SMART KEY MODULE

8712-04

GENERAL INFORMATION

1. SPECIFICATIONS

▶ **SKM (Smart Key Module)**

Category	Item	Specifications
SKM unit (Electric)	Rated voltage	12.0V
	Operating voltage	9.0V ~ 16.0V (CAN: 7.0V to 18.0 V)
	Operating temperature	−30˚C ~ +80˚C
	Max. operating humidity	95%
	Dark current	Below 5 mA
	Voltage drop	Below 1.0 V
SKM unit (wireless)	Receive frequency	433.92MHz ± 0.0125MHz
	Frequency bandwidth	15KHz ± 2KHz or less
	Receive distance	30 m or longer (when no obstacles)

▶ **Emergency antenna**

Category	Item	Specifications
Emergency antenna	Rated voltage	12.0 V
	Operating current	1.2 A (13.0 V)
	Operating temperature	−30°C ~ +80°C
	Coil inductance	440 uH ± 20 uH
	Modulation type	FSK (Frequency Shift Keying)
	Sending/receiving frequency	134.2KHz ± 0.42KHz

▶ **Smart key**

Category	Item	Specifications	
Smart key (Electric)	Operating voltage	3.0V	
	Operating temperature	−20˚C ~ +60˚C	
	Battery type	CR2032	
Smart key (wireless)	-	**RF (Radio Frequency) transmission**	**LF (Low Frequency) reception**
	Transmit/receive frequency	433.92 MHz ± 0.0125 MHz	134.2 kHz ± 2.0 kHz
	Modulation type	FSK (Frequency Shift Keying)	

* Smart key registration: max. 3

▶ **LF (Low Frequency) antenna**

Category	Item	Specifications
Smart key antenna	Frequency	134.2KHz ± 2.0KHz
	Current consumption	Max. 1.2A
	Operating temperature	−30˚C ~ +80˚C
Door outside handle switch	Operating voltage	5.0V
	Rated current	5 ~ 20mA
	Operating temperature	−30˚C ~ +80˚C

▶ **Exterior buzzer (SKM buzzer)**

Category	Item	Specifications
External buzzer (SKM buzzer)	Operating voltage	7.5 V ~ 14.5 V
	Operation temperature	−30˚C ~ 80˚C
	Sound pressure level	83 dB

Modification basis	
Application basis	
Affected VIN	

2. CODING ITEMS FOR ELECTRICAL UNITS REPLACEMENT

Category	EMS registration	Variant coding	Smart key & Transponder coding	Remarks
When replacing ECU	carried out under SKM menu	-	-	
When replacing BCM	-	carried out under BCM menu	-	
When replacing smart key	-	-	carried out under SKM menu	-
When replacing SKM	carried out under SKM menu	-	carried out under SKM menu	

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

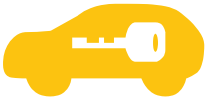
The SKM (Smart Key Module) system is equipped to only the vehicles with smart key and is to prevent theft and enhance the driver experience. When the driver presses a door handle switch carrying a smart key, this system checks the smart key information and driver door status and locks/unlocks the doors (passive entry function). The vehicle can be started when the driver enters the vehicle and presses the START/STOP switch (passive start function).

2. COMPONENTS

A Start/stop switch and emergency coil

Emergency antenna	START/STOP SWITCH
	

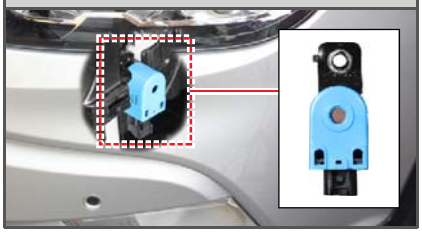
B Key in/out indicator



C SKM

D BCM

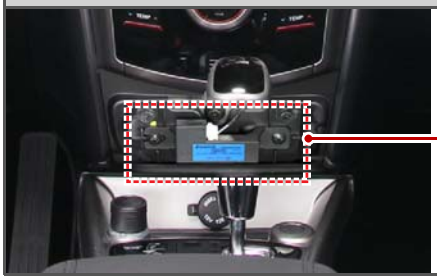
E Exterior buzzer (SKM buzzer)



