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WO 93/01665 A1 US 5335276 A

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(54) Transmitting short messages in a cordless phone system

(57) In order to transmit short text messages between a cordless phone portable part PP and a short message service centre SC, a data transfer protocol at least partly complying with the DECT system is used between the portable part and a fixed part FP of the cordless phone system, and a data transfer protocol that is at least partly in accordance with the GSM system short message service protocol. The short messages may be transferred between the fixed part FP and the short message service centre SC through a GSM service centre (Fig.4). Alternatively, the short messages may be transferred directly between the fixed part FP and the short message service centre SC (Fig.5). An interworking level may use the GSM short message transfer protocol SM-TP (Figs.8,10), or short message relay protocol SM-RP (Fig.7), or short message control protocol SM-CP (Fig.6).

Fig.3.

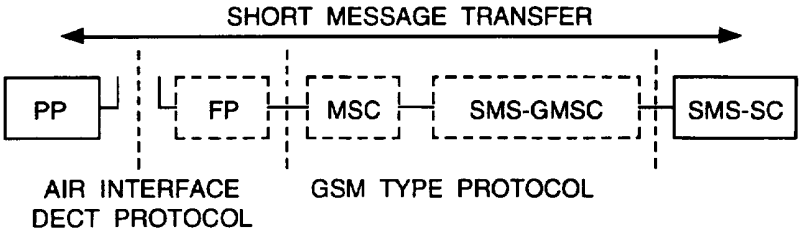

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Fig.1.

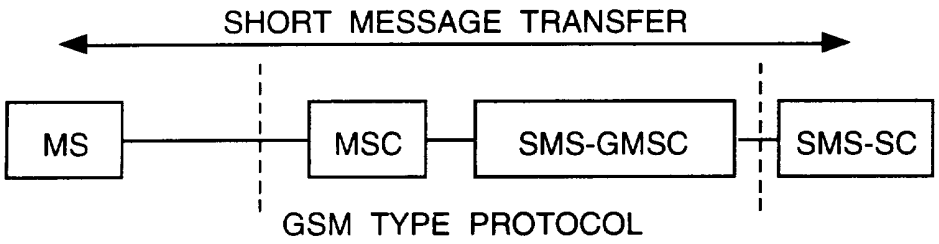

SHORT MESSAGE TRANSFER
MS
MSC
SMS-GMSC
SMS-SC
GSM TYPE PROTOCOL

Fig.2.

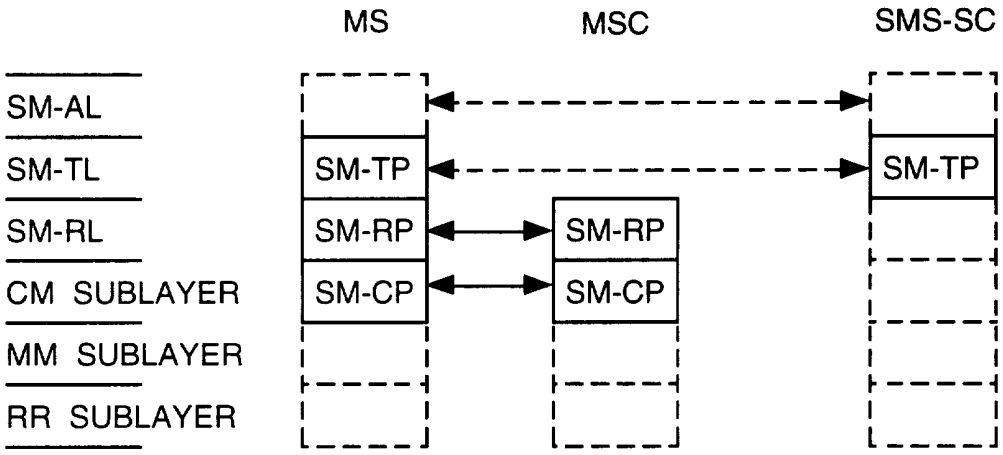

MS
MSC
SMS-SC
SM-AL
SM-TL
SM-RL
CM SUBLAYER
MM SUBLAYER
RR SUBLAYER
SM-TP
SM-RP
SM-CP
SM-RP
SM-CP
SM-TP

Fig.3.

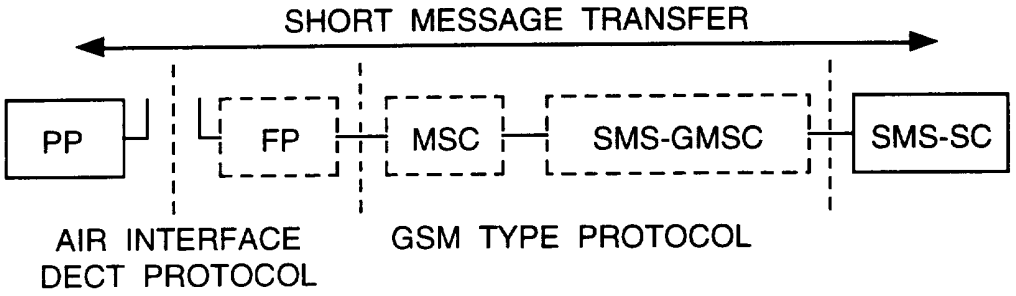


Fig.4.

