Component Procedures: Forward Looking Camera

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Component Procedures: Forward Looking Camera

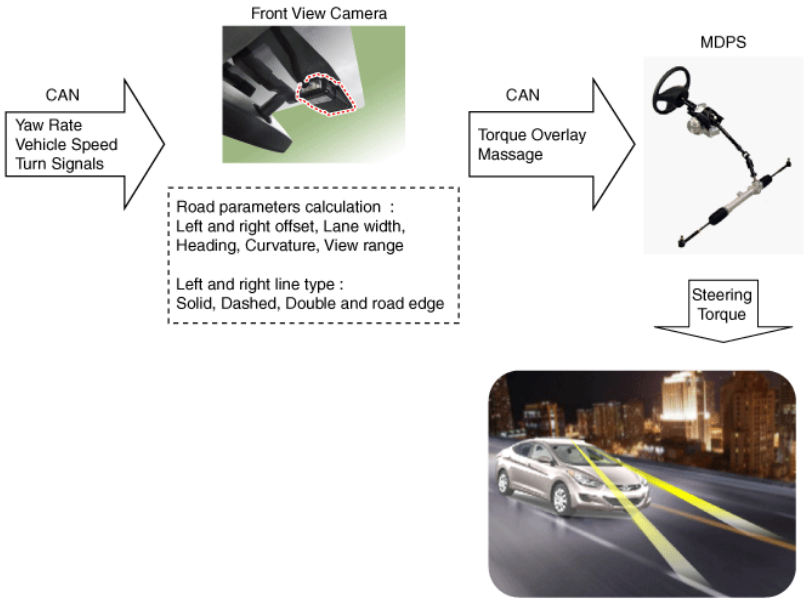
Front View Camera System - Description and Operation (Article 44721)

- Description

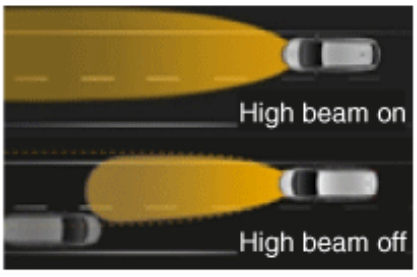
LKA Controller Typical Operating Conditions

- Vehicle speed within 60kph – 200kph
- A lane is clearly visible.
- Driver is not overriding the system – applying a large steering torque
- Directional (including hazard) signals are off
- The lane width is within 2.7m to 4.2m
- The curvature of lane is greater than 250m
- The vehicle's absolute lateral acceleration is < 2.5m/s2
- The driver's hands are on the steering wheel
- The vehicle is not out of the lane by greater 0.3m
- The absolute steering angle is < a given value (e.g 90 degrees)
- The maximum allowable time for maximum torque application has not been exceeded. (90 seconds)
- Reverse or EPS city mode is not engaged
- No fault is present in the system

Block Diagram



- Lane Keeping Assist (LKA) : The system is designed to help recognize the lane ahead and to give off a lane departure warning when the vehicle starts moving out of the lane by using the camera image and vehicle signal information.
- High Beam Assist (HBA) : Detects head lamp and tail lamp lights of vehicle ahead and turns the high beam ON/OFF.

1. Lane Keeping Assist (LKA)	2. High Beam Assist (HBA)
	
(Lane keeping Assist)	(When detecting light from vehicle in front)

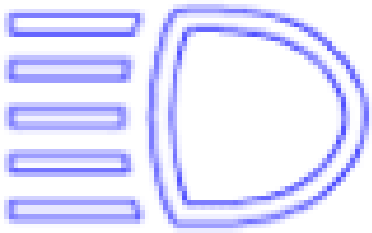
Lane Keeping Assist Display (Instrument Panel)

- Press the LKA switch to turn on the LKA lamp on the instrument panel and display the status of the lane departure warning system at the center of the instrument panel. The different statuses of LDW is shown in the following table. Lane not detected Lane detected and LKA system engaged LKA Cancelled Right side deviation Left side deviation LKA Cancelled

Lane not detected Lane detected and LKA system engaged LKA Cancelled

Right side deviation Left side deviation LKA Cancelled

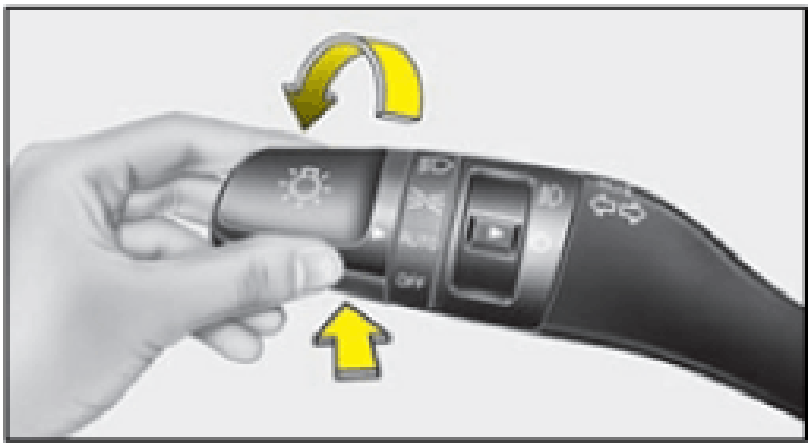
- High Beam Assist (Multi-Function Switch Auto/High Beam Position) Description Display status in Cluster Remarks Turned on in the cluster when HBA is on. Vehicle speed of 45 km/h or above
Description Display status in Cluster Remarks
Turned on in the cluster when HBA is on. Vehicle speed of 45 km/h or above



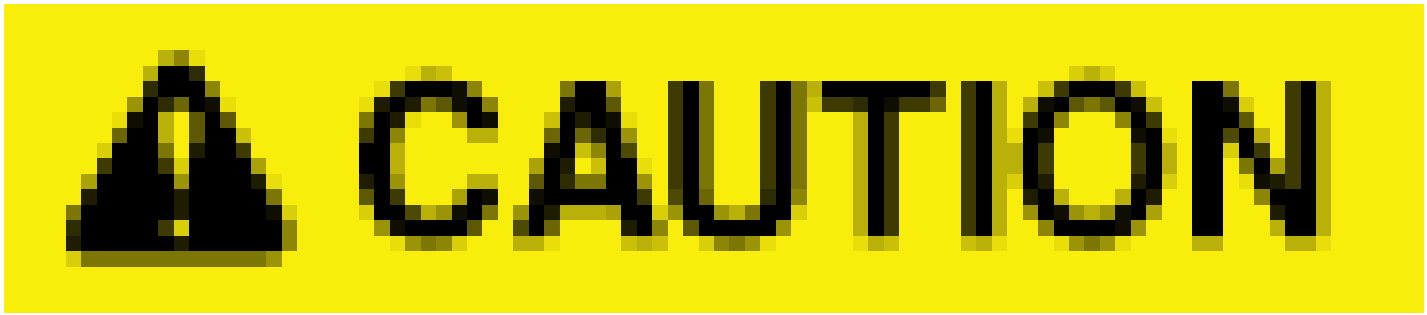
LKA ON/OFF Switch

- When the LKA switch is pressed, the LKA is on while the LDW lamp is on. When the switch is pressed again, the LKA is off and the display lamp is off.