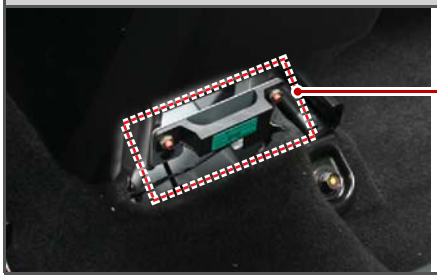
Smart key

Modification basis	
Application basis	
Affected VIN	

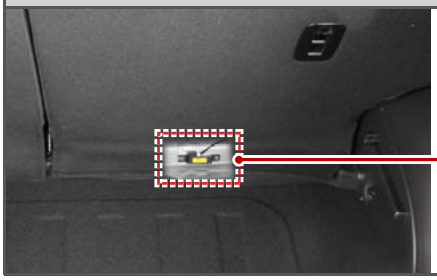
F Interior (front) antenna



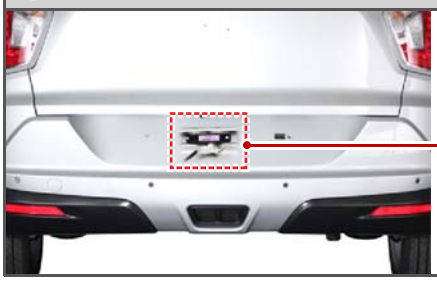
G Interior (center) antenna



H Interior (rear) antenna



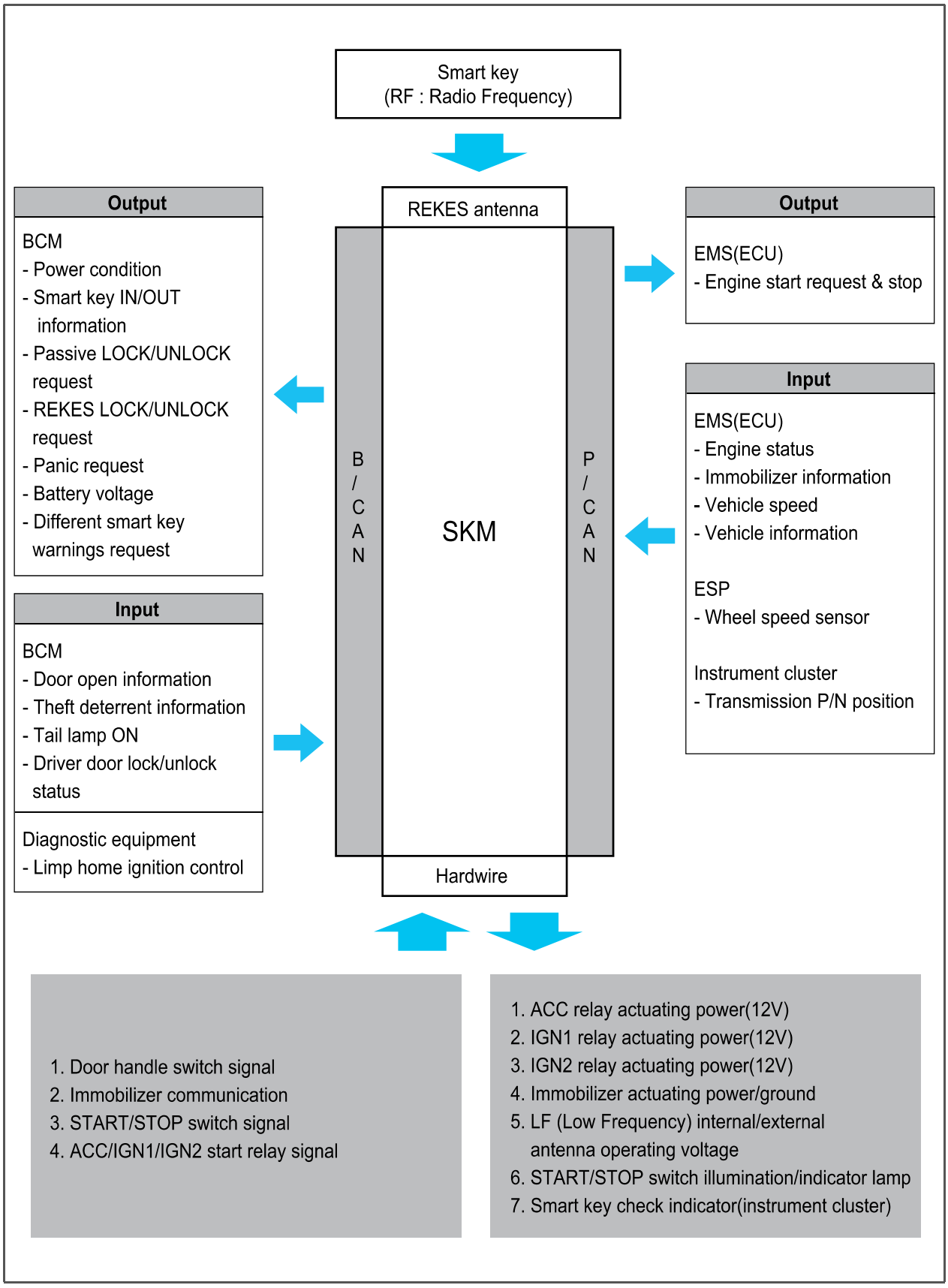
I Exterior (bumper) antenna



J Door handle switch & antenna

Modification basis	
Application basis	
Affected VIN	

3. INPUT/OUTPUT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

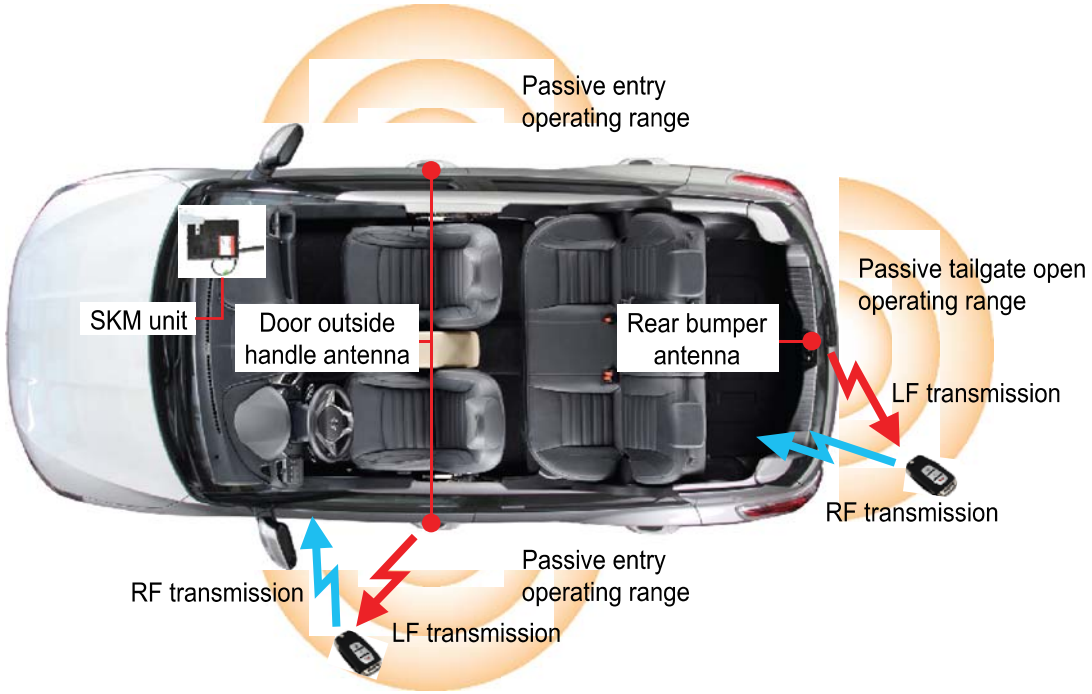
4. PASSIVE ENTRY MANAGEMENT

- Searching for a smart key signal from the outside the vehicle is prioritized in the theft deterrent mode when the passive entry (operating door handle switch) signal is received. Searching for a smart key signal from the inside is prioritized when the theft deterrent mode is deactivated.
- Searching for a smart key is carried out for a maximum of 1.5 seconds.

1) Passive Function

(1) Passive entry actuation area

- The passive entry actuation area refers to the area where passive LOCK/UNLOCK can be performed by pressing the switch on the driver or passenger door handle with a smart key carried by the driver.
- The passive tailgate open actuation area refers to the area where the tailgate can be opened by pressing the tailgate switch with a smart key carried by the driver.



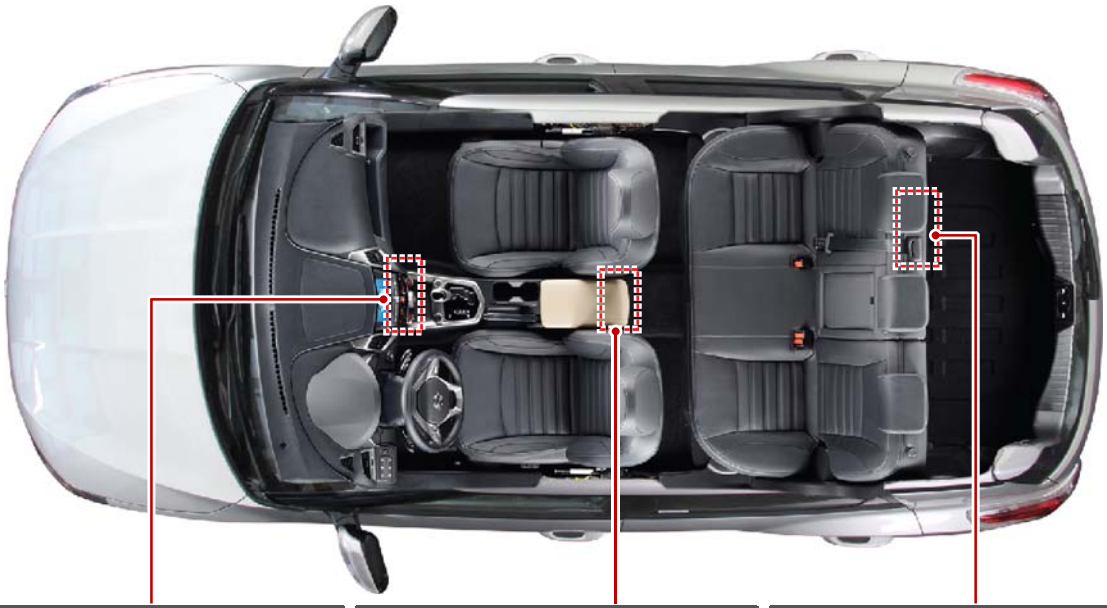
LF transmission: Authentication request signal
RF transmission: Response signal

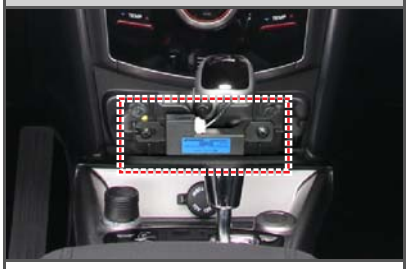
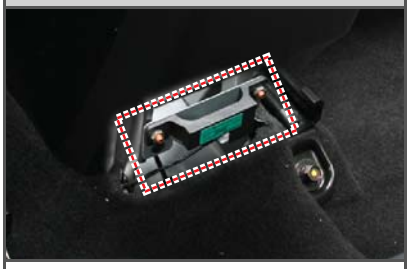
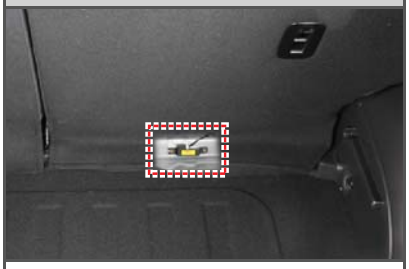
NOTE

- Passive entry function actuation area: Within 1m from the door handle antenna
- Passive tailgate open actuation area: Within 1m from the center of the bumper

(2) Passive start actuation area

- Starting the engine by pressing the START/STOP switch with the gear selector lever in "P" or "N" position and the brake pedal depressed (START/STOP switch LED: green) after the driver has entered the vehicle carrying a smart key.



Interior (front) antenna	Interior (center) antenna	Interior (rear) antenna
		
		