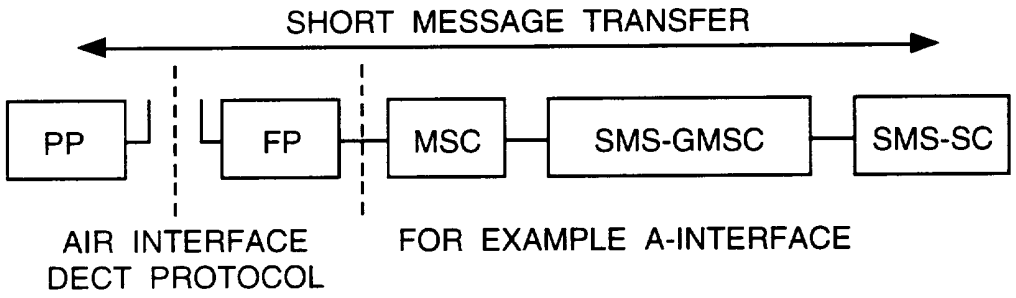


Fig.5.

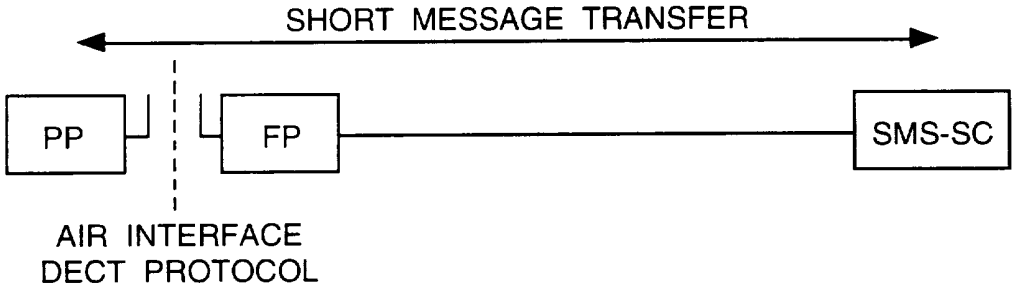


Fig.6.

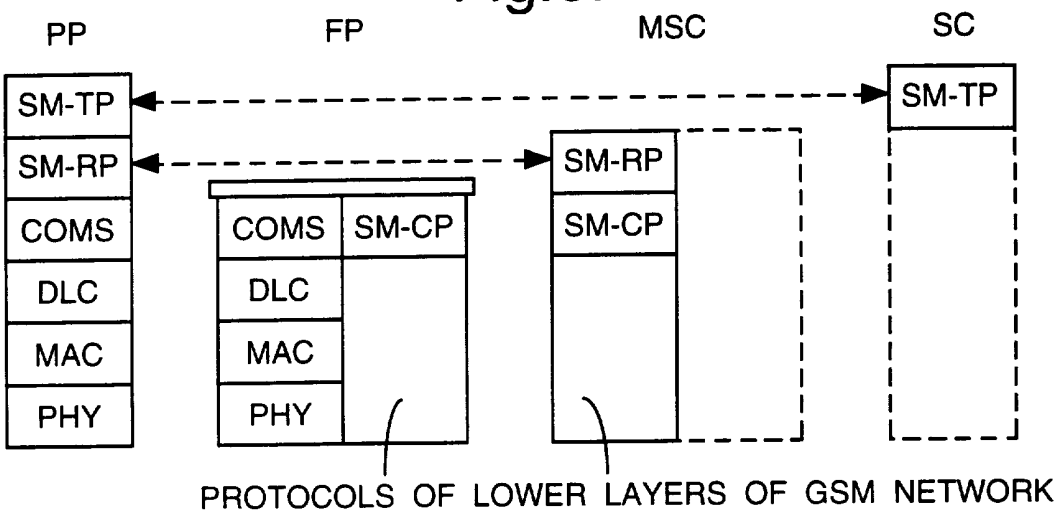


Fig.7.

