The present invention relates to a vehicle audio management system and method for managing audio messages in a vehicle.

The system includes an input device, arranged for receiving input from a vehicle operator. The system further includes a selecting means, arranged for selecting an audio message to be emitted from a queue of at least one audio message waiting to be emitted, and for performing the selection based on said input.

[Continued on next page]
DEVICE AND METHOD FOR MANAGING AUDIO MESSAGES IN A VEHICLE

Field of the invention
The present invention relates to a vehicle audio message management system. The present invention also relates to a vehicle including such a vehicle audio message management system, to a method for managing audio messages in a vehicle, to a computer program executing the method and to a computer program product wherein the computer program is included.

Related art and background of the invention
Vehicle audio management systems managing signals from a number of audio sources are previously known in the background art. These systems include a plurality of audio sources and a selecting means arranged to select one of the audio signals, based on priority levels assigned to the audio sources by the system, and to output the selected audio signal to a sound emitting system, as one single sound emitting system handles signals from a plurality of audio sources. Such an audio management system is known from document WO 2005/055046.

WO2005/055046 shows a system for interaction between a vehicle operator and a plurality of applications. In this document, a system is presented that handles the problem of managing messages from a number of applications, such as radio, CD, DVD, navigation systems or the like, more or less simultaneously requesting to confront an operator of a vehicle. This is achieved by controlling the operator interaction and communication based on a number of parameters, such as the complexity of the driving situation, operator activity, identity, state and characteristics of the operator, specific driving situations and overall environment or context. Based on these parameters, the system thus selects the most important interaction or communication and presents this to the operator and puts the other interactions or communications in a waiting queue. The system shown in this document is fully automated and handles the whole selection procedure for the operator.

In background art solutions, such as the one shown in document WO2005/055046, there may be a discrepancy between the system priority level given to an interaction
or a communication and the priority level for the same interaction or communication expected by the vehicle operator. A vehicle operator could, for instance, be more interested in other interactions or communications than the one the system, in a specific moment, automatically emits to him, based on how important the system has estimated the interactions or communications. The expectations of different vehicle operators can differ very much from person to person, since personalities and wishes presumably are different for different persons. The expectations and needs of a certain vehicle operator can further change from time to time. Also, in for instance a haulage business, a number of vehicle operators may use the same vehicle. It would thus be very difficult, time consuming and costly to customize the system for each person driving a certain vehicle and to accommodate the different expectations of every operator of a vehicle at any given moment. The prior art solutions therefore have customizing and quality problems.

**Aim and most important features of the invention**

It is an object of the present invention to provide a vehicle audio message management system and method that solve the above stated problems.

The present invention aims to provide a system that is more easily vehicle operator customized and that gives the vehicle operator a better quality experience than the vehicle audio management systems known in the background art.

The object is achieved by the above mentioned vehicle audio message management system according to the characterizing portion of claim 1, i.e. that said system includes an input device, arranged for receiving input from a vehicle operator, wherein said input is related to at least one audio message that is to be prevented from being emitted, and a selecting means, arranged for selecting an audio message to be emitted from a queue of at least one audio message waiting to be emitted, and for performing the selection based on said input.

The object is also achieved by the above mentioned vehicle according to the characterizing portion of claim 17.
The object is also achieved by the above mentioned method for managing audio messages in a vehicle according to the characterizing portion of claim 18, i.e. by, if input, related to at least one audio message that is to be prevented from being emitted, is given to the system by a vehicle operator, selecting an audio message to be emitted from a queue of at least one audio message waiting to be emitted, wherein the selection is based on said input.

The object is also achieved by the above mentioned computer program according to the characterizing portion of claim 29.

The object is also achieved by the above mentioned computer program product according to the characterizing portion of claim 30.

The vehicle audio message management system and method according to the present invention makes it possible for the vehicle operator to, in a simple way, customize his/her audio listening experience in a way that lets him/her listen to exactly the specific audio message he/she wants to listen to at any given moment, regardless of the set priority levels for automatically determining the emitting order of audio messages by the system. The vehicle operator can thus choose to listen to the audio message of the highest importance or may, by a simple operation, pause or skip that message and choose to listen to another audio message of lesser importance waiting in queue. The present invention thereby alleviates the quality problems experienced by users of background art audio management system, in which the vehicle operator has been forced to have his favourite real time type of audio message, such as a radio sport show, interrupted by audio messages that the vehicle operator, at least for the moment, finds less important than the system does.

