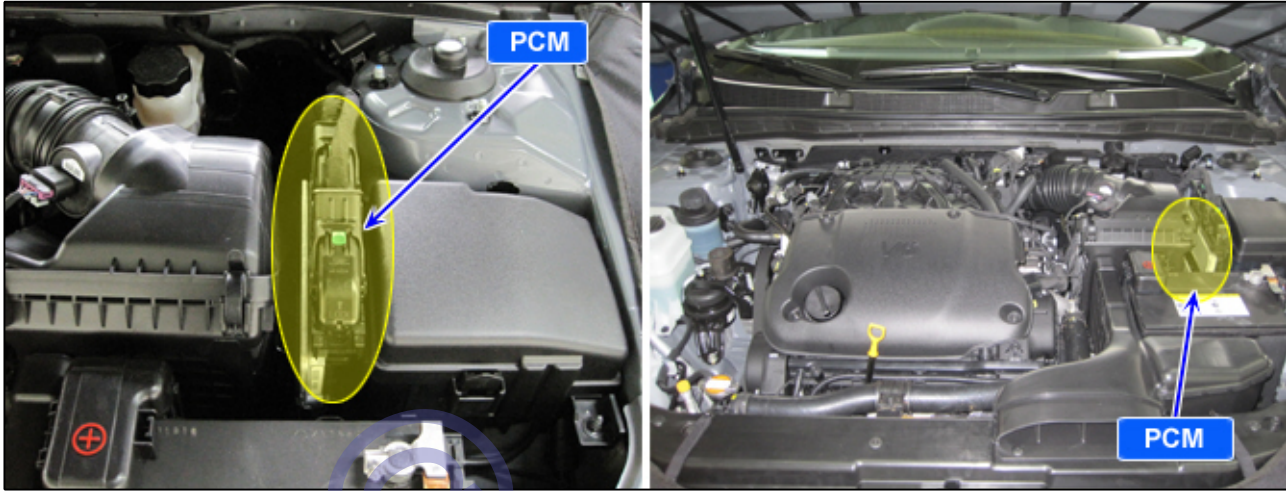


P1610 Non-Immobilizer-EMS Connected to an Immobilizer

Component Location



VG12IMM10P161011

General Description

The immobilizer system consists of a passive challenge-response (mutual authentication) transponder inside the key head, the encoded SMARTRA3 unit / key and the PCM can decode the secret code stored in the SMARTRA3.

The PCM carries out the immobilizer function, the SMARTRA3 management and the key management. The immobilizer function is the unlocking of PCM only after detection of a valid ignition key/ the SMARTRA3 and the locking of PCM after switching off the engine. The PCM communicates the encoded messages to the SMARTRA3 via a dedicated communication line and confirms the key with the SMARTRA3.

The PCM related to immobilizer has the 3 kinds of software. At the first IGN on, the PCM concludes the software of each option (smart key, non-encoded SMARTRA3, encoded SMARTRA3) by communication. It is called "The autodection for PCM". The PCM keeps the previous option before being neutral when it is setted to each option.

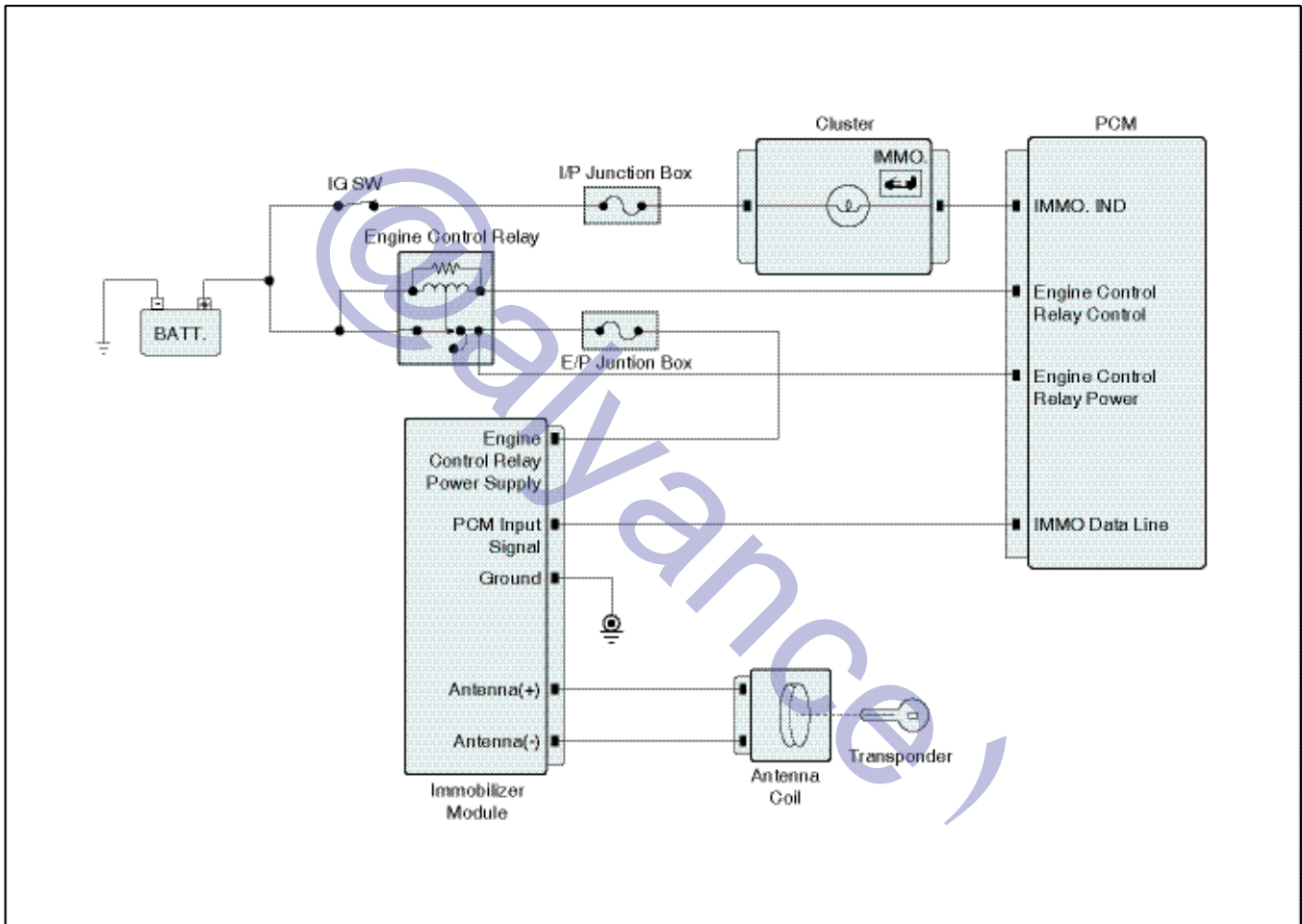
DTC Description

The PCM sets DTC P1610 if Non Immobilizer EMS is installed on vehicle equipped with Immobilizer.

DTC Detecting Condition

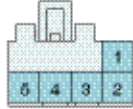
Item	Detecting Condition	Possible Cause
DTC Strategy	• -	1. Invalid PCM
Enable Conditions	• IG ON	
Threshold value	• Non Immobilizer PCM connected	
Detecting time	• Immediately	
Fail Safe	• -	

Diagnostic Circuit Diagram



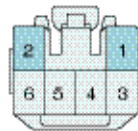
VG12IMM10P1610D

<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



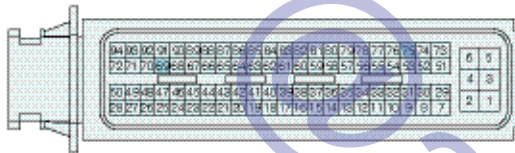
1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



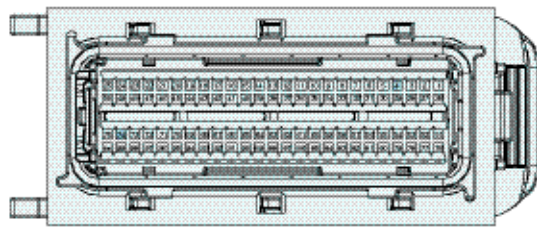
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P1610D1

Signal Waveform & Data

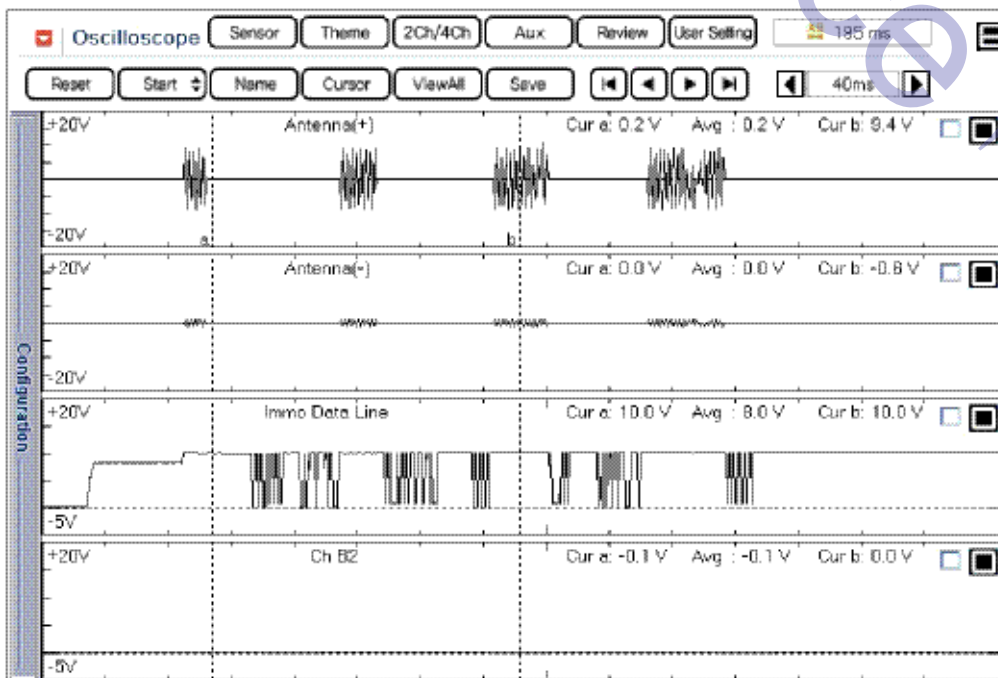


Fig.1

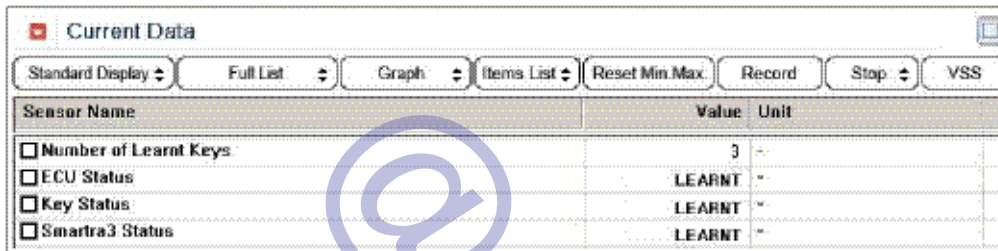
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Check status
 - 1) IGN "ON" & Engine "OFF"
 - 2) Monitor the "ECM Status" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smarta3 Status	LEARNT	-

Fig.1

VG12IMM10P161012S

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

- 3) Has the ECM been learnt ?

YES ► Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ► Substitute with a EMS equipped with Immobilizer and perform the Key teaching procedure with scantool and check for proper operation

If the problem is corrected, replace EMS and then go to "Verification of Vehicle Repair" procedure.

NOTICE

If the EMS is only replaced using an existing key and SMARTRA3, after replacing the "virgin" or "neutral" EMS, reteaching is possible by key Learning mode of scanner.

When the same PIN used in existing vehicle is only inputted, the SMARTRA3 Learning and key Learnings are possible.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

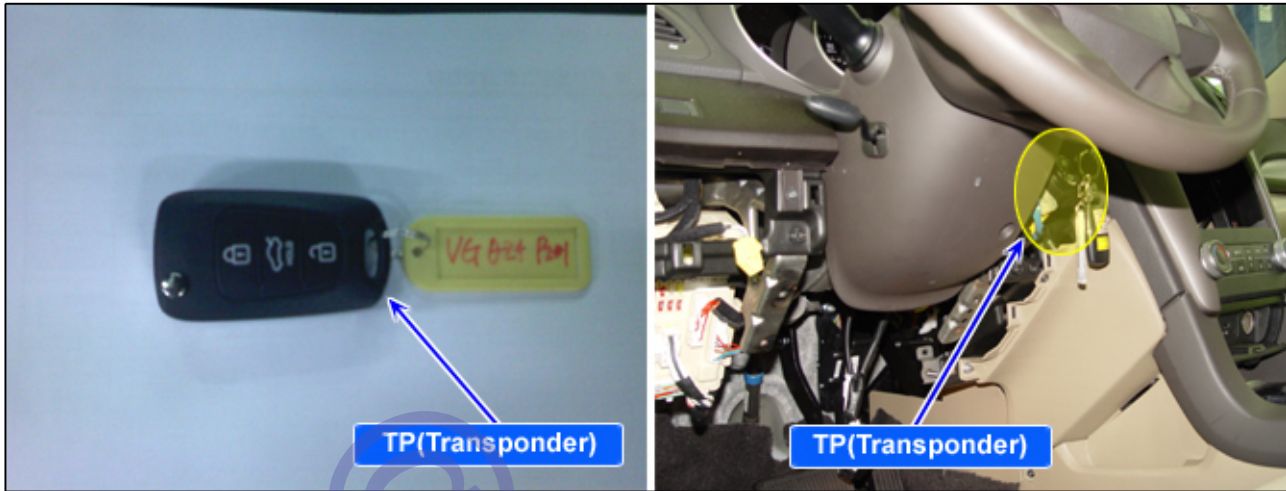
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ► Go to the applicable troubleshooting procedure.

NO ► System is performing to specification at this time.

P1674 Immobilizer-Transponder status Error

Component Location



VG12IMM10P167411

General Description

The vehicle immobilizer system consists of the PCM, the SMARTRA3 and ignition keys with built-in transponder.

The PCM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder.

The encryption algorithm (between PCM and SMARTRA3) is the one offered from BOSCH.

The encryption algorithm (between PCM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the PCM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.

The Key teaching procedure starts with PCM request of PIN from Scanner. The "virgin" PCM stores the PIN and the key Learning can be started. The "learnt" PCM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.

Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by PCM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the PCM. In this case, The PCM can't execute the key learning process.

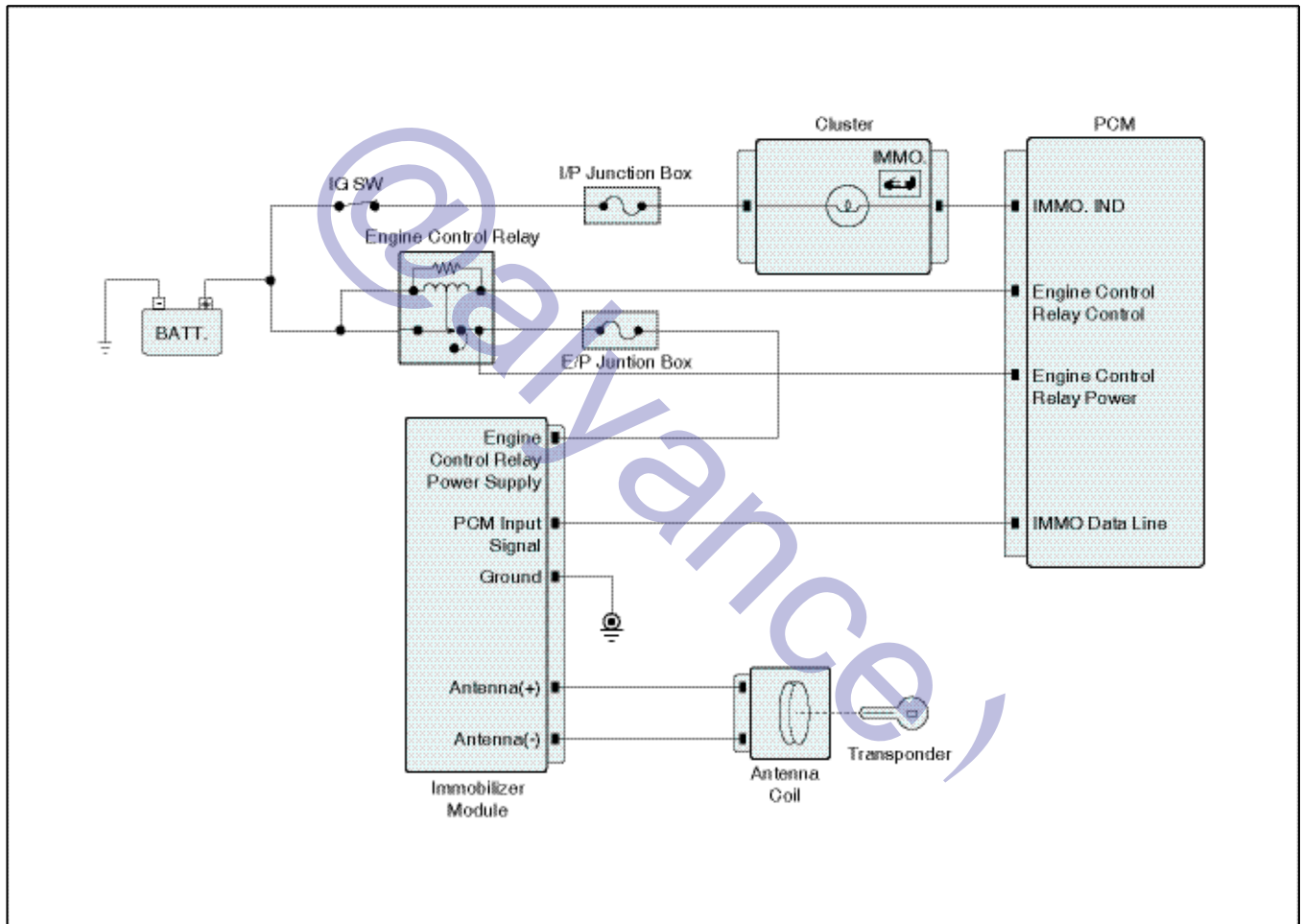
DTC Description

The PCM sets DTC P1674 if transponder key that can't be register(Transponder not in the password mode or whose transport data has been changed) is inserted for registration procedure.

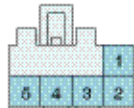
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	1. Invalid transponder. ※ Key not in 'VIRGIN' Status or with invalid ID code
Enable Conditions	• IG ON (On Registering TP Procedure)	
Threshold value	• Key not in 'VIRGIN' Status or with invalid ID code	
Detecting time	• Immediately	
Fail Safe	• -	

Diagnostic Circuit Diagram

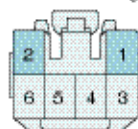


<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



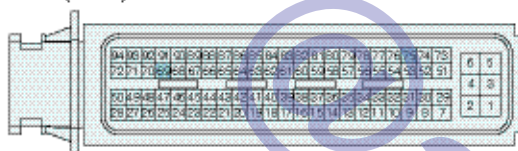
1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



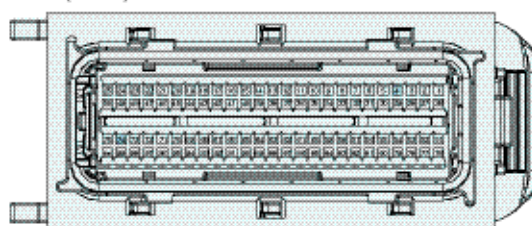
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P1610D1

Signal Waveform & Data

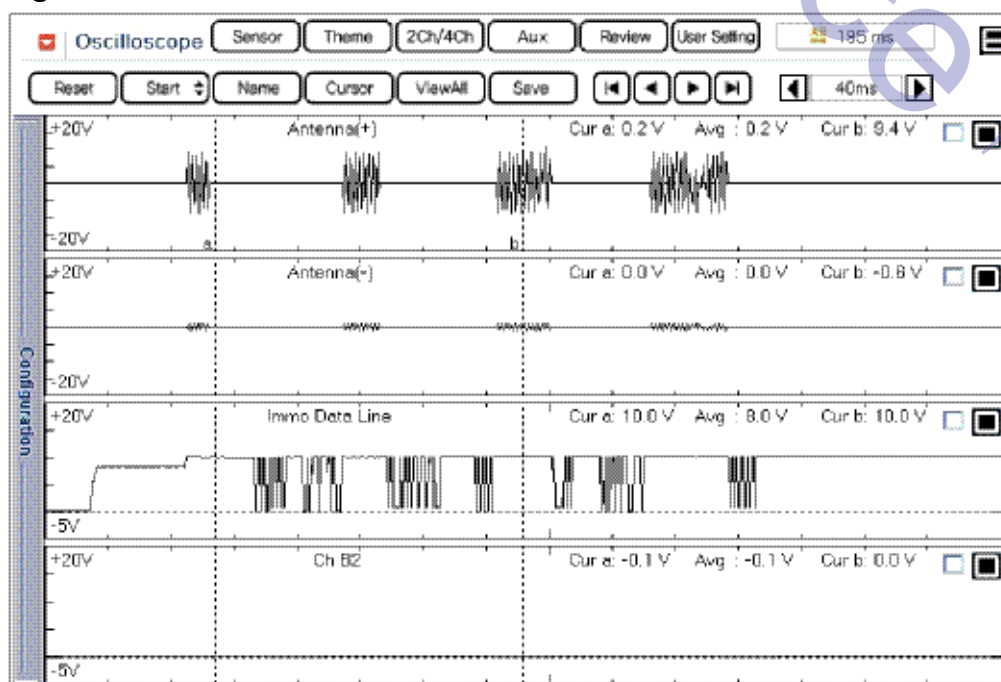


Fig.1

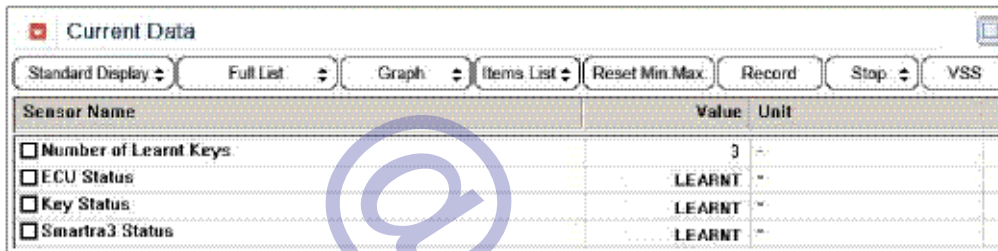
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Check status
 - 1) IGN "ON" & Engine "OFF"
 - 2) Monitor the "ECM, Key and Smartra Status" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

- 3) Have both the ECM and KEY status been learnt ?

YES ▶ Substitute with known good "virgin" transponder and go to "Component Inspection" Procedure.

NO ▶ Go to "Component Inspection" Procedure.

Component Inspection

1. Check transponder
 - 1) IGN "ON" & Engine "OFF"
 - 2) Neutralize PCM and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize PCM and to Register transponder key

- 3) Are Neutralizing and Registering completed normally ?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VG12IMM10P161012S

- NO** ▶ Substitute with a known-good transponder and perform key teaching procedure with scanner.
If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

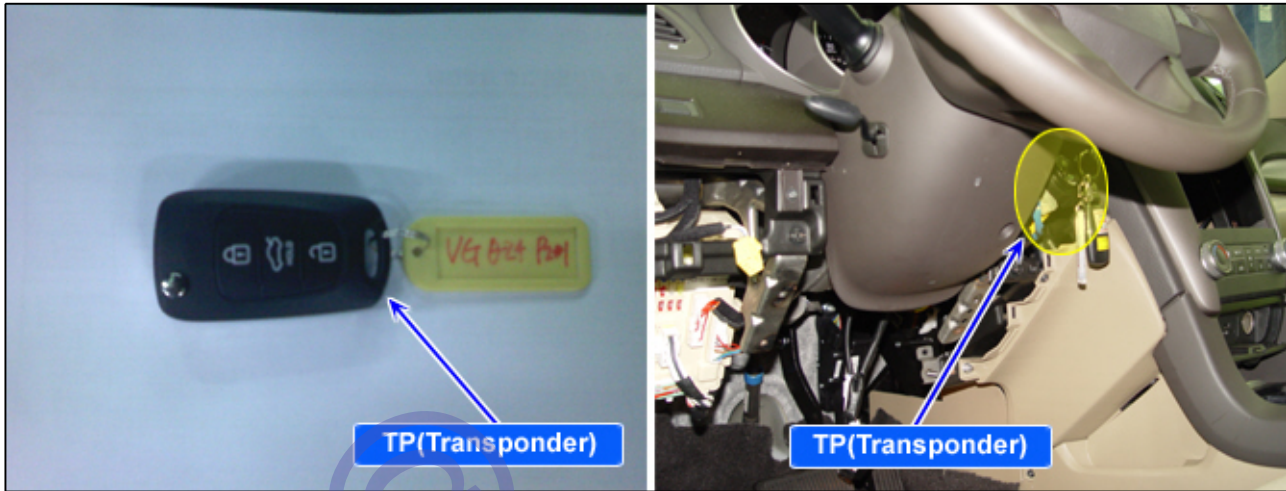
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

P1675 Immobilizer-Transponder Programming Error

Component Location



VG12IMM10P167411

General Description

The vehicle immobilizer system consists of the PCM, the SMARTRA3 and ignition keys with built-in transponder.

The PCM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder.

The encryption algorithm (between PCM and SMARTRA3) is the one offered from BOSCH.

