Technical training.
Product information.

G12 Telephone and Telematics Systems

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BMW Group University
Technical Training
ST1501 8/1/2015

BMW Service

General information

Symbols used

The following symbol is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as the result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

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G12 Telephone and Telematics Systems

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1. Introduction

In addition to the hands-free telephone system with a base plate with connection to the exterior antenna a brand new wireless charging telephone feature is standard equipment. Charging takes place wirelessly for the first time using **wireless charging technology** in the new BMW 7 Series.

Another new feature of the G12 is transmission of cell phone data by means of **Near Field Communication or NFC for short**. NFC is used for the first time in a BMW, it offers a simplified connection setup for Bluetooth pairing of the customer's cell phone.

Together with the revised Head Unit High 2, a new telematic control unit is being introduced at BMW. The **Telematic Communication Box 2 TCB2 as a roof-mounted version** offers the cell radio standard Long Term Evolution LTE in the vehicle for the first time. This new feature permits both connection of vehicle such as TeleService and Connected Drive as well as realization of a high-speed access to the internet. This **Wi-Fi hotspot** is available to customers as optional equipment.

G12 Telephone and Telematics Systems

2. Special Equipment

2.1. Standard telephone system

In the G12, the standard equipment again includes the **Bluetooth hands-free system** together with Bluetooth audio streaming and a USB interface. An AUX-In interface is no longer offered in the G12. An exception to this is the separate connection option in the rear seat entertainment system. The hardware for the Bluetooth hands-free system is comprised in the Head Unit High 2.

In current BMW vehicles and depending on the optional equipment, a base plate and phone cradle is provided so that customers can use snap-in adapters in the vehicle. The base plate is located in the front center console of the vehicle. It is used for charging the cell phone and has a USB interface for the music player connection. Connected via the external vehicle antenna, the field strength for the customer's cell phone is significantly improved. Use of the external vehicle antenna is particularly advantageous because it greatly enhances the field strength depending on frequency. The standard equipment telephone system on the US market G12 includes the 6NW Wireless Charging. This base plate and phone cradle is no longer needed as the system uses a wireless charging tray that performs all of the same functions.

A 2nd microphone is installed in the vehicle as standard to enhance the operation of the hands-free system, in particular for the front passenger.

The vehicle equipped with two USB interfaces and there is no longer an AUX-IN port available. Both USB interfaces are connected to the head unit and can be accessed in the new main menu under "Media/Radio".

A charge current of up to 2.1A is available via both USB interfaces to supply the customer's smart devices. This is made possible due to the use of an additional USB hub which is installed as standard. Both audio and video content can be played back from a USB stick via these interfaces.

G12 Telephone and Telematics Systems

2. Special Equipment

USB ports in the G12

G12 Telephone and Telematics Systems

2. Special Equipment

Index	Explanation
1	Additional USB hub in combination with the standard equipment Telephone with wireless charging (SA 6NW)
2	Standard USB interface in the front center console (aluminum design)
3	Optional USB interface in the center console storage compartment **(Not available for US market)**
3a	Additional USB interface in the storage compartment (SA 6NW) Telephone with wireless charging.
3b	Telephone cradle and USB interface in the storage compartment **(Not available for the US market)**

The standard telephone function permits simultaneous connection of 2 telephones. A 3rd cell phone can be used as an external Bluetooth audio source if required. Up to 4 telephones can be registered in advance.

Numerous additional office functions can be additionally enabled in the main menu Communication/ Office in combination with the convenient telephone function. For example, the address book supports contact photos if these are maintained and stored on the cell phone. You can find out whether a specific cell phone is suitable for this feature at:

www.bmw.com/bluetooth

Wi-Fi Hotspot

A **Wi-Fi hotspot** is prepared in the vehicle as a highlight of the convenient telephone function. This can be activated thanks to special optional equipment which is added to the vehicle together with convenient telephone or wireless charging. For further information Wi-Fi Hotspot See Chapter 2.

User-initiated software update

A customer-initiated software update (KISU update) for multimedia and telephone is possible as standard in the G12.

Telephone with wireless charging

Telephone with Wireless Charging (SA 6NW) is offered as standard equipment in the US market (See illustration). The scope of hardware and functions is enhanced with a **special wireless charging tray** which is installed in the vehicle instead of the base plate. This smartphone charging tray, called "wireless charging tray", is fitted on the side of the center console and permits inductive charging as well as inductive coupling with the external vehicle antenna.

In addition to the customer's smartphone, which remains fully functional with respect to the hands-free system during charging, it is also possible to perform wireless charging of the BMW Display key (SA 3DS).

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2. Special Equipment

2.2. Wi-Fi Hotspot

The **Wi-Fi Hotspot (SA 6WD)** in the vehicle is also already **standard for the US market and included along with telephone with wireless charging (SA 6NW)**. The system is offered as a free monthly trial.

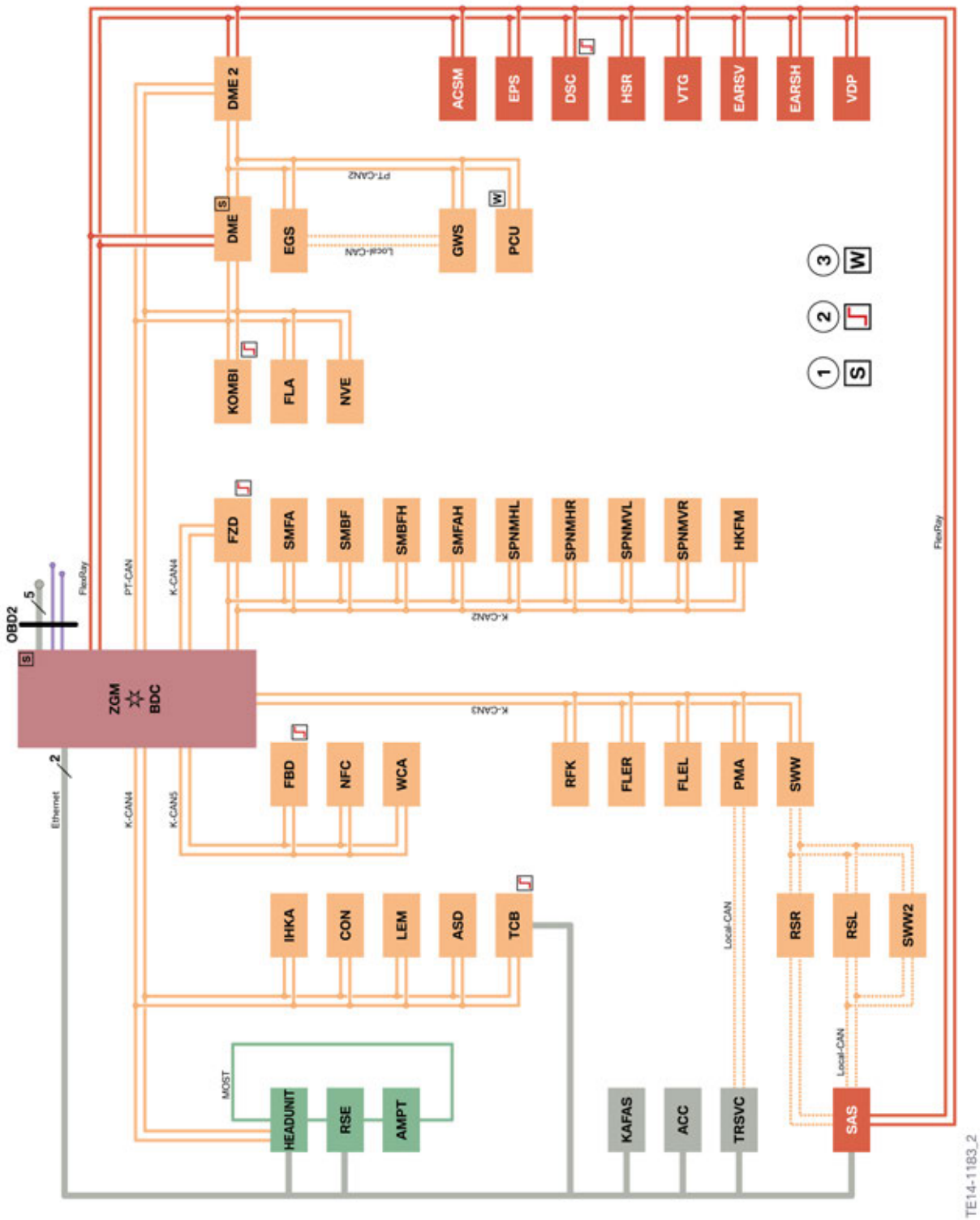
It is only necessary to purchase a mobile data plan from your cell phone carrier (i.e. AT&T). Depending on local LTE availability and taking into account country-specific restrictions, the customer can then surf in the internet with up to 10 devices with a maximum download rate of 100 Mbit/s.

The purchase of the (pay as you go) plan takes place exclusively via the customer's cell end device (PC, smartphone, tablet etc.). The connection is done via the TCB 2 SIM card. When connecting to the Wi-Fi hotspot the phone will open a landing page (similar to a hotel Wi-Fi connection) to log in. The TCB 2 uses a double connection, one for the BMW ConnectedDrive and telematics functions via the BMW server and the other for the Wi-Fi hotspot via AT&T server

G12 Telephone and Telematics Systems

3. Overview of Telephone Systems

3.1. Data bus overview



G12 bus overview

G12 Telephone and Telematics Systems

3. Overview of Telephone Systems

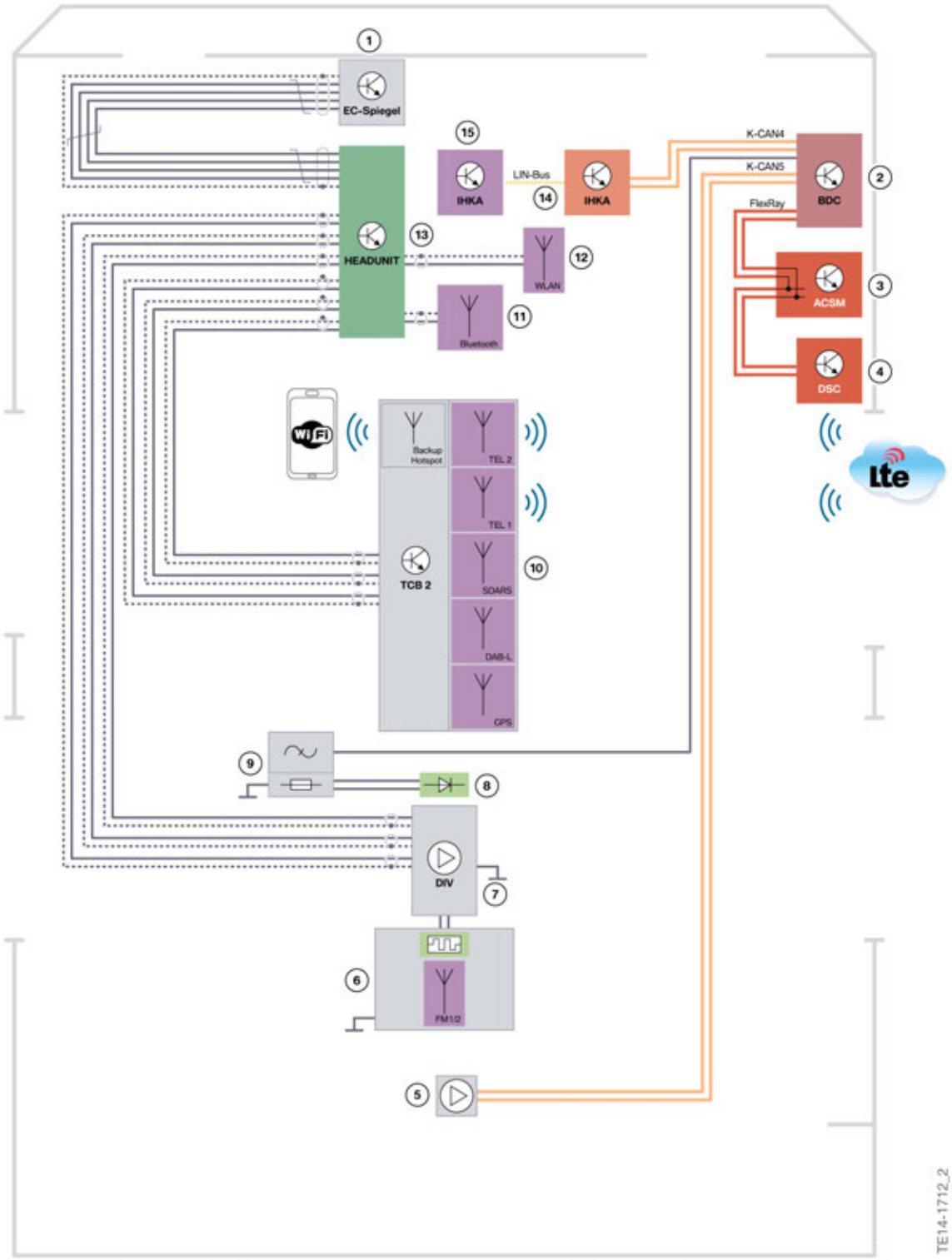
Abbreviation	Explanation
ACC	Active cruise control
ACSM	Crash Safety Module
AMPT	Amplifier Top (top high fidelity amplifier)
ASD	Active Sound Design
BDC	Body Domain Controller
CON	Controller
DME	Digital Motor Electronics
DSC	Dynamic Stability Control
EARSH	Electric active roll stabilization rear
EARSV	Electric active roll stabilization front
EGS	Electronic transmission control
EPS	Electromechanical Power Steering
FLA	High-beam assistant
FLER	Frontal Light Electronics Right
FLEL	Frontal Light Electronics Left
FZD	Roof function center
GWS	Gear selector
HEADUNIT	Head Unit High 2
HKA Rear climate control	Automatic rear air-conditioning and heating
HKFM	Tailgate function module
HSR	Rear axle slip angle control
IHKA	Integrated automatic heating / air conditioning
KAFAS	Camera-based driver support systems
KOMBI	Instrument panel
LEM	Light Effect Manager
NFC	Near Field Communication
NVE	Night Vision Electronics
PCU	Power Control Unit
PMA	Parking maneuvering assistant
RFK	Rear view camera
RSE	Rear Seat Entertainment
RSL	Radar Sensor Left (avoidance assistant)
RSR	Radar Sensor Right (avoidance assistant)
SAS	Optional equipment system