- High Beam Auto Control Switch : High Beam Auto Control System is turned ON if the Multifunction Switch Light SW is set to AUTO, and the Light SW is set to High Beam position (Pushed). If the Light SW is not set to AUTO, or to High Beam position, the High Beam Auto Control System is turned OFF.
- If the Light SW is not set to AUTO, or to High Beam position, the High Beam Auto Control System is turned OFF.



Warning
- Visual warning : The warning is displayed on the cluster.
- Audio warning : The warning sound is issued from the speakers connected to the cluster or from the speakers connected to the external amplifier if there is an external amplifier.
LKA is capable of recognizing continuing lines as lanes and has limited lane recognition capabilities when it comes to sharp-bending roads. In addition, the system may not function properly under the following circumstances : No or faded lane markings (failed lane detection). Low visibility due to foul weather conditions. Low light or sudden change in exterior light conditions. Sharp bends of the road (curvature radius of less than 250m). Sidewalks and other dividing structures along the edge of the lane. Dirty windshield (low camera visibility).



- No or faded lane markings (failed lane detection).
- Low visibility due to foul weather conditions.
- Low light or sudden change in exterior light conditions.
- Sharp bends of the road (curvature radius of less than 250m).
- Sidewalks and other dividing structures along the edge of the lane.
- Dirty windshield (low camera visibility).

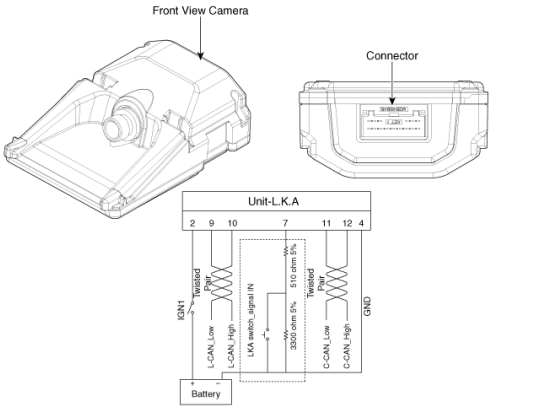
Front View Camera System - Components and Components Location (Article 44720)

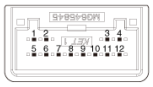
- Components

1. LKA ON/OFF Switch 2. Instrument Cluster 3. Front view camera

Front View Camera Unit - Components and Components Location (Article 44724)

- Components





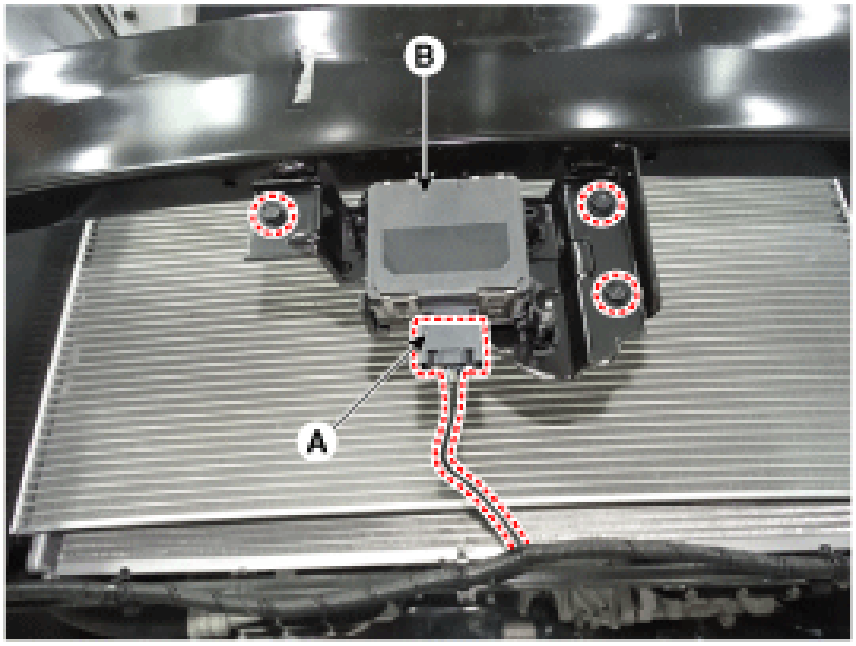
Pin	Description	Pin	Description
1	-	7	LKA ON/OFF Switch
2	IGN1	8	-
3	-	9	L-CAN Low
4	GND	10	L-CAN High
5	-	11	CAN Low
6	-	12	CAN High

Autonomous Emergency Braking (AEB) System - Repair Procedures (Article 45224)

- Removal

[AEB Radar]

- Turn the ignition switch off and disconnect the battery (-) cable.
- Remove the front bumper cover (Refer to Body - "Front Bumper")
- Disconnect the AEB radar connector (A).
- Remove the AEB unit (B).



[LDWS Camera]

- Disconnect the battery (-) cable.
- Remove the camera. (Refer to Body Electrical System - "Lane Departure Warning System (LDWS)")

- Installation

- Installation is the reverse of removal. The vertical installation angle of the unit must be within 2■± 0.4■. (not 0 degree) ■ Before installing the bumper onto the vehicle, measure the vertical angle of the unit with a protractor as shown.