The encryption algorithm (between PCM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the PCM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.

The Key teaching procedure starts with PCM request of PIN from Scanner. The "virgin" PCM stores the PIN and the key Learning can be started. The "learnt" PCM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.

Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by PCM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the PCM. In this case, The PCM can't execute the key learning process.

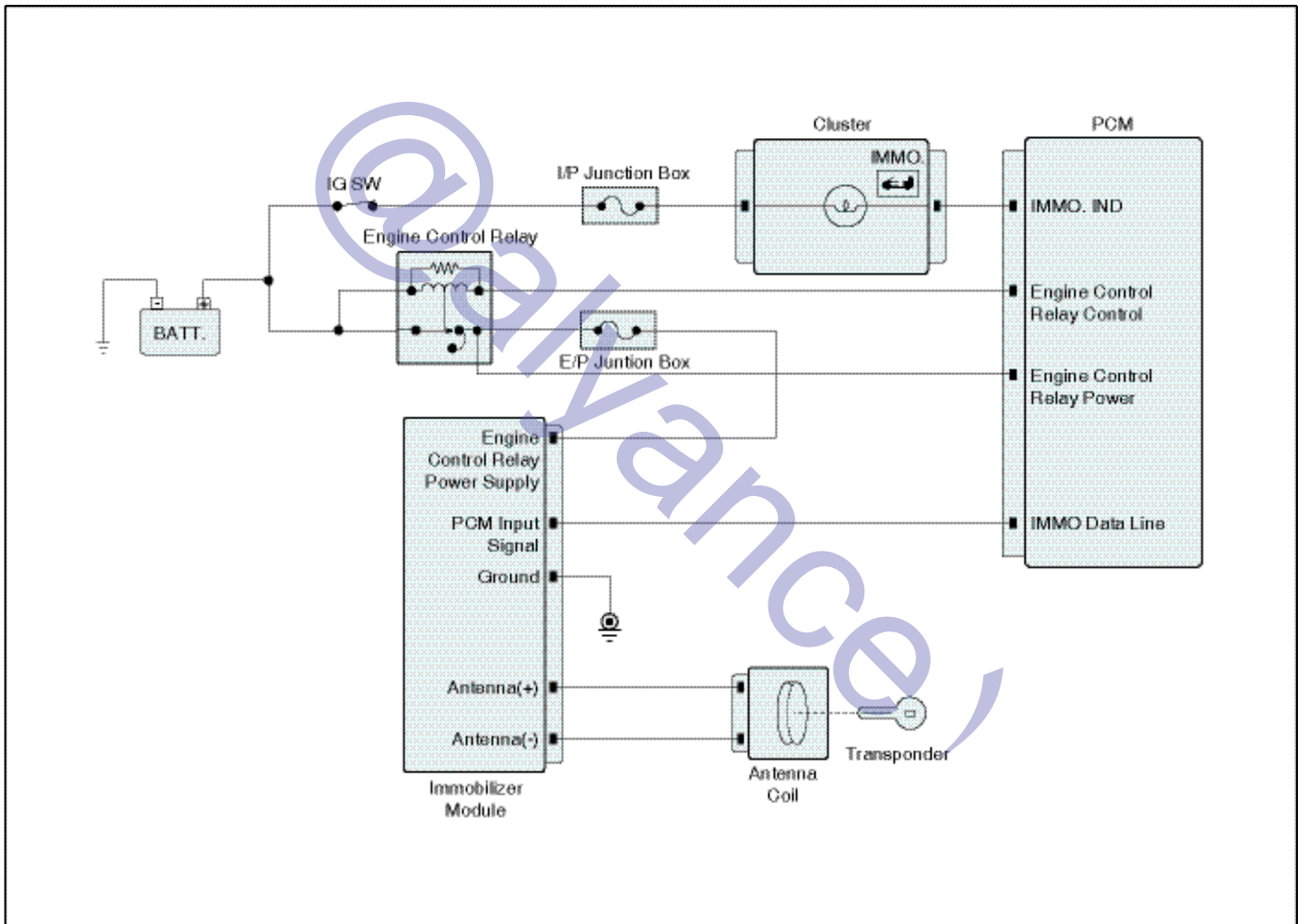
DTC Description

The PCM sets DTC P1675 if characteristic data of transponder doesn't coincide with that of PCM owing to transponder programming error

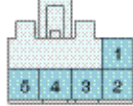
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	1. Invalid transponder. ※ Invalid characteristic data ※ No transponder or more than two transponder is detected by coil antenna
Enable Conditions	• IG ON(During the authentication)	
Threshold value	• Invalid characteristic data • No transponder or more than two transponder is detected by coil antenna	
Detecting time	• Immediately	
Fail Safe	• -	

Diagnostic Circuit Diagram

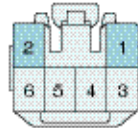


<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



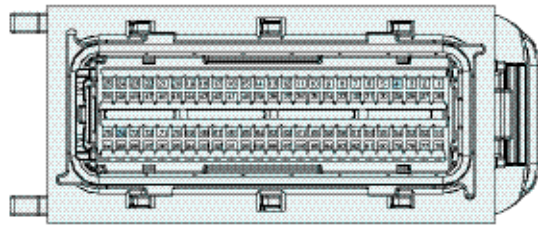
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P1610D1

Signal Waveform & Data

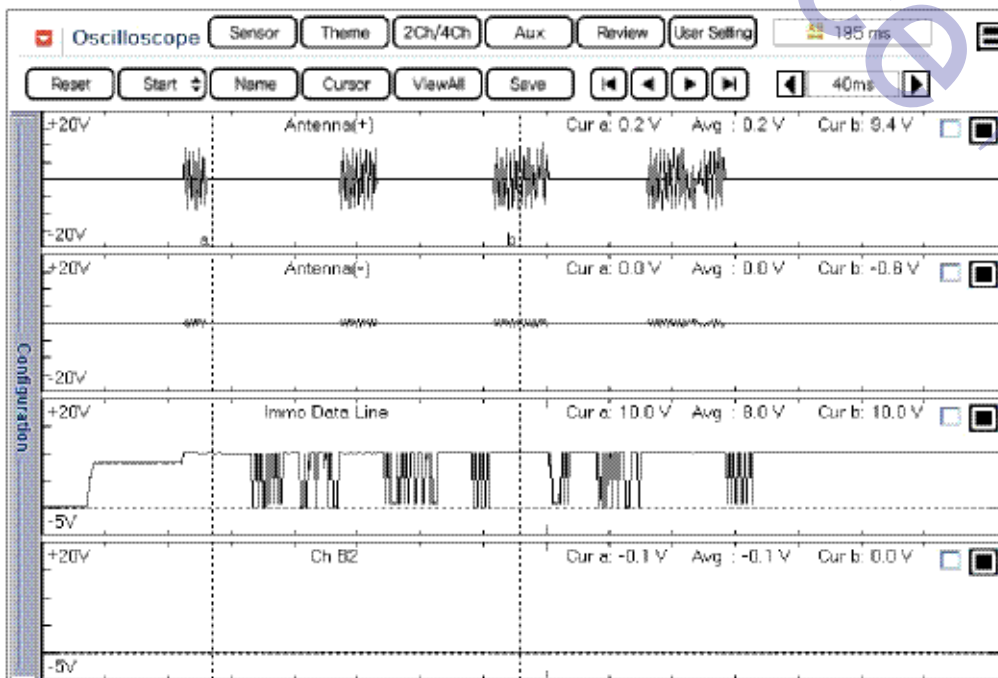


Fig.1

VG12IMM10P161011S

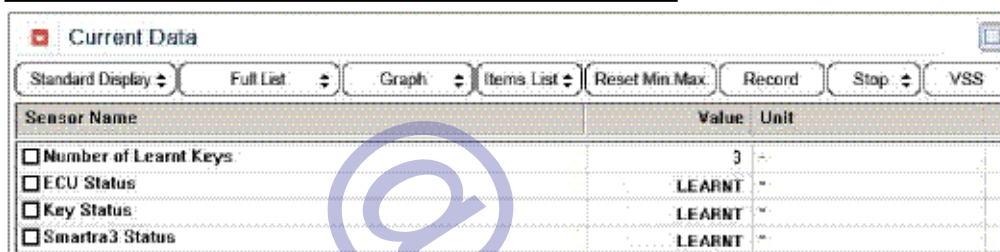
Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Check status

- 1) IGN "ON" & Engine "OFF"
- 2) Monitor the "ECM, Key and Smartra Status" Parameter on the Scantool.

Specification : 'LEARNT'



Current Data		
Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt.

- 3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS" Parameter within specifications?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the PCM or SMARTRA . And This DTC has not erased in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure

NO ▶ Go to "Component Inspection" Procedure.

Component Inspection

1. Check transponder

- 1) IGN "ON" & Engine "OFF"
- 2) Neutralize PCM and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize PCM and to Register transponder key

- 3) Are Neutralizing and Registering completed normally ?

VG12IMM10P161012S

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good transponder and perform the key teaching procedure with scanner.
If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

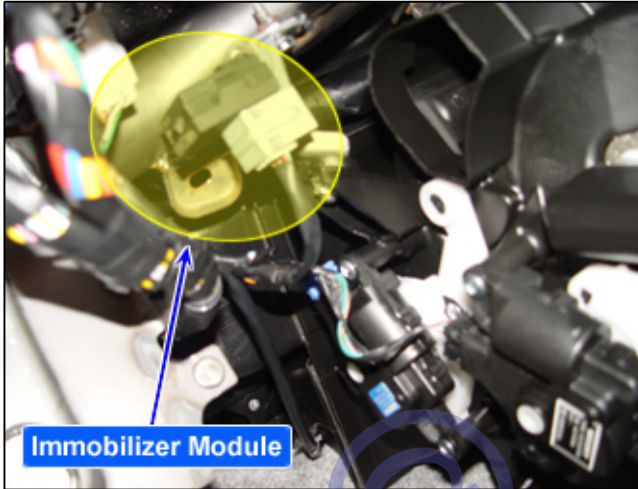
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

P1676 Immobilizer-Smartra Message Error

Component Location



VG12IMM10P167611

General Description

1. The sequences of the PIN code storage are as follows.

1) Input the PIN code into the scanner when key teaching process.

The scanner transmits the Encrypted Code to the PCM after converting the PIN code into Encrypted Code.

2) When the PCM gets the first key learning command, it transmits the SMARTRA3 learnt command and Encrypted Code to the SMARTRA3

3) If the SMARTRA3 status is virgin/neutral, the SMARTRA3 stores Encrypted Code in EEPROM and transmits the success message of the Encrypted Code storage.

(If the SMARTRA3 is learnt, the SMARTRA3 compares Encrypted Code transmitted by the PCM with Encrypted Code stored in EEPROM and transmits the (in)correct Encrypted Code message to PCM)

4) If the SMARTRA3 is learnt normally or the Encrypted Code of the registered SMARTRA3 is the same as the PCM, the PCM begins operation the Transponder Learning.

5) If the learning of the first transponder, the PCM stores the Encrypted Code in its EEPROM and converts state into learnt state.

2. The SMARTRA3 learning :

1) starts with EMS request of PIN from scanner

through the key teaching procedure.

2) is possible in case that the status of SMARTAR is "virgin" or "neutral".

3) In case that the SMARTRA3 is "learnt", the SMARTRA3 will transmits the information if PIN inputted from scanner is same as the PIN in SMARTRA3.

4) is possible regardless of key status.

3. The sequence of the SMARTRA3 confirms are as follows.

1) After communication with the SMARTRA3, the PCM transmits the random number with requirement of the TP ID information.

2) The SMARTRA3 encrypts the random number and transmits the result(Encrypted Random Number) to the PCM with TP ID information.

3) The PCM compares the result transmitted from the SMARTRA3 with the result calculated by PCM.

And If result are coincided with each other; the ECS concludes the valid confirmation of the SMARTRA3.

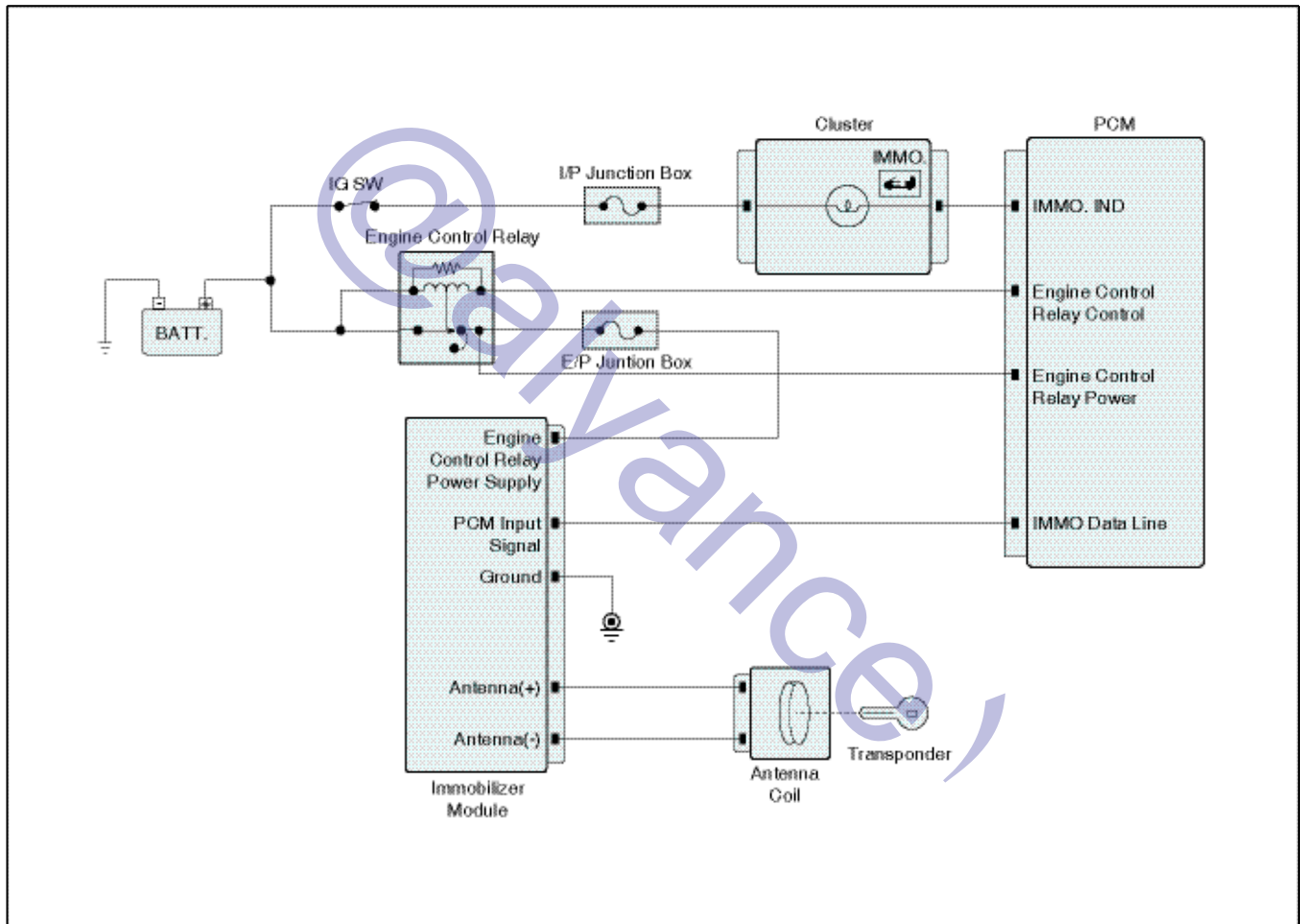
DTC Description

The PCM sets DTC P1676 if there's any fault in message from SMARTRA to ECU

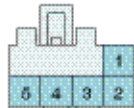
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	1. Faulty SMARTRA
Enable Conditions	• IG ON	
Threshold value	• SMARTRA Message error	
Detecting time	• Immediately	
Fail Safe	• -	

Diagnostic Circuit Diagram

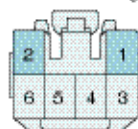


<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



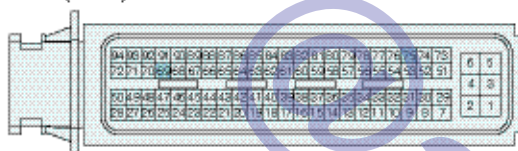
1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



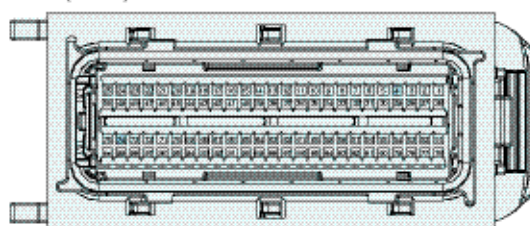
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P1610D1

Signal Waveform & Data

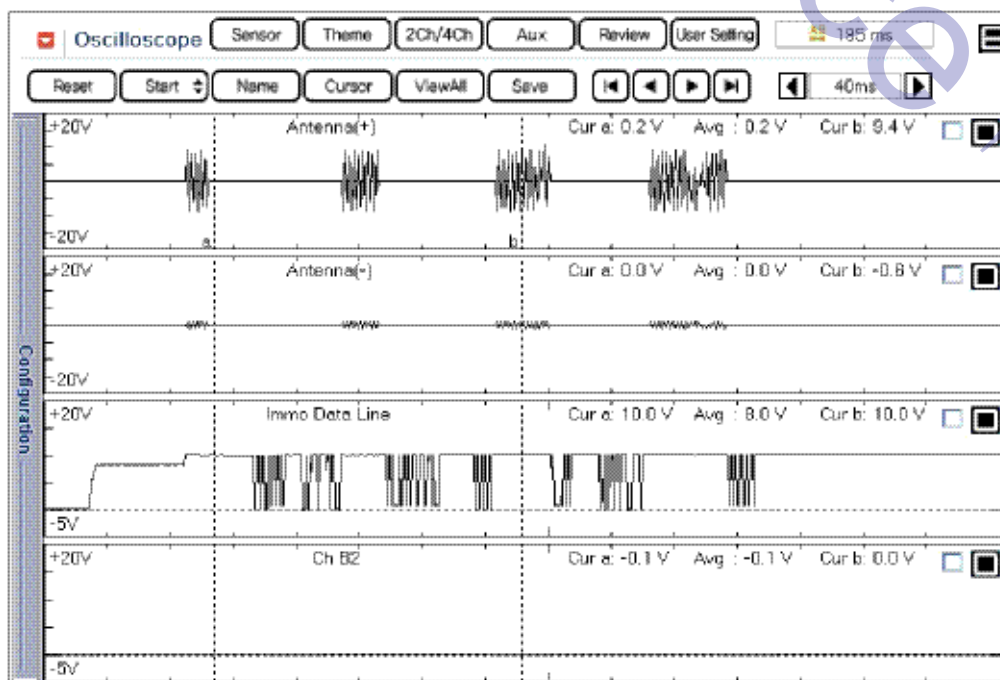


Fig.1

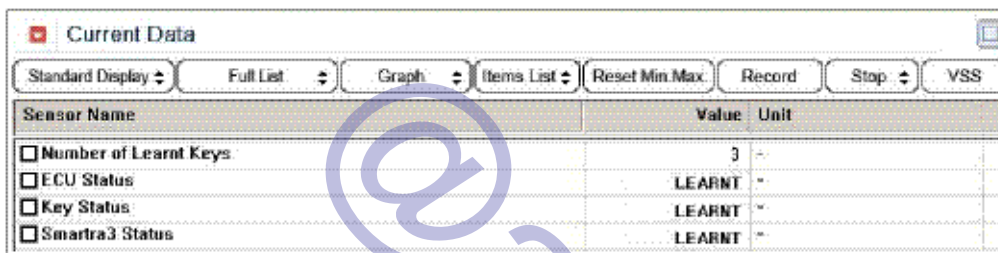
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Check transponder and ECU status
 - 1) IGN "ON" & Engine "OFF" with key intended to register
 - 2) Monitor the "ECU, KEY, Smartra STATUS" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, the Key in key cylinder has been learnt and SMARTRA3 has been learnt

- 3) Has the KEY status learnt ?

YES ► Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the PCM or SMARTRA . And this DTC has not erased in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure .

NO ► Go to "Component Inspection" Procedure.

Component Inspection

1. Check SMARTRA
 - 1) IGN "ON" & Engine "OFF"
 - 2) Neutralize SMARTRA with scantool.
 - 3) Neutralize ECM and Register transponder key by scantool.
- NOTICE**
Pin code is required to Neutralize SMARTRA & ECM and to Register transponder key
- 4) Are Neutralizing and Registering Key completed normally ?

VG12IMM10P161012S

YES ► Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the PCM or SMARTRA . Or It has not erased this DTC in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure .

NO ► Substitute with a known-good SMARTRA and perform the Key teaching. If the problem is corrected, replace SMARTRA and then go to "Verification of Vehicle Repair" procedure.

NOTICE

If the SMARTRA3 is only replaced using an existing key and PCM, after replacing the "virgin" or "neutral" SMARTRA3, reteaching is possible by key Learning mode of GDS. In this case, all existing key must be retaught.

If SMATRA3 is replaced to another one (used at other vehicle), it can only recycle its neutralized first before replacing.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.

2. Operate the vehicle and monitor the DTC on the scantool.

3. Are any DTCs present?

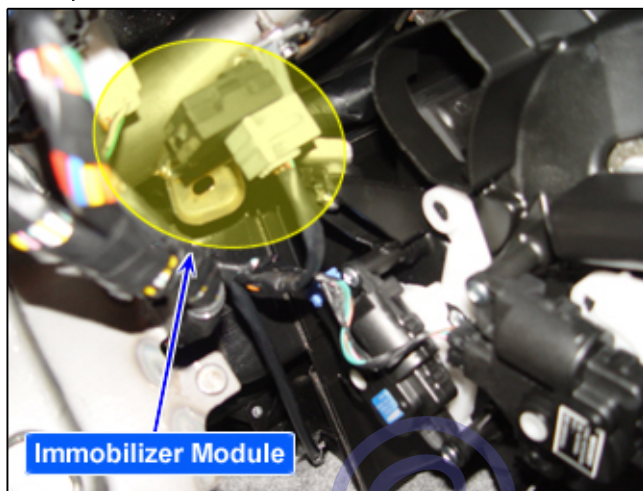
YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

@alyance,

P169A Immobilizer-SMARTRA Authentication Fail

Component Location



VG12IMM10P167611

General Description

1. The sequences of the PIN code storage are as follows.

- 1) Input the PIN code into the scanner when key teaching process.

The scanner transmits the Encrypted Code to the PCM after converting the PIN code into Encrypted Code.

- 2) When the PCM gets the first key learning command, it transmits the SMARTRA3 learnt command and Encrypted Code to the SMARTRA3

- 3) If the SMARTRA3 statue is virgin/neutral, the SMARTRA3 stores Encrypted Code in EEPROM and transmits the success message of the Encrypted Code storage.

(If the SMARTRA3 is learnt, the SMARTRA3 compares Encrypted Code transmitted by the PCM with Encrypted Code stored in EEPROM and transmits the (in)correct Encrypted Code message to PCM)

- 4) If the SMARTRA3 is learnt normally or the Encrypted Code of the registered SMARTRA3 is same as the PCM, the PCM begins operation the Transponder Learning.

- 5) If the learning of the first transponder, the PCM stores the Encrypted Code in its EEPROM and converts state into learnt state.

2. The SMARTRA3 learning :

- 1) starts with EMS request of PIN from scanner

through the key teaching procedure.

- 2) is possible in case that the status of SMARTAR is "virgin" or "neutral".

- 3) In case that the SMARTRA3 is "learnt", the SMARTRA3 will transmits the information if PIN inputted from scanner is same as the PIN in SMARTRA3.

- 4) is possible regardless of key status.

3. The sequence of the SMARTRA3 confirms are as follows.

- 1) After communication with the SMARTRA3, the PCM transmits the random number with requirement of the TP ID information.

- 2) The SMARTRA3 encryptes the random number and transmits the result(Encrypted Random Number) to the PCM with TP ID information.

- 3) The PCM compares the result transmitted from the SMARTRA3 with the result calculated by PCM.

And If result are coincided with each other; the ECS concludes the valid confirmation of the SMARTRA3.

