  | Vehicle speed status: OK, fault, does not exist |  |  | All | Vehicle Speed Section 3.7.1.3 |
| VehYaw\_W\_Actl |  | Used by BLIS VRR to reduce false alerts from targets in nonblind zone lanes on curved roads. |  |  | BLIS  RCTB | Vehicle Turn Radius Section 3.7.1.12 |
| WhlRotatFr\_No\_Cnt |  | Optional – Used when the supplier incorporates turn radius in their algorithm: Front Wheel. May not be present on all vehicles. |  |  | BLIS  RCTB | Vehicle Turn Radius Section 3.7.1.12 |
| CtaBrk\_D\_Stat |  | ABS status for the CTA brake interface |  | 0x0: Closed  0x1: Opened  0x2: Active  0x3: Denied | RCTB | Reverse braking assist Interface between SOD and ABS, Section 3.7.11 |
| WhlDirFl\_D\_Actl  WhlDirFr\_D\_Actl  WhlDirRl\_D\_Actl  WhlDirRr\_D\_Actl |  | Wheel Direction from ABS. Only one axle is equipped with bi-directional sensors. |  | 0x0: Forward  0x1: Backward  0x2: Unknown  0x3: Failed | RCTB | To determine direction of travel, used by RCTB, see section 3.7.11 |
| StePinComp\_An\_Est  SteWhlComp\_An\_Est |  | Current steering angle at the pinion.  0: driving straight ahead.  Negative values: steering clockwise  Positive values: steering counter clockwise |  |  | RCTB | Turn Radius Processing, Section  3.7.1.12 |
| Rba\_D\_Stat\_Intern |  | To turn on/off RCTB in SOD, and to provide overall system availability status from all RBA modules. |  | 0x0: OFF  0x1: ON  0x2: DISABLED  0x3: Not Used | RCTB | Section 3.4.1.5 RCTB initialization and section 3.5.6 RCTB ON/OFF Processing |
| RbaSys\_D\_Stat\_Intern |  | Faulted/Not faulted status of RBA Controller |  | 0x0: Disabled  0x1: Suspended  0x2: Available  0x3: Faulty  0x4 – 0x7: Unused | RCTB | Section 3.5.6 RCTB ON/OFF Processing |
| SodSnsLeft\_D\_Stat  SodSnsRight\_D\_Stat |  | BLIS data exchange between the Rear corner SODs |  |  | BLIS | LH RH SOD Module Data Exchange Section 3.7.1.13 |
| CtaSnsLeft\_D\_Stat  CtaSnsRight\_D\_Stat |  | CTA data exchange between the Rear corner SODs |  |  | CTA | LH RH SOD Module Data Exchange Section 3.7.1.13 |
| BttLeft\_D\_Stat  BttRight\_D\_Stat |  |  |  | Refer to DBC file | BTT | LH RH SOD Module Data Exchange Section 3.7.1.13 |
| BttLeft\_D\_RqDrv  BttLeft\_D\_RqDrv |  |  |  | Refer to DBC file | BTT | LH RH SOD Module Data Exchange Section 3.7.1.13 |
| ApaMde\_D\_Stat\_Intern |  |  |  | Refer to DBC file |  | BLIS CTA operation during autopark mode |
| Left/Right ID |  | Hardwire I/O Pin Switched |  |  | BLIS  CTA | Section 3.1 |
| SodAltLeft\_D2\_StatAft | GFM2 | Aftermarket left radar object detection |  | 0x0: Standby  0x1: Active No Detection 0x2: Active With Detection  0x3: Faulty | BTT5G | Cluster/APIM Interface Section 7 |
| SodAltRight\_D2\_StatAft | GFM3 | Aftermarket right radar object detection |  | 0x0: Standby  0x1: Active No Detection 0x2: Active With Detection  0x3: Faulty | BTT5G | Cluster/APIM Interface Section 7 |
| Btt\_L2\_Actl2 | APIM | Cluster trailer length data for 5th wheel and gooseneck with aux radars. |  | Hx0A-66 is valid length, 0x7E is no data / customer cancel, 0x7F is invalid | BTT5G | Cluster/APIM Interface Section 7 |