Operational Description and User Manual
Model: INT TAGE NFC

I. Table of Contents

1 General product overview

1.1.1 Function CA:

There are two different capacitive sensors. The first sensor is used for unlock function. This sensor can distinguish an approach and a touch in SW, but there is only a LIN or UART signalization for unlock touch. The second sensor is used for lock function and is designed as a touch sensor. A SW differentiation between lock approach and lock touch is also possible, but just as the unlock sensor there is only a LIN or UART signalization for the lock touch.
Keyless access is enabled by activating the sensors on the door handle in combination with the door handle-ECU, whereby the vehicle can be unlocked or locked.

1.1.2 Function NFC:

To enable communication with an NFC device, the door handle electronics CA + NFC has a highly integrated transceiver IC for contactless communication at 13,56MHz for automotive applications. This reader has a gateway function, the possibility to buffer required data and various diagnostic informations can be provided as well.
The data is transferred to the NFC device according to ISO/IEC 14443-A and the data transmission to the vehicle is realized via LIN-Bus interface. ECP is implemented to communicate with Apple NFC devices.
In LPCD mode the door handle electronics checks the magnetic field for amplitude or phase change. This LPCD polling takes place in adjustable interval lengths.

1.2 Environmental conditions

- Operating temperature range:	-40 to +85°C
- Storage temperature range:	40 to +105°C
- Repainting temperature:	110°C for 1h, 130°C for 0,25h
- Room temperature:	+23°C ± 5°C
- Air humidity:	25% to 90%
- Test temperature for EOL-Test:	Room temperature

1.3 General manufacturing instructions

- At the beginning of the production process, the serial number is marked on the PCB.
- An unacceptable deflection of the board while placing components must be avoided.
- PCB separation is a particularly critical process. Torsional stress during separation and impact stress during punching shall be avoided.
- The method for depanelling must ensure that no components be damaged. An evidence of the equipment manufacturer is necessary.
- The soldering process should be reflow soldering and selective wave soldering.
- Active cooling of the board after soldering is not permitted.
- The components specifications concerning the temperature gradients must be adhered.
- A reworking of a SMD component with a soldering iron is prohibited.