- Passive start actuation area: whole vehicle interior

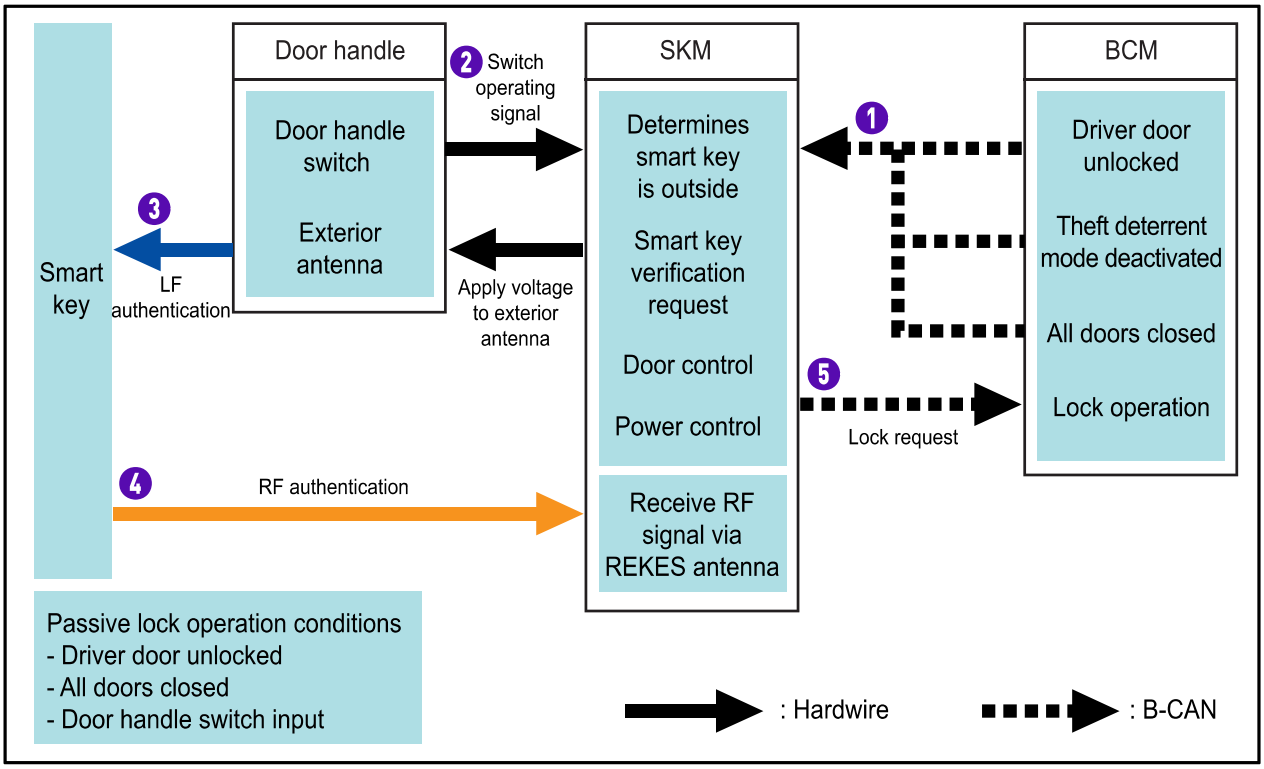
CAUTION

- The smart key authentication many not possible in an area where the communication is poor, such as the seat cushion that the seat heated wire is operated, around the pedals and the on the floor. The smart key system malfunctions may occur when generating radio waves around the smart key
- or vehicle, or attaching a electronic device which generates radio waves on the smart key or vehicle.

Modification basis	
Application basis	
Affected VIN	

(3) Passive LOCK

The passive LOCK (door LOCK) is activated by the door handle switch with a valid smart key present within the passive entry actuation area.



▶ Passive LOCK and authentication by door handle switch

- With power off or ACC on,

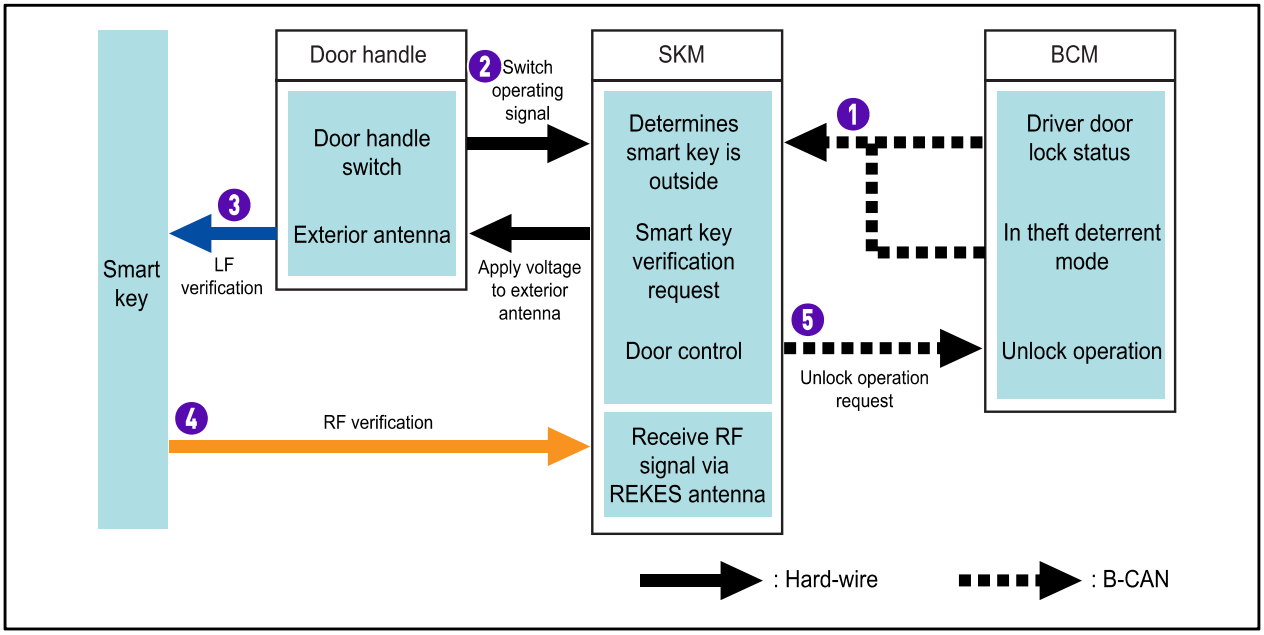
1. When all doors are closed, driver door is unlocked, system is in disarmed mode and
2. The door handle switch on the driver or passenger door is pressed briefly,
3. The SKM verifies if a smart key is outside the vehicle using the door handle antenna (LF authentication) (The SKM searches the last smart key used first. Searching for a smart key signal from the outside the vehicle is followed by searching from the inside the vehicle).
4. The authentication signal (RF authentication) from the smart key is sent to the REKES antenna of the SKM.
5. The SKM sends the Passive LOCK signal to the BCM through the B-CAN if the verified smart key is found outside the vehicle.
6. The BCM receives the signal from the SKM and controls the door LOCK actuator and turn signal lamp. (Hazard warning lamp flashes twice when system enters theft deterrent mode.)

NOTE

- If no smart key is identified as being outside the vehicle, the passive LOCK process is stopped and restarted when the next signal is received from the door handle switch.
- When the door handle switch is pressed with ACC ON and driver door unlocked, the SKM changes the ignition status to OFF and sends the passive LOCK signal to the BCM through the B-CAN to lock the door. The BCM ignores the signal if the ignition is turned ON.

(4) Passive UNLOCK

The passive UNLOCK (door UNLOCK) is activated by the door handle switch with a valid smart key present within the passive entry actuation area.



▶ Passive UNLOCK and authentication by door handle switch

1. The driver door is locked and the system in the theft deterrent mode.
2. The door handle switch on the driver or passenger door is pressed briefly.
3. The SKM verifies if a smart key is outside the vehicle using the door handle antenna (LF authentication) (The SKM searches the last smart key used first).
4. The authentication signal (RF authentication) from the smart key is sent to the REKES antenna of the SKM.
5. The SKM sends the Passive UNLOCK signal to the BCM through the B-CAN if the verified smart key is found outside the vehicle.
6. The BCM receives the signal from the SKM and controls the door UNLOCK actuator and turn signal lamp. (Hazard warning lamp flashes once when system enters theft deterrent mode.)

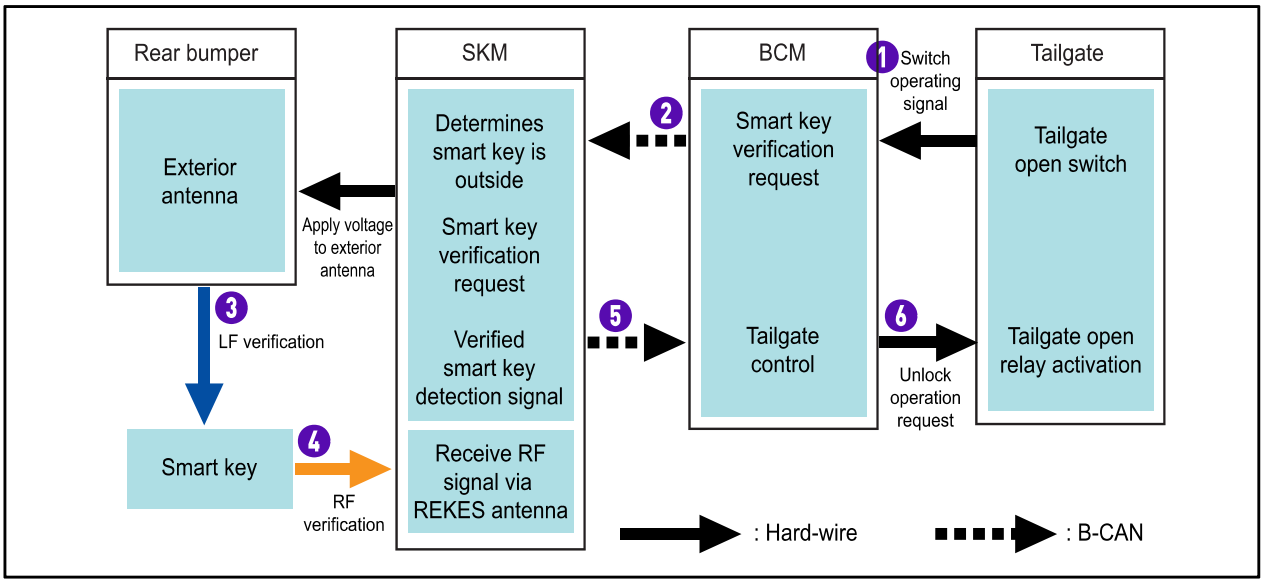
NOTE

- If no smart key is identified as being outside the vehicle, the passive UNLOCK process is stopped and restarted when the next signal is received from the door handle switch.
- When the driver door is locked with ACC ON, the SKM sends the Passive UNLOCK signal to the BCM through the B-CAN to unlock the door without changing the ignition status to OFF. (The vehicle power is turned OFF when the door is opened.)
- Smart key searching
  * Theft deterrent mode: deactivated after searching the outside vehicle
  * Theft deterrent mode deactivated: outside searching after inside searching

Modification basis	
Application basis	
Affected VIN	

(5) Passive tailgate open

The tailgate open control is activated by the tailgate open switch with a valid smart key present within the passive entry actuation area.