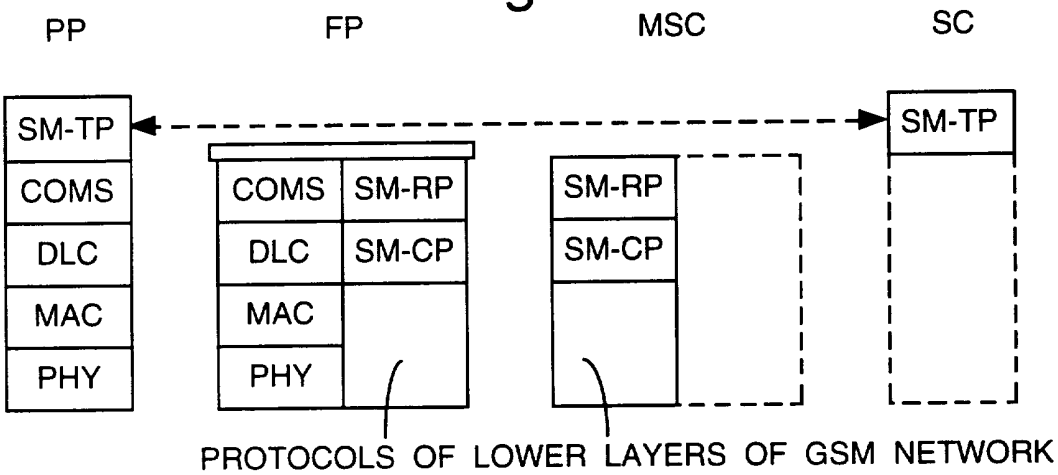


Fig.8.

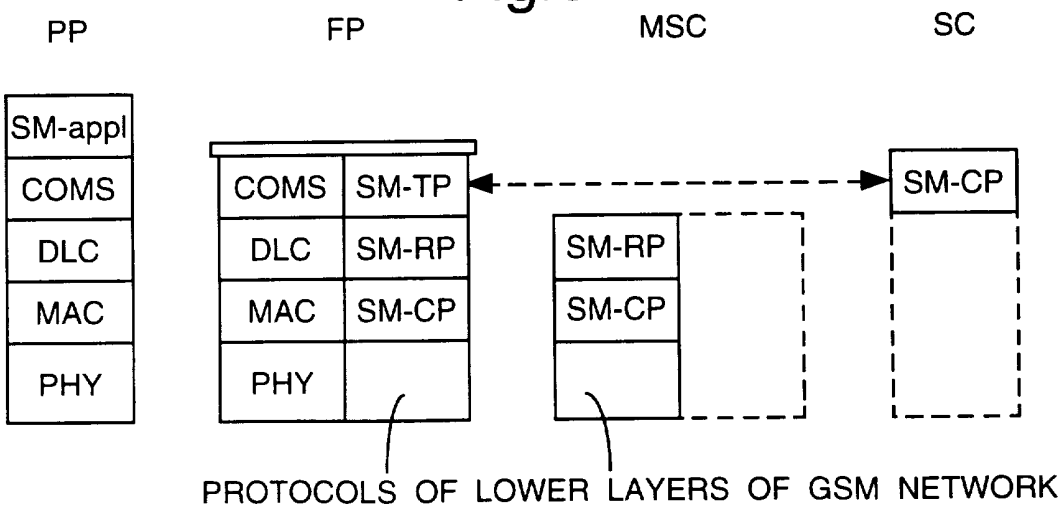


Fig.9.

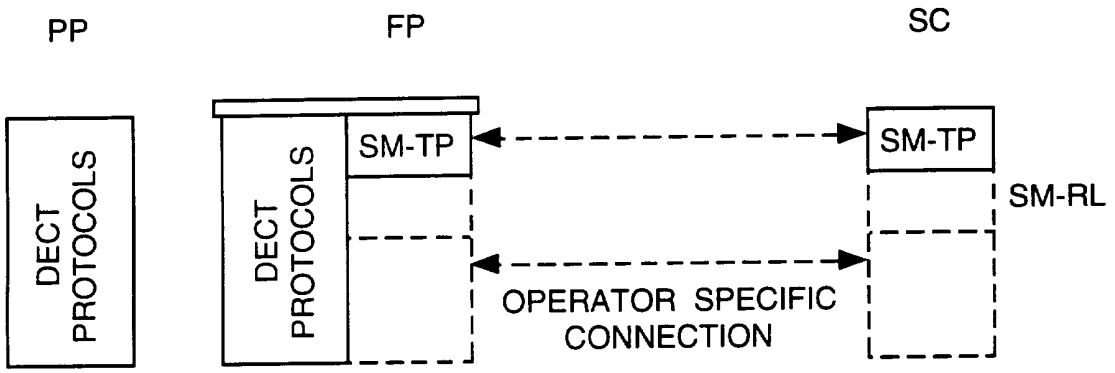
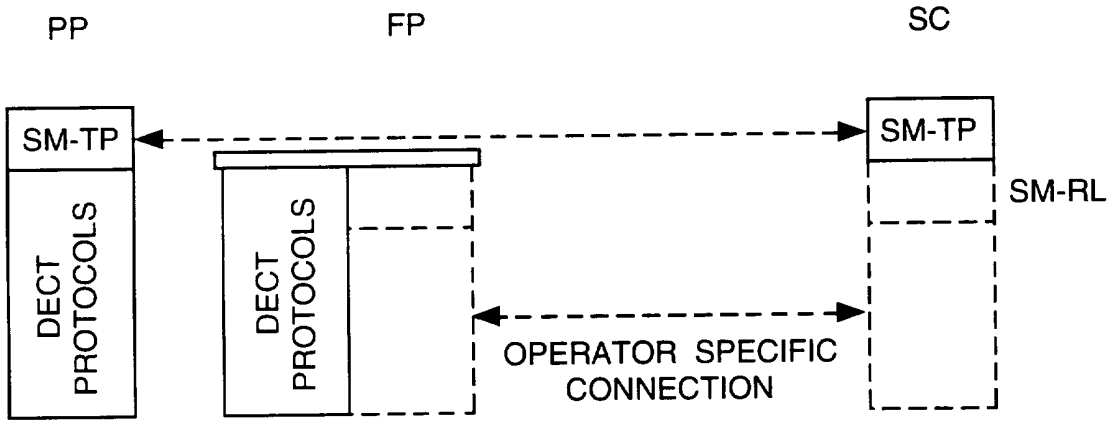