1.1 Assembly concept of electronics INT TAGE RED

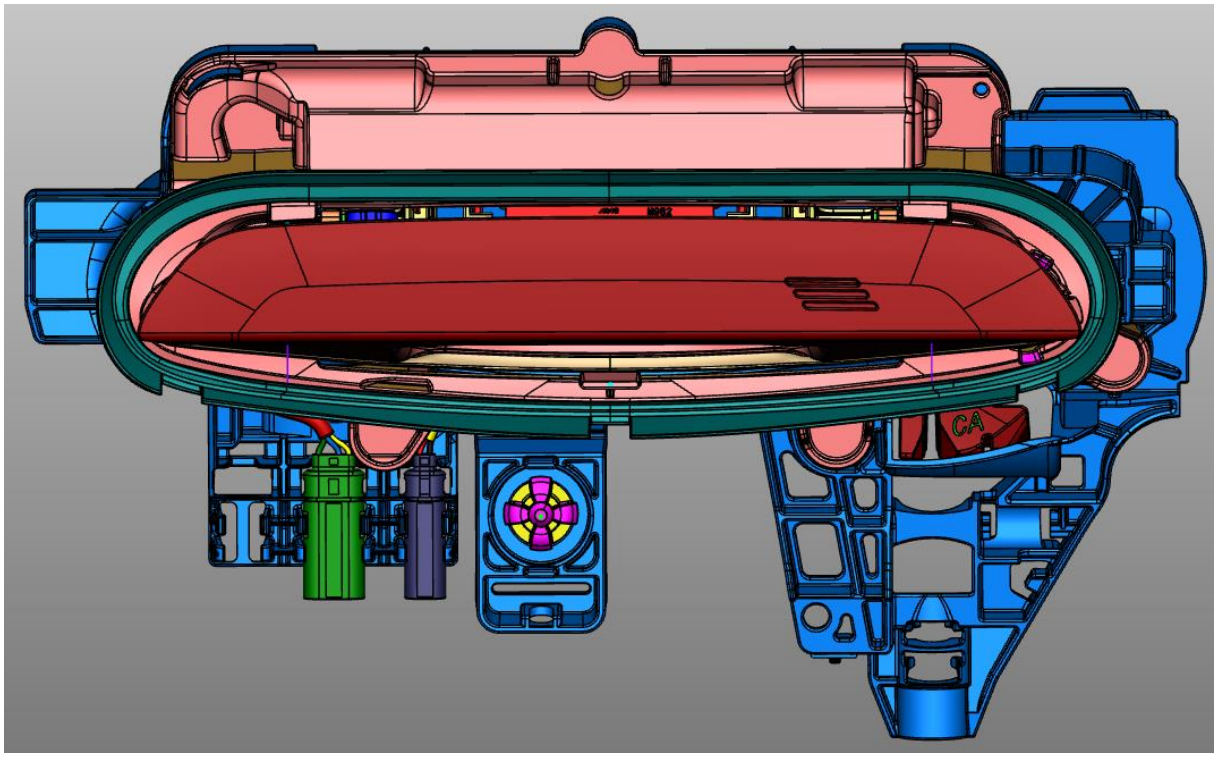

Figure 1: INT TAGE RED with electronics plugged in bracket

1.1.1 NFC antenna

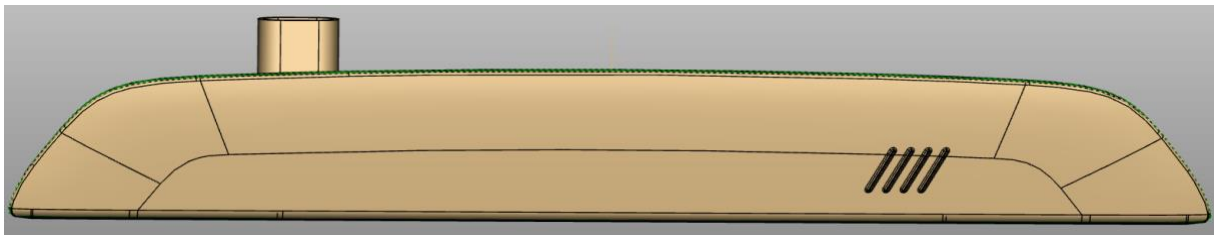

Figure 2: Detection area NFC antenna

1.2 Connector definitions

1.2.1 Connector BMW G26, INT TAGE RED

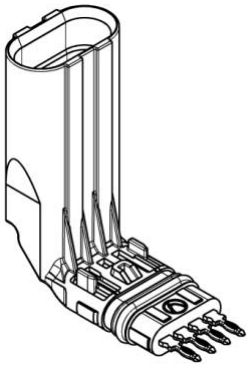

Figure 3: BMW G26 CA + NFC door handle connector

Only the BMW G26/ G42 CA + NFC TAGE have the following connector pins (TAGE side):

- Pin 1 = clamp 30 (+Ubat)
- Pin 2 = clamp 31 (GND)
- Pin 3 = LIN
- Pin 4 = UART

The following picture shows the wire harness which will be plugged in the bracket and which will be used as an adapter cable between vehicle wire harness and door handle electronic.

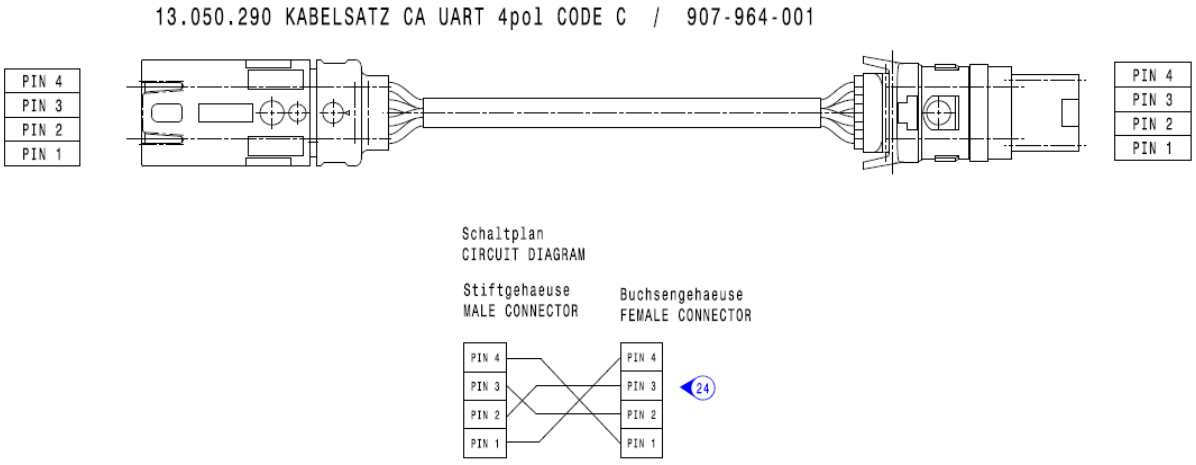

Figure 4: BMW G26 CA + NFC wire harness

Due to pin rotation in male connector there is the following pin assignment (vehicle side):