▶ Passive tailgate open by tailgate open switch

- When driver door is locked, system is in theft deterrent mode and

1. The tailgate open switch operation signal is received,
2. The BCM sends the valid smart key authentication request signal to the SKM.
3. The SKM verifies if a smart key is outside the vehicle using the corresponding rear bumper antenna (LF authentication) (The SKM searches the last smart key used first. If a valid smart key searching is completed, searching for a key in the luggage compartment and inside the vehicle is started).
   The authentication signal (RF authentication) from the smart key is sent to the REKES antenna of the
4. SKM.
   The SKM sends the Passive tailgate open signal to the BCM through the B-CAN if the verified smart
5. key is found outside the vehicle.
   The BCM activates the tailgate open relay according to the signal received from the SKM.
6. (Only the theft deterrent mode for tailgate is deactivated.)

NOTE

When opening and closing passive tailgate (when valid smart key detected indoors)

- SKM searches for smart key indoors
- "Smart Key Detected" warning triggered if valid smart key detected indoors

When opening and closing passive tailgate (when valid smart key not detected indoors)

- SKM searches for smart key indoors
- Valid smart key not detected indoors
- Tailgate door locked and system enters theft deterrent mode

5. REKES CONTROL FUNCTION

▶ REKES LOCK operation

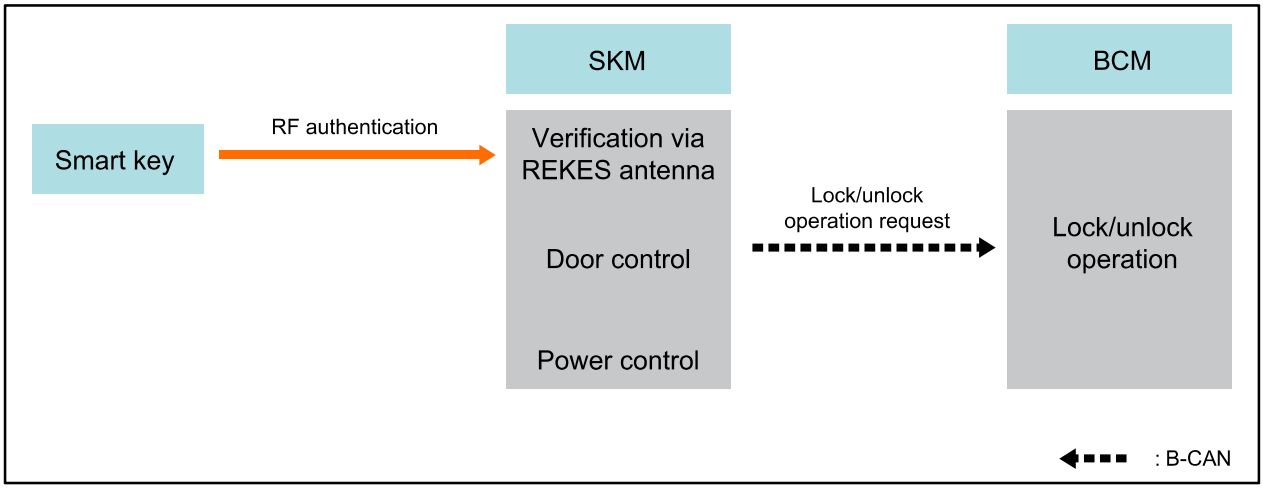
1. Press LOCK button on the smart key for less than 1.5 seconds to send REKES lock signal
2. The SKM receives the REKES LOCK signal and sends the REKES LOCK request signal to the BCM through B-CAN.
3. The BCM outputs the door LOCK signal according to the signal received from the SKM.

NOTE

When the REKES LOCK signal is received with the ACC ON, the ACC is turned OFF and the REKES LOCK signal is sent.

▶ REKES unlock operation

1. Press UNLOCK button on the smart key for more than 0.03 seconds to send REKES lock signal
2. The SKM receives the REKES UNLOCK signal and sends the REKES UNLOCK request signal to the BCM through B-CAN.
3. The BCM outputs the door UNLOCK signal according to the signal received from the SKM.



▶ REKES panic

1. With ignition key in OFF, ACC or IGN position,
2. The panic signal is sent when the panic button on the smart key is pressed for 1 second or longer.
3. The SKM receives the panic signal and sends the panic request signal to the BCM through B-CAN.
4. The BCM controls the panic alarm and hazard warning lamp.

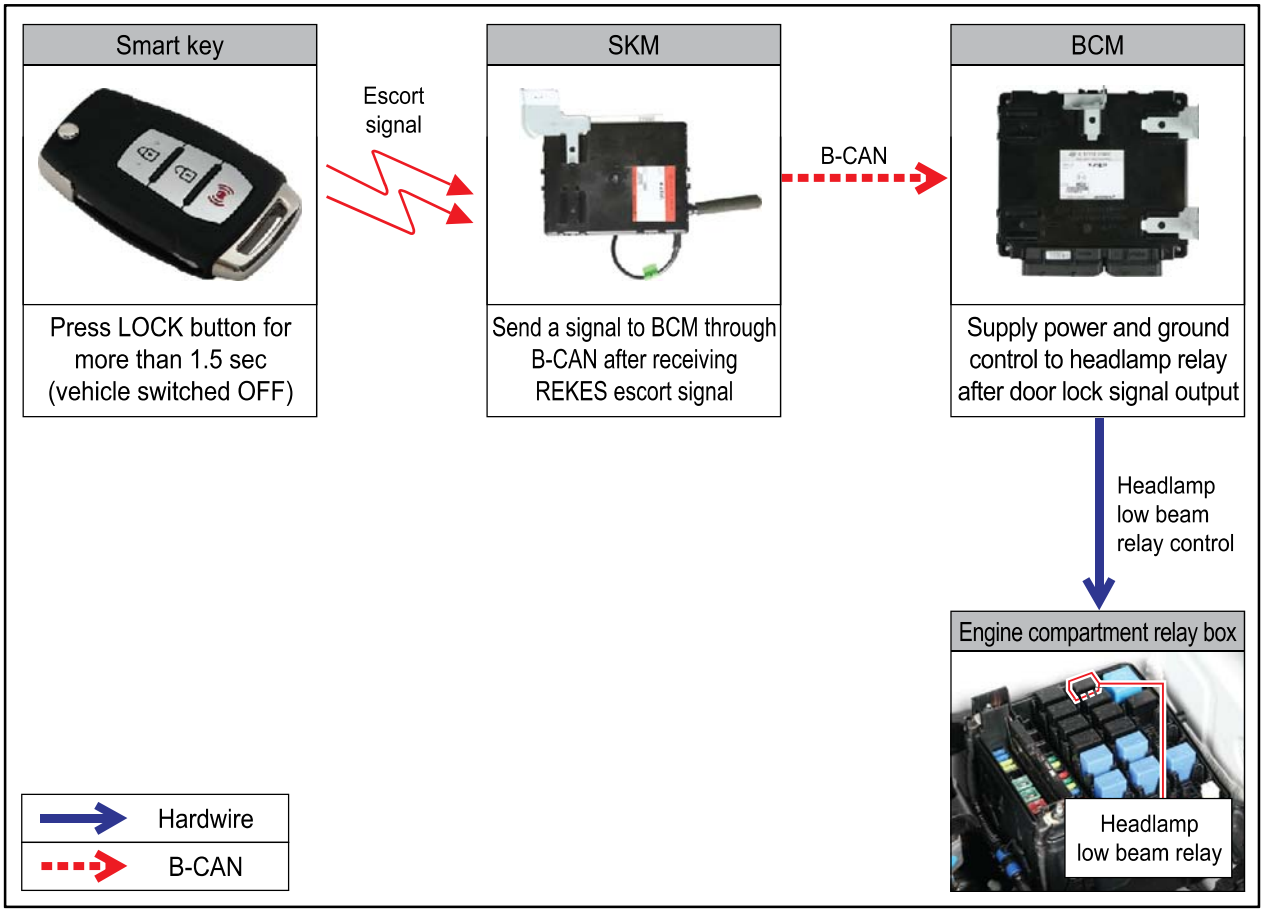
NOTE

When the panic button on the smart key is pressed again during the panic alarm operation, the SKM sends the panic operation command to the BCM to stop the panic alarm.