PP
FP
SC
DECT PROTOCOLS
DECT PROTOCOLS
SM-TP
SM-TP
SM-RL
OPERATOR SPECIFIC CONNECTION

Fig.10.


PP
FP
SC
SM-TP
DECT PROTOCOLS
DECT PROTOCOLS
SM-TP
SM-RL
OPERATOR SPECIFIC CONNECTION

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METHOD AND SYSTEM FOR DATA TRANSMISSION

The present invention relates to a method and system for short message transmission by using the DECT data communications system.

For short-range data transfer, e.g. inside buildings, it is known to use cordless paging and telephone systems, like those according to CEPT CT1 and CEPT CT2 standards. However, these kind of systems do not usually provide transfer of data in text form, the so called short messages. Further, it is not possible to transfer short messages between the system and the public telenetwork.

To be used mainly for speech transmission there are cordless mobile phone systems like NMT (Nordic Mobile Telephone System) and GSM (Global System for Mobile Communications). These are meant as long-range communication networks. The digital GSM-system also provides short message transmission. The GSM-system has been described in the following publication, i.a.: M.Mouly, M-B.Pautet: The GSM System for Mobile Communications, 1992.

In the GSM system the short messages are transmitted through the short message service centre SC. The mobile terminated short messages (SM-MT) are transferred from the short message service centre through the short message gateway mobile services switching centre SMS-GMSC and the GSM mobile services switching centre MSC to the mobile station MS (figure 1). In the mobile station the short message can be stored in the memory of the SIM card (Subscriber Identity Module) or the mobile station (MS). Mobile originated short messages (SM-MO) are transferred along the respective transmission path to the short message service centre SC transmitting the short message further to the desired address.

Short message transfer does not require establishment of an end-to-end traffic path between the mobile station and the short message service centre. The mobile

station can send and receive short messages even during a call or when it is not in a state for receiving calls.

Figure 2 illustrates protocols and protocol layers used in short message transfer of the GSM system. There are four layers in the short message service protocol structure: lower layers, short message relay (SM-RL), short message transfer (SM-TL) and application layer (SM-AL). The short message transfer protocol SM-TP, short message relay protocol SM-RP and short message control protocol SM-CP are used for the transfer of short messages.

The control protocol SM-CP is used between the mobile services switching centre MSC and the mobile station MS and it is a part of the connection management layer CM. Its purpose is to carry the information of the upper layers. There are three messages used: {CP-DATA}, {CP-ACK} and {CP-ERROR}.

Also the relay protocol SM-RP is used between the mobile switching centre and the mobile station. The protocol data units PDU are carried in the user data field of the control protocol SM-CP. The purpose of the SM-RP protocol is to manage references and addresses. There are four messages used: {RP-DATA}, {RP-SMMA}, {RP-ACK} AND {RP-ERROR}. The {RP-SMMA} is a signal of a released short message memory.

The short message transfer protocol SM-TP is an end-to-end protocol used between the service centre SC and the mobile station MS. It includes the following messages: {SMS-DELIVER}, {SMS-SUBMIT}, {SMS-COMMAND}, {SMS-STATUS-REPORT}, {SMS-SUBMIT-REPORT} and {SMS-DELIVERY-REPORT}. SM-TP layer information is carried in the user data fields of the {RP-DATA} and {RP-ERROR} messages of the SM-RP layer. {RP-DATA} may contain {SMS DELIVER}, {SMS-SUBMIT}, {SMS-COMMAND} and {SMS-STATUS-REPORT} SM-TP layer massages whereas {RP-ERROR} may contain {SMS-SUBMIT-REPORT} and {SMS-DELIVERY-REPORT} messages. {SMS-DELIVER} is used in mobile terminated short message transfer and {SMS-SUBMIT} in mobile originated short message transfer. These

messages are used for delivering the short message data. The lower layers are responsible for delivery of the acknowledgements.