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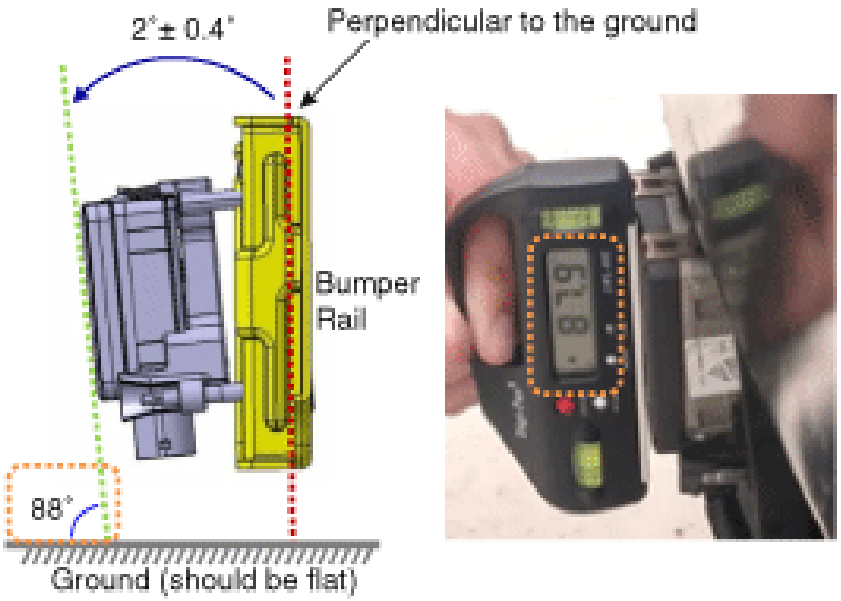
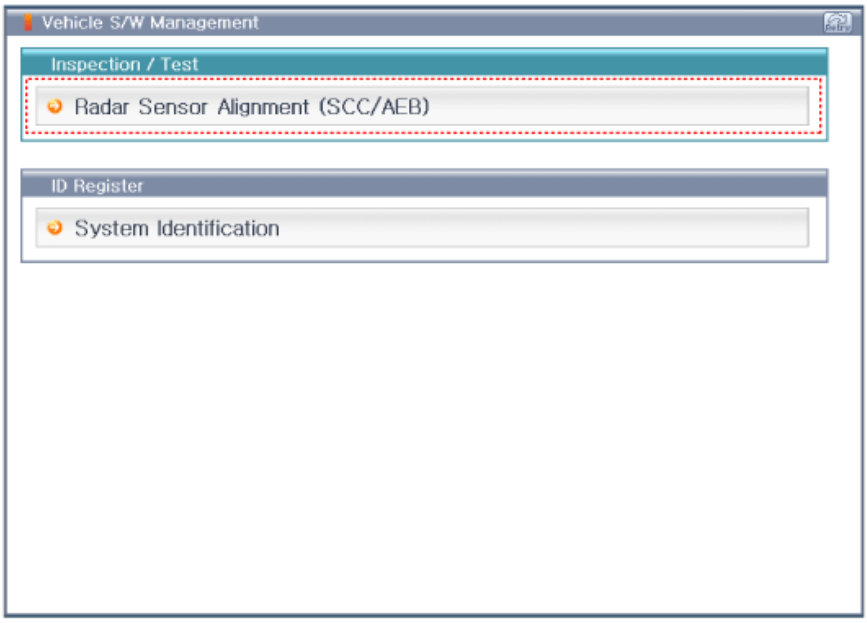
NOTICE

- The vertical installation angle of the unit must be within 2■± 0.4■. (not 0 degree) ■ Before installing the bumper onto the vehicle, measure the vertical angle of the unit with a protractor as shown.



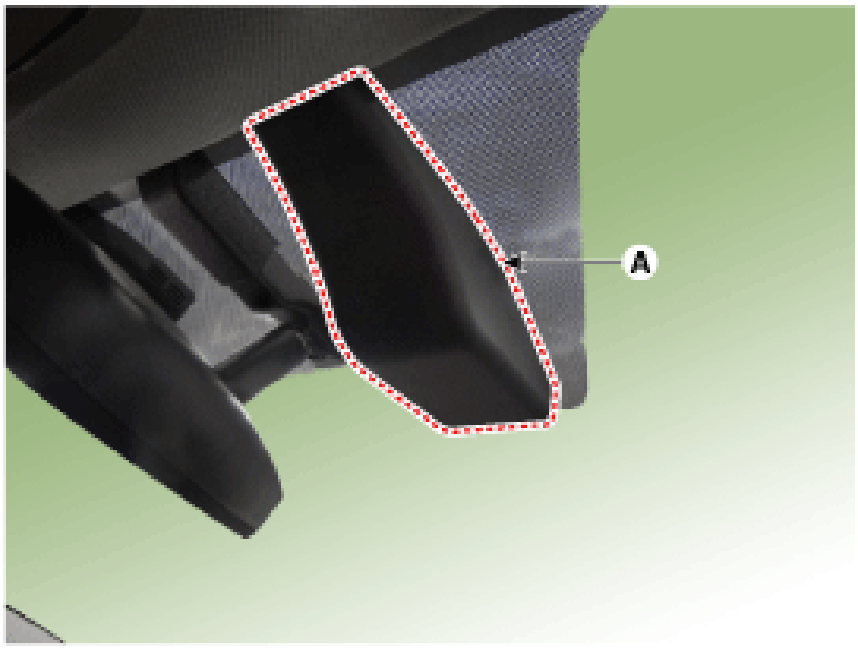
- Perform the AEB(SCC) radar alignment. (Refer to Engine Electrical System - "Smart Cruise Control Unit")



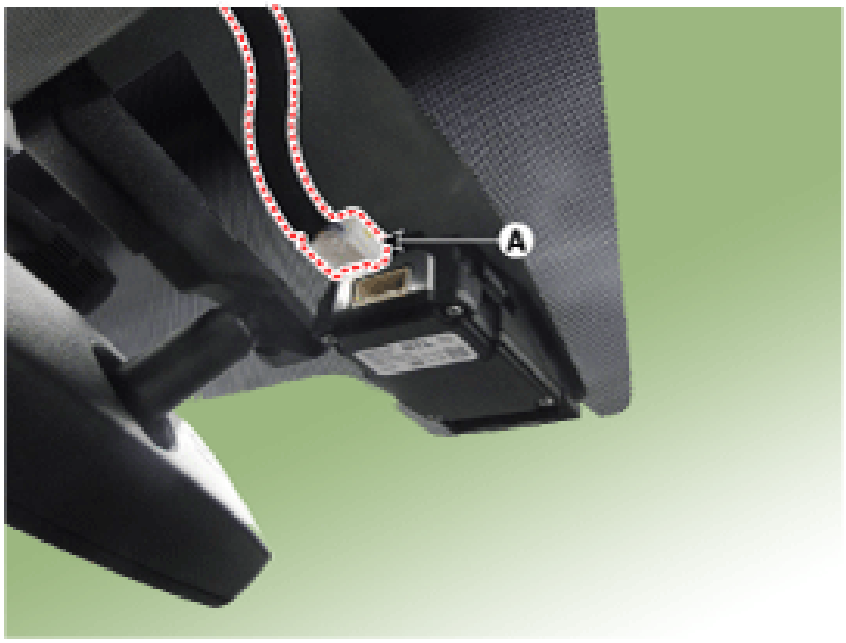
[LDWS Camera]
- Installation is the reverse of removal.
- Perform Service Point Target Auto Calibration (SPTAC). (Refer to Body Electrical System - "Lane Departure Warning System (LDWS)")

Front View Camera Unit - Repair Procedures (Article 44725)