Abbreviation	Explanation
SMBF	Seat module, passenger
SMFA	Seat module, driver
SMFAH	Seat module, driver, rear
SPNMHL	Seat pneumatics module back left
SPNMHR	Seat pneumatics module back right
SPNMVL	Seat pneumatics module front left
SPNMVR	Seat pneumatics module front right
SWW	Lane change warning (Primary)
SWW2	Lane change warning (Secondary)
TCB2	Telematic control unit 2
TRSVC	Control unit for rear view camera and SideView
VDP	Vertical Dynamic Platform
VTG	Transfer box
WCA	Wireless charging tray
1	Start-up node control units for starting and synchronizing the FlexRay bus system
2	Control units with wake-up authorization
3	Control units also connected at terminal 15WUP

G12 Telephone and Telematics Systems

3. Overview of Telephone Systems

3.2. Antenna system in G12



G12 antenna system

G12 Telephone and Telematics Systems
3. Overview of Telephone Systems

Index	Explanation
1	Electrochromatic mirror
2	Body Domain Controller (BDC)
3	Crash Safety Module (ACSM)
4	Dynamic Stability Control (DSC)
5	Remote control service receiver (FBD) (with K-CAN connection for first time)
6	Rear window heating and antennas (FM/AM and FM2)
7	Rear window diversity and antenna amplifier (FM/AM and FM2)
8	Additional brake light
9	E-filter against interference from additional brake light
10	Antenna system + control unit TCB2 for convenient telephone (SA 6NS) or Telephone with Wireless Charging (SA 6NW); snap-in roof-mounted antenna in the fin with SDARS (US), TEL1 (telephone), TEL2 (telematics) and GPS
11	Bluetooth antenna connected to the Head Unit High 2
12	Wi-Fi®Direct antenna connected to the Head Unit High 2
13	Head Unit High 2
14	Integrated automatic heating / air conditioning (IHKA)
15	IHKA control panel

3.3. Convenient telephone/WCA

Wireless Charging (SA 6NW) WCA includes Convenient telephone (SA 6NS) and is standard equipment in the US market.

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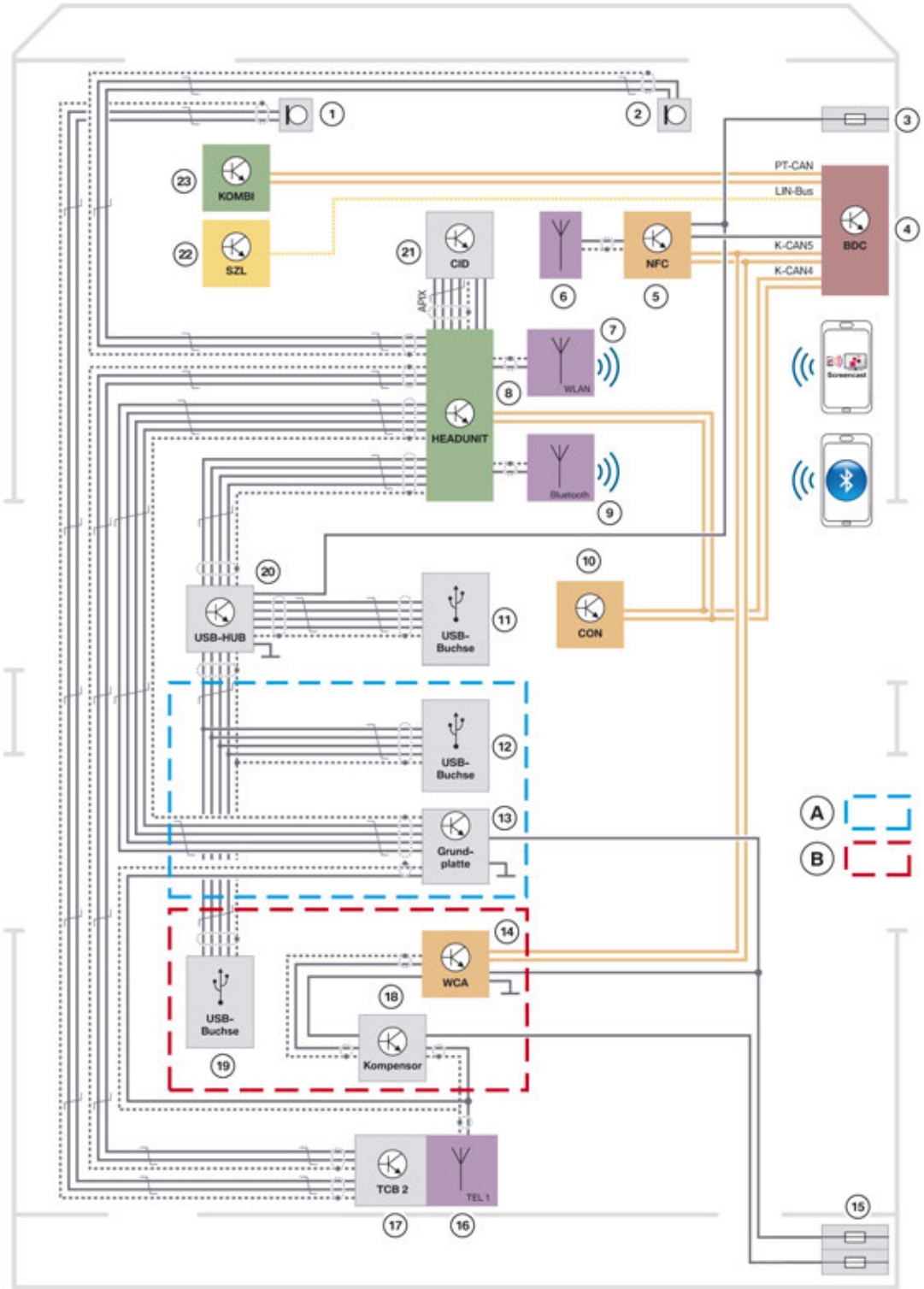
3. Overview of Telephone Systems



Convenient telephone is included with wireless charging tray WCA (SA 6NW) in the G12.

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3. Overview of Telephone Systems

Index	Explanation
A	Convenient telephone (SA 6NS)
B	Wireless Charging (SA 6WA)
1	Microphone, driver's side
2	Microphone, passenger's side
3	Power distribution box, front
4	Body Domain Controller (BDC)
5	Control unit, Near Field Communication
6	Antenna, Near Field Communication
7	Wi-Fi®Direct antenna on the head unit
8	Head Unit High 2
9	Bluetooth antenna
10	Controller (CON)
11	USB interface (standard)
12	Additional USB interface in the center console
13	Base plate for snap-in adapter for smartphone (USB connection)
14	Wireless charging tray
15	Power distribution box, rear
16	Telephone antenna
17	TCB2 with integrated fin (TEL1 for WCA and base plate, integrated Wi-Fi hotspot)
18	WCA line compensator
19	Additional USB interface in the center console
20	USB hub
21	Central information display (CID)
22	Steering column switch cluster (SZL)
23	Instrument panel (KOMBI)

G12 Telephone and Telematics Systems

4. Telematic Communication Box 2 (TCB2)

4.1. Comparison with TCB

The tasks of the Telematic Communication Box (telematic control unit installed since 07/12) were clearly defined up to now. The TCB was the modem in the vehicle with integrated SIM card and emergency running properties in the event of failure of the vehicle electrical system (emergency power supply with own battery). Both TeleServices and the ConnectedDrive services (ASSIST, ONLINE, Remote and Internet) use this modem with connected telematic antenna in the roof fin. The emergency GSM antenna was a separate component and was hard-wired to the TCB, in addition to a microphone and an emergency loudspeaker.

4.2. New features of the TCB2

From the F23 on, the TCB2 **as a luggage compartment version** which uses both antennas for reception of the data services (LTE) for the first time with combined operation of the telematic antenna and a separate emergency antenna (backup)

The **roof-mounted version** of the TCB2 was introduced with the F30 LCI. It is the next evolutionary phase of the TCB2 and now also makes its debut in the new BMW 7 Series. **Two** integrated telematic antennas (TEL1 and TEL2) ensure first-class LTE data reception. The integrated emergency GSM antenna (backup) now also serves simultaneously as a "hub" for the Wi-Fi hotspot in the vehicle. The US version includes the 4G + Wi-Fi hotspot (SA 6WD) feature as standard equipment and it uses an AT&T® SIM card as the previous TCB.

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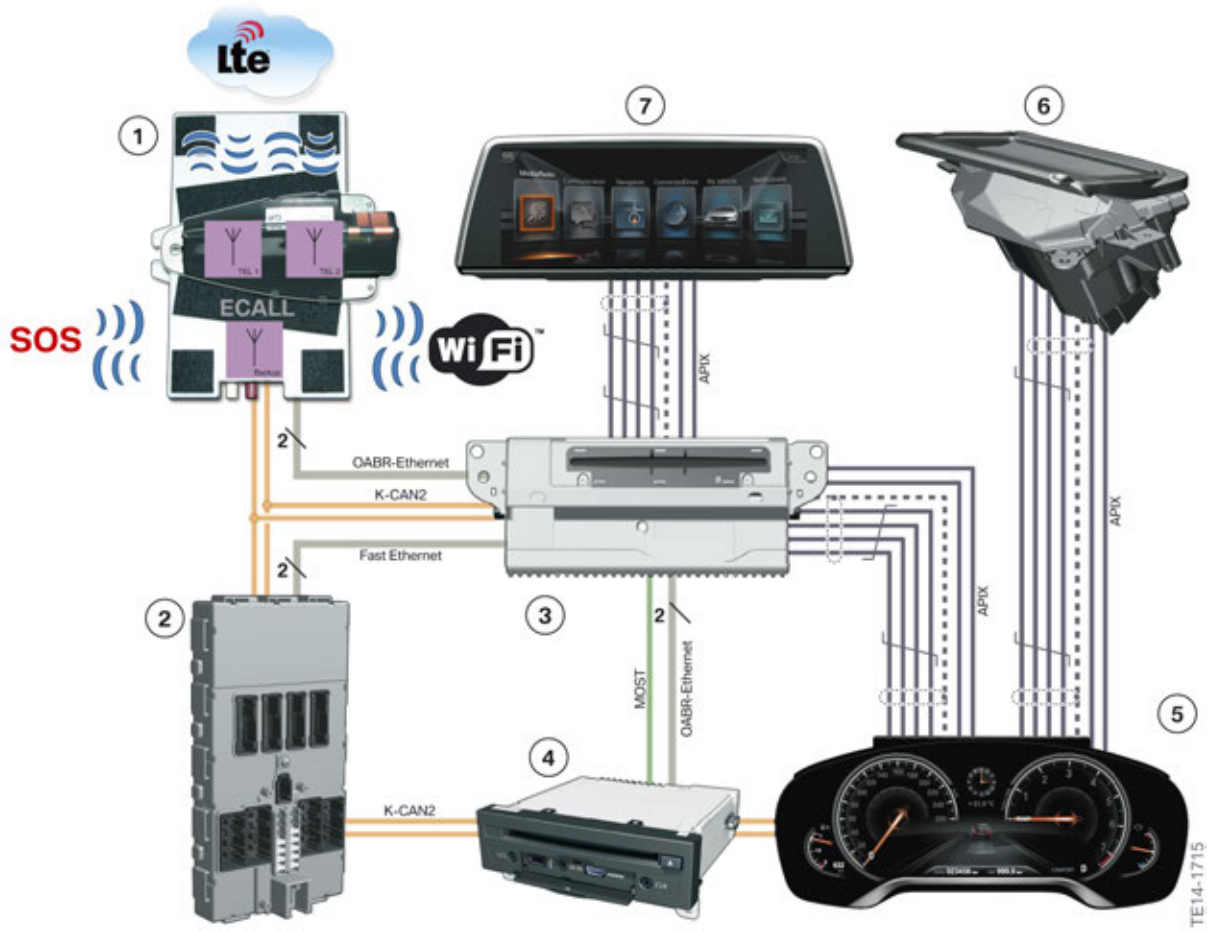
4. Telematic Communication Box 2 (TCB2)