In an embodiment of the present invention, data buses, such as CAN (Controller Area Network), MOST (Media Oriented Systems Transport), Byteflight, TTCAN (Time Triggered Controller Area Network), Flexray, LIN (Local Interconnected Network) or the like, may be used for cabling in the system. The use of data buses is a very compact, light and small cabling alternative, which is very advantageous to use in vehicles having limited space and being sensitive to heavy cabling.
In an embodiment of the present invention, the audio sources may provide the system with low level audio signals. The use of low level signal cables is also advantageous since these cables are less costly, lighter and needs less space than high level signal cables.

Detailed exemplary embodiments and advantages of the vehicle audio message management system and method according to the invention will now be described with reference to the appended drawings illustrating some preferred embodiments.

**Brief description of the drawings**

Fig. 1 shows a vehicle audio message management system according to an embodiment of the present invention.

Fig. 2 shows an exemplary view of the display used for displaying queuing audio messages.

Fig. 3 shows a schematic view of the input device.

Fig. 4 shows a simplified schematic view of a possible implementation of an audio priority device.

Fig. 5 shows a simplified view of a possible design of the input device.

Fig. 6 shows a flowchart of the method according to the invention.

**Detailed description of preferred embodiments**

Fig. 1 shows a vehicle audio message management system according to an embodiment of the present invention. The system includes a control unit 110, which controls the operation of the whole system. This control unit may be a so-called coordinator system unit COO (not shown), responsible for interconnecting separate data communication buses in the vehicle, or any other type of control unit. The COO ensures that signals are not unintentionally transmitted from one communication bus
to another and further controls bus load and prevents bus overload on each vehicle
internal communication bus. The system also includes a number of audio sources
161-167 creating audio signals that are to be emitted to an operator of a vehicle. An
audio priority device 140 selects which one of the audio sources to emit to the vehicle
operator. The audio priority device 140 alternatively selects which type of audio
message to emit, in case at least two messages emanate from the same audio
source, based on a predetermined priority order for presentation corresponding to
message type. The audio management system further includes a sound emitting
system including at least one speaker 150. A vehicle operator interaction system is
further included in the audio management system. The vehicle operator interaction
system includes an input device 130 and preferably both not necessarily a display
120, both preferably being located in the driving compartment of the vehicle, within
sight and reach of the vehicle operator. The audio sources 161-167 are connected to
the control unit 110 and/or audio priority device 140 by audio source cables 171-177.
The display 120, input device 130 and the audio priority device 140 are coupled to
the control unit 110 by system cables 181-183. The at least one speaker 150 is
coupled to the audio priority device by at least one speaker cable 184. For example,
the present invention can be implemented at least partially as a computer program
stored and executed in, e.g., a computer. Control units that comprise one or more
processing units are to be regarded as computers, and thus said computer program
can be stored and executed in, e.g., control unit 110.

In fig. 1, seven audio sources 161-167 are shown as an exemplary illustration. The
invention is, however, not restricted to a specific number of audio sources. These
audio sources 161-167 may include music creating systems, such as radios, CD
players, mp3 players or the like; communication equipment, such as mobile
telephones, communication radios or the like; multimedia equipment, such as DVD
players or the like; navigation systems, such as Global Positioning Systems (GPS) or
the like; and safety systems, such as Lane Departure Warning (LDW) systems,
radars or the like. The system according to the invention can easily be modified to
to any number of audio sources. The number of speakers 150 of the sound emitting
system can also be varied in a large number of ways.
The audio sources 161-167 may create or provide audio messages of differing types. It can easily be realised that different audio sources may provide different types of audio messages being of different importance, for instance, a CD player may provide one type of audio messages of a certain level of importance and a navigation system may provide another type of audio messages of another level of importance. But also one single audio source may provide different types of audio messages of differing importance. For example, a radar system may provide messages warning for a collision about to happen and also messages informing the vehicle operator of physical details, such as vehicles, pedestrians or structures further away from the vehicle. Another example may be a radio that provides normal radio signals messages and also RDS (Radio Data System) messages.

The audio source cables 171-177, the at least one speaker cable 184 and the system cables 181-183 may be implemented using a number of different types of cables. Single cables as well as data buses, such as CAN (Controller Area Network), MOST (Media Oriented Systems Transport), Byteflight, TTCAN (Time Triggered Controller Area Network), Flexray, LIN (Local Interconnected Network) or the like, may be used for these cables. At least system cables 181 and 183 and possibly some or all of the audio source cables 171-177 may, in some embodiments of the preferred invention, preferably be implemented using data buses. The use of buses is further a very compact, light and small cabling alternative, which is advantageous in vehicles. Heavy and space consuming cabling is generally a problem in vehicles. There is often a very limited amount of installation space in vehicles, especially since audio management systems often are installed after the vehicle has been assembled in a factory.