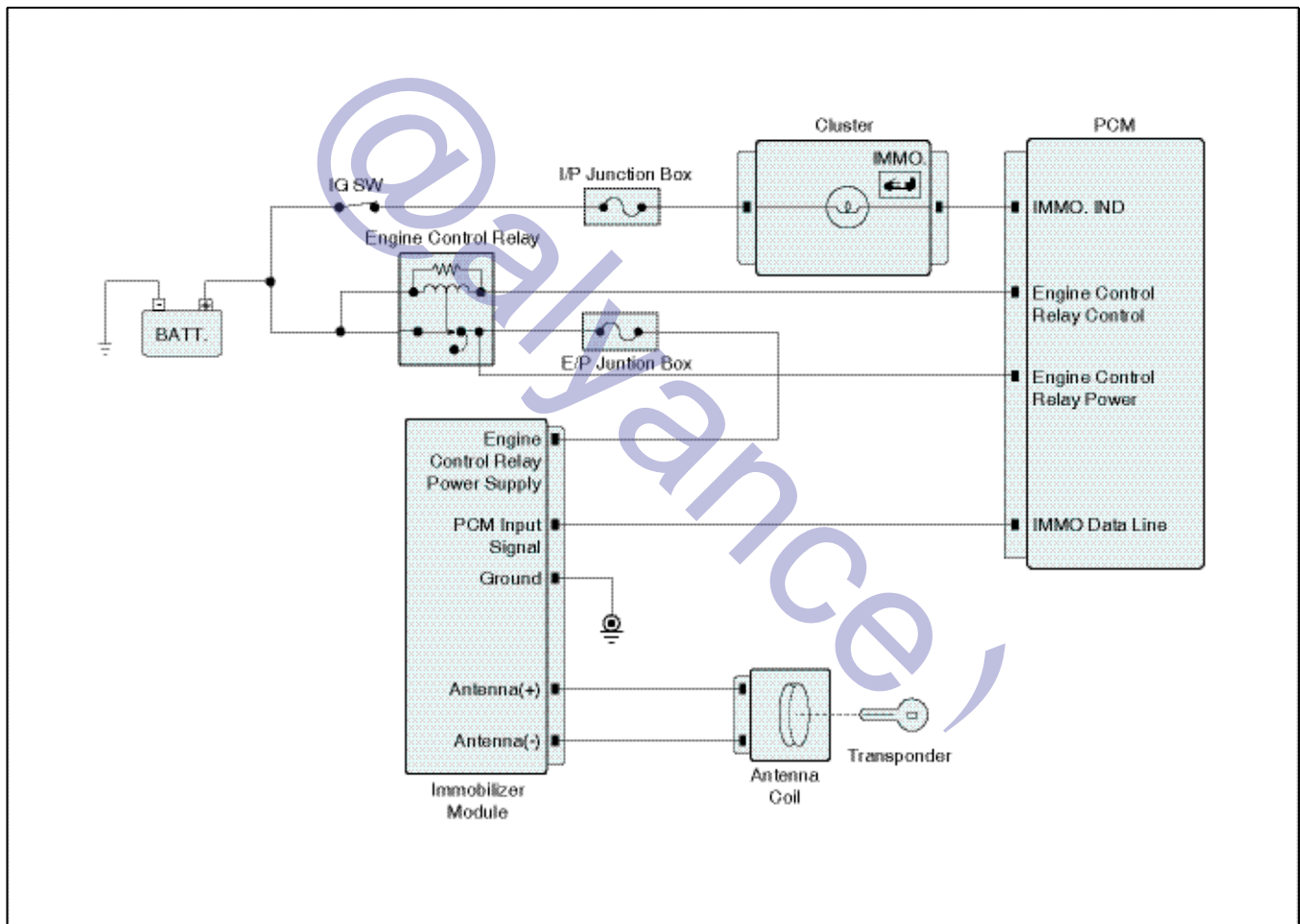
DTC Description

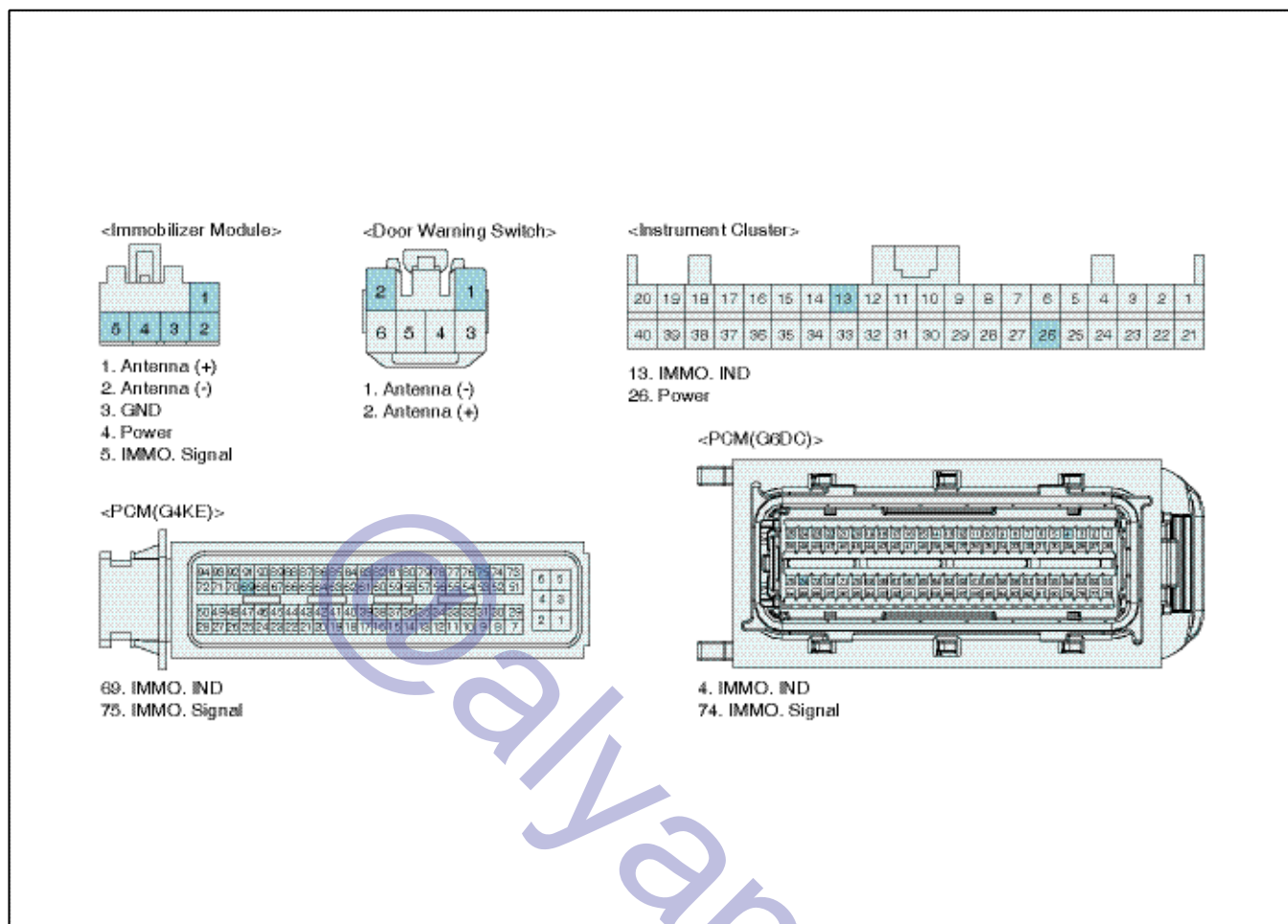
The PCM sets DTC P169A if authentication between PCM and SMARTRA has failed.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	1. Locking of SMARTRA
Enable Conditions	• IG ON	
Threshold value	• Virgin SMARTRA at Learnt EMS • Neutral SMARTRA at Learnt EMS • Incorect the Authetication of EMS and SMARTRA • Locking of SMARTRA	
Detecting time	• -	

Diagnostic Circuit Diagram





VG12IMM10P1610D1

Signal Waveform & Data

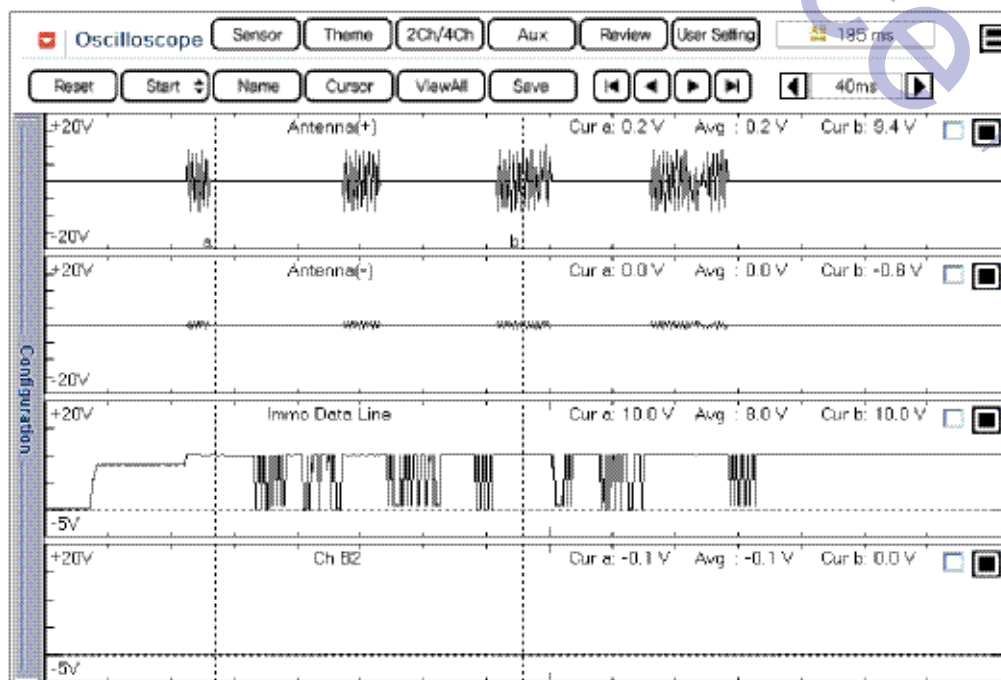


Fig.1

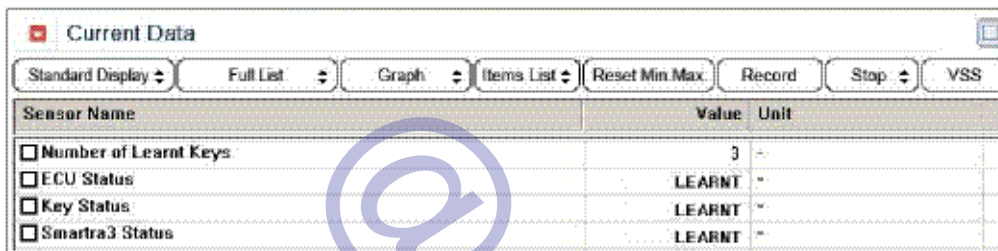
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool data

1. Connect scantool to Data Link Connector(DLC).
2. IGN "ON" & Engine "OFF"
3. Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS" Parameter on the Scantool.

Specification : 'LEARNT'



Current Data		
Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt.

4. Has the "SMARTRA STATUS" been learnt ?

YES ► Keep "KEY ON" status for 1 hours to withdraw "Locked by Timer" status. Then register transponder and go to "Verification of Vehicle Repair" procedure.

NO ► Go to 'Component Inspection' procedure.

Component Inspection

1. Check SMARTRA
 - 1) IGN "ON" & Engine "OFF"
 - 2) Neutralize Both "SMARTRA" and "PCM" and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize SMARTRA and to Register transponder key

- 3) Are Neutralizing and Registering completed normally ?

YES ► Perform all the key teaching procedure with scantool.(All the keys must be retaught)and then, go to "Verification of Vehicle Repair" Procedure.

VG12IMM10P161012S

- NO** ► Substitute with a known-good SMARTRA and Perform Key teaching procedure.
 ► If the problem is corrected, replace SMARTRA and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

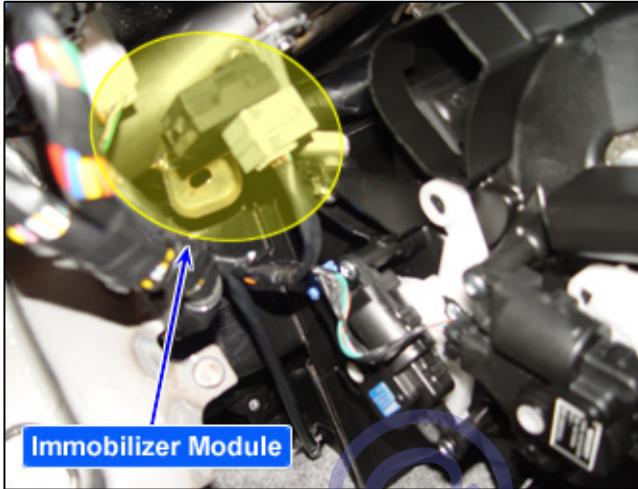
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ► Go to the applicable troubleshooting procedure

NO ► System is performing to specification at this time.

P1690 Immobilizer-Smartra No Response

Component Location



VG12IMM10P167611

General Description

1. The sequences of the PIN code storage are as follows.

- 1) Input the PIN code into the scanner when key teaching process.

The scanner transmits the Encrypted Code to the PCM after converting the PIN code into Encrypted Code.

- 2) When the PCM gets the first key learning command, it transmits the SMARTRA3 learnt command and Encrypted Code to the SMARTRA3

- 3) If the SMARTRA3 statue is virgin/neutral, the SMARTRA3 stores Encrypted Code in EEPROM and transmits the success message of the Encrypted Code storage.

(If the SMARTRA3 is learnt, the SMARTRA3 compares Encrypted Code transmitted by the PCM with Encrypted Code stored in EEPROM and transmits the (in)correct Encrypted Code message to PCM)

- 4) If the SMARTRA3 is learnt normally or the Encrypted Code of the registered SMARTRA3 is same as the PCM, the PCM begins operation the Transponder Learning.

- 5) If the learning of the first transponder, the PCM stores the Encrypted Code in its EEPROM and converts state into learnt state.

2. The SMARTRA3 learning :

- 1) starts with EMS request of PIN from scanner

through the key teaching procedure.

- 2) is possible in case that the status of SMARTAR is "virgin" or "neutral".

- 3) In case that the SMARTRA3 is "learnt", the SMARTRA3 will transmits the information if PIN inputted from scanner is same as the PIN in SMARTRA3.

- 4) is possible regardless of key status.

3. The sequence of the SMARTRA3 confirms are as follows.

- 1) After communication with the SMARTRA3, the PCM transmits the random number with requirement of the TP ID information.

- 2) The SMARTRA3 encryptes the random number and transmits the result(Encrypted Random Number) to the PCM with TP ID information.

- 3) The PCM compares the result transmitted from the SMARTRA3 with the result calculated by PCM.

And If result are coincided with each other; the ECS concludes the valid confirmation of the SMARTRA3.

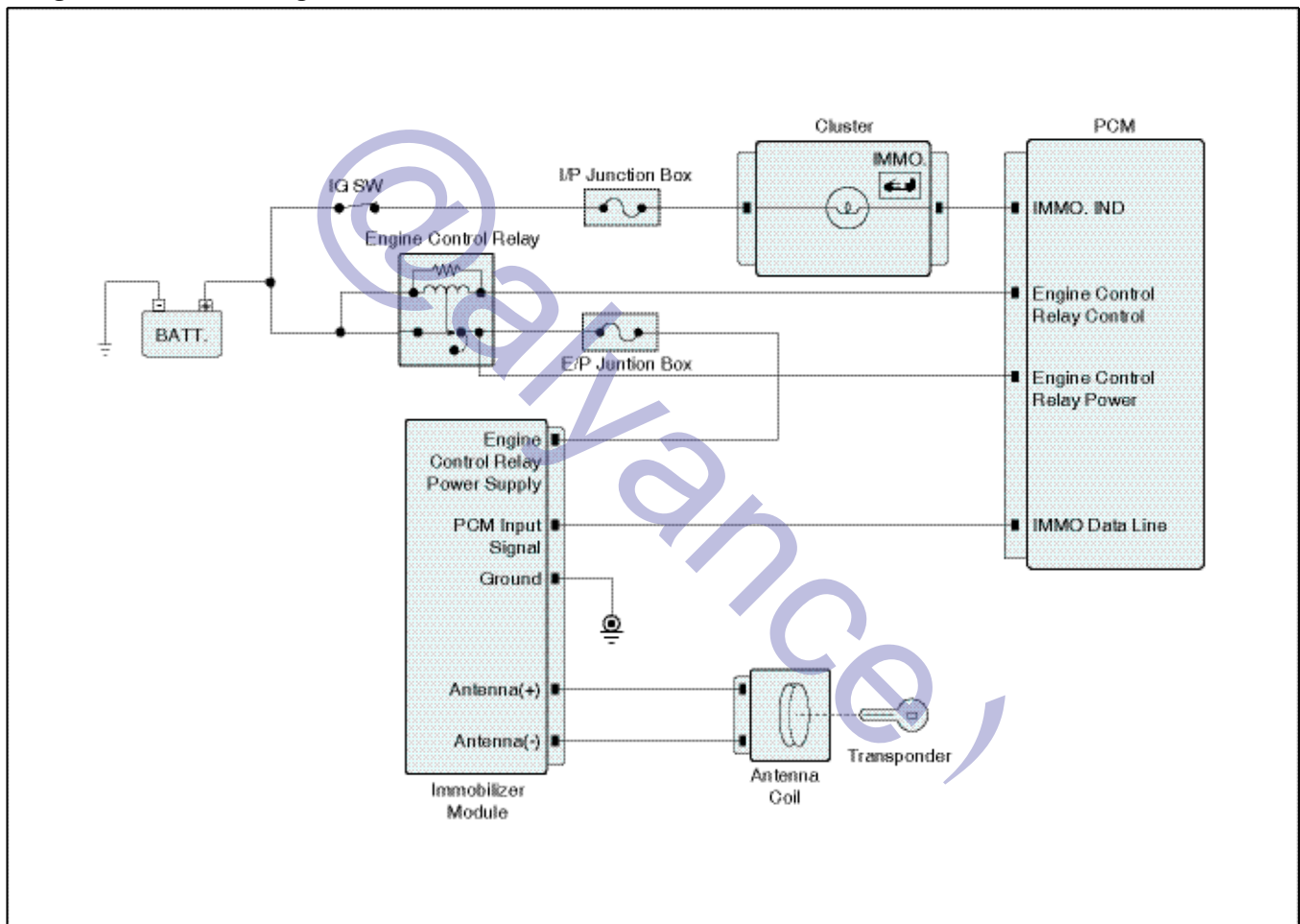
DTC Description

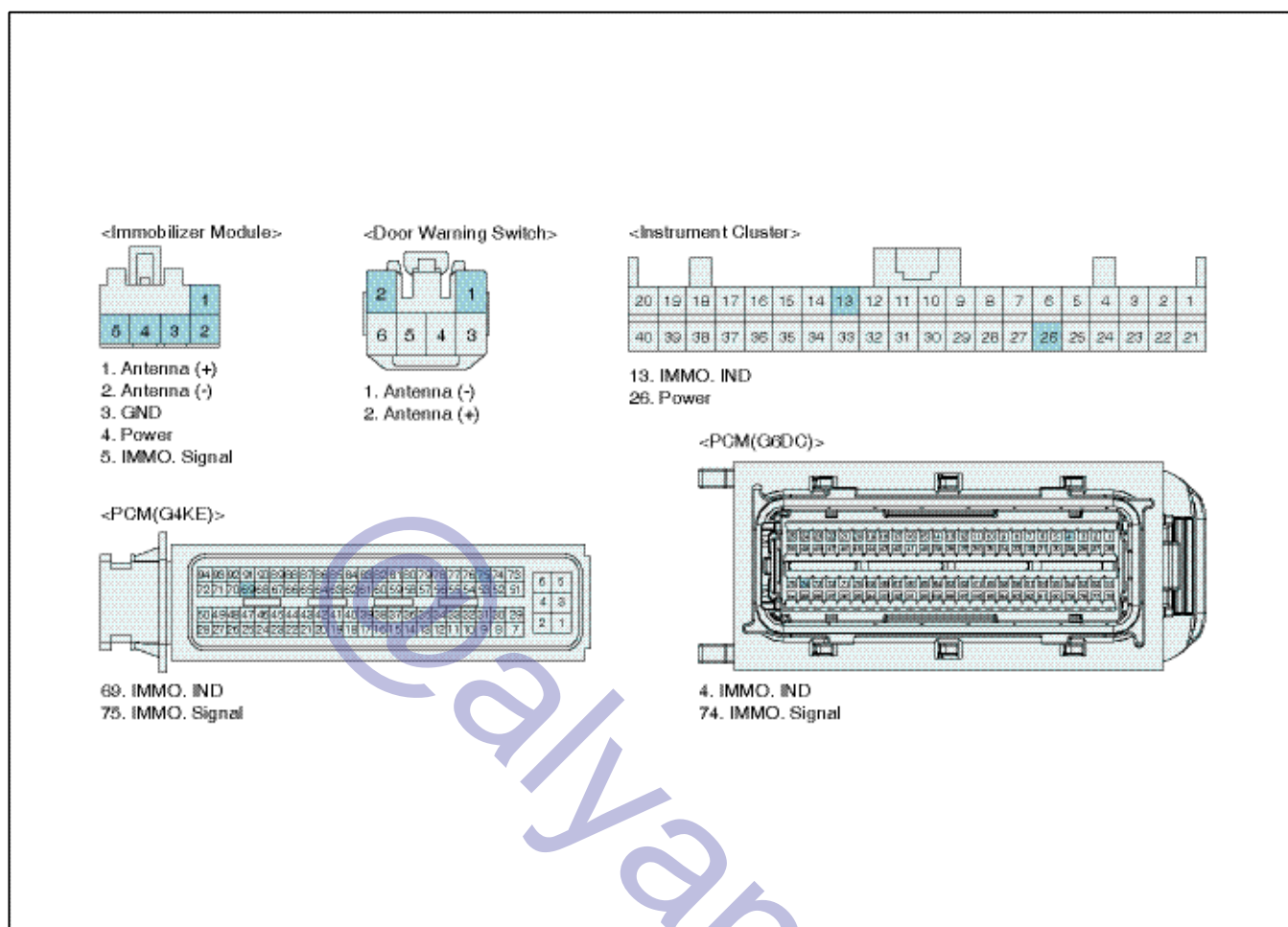
The PCM sets DTC P1690 if there's No Response from SMARTRA.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	1. Open Circuit in signal harness 2. Short Circuit in signal harness 3. Faulty SMARTRA
Enable Conditions	• IG ON	
Threshold value	• No signal from SMARTRA	
Detecting time	• -	
Fail Safe	• -	

Diagnostic Circuit Diagram





VG12IMM10P1610D1

Signal Waveform & Data

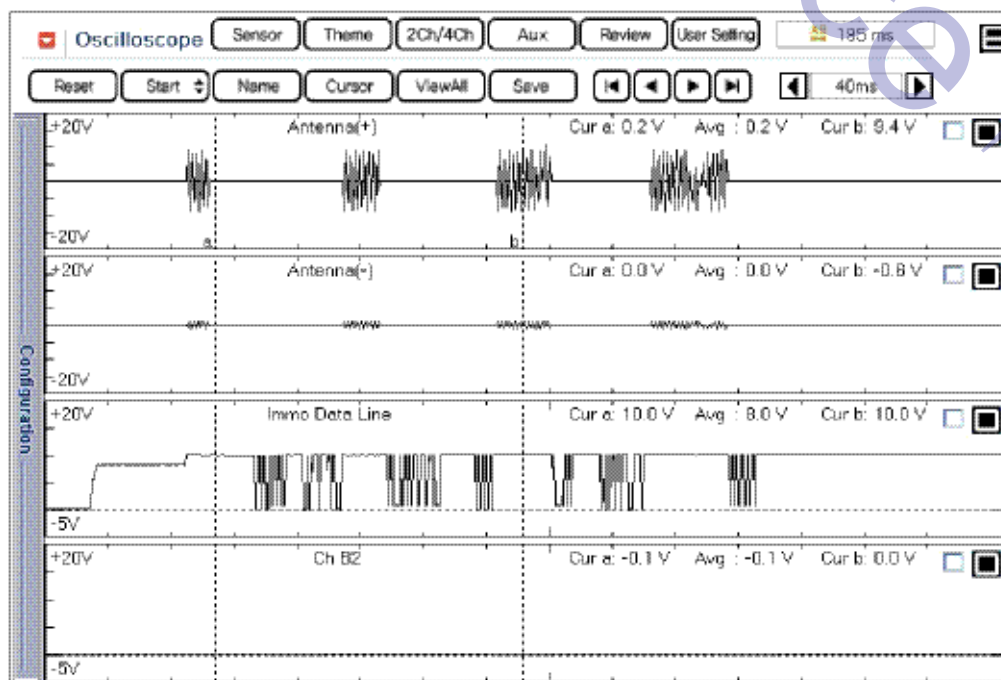


Fig.1

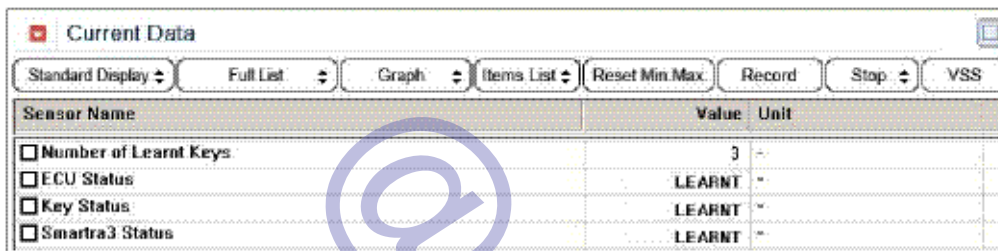
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. IG "ON" & Engine "OFF"
3. Monitor the "ECU, KEY and Smartra STATUS" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

VG12IMM10P161012S

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, the Key in key cylinder has been learnt and SMARTRA3 has been learnt.

4. Has the "Smartra STATUS" been learnt ?

YES ► Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the PCM or SMARTRA . And this DTC has not erased in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure

NO ► Go to "Inspection & Repair" procedure

1. Check for open in harness

- 1) Ignition "OFF"
- 2) Disconnect SMARTRA Connector.
- 3) Ignition "ON" & Engine "OFF"
- 4) Measure voltage between Engine Control Relay Power of SMARTRA harness connector and chassis ground.

