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2020.0 DEFENDER (LE), 419-01B

ANTI-THEFT - PASSIVE (G2342566)

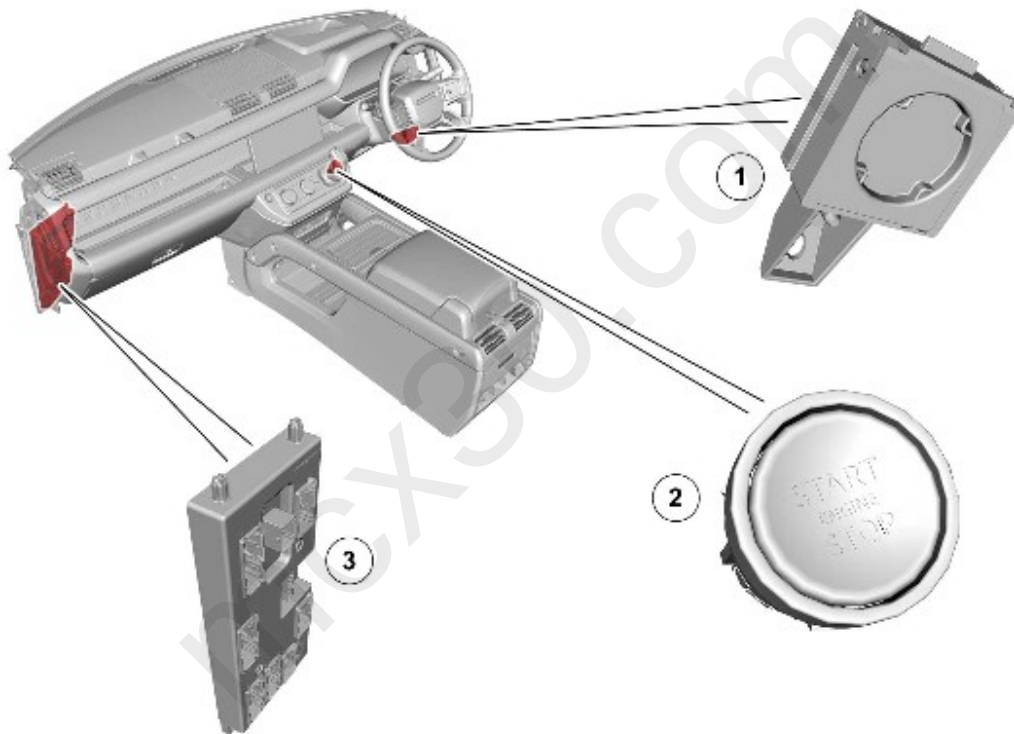
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COMPONENT LOCATION

COMPONENT LOCATION - 1 OF 4

 NOTE:

Right Hand Drive (RHD) vehicle is shown, Left Hand Drive (LHD) vehicle is similar.



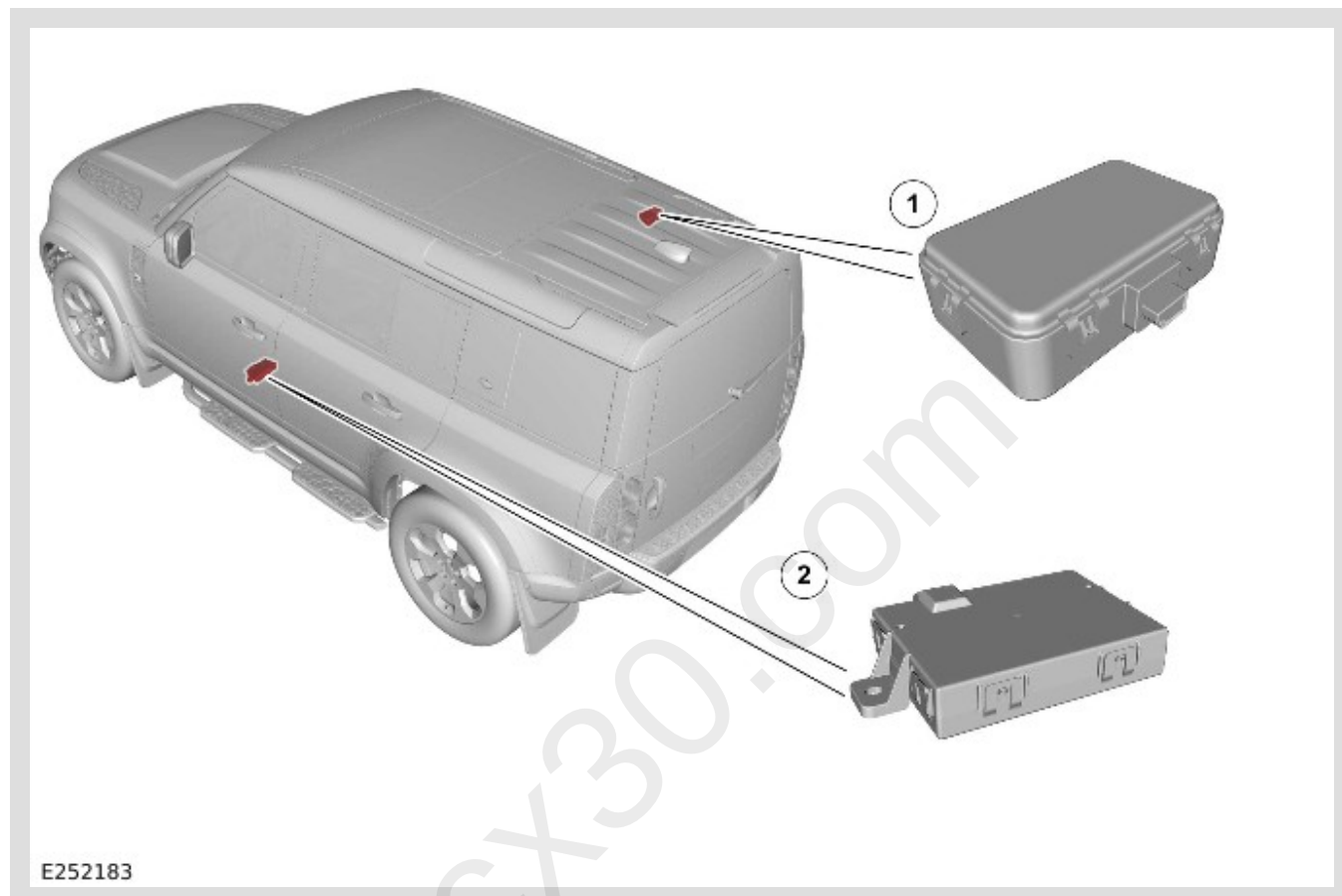
E252182

ITEM	DESCRIPTION
1	Immobilizer Antenna Unit (IAU)
2	Ignition switch
3	Body Control Module (BCM)/ Gateway Control Module (GWM)

COMPONENT LOCATION - 2 OF 4

NOTES:

- RHD vehicle is shown, LHD vehicle is similar.
- Vehicle with 5 doors is shown, Vehicle with 3 doors is similar.

