# eFFA: SUC Parking Distance Control (PDC) with Active Braking

## Function: Obstacle Detection

| **Function** | **Guideword** | **Cause** | **Effect**  **(Local)** | **Mode** | **Situation** | **Effect**  **(Vehicle Level)** | **Rating**  **(Failure / Hazard / None)** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Obstacle Detection | Omission | Sensor covered by Environmental factors(Dust/Ice/rain..etc)  Sensor Hardware failure | Obstacle is not detected | Disabled | Vehicle Parked  Vehicle Stationary  Vehicle moving slowly reverse  Vehicle moving slowly forward | No Effect | None |
|  |  |  |  | Engaged w/o Active Braking  Engaged with Active Braking | Vehicle Stationary | Vehicle may not detect obstacles | Failure |
|  |  |  |  | Engaged w/o Active Braking  Engaged with Active Braking | Vehicle moving slowly reverse  Vehicle moving slowly forward | The Vehicle might fail to detect obstacles and could potentially come into contact with them | Failure and Hazard |
|  | Commission | Electrical short circuit  Software malfunction in detection algorithm | False Detection of an obstacle/ System activated braking without obstacle in vicinity | Disabled | Vehicle Parked  Vehicle Stationary  Vehicle moving slowly reverse  Vehicle moving slowly forward | No Effect | None |
|  |  |  |  | Engaged w/o Active Braking  Engaged with Active Braking | Vehicle Stationary | Vehicle inaccurately detects an obstacle and engages the brakes and the alarm | Failure |
|  |  |  |  | Engaged w/o Active Braking  Engaged with Active Braking | Vehicle moving slowly reverse  Vehicle moving slowly forward | Vehicle inaccurately detects an obstacle and engages the brakes and the alarm | Failure |
|  | Incorrect | Sensor Miscalibration  Electromagnetic Interference  Transparent objects in the sensor range  Sensor Misalignment | Obstacle detected at an inaccurate distance | Disabled | Vehicle Parked  Vehicle Stationary  Vehicle moving slowly reverse  Vehicle moving slowly forward | No Effect | None |
|  |  |  |  | Engaged w/o Active Braking  Engaged with Active Braking | Vehicle Stationary | Vehicle detects an obstacle at an incorrect distance and engages the brakes and the alarm OR Vehicle inaccurately does NOT detect an obstacle and does not engage the brakes and the alarm | Failure |
|  |  |  |  | Engaged w/o Active Braking | Vehicle moving slowly reverse  Vehicle moving slowly forward | Vehicle inaccurately does NOT detect an obstacle and does not engage the brakes and the alarm | Hazard |
|  |  |  |  | Engaged with Active Braking | Vehicle moving slowly reverse  Vehicle moving slowly forward | Vehicle detects an obstacle initially but then inaccurately does not detect it anymore (e.g only part of the obstacle is detected) | Hazard |

The following assumptions were made for Obstacle Detection:

* The PDC will be disengaged above a speed threshold.
* The mode Enabled and Disengaged is not applicable in this eFFA analysis for obstacle detection since the PDC is disengaged.
* It is assumed that the mode disabled is chosen intentionally
* It is assumed that when the vehicle is parked the PDC is disengaged, hence this situation is not applicable in the eFFA analysis.
* The operating situations vehicle moving fast reverse and vehicle moving fast forward are not applicable in this eFFA analysis as the PDC will be engaged.