- Pin 1 (yellow) = UART
- Pin 2 (white) = LIN
- Pin 3 (brown) = clamp 31 (GND)
- Pin 4 (red) = clamp 30 (+Ubat)

2 Electrical Characteristics

2.1 Operating voltages

- Operating voltage range: +Ubat = 9V to 16V DC
- LIN operating voltage range: +Ubat = 8V to 18V DC
- Test voltage for EOL: +Ubat = 12V ± 2% DC

2.2 Current consumption

- Series parts current consumption:
  - Quiescent current: I_{quies} ≤ 400µA for 4 TAGE per vehicle
    I_{quies} ≤ 200µA for 2 TAGE per vehicle
    CA = 65µA
    CA + NFC = 150µA
  - Active current: I_{active} ≤ 250mA
    CA < 10mA
    CA + NFC < 120mA

The final values have to be defined with series parts by Huf-HQ.

2.3 Timing conditions

- Polling rate:
  - CA 20ms
  - CA + NFC 20ms (Kapa), 100ms (NFC)
- NFC-LPCD pulse: 40µs
- Clock rate microcontroller:
  - Kapaburst (333kHz/ 400kHz) 4MHz
  - A/D conversion + data handling 32MHz
- Baudrate:
  - UART 4800Bit/s up to 38400Bit/s
  - LIN 9600Bit/s up to 38400Bit/s

3 Interface Description

3.1 UART interface (SP2018)

The UART (K-Line) interface is an unidirectional, one-wire, half duplex interface with clamp 30 level. It uses an NPN transistor along with a typ. 30kOhm pull-up resistor for current modulation communication with an external electronic control unit. The communication goes in one direction (from TAGE to ZSG). For diagnostic function, there are bidirectional communication messages.

- R_Slave:
  - Min. = 20kOhm
  - Typ. = 30kOhm
  - Max. = 47kOhm

- R_Master:
  - Min. = 900Ohm
  - Typ. = 1000Ohm
  - Max. = 1100Ohm

- High signal = Pull-up resistor is not active (no modulation current flows)
- Low signal = Pull-up resistor is active (modulation current flows)

Baud rate	4800Bit/s (+/- 5,2%) up to 38400Bit/s
Data Bits	8 Bits
Start Bit	1 Bit
Stop Bit	2 Bit
Parity	1 Bit even parity

3.2 **LIN Interface**

The LIN interface is a bidirectional, one-wire interface with a LIN-Transceiver, which is compliant to LIN standard 2.2 for communication with the ZSG. The external connection of the LIN-Transceiver is conform to the OEM_Hardware_Requirements_CAN-LIN-FR-Interfaces_v1.2 [OEM_LIN_1.2].
The LIN Bus is primarily intended for in-vehicle subnetworks using baud rates up to 20 kBit/s
A 1kOhm terminating resistor between pin LIN and clamp 30 is necessary to check the LIN communication with the oscilloscope.
It is possible to check the LIN Bus communication with a Vector LIN/CAN interface (HW-Tool) together with CANoe (SW-Tool)
During development process, flashing via LIN is possible. In series production the LIN flash interface will be locked by an implementation of the master ECU.
The wake-up time of LIN communication is < 100ms.

Baud rate	19200kBit/s +/-14%
ID-length	1 Byte
Message length	8 Bytes
Synchronization	Master initializes communication
Sync Break	>= 13Bit
Sync Feld	1 Byte
Checksum	1 Byte

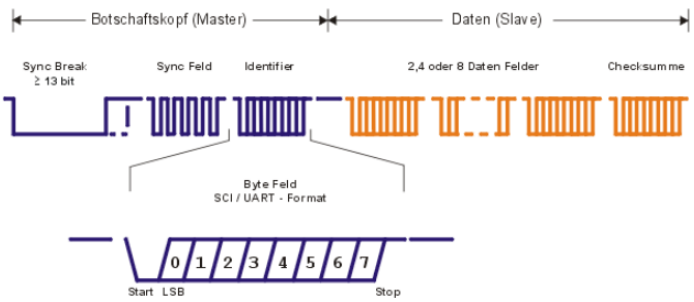

Figure 5: Typical LIN message

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3.2.1 NFC Function test

For the NFC function test an ISO/IEC 14443 type A card shall be used to read the UID of the card. It is advantageous to use a Type A card with a 4 byte UID, because this will shorten the test time. Thus the instruction sequence mentioned in this chapter does not need more than 100ms to detect a smartcard.
A typical approach speed of the NFC card is 100mm/s.