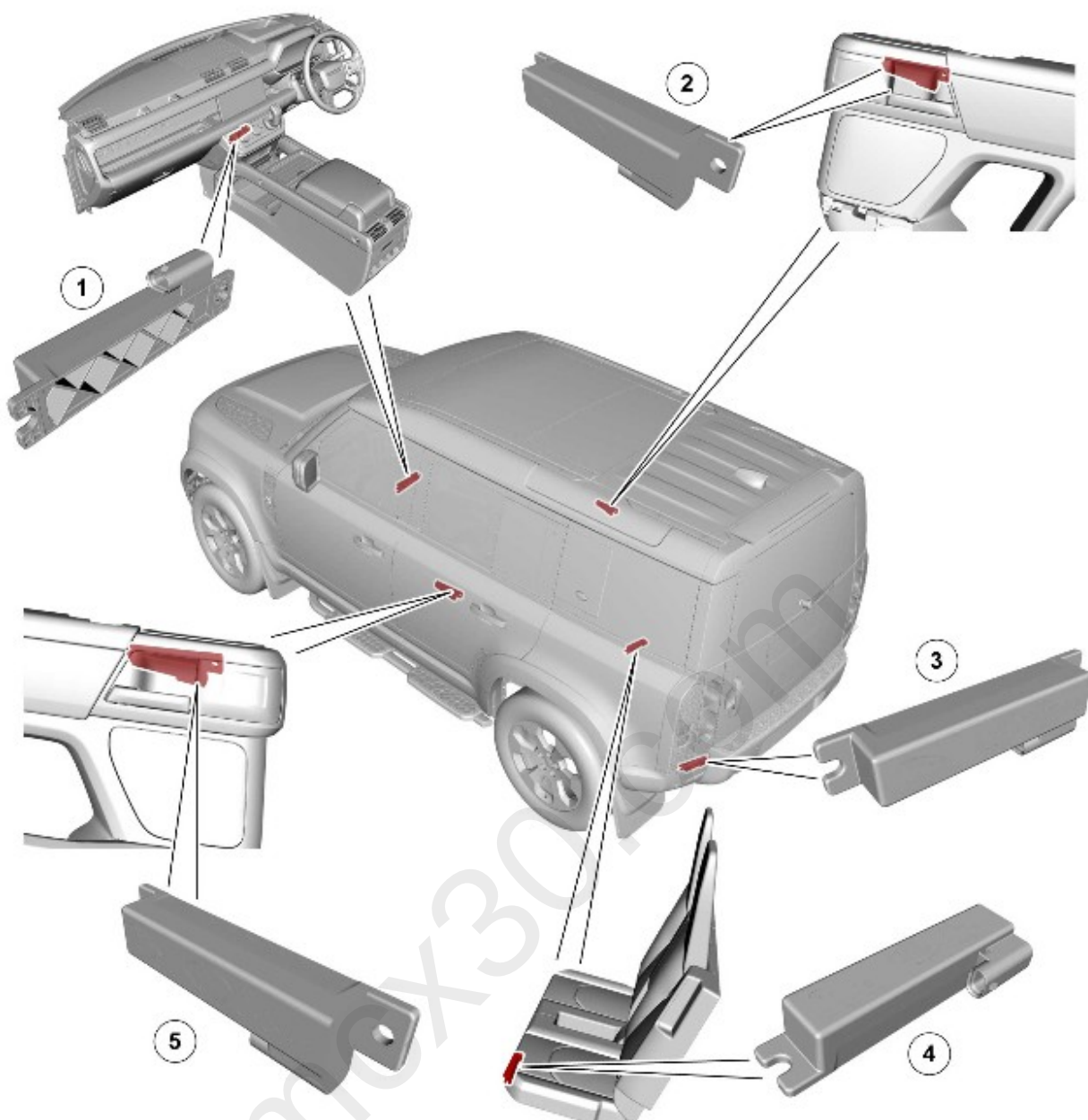


ITEM	DESCRIPTION
1	Radio Frequency (RF) receiver
2	Remote Function Actuator (RFA)

COMPONENT LOCATION - 3 OF 4

NOTES:

- RHD vehicle is shown, LHD vehicle is similar.
- Vehicle with 5 doors is shown, Vehicle with 3 doors is similar.