The short message service of the GSM system is described in more detail in the following publications:

Recommendation GSM 04.11 Version 4.7.0: Point-to-Point Short Message Service Support on Mobile Radio Interface, European Telecommunications Standards Institute / TC-GSM, 1994, 114 pages,

Recommendation GSM 03,40 Version 3.5.0: Technical Realisation of the Short Message Service - Point-to-Point, European Telecommunications Standards Institute / TC-GSM, 1993, 100 pages.

The above mentioned mobile service systems work on a wide area and because of the wide range there are a rather restrictive amount of radio channels to be used. Therefore, it is not profitable to use these systems at short range, e.g. for a cordless data transmission inside a building.

For the cordless communications at short range there has been developed the so called DECT system (Digital European Cordless Telecommunications), a cordless data/voice transmission system that provides profitable data/voice transfer means for calls. However, a disadvantage of this system is that transfer of short messages is not provided.

The structure of the cordless telecommunications system DECT is described in more detail in the following publication: European Telecommunication Standard ETS 300 175 1-9: Radio Equipment and Systems (RES); Digital European Cordless Telecommunications (DECT) Common Interface, European Telecommunications Standards Institute, 1992.

So, with reference to what has been stated above, by the technique of prior art it is not possible with reasonable costs to establish a cordless, short-range data transmission system, that would provide point-to-point short message transfer as well within the system as between the system and an external data transfer network like public telenetwork.

An aim of embodiments of the present invention may be to provide a method and system for transferring short messages through the cordless DECT system, so that the above mentioned disadvantages are solved.

According to a first aspect of the invention there is provided a method as stated in the characterising part of claim 1; and according to a second aspect of the invention there is provided a system as stated in the characterising part of claim 17. Other preferred aspects of the invention are described in the dependent claims.

An advantage of the invention may be to combine the short message service centre SC and the DECT system so that a short message data transmission protocol at least partly of DECT type is used between the portable part PP and the fixed part FP and a data transmission protocol preferably of GSM type is used between the fixed part FP and the short message service centre SC (figure 3). The protocol interworking can be done in the interworking unit IWU. The portable part means here a mobile station, a cordless phone or other portable terminal substantially in accordance with the DECT system. Correspondingly, the fixed part FP means a base station or some other immobile data transmitting means substantially in accordance with the DECT system, that transfers data cordlessly with one or many portable parts and mainly through wire to other telecommunication systems.

In the following the present invention is described by way of example with the help of some preferred embodiments, with reference to the accompanying drawings, where

Figure 1 is a block diagram of short message transfer of the GSM system,

Figure 2 shows protocol layers and protocols used by the short message transfer of the GSM system,

Figure 3 shows a block diagram according to a general embodiment of the present invention,

Figure 4 shows a block diagram according to an embodiment of the present invention when the short messages are transferred through the GSM service centre,

Figure 5 shows a block diagram according to an embodiment of the present invention when the short messages are transferred directly through the fixed part and the short message service centre,

Figure 6 shows one signal flow diagram according to an embodiment of the present invention when using the control protocol SM-CP as interworking level between the fixed part and the GSM service centre,

Figure 7 shows one signal flow diagram according to an embodiment of the present invention when using the relay protocol SM-RP as interworking level between the fixed part and the GSM service centre,

Figure 8 shows one signal flow diagram according to an embodiment of the present invention when using the transfer protocol SM-TP as interworking level between the fixed part and the GSM service centre,

Figure 9 shows one signal flow diagram according to an embodiment of the present invention when using the protocol under the transfer protocol SM-TP as interworking level between the fixed part and the short message service centre and

Figure 10 shows one signal flow diagram according to an embodiment of the present invention when using the transfer protocol SM-TP as interworking level between the fixed part and the short message service centre.

The following abbreviations will be used in figures and in the text:

PP	Portable part
FP	Fix part
MSC	Mobile services switching centre
GMSC	Gateway mobile services switching centre
SMS-GMSC	Short message gateway mobile services switching centre
SC	Short message service centre
SMS-SC	Short message service centre
IWU	Interworking unit
LAPU	Link access protocol user
C	Control level of data transfer protocol
U	User level of data transfer protocol
SMS	Short message services
SM-MO	Mobile originated short message
SM-MT	Mobile terminated short message
CC	Call Control
COMS	Connection oriented message service
DLC	Data link control
MAC	Medium access control layer
PHY	Physical layer
SM-TP	Short message transfer protocol
SM-RP	Short message relay protocol
SM-CP	Short message control protocol

TP	Transfer protocol
CP	Control protocol
RP	Relay protocol
PDU	Protocol data unit

TL	Transfer layer
CL	Control layer
RL	Relay layer
AL	Application layer
CM	Connection management
MM	Mobility management
RR	Radio resource management

In this description there has been used generally known terms of the DECT and GSM systems explained in more detail, for example, in the publications mentioned as references in the first part.

Two types of messages can be discriminated in the short message transfer: the mobile originated short messages (SM-MO) and the mobile terminated short messages (SM-MT). When no transfer direction has been separately mentioned, the statement is applicable to both of the transfer directions.