Specification : 9~16V

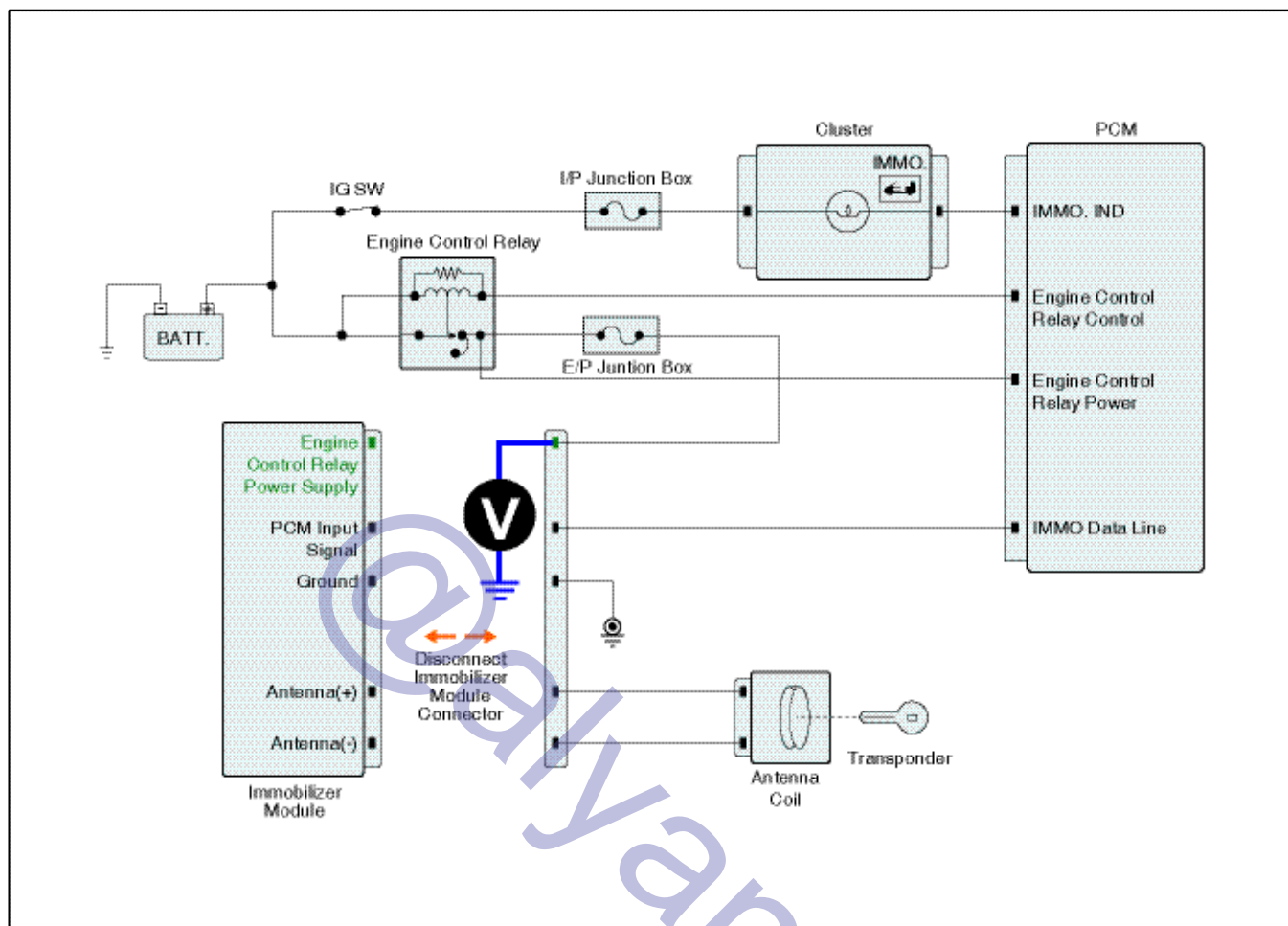
Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ► Repair as necessary and go to "Verification Vehicle Repair" procedure

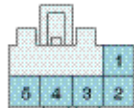
NO ► Go to "W/Harness Inspection" procedure

Power circuit Inspection



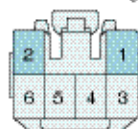
VG12IMM10P169031

<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



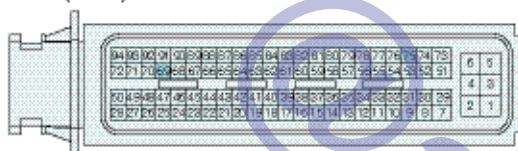
1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



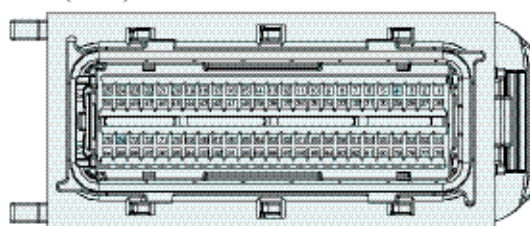
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P169031-1

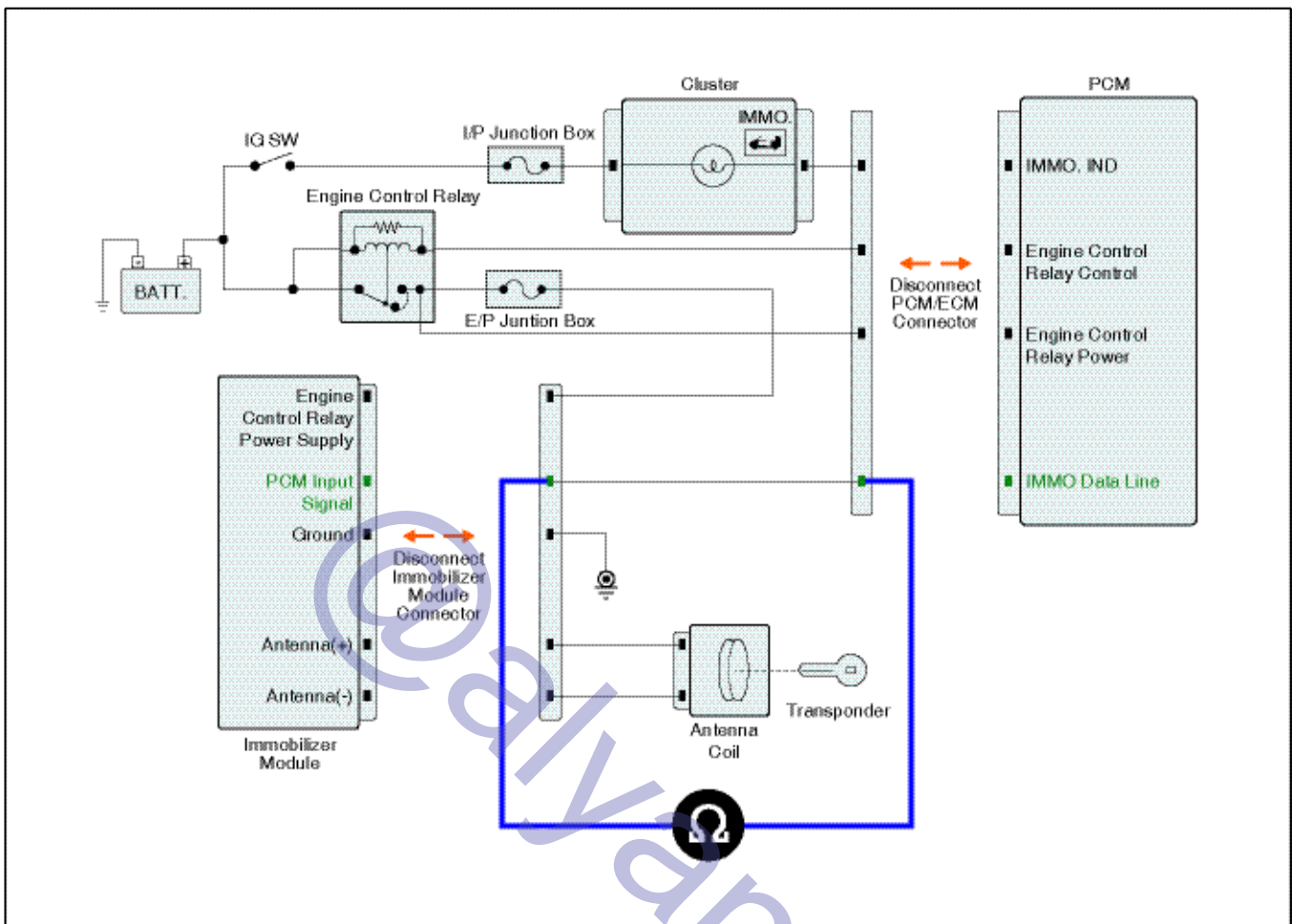
5) Is the measured voltage within specifications?

- YES** ► Go to "Signal circuit Inspection" procedure
- NO** ► Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Signal circuit Inspection

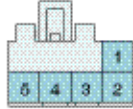
1. Check for open in harness
 - 1) Ignition "OFF"
 - 2) Disconnect SMARTRA connector.
 - 3) Measure resistance between signal terminal of smartra harness connector and PCM hareness connector.

Specification : 1 Ω or less



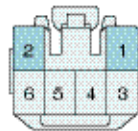
VG12IMM10P169032

<Immobilizer Module>



- 1. Antenna (+)
- 2. Antenna (-)
- 3. GND
- 4. Power
- 5. IMMO. Signal

<Door Warning Switch>



- 1. Antenna (-)
- 2. Antenna (+)

<Instrument Cluster>



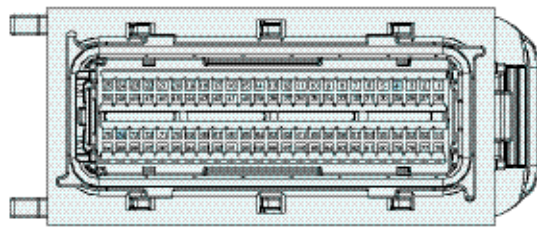
- 13. IMMO. IND
- 26. Power

<PCM(G4KE)>



- 69. IMMO. IND
- 75. IMMO. Signal

<PCM(G6DC)>



- 4. IMMO. IND
- 74. IMMO. Signal

VG12IMM10P169032-1

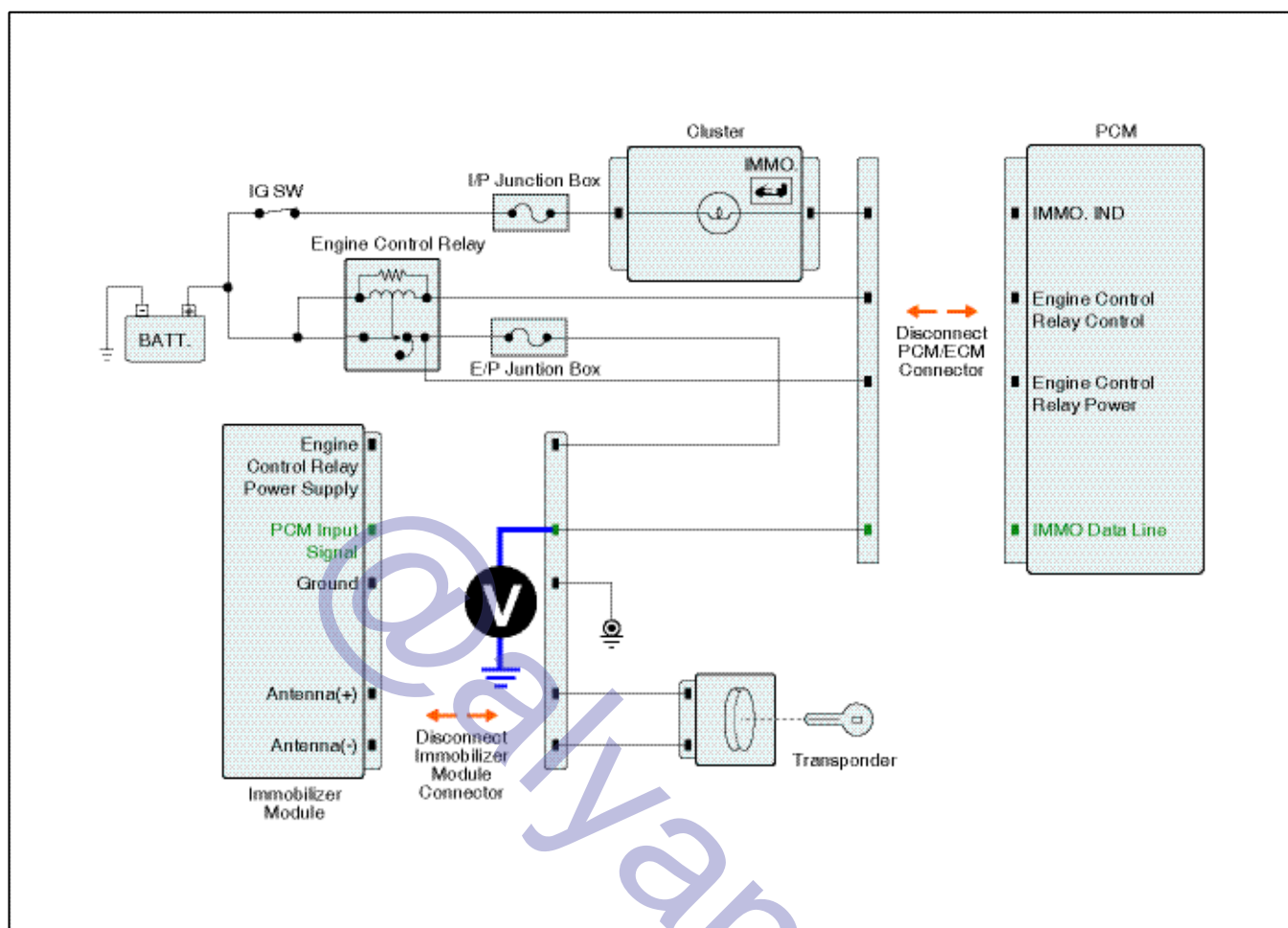
4) Is the measured resistance within specifications?

- YES** ► Go to "Check for short in harness" procedure.
- NO** ► Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short in harness

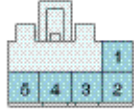
- 1) Ignition "OFF"
- 2) Disconnect SMARTRA connector.
- 3) Ignition "ON" & Engine "OFF"
- 4) Measure voltage between signal terminal of SMARTRA harness connector and chassis ground.

Specification : Approx. 5.48V



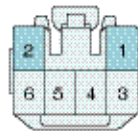
VG12IMM10P169033

<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



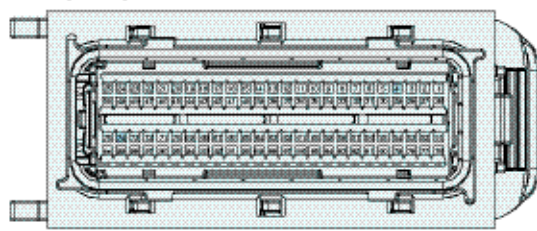
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P169032-1

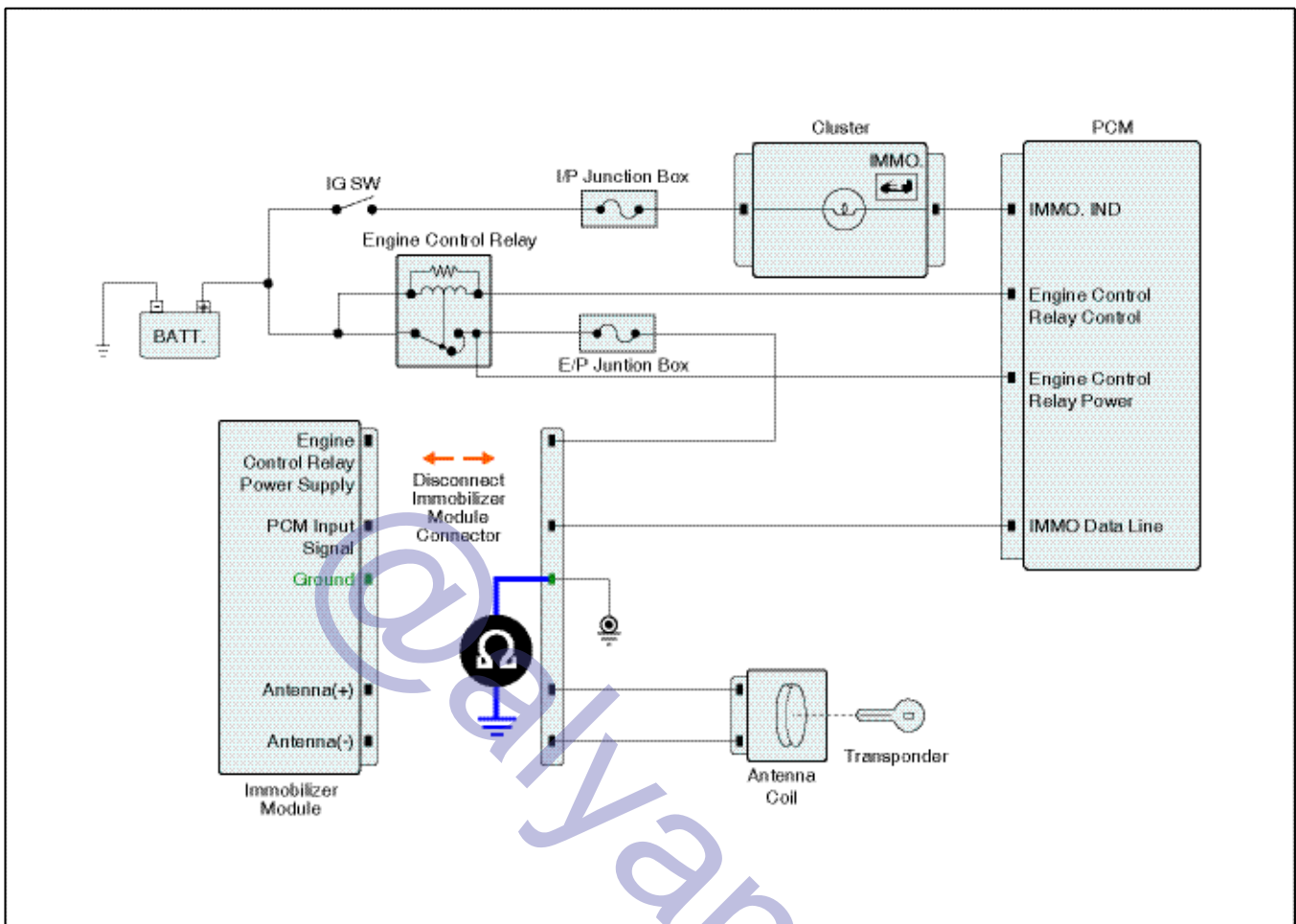
5) Is the measured voltage within specifications?

- YES** ► Go to "Signal circuit Inspection" procedure
- NO** ► Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

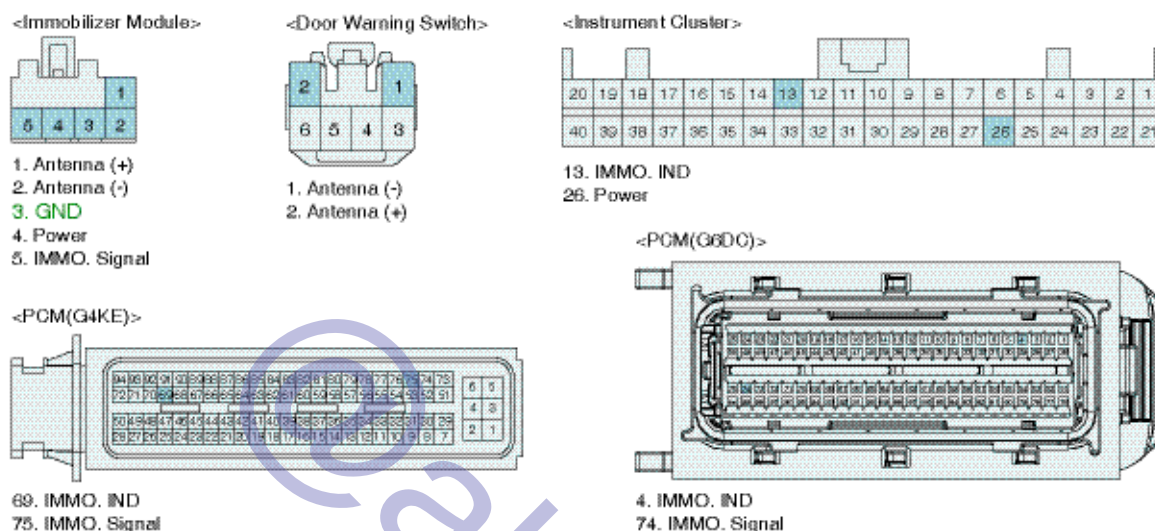
Ground circuit Inspection

1. Check for open in ground harness
 - 1) Ignition "OFF"
 - 2) Disconnect SMARTRA connector.
 - 3) Measure resistance between ground terminal of SMARTRA harness and chassis ground.

Specification : 1 Ω or less



VG12IMM10P169034



VG12IMM10P169034-1

4) Is the measured resistance within specifications?

YES ▶ Go to "Component Inspection" procedure.

NO ▶ Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good SMARTRA and Perform Key teaching procedure.
▶ If the problem is corrected, replace SMARTRA and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Check SMARTRA

- 1) IG"ON" & Engine "OFF"
- 2) Neutralize Both "SMARTRA" and "PCM" and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize SMARTRA and to Register transponder key

3) Are Neutralizing and Registering completed normally ?

YES ▶ Perform all the key teaching procedure with scantool. (All the keys must be retaught) and then, go to "Verification of Vehicle Repair" Procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

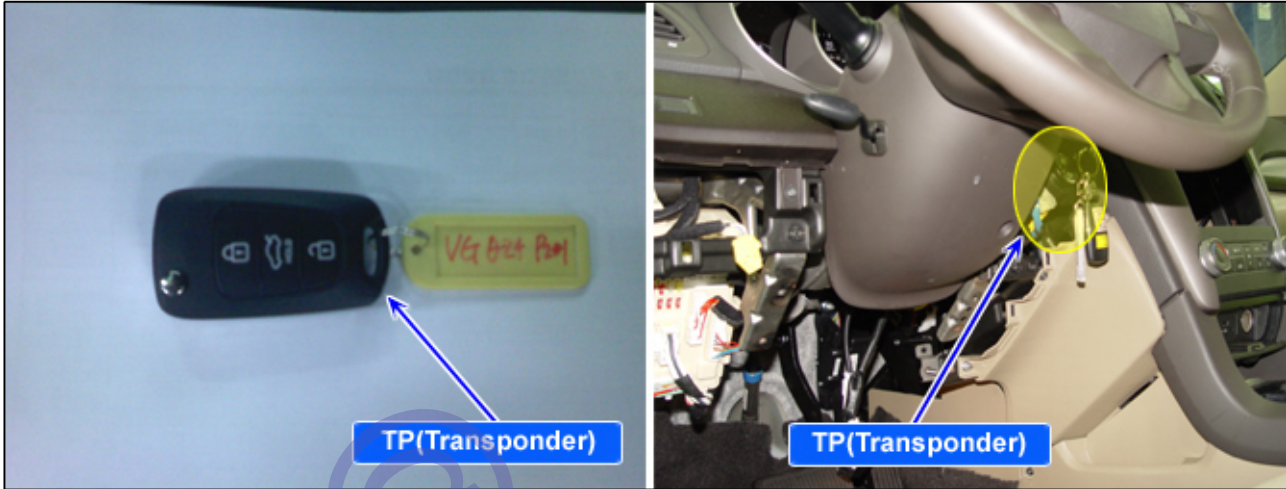
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure

NO ▶ System is performing to specification at this time.

P1691 Immobilizer-Antenna Coil Error

Component Location



VG12IMM10P167411

General Description

This wireless communication runs on RF (Radio frequency of 125 kHz). The antenna coil is mounted on the top of ignition lock for RF transmission and receiving. The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the PCM are converted into an RF signal, which is transmitted, to the transponder by the antenna.