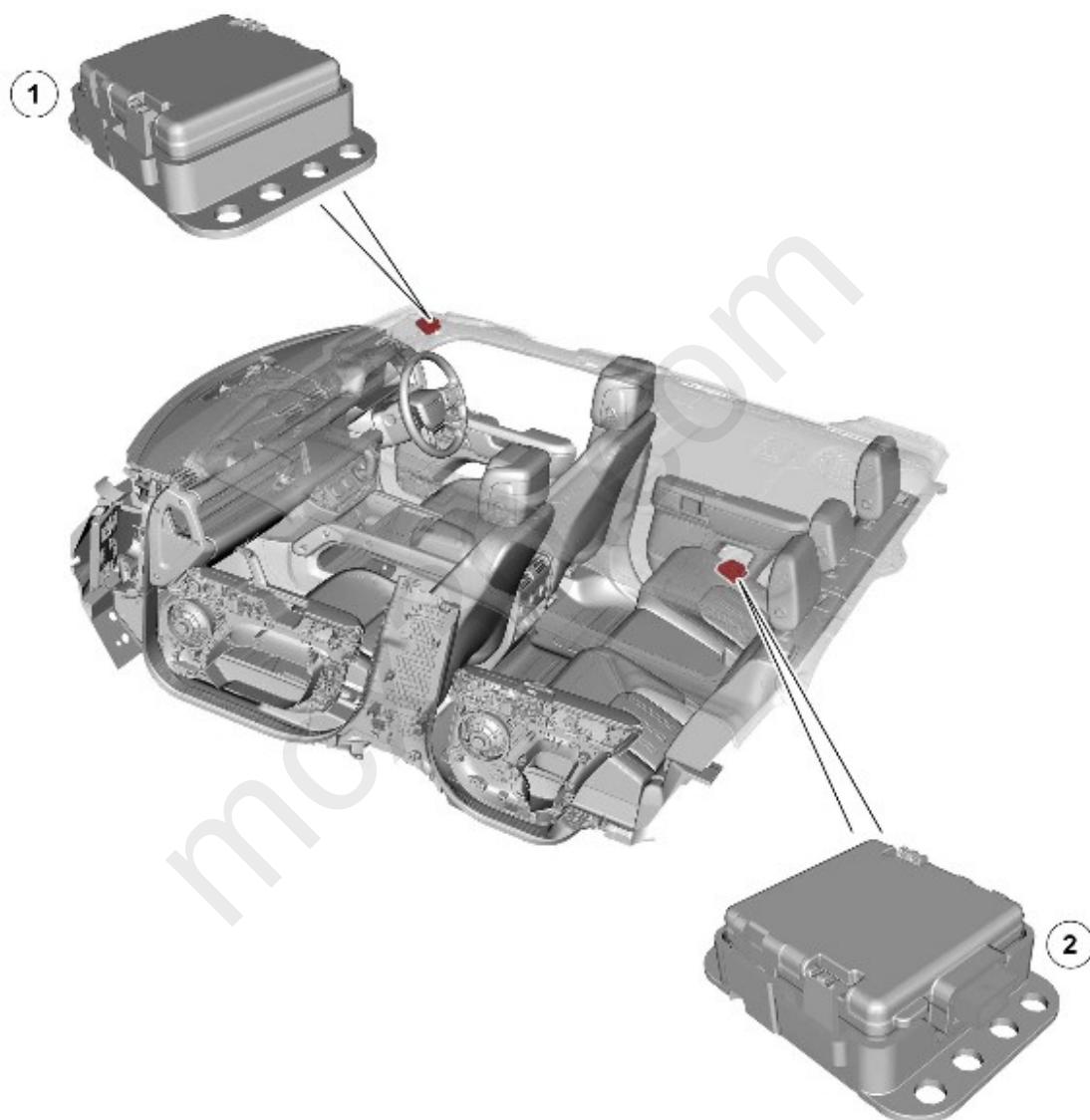


E252189

ITEM	DESCRIPTION
1	Low Frequency (LF) - Front passenger compartment
2	LF - Right passenger compartment
3	LF - Left luggage compartment
4	LF - Rear passenger compartment - Only for passive start system
5	LF - Left passenger compartment

 NOTES:

- RHD vehicle is shown, LHD vehicle is similar.
- Vehicle with 5 doors is shown, Vehicle with 3 doors is similar.



E252185

ITEM	DESCRIPTION
1	Passive entry transceiver - Front
2	Passive entry transceiver - Rear

OVERVIEW

The passive start system relies on the detection of a uniquely coded smart key through LF antennas strategically situated within the vehicle. The LF antennas sense when the smart key is in the active transmission zone of the LF antennas. The transmission zone allows the smart key to be detected inside the vehicle. For this reason the orientation and position of the antennas is critical to the correct functioning of the system. The smart key also operates the passive entry system.

For additional information, refer to: [Handles, Locks, Latches and Entry Systems](#) (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

The passive start system provides a secure interface between the BCM/ GWM and the Powertrain Control Module (PCM). The interface prevents unauthorized starting of the engine. Encoded data exchange between the smart key and multiple control modules immobilizes the engine crank system and the fuel system.

Engine starting is initiated when the encoded data exchange between the smart key and the control modules is verified. The engine management system then allows engine crank and fueling when an authorization data message is received from the BCM/ GWM.

The engine can be started by pressing the ignition switch when PARK position is selected and the brake pedal is pressed.

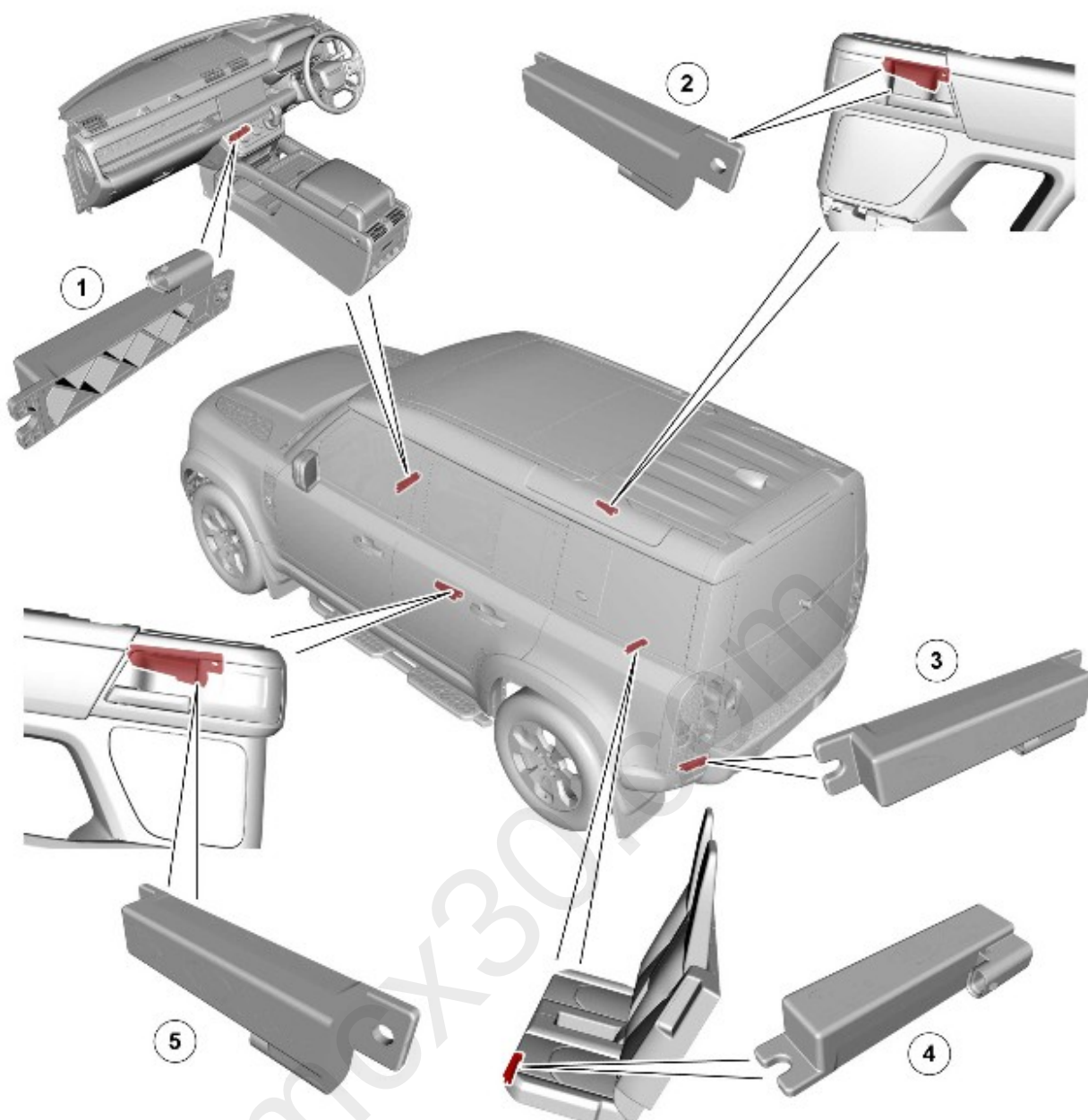
DESCRIPTION

LF ANTENNAS



NOTES:

- RHD vehicle is shown, LHD vehicle is similar.
- Vehicle with 5 doors is shown, Vehicle with 3 doors is similar.



E252189

ITEM	DESCRIPTION
1	LF - Front passenger compartment
2	LF - Right passenger compartment
3	LF - Left luggage compartment
4	LF - Rear passenger compartment - Only for passive start system
5	LF - Left passenger compartment

There are 5 LF antennas for the Passive Entry Passive Start (PEPS) system positioned in the following locations:

- There is 1 LF antenna located in the front floor console.