The audio sources 161-167 may, in different embodiments of the present invention, provide the system with either low level audio signals or high level audio signals. Audio sources providing the system with high level signals should preferably be connected to the system using cables suitable for high level signals. The at least one speaker cable should also be implemented using a cable coping with carrying signals for a loud speaker. The use of low level signal cables is advantageous since these cables are less costly, lighter and needs less space than high level signal cables.
In the vehicle audio message management system shown in fig. 1, the system assigns priority levels to each of the types of audio messages. This can be done in a number of more or less complex ways. The priority levels can be strictly set based on the types of audio messages in a fix manner or can be adapted according to a number of parameters, such as a vehicle operator environment or the like.

These priority levels are used in the audio management system because of the risk of a conflict situation occurring when a plurality of audio messages at more or less the same time request for being presented to the vehicle operator. The system thus has to select one of the pluralities of audio signals to output to a sound emitting system, as one single sound emitting system handles signals from a plurality of audio sources. The priority levels are used by the system in this selection process. For instance, if a radio traffic information message has been given a higher priority by the system than a CD-player message, then the radio traffic information message will interrupt the CD-player message and emit the traffic information to the vehicle operator. If a plurality of audio messages are being simultaneously provided by different audio sources for communication to the vehicle operator there will be, based on the different priority levels assigned to the different types of audio messages or assigned to the different audio sources, a queue of audio messages waiting to be audibly presented or emitted to the vehicle operator. Two or more audio messages may also be mixed, emitting a composite signal containing the two or more audio messages to the vehicle operator.

According to an embodiment of the present invention, the queue of audio messages and possibly also the audio message presently being emitted are displayed to the vehicle operator on the display 120 located in the driving compartment, preferably in an instrument panel. The display shows a list of identifiers corresponding to the queued audio messages. These identifiers may be alphanumerical identifiers identifying the audio messages, such as "CD" for the CD-player messages, "Nav" for the navigation system messages and the like. The identifiers may also be graphical identifiers, such as icons, pictures and the like. The identifiers may also have any other shape or form useful for identifying the audio messages. The identifiers shown
on the display may be possible to highlight, such that a currently emitted audio message may be highlighted if it is shown on the display.

According to the present invention, the vehicle operator has an input device 130 within reach, preferably on the steering wheel, in the instrument panel or extending from the steering column. By the use of this input device, the vehicle operator may skip the currently emitted audio message and instead emit the first audio message in the list of displayed audio messages. This may for instance be done simply by pushing a button being part of the input device. The vehicle operator may also skip more than one audio message by repeatedly pushing the button or by performing another action on the input device. The vehicle operator may further, by use of another button pushing pattern or use of another button or the like, order the system to not emit a type of audio message for the moment, for a limited time or from the moment on. The input device may also include other signal generating entities that may be operated by the vehicle operator to control the system. Such signal generating entities may be rocker switches, scrolling devices and joysticks.

The combination of the display 120 and the easily used input device 130 makes it possible for the vehicle operator to, in a simple way, see what types of audio messages that are queuing to present audio to the vehicle operator and, if he wishes, skip the currently emitted audio message and possibly also other audio messages in the queue and select the audio message he wants to listen to. The present invention thus offers an easily implemented and by the vehicle operator easily handled solution to the customizing and quality problems of background art systems. It is likely that a vehicle operator from time to time wants to have the possibility to select another type of audio message than the one the system emits to him based on the preset priority levels. For instance, if a vehicle operator knows the travel route ahead he might prefer to listen to the CD-player instead of constantly hearing directions from the navigation system, even though the navigation system has been assigned a higher priority than the CD-player in the system. The present invention lets him chose which one of the types of audio messages wanting his attention that should be emitted to him. A vehicle operator may, in an audio message management system according to the present invention, also order the system to not emit a certain type of audio
message, such as navigation instructions, for a set time period. This could be useful for blocking interruptions during, for instance, a radio program the vehicle operator wants to listen to in real time, such as a radio program covering a sporting event or the like.

Fig. 2 shows an exemplary view of the display 220 used for displaying queuing audio messages and possibly also showing the currently emitted audio message. As is shown in fig. 2, a list of audio messages may be displayed on the display 220. This list may include only the audio messages in the queue, waiting to be emitted to the vehicle operator. The list may also include the audio message currently being emitted, preferably highlighted or otherwise marked in a way that makes in easy for the vehicle operator to see that this audio message is currently being emitted.