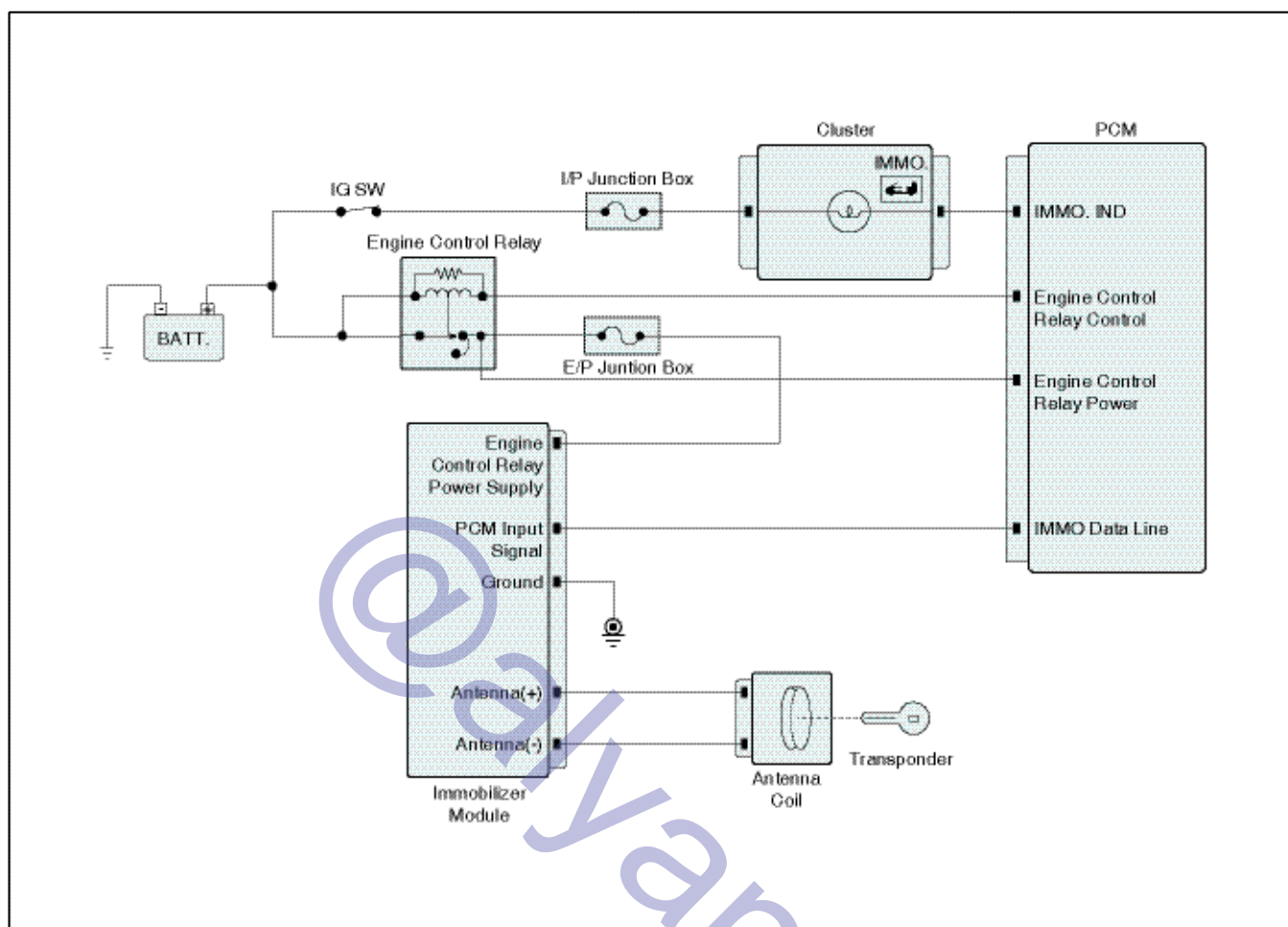
DTC Description

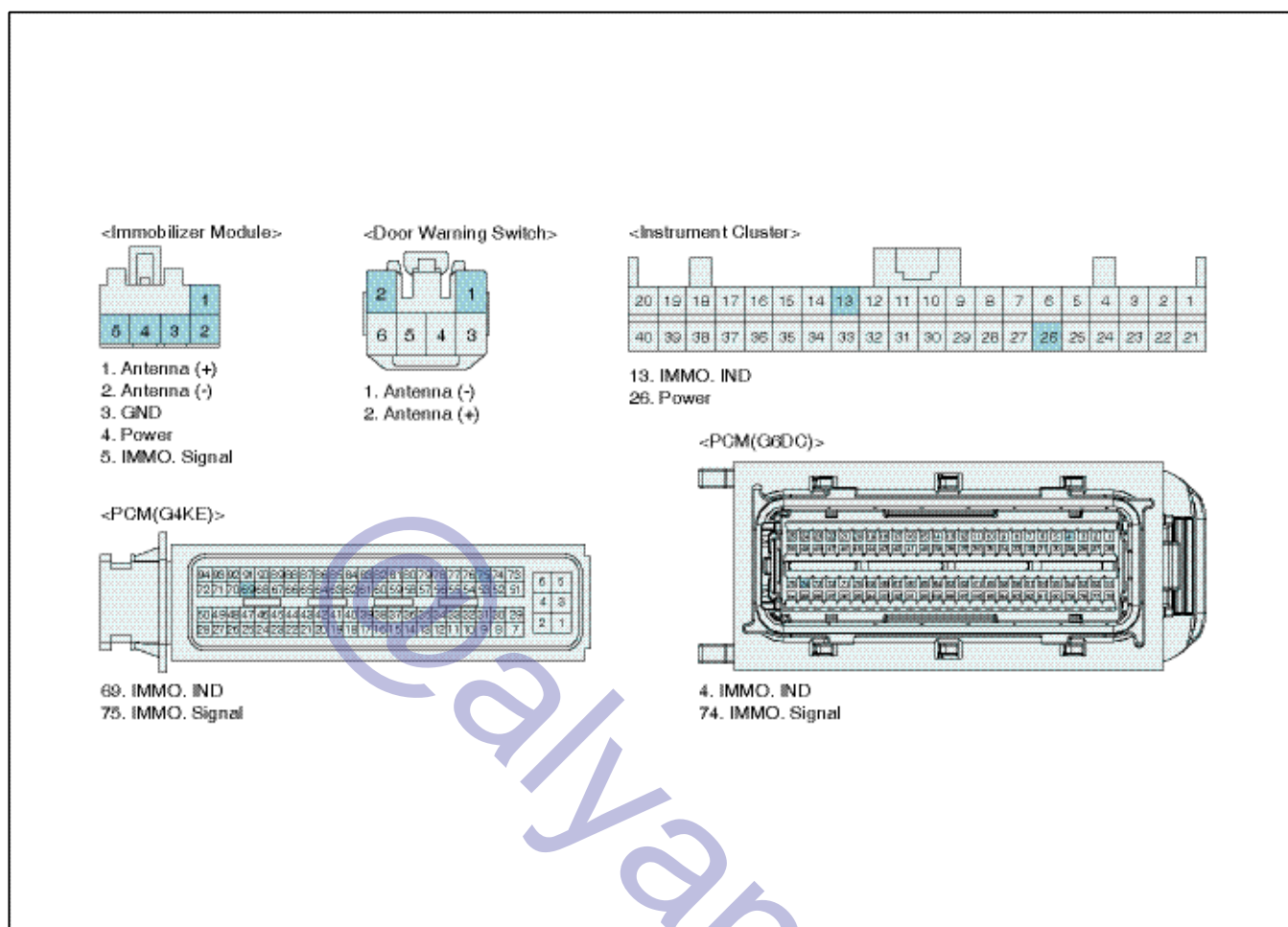
The PCM sets DTC P1691 if there's any fault in immobilizer antenna coil.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	1. Open Circuit in antenna coil 2. Short Circuit in antenna coil 3. Faulty antenna coil
Enable Conditions	• IG ON	
Threshold value	• Error in antenna coil signal	
Detecting time	• -	
Fail Safe	• -	

Diagnostic Circuit Diagram





VG12IMM10P1610D1

Signal Waveform & Data

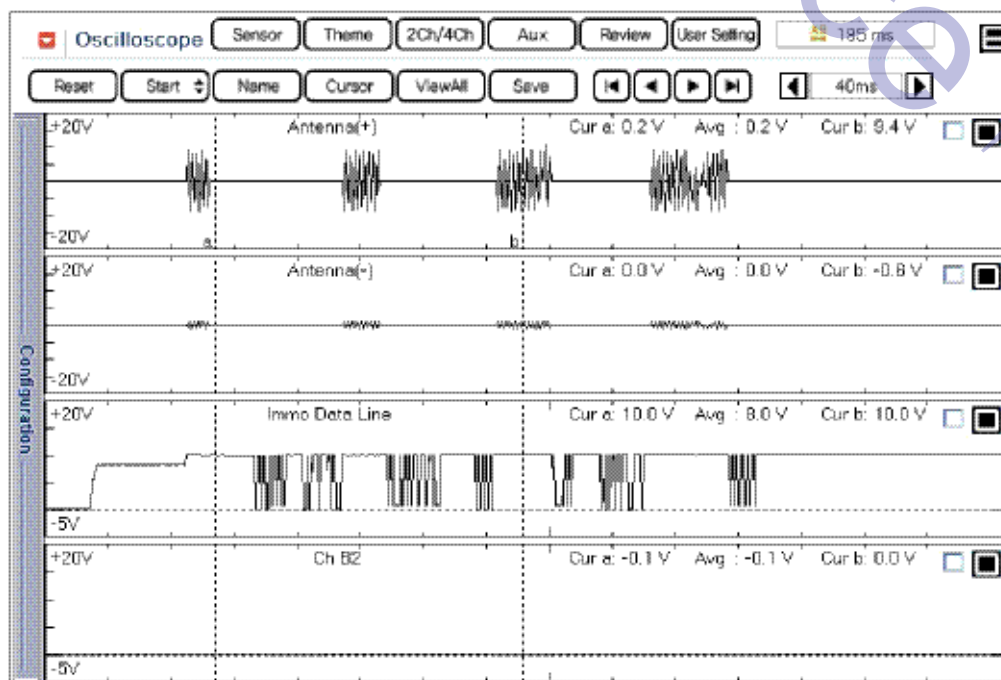


Fig.1

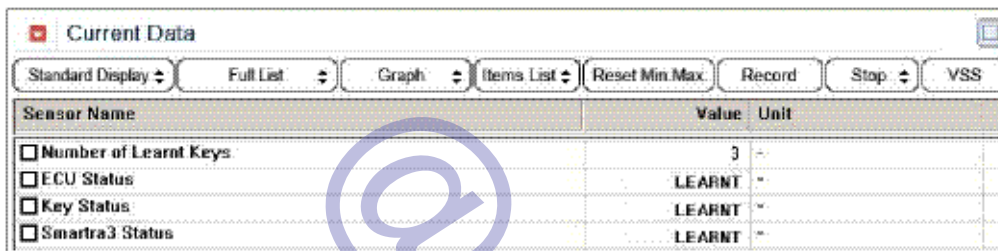
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. IG "ON" & Engine "OFF"
3. Monitor the "ECU, KEY and Smartra STATUS" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

VG12IMM10P161012S

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, the Key in key cylinder has been learnt and SMARTRA3 has been learnt.

4. Have the both "ECM, KEY and Smartra STATUS" been learnt ?

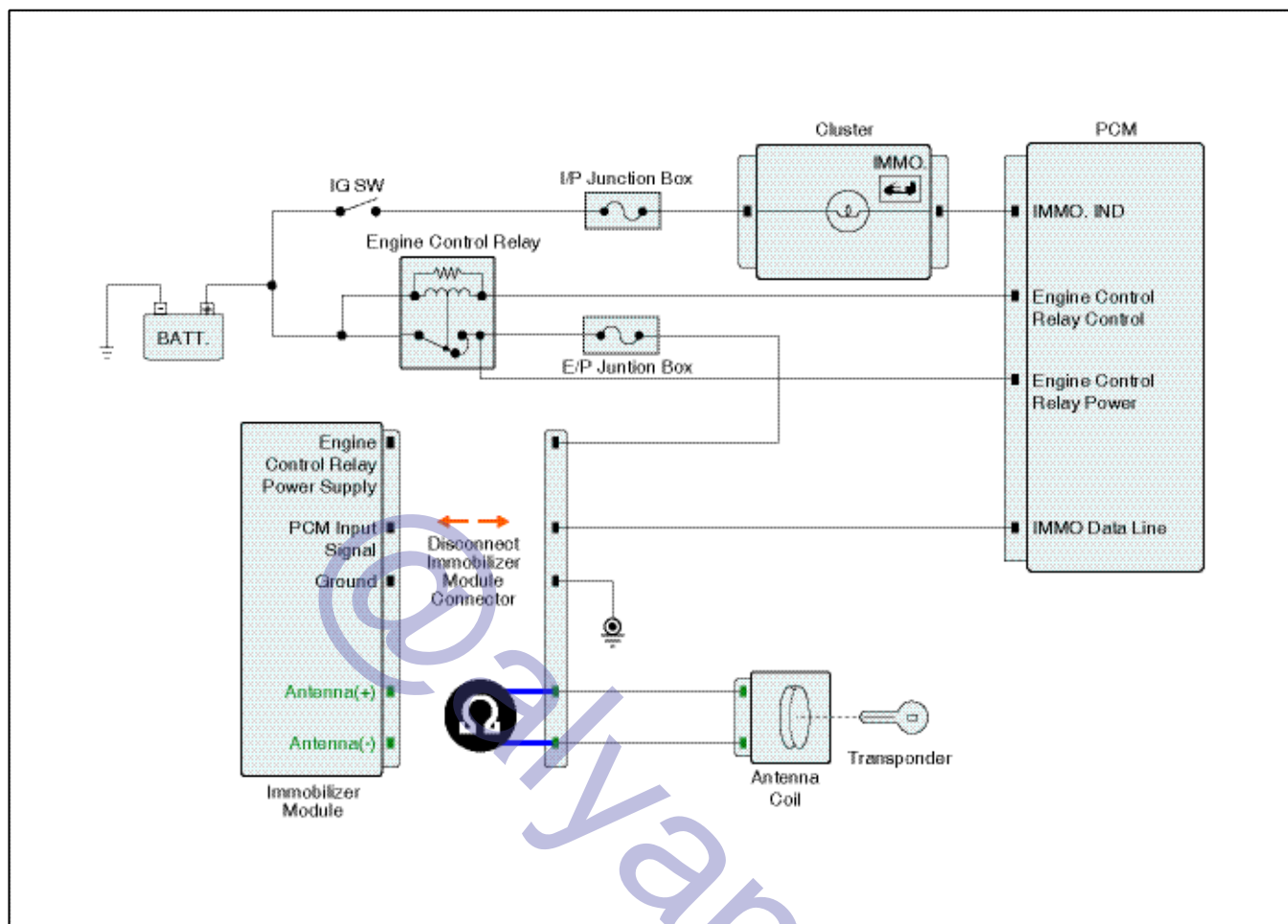
YES ► Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the PCM or SMARTRA . And this DTC has not erased in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure

NO ► Go to "Component Inspection" procedure

Component Inspection

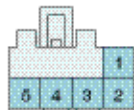
1. Check coil antenna.
 - 1) Ignition "OFF"
 - 2) Disconnect SMARTRA connector.
 - 3) Measure resistance between antenna coil(+) and (-) terminal of SMARTRA harness connector.

Specification : Approx 8.5 Ω



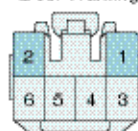
VG12IMM10P169141

<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



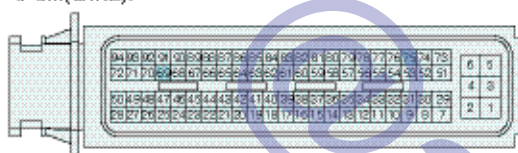
1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



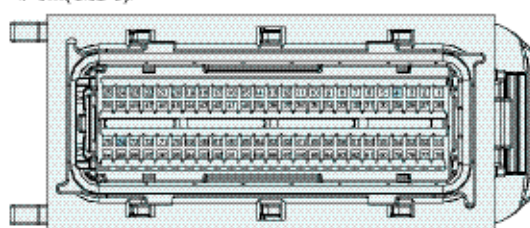
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P169141-1

4) Is the measured resistance within specifications?

- YES** ▶ Go to "Check SMARTRA" procedure
- NO** ▶ Check for open or short in antenna coil. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check SMARTRA

- 1) IGN "ON" & Engine "OFF"
- 2) Neutralize Both "SMARTRA" and "PCM" and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize SMARTRA and to Register transponder key

- 3) Are Neutralizing and Registering completed normally ?

- YES** ▶ Perform all the key teaching procedure with scantool. (All the keys must be retaught) and then, go to "Verification of Vehicle Repair" Procedure.

- NO** ▶ Substitute with a known-good SMARTRA and Perform Key teaching procedure.
- ▶ If the problem is corrected, replace SMARTRA and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

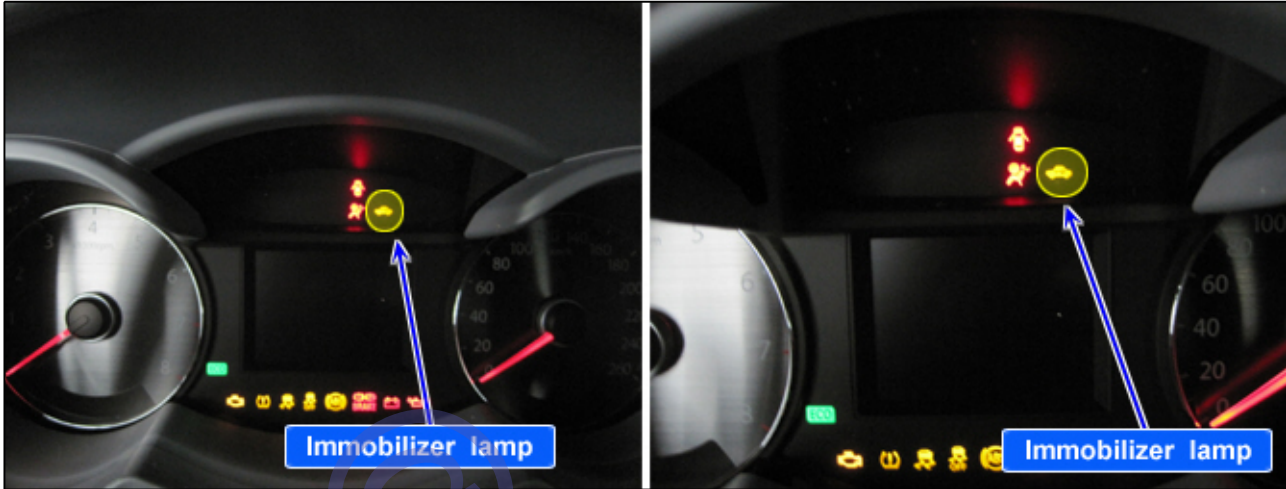
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

- YES** ▶ Go to the applicable troubleshooting procedure
- NO** ▶ System is performing to specification at this time.

P1692 Immobilizer Indicator Lamp Error

Component Location



VG12IMM10P169211

General Description

When driver inserts key and IGN "ON", Immobilizer informs status of system and result of Authentication by blinking of immobilizer lamp on instrument cluster. Through Authentication procedure immobilizer lamp keep lighting up till engine starts. In normal status. Immobilizer lamp lights up for 30sec Right after ignition "ON". If there's any fault in immobilizer system or in Authentication, lamp blinks 5 times after ignition "ON"

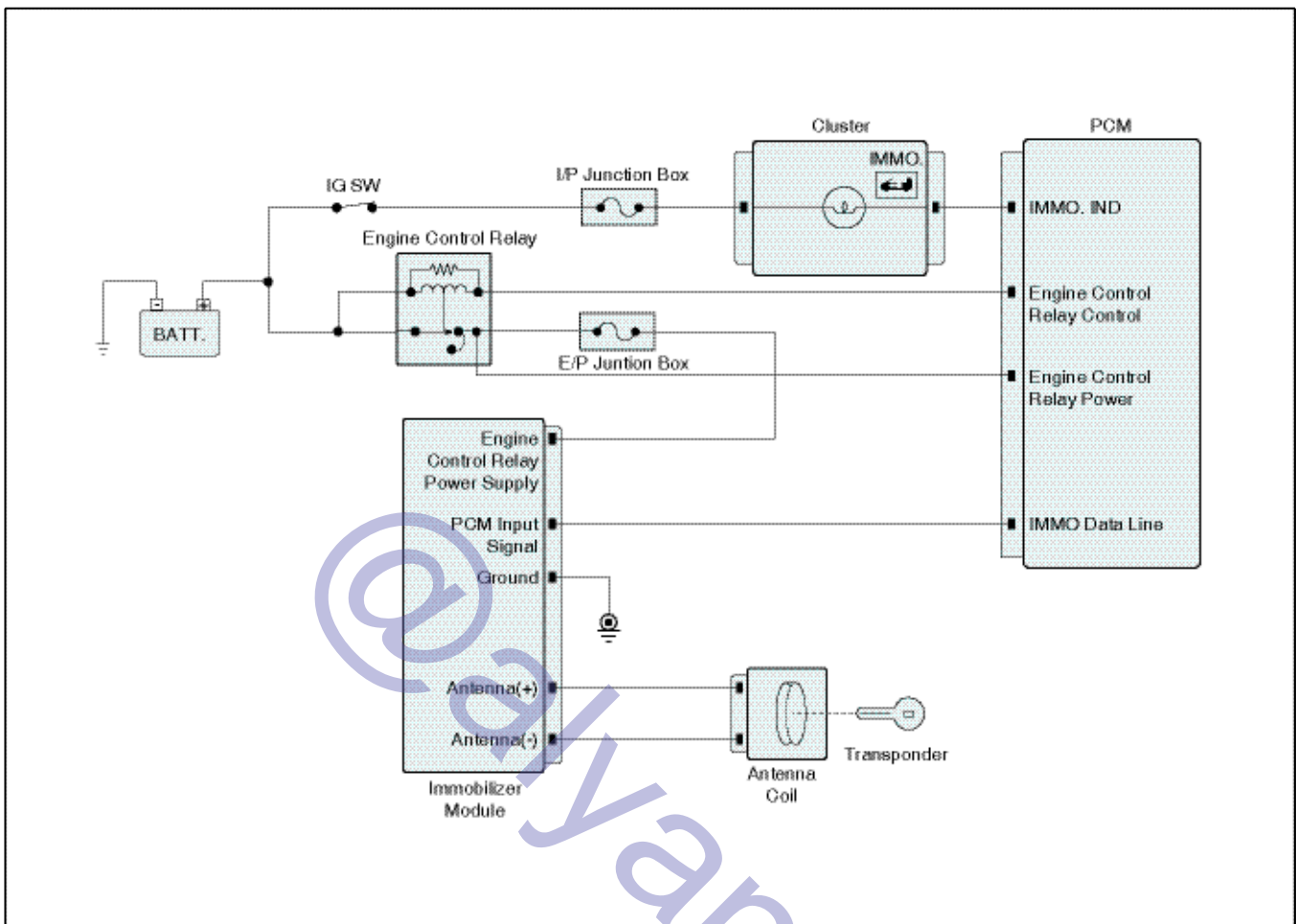
DTC Description

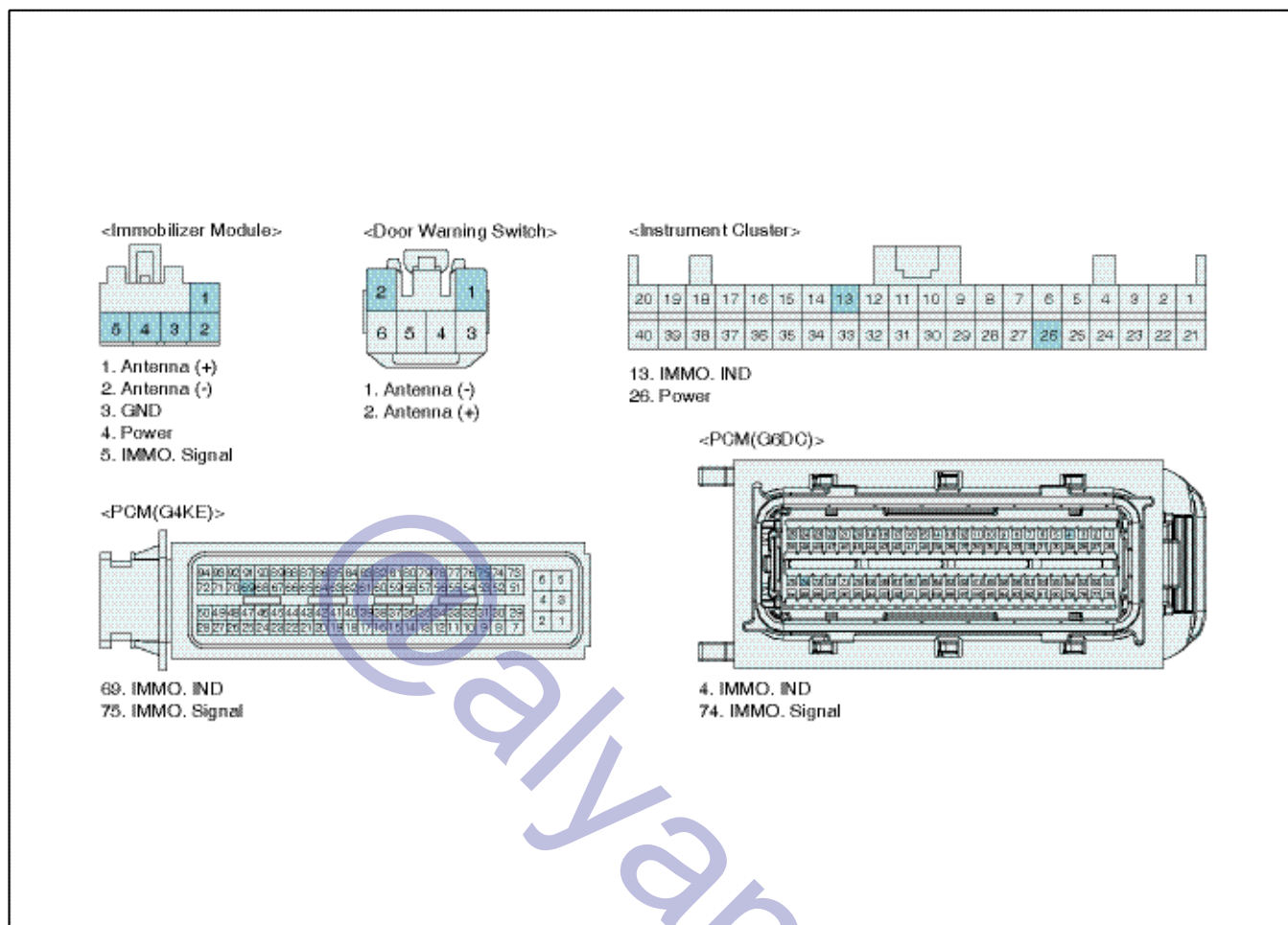
The PCM sets DTC P1692 if there's short circuit in immobilizer lamp circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	1. Short Circuit in immobilizer lamp circuit. 2. Open/Short in control harness 3. Faulty PCM
Enable Conditions	• IG ON	
Threshold value	• Short to GND, Wiring open	
Detecting time	• -	
Fail Safe	• -	