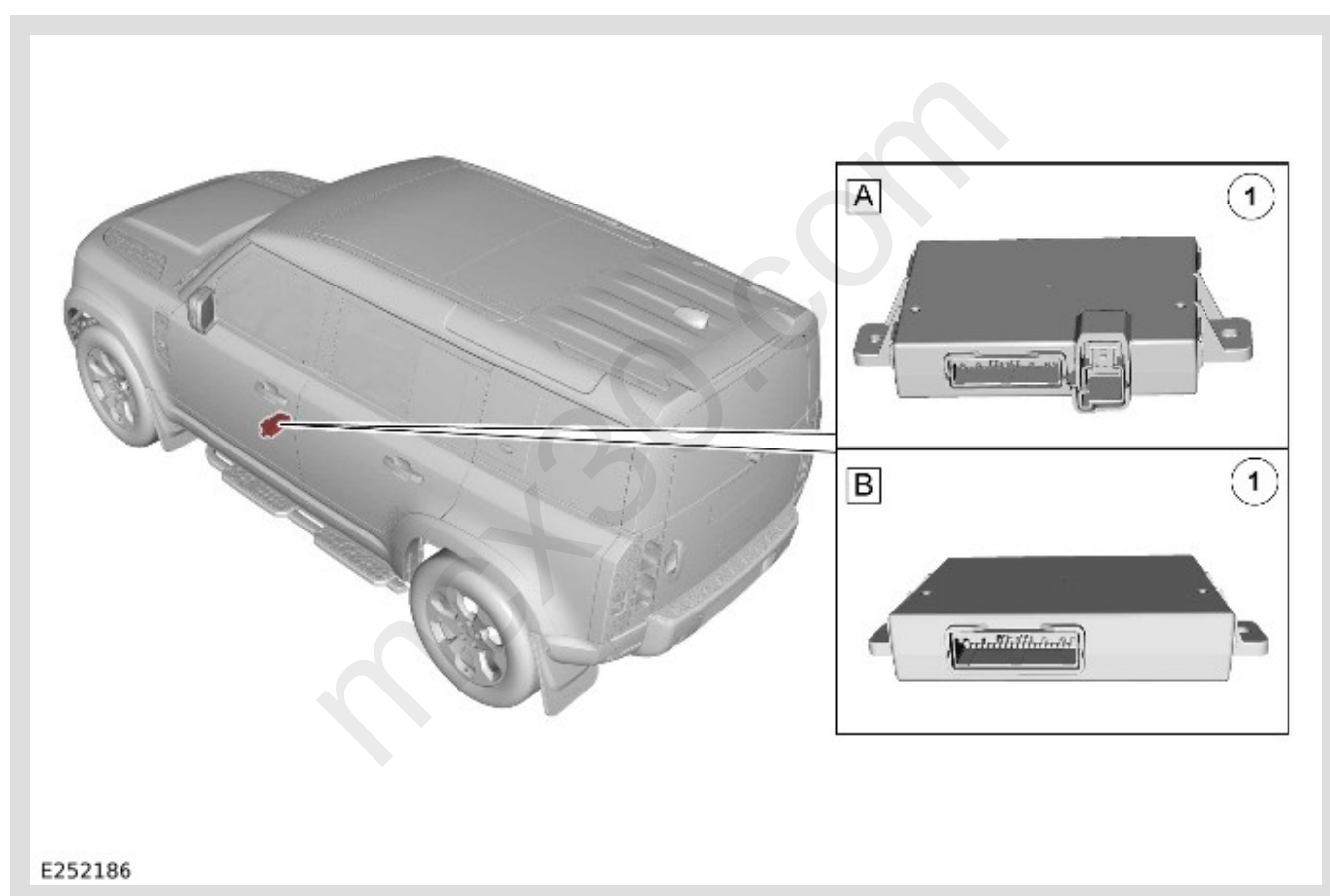
- There is 1 LF antenna located in each rear door.
- There is 1 LF antenna located beneath the third row seats, the antenna only for passive start system.
- There is 1 LF antenna located behind the rear bumper.

The RFA transmits a LF signal through the antennas which is received by the smart key. The smart key then responds by transmitting a RF signal which is received by the RF receiver. The RF receiver sends the signal to the RFA.

RFA

NOTES:

- Vehicle with 5 doors is shown. Vehicle with 3 doors is similar.
- Before you configure a new RFA, put ALL the vehicle keys on the center console.



ITEM	DESCRIPTION
A	Vehicles with PEPS system
B	Vehicles with passive start system
1	RFA

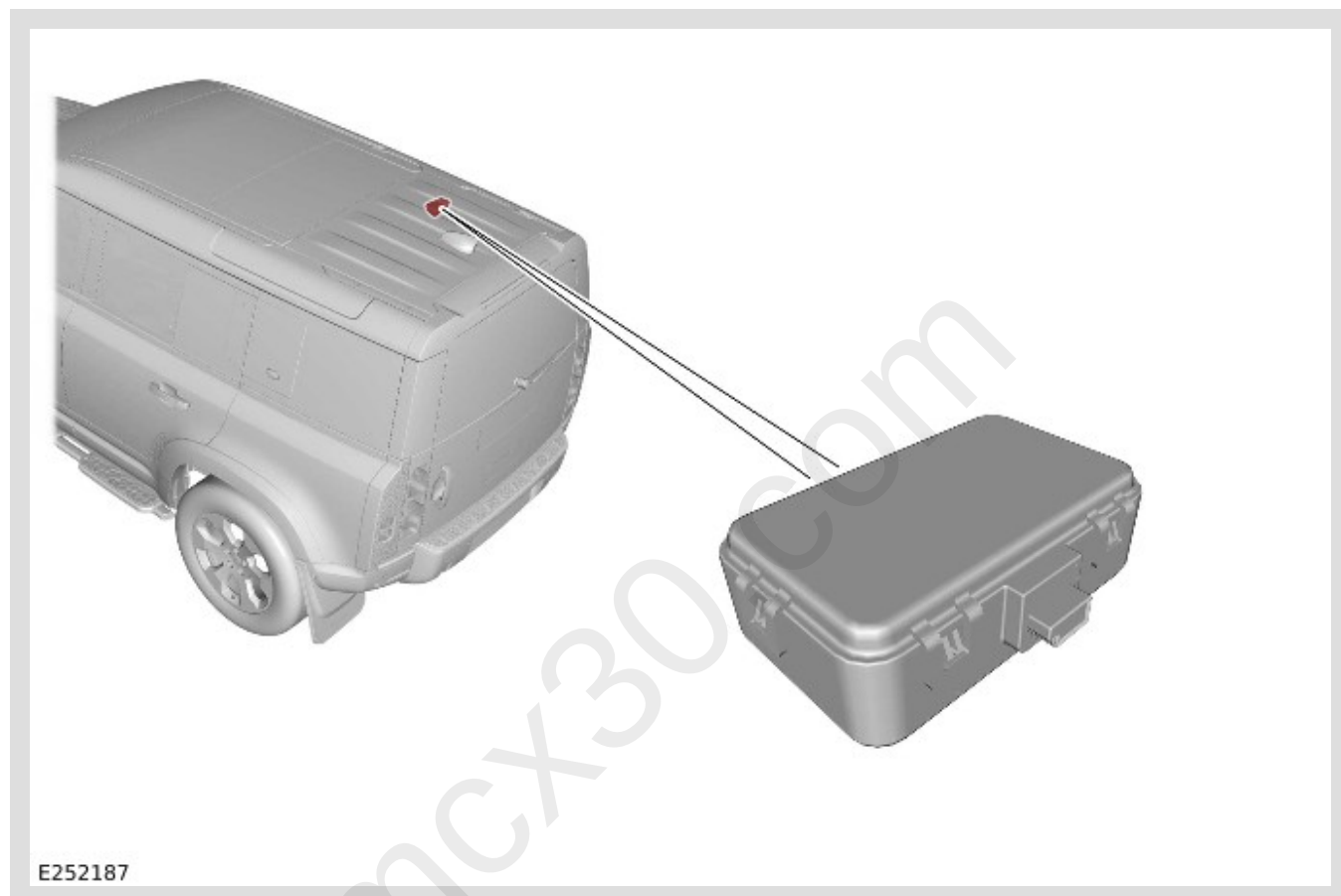
The RFA is located in the below of the front left seat.

