Document : **User Manual for HI IBU**

Project : **HI IBU**

Project Code :

Version: 0.1

Date: May 18, 2015

Engineering change order-No.:

Design Freeze No.:

Number of pages: 12

Filename: User Manual for HI IBU_ENG.doc

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1.1 Scope of HI IBU System

IBU(Integrated Body control unit) integrate BCM, Smart Key system and TPMS receiver in one ECU

1.1.1 Smart key system offer following feature

- passive access to two doors and trunk; driver side, passenger side, and trunk/tailgate
- passive start after interior detection of the SMART KEY FOB.
- LF-RF communication (based on Continental's SMART KEY system)
- passive access/locking of the two front doors via a toggle push button in the door handles
- passive access trunk/tailgate via the trunk lid switch at the trunk
- immobilizer backup solution integrated into IBU
- communication to the engine management system via a single line interface
- communication to the ESCL via a single line interface
- block of the steering column by the ESCL device

1.1.2 BCM functions offer following feature

- BCM functions are for user convenience and warning for user safety
- BCM functions directly or indirectrly control Lamps, Indicators, Rear curtain, Steering wheel heat and relay
- BCM function s receive inputs by wire or communication (CAN, LIN)

1.1.3 TPMS receiver functions offer following feature

- Process receive data from TPMS sensor
- Do display or warning according to received TPMS sensor data

1.2 short description of the SYSTEM

1.2.1 General Definition of IBU

The SMART KEY system is a system that allows the user to access and operate a vehicle in a very convenient way.

The SMART KEY system is triggered by pressing a push button in the door handle or by pressing a start-stop button in the dash board.

After triggered, the vehicle sends out a LF telegram to all antenna output. And then Smartkey FOB measures the power of each antenna, and sends this information to SMARTKEY UNIT(IBU). From this information, Smart Key unit determines the location of SMART KEY FOB and decides whether to perform a particular action (unlocking, locking…) or to remain inactive.

1.2.2 Wireless Communication

Electromagnetic waves are used to exchange information between the vehicle and the SMART KEY FOB. Both, vehicle and SMART KEY FOB are equipped with a transmitter, a receiver and several antennas.

1.2.3 concept Description

With this concept it is possible to have a set of interior antennas that cover the vehicle's interior and a set of exterior antennas that cover the vehicle's exterior.
For an unambiguous separation between the vehicle's interior and exterior it is sufficient that at least one area is covered exactly by the corresponding operating ranges of the antennas.

The functions of the SMART KEY system have to be provided in a clearly defined and limited range. For the up-link from the vehicle to the SMART KEY FOB, a magnetic field with a frequency of 125 kHz and ASK modulation is used.

Technical aspects of 125 kHz – magnetic field:

- virtually no reflections,
- cubical decrease of field strength → allows good range control,
- released frequency band (ISM),
- high penetration,
- low quiescent current demand due to 125 kHz input stage (SMART KEY FOB),
- less sensitive for detuning compared to higher frequency.

For the down-link from the SMART KEY FOB to the vehicle, the standard radio frequency (RF) is used (similar to the classic remote control functions) with FSK modulation.

1.2.4 System Architecture

The system is designed as an optional system, making it possible to equip vehicles of the same car-Line with different levels of access control systems.

The system is suitable to be integrated into an existing architecture that provides central locking functions with standard remote control. This proposal assumes that the following functions / devices are already present in the vehicle's architecture.

- Central locking system (latch / motor – drivers etc.)
- Standard body control functions
- Warning buzzer
- Indicators
- Lamps
- Wiper control system
- TPMS warnging and display
- Convenience equipments

1.2.5 Main Functions

- The system allows the user to access and exit (unlock and lock) the vehicle without performing any actions with the SMART KEY FOB.
- The system allows the user to control ESCL lock/unlock, to operate relaies to provide power(Off, Accessory, Ignition) to other ECU, and to start/stop the vehicle's engine without performing any actions with the SMART KEY FOB.
- Additionally, the system offers the user can operate all vehicle functions by contacting the Fob to the Start/stop button, which have Immobilizer antenna(terminal control fuction), and by inserting the mechanical key blade into the door handle(Passive access function).