| **Function** | **Guideword** | **Cause** | **Effect**  **(Local)** | **Mode** | **Situation** | **Effect**  **(Vehicle Level)** | **Rating**  **(Failure / Hazard / None)** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Function: Braking System** | | | | | | | |
| Active Braking | Omission | Faulty wiring to brake controls, brake failure, SUC’s I/O failure, SUC’s power supply failure | No stopping of vehicle when active braking should be applied | Disabled | Vehicle parked  Vehicle stationary  Vehicle moving fast reverse  Vehicle moving fast forward | N/A |  |
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| Vehicle moving slowly reverse | Active braking not applied when obstacle present | Failure and Hazard |
| Vehicle moving slowly forward | Active braking not applied when obstacle present | Failure and Hazard |
| Enabled and Disengaged | All situations | N/A |  |
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| Engaged w/o Active Braking | All situations | N/A |  |
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| Active Braking | Vehicle parked  Vehicle stationary  Vehicle moving fast reverse  Vehicle moving fast forward | N/A |  |
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| Vehicle moving slowly reverse | Vehicle does not stop when obstacle is present | Failure and Hazard |
| Vehicle moving slowly forward | Vehicle does not stop when obstacle is present | Failure and Hazard |
| Active Braking | Commission | Faulty wiring to brake controls, brake failure, SUC’s I/O failure, SUC’s power supply failure | Incorrect stopping of vehicle when active braking should not be applied | Disabled | Vehicle parked  Vehicle stationary | N/A |  |
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| Vehicle moving fast reverse | Active braking applied incorrectly at fast speed | Failure and Hazard |
| Vehicle moving fast forward | Active braking applied incorrectly at fast speed | Failure and Hazard |
| Vehicle moving slowly reverse | Active braking applied incorrectly at low speed | Failure |
| Vehicle moving slowly forward | Active braking applied at low speed | Failure |
| Enabled and Disengaged | Vehicle parked | N/A |  |
| Vehicle stationary |
| Vehicle moving fast reverse | Active braking applied incorrectly at fast speed | Failure and Hazard |
| Vehicle moving fast forward | Active braking applied incorrectly at fast speed | Failure and Hazard |
| Vehicle moving slowly reverse | Active braking applied incorrectly at low speed | Failure |
| Vehicle moving slowly forward | Active braking applied at low speed | Failure |
| Engaged w/o Active Braking | Vehicle parked | N/A |  |
| Vehicle stationary |
| Vehicle moving fast reverse | Active braking applied incorrectly at fast speed | Failure and Hazard |
| Vehicle moving fast forward | Active braking applied incorrectly at fast speed | Failure and Hazard |
| Vehicle moving slowly reverse | Active braking applied incorrectly at low speed | Failure |
| Vehicle moving slowly forward | Active braking applied at low speed | Failure |
| Active Braking | Vehicle parked | N/A |  |
| Vehicle stationary |
| Vehicle moving fast reverse | Active braking applied incorrectly at fast speed | Failure and Hazard |
| Vehicle moving fast forward | Active braking applied incorrectly at fast speed | Failure and Hazard |
| Vehicle moving slowly reverse | N/A, correct behavior |  |
| Vehicle moving slowly forward |
| Active Braking | Incorrect | Faulty wiring to brake controls, brake failure,SUC’s I/O failure, SUC’s power supply failure | Stopping of vehicle done late when active braking should be applied | Disabled | Vehicle parked  Vehicle stationary  Vehicle moving fast reverse  Vehicle moving fast forward | N/A |  |
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| Vehicle moving slowly reverse | Active braking not applied when obstacle present | Failure and Hazard |
| Vehicle moving slowly forward | Active braking not applied when obstacle present | Failure and Hazard |
| Enabled and Disengaged | All situations | N/A |  |
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| Engaged w/o Active Braking | All situations | N/A |  |
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| Active Braking | Vehicle parked  Vehicle stationary  Vehicle moving fast reverse  Vehicle moving fast forward | N/A |  |
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| Vehicle moving slowly reverse | Vehicle does not stop when planned when obstacle is present | Failure and Hazard |
| Vehicle moving slowly forward | Vehicle does not stop when planned when obstacle is present | Failure and Hazard |
| **Function: Visual Notification** | | | | | | | |
| Visual Notification | Omission | Faulty wiring to display screen, fault in controls allocating imagery to screen, display failure, SUC’s I/O failure, SUC’s power supply failure | No visual notification (e.g., no parking guidelines, and not showing detected obstacles) displayed to driver | Disabled | 1. Vehicle parked  2. Vehicle stationary  3. Vehicle moving fast reverse  4. Vehicle moving fast forward  5. Vehicle moving slowly reverse  6. Vehicle moving slowly forward | N/A  (no visual notification is intended while SUC is off) | None |
| Enabled and Disengaged | 1. Vehicle parked  2. Vehicle stationary  3. Vehicle moving fast reverse  4. Vehicle moving fast forward | N/A  (no visual notification is intended while SUC is off) | None |
| Engaged w/o Active Braking | 1. Vehicle moving slowly reverse  2. Vehicle moving slowly forward  (1,2,3) | Collision with object/pedestrian/vehicle where driver cannot see | Failure/Hazard |
| Active Braking | 1. Vehicle moving slowly reverse  2. Vehicle moving slowly forward  (1,2,3) | Collision avoided | Failure |
|  | Commission | Faulty wiring to display screen, fault in controls allocating imagery to screen, display failure, SUC’s I/O failure, SUC’s power supply failure | Visual notification displayed to the driver when unintendedly or unexpectedly (no obstacle present or PDC disabled). | 1. Disabled  2. Enabled and Disengaged  3. Engaged w/o Active Braking  4. Active Braking | 1. Vehicle parked  2. Vehicle stationary  3. Vehicle moving fast reverse  4. Vehicle moving fast forward  5. Vehicle moving slowly reverse  6. Vehicle moving slowly forward | Driver annoyance | Failure |
|  | Incorrect | Faulty wiring to display screen, fault in controls allocating imagery to screen, display failure, SUC’s I/O failure, SUC’s power supply failure | Visual notification displayed to driver is indicating wrong information (Incorrect direction of travel, incorrect visual display, displayed too early | 1. Disabled  2. Enabled and Disengaged  3. Engaged w/o Active Braking  4. Active Braking | 1. Vehicle moving slowly reverse  2. Vehicle moving slowly forward | Mode 3: could display misleading info about obstacles to driver | Failure/Hazard |