Modification basis	
Application basis	
Affected VIN	

▶ REKES escort

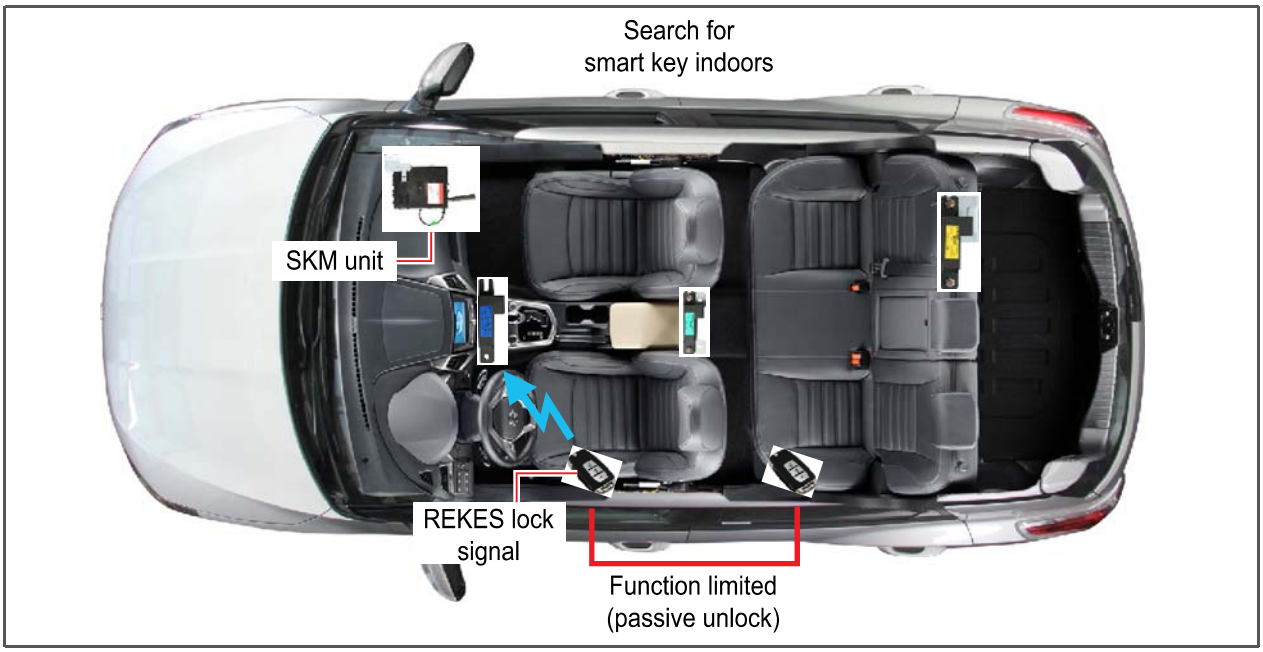
1. The LOCK button on the smart key is pressed 1.5 second or more.
2. The system enters the theft deterrent mode after the doors are locked.
3. The SKM receives the REKES escort signal and sends the REKES escort request signal to the BCM through B-CAN.
4. After receiving the escort signal, the BCM turns on the headlamp for 20 seconds and then turns off the headlamp by controlling the circuit that supplies the power to the headlamp relay and ground that controls the relay.



6. SMART KEY FUNCTION LIMITATION (SILENT)/ DEACTIVATION

▶ **Silent smart key**

Limits the passive UNLOCK function when searching for the smart key which activated the REKES LOCK inside the vehicle (including external/internal antenna overlapping area), to prevent the break-in.



Silent activation conditions **- All doors closed (B-CAN)** **- Theft deterrent mode activated (B-CAN)** **- Smart key search**	Silent: The passive UNLOCK is unavailable when REKES LOCK is carried out with a smart key inside the vehicle.

- **Silent smart key activation**

1. The REKES LOCK (theft deterrent mode activation) request signal is sent by a smart key inside the vehicle.
2. The smart key activated REKES LOCK is found in the vehicle.
3. All smart keys in the vehicle including the one that output the REKES LOCK are memorized as silent smart keys, and the passive UNLOCK is not available with these keys.

- **Silent smart key function**

1. Passive UNLOCK not available
2. Passive start & power control available
3. REKES function available

- **Cancellation of silent smart key**

1. When the theft deterrent mode is deactivated, the silent smart key functions are available.

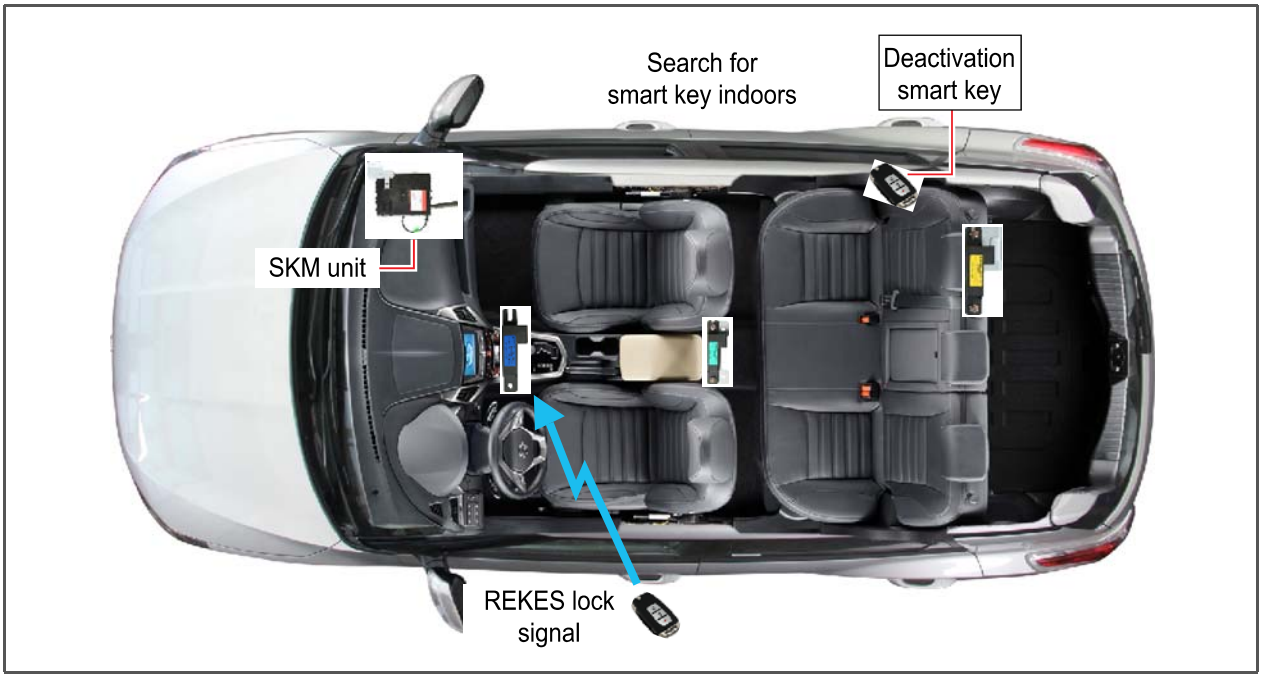
Modification basis	
Application basis	
Affected VIN	

▶ Smart key deactivation

This function prevents the operation by the smart key inside the vehicle even if the driver breaks in the vehicle in the theft deterrent mode.

NOTE

In theft deterrent mode, the smart key(s) inside the vehicle is deactivated to prevent theft.



Deactivation conditions **- All doors closed (B-CAN)** **- Theft deterrent mode activated (B-CAN)** **- Smart key search**	FOB deactivation: The smart key inside the vehicle is deactivated when the passive LOCK/REKES LOCK signal is input by a smart key from the outside.

- **Smart key deactivation**

1. The REKES LOCK/passive LOCK (theft deterrent mode activation) request signal is sent by a smart key outside the vehicle.
2. The smart key activated door LOCK is not found in the vehicle.
3. The system memorizes all smart keys found inside the vehicle as deactivated ones.

- **Smart key deactivation actuation area**

1. Passive entry not available
2. Passive starting & power control not available
3. REKES function not available

- **Cancellation of smart key deactivation**

1. When the theft deterrent mode is deactivated using a smart key outside the vehicle, the deactivated smart key functions returns to be available.

7. SMART KEY AUTHENTICATION TIME CONTROL

The smart key authentication time control consists of pre-authentication timer and immobilizer authentication timer, and no authentication process is required for 30 seconds after the each authentication process has been completed.

- Pre-authentication timer: Time for performing start & power mode function that controls the vehicle power.
- Immobilizer authentication timer: Time for which the start with a smart key is possible after the SKM and EMS (ECU) verify the immobilizer.