Diagnostic Circuit Diagram





VG12IMM10P1610D1

Signal Waveform & Data

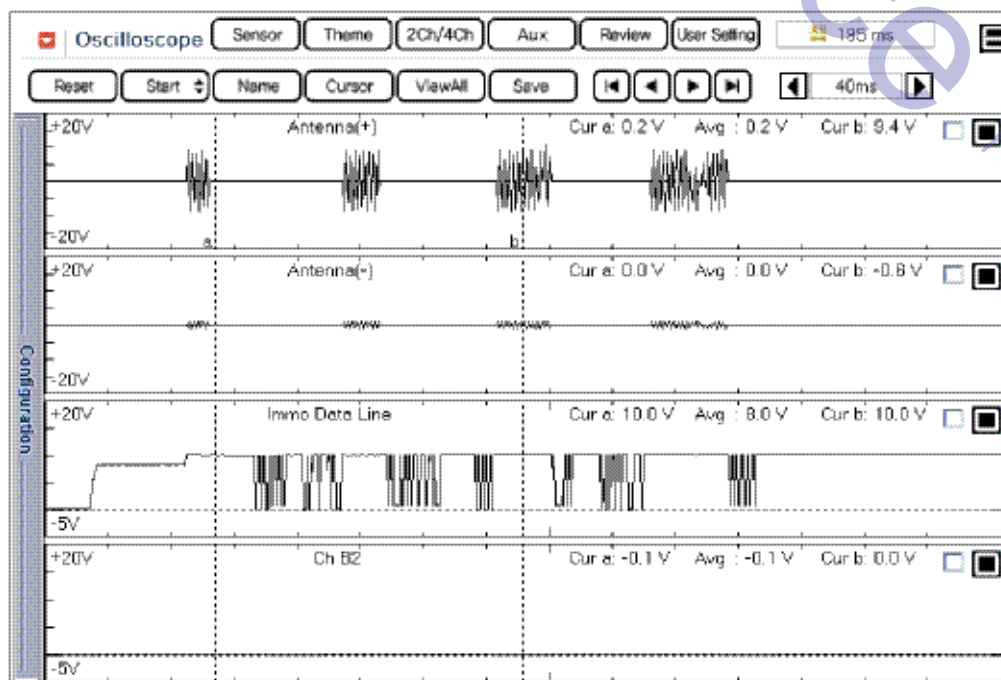


Fig.1

VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ► Repair as necessary and go to "Verification Vehicle Repair" procedure

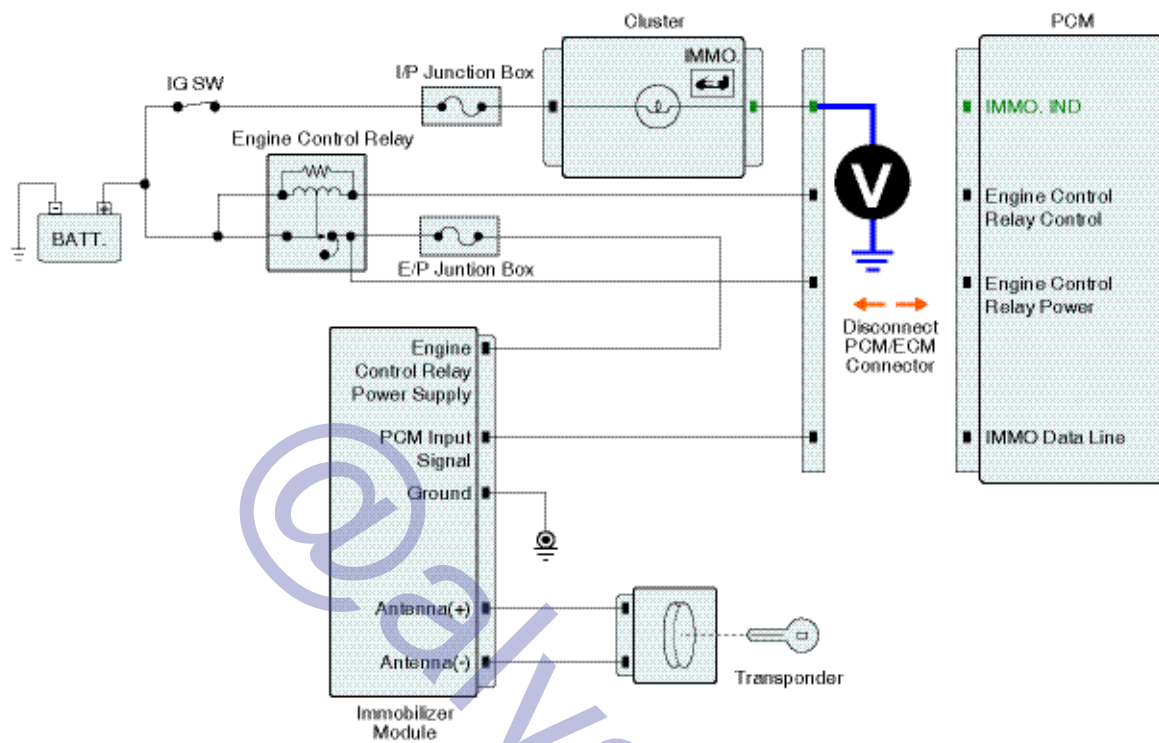
NO ► Go to "W/Harness Inspection" procedure

Control circuit inspection

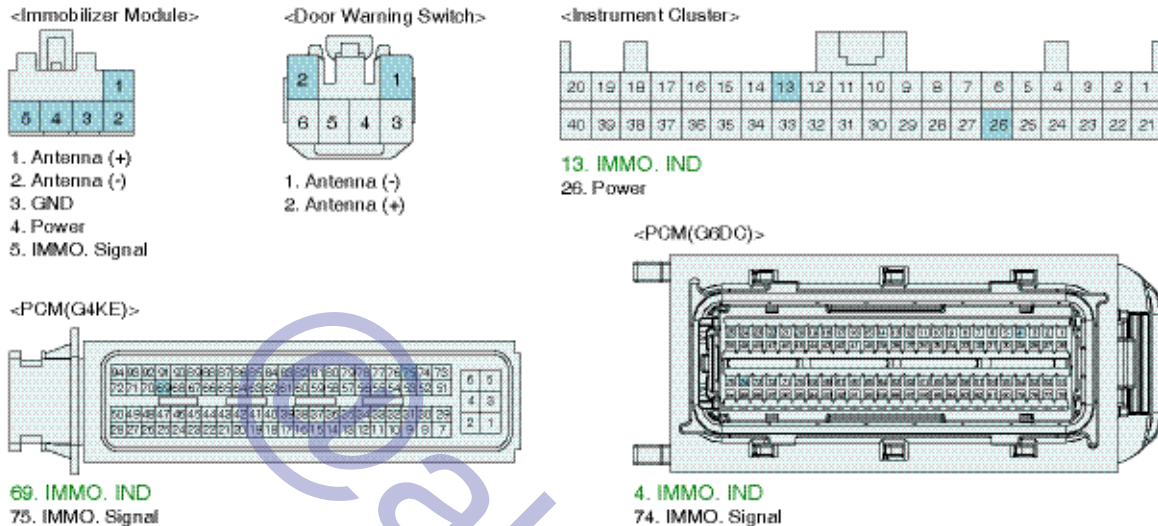
■ Check for open in harness

1. IG KEY OFF.
2. Connect SMARTRA connector and disconnect PCM connector .
3. IG KEY ON & Engine "OFF".
4. Measure voltage between indicator terminal of PCM harness connector and chassis ground.

Specification : Batt.



VG12IMM10P169231



VG12IMM10P169231-1

5. Is the measured voltage within specifications?

- YES** ▶ Go to "Component Inspection" procedure
- NO** ▶ Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Visual/Physical Inspection

■ Check immobilizer lamp circuit

1. Ignition "ON" & Engine "OFF"
2. Check if immobilizer lamp operates properly.

NOTICE

Right after ignition "ON", Immobilizer lamp lights up for 30sec.

If lamp blinks 5 times after ignition "ON", a fault exists in immobilizer system.

3. Is the immobilizer lamp operating properly?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

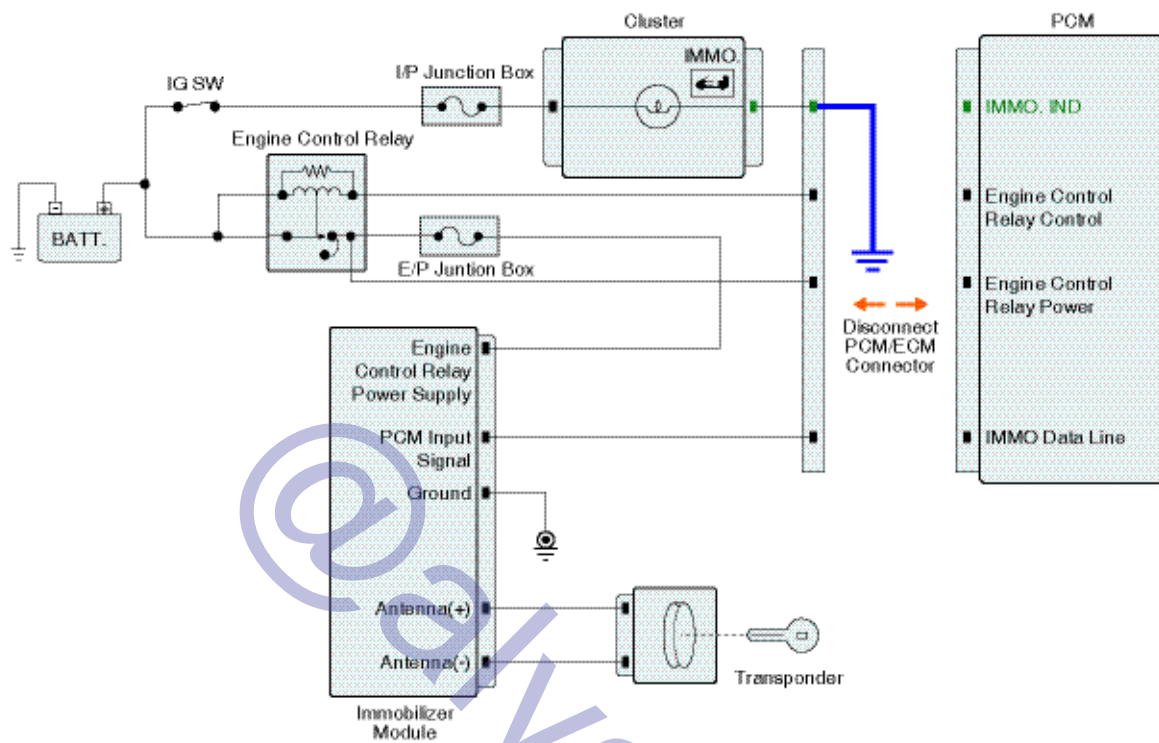
NO ▶ Go to "Component Inspection" procedure.

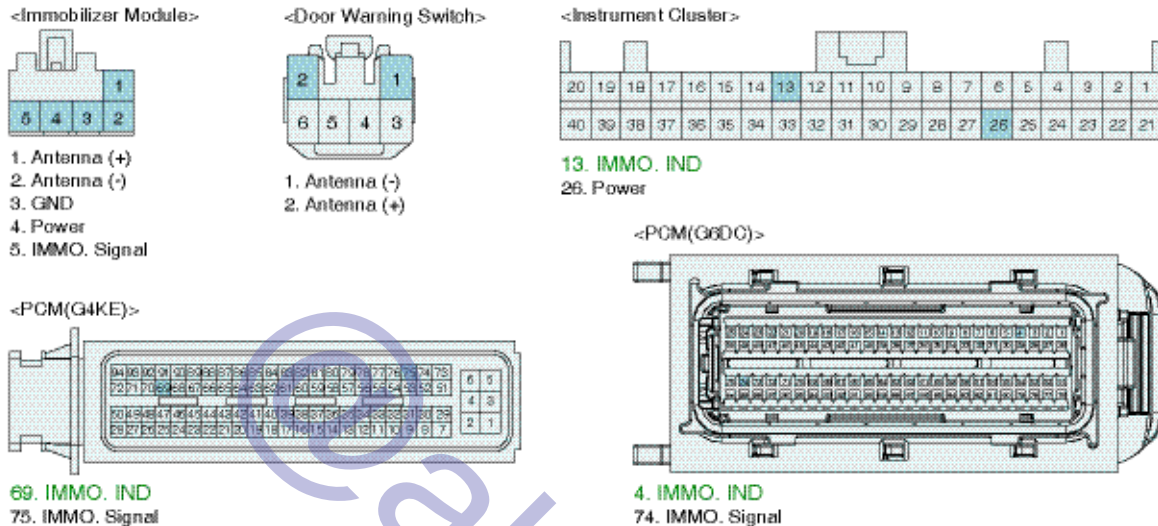
Component Inspection

■ Check immobilizer lamp.

1. IG KEY OFF
2. Connect SMARTRA connector and disconnect PCM connector
3. Ground indicator terminal of PCM harness connector with wire
4. IG KEY ON & Engine "OFF"

Specification : Immobilizer lamp "ON"





VG12IMM10P169231-1

5. Is the Immobilizer lamp "ON" ?

- YES** ▶ Substitute with a known-good PCM and check for proper operation.
▶ If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTICE

ECM substituted for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize ECM and to Register transponder key

- NO** ▶ Check that fuse has blown off and harness between PCM connector and Battery is in normal condition. And, check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

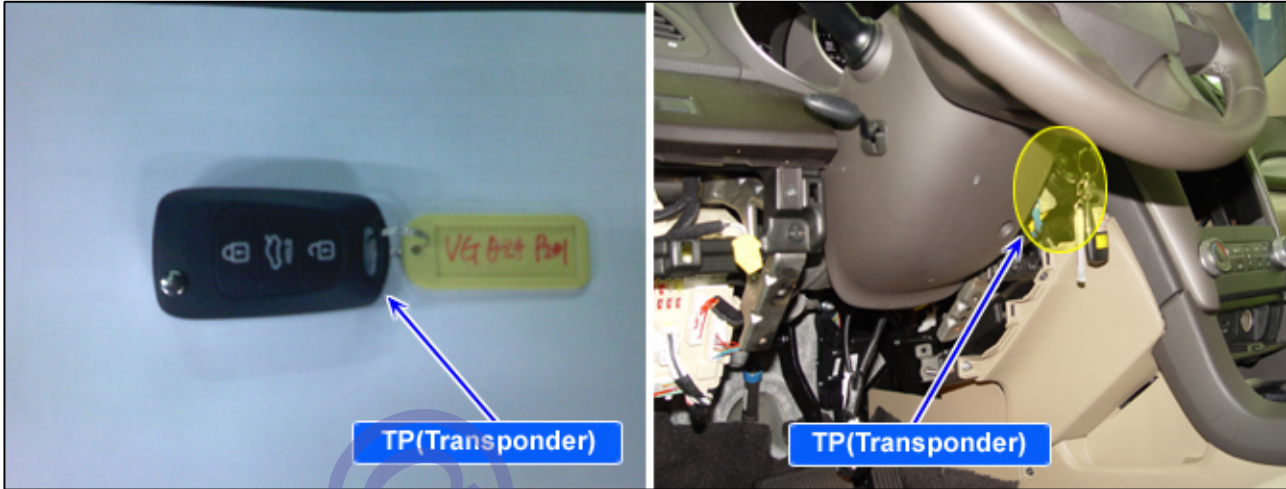
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

- YES** ▶ Go to the applicable troubleshooting procedure
- NO** ▶ System is performing to specification at this time.

P1693 Immobilizer-Transponder Error

Component Location



VG12IMM10P167411

General Description

The vehicle immobilizer system consists of the PCM, the SMARTRA3 and ignition keys with built-in transponder.

The PCM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder.

The encryption algorithm (between PCM and SMARTRA3) is the one offered from BOSCH.

The encryption algorithm (between PCM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the PCM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.

The Key teaching procedure starts with PCM request of PIN from Scanner. The "virgin" PCM stores the PIN and the key Learning can be started. The "learnt" PCM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.

Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by PCM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the PCM. In this case, The PCM can't execute the key learning process.

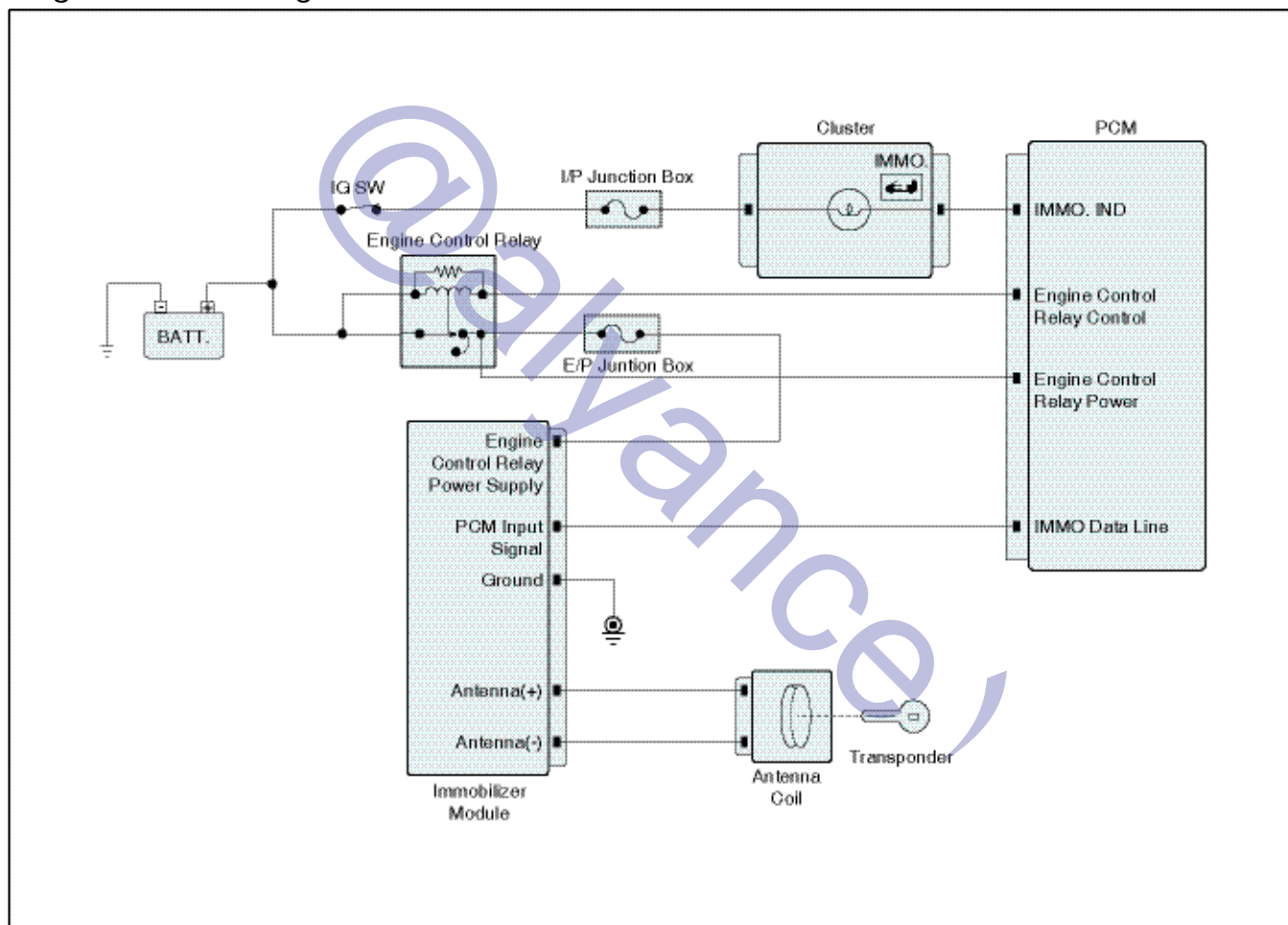
DTC Description

The PCM sets DTC P1693 if there's abnormal response from transponder.

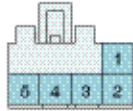
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	-	1. Corrupted data from Transponder 2. More than one TP in the magnetic field 3. No TP(Key without TP) in the magnetic field
Enable Conditions	IG ON	
Threshold value	- Corrupted data from Transponder - More than one TP in the magnetic field - No TP(Key without TP) in the magnetic field	
Detecting time	-	
Fail Safe	-	

Diagnostic Circuit Diagram

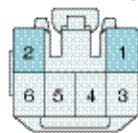


<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



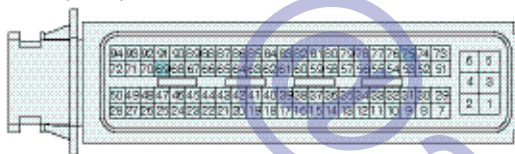
1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



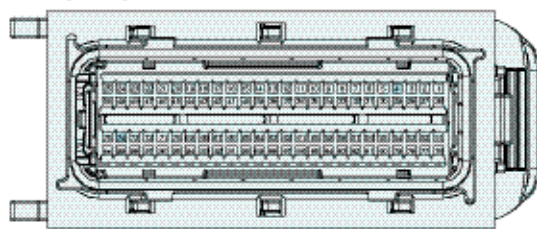
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P1610D1

Signal Waveform & Data

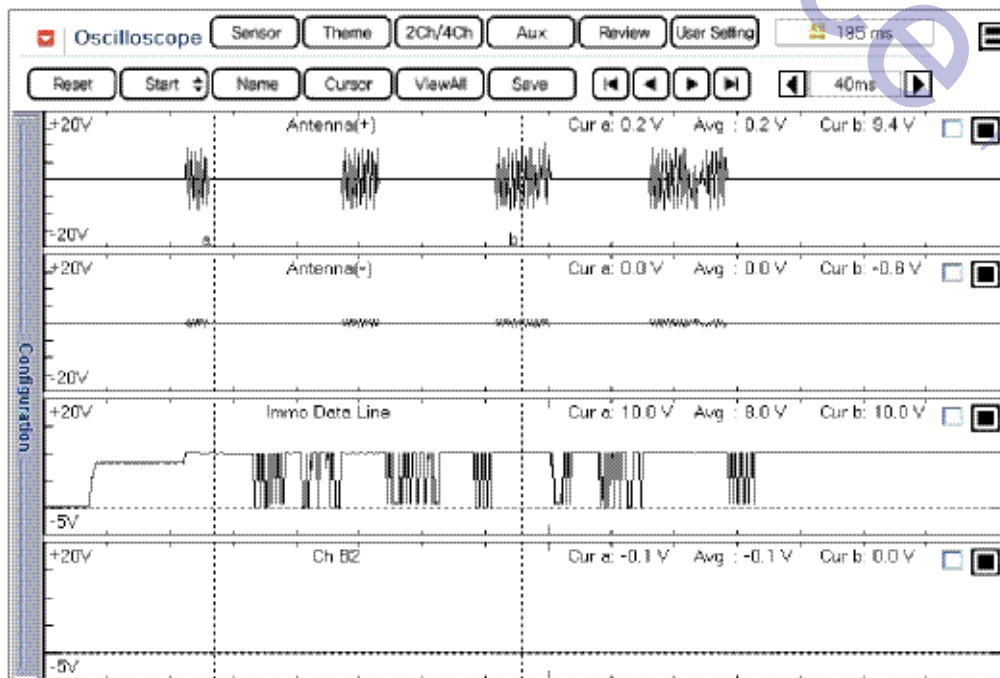


Fig.1

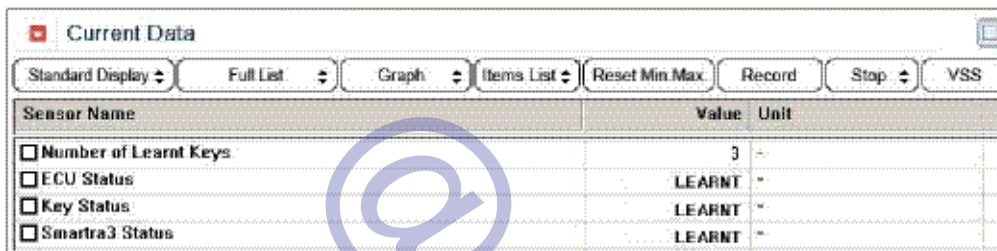
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Check transponder and ECU status
 - 1) IGN "ON" & Engine "OFF"
 - 2) Monitor the "ECU, KEY and Smartra STATUS" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

- 3) Have both the PCM and KEY status been learnt ?

YES ▶ Substitute with known good "virgin" transponder and go to "Component Inspection" Procedure.

NO ▶ Go to "Component Inspection" Procedure.

Component Inspection

1. Check transponder
 - 1) IGN "ON" & Engine "OFF"
 - 2) Neutralize PCM and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize PCM and to Register transponder key

- 3) Are Neutralizing and Registering completed normally ?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VG12IMM10P161012S

- NO** ▶ Substitute with a known-good transponder and perform the key teaching procedure.
 ▶ If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

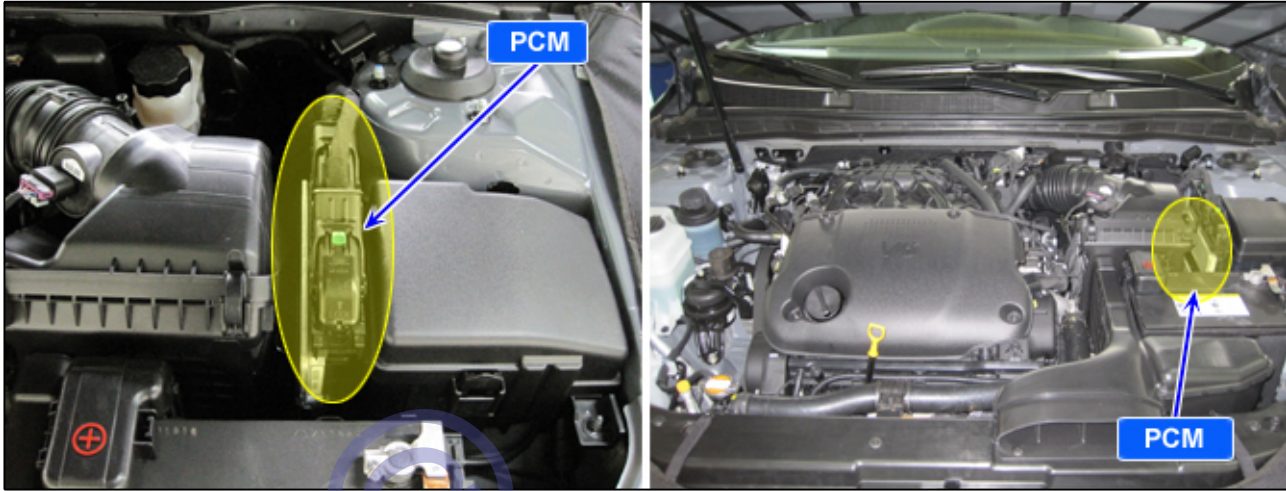
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure

NO ▶ System is performing to specification at this time.