This invention will be described in the following by detailing two embodiments and their preferred alternative implementations. In the first embodiment the short messages are transferred between the fixed part FP and the short message service centre SC through the GSM service centre and in the second embodiment the short messages are transferred directly between the fixed part FP and the short message service centre. An advantage of the former embodiment lies in the fact that the mobility management MM of the GSM system can be used. An advantage of the latter embodiment is that the DECT system can function independently of the GSM-network.

Figure 4 shows a block diagram of the system in accordance with the invention when using a GSM service centre. The DECT/GSM interworking implemented by using the DECT/GSM interworking profile is used in this embodiment. In this solution the short messages are transmitted between the service centre and the DECT system in the GSM network and a logical access point to the DECT system can be , for example, the A-interface or the A-bis-interface of the GSM system. The A-interface is described in detail in the CCITT recommendations Q.702, Q.703, Q.704 and Q.707 as well as in the ETSI recommendation TS GSM 08.06. By using this embodiment the mobility management MM can be implemented with help of the GSM system.

These embodiments have several alternative implementations depending on, among others, which interworking level of the data transfer protocol or which level of the radio interface is used. Interworking level here means the uppermost protocol layer terminated to the fixed part FP, on which layer the mentioned protocol is mapped to the DECT protocol or alternatively the protocol is ignored or simulated by the interworking unit IWU.

An interworking level can preferably use protocol SM-CP, SM-RP or SM-TP.

Figure 6 shows a solution where the interworking level is the control protocol SM-CP. The transfer protocol SM-TP and relay protocol SM-RP are transmitted intact over the radio interface. In this case the control protocol SM-CP messages are mapped into the respective DECT network layer messages.

An advantage of this solution is that the service standard of the GSM system will be reached, whereby an end-to-end acknowledgement of the message is provided with as few protocol interworking as possible.

Figure 7 shows a solution where as well as the control protocol SM-CP, the relay protocol SM-RP interworks with the interworking unit IWU of the fixed part FP. In this case either one or both of the SM-RP and SM-CP messages will be mapped to

respective DECT network layer messages. Here the DECT protocols provide the services of the relay protocol SM-RP to the SM-TP layer in the portable part, i.e. they replace the relay protocol SM-RP in the DECT air interface.

An advantage of this solution lies in the fact that the implementation of the portable part is simple, as the number of protocols to be brought to the portable part is small, but still a good service standard will be reached.

Figure 8 shows a solution where the interworking is on the layer of the transfer protocol SM-TP. The SM-RP and/or the SM-CP messages will be mapped to the DECT network layer messages. The SM-TP user data information will be transmitted across the air interface while the fixed part utilises the rest of the information of the SM-TP protocol. In this case the short message application is DECT specific. Further, in this case the short messages are stored by the fixed part until the portable part can be reached. Thus, the fixed part acts as an intermediate short message service centre. Another option is that the fixed part FP informs the service centre SC if the portable part PP is not available.

With this solution there has to be accepted a lower service standard, but an advantage of this solution is that it provides the basic functions of short message transmission with a very simple and inexpensive construction of the portable part.

In the above mentioned solutions the lowest interworking level is the SM-CP protocol. In addition to the SM-CP protocol the protocol configuration of figure 5 also has the interworking of SM-RP and the configuration of figure 6 also the interworking of SM-RP and SM-TP. In the cases of figures 5 and 6 it is also possible that the information of the SM-CP protocol is not transferred between the fixed part FP and the portable part PP, in which case the control protocol SM-CP is terminated in the fix part. In that case the relay protocol SM-RP and the respective DECT protocol include the required control information.

In the second embodiment of the present invention the interworking of the DECT system and the short message service centre SC (figure 5) is used. In this case the DECT system can be directly connected with the short message service centre. The carrier for the short messages can be an operator specific network, for instance the X.25 network. Services of the transfer protocol SM-TP and the SM-RL layer can be provided , for example, according to the GSM-SMS recommendations. An advantage of this option is that the DECT system does not have to be connected directly to the GSM network. So the DECT network can act independently without support of the GSM system but still offering a short message transmission of GSM type. Thus, the functional demands for the portable part and the fixed part are lower and are easier to implement.

When transmitting short messages directly between the fixed part and the short message service centre the interworking can be on the level of the transfer protocol SM-TP or a protocol layer under SM-TP, like the relay layer SM-RL. The corresponding solutions are illustrated in figures 9 and 10.

In the solution illustrated in figure 9 the messages of the transport protocol SM-TP are brought intact to the portable part PP which has an application for handling messages in form of the transfer protocol SM-TP. In this case the interworking is done on the protocol layer under the transfer protocol layer SM-TP, which provides services that correspond with the GSM specification.

With this solution there has to be accepted a lower service standard, but an advantage of this solution is that it provides the basic functions of short message transmission with a very simple and inexpensive construction of the portable part PP.

In the solution illustrated in figure 10 the interworking level is the transfer protocol SM-TP. In this case the transfer protocol SM-TP in question and the protocol under it interwork with the respective DECT protocols in the fixed part FP. There will be a DECT proprietary short message application which has similar characteristics as the

GSM short message application. In this case the fixed part FP acts as a short message receiver transmitting the messages in a simple form to the portable part. The fixed part can act as an intermediate short message service centre and store the messages for the portable part, if the portable part is not available. Alternatively it may signal to the service centre SC that the portable part is not available, so that the service centre SC can store the message.

An advantage of this solution is that the implementation of the portable part is simple, as the number of protocols to be brought to the portable part is small, but still a good service standard will be reached.

With the direct interworking of the DECT system and the short message centre the interworking of the protocol under the transfer protocol layer SM-TP will be required, since the acknowledgements of the transfer protocol SM-TP are delivered by this protocol layer. Services provided by the layer can be implemented according to the GSM specifications.

In both of the foregoing embodiments the radio interface control will be implemented by using the DECT system. This can be done with the connection oriented message service COMS, on the call control layer CC or with some DECT data profile. The connection oriented message service COMS provides transfer of acknowledgements of the transmitted information, which improves the reliability of the data transmission. An advantage of acting on the call control layer is that the CC entity already existing in every portable part and fixed part can be used and there is no need to establish or use a separate protocol especially for the short message transmission in order to carry the messages.

Several DECT subsystems can be connected to the short message service centre SC, a part of which can be directly connected to the short message service centre SC and a part through the GSM service centre. In this case it is preferable to use the respective interworking level between the fixed part and the short message

service centre and between the fixed part and the GSM service centre. Thus a portable part PP of the same type can be used in all DECT subsystems.

An active portable part PP can receive and send short messages even during a call and the services do not require establishment of an end-to-end traffic path.

By using the solution in accordance with the present invention short-range communication can be realised in different ways by using components of the DECT system, the manufacturing costs of which are reasonable. With this invention short messages can be transmitted between different parts of the system and between the system and an external one.

As a summary a number of combinations of above mentioned example solutions can be seen on the following table:

GSM service as intermediate	Interworking level	Air interface
YES	CP	CC
YES	CP	COMS
YES	RP	CC
YES	RP	COMS
YES	TP	CC
YES	TP	COMS
NO	Level under TP	CC
NO	Level under TP	COMS
NO	TP	CC
NO	TP	COMS

Each of the above mentioned combinations provides advantages of the respective configurations mentioned in the combination, the said advantages being stated in the foregoing description.

Some embodiments and preferred configurations of the method according to the present invention have been described in the foregoing, but naturally various modifications of the principle according to the invention can be made within the scope of the claims, e.g. concerning functional details and the range of use. Constructions of the devices to be used in connection with the present invention have not been described in detail in this specification as it is seen as a part of normal knowledge of the field, to be put in practice by a specialist after having read this specification.

It should be understood that the foregoing description is only illustrative of the invention. Various alternatives and modifications can be devised by those skilled in the art without departing from the invention. Accordingly, the present invention is intended to embrace all such alternatives, modifications and variances which fall within the scope of the appended claims.

The present invention includes any novel feature or combination of features disclosed herein either explicitly or any generalisation thereof irrespective of whether or not it relates to the claimed invention or mitigates any or all of the problems addressed.

CLAIMS

1. A method for transmitting short messages between a portable part (PP), a fixed part (FP) and a short message service centre (SC) so that the information is transferred between the portable part (PP) and the fixed part (FP) through radio interface, characterised in that a first data transfer protocol corresponding at least partly with the DECT system is used in the data transfer between the portable part (PP) and the fixed part (FP) and a second data transfer protocol being different from the said first data transfer protocol is used in the data transfer between the fixed part (FP) and the short message service centre (SC).

2. A method in accordance with claim 1, characterised in that protocol interworking of the first and the second protocol is done in the fixed part (FP).

3. A method in accordance with claim 1 or 2, characterised in that said second data transfer protocol is at least partly in accordance with the GSM system.

4. A method in accordance with any of claims 1 to 3, characterised in that as interworking level is used a protocol under the short message transfer protocol (SM-TP) and the protocol under the transfer protocol interworks with the respective DECT protocol whereas the transfer protocol (SM-TP) is transmitted between the portable part and the short message service centre substantially intact.

5. A method in accordance with claim 4, characterised in that the information of the protocol layer under the transfer protocol (SM-TP) is transmitted between the portable part and the fixed part as a DECT protocol in form of the relay protocol (SM-RP).

6. A method in accordance with any of claims 1 to 3, characterised in that as interworking level is used the transfer protocol (SM-TP) and the transfer protocol (SM-TP) and the protocol under the transfer protocol (SM-TP) interworks with the respective DECT protocols.

7. A method in accordance with any of claims 1 to 3, characterised in that short messages between the fixed part and the short message service centre are transmitted through the GSM mobile services switching centre (MSC).

8. A method in accordance with claim 7, characterised in that as interworking level is used the short message control protocol (SM-CP) and the control protocol interworks with the respective DECT protocol whereas the transfer protocol (SM-TP) and the relay protocol (SM-RP) are transmitted through the fixed part (FP) substantially intact.

9. A method in accordance with claim 7, characterised in that as interworking level is used the short message relay protocol (SM-RP) and the relay protocol (SM-RP) and the control protocol (SM-CP) interwork with the respective DECT protocols whereas the transfer protocol (SM-TP) is transmitted through the fixed part (FP) substantially intact.

10. A method in accordance with claim 7, characterised in that as interworking level is used the short message relay protocol (SM-RP) and the relay protocol (SM-RP) interworks with the respective DECT protocol whereas the information of the control protocol (SM-CP) is not transmitted between the portable part and the fixed part and the transfer protocol (SM-TP) is transmitted through the fixed part (FP) substantially intact.

11. A method in accordance with claim 7, characterised in that as interworking level is used the short message transfer protocol (SM-TP) and the transfer protocol (SM-TP), relay protocol (SM-RP) and control protocol (SM-CP) interwork with the respective DECT protocols.

12. A method in accordance with claim 7, characterised in that as interworking level is used the short message transfer protocol (SM-TP) and the transfer protocol (SM-TP) and the relay protocol (SM-RP) interwork with the respective DECT protocols whereas the information of the control protocol (SM-CP) is not transmitted between the portable part (PP) and the fixed part (FP).

13. A method in accordance with any of claims 4, 5, 8, 9 or 10, characterised in that in the portable part (PP) is used a short message application of GSM type.

14. A method in accordance with any of claims 6, 11 or 12, characterised in that in the portable part (PP) is used a short message application of DECT type.

15. A method in accordance with any of the foregoing claims, characterised in that in the data transfer between the fixed part (FP) and the portable part (PP) is used the call control layer (CC).

16. A method in accordance with any of the foregoing claims, characterised in that in the data transfer between the fixed part (FP) and the portable part (PP) is used the connection oriented message service (COMS).

17. A system for transmitting short messages including a portable part (PP), a fixed part (FP) and a short message service centre (SC), characterised in that the portable part and the fixed part have means for using the first data transfer protocol in the data transfer between the portable part and the fix part, and the fixed part has means for using the second data transfer protocol in the data transfer between the fixed part and the short message centre, the said first data transfer protocol being at least partly in accordance with the DECT system and the said second data transfer protocol being different from the said first data transfer protocol.

18. A system in accordance with claim 17, characterised in that the portable part (PP) and the fixed part (FP) have means for the radio interface interworking substantially according to the DECT system.

19. A system in accordance with claim 17 or 18, characterised in that the second data transfer protocol is at least partly in accordance with the GSM system.

20. A system in accordance with any of claims 17 to 19, characterised in that the fixed part (FP) has means for interworking of the first protocol with the second protocol.

21. A system in accordance with claim 20, characterised in that the said means for protocol interworking include an interworking unit (IWU).

22. A system in accordance with claim 17, characterised in that the portable part (PP) has means for reading and/or forming transfer protocols (SM-TP) substantially in accordance with the GSM system.

23. A system in accordance with claim 22, characterised in that the portable part (PP) has means for reading and/or forming relay protocols (SM-RP) in form of the GSM system.

24. A system in accordance of any of the foregoing claims, characterised in that the portable part (PP) has means for storing short messages in a card equipped with memory, like a SIM card complying with the GSM system.

25. A system in accordance with any of claims 17 to 24, characterised in that on the data transfer path between the fixed part (FP) and the short message service centre (SC) there is a centre (MSC) substantially of the GSM type for transmission of short messages.

26. A system in accordance with claim 25, characterised in that as interface between the fixed part (FP) and the GSM centre (MSC) there is substantially an A-interface of the GSM system.

27. A method as described with particular reference to figure 6.

28. A method as described with particular reference to figure 7.

29. A method as described with particular reference to figure 8.

30. A method as described with particular reference to figure 9.

31. A method as described with particular reference to figure 10.

32. A system as described with particular reference to figure 6.

33. A system as described with particular reference to figure 7.

34. A system as described with particular reference to figure 8.

35. A system as described with particular reference to figure 9.

36. A system as described with particular reference to figure 10.

The Patent Office

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Claims searched: 1 to 26

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Other: ONLINE : WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	EP0399520A2	(HITACHI) - Figs.1,2; Abstract	1,17 at least
A,P	WO95/33348A1	(ERICSSON) - page 7 lines 29-37	1,3,17,19
Y	WO94/13070A1	(MOTOROLA) - Fig.1; Abstract	1,17 at least
Y	WO93/01665A1	(MOTOROLA) - Fig.1; Abstract	1,17 at least
Y	US5335276	(TEXAS) - Figs.1,8,9a-9d; Abstract, column 16 lines 21-36, column 17 lines 12-24	1,17 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.