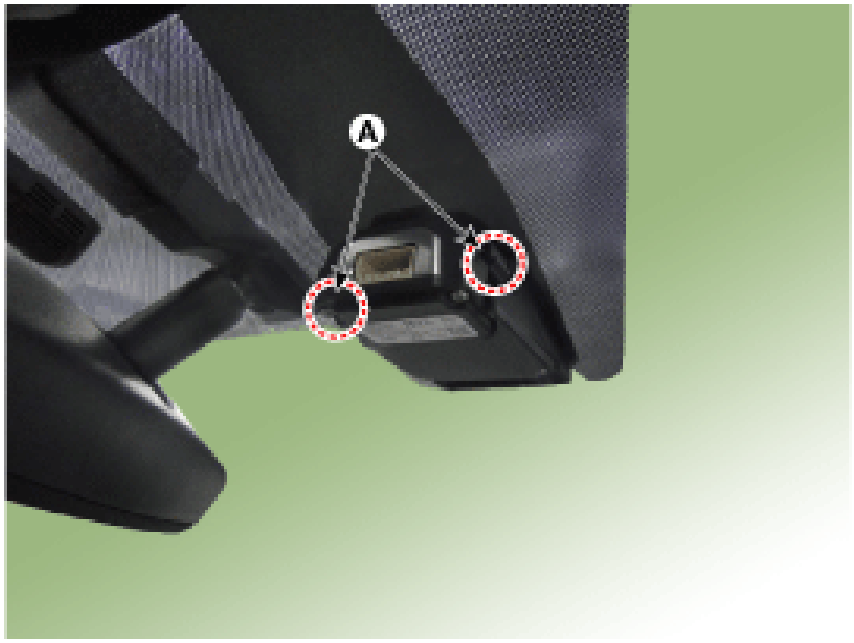
- Removal
- Disconnect the negative (-) battery terminal.
- Remove the fron view camera unit cover (A).



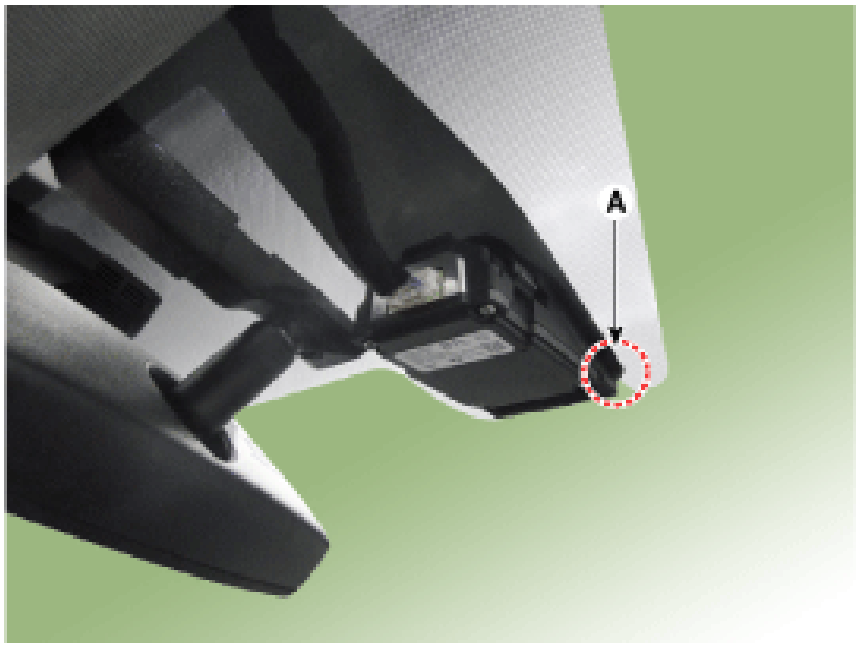
- Disconnect the fron view camera unit connector (A).



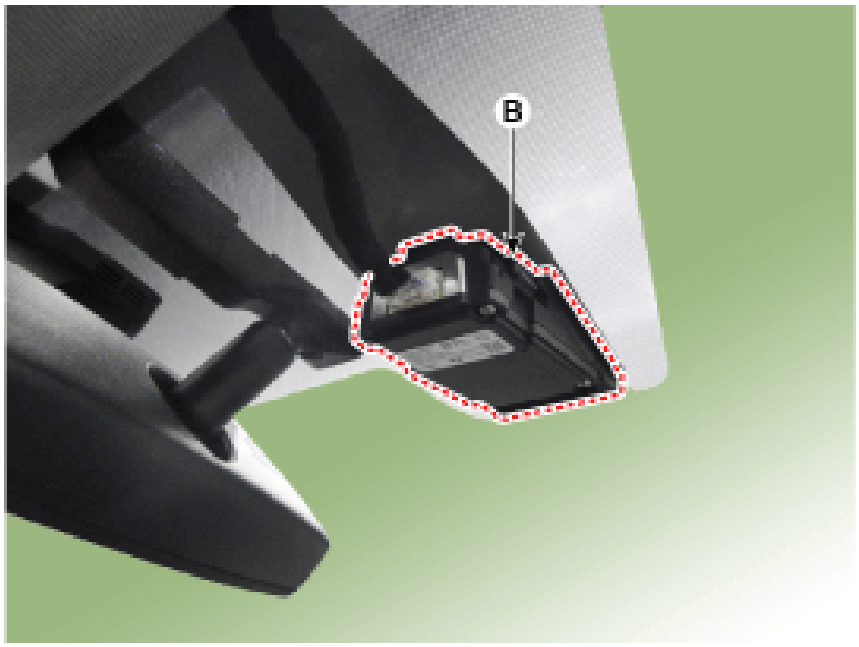
- Remove the fron view camera unit after disengaging the mounting bracket (A).



- Installation
- Align fron view camera with windshield bracket using forward edge point (A).



- Engage snaps and pivot upward to lock point (B). Fron view camera unit is fully assembled when a single click sound is hear.



Fron view camera unit is fully assembled when a single click sound is hear.

NOTICE

- Fron view camera unit is fully assembled when a single click sound is hear.
- Connect the fron view camera unit connector.
- Connect the negative (-) battery terminal.

Front View Camera System - Repair Procedures (Article 44723)

- Service Point Target Auto Calibration (SPTAC)

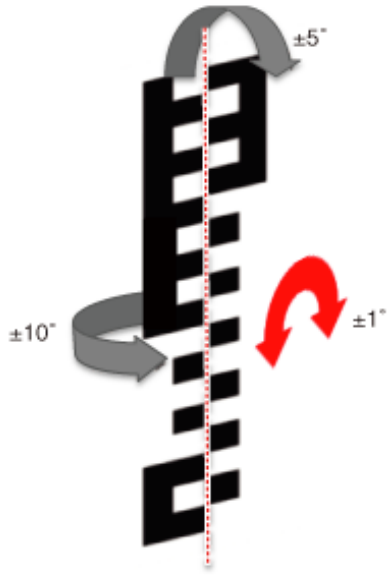
When you need calibration :

- Front view camera is removed and mounted
- Replace front view camera with a new one
- Windshield glass changed
- Front view camera coupler of the windshield glass is deformed

Service Point Target Auto Calibration (SPTAC)