Category	Pre-authentication timer	Immobilizer authentication timer
Operating power	Power OFF, ACC, IGN ON	IGN ON after pre-authentication (ACC)
Function	Time for which the power control can be carried out under the verified conditions (30 seconds after the authentication)	Time for which the start request can be carried out without a smart key under the verified conditions (30 seconds after the authentication)
Input conditions	1. All doors closed (including tailgate) 2. START/STOP switch input 3. Brake switch signal input 4. Smart key searching completed 5. Engine start ON to OFF	1. Brake switch signal input 2. START/STOP switch input
Authentication conditions	Smart key searching completed after the following conditions are met: 1. Close signal input after any door opened 2. Brake switch signal input 3. START/STOP switch signal input 4. After IGN OFF	1. Power changed from ACC to IGN ON after valid pre-authentication 2. Power changed from ACC to IGN ON by smart key authentication after pre-authentication timer expires (30 s) 3. Smart key authenticated by brake switch input after immobilizer authentication timer expires (30 s) with IGN ON Smart key authenticated when turning 4. START/STOP switch from off to on and immobilizer authentication timer expires (30 s) with IGN on, immobilizer authenticated and brake switch input

Modification basis	
Application basis	
Affected VIN	

Category	Pre-authentication timer	Immobilizer authentication timer
Deactivation conditions	1. 30 seconds has been passed after the pre-authentication timer 2. Door handle switch ON 3. IGN ON 4. Theft deterrent mode activation/ deactivation 5. Door status changed (open/closed)	1. 30 seconds has been passed after the immobilizer authentication timer 2. IGN1 OFF 3. No smart key is found inside the vehicle with all doors closed after any door has been opened and then closed.
If any condition for pre-authentication timer and immobilizer authentication timer is met, no authentication process is required for 30 seconds after the each authentication process has been completed.		

NOTE

Operation before pre-authentication timer

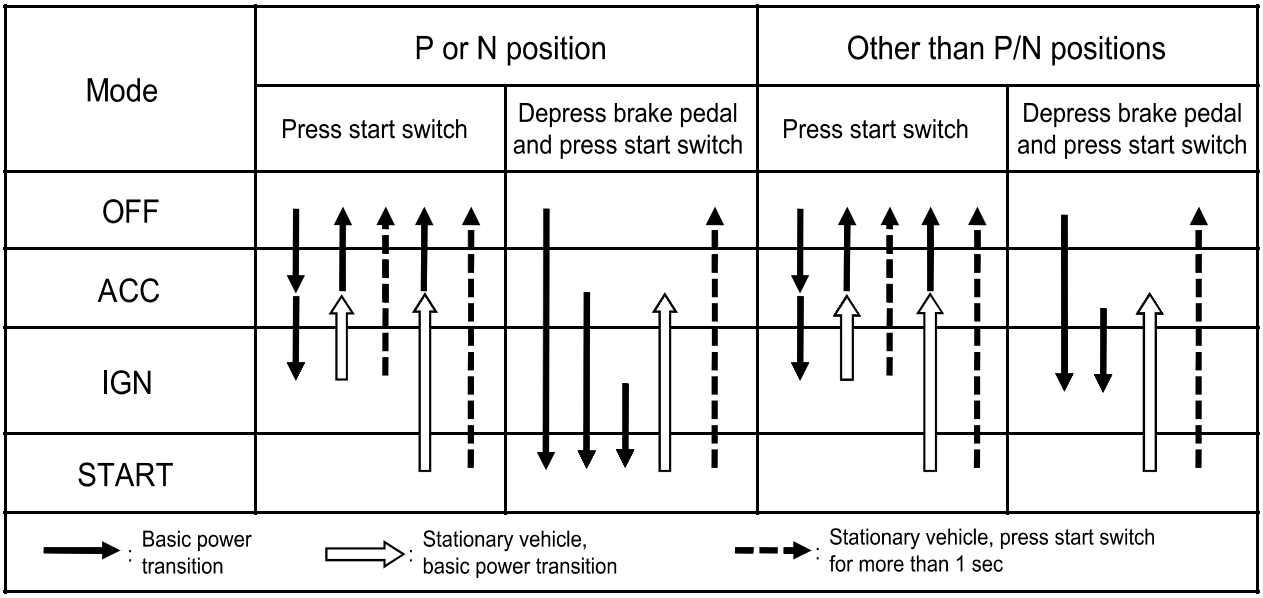
- Passive LOCK/UNLOCK
- REKES LOCK/UNLOCK

Ignition status after immobilizer authentication

- The immobilizer authentication has been completed when the engine starts.
- The immobilizer authentication is not deactivated until the ignition is turned to ON, OFF or ACC ON.
- The immobilizer is not deactivated when the key out warning condition is met while the engine is running.

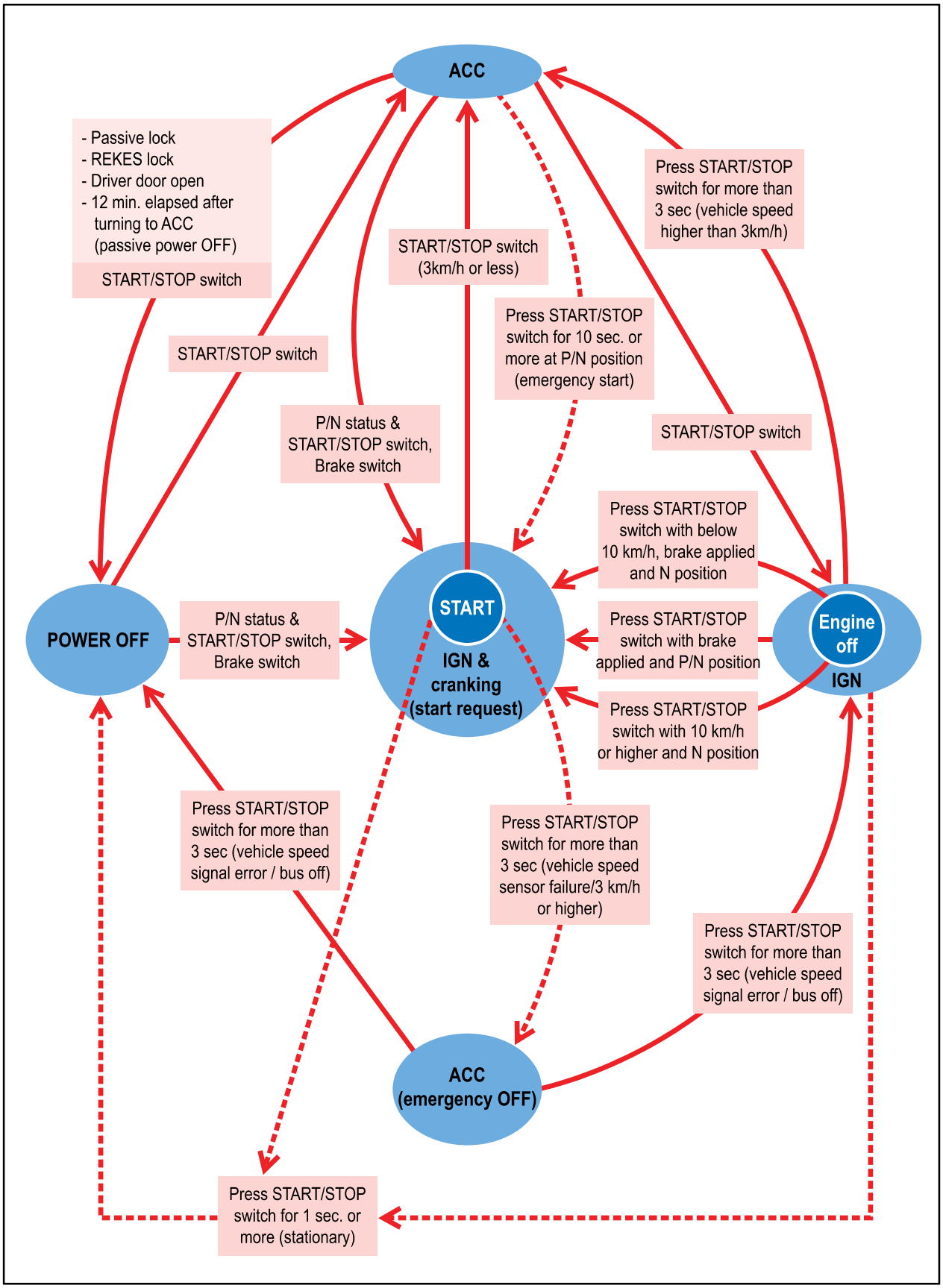
8. START & POWER MODE CONTROL

The ignition status is changed to OFF, ACC ON, IGN ON and engine cranking by one START/STOP switch.