P1694 Immobilizer-EMS Message Error

Component Location



VG12IMM10P161011

General Description

The PCM and the SMARTRA communicate by dedicated line. During this communication of PCM and SMARTRA, the K line of PCM cannot be used for communication. The PCM controls the communication either to SMARTRA or to other devices(e.g. scanner) on K line by switching of a multiplexer and specific communication procedures. The multiplexer is a part of PCM H/W.

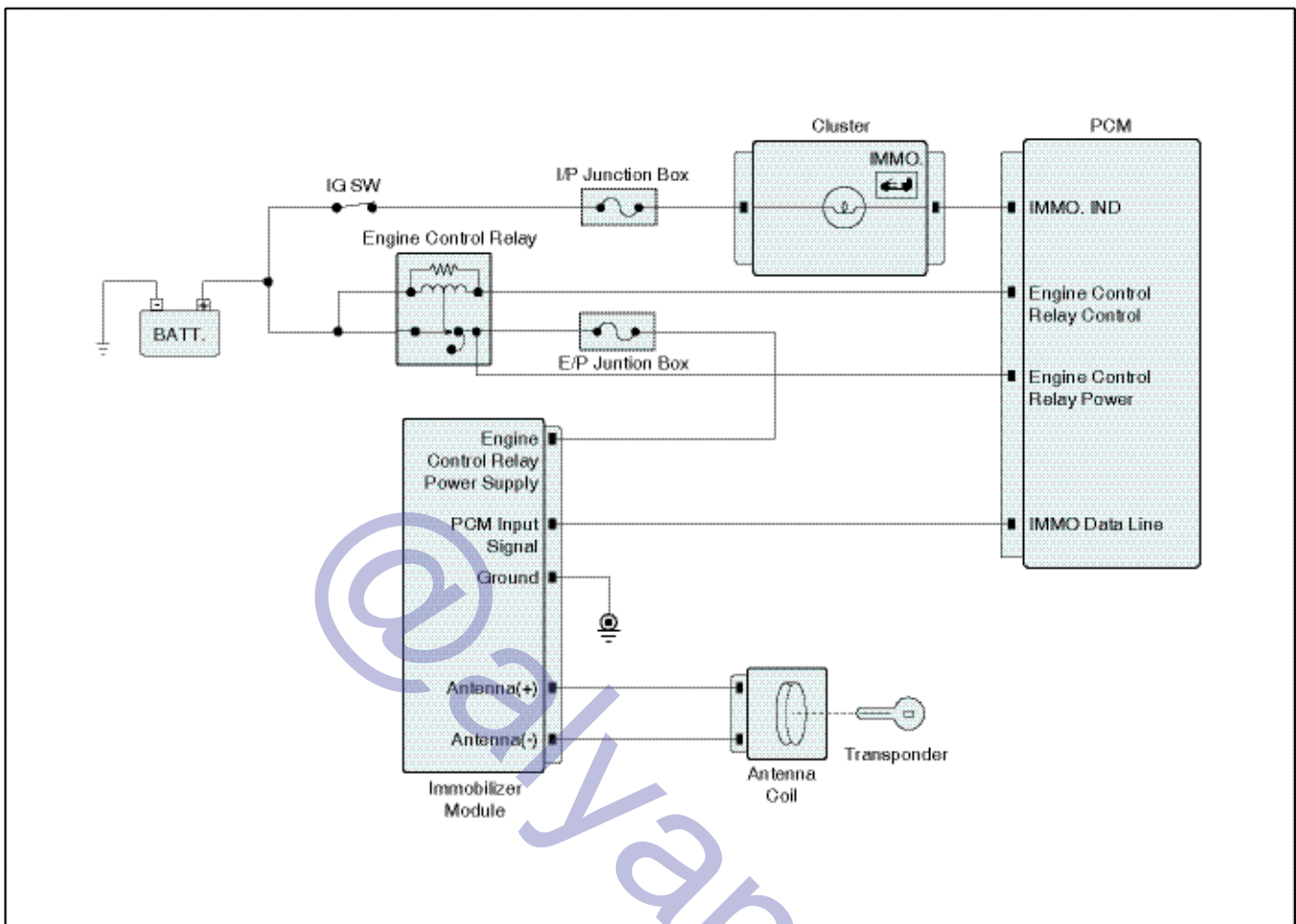
DTC Description

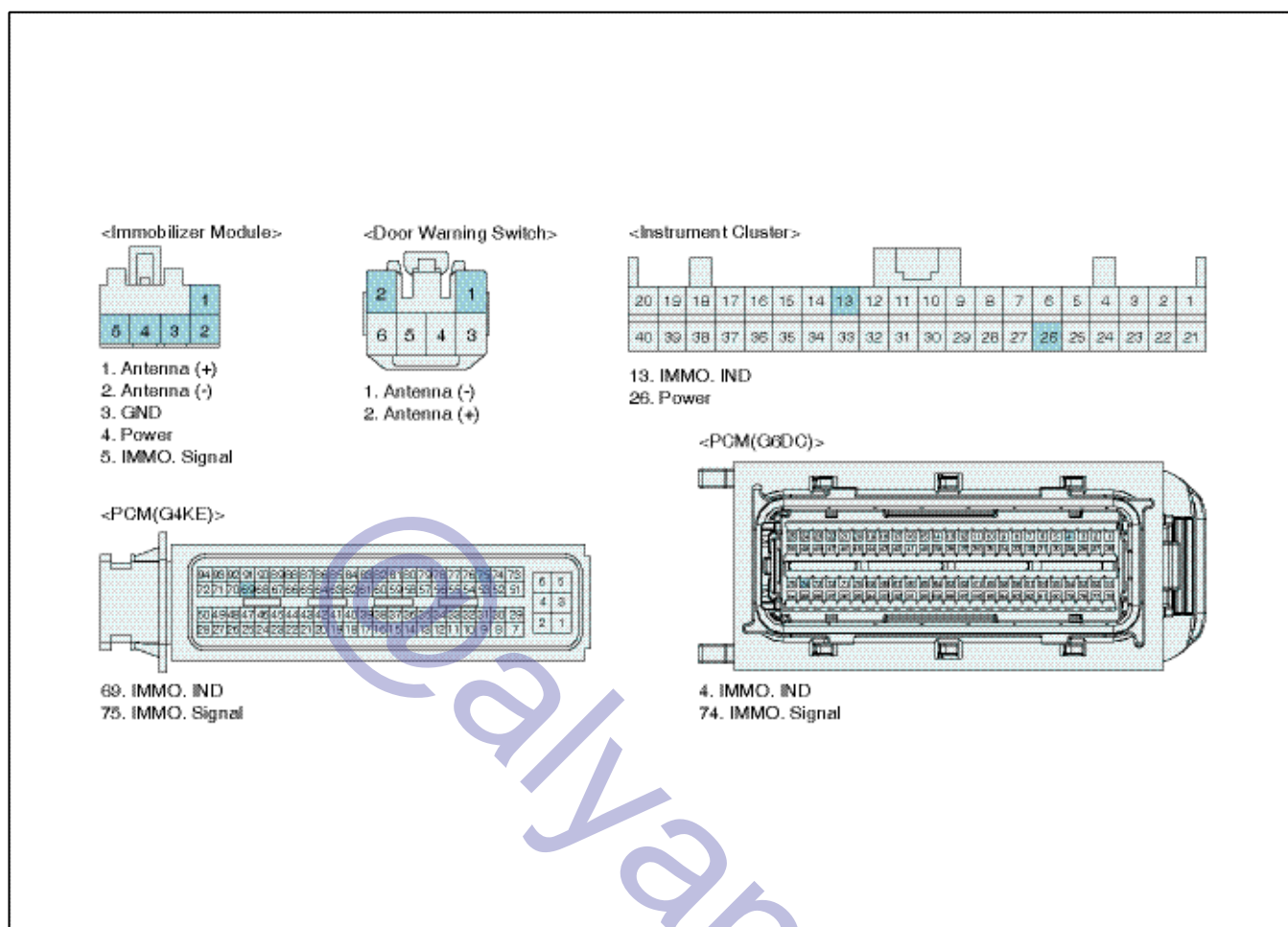
The PCM sets DTC P1694 if Request from EMS is invalid.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	-	1. Faulty PCM ✖ Protocol layer violation - Invalid request - Check sum error
Enable Conditions	IG ON	
Threshold value	- Protocol layer violation - Invalid request - Check sum error	
Detecting time	-	
Fail Safe	-	

Diagnostic Circuit Diagram





VG12IMM10P1610D1

Signal Waveform & Data

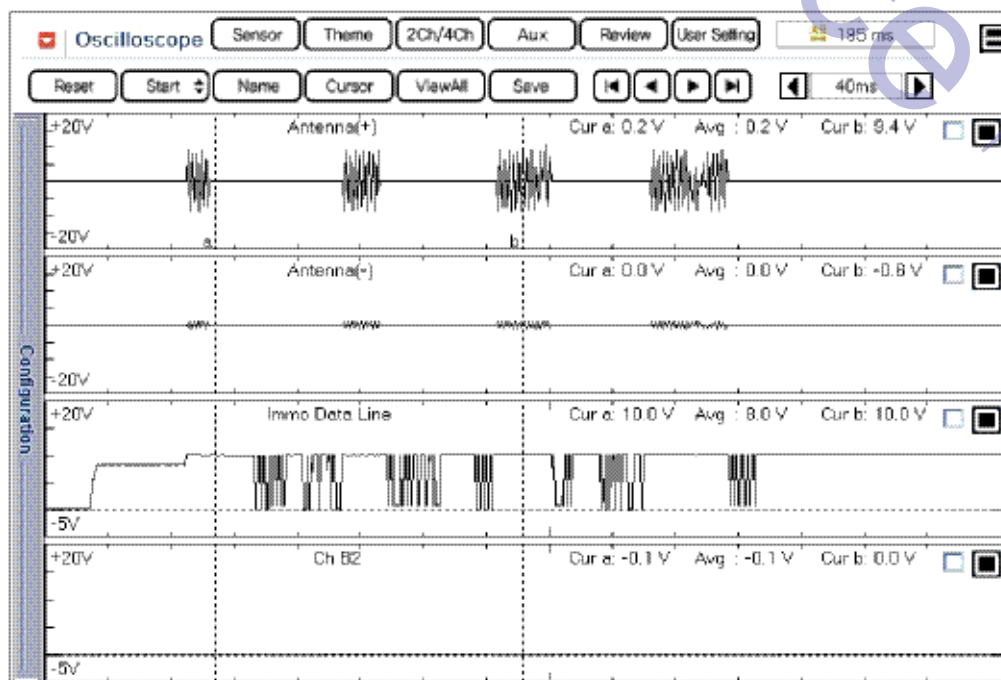


Fig.1

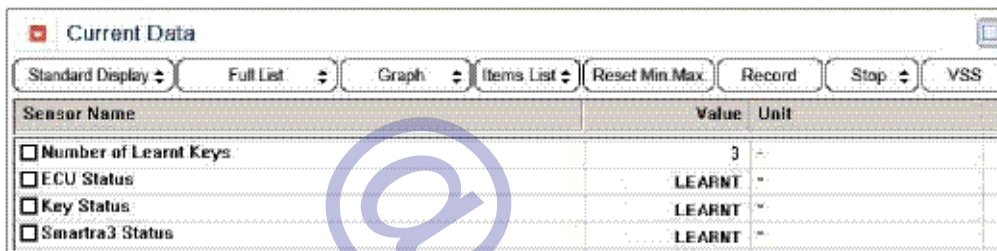
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Check status
 - 1) IGN "ON" & Engine "OFF"
 - 2) Monitor the "ECU, KEY and Smartra STATUS" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

- 3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS" Parameter within specifications?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the PCM or SMARTRA . And this DTC has not erased in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure

NO ▶ Go to "Component Inspection" procedure

Component Inspection

1. Check PCM
 - 1) IGN "ON" & Engine "OFF"
 - 2) Neutralize PCM and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize PCM and to Register transponder key

- 3) Are Neutralizing and Registering completed normally ?

VG12IMM10P161012S

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good PCM and perform key teaching procedure.
▶ If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTICE

PCM substituted for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize PCM and to Register transponder key

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

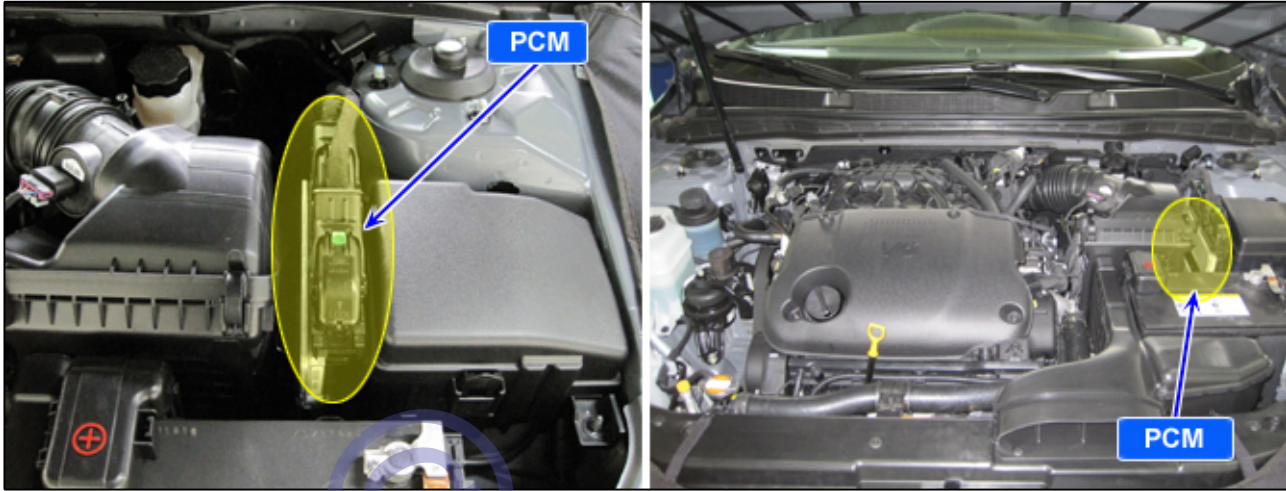
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure

NO ▶ System is performing to specification at this time.

P1695 Immobilizer-EMS Memory Error

Component Location



VG12IMM10P161011

General Description

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.).

The immobilizer data are stored by three independent entries.

The data from EEPROM are evaluated by "2 of 3 decision". That means all three entries are read and the content is compared before authentication process.

If the contents of all entries are equal, the authentication will run without additional measures.

If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective" is stored at PCM.

If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective" will be stored. The limp home function cannot be activated. The PCM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

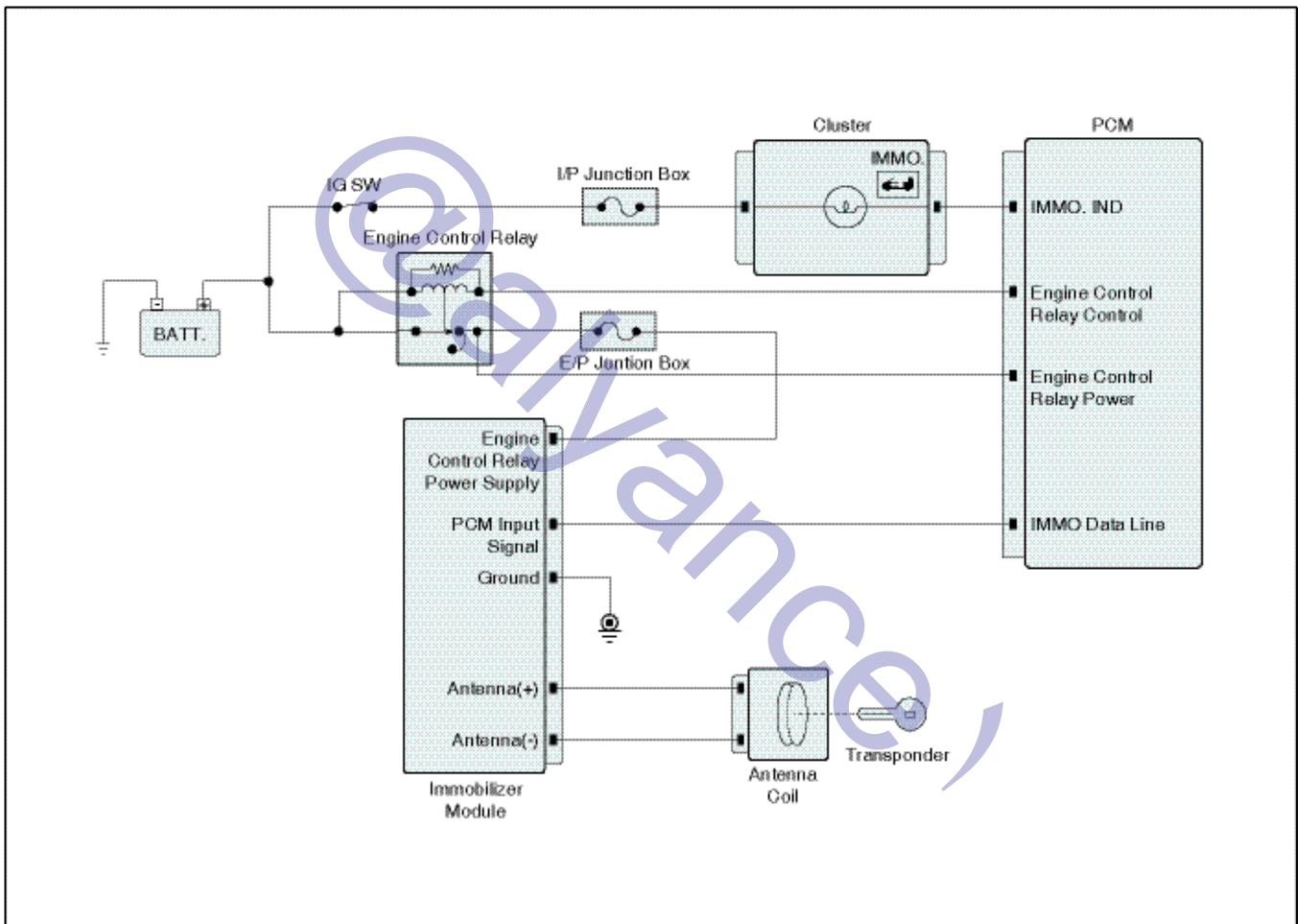
DTC Description

The PCM sets DTC P1695 if there's any fault in PCM internal permanent memory(EEPROM or Flash etc.)

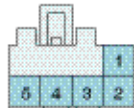
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	-	1. Faulty PCM
Enable Conditions	IG ON	
Threshold value	- Inconsistent data of EEPROM - Invalid write operation to EEPROM	
Detecting time	-	
Fail Safe	-	

Diagnostic Circuit Diagram

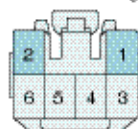


<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



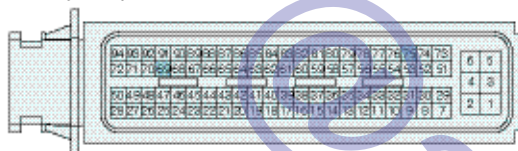
1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



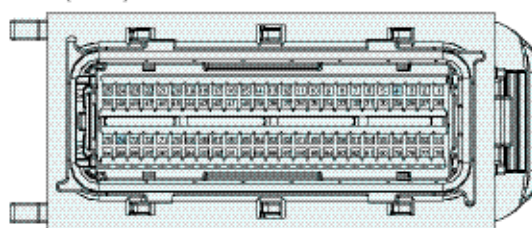
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P1610D1

Signal Waveform & Data

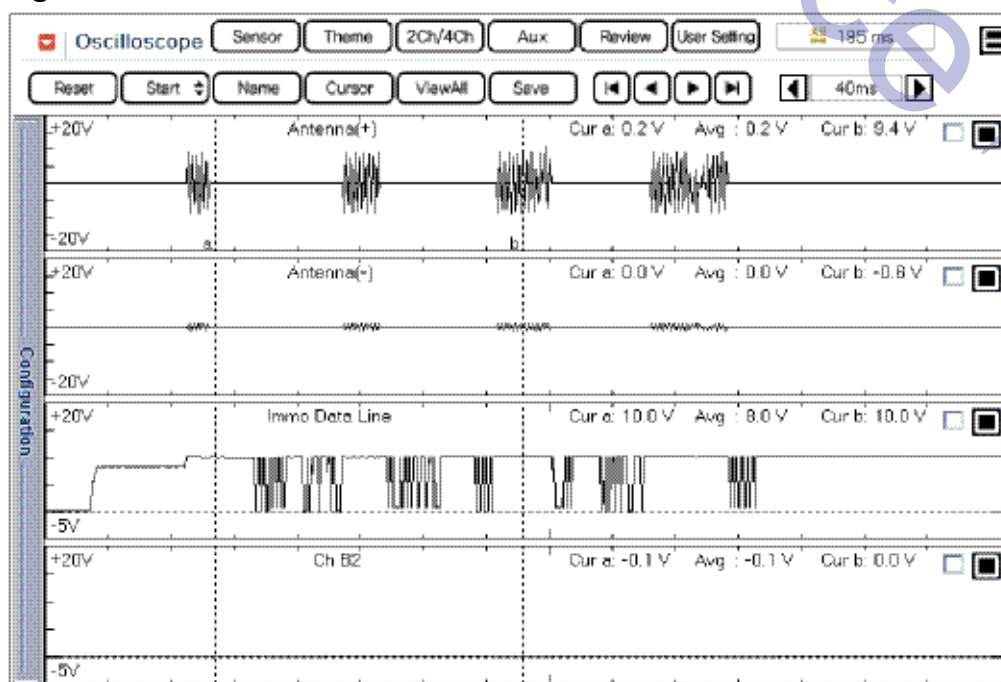


Fig.1

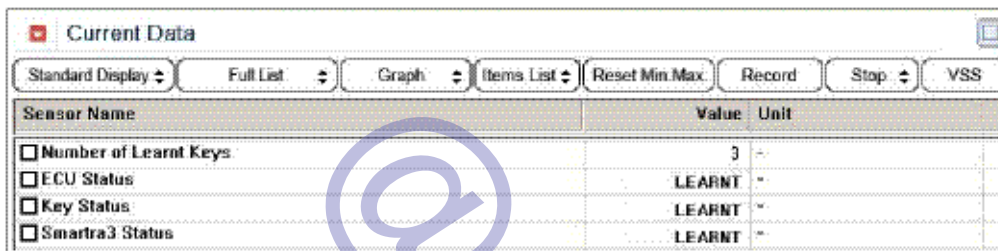
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Check status
 - 1) IGN "ON" & Engine "OFF"
 - 2) Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

- 3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS" Parameter within specifications?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the PCM or SMARTRA . And this DTC has not erased in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure

NO ▶ Go to "Component Inspection" procedure

Component Inspection

1. Check PCM
 - 1) IGN "ON" & Engine "OFF"
 - 2) Neutralize ECM and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize PCM and to Register transponder key

- 3) Are Neutralizing and Registering completed normally ?

VG12IMM10P161012S

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good PCM and then key teaching procedure
 ▶ If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

NOTICE

PCM substituted for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize PCM and to Register transponder key

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

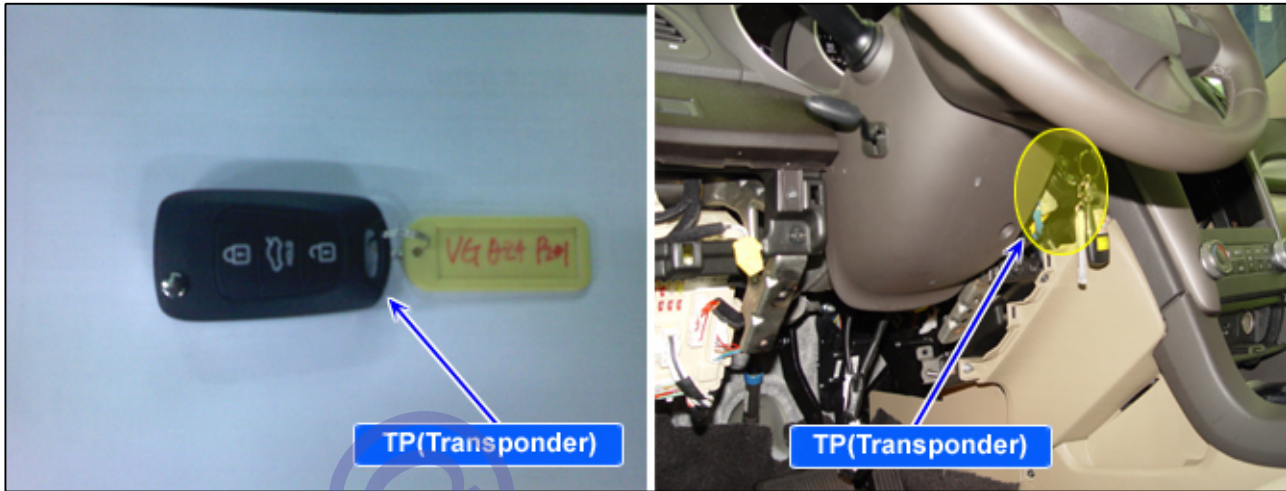
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure

NO ▶ System is performing to specification at this time.