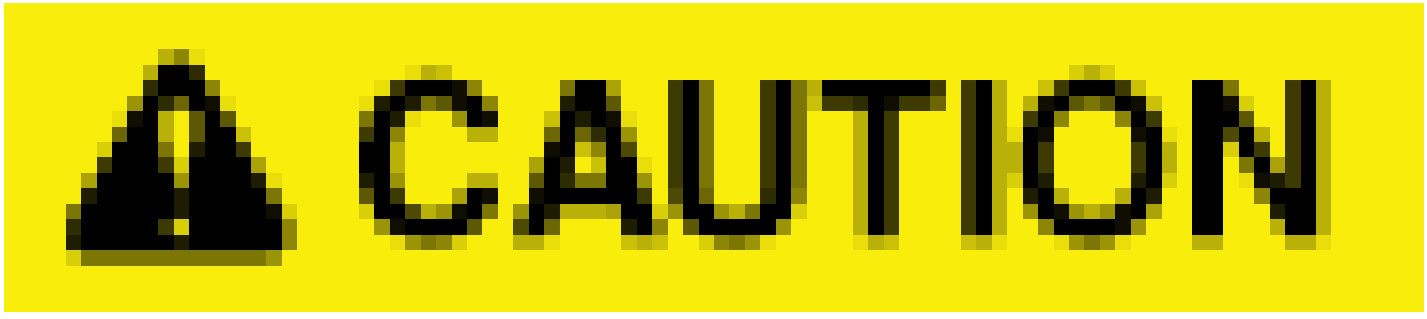
- Method for Correct Alignment of Calibration Target In order to complete the calibration of the front view camera successfully, install the calibration target as follows: Install the target (SST: 09890-3V100) vertical to the ground and from the camera referring to the below tolerance angle. The tolerance ± 1° for the left and right gradient is very important and is sensitive to the flatness of the ground. Install the compensator vertically using the Level Laser (SST: 09958-3T060 or 09964-C1200). Arrange the Level Laser (A) on the center of the vehicle by installing it on the roof center above the vehicle's front windshield (same for both short and long distance calibrations) . Have the laser illuminate starting from the roof center and to all the way to the center of the target, passing through the emblem center. The level laser must be set to 'ON' and the holding (locking) function is not used. Target is mounted to rigid backer material to maintain flatness requirements. Target has reflective (not faded or poorly painted) markings that are unlike from lane features. Target is 30 cm wide and 100 cm tall. Mounting area must NOT have cross hatch patterns or textual markings near the target. Target should be well lit for optimal performance using non-fluctuating illumination. There shall be no continuous shadows cast on the target. The light should be directed toward the target front and the target front should be brighter than the target rear and target.
- Install the target (SST: 09890-3V100) vertical to the ground and from the camera referring to the below

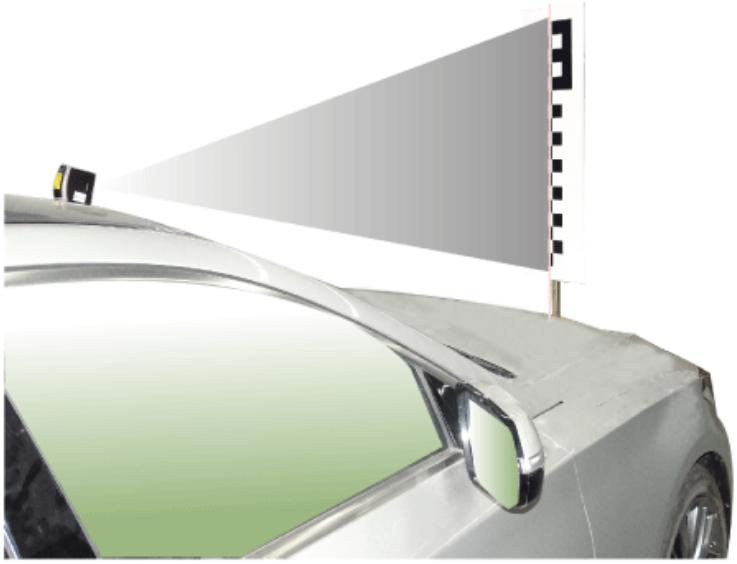
tolerance angle.



	L/R torsion	F/B gradient	L/R gradient
Tolerance angle	± 10˚	± 5˚	± 1˚

The tolerance ± 1° for the left and right gradient is very important and is sensitive to the flatness of the ground. Install the compensator vertically using the Level Laser (SST: 09958-3T060 or 09964-C1200). Arrange the Level Laser (A) on the center of the vehicle by installing it on the roof center above the vehicle's front windshield (same for both short and long distance calibrations) . Have the laser illuminate starting from the roof center and to all the way to the center of the target, passing through the emblem center. The level laser must be set to 'ON' and the holding (locking) function is not used.





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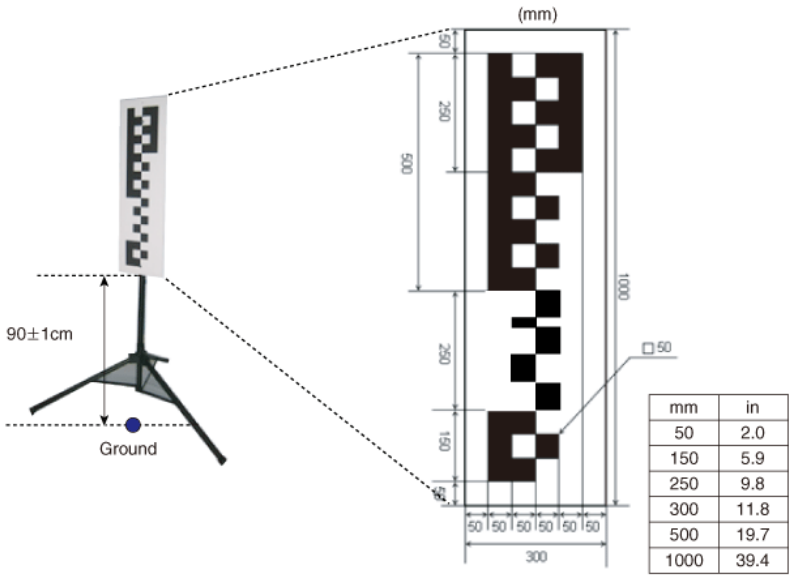