4.3. System connection



Vehicle electrical system connection TCB2 in the G12

Index	Explanation
1	Combination of TCB2 (includes emergency call antenna) and fin with telephone (TEL1) and telematic antenna (TEL2) for emergency call function, remote services, TeleServices and ConnectedDrive services
2	Body Domain Controller
3	Head Unit High 2
4	Control unit for rear seat entertainment system (RSE)
5	Instrument panel (KOMBI)
6	Head-Up Display (HUD)
7	Central information display (CID)

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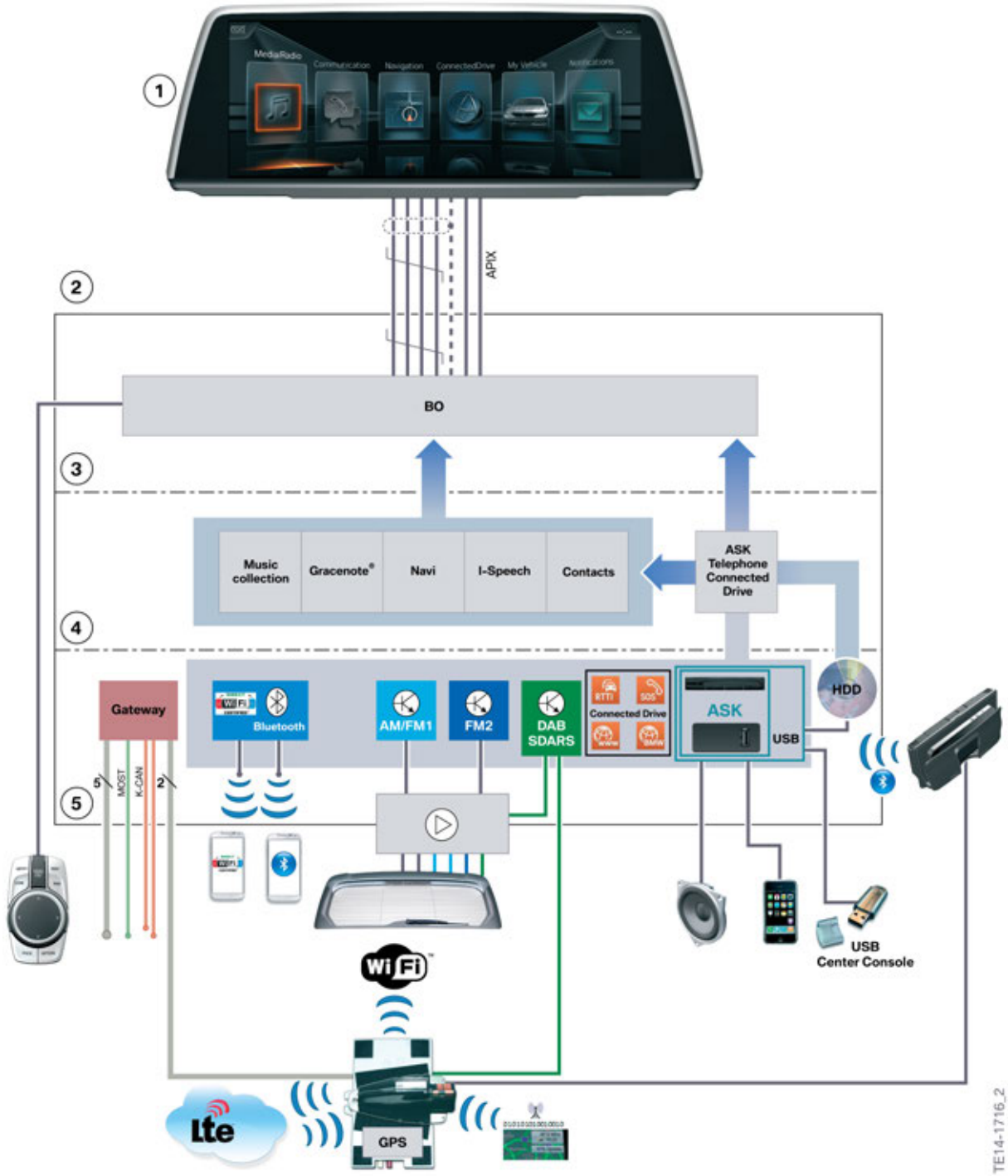
4. Telematic Communication Box 2 (TCB2)

4.4. Functional wiring diagram of head unit with TCB2

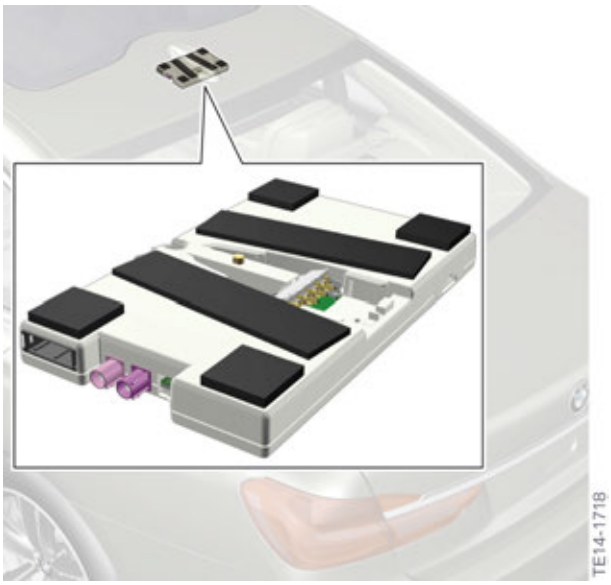


Functional wiring diagram of HU-H2 including TCB2

Index	Explanation
1	Central information display (CID)
2	Head Unit High 2
3	User interface
4	Application/software
5	Interfaces / Hardware connection

4.5. Installation location

The TCB2 with associated roof fin (roof-mounted antenna) is located just in front of the rear window between the roof and roofliner of the G12.



TCB2 installation location including the roof fin in the G12

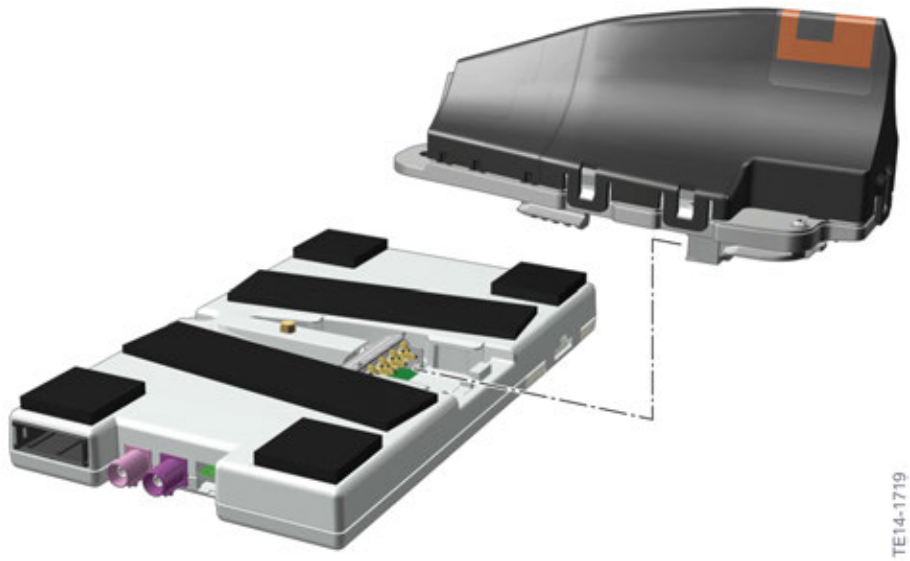
G12 Telephone and Telematics Systems

4. Telematic Communication Box 2 (TCB2)

4.6. Design of the TCB2

4.6.1. Individual components

The TCB2 is engaged in the roof-mounted antenna connected with the vehicle. This makes it possible to reduce conduction losses and EMC interference.



Individual components of TCB2

Index	Explanation
1	Telematic antenna fin **as standard** with: TEL1 (telephone and telematics for LTE) and TEL2 (telematic) antenna and GPS antenna in the roof fin; SDARS antenna (for US vehicles).
2	Bottom part of the TCB2 with integrated emergency call antenna and additional integrated "Hub" for the Wi-Fi hotspot (SA 6WD) in combination with convenient telephone and wireless charging (SA 6NW).

4.6.2. Hardware: roof fin

In the roof-mounted version, the TCB2 control unit is installed directly into the **roof-mounted (fin) antenna** during installation at the assembly plant. The antenna contacts of the roof fin are connected with the connection points in the TCB2 control units with the minimum possible electrical resistance. The contacts are gold-plated and have short travels since they are combined into one component at the assembly plant by the engagement process.

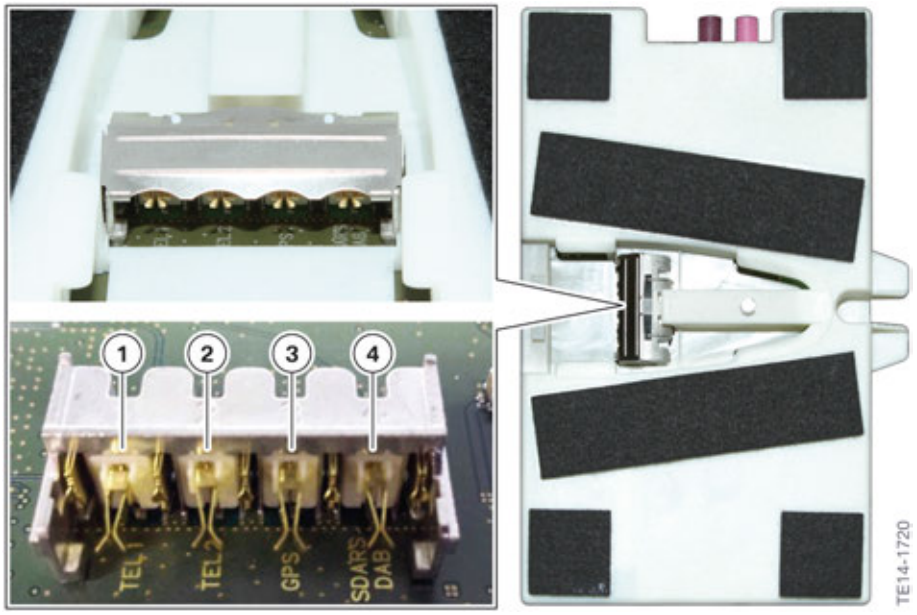


Illustration of pinning on TCB2

Index	Explanation
1	TEL1 connection for the telephone antenna (+ LTE telematics function)
2	TEL2 for the telematic antenna (ECall, MIMO and Wi-Fi hotspot)
3	GPS antenna (optional)
4	SDARS (standard for US)