The RFA controls signal transmissions to and from the smart key and provides authorization to allow the vehicle to be unlocked and started. The RFA has a High Speed (HS) Controller Area Network (CAN) body systems bus connection to the BCM/ GWM.

RF RECEIVER

NOTE:

Vehicle with 5 doors is shown. Vehicle with 3 doors is similar.



The RF receiver is located in the rear headliner.

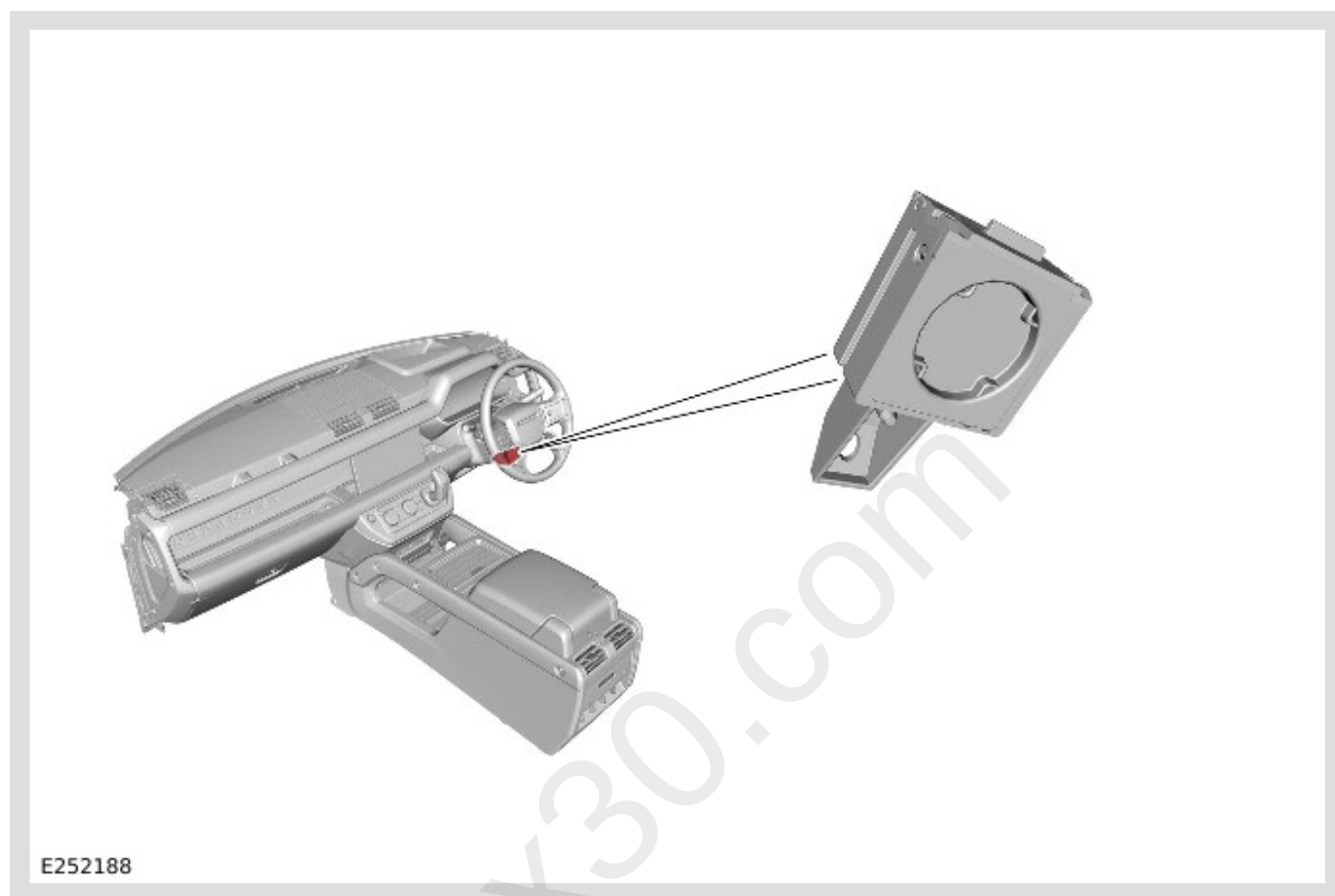
The RF receiver receives RF signals from the smart key. When the RF receiver receives a signal from the smart key, the RF receiver passes the signal to the RFA.

There are 2 types of RF receiver available as detailed in the table below.

Part No. suffix	Operating frequency	Vehicle specification
A#	315 MHz	North American Specification (NAS), Japan and Korea
B#	433 MHz	Europe and Rest of World (ROW)

 NOTE:

RHD vehicle is shown, LHD vehicle is similar.



The IAU is installed underneath of the lower steering column cover and secured with a screw, for both auto and manual columns.

The IAU is used when the RFA is unable to authorize the smart key.