Fig. 3 shows a schematic view of the input device 330. A simple implementation of the input device may include a pulse generating toggle switch 331 coupled to ground. Such a toggle switch generates a pulse when being pushed. This pulse is interpreted by the audio message management system as being, for instance, an order from the vehicle operator to skip the currently emitted audio message and instead emit the first audio message in the queue. A number of pushes generating a pulse pattern or a long time push may be interpreted as another order from the vehicle operator to the system, resulting in another action by the system. Fig. 3 shows only a non-detailed view of a possible implementation of the input device 330. A skilled person realises that this input device can be implemented in a number of ways. Essentially, more or less any pulse or signal creating circuit could be used as such an input device. The device may therefore also include, for example one button, more than one button, rocker switch, scrolling device, joystick or the like. The signal creating circuit may further be located in a signal generating entity coupled to the input device. This signal generating entity may be located essentially anywhere on the vehicle, but preferably within comfortable reach of the vehicle operator, and may be coupled to the input device using a signaling bus, such as a CAN or the like.

Fig. 4 shows a simplified schematic view of a possible implementation of an audio priority device 400. The audio priority device 400 has a number of audio source input
connectors 401-405 and an output connector 406. Cables conveying audio signals from the audio sources are connected to the audio source input connectors 401-405 and are provided to a selecting means 410 on signal lines 411-415. A selection switch 420 within the selecting means 410 is then switched into a position that lets the chosen signal through to the output connector 406.

The selecting means 410, more specifically the selection switch 420, is controlled in such a way that audio messages are chosen by the selection switch 420 in accordance with the priority levels assigned to the different types of audio messages by the system. According to the present invention, the selection switch 420 may further be controlled to skip the audio message presently being emitted and switch to another audio message. This forced selection is performed when the selection means receives a pulse or a signal generated by the input device 330 as a reaction, for instance, to a button being pushed. The selecting means 410 is thus controlled both by a selection/switching pattern resulting from the priority levels given to the different types of audio messages by the system and by selection/switching orders given by the vehicle operator through the input device 330.

The simplified schematic view of audio priority device 400 shown in fig. 4 is not meant to show all details of the audio priority device, but is more meant to illustrate a general selection process of the device. A more detailed view of the audio priority device 400 may further include signal detection circuits for detection of whether there are signals present at the audio source connectors 401-405, a control circuit for controlling the selection switch 420 based on priority levels and vehicle operator input, and wiring carrying control signals. There is, as is clear to a skilled person, a number of ways to implement the details within the selecting means 400. The implementation may be a hardware implementation, a software implementation or any combination of the both.

Fig. 5 shows a simplified view of a possible design of the input device 530. The input device 530 may have a number of buttons 531-534 that may be used for controlling the system. For instance, button 531 may be used for scrolling up in a list of audio messages and button 532 may be used for scrolling down in the list. Button 533 may
be used for canceling an order. Button 534 may be used for confirming an order, i.e. an "enter" button. In fig. 5 there are four buttons present. However, as is realized by a skilled person, the number of buttons as well as the buttons themselves may easily be altered into any kind of signal generating entity and any number of buttons.

Fig. 6 shows a flowchart of the method according to the invention. In a first step, of the method according to the present invention, the method starts. In a second step, it is decided whether the vehicle operator has given an input to the system. If no input has been given, the method returns to the first step. If input has been given, the method proceeds to a third step. In the third step of the method, an audio message is selected to be emitted to the vehicle operator based on the input.

In different embodiments of the present invention, the amplification of the audio signals may be performed in different locations of the system. The amplification circuits may be integrated with the audio sources, with the audio priority device or with a radio subsequent to the audio priority device. The amplification circuits may also be located in an external amplification stage subsequent of the audio priority device. These different locations of the amplifying circuitry have different advantages. Amplification within the audio sources has the advantage that amplifying circuitry already existing in the audio sources may be used. Amplification within or subsequent to the audio priority device has the advantage that low level signal cables may be used from the audio sources to the location where the amplification takes place, which makes use of more simple, smaller and less costly cables. The amplification circuits and parts have for simplicity been omitted in the drawings.