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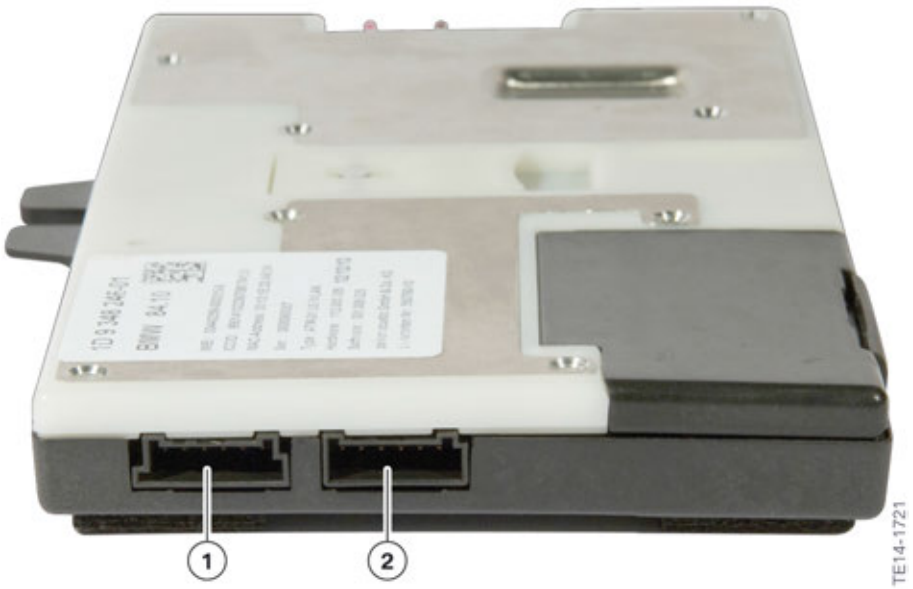
4. Telematic Communication Box 2 (TCB2)

4.7. Hardware: TCB2 control unit

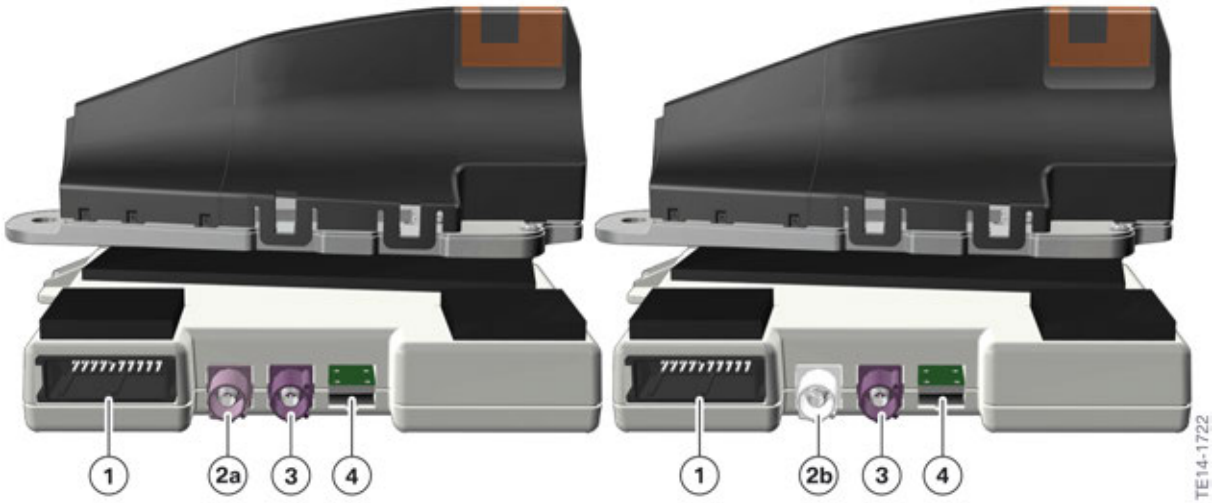
4.7.1. Front view



Front view of the TCB2

Index	Explanation
1	LED emergency call button, emergency call button, crash signal ACSM, K-CAN4
2	Emergency loudspeaker, telematic control unit (terminal 30F, ground)

4.7.2. Rear view



Rear view of the TCB2

Index	Explanation
1	OABR Ethernet, K-CAN4, driver's microphone (input and output)
2a	DAB L band antenna (not for US)
2b	SDARS antenna (US only)
3	TEL1 connection to base plate or wireless charging unit
4	Empty – no functionality

4.7.3. Emergency battery

The TCB2 is equipped with an emergency battery for power supply if the vehicle electrical system is no longer functional. This ensures that the E-CALL system is still supplied with power. The emergency battery can be ordered separately from BMW Parts and Accessories.

If an emergency battery develops a fault during the vehicle life cycle, the battery can be replaced. After removing the roofliner, the TCB2 can be separated from the antenna unit bonded into position in the vehicle roof by means of a release button located on the bottom of the control unit.

G12 Telephone and Telematics Systems

4. Telematic Communication Box 2 (TCB2)

A Check Control message will be displayed to the driver if the emergency battery is defective. Please observe the repair instructions for removal of the roofliner when servicing the emergency battery of the TCB2!

Release button on the TCB2

Please refer to the BMW repair instructions for the exact replacement procedure for the emergency battery.

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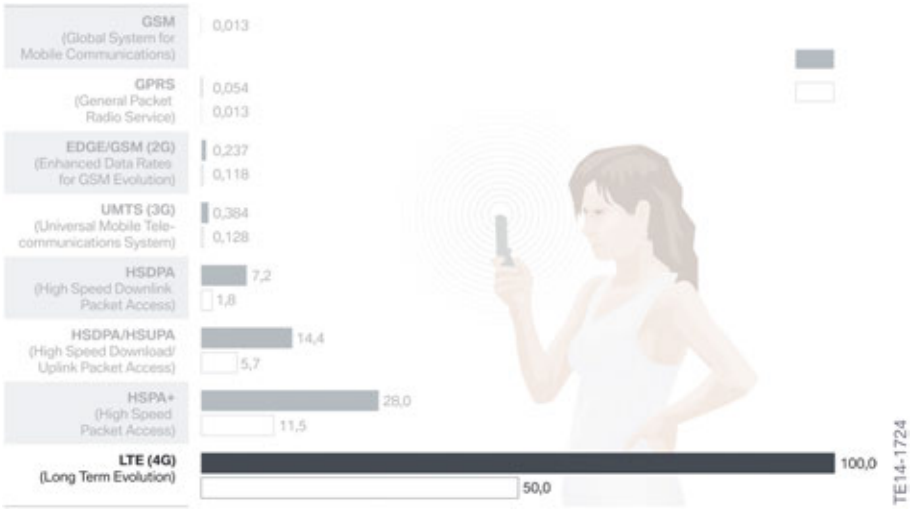
5. Telematics Services in the Vehicle

5.1. LTE data connection

5.1.1. Comparison of data transfer rates



Comparison of mobile radio data transfer rates

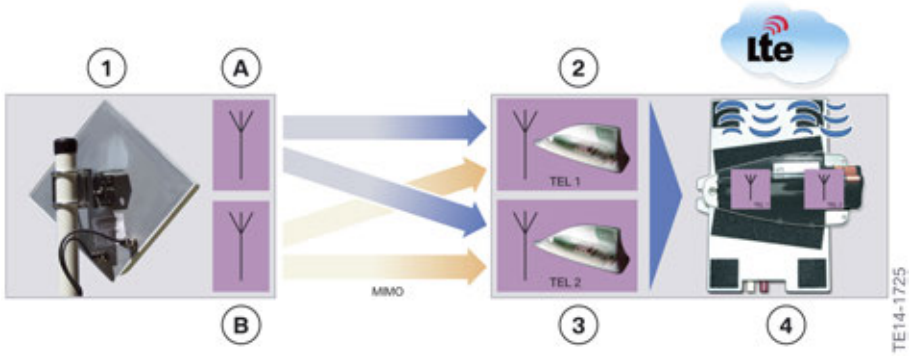
Long Term Evolution (LTE) is a 4th generation (4G) mobile radio standard. LTE can achieve a significantly higher download rate with up to 100 MBit/s. The basic diagram of UMTS is retained for LTE. A quick and reasonable changeover of the infrastructures of the UMTS technology (3G standard) to LTE Advanced (4G standard) is therefore possible.

The frequency ranges used differ depending on the region, and vary from about 700 to 2600 MHz. The term "Frequency Division Duplex" is understood as transmission and receiving from cell and base stations on tow different frequency bands: The mobile device transmits, in the Uplink channel, while the base station transmits, in the Downlink channel. Each of the two frequency ranges have a bandwidth of 5 MHz. Expressed simply, this means that 2 transmitters and 2 receivers in each case transmit and receive simultaneously with 2 different frequencies.

5.1.2. Multi Input Multiple Output (MIMO)

With MIMO technology (Multiple Input Multiple Output), it is possible for mobile radio providers to offer data speeds with a low error rate. MIMO is the basis for a special encoding procedure which uses both temporal and also spatial dimensions for information transfer (Space-Time Coding).

As a result, the quality (bit error frequency) and data rate of a wireless connection can be improved significantly. MIMO systems can transmit considerably more Bit/s per Hz bandwidth used, and are thus more efficient than conventional systems. In order to realize the MIMO technology at BMW **both data antennas** present in the vehicle area used simultaneously for the first time for the LTE connection. MIMO operates similar to the antenna diversity in the radio system. The signal of both antennas is sent, evaluated and combined to minimize errors and optimize data speed.



LTE reception in the G12

Index	Explanation
1	LTE transmitter system
A	LTE antenna 1
B	LTE antenna 2
2	Telephone antenna TEL1 for LTE reception
3	Telematic antenna TEL2 for LTE reception
4	Combination of LTE antennas 1 and 2. Consisting of the TEL1 and TEL2 antennas of the roof fin engaged in the TCB2

5.2. Emergency call system in the G12

5.2.1. Standard equipment

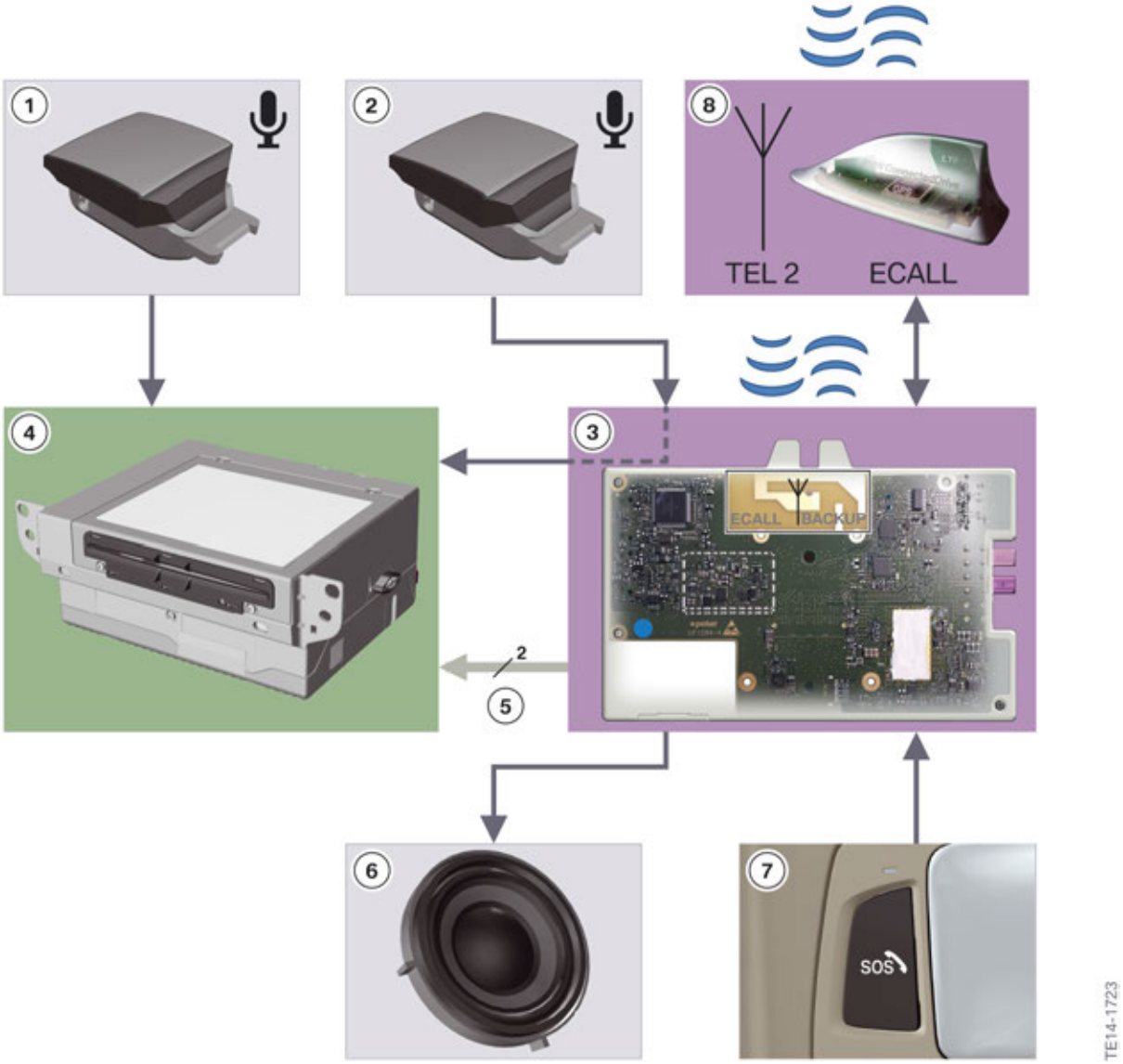
The G12 is equipped as standard with a manual emergency call in combination with an emergency call button and an emergency call antenna. Regular communication in the event of an emergency takes place via the SIM card in the TCB2 in combination with the telematic antenna.

5.2.2. Intelligent emergency call

The **Intelligent emergency call** (SA 6AC) is standard in the US market. Its offers and extension of the standard emergency call equipment. The telematics service "Intelligent emergency call" sets up a connection to emergency and rescue services via a **BMW Call Center** if necessary in the case of manual and automatic emergency calls. In addition to the current position of the vehicle, additional data is transmitted about the accident severity, for example.

G12 Telephone and Telematics Systems

5. Telematics Services in the Vehicle



Emergency call system in the G12

Index	Explanation
1	Microphone, passenger's side (Not for US)
2	Microphone, driver's side
3	TCB2 including integrated emergency call antenna
4	Head Unit High 2
5	OABR Ethernet
6	Emergency loudspeaker
7	Emergency call button
8	Telematic antenna (LTE2) in the roof fin

G12 Telephone and Telematics Systems

5. Telematics Services in the Vehicle

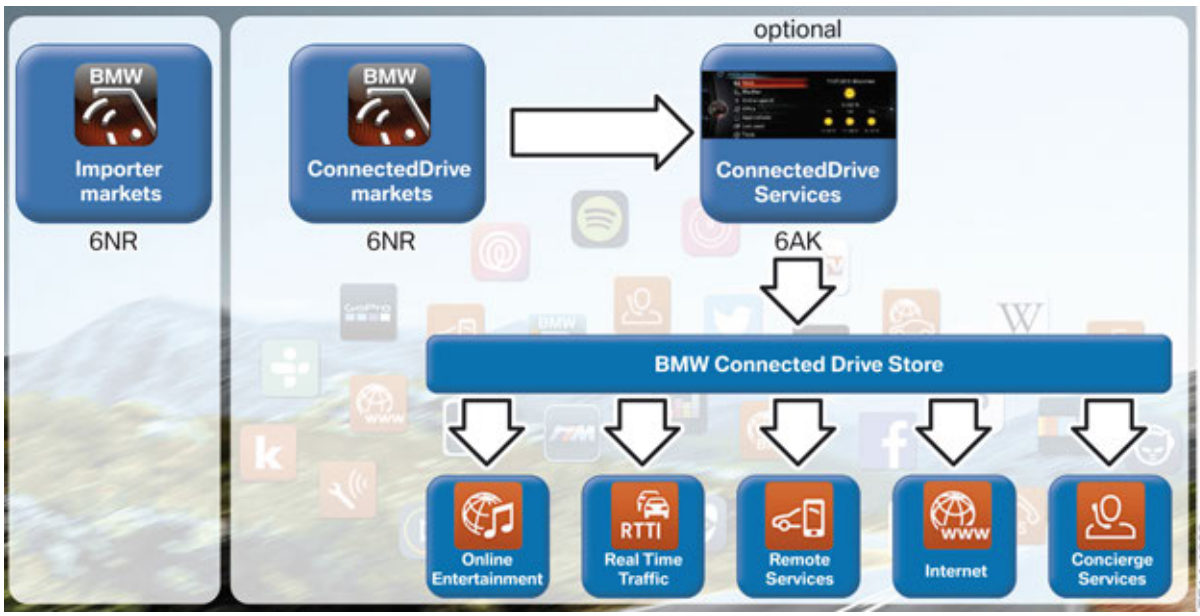
5.3. ConnectedDrive

5.3.1. Precondition

The basic prerequisite for the functionality of the ConnectedDrive services is already present as hardware in every G12. The **permanently installed SIM card an telematic control unit** (Telematic Communication Box 2) with roof fin are included in the basic equipment. The roof fin contains the telematic antenna for the telematic system.

5.3.2. ConnectedDrive Services

The complete hardware required to receive the ConnectedDrive services is therefore available. The ConnectedDrive services can be booked in the vehicle via the ConnectedDrive Store:



The **basic services** include:

1. ConnectedDrive Services (SA 6AK)

with the following content:

Vehicle Apps or BMW Online services

- BMW Online news
- BMW Online country information
- BMW Online gasoline price search
- BMW Online Office Mail

- BMW Online weather
- BMW Online search
- BMW ConnectedDrive Store

Remote services and Apps (BMW Connected & third-party providers)

2. Intelligent emergency call (SA 6AC)

You can find details on the intelligent emergency call function in Chapter 5.2 of this information bulletin!

TeleServices (SA 6AE) is standard equipment for the US market.

The following **ConncetedDrive services** are standard for the US market but can also be booked via the Connected Drive Store in the vehicle:

Equipment	Optional equipment	Function	Required basic equipment
Real Time Traffic Information	6AM	Traffic information via P-SIM*	Option 6AK
Concierge Service	6AN	Information service via P-SIM*	Option 6AK
Remote Services	6AP	Remote control functions via PC or smartphone	Option 6AK
Internet	6AR	Internet access via a secure BMW server (backend)	SA 6AK; SA 601/609
Apps	(6NR) already included with 6AK.	Applications on the smartphone that permit additional functions in the vehicle (web radio, navigation, music streaming services, etc.) in combination with the head unit.	Option 6AK
			*P-SIM=Prefit SIM=the SIM card permanently installed in the vehicle

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6. Connectivity

6.1. Player functions

6.1.1. History of player functions

Since an interface (AUX-In) for music for **external audio components (external devices)** was offered for the first time as standard at BMW in the 3 Series BMW (E90), the number of these interfaces has increased significantly over the course of the years. A quantum leap took place in 2007 when the introduction of the ULF-SBX-High meant that it was possible for the first time to feed external audio into the vehicle via a USB interface and to connect an iPod as a music player.

The first Bluetooth audio streaming and the first application function on a smartphone (Apps) were also realized via a telephone control unit, the Combox multimedia.

Alongside the familiar cable-connected solutions (wired, one-wire, two-wire, etc.), an increasing number of wireless solutions are being used in vehicles. A list of **all external interfaces** that have been implemented in BMW vehicles so far is provided below.

Feature	Interface (head unit)	Use/ vehicle	Optional equipment code
AUX-IN port for MP3 player	Radio or head unit	09/2005 (E90)	Depending on the radio or head unit (e.g. Radio Professional SA 663)
USB (audio only)	USB audio interface; ULF-SBX High via MOST to the head unit	11/2006 (E70)	Option 6FL
Music collection (music server on the HDD in the head unit)	Installed hard disk drive (HDD) in the CIC with USB port for data backup	011/2008 (E82, E90)	SA 609 (Navigation with CIC)
Smartphone connection (extended connection of a music player in the cell phone)	Base plate with built-in USB interface (gold contacts) connected with ULF-SBX-High via a USB hub	11/2008 (F01)	Option 6NF
Bluetooth audio streaming	Wireless via Bluetooth connection to COMBOX. The information is forwarded to the head unit via MOST.	09/2010 (F01)	Option 639
APPS (iPhone®)	Applications on the iPhone, which interact with the head unit via the USB audio interface and via the COMBOX	03/2011 (E8x, E9x)	Option 6NR

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Feature	Interface (head unit)	Use/ vehicle	Optional equipment code
iPhone®Video + Plugin	USB audio interface with additional video line (CVBS) in the base plate; plugin was Apple® Look&Feel in a BMW	03/2011–03/2013 (E8x, E9x)	SA 633; SA 6NF
USB (video stream of video files to the head unit)	USB audio interface to the head unit	07/2012 (F01 LCI)	SA 609; SA 6NF
Packages 6NH, 6NK, 6NL	Integration of Bluetooth audio streaming, USB audio interface and smartphone connection of the base plate into the various Connectivity optional equipment.	03/2013 (F10 LCI)	SA 6NH (with SA 6FL), SA 6NK (with SA 6FL and SA 6NF), SA 6NL (with SA 6FL and SA 6NF); SA 644 and SA 633 were replaced
APPS (Android)	Applications on the Android smartphone are transmitted to the head unit and interact with this via the USB audio interface. 2 modes (USB and Accessories Mode)	09/2013 (F10 LCI)	Option 6NR

Whereas functions were previously explained with the individual technical devices, a new approach is now necessary with the G12.

Due to the fact that the above list of functions has again been significantly extended for the G12, the **individual functions** would not receive adequate coverage if an explanation were to be provided in the same way as before (functions assigned to and subordinate to technical devices). The clarity of the explanation would be completely lost.

For this reason, we will go back to the customer and his needs. We will now consider the desired media from the point of view of the customer and will show the various options available to the customer so that he can achieve his goal directly. (For example, the customer would like to play back music via a smartphone in the snap-in adapter).

In addition, it must be noted that the interface functionality of the Combox was already ended in 2012 with integration in the Head Unit High.

Since the player functions, irrespective of whether external or internal, now take place in or with the head unit, you will find **a list of all options** available to the customer to play **audio, pictures video or apps** in the information bulletin “G12 Audio system".

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6.2. Wi-Fi Hotspot

6.2.1. Wi-Fi hotspot in the vehicle

The G12 is equipped with **numerous Wi-Fi links**. All vehicle-related services and functions are controlled via the **Vehicle Wi-Fi** (Wi-Fi®Direct).

Wi-Fi®Direct symbol

The **Wi-Fi Hotspot (SA 6WD) is standard equipment in the US market.** This feature provides the customer easy access to the internet. The term "Wi-Fi" is commonly used instead of WLAN. That is why the term Wi-Fi with the corresponding logo is often used in combination with the WLAN hotspot.

Wi-Fi symbol for a certified Wi-Fi hotspot

The hotspot is a multi-point connection similar to a home network. The hotspot performs the task of a "hub", as familiar from network technology. The customer can connect up to 10 devices to the hotspot (hub) and surf on the internet with a maximum download speed of 100 Mbit/s. A "Client to Client" connection is **not** possible. In other words, the devices cannot communicate with each other.
In network terms, this means that the "hub" does not have a "bridge" function.

The hardware in the vehicle for the hotspot is coupled to the optional equipment **wireless charging (SA 6NW)** which includes convenient telephone (SA 6NS).

The hotspot function can be used by the customer in combination with an existing or additional cell data plan. The customer must **independently** extend the data plan with the provider in the Europe and US versions. The procedure is similar to that for booking hotspot access in a hotel or a public hotspot in a café. After the data connection is set up between the end device (smartphone, tablet PC, etc.) and the hotspot, a provider page will be displayed where the customer can independently extend the data contract.

If the booking is successful, a connection will be set up to the free, unfiltered internet via the MIMO-LTE data connection in the **TCB2**. TEL1 and TEL2 in the roof antenna/roof fin are defined as telematic antennas for reception, as described in Chapter 5.

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6. Connectivity

Data graphic of hotspot in the G12

The **hotspot** allows the customer easy access to the internet for his smart devices (smartphones, tablets, PC, etc.) and also permits internet access with the Touch Command tablet available for the Rear Seat Entertainment.

For the first time at BMW, the GSM emergency antenna (BACKUP or ECALL antenna) integrated in the TCB2 is used as the hotspot antenna for the hotspot in the entire vehicle interior.

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Wi-Fi hotspot in the G12

The driver's position was intentionally not shown here as a Wi-Fi reception position. **When the vehicle is stationary**, the driver can of course also access the hotspot via a mobile end device (cell phone, tablet).

Alternative internet access options in the G12

There are therefore 2 options available in the G12 vehicles to access the internet.

The first possibility is the **Wi-Fi hotspot via the a connected cell phone** in combination with a customer SIM card with active data plan. Further details were previously described above.

The 2nd possibility for internet access is via the iDrive in the vehicle and coupled to the ConnectedDrive **"Internet" (SA6AR) which is offered free for one month trial period in the US market G12**. After the introductory phase (one month free trial), the customer can order the "Internet" (SA6AR) service via the ConnectedDrive store (for example). With this function a connection to the "filtered internet" is set up via a BMW server (backend) for the system operated via the iDrive system. The central information display or rear compartment display is used as a display here. The data is transmitted into the vehicle via this server in combination with TCB2 and the permanently installed SIM card.

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6.3. Wi-Fi-®Direct

6.3.1. What is Wi-Fi®Direct?

A new Wi-Fi standard is integrated in the vehicle for control and monitoring functions mainly by the rear seat entertainment “Command Tablet” and it is also used for the Screencast feature (see below for more information). This **“Vehicle Wi-Fi”** is a certified standard of the Wi-Fi®Alliance which is called **Wi-Fi®Direct**. Please visit the link below for further information.

http://www.wi-fi.org

Wi-Fi®Direct is a standard for wireless data transmission between two WLAN end devices **without** central Access Point. It is based on the international standard IEEE 802.11 (ISO/IEC 8802-11), which describes the properties of a wireless network.

In the G12, this data transmission always takes place by means of Wi-Fi®Direct between the head unit (with connected WLAN antenna) and the following end devices:

- Between the head unit and smartphone for the “Screencast” function (see next chapter in this training manual)
- Between head unit and Touch Command for the control and monitoring functions via tablet PC (see the “G12 Rear seat entertainment" training manual for more information.

Wi-Fi®Direct (Vehicle Wi-Fi) streaming sources in the G12

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6.4. Pairing

6.4.1. Pairing

Whereas it was previously possible in BMW vehicles to set up only Bluetooth connections for a hands-free system, Office functions or Bluetooth audio streaming, this is now extended to include 2 additional services. These are Wi-Fi®Direct in the vehicle **"Vehicle Wi-Fi"** and the Wi-Fi hotspot in the vehicle **"Internet hotspot"**.

Two examples are provided below of how the customer can activate the functions Wi-Fi®Direct (Vehicle Wi-Fi) and the Wi-Fi hotspot (Internet hotspot) and then connect a device with them.

Setting and setup of Wi-Fi®Direct (Wi-Fi services in the vehicle).

Index	Explanation
1	"Settings" submenu
Wi-Fi®Direct (Vehicle Wi-Fi)	
2a	Vehicle Wi-Fi active/inactive
2b	Screencast selection
2c	Selection of streaming device for Screencast
2d	Illustration of the Screencast function
Wi-Fi hotspot (Internet hotspot)	
3a	Internet Wi-Fi active/inactive
3b	Selection of Internet hotspot
3c	Illustration of the set Wi-Fi hotspot "Hotspot name" and "Hotspot key"
3d	Selection of the Wi-Fi hotspot in the vehicle on a smartphone

6.5. Screencast

6.5.1. Screencast (mirroring function)

Screencast is an open standard for connecting two computers with each other by means of a wireless connection. In the case of the G12, this function shares or “mirrors” the screen content of a smartphone or tablet with the head unit. The content is displayed in the vehicle on the central information display. Wi-Fi®Direct is used as the data transmission standard in the G12 Wi-Fi®Direct.

If a rear seat entertainment system is installed, the content can also be projected onto the two rear compartment displays via the head unit and RSE control unit if the customer wishes.

Speedlock

Image files, music files and films can be played back as content with the Screencast function. However, the content on the CID is suppressed at a vehicle speed of more than **7 km/h** (5 mph). The content remains visible on the rear compartment displays at speeds above 7 km/h (5mph).

Since the head unit **cannot** detect what screen content is streamed to the vehicle via Screencast, the above-described speedlock is always activated at a speed of 7 km/h. This applies irrespective of whether a film with moving pictures, a music track or photos or screen content are displayed. Music and audio playback are not affected by the Screencast speedlock.

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Screencast in the G12

6.6. Wireless charging

6.6.1. Definition of wireless charging

Telephone with wireless charging (SA 6NW) is an innovation for BMW vehicles. In the new BMW 7 Series, charging of telephones takes place wirelessly for the first time using **wireless charging technology**. There is the so-called "Qi®" symbol for wireless charging products. The Chinese word for life energy is a copyrighted standard of the Wireless Power Consortium.

http://www.wirelesspowerconsortium.com/

This standard is intended to ensure that individual chargers are compatible for all devices.

Qi® symbol

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6.6.2. Wireless charging in the G12

Wireless charging (WCA) in the G12 is visible for the customer in the form of a special wireless charging tray. The **Telephone with wireless charging** (SA 6NW) is standard equipment for the US market. Instead of a base plate, the vehicle is then equipped with a wireless charging tray.

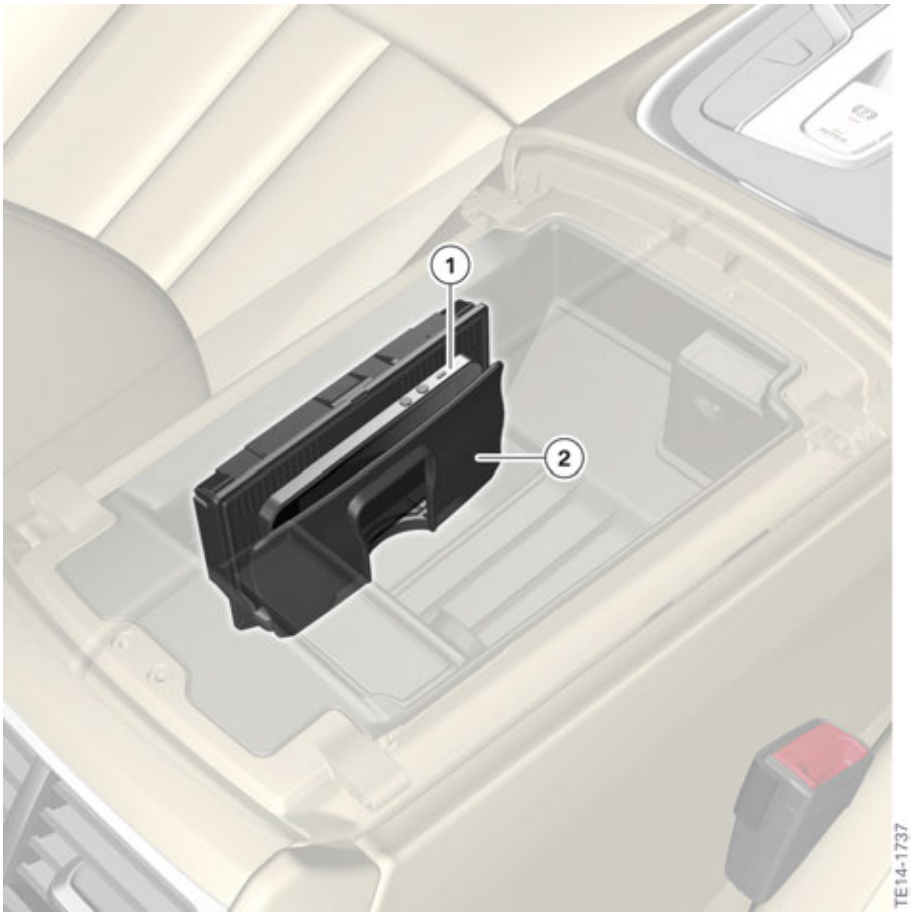
In the case of telephone with wireless charging, both Qi®-capable cell phones or optionally the BMW Display key (SA 3DS) are charged in the G12.

A large number of cell phones are already equipped with the WCA function (Qi® ready) and can be charged in the wireless charging tray. In addition, the function can be retrofitted to the cell phone by fitting a WCA-capable rear cover or adding a WCA-capable case.

Never place a cell phone and the BMW Display key in the wireless charging tray together.

Only one of the two devices would be charged.

Bluetooth audio streaming, Bluetooth Apps streaming, Screencast (Desktop Sharing) and associate image or video streaming via Android smart devices can be used in the vehicle during charging of the cell phone in the wireless charging tray. Details of the individual streaming services can be found in the “G12 Audio systems” training manual.



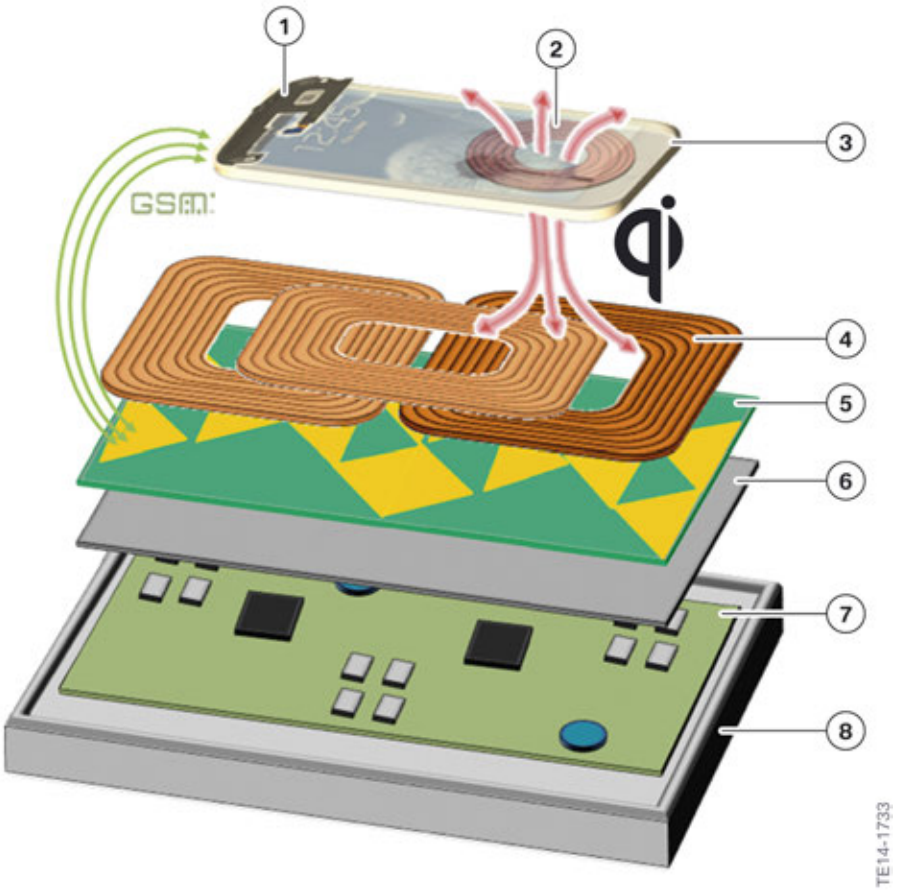
Wireless charging tray in the G12

Index	Explanation
1	Cell phone with a corresponding inductive case (Qi®-certified)
2	Wireless charging tray in the G12

Wireless charging tray with inserted BMW Display key

6.6.3. Basic principle

The principle of the wireless charging technology is based on induction. A transmitter coil and a receiver coil wirelessly transmit the charging voltage for the cell phone.



Basic principle of wireless charging

Index	Explanation
1	Smartphone with coupling antenna for cell reception
2	Induction coil in the outer cover of the smartphone
3	Outer cover of the smartphone with receiver coil
4	Transmitter coil in the wireless charging tray
5	Telephone antenna in the wireless charging tray (inductive)
6	Ferrite in the wireless charging tray
7	Electronics with connections for the vehicle electrical system of the wireless charging tray
8	Outer cover of the wireless charging tray

6.6.4. Connection to the vehicle electrical system

The wireless charging tray is connected to the vehicle electrical system by voltage supply via the rear power distribution box. The antenna input of the wireless charging tray is also connected with the TCB2 and thus with the TEL1 telephone antenna in the fin via a line compensator. The system also has an activation line from the WCA tray to the line compensator.

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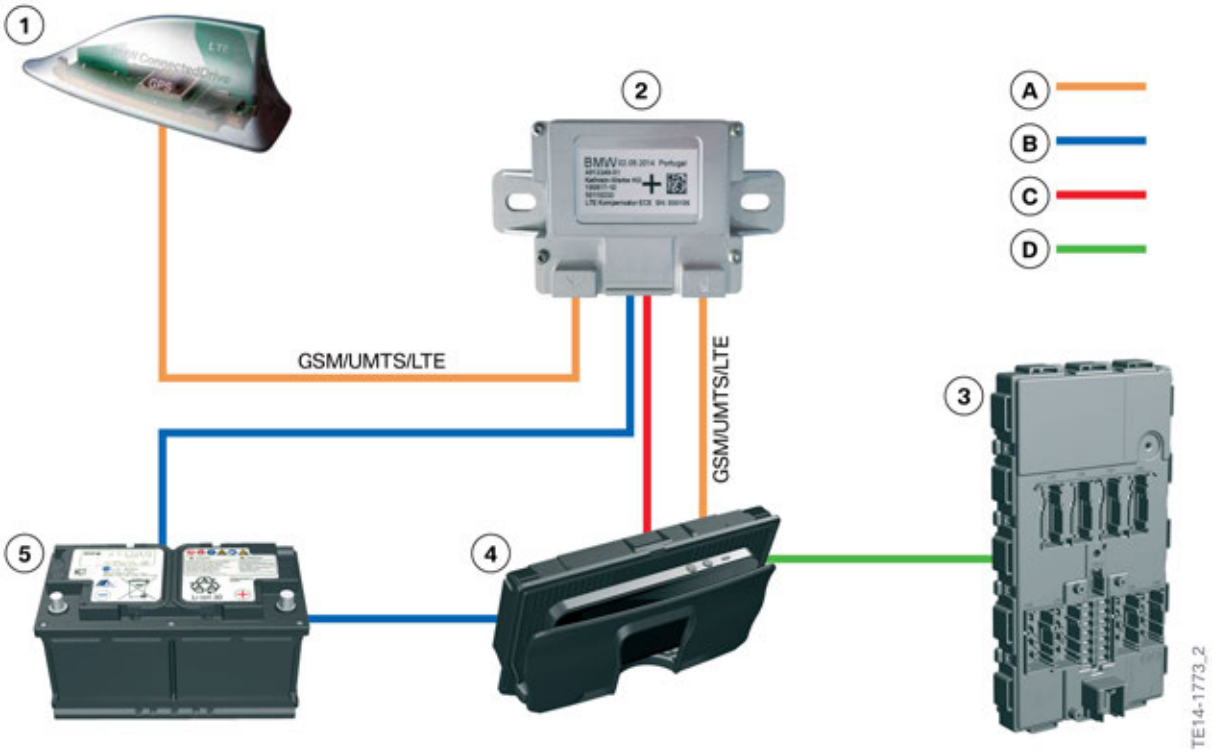

Wireless charging in the G12 vehicle electrical system

Index	Explanation
Conductors	
A	Antenna lines
B	Voltage supply
C	Activation line
D	K-CAN5 connection
Components	
1	TCB2/fin with telephone antenna TEL1
2	Line compensator
3	Body Domain Controller (BDC)
4	Wireless charging tray
5	Vehicle electrical system voltage supply

6.6.5. Wireless charging hardware

The wireless charging tray has a connection for voltage supply and K-CAN5 connection. An antenna line is also fitted which is connected with a line compensator. An activation line is additionally provided for this line compensator.

Wireless charging tray connections

Index	Explanation
1	Voltage supply, connection to the K-CAN5, activation line for line compensator
2	Antenna connection to TEL1 telephone antenna in the roof fin (via the line compensator)

6.6.6. Line compensator

In order to compensate for the losses of wireless charging, the G12 is equipped with an LTE-capable line compensator (SIMO). With this line compensator, the reception quality of the wireless charging transmit/receive system again reaches the level of a base plate.

The line compensator is installed in the rear area of the G12 and is connected with the wireless charging antenna and TEL1 in the roof fin. In addition, the line compensator is connected to the voltage supply via the BDC and an activation line of the WCA tray.

Line compensator in the G12

Index	Explanation
1	Connection to the telephone antenna TEL1 in the TCB2 or roof fin
2	Voltage supply, activation line for line compensator
3	Antenna connection of the wireless charging tray

6.6.7. Built-in and external WCA charging coils

Built-in WCA charging coils

A lot has happened on the smartphone market since the Palm®Pre smartphone was launched as the first smartphone with wireless charging in 2009.

The Palm®Pre uses a proprietary charging protocol (proprietary = manufacturer-specific, unpublished standard) which does not correspond to the protocol used in the G12 Qi® standard. This also means that the Palm®Pre is not supported by the WCA in the G12!

In addition to Google®Nexus 4 & 5, the Microsoft® (formerly Nokia®) devices Lumia 920 and 1520, the Samsung®Galaxy S6 has also been available with this technology since Spring 2015. All of these devices have the advantage that they support the Qi® standard and can therefore be used immediately in vehicles that are equipped with WCA technology.

External WCA charging coils

Back covers with WCA technology in accordance with the Qi® standard are now available on the free market for many cell phones. The receiver coil is then integrated in the plastic cover.

S4 device from Samsung® with WCA-capable back cover

A protective cover with integrated WCA technology is currently being developed for the iPhone® from Apple® by BMW Parts and Accessories. Further details about this will be available in 2016.

6.6.8. Compatible devices

There is again a reference guide for customers so that they can find out whether their smartphone is compatible with the G11/G12.

The BMW My-CE page at:

http://www.bmwusa.com/Standard/Content/Owner/BluetoothTechnology/bluetoothframedin.aspx

www.bmw.com/bluetooth

The web site provides information about **Wireless Charging (WCA)** in addition to the already familiar compatibility information. New here is the information about compatibility for Wi-Fi Hotspot, Near Field Communication NFC and Screencast.

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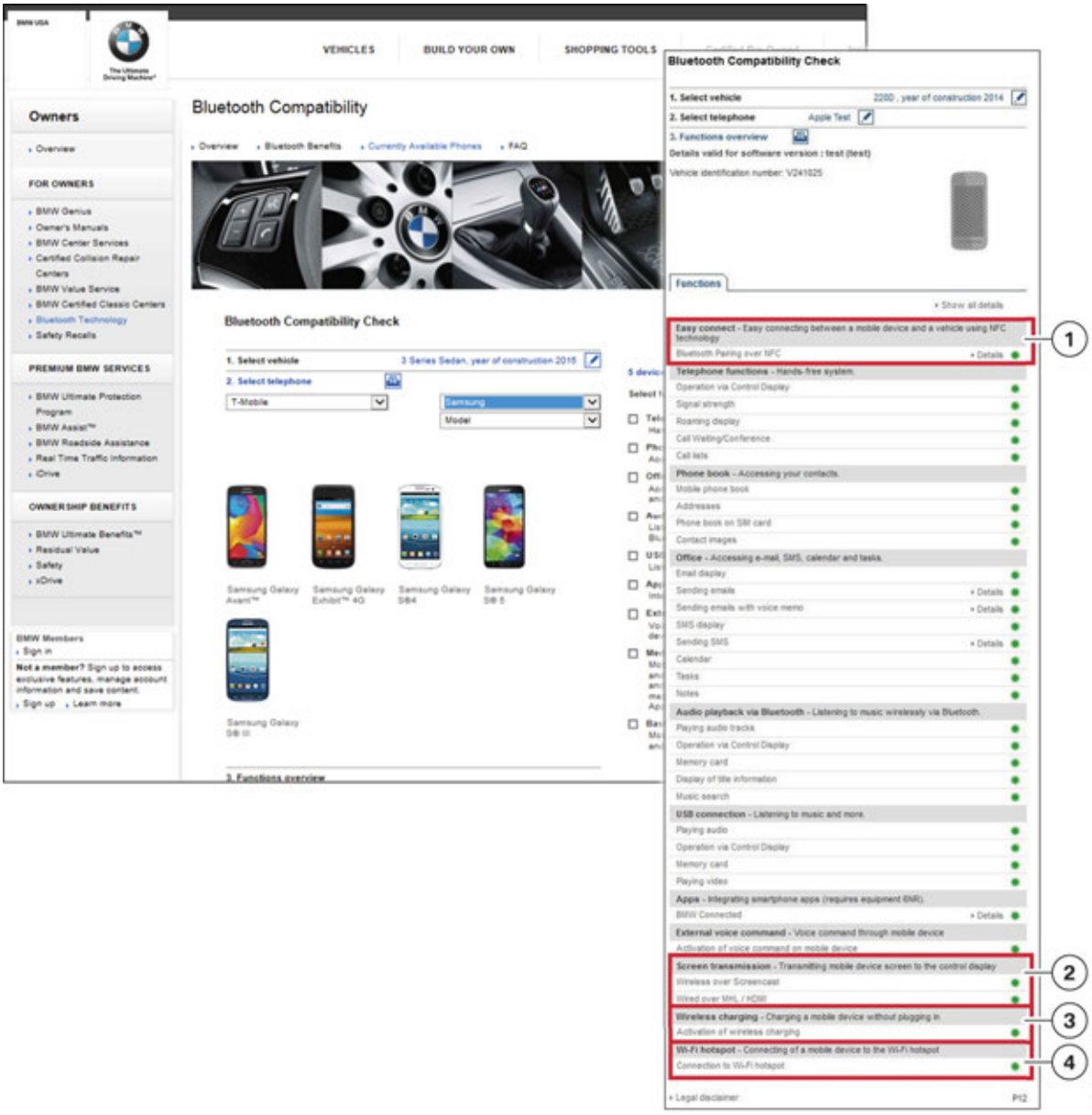

MY-CE information page for the customer

Index	Explanation
1	Near Field Communication (NFC)
2	Screencast
3	Wireless charging
4	WLAN hotspot

6.6.9. Status LED and possible incorrect operation

An LED is provided on the wireless charging tray in order to inform the customer about the respective status of the charging connection.

The LED starts to light up blue as soon as a metal object is inserted in the wireless charging tray. During this time, the electronics in the wireless charging tray checks whether the metal object is WCA- or Qi®-compatible and can be charged. If this is the case, i.e. if "brokering" was successful, the LED remains illuminated "blue" after 10 s. If this should not be the case, the LED will go off again after 10 s.

If there is a compatible device and another object in the wireless charging tray (e.g. a coin), both objects will be detected by the system and the charging procedure will **not** be started.

Charge status LED of the wireless charging tray

Index	Explanation
1	A compatible cell phone in the tray. The LED lights up blue for 10 s and remains blue.
2	A compatible cell phone and a **foreign body** in the tray. The LED lights up blue for 10 s and then changes its color.
3	A compatible cell phone and a **foreign body** in the tray. The LED lights up orange after 10 s.

To conclude the WCA topic, a short matrix is provided below which lists the different flashing codes.

Color	LED status	Description
Black	OFF	WCA off (terminal 30B off)
Black	OFF	WCA operational
Black	OFF	Cell phone detected, but not charging function. Cell phone is already fully charged or switched off.
Blue	Continuous illumination for 10 s	Metal object detected
Blue	Continuous illumination	Cell phone was detected and is being charged.
Blue	Continuous illumination	BMW Display key detected and is being charged. The LED status "blue" is also maintained during the short interruption when the Display key sends its identification to the BDC!
Blue	Continuous illumination	In exceptional cases a Qi®-capable cell phone and a small foreign body may be detected and the phone will still be charged. The threshold value has not been exceeded in this case.
Orange	Continuous illumination	Cell phone detected but no charging function due to overheating (temperature above 60° C (140° F)
Orange	Continuous illumination	Foreign body and cell phone detected, no charging function.
Red	Continuous illumination	Internal fault. Visit BMW Service.

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6.6.10. Forgotten cell phone alert

Another great feature of the G12 is that now, for the first time, a Check Control message can be output if a device is left behind in the vehicle. If a device is detected in the wireless charging tray the customer will be alerted before exiting the vehicle.

The Check Control message is then displayed both on the instrument cluster and on the CID.

The feature must be activated in the vehicle for it to work. The customer can activate/deactivate this function in the main menu "My Vehicle" – submenu "System settings" – "Wireless charging tray".

The warning is issued if the following warning triggers occur in the correct order:

1 Engine is started

2 Cell phone (object detected) in the wireless charging tray

3 Engine is stopped

4 Driver's door is opened (cell phone still in the wireless charging tray)

5 Check Control message is triggered

Forgotten cell phone alert

Index	Explanation
1	Forgotten cell phone alert

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6.7. Near Field Communication NFC

6.7.1. Introduction

What is it?

Near Field Communication or NFC allows data to be transmitted by means of wireless technology over short distances of up 4 cm. It was developed by Philips® and Sony® in 2002. It is based on RFID (Radio-Frequency Identification) technology with 13.56 MHz.

6.7.2. NFC transmitter

NFC transmitter

NFC offers various possibilities for communicating wirelessly and without pressing a button or key combination. NFC is used with smart cards in car parks, for example. There are also possibilities for using NFC in USB sticks, keys, smartphones, tablets and all conceivable kinds of electronic devices.

6.7.3. Use at BMW

Instead of initiating data setup for a connection via the iDrive system or the controller, it is now possible with the G12 to pair **a smartphone** with the vehicle much faster via NFC.