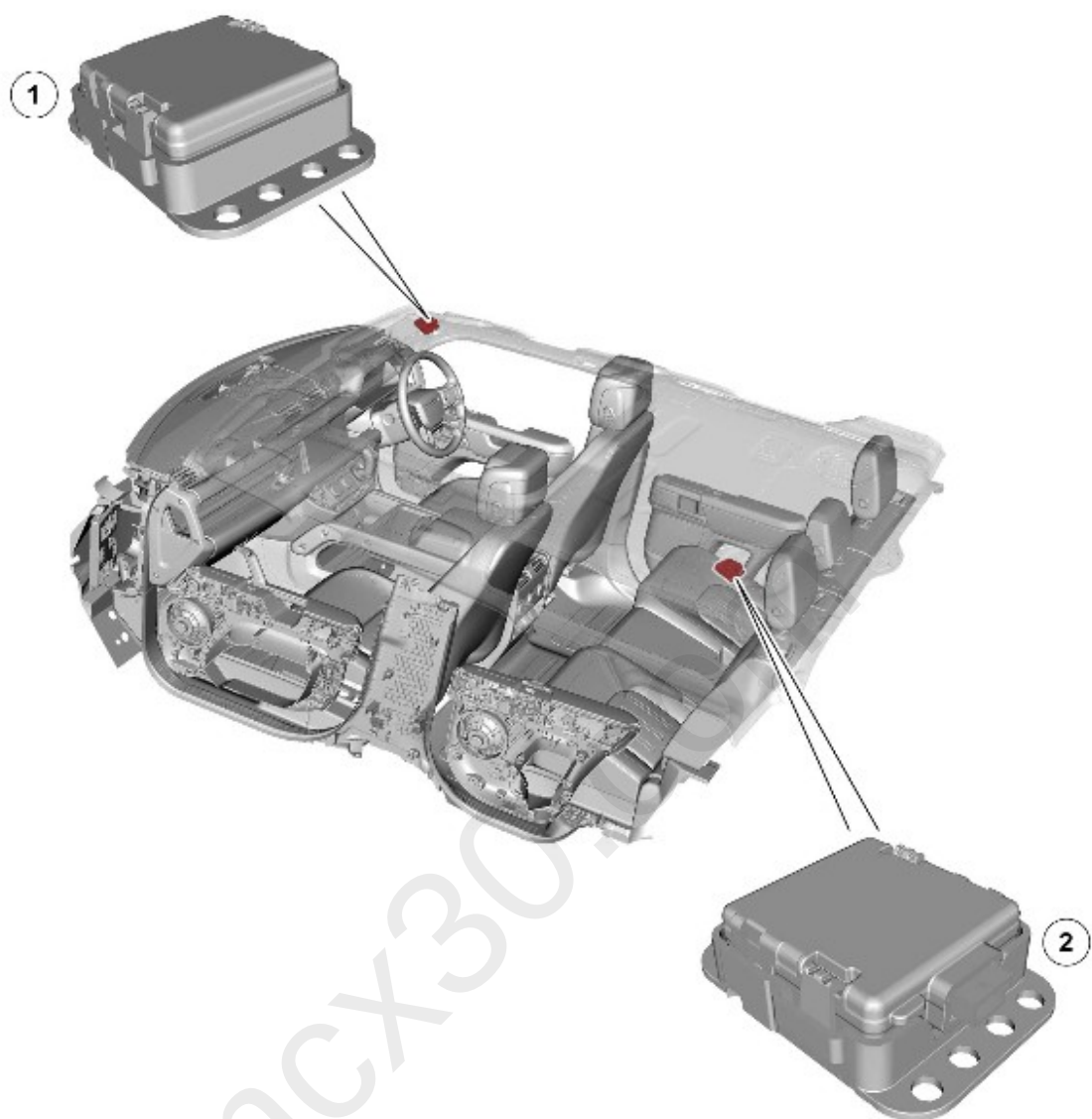
The RFA is unable to identify the smart key when the smart key battery voltage is low or there is RF interference.

The transponder within the smart key can be read in the conventional manner.

The driver is alerted to this by an audible chime and a message is displayed in the Instrument Panel Cluster (IPC). The message is 'Place Smart Key as shown, and press start button'.

PASSIVE ENTRY TRANSCEIVER **NOTES:**

- RHD vehicle is shown, LHD vehicle is similar.
- Vehicle with 5 doors is shown, Vehicle with 3 doors is similar.



E252185

ITEM	DESCRIPTION
1	Passive entry transceiver - Front
2	Passive entry transceiver - Rear

There are 2 passive entry transceivers in a vehicle, 1 on the front headliner and the other on the rear of the headliner. The passive entry transceivers are used to locate the position of the smart key from the vehicle. The passive entry transceivers communicate with the RFA through a Local Interconnect Network (LIN). Each passive entry transceiver has a power supply from the Rear Junction Box (BCMB) and a ground connection. When the passive start sequence is initiated and a smart key is detected, the passive entry transceivers calculate the distance of the smart key. Then the RFA allows the authorization of the smart key only when this distance is within permissible limits.

**NOTE:**

The passive entry transceivers are only equipped on PEPS vehicles, and ultra wide band in permitted markets. When the passive entry transceivers are not equipped, the RFA performs the smart key authentication through LF challenge to the smart key. The responses from the smart key are received through the RF receiver.

The passive entry transceivers are also involved with the passive entry system.

For additional information, refer to: [Handles, Locks, Latches and Entry Systems](#) (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

PEPS SYSTEM**NOTE:**

The smart key does not need to be held adjacent to the IAU. However this function is still supported to cover error states.

The PEPS system includes enhancements to further improve vehicle security.

The smart key includes ultra wide band technology. Ultra wide band technology includes 2 new passive entry transceivers, which are programed to the vehicle in conjunction with smart keys.

OPERATION**PASSIVE START SYSTEM**

The RFA prompts each of the internal LF antennas to output a signal. When the smart key is in the passenger compartment, the smart key detects the LF signals. The smart key responds with a data identification signal back to the RF receiver. The RF receiver sends the data identification signals to the RFA.

In addition the RFA sends a separate challenge, through the passive entry transceivers to the smart key. The RFA sends this data to authenticate and obtain the smart key position with accuracy.

When the data received matches that stored in the RFA, the RFA continues the passive start process by communicating a 'smart key valid' signal. The valid signal is received by the BCM/ GWM through the HS CAN body systems bus.

The BCM/ GWM receives the authorization and confirms the response with an internal calculation. The BCM/ GWM passes coded data to the IPC on the HS CAN Human Machine Interface (HMI) systems bus. Upon confirmation from the IPC, Power Mode 6 (ignition ON) is enabled.

The BCM/ GWM exchanges encrypted data with the Electric Steering Column Lock Control Module (VIM) mechanism. The data authorizes the unlocking of the steering column. The IPC only provides a ground for the VIM motor. The BCM / GWM then sends a mobilization signal to the PCM.

The BCM/ GWM enables the fuel pump relay which provides a startup battery voltage supply to the Fuel Pump Driver Module (FPDM).

When the RFA fails to locate the smart key, a message is displayed in the IPC message center. The message is 'Place Smart Key as shown, and press start button'.

The keyless start backup process must be used to mobilize and start the vehicle.

PASSIVE START BACKUP

When the vehicle is unlocked with the emergency key or the vehicle does not detect a smart key. Using the passive start backup procedure is then necessary for the following:

- Disarm the alarm
- Start the engine.

The following passive start backup process must be followed in this event:

- Pressing the ignition switch when the RFA fails to locate the smart key. 'Place Smart Key as shown, and press start button' appears in the IPC message center.
- For vehicles with a manual or powered steering column, position the smart key under the lower steering column cowl. The switches on the smart key must face outwards.
- Pressing the ignition switch with the brake pedal pressed to start the engine.



NOTE:

When the 'Place Smart Key as shown, and press start button' message is no longer displayed (only displayed for 10 seconds), the sequence has to be repeated.