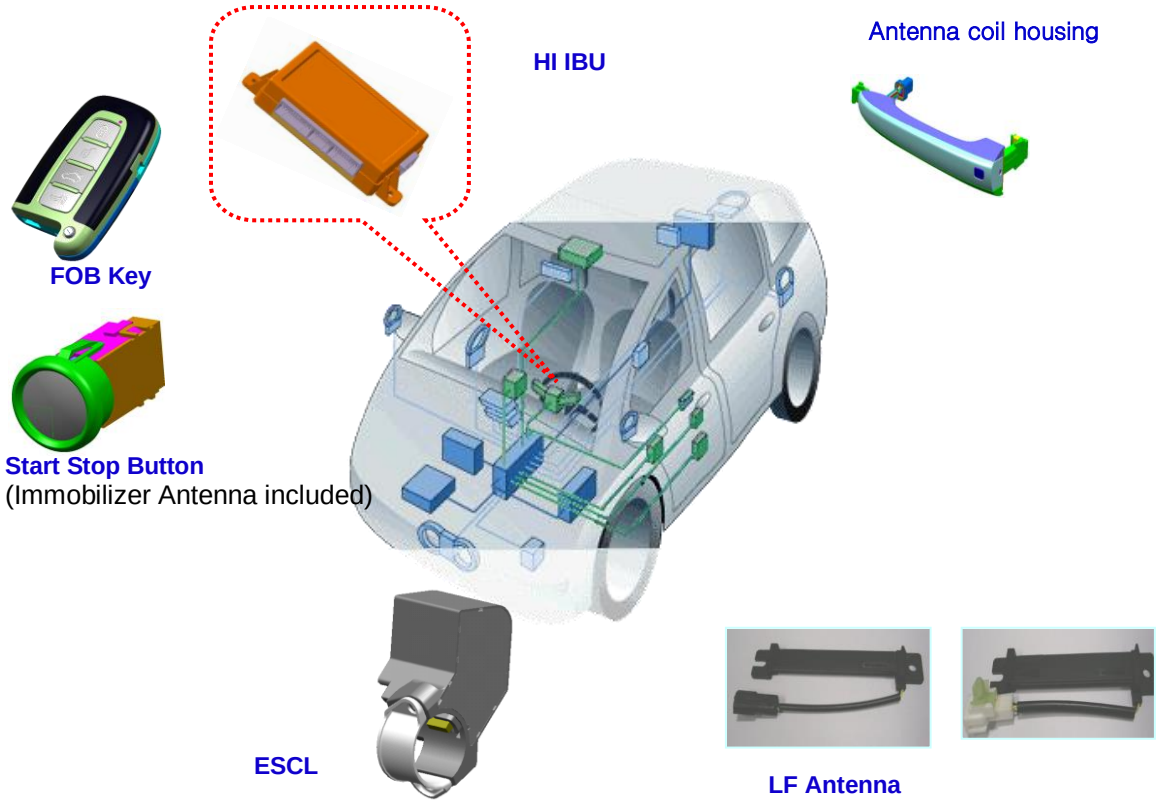

Figure 1: Offered System Components

2.3 HI IBU ECU

IBU ECU manages all functions related to “Passive Access”, “Passive Unlocking” , “Passive Authorization for Operation”, "Terminal control" .

IBU ECU reads the inputs (Door Lock/unlock, SSB SW, ESCL unlock status, PARK position Switch, Brake input SW etc.), controls the outputs (e.g. exterior or interior antennas, terminal control output, ESCL power, Immobilizer antenna), and communicates via the CAN (depends on the vehicle) as well as a single line interface to further devices of the car.
For the communication with the SMART KEY FOB, IBU ECU generates a request (challenge) as an encoded and modulated 125 kHz signal at the inductive antenna outputs and receives the SMART KEY FOB’s response via the RF receiver.
Or for immobilizer communicaiton, IBU ECU sends 125Khz LF signal to SSB's immobilizer antenna, and receives Response from Immobilizer antenna.

The main functional blocks of the IBU ECU are:

- Power supply
- Microcontroller with FLASH Memory
- Single Line Interface to ESCL
- Single Line Interface to EMS
- Input stage
- LF antenna amplifier/driver
- Immobilizer Antenna output
- ESCL power supply
- Terminal Control(ACC, IGN1/2, Start Rly)
- CAN communication with Other
- ECU Internal receiver(433Mhz)
- Rear curtain control
- Steering wheel heat control
- Head lamp wahser relay control
- Indicators control
- TPMS data receiver
- Lamps control
- High speed CAN communication
- Low speed CAN communicaton
- LIN communication

The LF antenna amplifier/driver generates a 125 kHz sinusoidal carrier signal, which is distributed to the different antennas.

The signal for Interior antenna and exterior antenna is 100%-ASK modulated by switching on and off the carrier (the data is Manchester encoded). The power of the carrier is adjustable by software, which means, it is possible to set the power level of the antenna driver for every LF-telegram (e.g. power level stored in the EEPROM) in case of PASE LF Antenna.

And also the signal for immobilizer antenna is ASK modulated signal. Amplitude Shift Keying for write and AM/PM for the read operation. The receiver charteristics(amplifier gain, filter cutoff frequencies) can be optimized to system and transponder requirements.

3. Homologation

FCC Compliance Statement.

This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions :
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

Do Not

Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void user's authority to operate the equipment.

IC Compliance Statement.

This device complies with Industry Canada licence-exempt RSS standard(s).
Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le present appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisee aux deux conditions suivantes :
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioelectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement.