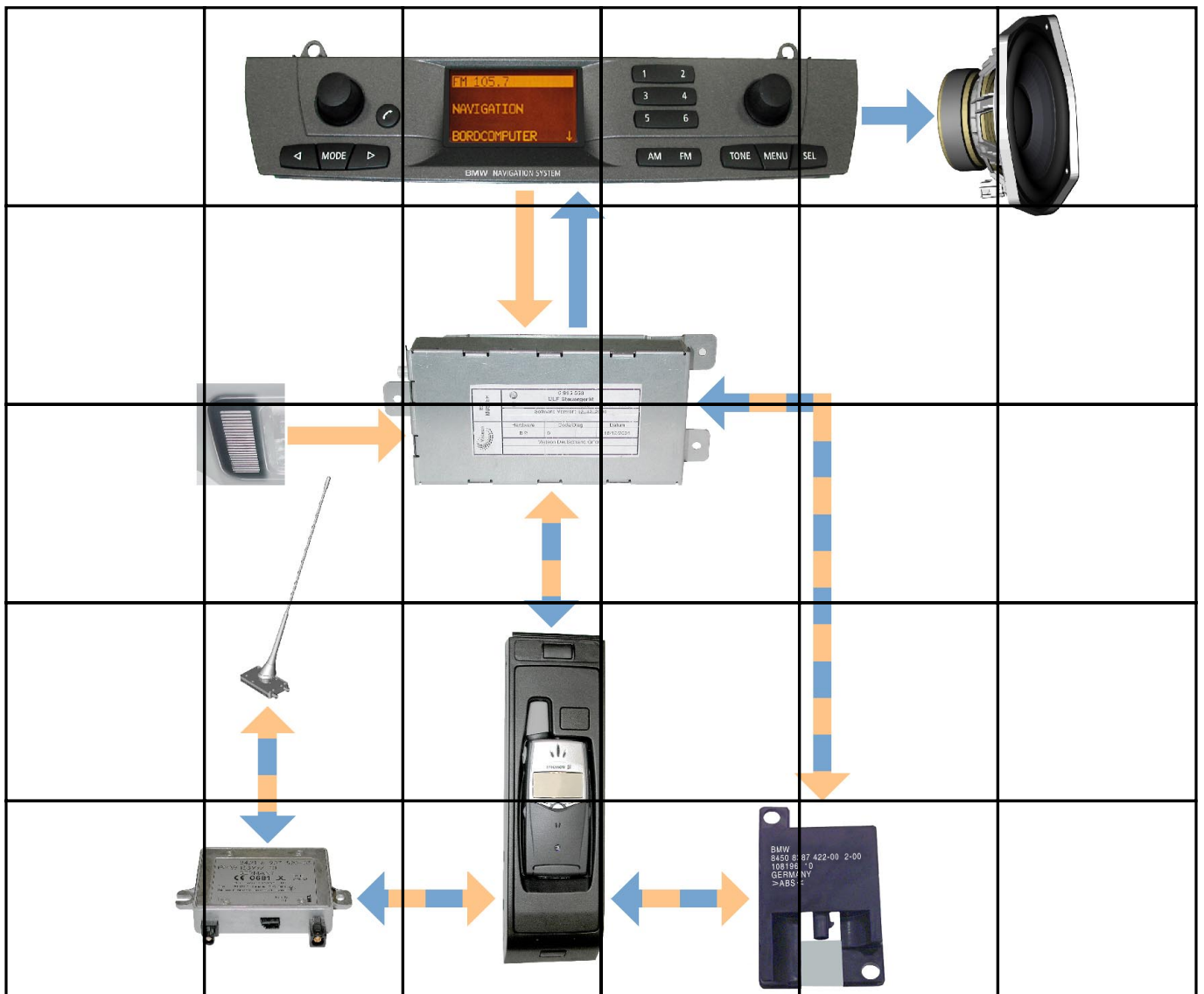# BMW
Service Training

Bluetooth Mobile Phone
Seminar Working Material

NOTE
The information contained in this training course manual is intended solely for participants of the BMW Service Training course.
Refer to the relevant "Technical Service" information for any changes/ supplements to the Technical Data.

Contents

Universal charging and hands-free unit, ULF

Introduction

The universal charging and hands-free unit ULF (option 644) is designed for use in connection with Bluetooth mobile phones.

For the first time BMW has introduced a new telephone generation that provides the customer with the option of using standard mobile phones with Bluetooth technology. The launch will take place in September 2002 in the models E46, E39 and E53.

The universal charging and hands-free unit ULF forms the interface between the Bluetooth mobile phone and vehicle. It combines the functions of the Bluetooth mobile phone with the telephone functions of the vehicle.

The Bluetooth mobile phone is the transceiver. The GSM aerial of the vehicle is connected via the base plate and the snap-in adapter directly to the mobile phone.

KT-10767

Fig. 1: Cradle for Bluetooth mobile phone

Advantages of the ULF:

- Thanks to automatic configuration of the wireless connection in the vehicle, no operating functions whatsoever are required for daily use. A cordless connection is established automatically while making available the familiar comfort functions (handset pick-up, telephone book selection).

- The control function of Bluetooth mobile phones are standardized irrespective of the manufacturer and therefore allow connection of the telephone of different manufacturers and types to the ULF in BMW Group vehicles.

- What is Bluetooth?

The name Bluetooth is derived from the Danish king of the same name who lived in the 10th century. He united and unified his kingdom and today lends his name to a technology that connects devices in the short radio range.

Bluetooth is a new short-range radio standard that allows several devices to communicate with each other simultaneously. In contrast, only one connection can be set up simultaneously between two devices operating on infrared interfaces. Communication can therefore only take place "point to point." The distance between the devices must not be greater than 1 meter.

With Bluetooth, it is possible to connect up to eight users to a network (Piconet) within a range of up to 10 m.
The ULF allows four users to set up a connection in the vehicle.

Fig. 2: Bluetooth system network   KT-10770

- Transmission

The system uses the licence-free, global industrial scientific medical band (ISM) at 2.45 GHz. This frequency range from 2.402 GHz to 2.480 GHz is subdivided into 79 channels at 1 MHz bandwidth.

The channels are changed 1600 times per second to avoid interference in connection with other devices and to make interception more difficult.
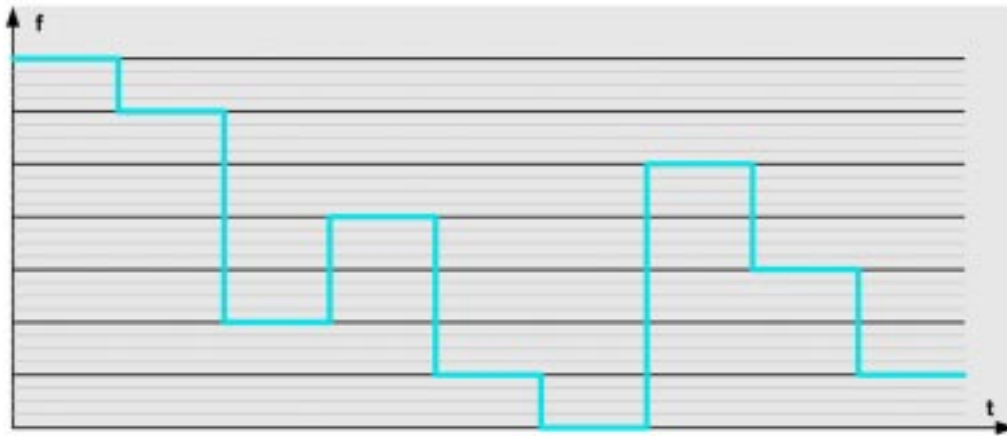

Fig. 3: Frequency change during data transfer

KT-10769

Note:

The signal range is shortened substantially when using the hands-free facility to make a call together with the Bluetooth mobile phone and turning the head into the transmitter range from the Bluetooth mobile phone to the Bluetooth aerial.

The attenuation is particularly high when an obstruction contains water molecules.

Reason:

The resonance frequency of water approximately corresponds to the transmit frequency of the ISM band.

- Data and voice

Bluetooth was developed for the transmission of both voice as well as data. A bandwidth of approx. 1 MBit/s is available for this purpose.

- Interception security

All transmitted data can be scrambled and unscrambled. It is possible to differentiate up to 281 trillion devices.

Changing the frequencies 1600 times per second is a further decisive security feature. The relatively small range of approx. 10 m also contributes to security as tampering with the data flow is only possible in the immediate vicinity.

A coupling procedure in which a pass key is entered is required once (initial logon) to establish a secure connection between two Bluetooth devices.

System overview

KT-10611

Fig. 4: System overview of universal charging and hands-free unit ULF

Index	Explanation	Index	Explanation
1	BMW multi-information radio	5	GSM aerial
2	Output speaker	6	Microphone
3	Bluetooth aerial	7	ULF control unit
4	Compensator (not standard equipment)	8	Base plate with snap-in adapter and Bluetooth mobile phone

System diagram
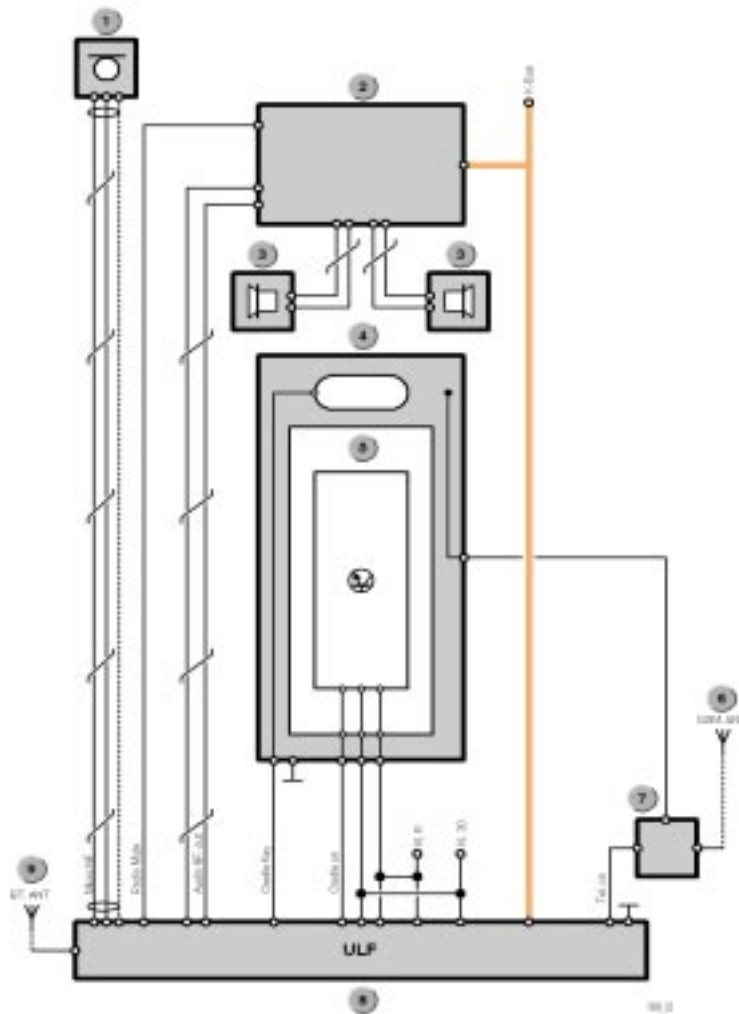
Fig. 5: System circuit diagram for universal charging and hands-free unit

Index	Explanation
1	Hands-free microphone
2	Radio
3	Speaker
4	Base plate
5	Snap-in adapter
6	GSM aerial
7	Compensator (not standard equipment)
8	Control unit for universal charging and hands-free unit
9	Bluetooth aerial

Components

The telephone preparation package for the various Bluetooth mobile phones consists of the following components:

- ULF control unit

- Base plate

- Snap-in adapter (not included in scope of delivery)

- Hands-free microphone

- GSM aerial

- Bluetooth aerial

- Compensator (not included in scope of delivery)

- Display unit (radio display or screen)

- ULF control unit

The ULF forms the interface between the Bluetooth mobile phones and the electronic systems in the vehicle.

The ULF system contains following assemblies:

- The module for controlling the digital hands-free facility

- AF signal output for the speakers

- The Bluetooth module for controlling all Bluetooth users

- An I/K-bus interface for connection to the vehicle

- An aerial interface for the Bluetooth aerial (internal)

Fig. 6: ULF control unit   KT-10541

The ULF modules are described in the following. The ULF consists of the following modules:

- Bluetooth module

- Hands-free module

- Power module

- I/K-bus interface

Bluetooth module

The Bluetooth module is connected to the Bluetooth aerial. It establishes the connection between the Bluetooth mobile phone and the vehicle.

Hands-free module

The hands-free module in the ULF controls the input/output of AF signals in hands-free mode. Hands-free mode is activated by pressing the send/receive key in the base plate on the multi-function steering wheel or in the radio control panel.

The hands-free facility is designed for full-duplex transmission. This means the user can listen and speak simultaneously. Voice transmission takes place via a microphone in the vehicle interior.

Power module

The power module in the ULF control unit regulates the voltage supply and monitors system shut-down in the event of under-voltage.

I/K-bus interface

The interface in the ULF control unit for the I/K-bus controls the procedure for transmitting and receiving data telegrams via the I/K-bus in connection with other I/K-bus users.

- Bluetooth mobile phone cradle

The base plate is included in the scope of delivery of the telephone preparation package. A cradle is inserted in the base plate on delivery of the vehicle.
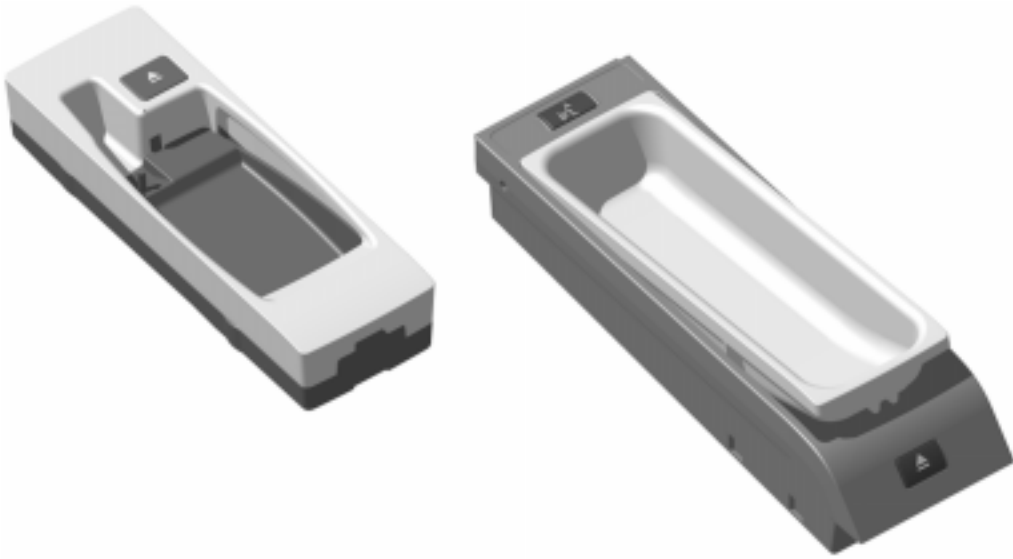
Fig. 7: Base plate with cradle/snap-in adapter   KT-10785

A specific snap-in adapter is necessary corresponding to the type of Bluetooth mobile phone used. It is snapped into the base plate instead of the cradle and establishes the connection between the base plate and Bluetooth mobile phone. The snap-in adapter is available only for mobile phones approved for the BMW Group.

Base plate

The base plate serves the purpose of accepting the snap-in adapter and therefore the Bluetooth mobile phone.
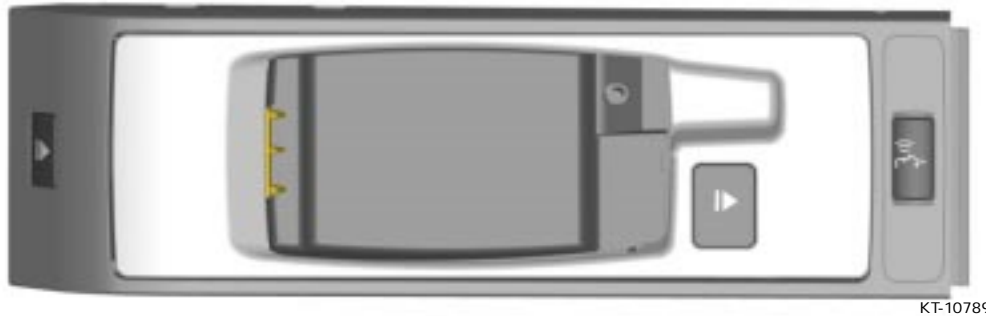

KT-10789

Fig. 8: Base plate with snap-in adapter

The base plate establishes the connection to the ULF and to the vehicle wiring harness.

The charging module is integrated in the snap-in adapter. The snap-in adapter is powered by the ULF control unit as soon as it is connected with the base plate. The charger is active and adapted to the corresponding Bluetooth mobile phone.

The Bluetooth mobile phone is charged only when the following parameters in the charging module apply:

- Snap-in adapter fitted in base plate

- Telephone inserted in snap-in adapter

- Terminal R or after-run time active

- No overvoltage > 16 V

- No undervoltage > 9 V

Snap-in adapter

Two snap-in adapters are currently available (described in the following).

The snap-in adapter regulates battery charging in the Bluetooth mobile phone and establishes the connection to the GSM vehicle aerial.

The after-run time is set at the plant to 12 minutes. The after-run time can be defined as required in the range between 0 to 60 minutes. The mobile phone functions are available during this period of time and charging of the mobile phone battery is ensured.
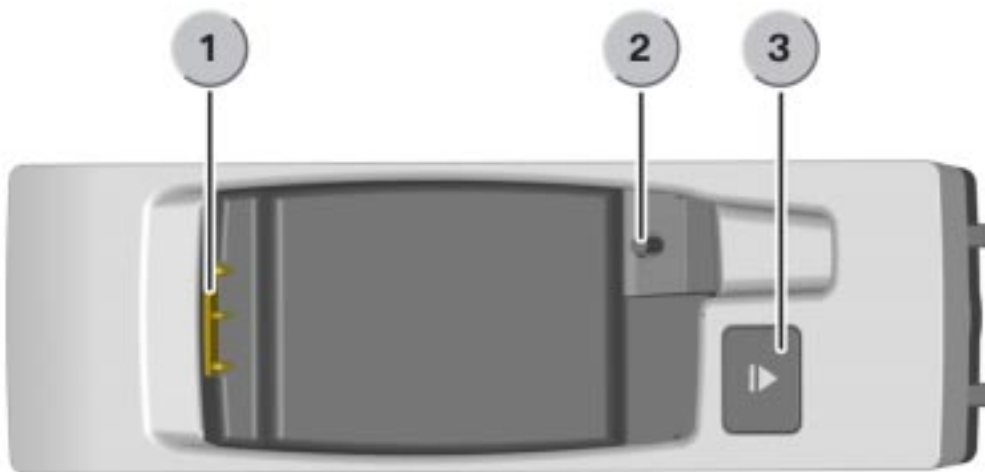

Fig. 9: Snap-in adapter

KT-10790

Index	Designation
1	Charge contacts
2	Aerial connection
3	Eject button, Bluetooth mobile phone

- Bluetooth mobile phone

Essentially, all Bluetooth mobile phones can be operated together with the universal charging and hands-free unit. However, a specific snap-in adapter is necessary for each type of mobile phone.

Snap-in adapters will be available for the following mobile phones from series launch:

- Nokia 6310/6310i

- Ericsson T39

KT-10576

Fig. 10: Bluetooth mobile phone Nokia 6310 (left) and Ericsson T39 (right)

- GSM aerial and hands-free unit

The GSM aerial and the hands-free unit correspond to those of the fixed installation system.

- Compensator

A line compensator is available as a special accessory for compensating line losses. It increases the output power at the vehicle telephone aerial up to a maximum of 2 Watt.

In this way, the compensator improves the transmit and receive power of the telephone in areas with weak network structure.

Fig. 11: Compensator

- Bluetooth aerial

The Bluetooth aerial operates on a frequency of 2.45 GHz. It is of identical design as the earlier WDCT (worldwide digital cordless telephone) aerial.

Fig. 12: Bluetooth aerial   KT-9168

System functions

- Telephoning

The mobile phone must always be inserted and locked in the snap-in adapter while driving.

A locked mobile phone offers the following advantages:

- Fixed in position in vehicle

- Connection of the external aerial (GSM aerial) and consequently the user is exposed to distinctly lower radiation

- Continuous monitoring of battery charge status

The telephone functions such as hands-free for instance are also available when the Bluetooth mobile phone is located in a different position in the vehicle.

Accepting a call

The call ringer in the Bluetooth mobile phone sounds when a mobile phone signal is received via the GSM aerial. At the same time, a signal is sent via the Bluetooth interface in the mobile phone to the Bluetooth aerial in the vehicle.

The Bluetooth aerial is connected to the Bluetooth module in the charging and hands-free unit ULF. The ULF recognizes the incoming call and mutes the radio. The speakers for outputting the tone signal are enabled by the audio system and the tone signal additionally sounds.

The following options are available for accepting the call:

- Press send/receive key on radio/operating unit
- Press send/receive key on base plate
- Press send/receive key on MFL (if installed)
- Press send/receive key on mobile phone

Conducting a call

If the call is accepted by pressing the send/receive key on the radio or on the base plate, it will be conducted via the hands-free microphone and vehicle speakers.
If a call is accepted by pressing the send/receive key on the mobile phone, the reaction will depend on the type of handset. In the majority of cases, however, the question appears:

 "Do you wish to use the mobile phone?"

Refer to the operating instructions of the mobile phone for a detailed description of the operating procedure.

The hands-free facility is activated after pressing the send/ receive key. The incoming call is encoded (scrambled) via the Bluetooth interface in the mobile phone and sent to the Bluetooth aerial in the vehicle. The call is received by the ULF control unit and output via the audio speakers.

| KT-10004	KT-10775	KT-10776	KT-10774	KT-10777
GSM aerial	**Bluetooth mobile phone**	**Bluetooth aerial**	**ULF control unit**	**Audio speaker**
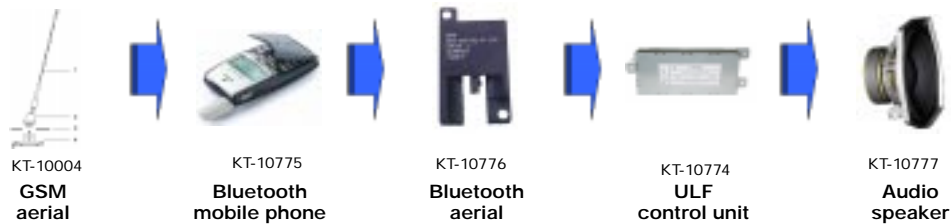
As the vehicle features a digital full-duplex hands-free facility, it is possible to simultaneously speak and listen to calls. An echo compensation facility avoids feedback when speaking into the microphone. The microphone signal is sent via an AF line to the ULF control unit. Here, the received AF signal is scrambled in the Bluetooth module and transferred via the Bluetooth aerial to the mobile phone. The mobile phone transmits the call via the GSM aerial.

KT-10772	KT-10775	KT-10776	KT-10774	KT-10004
Hands-free microphone	**ULF control unit**	**Bluetooth aerial**	**Bluetooth mobile phone**	**GSM aerial**

Data transfer

Data can be sent via a laptop for instance to the Bluetooth module in the Bluetooth mobile phone. From here when the Bluetooth mobile phone is inserted in the snap-in adapter, the data are transmitted via the GSM aerial.

KT-10771
Laptop

KT-10774
Bluetooth mobile phone

KT-10004
GSM aerial
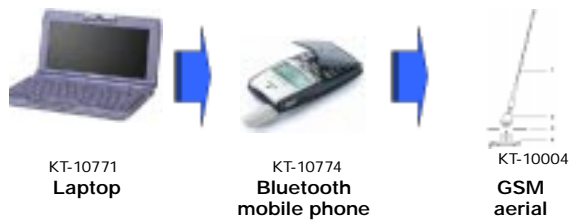
Ending a call

The following options are available for ending a call:

- Press send/receive key on radio/operating unit

- Press send/receive key on the base plate

- Press send/receive key on MFL (if installed)

- Press send/receive key on mobile phone

- Charging

The rechargeable battery in the Bluetooth mobile phone is charged automatically as soon as it is inserted in the snap-in adapter and recharging is necessary.

Charge status monitoring

The snap-in adapter features an electronic circuit which can check the charge status of the battery in the Bluetooth mobile phone via the charge contacts.

Battery charging

The voltage for battery charging is supplied from terminal 30 to the base plate and via contacts to the snap-in adapter.

Battery charging takes place under following preconditions:

- Terminal R active or after-run time active (cradle on)
- No overvoltage > 16 V
- No undervoltage > 9 V

Battery charging is also ensured during the after-run time.

Operation

- Initial operation

Before using for the first time, each Bluetooth mobile phone must be coupled with the charging and hands-free unit ULF. This coupling procedure is necessary in order to assign the mobile phone to the ULF in the vehicle.

After coupling, this mobile phone is recognized automatically by the ULF as soon as the handset is located in the vehicle interior.

Note

Depending on the mobile phone manufacturer, particular care must be taken prior to initial operation to ensure that no headset is coupled with the mobile phone. Various devices interpret the ULF as a headset and request deactivation of the headset. Please refer to the operating instructions of the mobile phone for detailed information.

Coupling

The mobile phone must be within the reception range (interior).

The coupling procedure differs corresponding to the different menu configurations of Bluetooth mobile phones. Please refer and adhere to the valid instructions provided by the manufac-turer.

By way of example, the following coupling operation describes the procedure in connection with the Bluetooth mobile phone Ericsson T39.

Procedure

Press accept key on the base plate and turn ignition key in position (terminal R). Release key after one second.

KT-10800

Fig. 13: Accept key

The "Setup" menu is activated. The telephone indicator lamps (yellow, red, green) blink.

KT-10788

Fig. 14: Screen display during coupling

Start the menu "Search for Bluetooth mobile phones" on the Bluetooth mobile phone.

Ericsson T39

In the case of the Ericsson T39 select the following menu items:

- Select Extras menu

- Select Bluetooth submenu

- Find handset

- Select corresponding handset (display BMW and the last 5 digits of the vehicle identification number)

- Following selection, a four-digit pass key must be entered.

Refer to the operating instructions for the pass key. If lost, the pass key can be read out via the BMW diagnosis tester.

Fig. 15: Display Ericsson T39 KT-10783

The message "Coupling successful" then appears in the vehicle display.

Turn the ignition key to position "0" to exit the Setup menu.

Linking several Bluetooth mobile phones

Up to four Bluetooth mobile phones can be coupled one after the other to the charging and hands-free unit ULF. The coupling operation corresponds to the procedure described above.

The handset coupled last has the highest priority. The telephone coupled first will drop out of the list if a fifth Bluetooth mobile phone is coupled.

Note

For incoming and outgoing calls, only the user coupled first can speak via the hands-free facility.

If two users enter the coupling range simultaneously, only the user with the highest priority (the user last coupled during the initial operation procedure) will be able to use the hands-free function for outgoing calls.

Deleting entries

The coupled Bluetooth mobile phones can only be deleted together in the ULF.

The setup menu must be activated again (press accept key and switch on terminal R) in order to delete entries. The accept key must then be pressed repeatedly for 10 seconds.

Adopting telephone book

Depending on the type of Bluetooth mobile phone, the telephone book is either transferred automatically (Nokia 6310) or manually by the user (Ericsson T39). The ULF must be in setup mode for manual transfer. The corresponding data can now be transferred. Automatic matching does not take place. If the addresses are changed, the transfer procedure must be repeated.

Example: Ericsson T39 operation

- Telephone book menu

- Visiting cards

- Send telephone book

- About Bluetooth

The ULF control unit must then be selected as the target address (BMW + last 5 digits of the vehicle identification number).

Refer to the operating instructions for detailed information on operation of the Bluetooth mobile phones.

Indicator lamps

The indicator lamps show the following:

KT-10779

Active call

KT-10778

SMS received (future function)

KT-10780

No mobile phone in range (steady light)

No network (flashing)