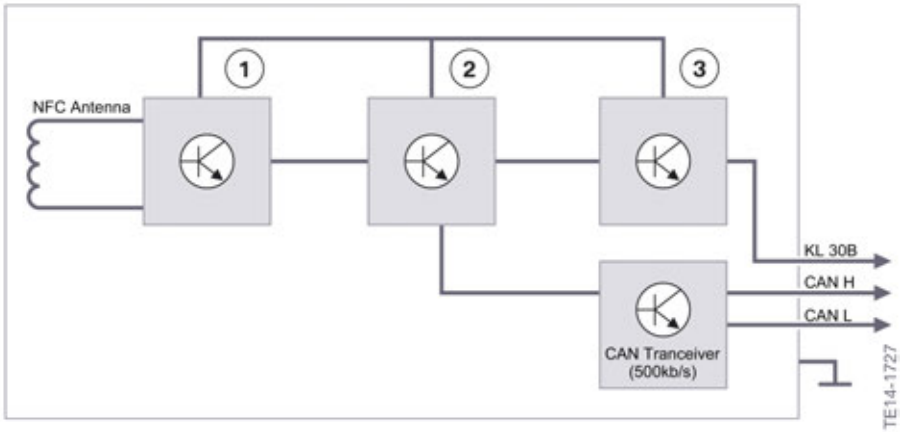
Transmitter versions for Near Field Communication

Index	Explanation
1	NFC chip in a Smart Card
2	NFC via a USB token
3	Version used in BMW G12 via an NFC-capable smartphone
4	NFC via an ID transmitter (ignition key)

Why was a smartphone chosen as an NFC transmitter? For the customer, this is the most customer-friendly application in the vehicle. In 2010, there were around 60 million smartphones that were equipped with NFC technology. In 2015, the figure will be around **550 million smartphones.** In addition to renowned manufacturers such as HTC®, Microsoft® (formerly Nokia®) and Samsung®, the iPhone®6 from Apple® is also equipped with NFC technology.

6.7.4. NFC basic principle

The following illustration shows the design of a simple receiver system for NFC technology.



Schematic illustration of NFC receiver

Index	Explanation
1	NFC receiver unit and antenna electronics
2	NFC control unit processing unit
3	NFC control unit

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6.7.5. NFC receiver

NFC receiver in G12

The NFC antenna (receiver unit) and the NFC control unit were separated in the G12 for package reasons. The installation location of the NFC antenna is indicated to the customer by means of a symbol on the air vent below the central information display. The reception antenna receives a signal from the transmitter antenna of the smartphone when the smartphone is at a distance of 1-2 cm from the NFC symbol.

Symbol for NFC under the air vent in G12

Index	Explanation
1	NFC symbol
2	Customer smartphone

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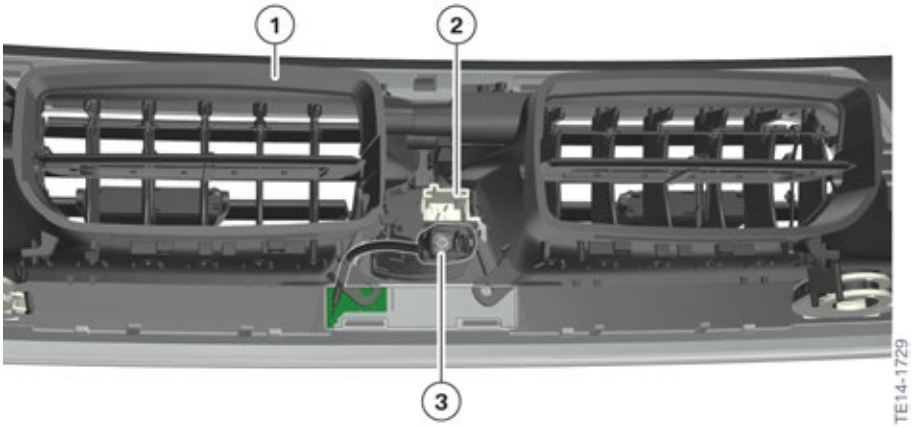
6.7.6. Installation locations of NFC components

Rear view of air vent

The NFC receiver unit and the NFC antenna connection components are visible when the front center air vent in the G12 is removed.



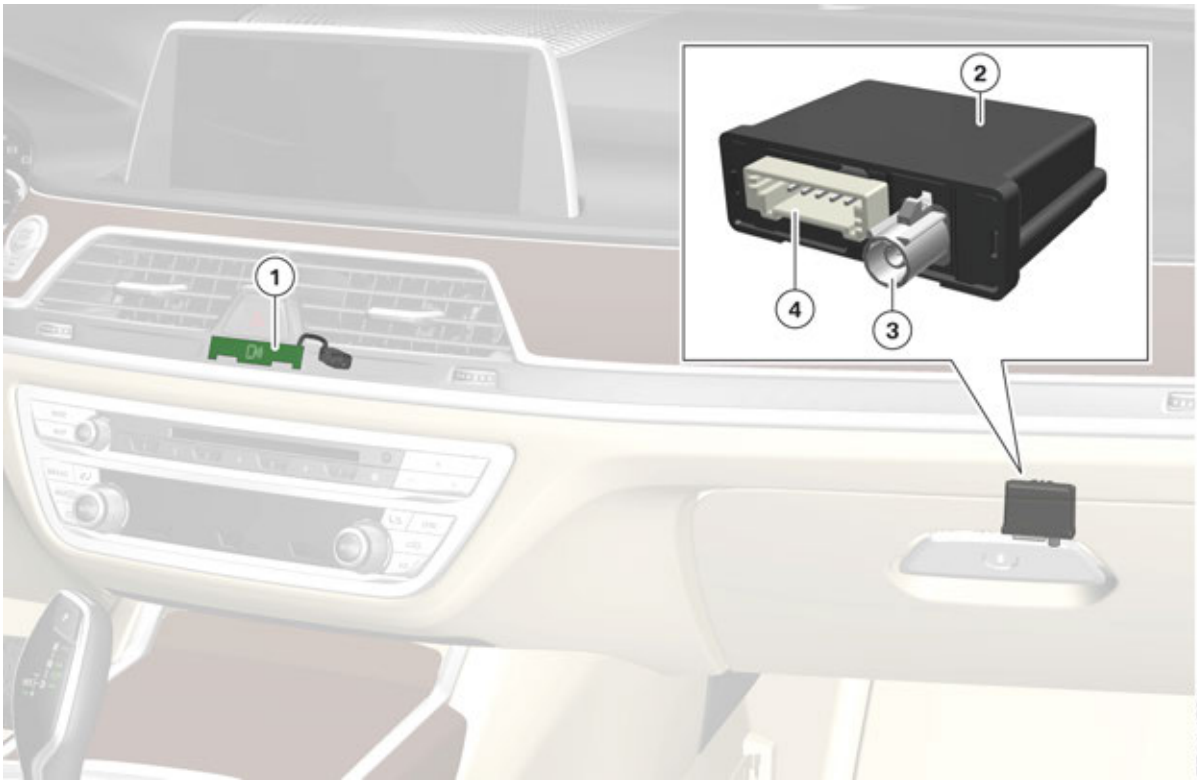
Rear view of air vent in G12

Index	Explanation
1	Rear view of front center air vent
2	Connection for Intelligent Safety button and hazard warning switch
3	NFC antenna port with connected NFC receiver unit

The NFC control unit is connected to the vehicle electrical system of the G12 via the K-CAN5.

NFC control unit

The NFC control unit is located on the rear wall of the glove box in the G12.



Installation positions of NFC antenna and NFC control unit

Index	Explanation
1	NFC receiver unit and antenna electronics
2	NFC control unit
3	Connection for NFC antenna
4	Voltage supply for NFC control unit, bus connection K-CAN5

6.7.7. NFC functions in the vehicle

NFC functions in the vehicle

At the series launch of the new BMW 7 Series G12, **Bluetooth pairing** for smartphones is possible via NFC.

Pairing via NFC is possible only if the NFC function has been activated on the smartphone before the pairing attempt.

As the next step, it is planned to perform pairing of cell devices with the Wi-Fi hotspot of the vehicle for the start of 2016.

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6.8. Overview of connectivity

To conclude the topic of connectivity, a table is provided below for the areas of telephone/ entertainment/connectivity showing which functions are offered by the respective options. **Although only the Wireless Charging (SA 6NW) option applies to the US market G12,** it is a useful tool to understand future telephone systems and their functions:

Function	Protocol/signal	Hands-free Bluetooth (SA 6NH)	Convenient telephone (SA 6NS)	Wireless Charging (SA 6NW)
Telephone				Standard in the US market G12
Bluetooth enabling	Hands Free Protocol (HFP)	X	X	X
Extended hands-free quality (second microphone for front passenger)	Hands Free Protocol (HFP)		X	X
Conferences	Hands Free Protocol (HFP)	X	X	X
Support for 2 telephones (3rd telephone only for Bluetooth audio)	Hands Free Protocol (HFP)		X	X
Call lists (last number redial, received, missed)	Hands Free Protocol (HFP)	X	X	X
Voice control with iPhone (SIRI)	iPod® Accessory Protocol (IAP)	X	X	X
Function	**Protocol/signal**	**Hands-free Bluetooth (SA 6NH)**	**Convenient telephone (SA 6NS)**	**Wireless Charging (SA 6NW)**
contacts				Standard in the US market G12
Access to vehicle and telephone contacts	Phone Book Access Profile (PBAP)	X	X	X

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Function	Protocol/signal	Hands-free Bluetooth (SA 6NH)	Convenient telephone (SA 6NS)	Wireless Charging (SA 6NW)
Saving contacts in the vehicle and as selection options for navigation (only in combination with navigation system Professional SA 609)	Phone Book Access Profile (PBAP)	X	X	X
Office				Standard in the US market G12
SMS text message/ e-mail / calendar / (voice) notes / tasks / contact pictures (support dependent on CE device)	Message Access Profile (MAP)		X	X
Function	**Protocol/signal**	**Hands-free Bluetooth (SA 6NH)**	**Convenient telephone (SA 6NS)**	**Wireless Charging (SA 6NW)**
Entertainment				Standard in the US market G12
AUX-IN port for external music player	Analogue audio signal	* (only with Rear Seat Entertainment SA 6FR)	* (only with Rear Seat Entertainment SA 6FR)	* (only with Rear Seat Entertainment SA 6FR)
1. USB port for USB sticks, external media players, iPod®, iPhone®	Message Access Profile (MAP); iPod Accessories Protocol (iAP)	X	X	X
2. USB port for USB sticks, external media players, iPod®, iPhone®	Message Access Profile (MAP); iPod Accessories Protocol (iAP)		X	X
Playback of compressed videos (only in combination with SA 609)	Various video decoders in the Head Unit High		X	X

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Function	Protocol/signal	Hands-free Bluetooth (SA 6NH)	Convenient telephone (SA 6NS)	Wireless Charging (SA 6NW)
Display of Album Cover Art with iPhone and HU-H (SA 609)	iPod® Accessory Protocol (IAP)	X	X	X
Bluetooth audio streaming	Audio/Video Remote Control Protocol (AVRCP) 1.3	X	X	X
Charging-Only mode (Information in the last row of the table)*		X	X	X
Audio/Picture/ Video streaming for Android® smartphones	Wi-Fi®Direct	X	X	X
Function	**Protocol/signal**	**Hands-free Bluetooth (SA 6NH)**	**Convenient telephone (SA 6NS)**	**Wireless Charging (SA 6NW)**
Charging function				Standard in the US market G12
1. USB port (1.5 A via the head unit); connected via USB hub (for SA 6NS or SA 6NW) also 2.1 A		X	X	X
2. Additional USB port with 2.1 A charge current			X	X
Wireless charging tray				X
Base plate for snap-in adapter (including external antenna connection and USB smartphone connection in the baseplate)			X	
Wi-Fi Hotspot				Standard in the US market G12

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Function	Protocol/signal	Hands-free Bluetooth (SA 6NH)	Convenient telephone (SA 6NS)	Wireless Charging (SA 6NW)
Wi-Fi hotspot (with prefit BMW SIM card and Connected Drive Store)			X	X
APPS				Standard in the US market G12
Apps (SA 6NR as part of SA 6AK). The application runs on the smartphone (iPhone® or Android®) supported with vehicle data and display on the vehicle CID). Cable-connected via USB port.			X	X
Apps (SA 6NR as part of SA 6AK). The application runs on the smartphone (iPhone® or Android®) supported with vehicle data and display on the CID of the vehicle). Wireless via Bluetooth.			X	X

G12 Telephone and Telematics Systems

6. Connectivity

Function	Protocol/signal	Hands-free Bluetooth (SA 6NH)	Convenient telephone (SA 6NS)	Wireless Charging (SA 6NW)
Seamless transition from Bluetooth (Wireless) to USB (cable-connected) and vice versa			X	X
Charging-Only mode (Information in the last row of the table)*			X	X

* Charging-Only mode:
If the external device is actively connected via Bluetooth Apps, there is **no longer** a seamless transition from **Bluetooth Audio or Apps (wireless)** to USB audio (cable-connected). This was the case with HU-H. The stream was stopped and switch over to cable took place.
In the G12, if Apps or audio playback is wished via cable or the USB port when a wireless source is already active, the Bluetooth function must first be **deactivated**. Otherwise the stream will continue wirelessly after connection for the charging function in spite of the cable connection.

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