Note:

1. The SUC shall not be required in situations where vehicle is parked or stationary, it shall not be considered in eFFA for hazard/failure analysis as these situations and the function shall be disengaged
2. High speed movement is outside of the scope of the PDC
3. The ‘Parked’ and ‘Stationary’ situations are excluded here as resulting effect will not introduce hazard but rather confusion or irritation to the driver

## Function: Sound Notification

| **Function** | **Guideword** | **Cause** | **Effect**  **(Local)** | **Mode** | **Situation** | **Effect**  **(Vehicle Level)** | **Rating**  **(Failure / Hazard / None)** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sound notification | Omission | Faulty wiring to speaker, speaker failure, SUC’s I/O failure, SUC’s supply failure, SUC’s logic failure | No sound notification generated | Disabled | 1. Vehicle parked  2. Vehicle stationary  3. Vehicle moving fast reverse  4. Vehicle moving fast forward  5. Vehicle moving slowly reverse  6. Vehicle moving slowly forward | N/A  (no sound generation intended while SUC is off) | None |
| Enabled and Disengaged | 1. Vehicle parked  2. Vehicle stationary  3. Vehicle moving fast reverse  4. Vehicle moving fast forward | N/A  (no sound generation intended while PDC is disengaged) | None |
| Engaged w/o Active Braking | 1. Vehicle moving slowly reverse[1](#rnmizyrtknrd)  2. Vehicle moving slowly forward[1](#rnmizyrtknrd) | Collision with human or object beyond driver visibility range | Failure & Hazard |
| Active Braking | 1. Vehicle moving slowly reverse[1](#rnmizyrtknrd)  2. Vehicle moving slowly forward[1](#rnmizyrtknrd) | Collision avoided | Failure |
| Sound Notification | Commission | Faulty wiring to speaker, speaker failure, SUC’s I/O failure, SUC’s logic failure | Sound notification generated unintendedly (e.g. while PDC disabled / disengaged or when no obstacle is detected) | Enabled and Disengaged | 1. Vehicle moving fast reverse[2](#8gcmcyo398v2)  2. Vehicle moving fast forward[2](#8gcmcyo398v2) | Driver annoyance or distraction | Failure & Hazard (depending on level of driver distraction) |
| 1. Disabled  2. Engaged w/o Active Braking  3. Active Braking | 1. Vehicle moving slowly reverse[1](#rnmizyrtknrd)  2. Vehicle moving slowly forward[1](#rnmizyrtknrd) | Driver annoyance or distraction | Failure  Hazard possible but low risk |
| Sound Notification | Incorrect | Faulty wiring to speaker, SUC’s I/O failure, SUC logic failure | Sound notification generated too early or too late; or at the wrong volume (while sound generation is intended) | Disabled | 1. Vehicle parked  2. Vehicle stationary  3. Vehicle moving fast reverse  4. Vehicle moving fast forward  5. Vehicle moving slowly reverse  6. Vehicle moving slowly forward | N/A  (no sound generation intended while SUC is off) | None |
| Enabled and Disengaged | 1. Vehicle parked  2. Vehicle stationary  3. Vehicle moving fast reverse  4. Vehicle moving fast forward | N/A  (no sound generation intended while PDC is disengaged) | None |
| Engaged w/o Active Braking | 1. Vehicle moving slowly reverse[1](#rnmizyrtknrd)  2. Vehicle moving slowly forward[1](#rnmizyrtknrd) | Collision with human or object in front of or behind vehicle | Failure & Hazard |
| Active Braking | 1. Vehicle moving slowly reverse[1](#rnmizyrtknrd)  2. Vehicle moving slowly forward[1](#rnmizyrtknrd) | 1. Collision avoided by Active Braking  2. Driver annoyance | Failure |

Notes for Sound Notification Function:

1 The other operating situations are excluded from this eFFA analysis line because the SUC shall not be needed or not result in a hazard (e.g. situations Vehicle parked or Vehicle stationary); or shall not be applicable during these operating situations (e.,g. PDC is expected to be disengaged during all the excluded situations)

2 The operating situations Vehicle parked and Vehicle Stationary are excluded from this eFFA analysis line because the failure shall merely be an annoyance and not result in a hazard for these two situations