Modification basis	
Application basis	
Affected VIN	

▶ Power control and engine start diagram



Modification basis	
Application basis	
Affected VIN	

▶ Engine starting

1. When the START/STOP button is pressed with the brake pedal applied (ON) and gear selector lever in P or N position, the SKM performs the immobilizer verification and sends the engine START request signal to the EMS if a normal coded smart key is found.
2. The SKM cuts off the power for IGN2 and ACC relays while the engine is cranking as cutting the electric load is necessary.
3. The SKM turns on the ACC/IGN2 relays after the engine cranking and sends the signal for IGN after starting to the BCM through the B-CAN.
4. Starting engine while driving

   - The engine start request signal is sent when the START/STOP switch is pressed, provided that the vehicle speed is less than 10 Km/h or no vehicle speed signal is input, the gear selector lever is in N position and the brake switch is ON with IGN ON (30 sec. authentication is not required).
   - The engine start request signal is sent regardless of the brake signal when the START/STOP switch is pressed, provided that the vehicle speed is 10 Km/h or more and the gear selector lever is in N position with IGN ON (30 sec. authentication is not required).

5. Impossible to start engine if:

   - Brake signal not received (at vehicle speed below 10 km/h)
   - START/STOP switch signal not received
   - Shift lever in any position other than "P" or "N" position (at vehicle speed below 10 km/h)

6. Emergency engine start

   - The emergency engine start is activated when pressing the START/STOP switch for more than 10 seconds, with ACC ON, when the brake signal is not received due to a faulty brake switch.

Modification basis	
Application basis	
Affected VIN	

▶ No engine operation

1. When the START/STOP button is pressed at the vehicle speed of 3 km/h or less, the SKM turns off
2. the IGN relay to stop the engine.
   When the vehicle speed is 3 km/h or more or no speed signal is input, the SKM performs the following functions:

Vehicle status	Conditions
3 km/h or faster	- When the START/STOP switch is pressed for 3 seconds or more, the ignition status is changed from IGN to ACC. - If the engine START/STOP switch is pressed again, the ignition status is changed from ACC to IGN.
Abnormal vehicle speed (No or abnormal CAN signal)	- When the START/STOP switch is pressed for 3 seconds or more, the ignition status is changed from IGN to ACC. - If the engine START/STOP switch is pressed again, the ignition status is changed from ACC to Power OFF. (DTC set)

3. When the START/STOP button is pressed and held with IGN ON, the ignition status is changed to OFF. When the START/STOP button is pressed briefly, the ignition status is changed to ACC ON.

▶ ACC ON to Power OFF

The SKM changes the ignition status to OFF from ACC ON when:

1. the engine START/STOP button is pressed with the brake pedal released after the ignition status is changed from IGN ON to ACC ON.
2. the REKES LOCK or passive LOCK signal is input with ACC ON.
3. the driver door is opened with ACC ON.
   (Driver door open signal input through B-CAN)
4. 12 minutes have passed with ACC ON.

9. START/STOP SWITCH CONTROL

1) Power Status

▶ **Ignition status indicator on START switch**

Color	Comes on when
OFF	IGN off, engine starts
Green	Engine start possible with START/STOP switch operation - Brake switch input & (IGN OFF / ACC ON / IGN ON)
Amber	ACC ON
Red	IGN ON & engine stops

▶ **START switch indicator output**

Power condition	Power OFF		ACC ON	IGN ON	Engine started	Startable engine	Error
	Door Closed	Door open					
Indicator							
	OFF	OFF	Amber	Red	OFF	Green	Flashes in red
Illumination lamp	OFF	ON	OFF				

- Illumination control for door coupled with START switch
- Illumination lamp comes on when driver door open (stays on as long as door open)
- Lamp goes out as soon as START switch is operated
- Lamp stays on for 10 sec. and goes out when driver door closed
- Timer is reset when driver door open

Modification basis	
Application basis	
Affected VIN	

10. ESCL CONTROL

- ESCL lock/unlock is not performed at ESCL virgin mode.
- The SKM does not carry out the ESCL LOCK control if the engine is running with IGN ON or the vehicle speed is 3 km/h or higher.
- ESCL LOCK should not be performed when the signal for P-CAN wheel speed is Invalid or non-reception.
- All the ESCL functions including START/STOP switch is disabled during anti-scanning flag bit set.
- The operating voltage range for ESCL is from 9 V to 16 V.

1) ESCL LOCK Control

When the ESCL is unlocked and the followings are met at normal condition:

- If the driver door is open or closed with ignition key OFF, the electric steering motor performs the steering column lock.
- If the theft deterrent mode is activated by the LOCK signal from the passive or REKES key when turning the ignition key from "ON" position to "OFF" position, the ESCL LOCK is performed.
- The ESCL LOCK is performed after 60 seconds since the ignition key is turned to B+ from "ON" or "ACC" position.

2) ESCL UNLOCL Control

When the ESCL is locked and the followings are met at normal condition:

- If the smart key is pressed with power off, the electric steering motor performs the steering column unlock. In some cases, power transition is carried out to ACC or IGN ON.
- If the power transition and start is not possible after retry to LOCK or UNLOCK operation, the power transition and start is not still possible after automatic retry and the warning lamp comes on.

3) ESCL Retry Control

1. ESCL operation is not possible if Bolt is “Failure”.
2. When the UNLOCK retry occurs after ESCL LOCK command, the ESCL LOCK is performed.
   - The UNLOCK retry is possible up to 2 times automatically. If the UNLOCK retry occurs 3 times in succession, the ESCL NOT LOCKED warning is triggered.
   - Reactivates when the ESCL LOCK conditions are met.
3. When the LOCK retry occurs after ESCL LOCK command, the command will be overridden without retry.
   - ESCL NOT LOCKED warning is triggered.
   - Reactivates when the UNLOCK conditions are met by pressing the START/STOP switch.
4. When the LOCK retry occurs after ESCL UNLOCK command, the ESCL UNLOCK is performed.
   - The LOCK retry is possible up to 2 times automatically. If the LOCK retry occurs 3 times in succession, the ESCL JAM warning is triggered.
   - Reactivates when the ESCL UNLOCK conditions are met by pressing the START/STOP switch.
5. When the UNLOCK retry occurs after ESCL UNLOCK command, the command will be overridden without retry.
   - After the command is overridden, the ESCL JAM warning is triggered.
   - Reactivates when the UNLOCK conditions are met by pressing the START/STOP switch after ESCL LOCK.

Modification basis	
Application basis	
Affected VIN	

11. SKM WARNING CONTROL

(1) Smart Key Not Detected Warning

▶ With ACC ON

1. When you open and close passenger and rear (LH/RH) doors excepting driver door,
2. SKM searches for a smart key by using the interior antenna if signal indicating that all doors are closed is received from BCM through B-CAN.
3. When no smart key is found, the SKM sends "Smart Key Not Detected" warning signal to the BCM and instrument cluster through B-CAN once for 10 seconds.
4. When you open and close driver door, with smart key not detected indoors, power status is changed to IGN OFF.

NOTE

"Smart Key Not Detected" warning deactivation conditions

- 10 sec. elapse (timer expires), IGN ON or smart key detected

▶ IGN ON and engine running

1. When you open and close driver/passenger and rear (LH/RH) doors and "Smart Key Not Detected" warning is not triggered,
2. If searching for smart key using interior antenna shows that no smart key detected,
   - The SKM sends the smart key not detected warning signal to the BCM and instrument cluster through B-CAN.
3. The smart key not detected warning is activated.
   - Smart key searching at intervals of 3 seconds using the interior antenna.
   - "Smart Key Not Detected" warning is activated at intervals of 10 seconds.

NOTE

"Smart Key Not Detected" warning deactivation conditions

- IGN OFF or smart key detected

(2) Smart Key Detected Warning (Smart Key Found Indoors)

▶ **Smart key deactivation warning**

1. With power off or ACC ON,
2. All door closed and authenticated smart key exists indoors/outdoors
3. The REKES LOCK or passive LOCK signal is input with a valid smart key from the outside the vehicle.
4. The SKM sends the theft deterrent mode signal to the BCM through B-CAN and the verified smart key is found inside the vehicle.
5. The SKM sends "Smart Key Detected" warning signal to the BCM and instrument cluster through B-CAN for 10 seconds.

NOTE

Smart key detected warning deactivation conditions

- The theft deterrent mode is deactivated.

▶ **Smart key inside vehicle warning**

1. The ignition is turned ON or OFF, or the ACC is turned ON.
2. When authenticated smart key exists only indoors with all doors closed and
3. The passive lock signal is received without authenticated smart key from the outside of the vehicle,
4. The SKM sends the theft deterrent mode signal to the BCM through B-CAN and the verified smart key is found inside the vehicle.
5. The SKM sends "Smart Key Detected" warning signal to the BCM and instrument cluster through B-CAN for 10 seconds.

NOTE

Smart key detected warning deactivation conditions

- No smart key is found inside the vehicle when a door is opened and then closed.

(3) Smart key authentication fail warning

In the event of smart key authentication for power status change or engine start, the SKM sends the "Smart Key Not Authenticated" signal to the instrument cluster through B-CAN for 10 seconds if the authenticated smart key is not found.