The process bypasses the data exchange between the RFA and the BCM/ GWM. The process is an inductive process and operates even if the battery in the smart key is discharged. A transponder within the smart key is detected by the IAU. The IAU communicates this code with the BCM/ GWM through a LIN connection. The BCM/ GWM then initiates the vehicle start process in the normal manner.

ULTRA WIDE BAND OPERATION

With the introduction of ultra wide band technology, recognizing the position of the smart key requires 2 pieces of distance information. The 2 passive entry transceivers are located in the headliner, 1 at the front and 1 at the rear. The passive entry transceivers enable full coverage inside and outside of the vehicle.

The following process takes place to validate the smart key:

- The RFA receives a door lock/unlock request.
- When the RFA receives the door lock/unlock request, it sends out the challenge data through the LF antenna to the smart key. The data is sent at 125 kHz.

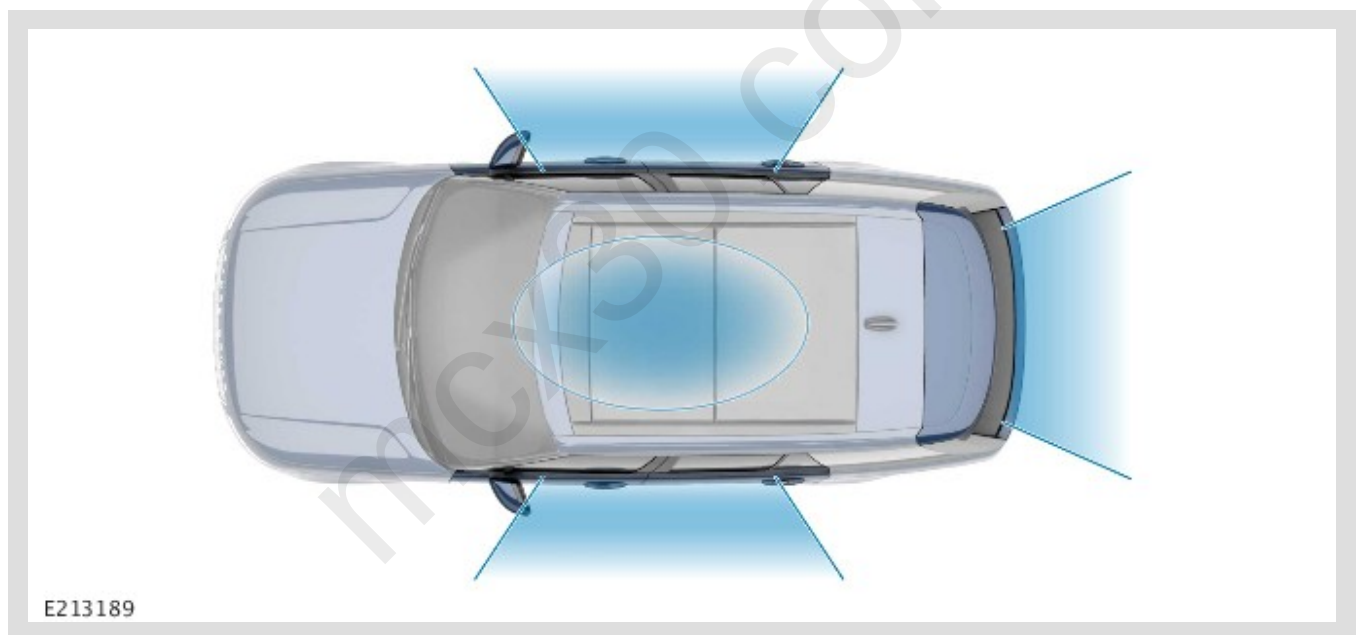
- The smart key responds to the LF signal, processing the received message and replies to the vehicle using a separate RF channel. Depending on market the RF channels are 433 MHz or 315 MHz.
- This response is received by the RF receiver.

In addition the RFA sends a separate challenge, through the passive entry transceivers to the smart key. The RFA sends this data to authenticate and obtain the smart key position with accuracy, using the following process:

- The challenge data is sent from the RFA through a LIN to the passive entry transceivers.
- The passive entry transceivers process and transmit the data, through a separate RF signal, at 3.99 GHz (4.5 GHz in China) to the smart key.
- On receipt of the signal the smart key responds with an authentication message back to the passive entry transceivers. The smart key responds by a RF signal through the LIN connection.

When the smart key is validated the system operates normally.

LOW FREQUENCY ZONES



The message contained in the beacon signals varies based on each transmitter zone. For example, the message varies based on when the zone is:

- Inside or outside the vehicle.
- The driver side, passenger side or the loadspace.

The capability allows the smart key to send specific answers, triggering actions such as opening the passenger door or starting the engine.