mm	in
50	2.0
150	5.9
250	9.8
300	11.8
500	19.7
1000	39.4

- Service Point Target Auto Calibration (SPTAC) Procedure It is recommended to check vehicle toe-in and tire pressure levels to ensure proper alignment of the camera to the "world" before proceeding with calibration. The vehicle to run the calibration routine is to be at nominal production loading capacity. Windshield must be clean and silk-screen checked so that there is no blockage of the camera. Service technician connects the diagnostic connector and starts the vehicle. The front view camera should not be activated by pressing the switch. The service calibration routine may not run correctly if any system level fault is active. If working with a replacement ECU : the service technician initiates the SPTAC Reset configuration. Service technician either aligns the vehicle to the target or the target to the vehicle. a. Locate the bottom of the target 90cm from the ground (max. tolerance : 1cm). b. Locate so that the central axis of the target and the central axis of the vehicle match (max. tolerance : 3cm). c. Locate the short-distance target (A) so that it adheres by 0cm (B) to the bumper front (max. tolerance : 5cm). d. The location of the long-distance target (C) is 100cm (D) before the bumper (max. tolerance : 5cm). Select Camera Calibration under Option of Global Diagnosis System (GDS). The technician should complete the short-distance calibration after checking the target location and "OK" message on the GDS. The technician should complete the long-distance calibration after checking the target location and "OK" message on the GDS (conduct the calibration twice : short and long distances). If the distance 100 ± 5 cm (39.4 ± 2 inch) is different from the distance indicated on the GDS, calibrate it according to the value indicated on the GDS.
- It is recommended to check vehicle toe-in and tire pressure levels to ensure proper alignment of the camera to the "world" before proceeding with calibration. The vehicle to run the calibration routine is to be at nominal production loading capacity.
- Windshield must be clean and silk-screen checked so that there is no blockage of the camera.
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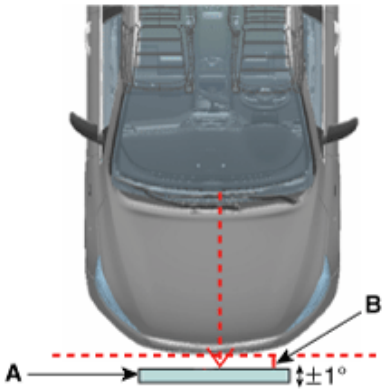
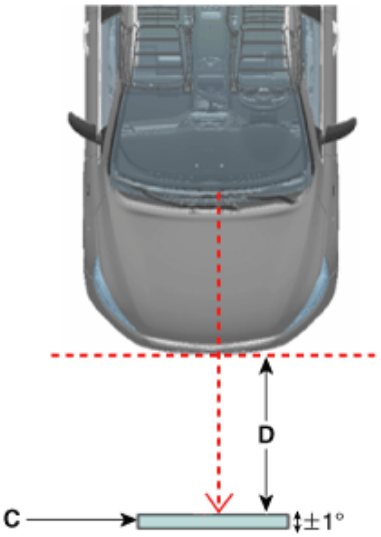
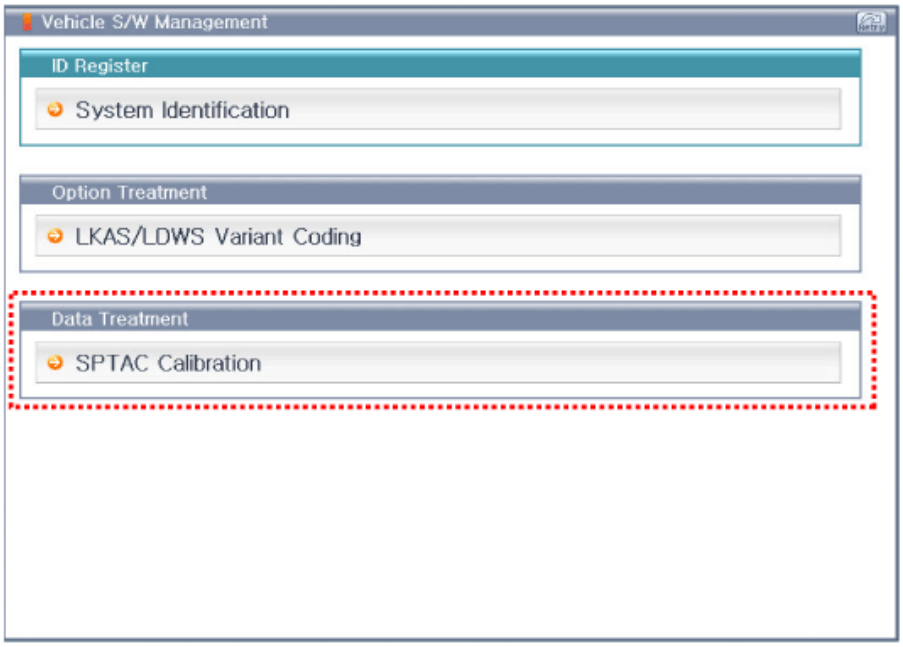
[The position of target in short distance]

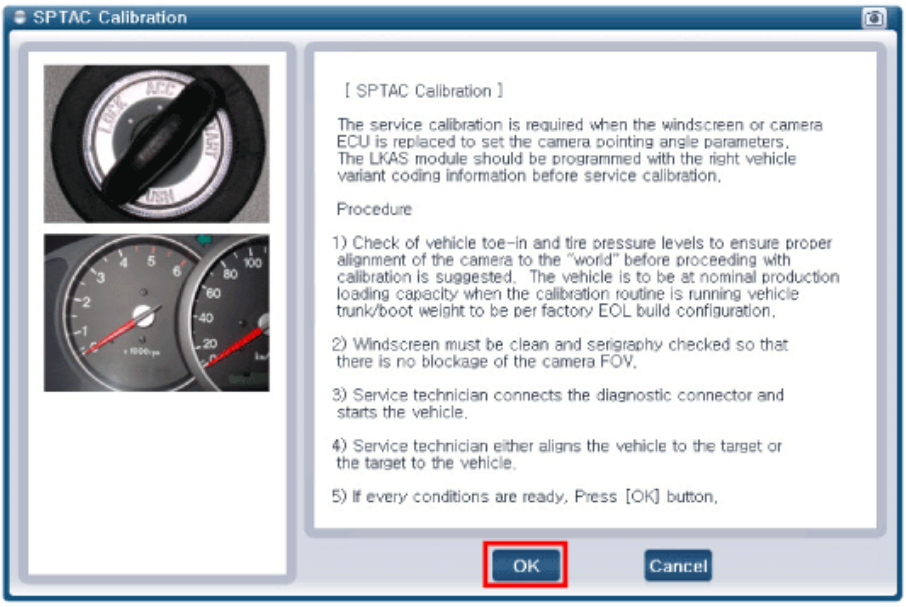


[The position of target in long distance]