The functional test has the following sequence:

- The NFC card will be placed vertically to the geometric plane of the NFC antenna so that the center point of the NFC antenna and the center point of the NFC card suit. (E.g. a distance of 1cm to the handle surface is recommended) **(1)**

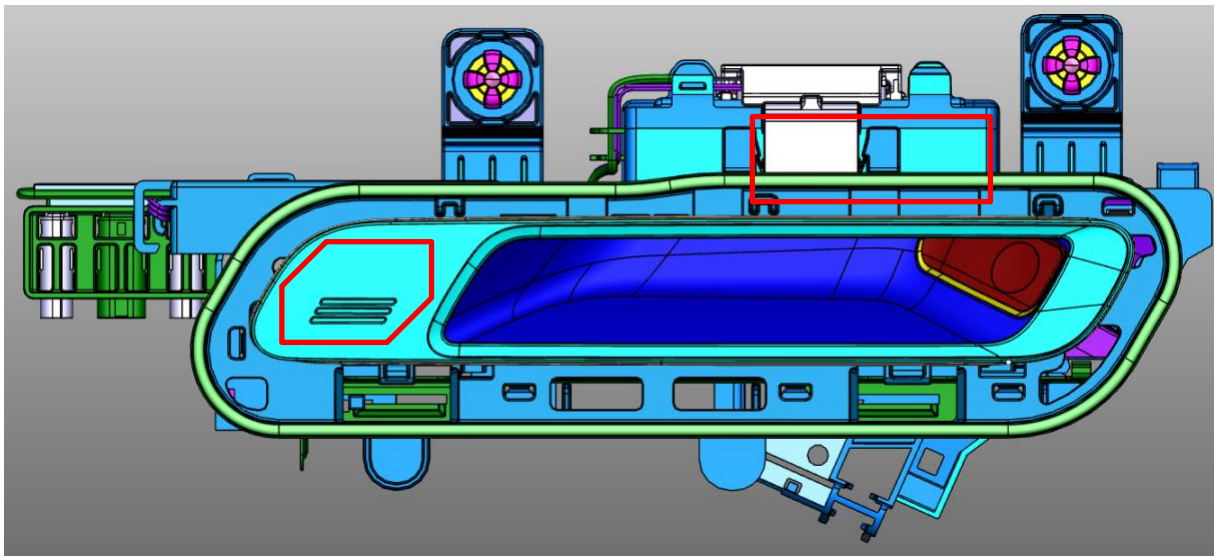

Figure 6: NFC detection area G26

- To start this test enable write protection (See chapter 4.2.21) and then activate NFC Burst Type A via diagnosis request 0x2E 0xFD 0x1A 0x02 (See chapter 4.2.16) and NAD 0x10. After 20ms the door handle electronics will turn in mode RF discovery pulse. In this mode the magnetic field is turned on continuously and

the TAGE sends cyclically a WUPA (amplitude modulation on the field) in order to initiate a communication with a PICC (Smartcard, Smartphone, Smartwatch, …) **(2)**

- Wait 100ms. **(3)**
- Check LIN frame ST_NFC_E_LIN: RCGD_NFC_Token_TYP_LIN == 0x4? (See chapter 4.2.9.1) **(4)**
- If Type 4A TAG has been successfully detected, the NFC function test ends, else repeat step (1) to (4). **(5)**

Radio equipment authorization to FCC in USA

FCC ID: YGOINTTAGERED

The transmitter will be supplied as an original equipment device to the car manufacturer.

According to 47 CFR 15.19 (labelling requirements) the car manufacturer will print the following text in the appropriate User's Manual of the car:

> 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.
>
> Usually this is followed by the following FCC caution:
> Any changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Radio equipment authorization to RSS-210 in Canada

IC ID: 4008C-INTTAGERED

The transmitter will be supplied as an original equipment device to the car manufacturer.

According to RSS-210 (labelling requirements) the car manufacturer will print the following text in the appropriate User's Manual of the car:

> 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 harmful interference, and
> (2) This device must accept any interference received, including interference that may cause undesired operation.
>
> Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
> (1) l'appareil ne doit pas produire de brouillage, et
> (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, mêmesi le brouillage est susceptible d'en compromettre le fonctionnement.
>
> Usually this is followed by the following RSS caution:
> Any changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

3 Regulatory Information

3.1 USA:

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.

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

3.2 Kanada:

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 harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

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

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

3.3 Taiwan

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