* **Power status change**
(OFF → ACC) / (OFF → IGN)/(ACC → IGN) / (IGN → engine ON)

NOTE

Smart key authentication failure warning is deactivated when:

- Authenticated smart key detected by START/STOP switch input signal while receiving smart key authentication failure warning for 10 sec.

Modification basis	
Application basis	
Affected VIN	

(4) Transponder authentication fail warning

The SKM searches for transponder in front of the START/STOP switch (emergency antenna) according to smart key authentication process. If no authenticated smart key is found, the SKM sends authentication failure signal to the instrument cluster through B-CAN for 10 seconds.

NOTE

Transponder authentication failure warning deactivated when:

- Transponder detected at START/STOP switch (emergency antenna) while transmitting transponder authentication failure warning for 10 sec.

(5) Transmission position warning

The SKM receives the shift lever position signal from the TCU through P-CAN with ignition on. If the shift lever is in any position other than "P" or "N" position when starting engine, it triggers transmission position warning through B-CAN for 10 seconds.

NOTE

Transmission position warning deactivated when:

- Ignition off
- Shift lever in "P" or "N" position

(6) ESCL JAM warning

The SKM transmits the warning active command to the BCAN through the BCAN signals such as ESCL NOT LOCKED warning signal or ESCL JAM warning signal within 10 seconds or until the active command deactivation conditions will be met, if jam is occurred when the electric steering motor is locked/unlocked.

▶ Failure Detecting Conditions

1. When the UNLOCK retry occurs after ESCL LOCK command, the ESCL LOCK is performed.
   - The UNLOCK retry is possible up to 2 times automatically. If the UNLOCK retry occurs 3 times in succession, the ESCL NOT LOCKED warning is triggered.
   - Reactivates when the ESCL LOCK conditions are met.
2. When the LOCK retry occurs after ESCL LOCK command, the command will be overridden without retry.
   - After the command is overridden, the ESCL NOT LOCKED warning is triggered.
   - Reactivates when the LOCK conditions are met by pressing the START/STOP switch after ESCL UNLOCK.
3. When the LOCK retry occurs after ESCL UNLOCK command, the ESCL UNLOCK is performed.
   - The LOCK retry is possible up to 2 times automatically. If the LOCK retry occurs 3 times in succession, the ESCL JAM warning is triggered.
   - Reactivates when the ESCL UNLOCK conditions are met by pressing the START/STOP switch.
4. When the UNLOCK retry occurs after ESCL UNLOCK command, the command will be overridden without retry.
   - After the command is overridden, the ESCL JAM warning is triggered.
   - Reactivates when the UNLOCK conditions are met by pressing the START/STOP switch after ESCL LOCK.

▶ ESCL JAM Warning Deactivation

The ESCL JAM FAILURE warning will be deactivated as soon as the signal "ESCL UNIT STATUS OK" is received by the ESCL restart when the ESCL UNLOCK (or LOCK) activation conditions are met again by pressing the START/STOP switch to change the ignition status within 10 seconds or after 10 seconds triggering the warning.

Modification basis	
Application basis	
Affected VIN	

(7) ESCL not locked warning

▶ **Failure Detecting Conditions**

1. When the LOCK retry occurs after ESCL LOCK command is issued, the retry command ends. (Reactivated if ESCL is locked after START/STOP switch is pressed to unlock ESCL)
2. When the UNLOCK retry occurs after ESCL LOCK command is issued, the UNLOCK retry can be attempted up to 2 times automatically. If retry occurs 3 times in a row

▶ **ESCL not locked Warning Deactivation**

1. Warning time of 10 seconds is over
2. If you press START/STOP switch to change power status and driving conditions are met again, the command is deactivated as soon as signal "UNIT status OK" is received after ESCL retry occurs.

NOTE

When ESCL JAM warning and ESCL NOT LOCKED warning are generated in order, only the last warning is transmitted.

(8) ESCL FAIL warning

The SKM monitors the ESCL and transmits the warning active command to the BCAN for 10 seconds through the BCAN signal "ESCLFailWarnCmd" if there is an error with operation.

▶ **Failure Transmitting Conditions**

1. ESCL bolt status failure
   - Bolt status "FAILURE" signal received once through LIN communication
2. ESCL no response error
   - No response or incorrect response from ESCL 3 times in succession
3. Status mismatch
   - Mismatch between ESCL bolt status and micro switch status
4. ESCL anti-scanning error
   - Verification fails 2 times in succession
5. ESCL Enable ERROR
   - If Enable output is on 3 times in a row but ESCL Enable bit is 0
6. ESCL Power OFF error
   - ESCL fail warning generated in the event of response to status request after power turned off
   - Response from ESCL while trying to transmit status messages 3 times after ESCL power line off

(9) ESCL not coded warning

▶ **Failure Detecting Conditions**

1. ESCL Status = Virgin
2. Starting condition for SKM met
   (START/STOP switch ON, brake ON, gear position (P or N), variant code and etc.)
3. Warning generated after starting try

▶ **ESCL NOT CODED Warning Deactivation**

- Warning Time out

(10) SKM error warning

▶ **SKM error transmission conditions**

If one of the following errors occurs when turning ignition off or on, the SKM sends an error warning to the BCM and instrument cluster through B-CAN for 10 seconds. It sends error warning again only when additional error occurs.

1. Low B+ (power) voltage
2. Low B+ (logic) voltage
3. High B+ (power) voltage
4. High B+ (logic) voltage
5. ACC ON fail
6. ACC OFF fail
7. IGN1 ON fail
8. IGN1 OFF fail
9. IGN2 ON fail
10. IGN2 OFF fail
11. START/STOP switch short circuit

Modification basis	
Application basis	
Affected VIN	

(11) Brake Not Applied warning

The SKM sends Brake Not Applied warning signal to the instrument cluster for 10 seconds when 2nd cycle starts after 1st ignition cycle (OFF-ACC-IGN-ACC-OFF) is completed with the brake not applied.

NOTE

Brake Not Applied warning deactivated when:

- Brake pedal is depressed (timer is also reset)
- 10 seconds elapse (timer expires)

(12) Smart key battery low warning

If low smart key battery is detected when authenticating the smart key for ignition cycle or engine start, the SKM sends a warning signal to the instrument cluster through B-CAN for 10 seconds. (stops sending within 10 seconds when deactivation conditions met)

NOTE

Smart key battery low warning deactivated when:

- Smart key battery voltage is normal
- Smart key battery is replaced with new one

(13) Priority of SKM warnings

No.	Warning operation	Buzzer position	Priority
1	Smart key out warning	Outdoor	1
2	Smart key reminder warning		
3	Smart key authentication failure warning	Indoor	2
4	Transponder authentication failure warning		
5	Smart key battery low warning		
6	Transmission position warning		
7	ESCL Jam warning		
8	ESCL Not Lock warning		
9	ESCL Fail warning		
10	SKM error warning		
11	Brake warning		

12. SKM IMMOBILIZER SYSTEM

1) System Description

The immobilizer system prevents the vehicle theft by allowing only the authorized key to start the engine. The transponder inside the key communicates with the SKM and EMS (ECU) through P-CAN communication, and the system permits the engine to start after confirming the encrypted coding.
When the START/STOP switch is pressed with the smart key put to the front of emergency antenna e.g. because of the smart key battery discharge, the SKM communicates with the EMS (ECU) through P-CAN, and the EMS (ECU) starts to control the engine only when the signal is valid.
A valid key verification time is provided for 10 seconds and the engine can be started during this time. If pressing the START/STOP switch again after this 10 seconds, the smart key authentication process should be performed again.

2) Configuration

Modification basis	
Application basis	
Affected VIN	

3) Operating Process

There are two different types of smart key authentications: immobilizer key and smart key.
The immobilizer authentication is applied to the smart key module (SKM) system, and verifies the transponder built in the smart key. When the smart key is put to the front of the START/STOP switch, a short-distance immobilizer authentication will be carried out between the transponder and the SKM. (LF and RF has a higher priority than short-distance immobilizer authentication.)
Once the key is verified, a valid key authentication time is provided for 10 seconds and the engine can be started by pressing the START/STOP switch during this time. If pressing the START/STOP switch after this 10 seconds, the key authentication process should be performed again.

1. When the ignition is turned ON, the EMS (ECU) sends the challenge message to the SKM through the P-CAN.
   (This is to verify whether the transponder of the smart key is valid. If the authentication fails, it transmits the re-authentication signals 3 times for 2 seconds. If 3rd re-authentication fails, the authentication is deactivated for 10 seconds and re-activated after that.)
2. The emergency antenna of the SKM system sends the encrypted cod to the transponder, and the transponder re-sends the encrypted code to the emergency antenna.
3. The encrypted sent to the emergency antenna is transmitted to the SKM.
4. The SKM compares this code with the encrypted code randomly transmitted by the internal logic.
   (The system compares the signal from transponder and encrypted signal from the emergency antenna)
5. Only when the two signals are identical, it recognizes the key as the verified one and transmits the positive message to the ECU.
6. The ECU enables the engine to be started.