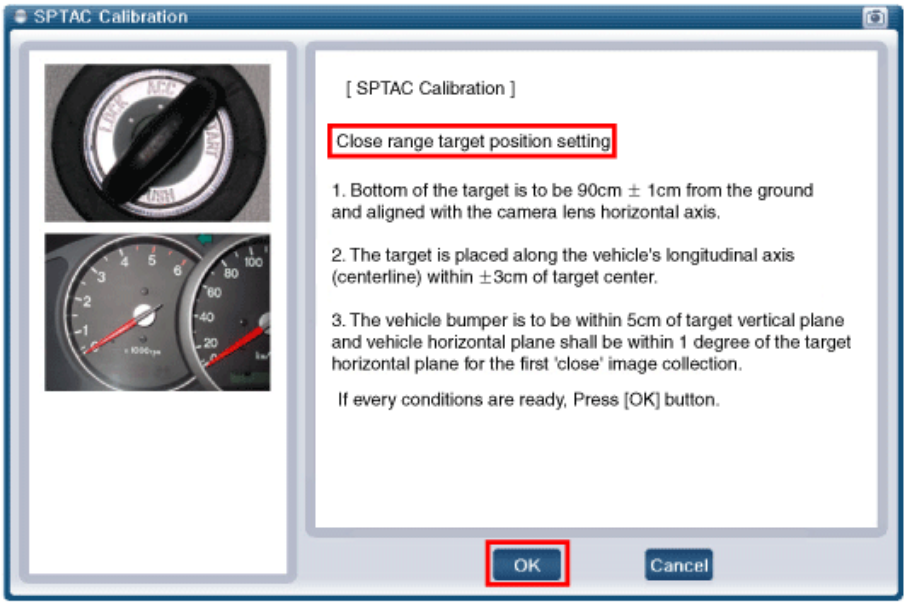


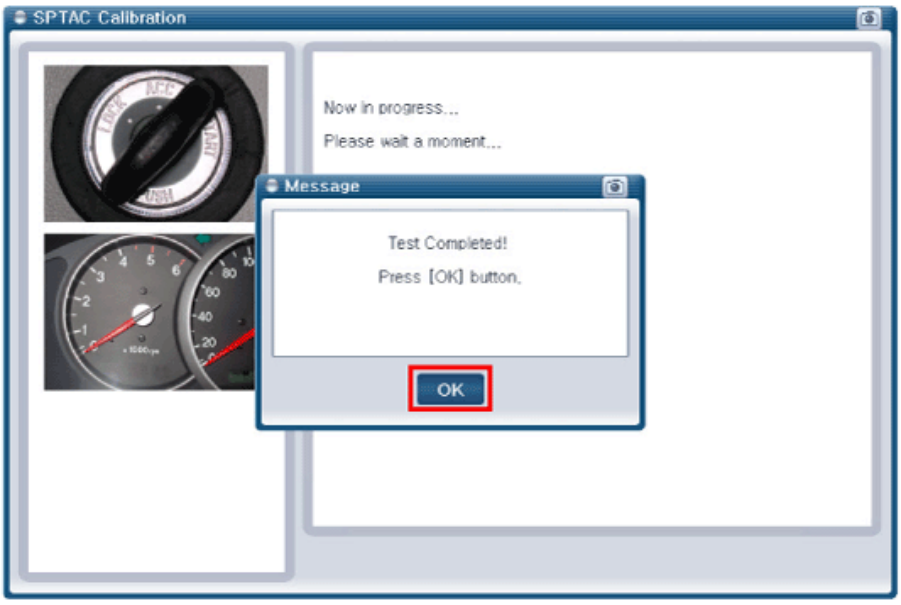
- Select Camera Calibration under Option of Global Diagnosis System (GDS).





- The technician should complete the short-distance calibration after checking the target location and "OK" message on the GDS.





- The technician should complete the long-distance calibration after checking the target location and "OK" message on the GDS (conduct the calibration twice : short and long distances). If the distance 100 ± 5 cm (39.4 ± 2 inch) is different from the distance indicated on the GDS, calibrate it according to the value indicated on the GDS.

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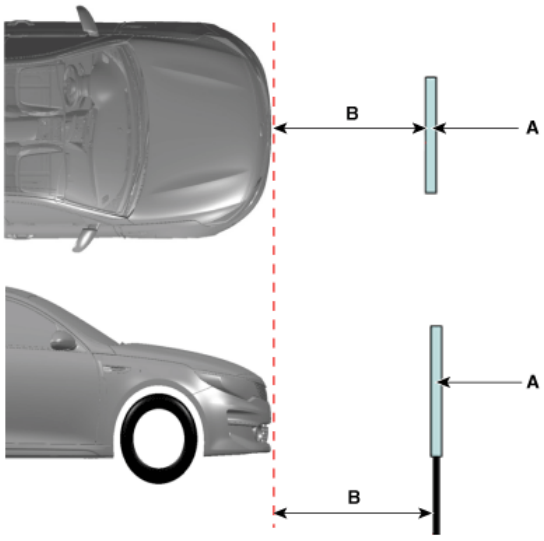
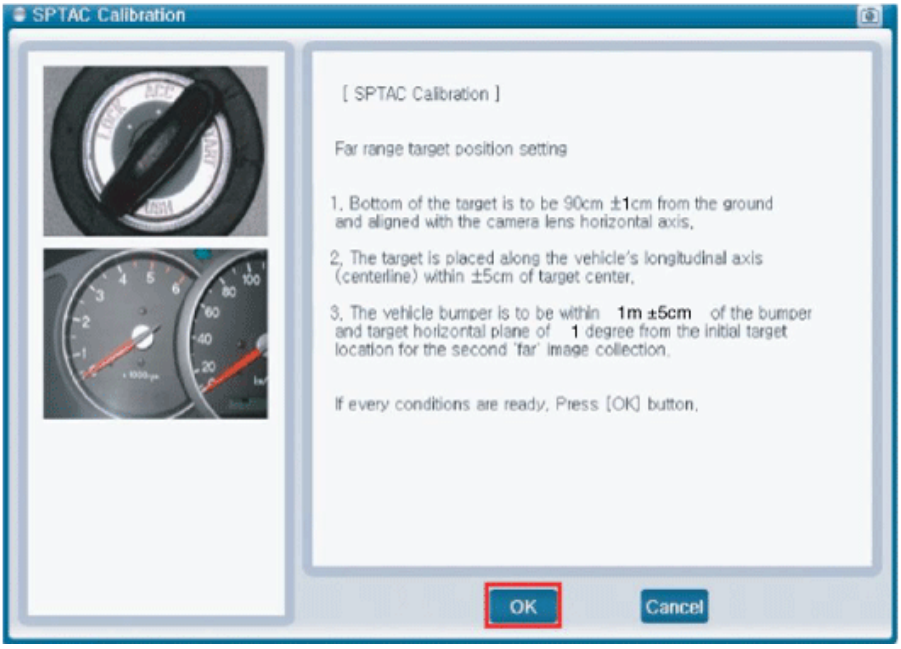
Information





Test Drive

Be sure to perform test drive to check for normal operation after performing calibration. Drive on straight road (of longer than 500 m) with 2 white or yellow lane marks at speed of over 60km/h (64mph), and check for the alert as you intentionally steer close to the lane mark. LKA operates properly if the lane mark segment space is less than 8 m. Perform test drive on car-only road or on a highway.