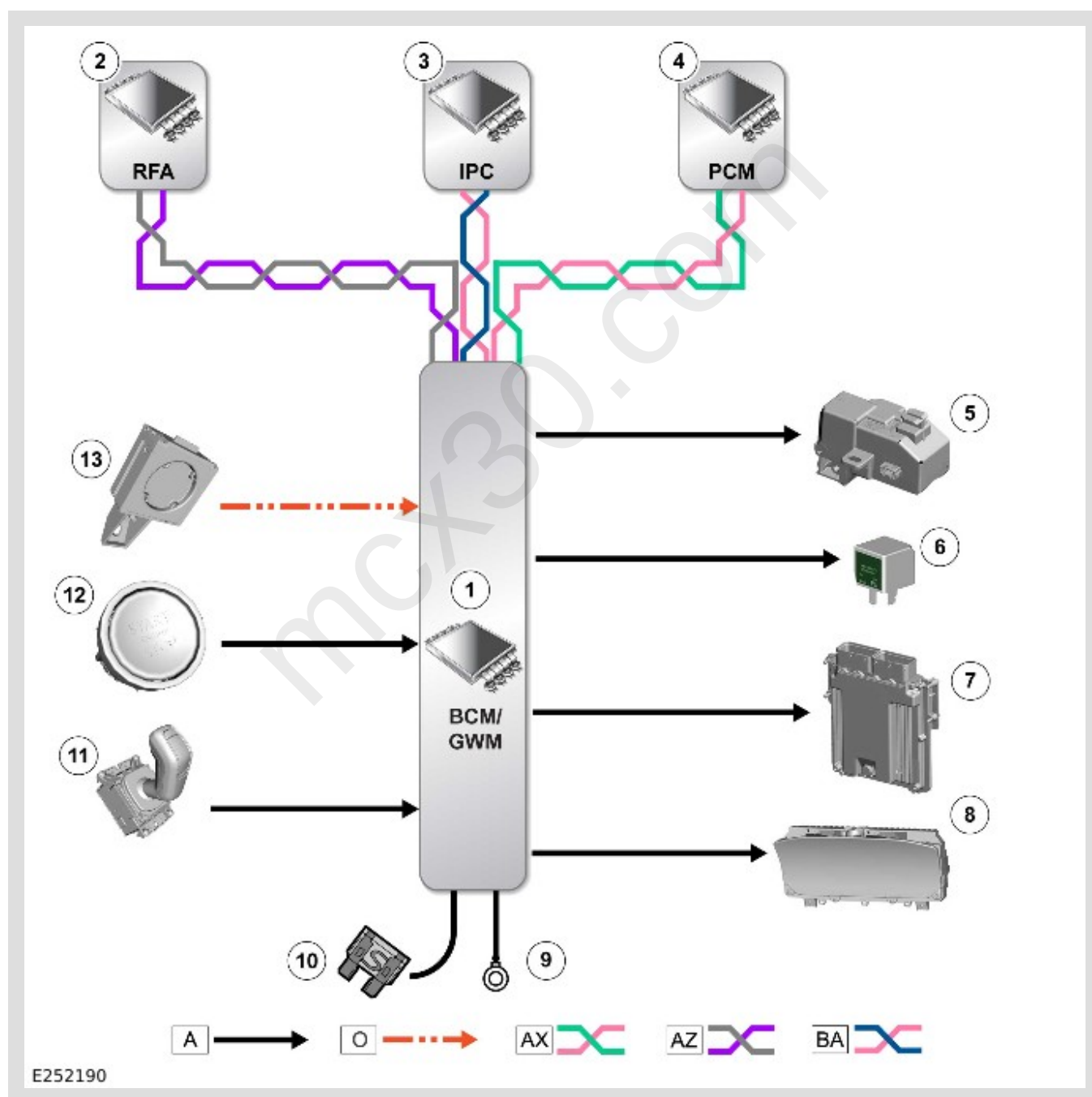
DIAGNOSTICS

The BCM/ GWM records any Diagnostic Trouble Code(s) (DTC) and related data. The DTC and related data are read using the Jaguar Land Rover (JLR) approved diagnostic equipment.

The JLR approved diagnostic equipment enables certain components to be activated and also read live data.

CONTROL DIAGRAM

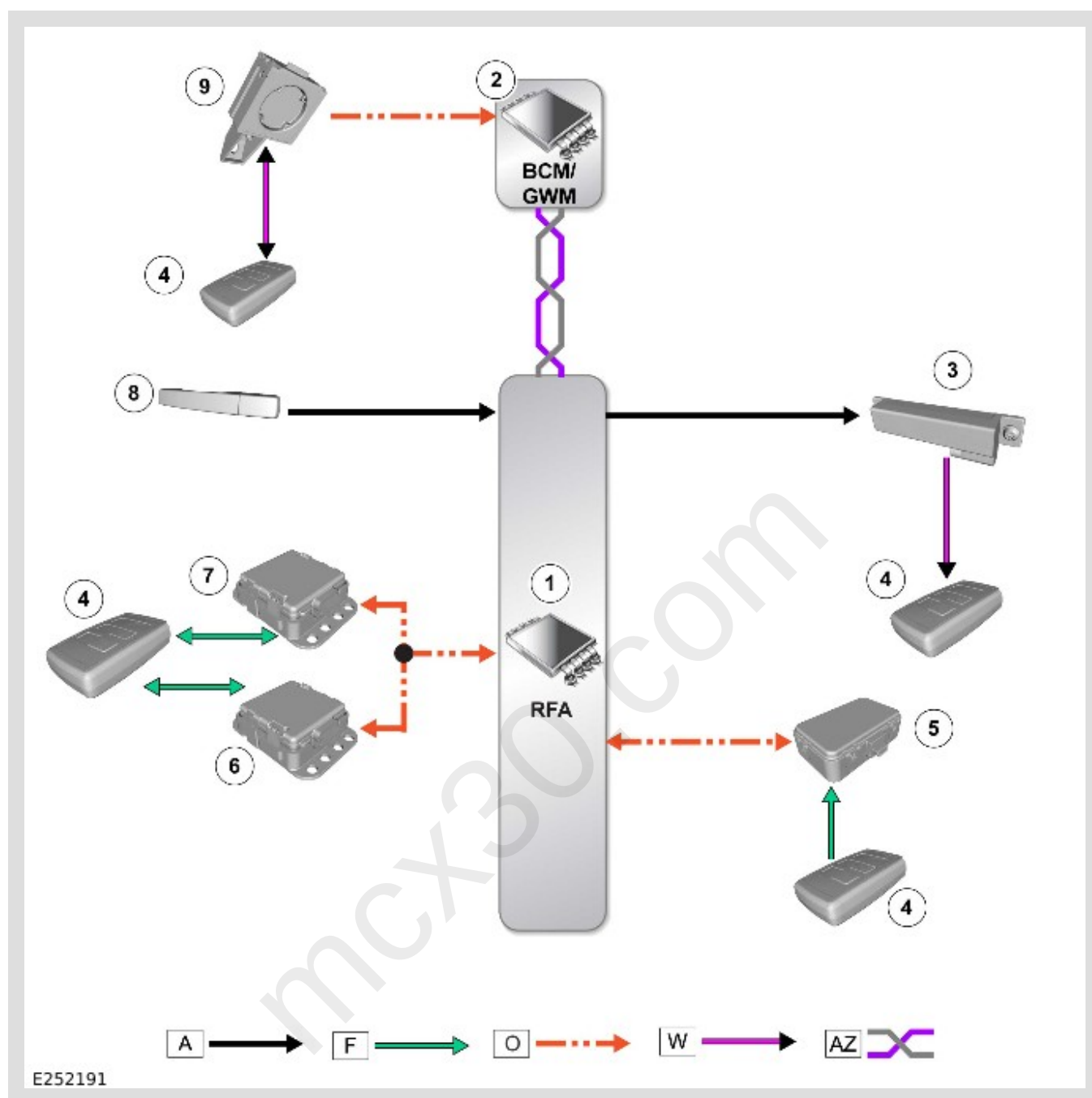
CONTROL DIAGRAM - 1 OF 2 - PASSIVE START



A = HARDWIRED: O = LIN: AX = FLEXRAY: AZ = HS CAN BODY SYSTEM BUS: BA = HS CAN HMI SYSTEM BUS.

ITEM	DESCRIPTION
1	BCM/ GWM
2	RFA
3	IPC
4	PCM
5	VIM
6	Fuel pump relay
7	PCM
8	IPC
9	Ground
10	Power supply
11	Transmission Control Switch (TCS)
12	Ignition switch
13	IAU

CONTROL DIAGRAM – 2 OF 2 – SMART KEY RECOGNITION AND DETECTION



A = HARDWIRED: F = RF TRANSMISSION: O = LIN: W = LF TRANSMISSION: AZ = HS CAN BODY SYSTEMS BUS.

ITEM	DESCRIPTION
1	RFA
2	BCM/ GWM
3	LF antenna (quantity 6)
4	Smart key
5	RF receiver

ITEM	DESCRIPTION
6	Passive entry transceiver - Front
7	Passive entry transceiver - Rear
8	Lock/unlock request - Door handle
9	IAU

cmIjaGFyZG1vcnRvbjsyMDIwLTASLTA4VDE4OjE5OjQ0Ljg3NFo7OTIuNDAuMTg5LjUzOw==

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