P1696 Immobilizer-Authentication Fail

Component Location



VG12IMM10P167411

General Description

The vehicle immobilizer system consists of the PCM, the SMARTRA3 and ignition keys with built-in transponder.

The PCM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder.

The encryption algorithm (between PCM and SMARTRA3) is the one offered from BOSCH.

The encryption algorithm (between PCM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the PCM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.

The Key teaching procedure starts with PCM request of PIN from Scanner. The "virgin" PCM stores the PIN and the key Learning can be started. The "learnt" PCM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.

Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by PCM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the PCM. In this case, The PCM can't execute the key learning process.

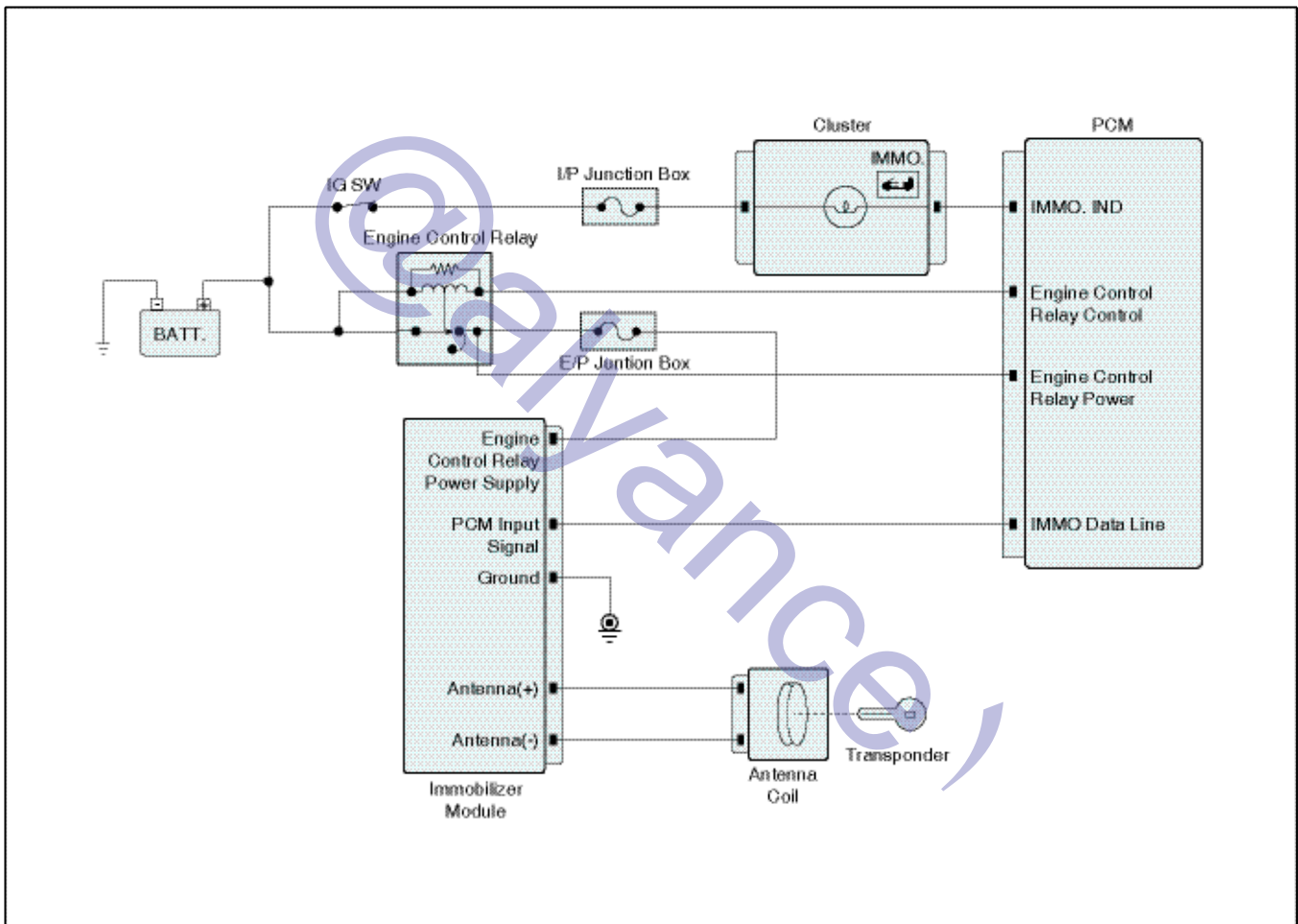
DTC Description

The PCM sets DTC P1696 if invalid key is inserted into key hole for Authentication

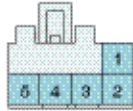
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	-	1. Invalid transponder.
Enable Conditions	IG ON	
Threshold value	- Virgin TP at PCM status "Learnt" - Learnt(Invalid) TP at PCM status "Learnt"	
Detecting time	Immediately	
Fail Safe	-	

Diagnostic Circuit Diagram

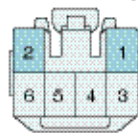


<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



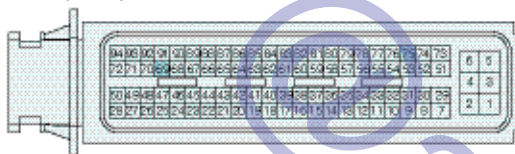
1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



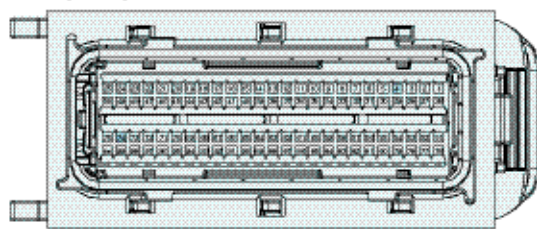
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P1610D1

Signal Waveform & Data

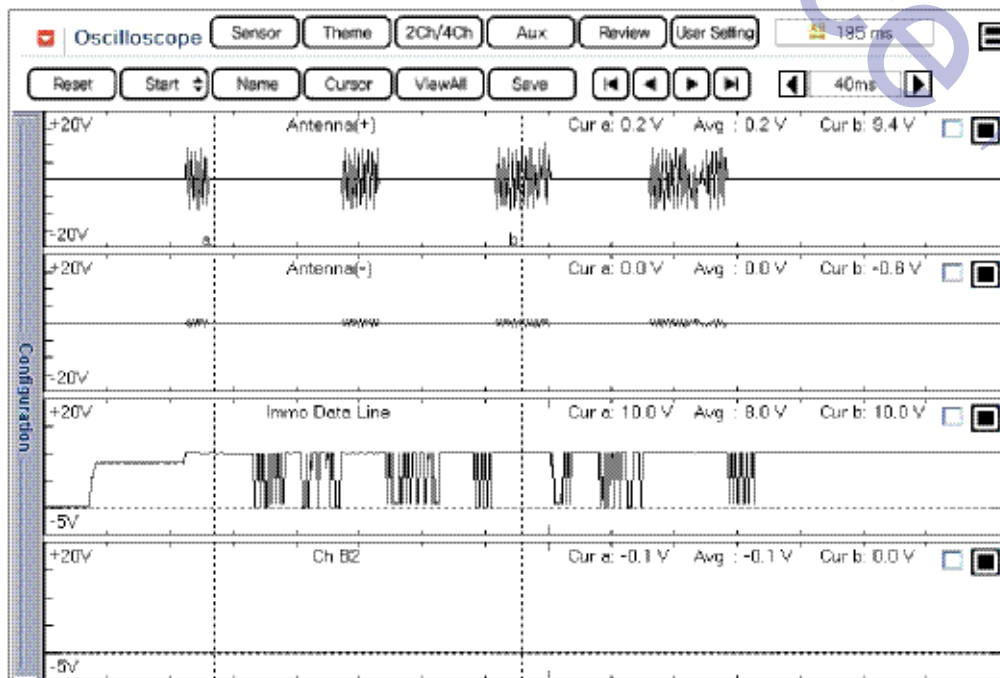


Fig.1

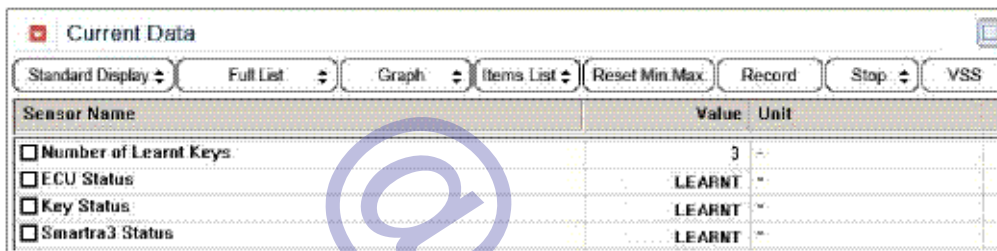
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Check status
 - 1) IGN "ON" & Engine "OFF"
 - 2) Monitor the "PCM, Key and Smartra Status" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

- 3) Have both the PCM and KEY status been learnt ?

YES ▶ Substitute with known good "virgin" transponder and go to "Component Inspection" Procedure.

NO ▶ Go to "Component Inspection" Procedure.

Component Inspection

1. Check transponder
 - 1) IGN "ON" & Engine "OFF"
 - 2) Neutralize PCM and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize PCM and to Register transponder key

- 3) Are Neutralizing and Registering completed normally ?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VG12IMM10P161012S

- NO** ▶ Substitute with a known-good transponder and perform key teaching procedure with scanner.
- ▶ If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

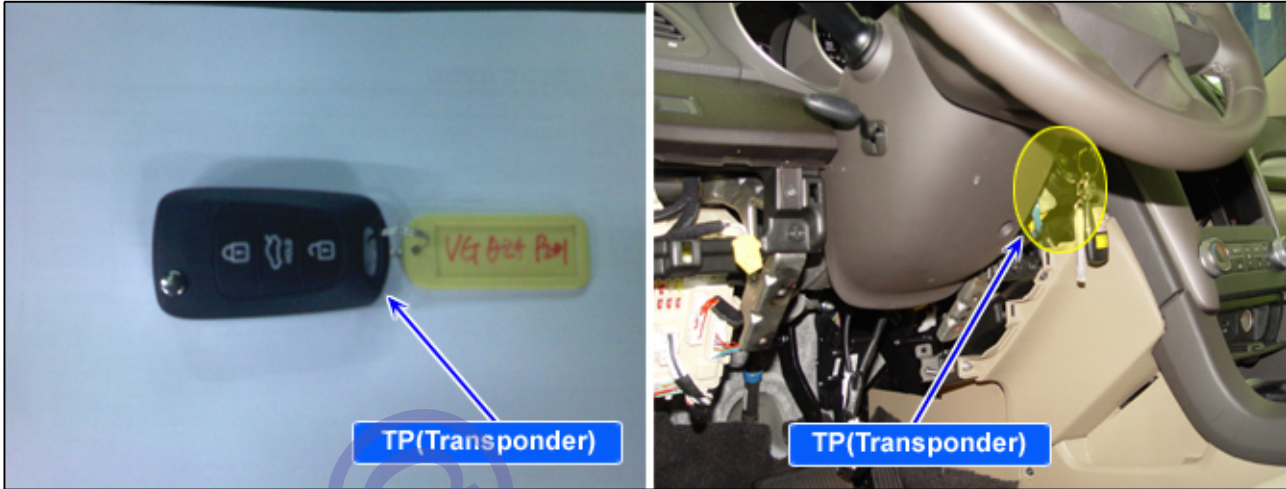
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure

NO ▶ System is performing to specification at this time.

P1699 Immobilizer-Twice Overtrial

Component Location



VG12IMM10P167411

General Description

This is a special function for engine start by vehicle manufacturer. The engine can be started for moving from the production line to an area where the key teaching is conducted

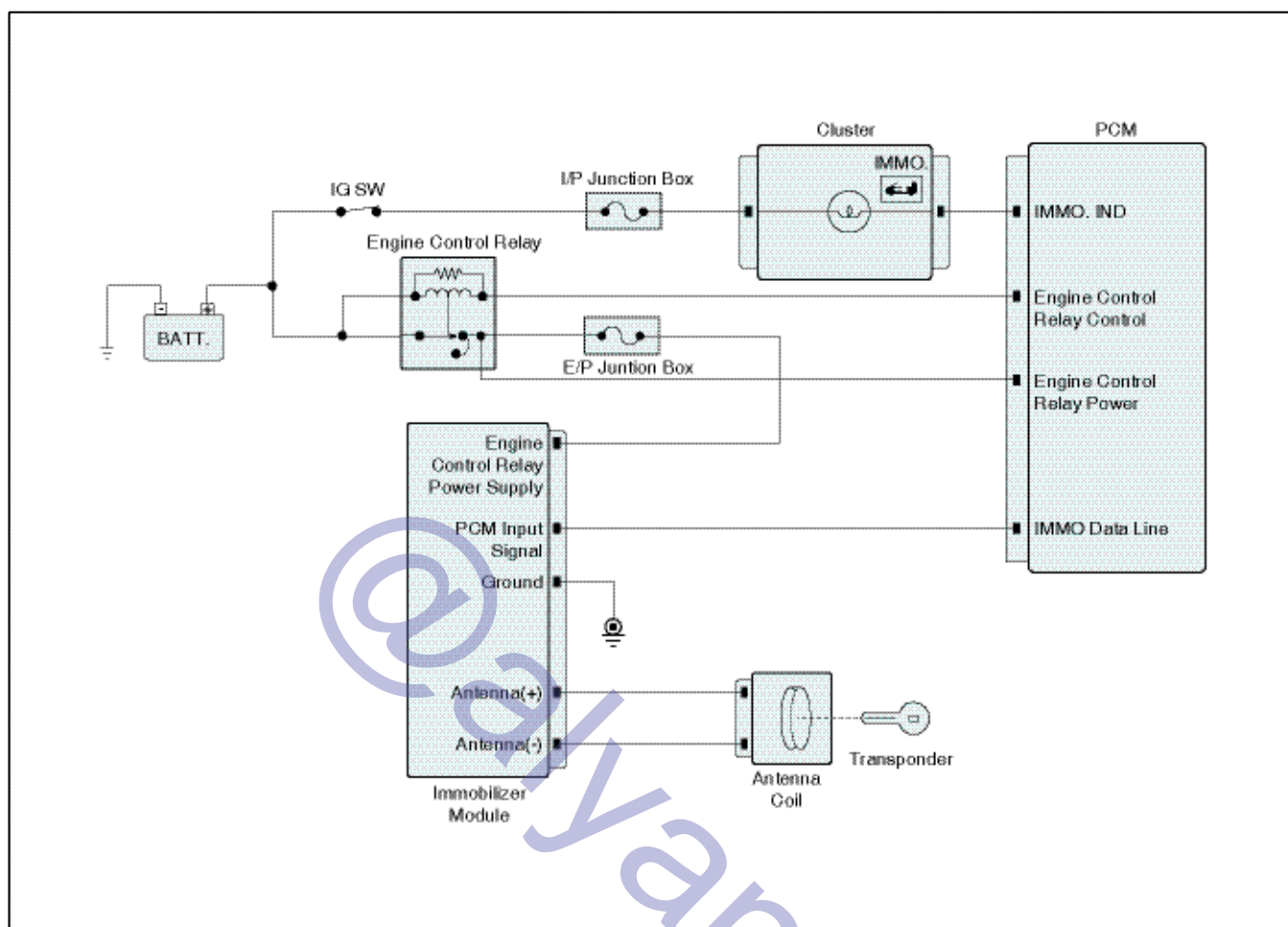
DTC Description

The PCM sets DTC P1699 if the maximum limit of Twice IGN is Exceeded.

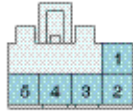
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	1. Over time trial of Twice IGN
Enable Conditions	• IG ON	
Threshold value	• Twice IGN $\geq$ 32 times	
Detecting time	• -	
Fail Safe	• -	

Diagnostic Circuit Diagram

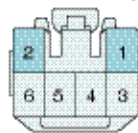


<Immobilizer Module>



1. Antenna (+)
2. Antenna (-)
3. GND
4. Power
5. IMMO. Signal

<Door Warning Switch>



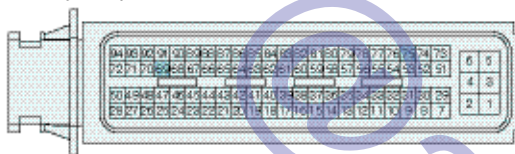
1. Antenna (-)
2. Antenna (+)

<Instrument Cluster>



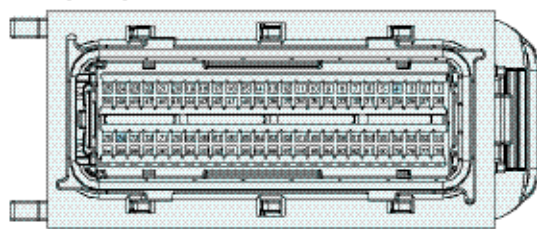
13. IMMO. IND
26. Power

<PCM(G4KE)>



69. IMMO. IND
75. IMMO. Signal

<PCM(G6DC)>



4. IMMO. IND
74. IMMO. Signal

VG12IMM10P1610D1

Signal Waveform & Data

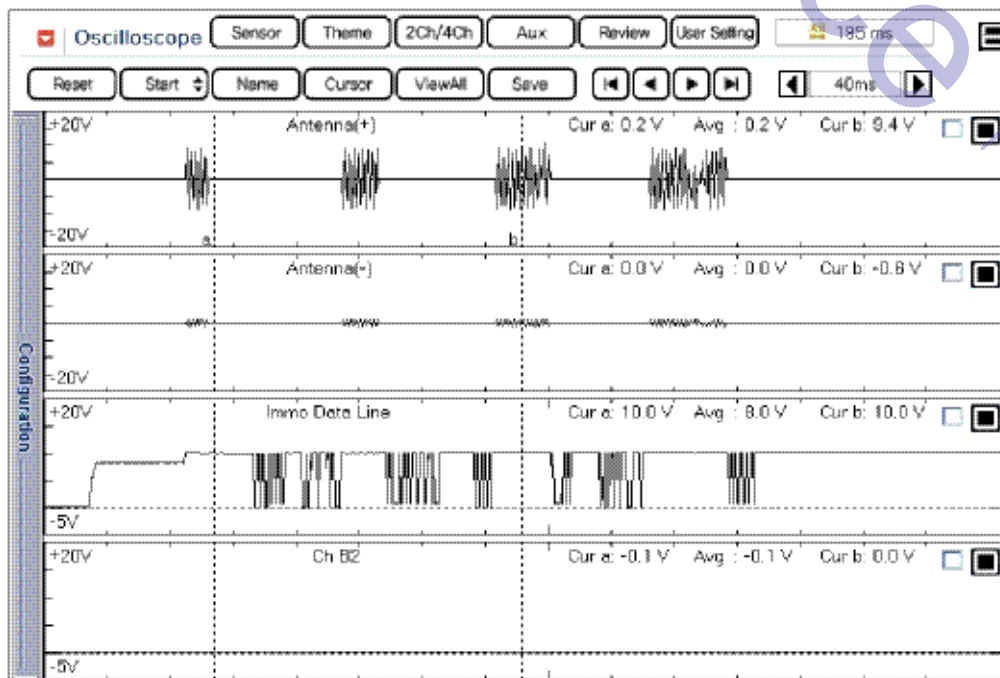


Fig.1

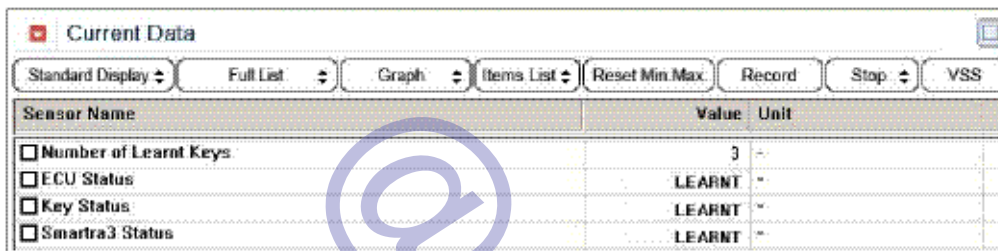
VG12IMM10P161011S

Fig.1) A normal signal waveform of antenna and immobilizer communication when IG key(TP : Transponder) is OFF to ON.

Monitor Scantool Data

1. Check status
 - 1) IGN "ON" & Engine "OFF"
 - 2) Monitor the "PCM, Key and Smartra Status" Parameter on the Scantool.

Specification : 'LEARNT'



Sensor Name	Value	Unit
☐ Number of Learnt Keys	3	-
☐ ECU Status	LEARNT	-
☐ Key Status	LEARNT	-
☐ Smartra3 Status	LEARNT	-

Fig.1

VG12IMM10P161012S

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt.

- 3) Is the "ECU STATUS" Parameter "Locked"?

- YES** ► Keep "KEY ON" status for 1 hours to withdraw "Locked by Timer" status. Then turn the key OFF for 10seconds. Next register transponder and go to "Verification of Vehicle Repair" procedure.
- NO** ► Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the PCM or SMARTRA . And this DTC has not erased in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure

NO ► System is performing to specification at this time.

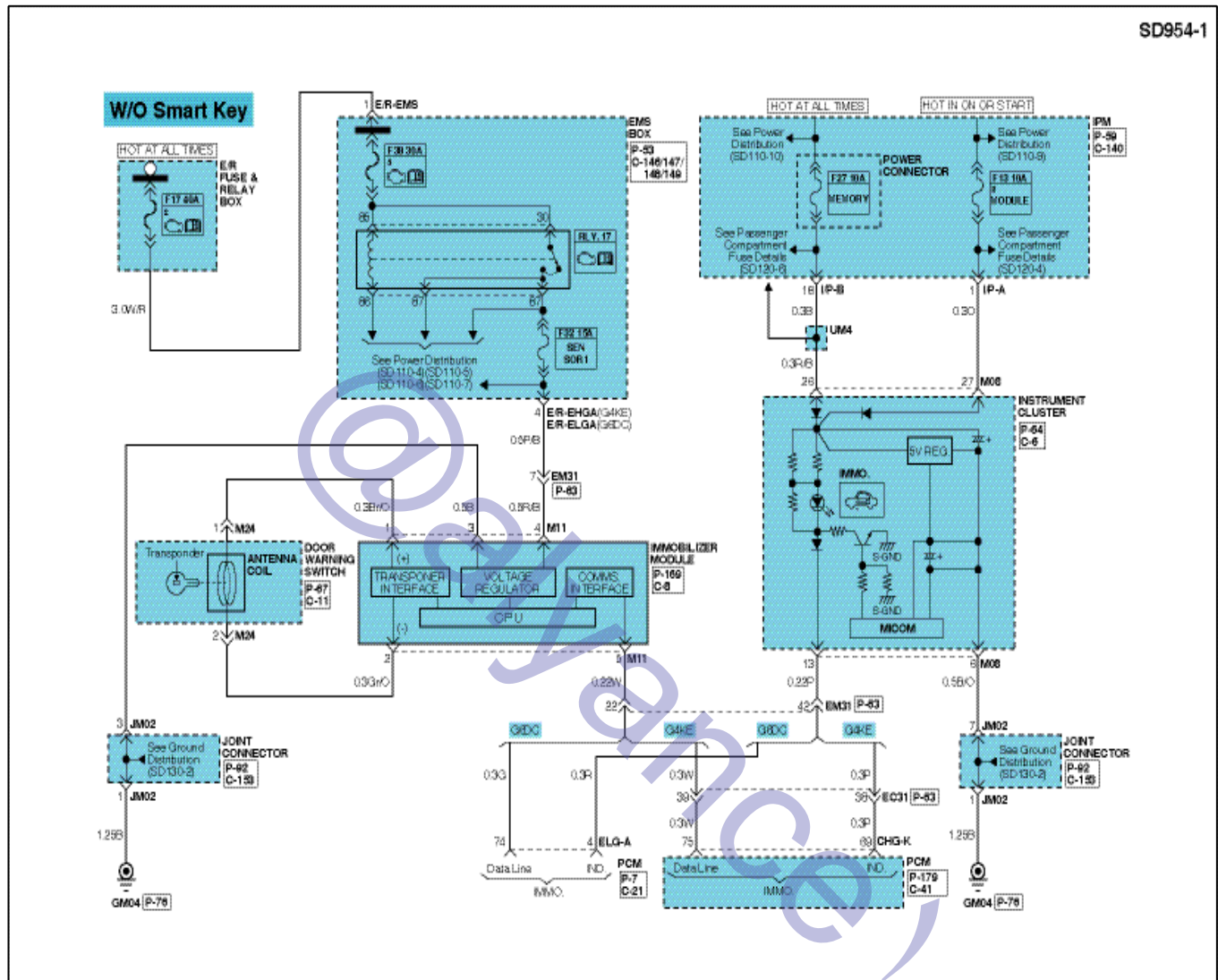
Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ► Go to the applicable troubleshooting procedure

Full Circuit Diagram



VG12IMM10954-1