- Be sure to perform test drive to check for normal operation after performing calibration.
- Drive on straight road (of longer than 500 m) with 2 white or yellow lane marks at speed of over 60km/h (64mph), and check for the alert as you intentionally steer close to the lane mark.
- LKA operates properly if the lane mark segment space is less than 8 m.
- Perform test drive on car-only road or on a highway.

The LKA may not activate properly in the following conditions The LKA may not activate properly when: It is difficult to distinguish the lane from the road due to dust built up on the lane. It is difficult to distinguish the color of the lane line from the road. There is a mark that looks like a lane line near the line. The lane line is indistinct or damaged. The number of lanes increases or decreases or the lane lines are crossing (driving through toll plaza, toll gate, road merging or dividing area, etc.). There are more than two lane lines. The lane is very wide or narrow. The lane is not visible due to snow, rain, stain, a puddle or other factors. Shadows of objects (median strip, guard rail, noise barriers, etc.) surrounding the road are casted on the lane. The lane is congested or it is replaced by a structure in a construction area. There is a indication on the road surface such as crosswalk or road signs. The lane inside the tunnel is covered with dust or oil. The brightness outside changes suddenly such as when entering or exiting a tunnel. The head lamps are not on at night or in a tunnel, or light level is low. There is a boundary structure. Light such as street light, sunlight or oncoming vehicle light reflects from the water on the road. Driving with the sun in front of you. Driving on the bus-only lane or on the left/right of the lane. The lane suddenly disappears at certain locations such as at the intersection. The distance from the vehicle ahead is extremely short or that vehicle drives hiding the lane line. Driving on a steep grade or a sharp curve. The vehicle vibrates heavily. The surrounding of the inside rear view mirror temperature is high due to direct sun light. The lens or windshield is covered with foreign matter. Tthe sensor cannot detect the lane because of fog, heavy rain, or heavy snow. The windshield is fogged by humid air in the vehicle. Putting something on the crash pad.

- It is difficult to distinguish the lane from the road due to dust built up on the lane.
- It is difficult to distinguish the color of the lane line from the road.
- There is a mark that looks like a lane line near the line.
- The lane line is indistinct or damaged.
- The number of lanes increases or decreases or the lane lines are crossing (driving through toll plaza, toll gate, road merging or dividing area, etc.).
- There are more than two lane lines.
- The lane is very wide or narrow.
- The lane is not visible due to snow, rain, stain, a puddle or other factors.
- Shadows of objects (median strip, guard rail, noise barriers, etc.) surrounding the road are casted on the lane.

- The lane is congested or it is replaced by a structure in a construction area.
- There is a indication on the road surface such as crosswalk or road signs.
- The lane inside the tunnel is covered with dust or oil.
- The brightness outside changes suddenly such as when entering or exiting a tunnel.
- The head lamps are not on at night or in a tunnel, or light level is low.
- There is a boundary structure.
- Light such as street light, sunlight or oncoming vehicle light reflects from the water on the road.
- Driving with the sun in front of you.
- Driving on the bus-only lane or on the left/right of the lane.
- The lane suddenly disappears at certain locations such as at the intersection.
- The distance from the vehicle ahead is extremely short or that vehicle drives hiding the lane line.
- Driving on a steep grade or a sharp curve.
- The vehicle vibrates heavily.
- The surrounding of the inside rear view mirror temperature is high due to direct sun light.
- The lens or windshield is covered with foreign matter.
- Tthe sensor cannot detect the lane because of fog, heavy rain, or heavy snow.
- The windshield is fogged by humid air in the vehicle.
- Putting something on the crash pad.

The LKA may not activate properly in the following conditions: The LKA is a system to prevent lane departure and assist steering. In any case, do not rely on the steering assist system, and the driver must take the necessary precautions to determine safety matters. Driver is responsible for being aware of surroundings and steering the vehicle for safe driving practices. Do not steer the steering wheel suddenly when the steering wheel is being assisted by the system. LKA helps prevent the driver from moving out of the lane unintentionally by assisting the driver's steering. LKA is not working if the camera cannot detect the lane or if the vehicle speed does not exceed 64km/h(40mph), Do not disassemble front view camera temporarily for tinted window or attaching any types of coatings and accessories. Do not allow any water or liquid to contact the front view camera. Do not remove the front view camera parts and do not damage the front view camera by a strong impact. Do not put objects that reflect light on the crash pad. Excessive noise can make the LKA alarm sound unheard.

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- Do not allow any water or liquid to contact the front view camera.
- Do not remove the front view camera parts and do not damage the front view camera by a strong impact.
- Do not put objects that reflect light on the crash pad.
- Excessive noise can make the LKA alarm sound unheard.

High Beam Assist

The system may not operate normally in the below conditions. When the light from the oncoming or front vehicle is not detected because of lamp damage, hidden from sight, etc. When the lamp of the oncoming or front vehicle is covered with dust, snow or water. When the light from the oncoming or front vehicle is not detected because of exhaust fume, smoke, fog, snow, etc. When the front window is covered with foreign matters such as ice, dust, fog, or is damaged. When there is a similar shape lamp with the front vehicle's lamps. When it is hard to see because of fog, heavy rain or snow. When the headlamp is not repaired or replaced at an authorized dealer. When headlamp aiming is not properly adjusted. When driving on a narrow curved road or rough road. When driving downhill or uphill. When only part of the vehicle in front is visible on a crossroad or curved road. When there is a traffic light, reflecting sign, flashing sign or mirror. When the road conditions are bad such as being wet or covered with snow. When the front vehicle's headlamps are off but the fog lamps on. When a vehicle suddenly appears from a curve. When the vehicle is tilted from a flat tire or being towed. When the LDW /LKA warning light illuminates. Replace MFC with a new one Windshield glass changed

- When the light from the oncoming or front vehicle is not detected because of lamp damage, hidden from sight, etc.
- When the lamp of the oncoming or front vehicle is covered with dust, snow or water.
- When the light from the oncoming or front vehicle is not detected because of exhaust fume, smoke, fog, snow, etc.

- When the front window is covered with foreign matters such as ice, dust, fog, or is damaged.
- When there is a similar shape lamp with the front vehicle’s lamps.
- When it is hard to see because of fog, heavy rain or snow.
- When the headlamp is not repaired or replaced at an authorized dealer.
- When headlamp aiming is not properly adjusted.
- When driving on a narrow curved road or rough road.
- When driving downhill or uphill.
- When only part of the vehicle in front is visible on a crossroad or curved road.
- When there is a traffic light, reflecting sign, flashing sign or mirror.
- When the road conditions are bad such as being wet or covered with snow.
- When the front vehicle’s headlamps are off but the fog lamps on.
- When a vehicle suddenly appears from a curve.
- When the vehicle is tilted from a flat tire or being towed.
- When the LDW /LKA warning light illuminates.
- Replace MFC with a new one