In an embodiment of the present invention, the vehicle audio message management system further includes a memory used for storing audio messages received from the audio sources. Having the possibility to store a message from an audio source allows for a vehicle operator to store an important message while listening to another audio message until the vehicle operator is available to receive the message. The possibility to store and later play the stored message has a number of advantages. It has listening quality advantages, since the vehicle operator can listen to the message when he wants to. It may also have safety advantages if the stored message is very
important and needs the full attention of the vehicle operator or even forces the vehicle operator to take notes or the like of the message. In such a case it is much safer that the vehicle operator stores the message and listens to it when he has stopped the vehicle. The memory circuits have for simplicity reasons been omitted in the drawing.

Further, if an audio source is connected to the system using a signaling bus, the audio source may be paused by the system. The system may then, via the signaling bus, order the audio source to delay presentation of a type of audio message. This has the advantage that no memory for storing messages is needed for these delayed messages. However, real time messages that can not be delayed and messages from audio sources not connected to the signaling bus, such as audio sources installed after the vehicle has been assembled, may not be controlled in this way.

In an embodiment of the present invention, a speech syntheses function is implemented in the vehicle audio message management system, allowing the system to receive, from for instance the navigation system, signals corresponding to text, words and phrases and from these signals put together messages to emit to the vehicle operator. This has the advantage that less signaling has to be performed compared to if the actual audio signals were to be received in the system. The speech syntheses circuits have also been omitted in the drawing. As is clear to a skilled person, the memory and speech syntheses circuitry may be implemented in a number of ways, and may also be integrated in a number of circuits in the system. For instance, they may be integrated in the audio priority device or in another circuit in the system.

The vehicle audio message management system and method for managing audio messages according to the invention may be modified by those skilled in the art, as compared to the exemplary embodiments described above.

As is obvious for a skilled person, a number of other implementations, modifications, variations and/or additions can be made to the above described exemplary embodiments. It is to be understood that the invention includes all such other
implementations, modifications, variations and/or additions which fall within the scope of the claims.
Claims

1. A vehicle audio message management system arranged for selecting when to emit different types of audio messages from at least one audio source, said different types of audio messages having a predetermined presentation order based on predetermined priority levels corresponding to the different types of audio messages, characterized in that said system includes:
   - an input device, arranged for receiving input from a vehicle operator, wherein said input is related to at least one audio message that is to be prevented from being emitted, and
   - a selecting means, arranged for selecting an audio message to be emitted from a queue of at least one audio message waiting to be emitted, and for performing the selection based on said input.

2. Vehicle audio message management system as claimed in claim 1, wherein each of said different types of audio messages originate from different audio sources, each of said audio sources having a predetermined priority level.

3. Vehicle audio message management system as claimed in claim 1, wherein at least two of said different types of audio messages originate from one audio source.

4. Vehicle audio message management system as claimed in claim 1, wherein said system further includes an indicator, arranged for indicating that at least one audio message is waiting to be emitted.

5. Vehicle audio message management system as claimed in claim 4, wherein said indicator is a display arranged for displaying a list including at least said queue of audio messages waiting to be emitted.

6. Vehicle audio message management system as claimed in claim 5, wherein said list further includes the audio message currently being emitted.
7. Vehicle audio message management system as claimed in claim 4, wherein said indicator includes at least one lamp, arranged for being lit when at least one audio message is waiting to be displayed.

8. Vehicle audio message management system as claimed in claim 4, wherein said indicator includes at least one lamp, arranged for being lit in a way that presents information relating to at least one on the following conditions in the group: audio messages waiting, number of audio messages waiting, priority level of audio messages waiting.

9. Vehicle audio message management system as claimed in claim 1, wherein said input device and said selecting means are connected by signaling buses.

10. Vehicle audio message management system as claimed in claim 4, wherein said indicator, said input device and said selecting means are connected by signaling buses.

11. Vehicle audio message management system as claimed in claim 1, wherein said audio sources are connected to the system using signaling buses.

12. Vehicle audio message management system as claimed in any one of claims 9-11, wherein said buses include at least one of the following buses in the group: CAN (Controller Area Network), MOST (Media Oriented Systems Transport), Byteflight, TTCAN (Time Triggered Controller Area Network), Flexray, LIN (Local Interconnected Network).

13. Vehicle audio message management system as claimed in claim 1, wherein said audio sources are connected to the system using low level signal cables.

14. Vehicle audio message management system as claimed in claim 1, wherein said at least one audio source includes at least one of the following audio sources in
the group: radio, CD player, mp3 player, mobile telephone, DVD player, navigation system, radar, Lane Departure Warning (LDW) system.

15. Vehicle audio message management system as claimed in claim 1, wherein said system further includes a storage device including a memory arranged for storing different types of audio messages from said audio sources.

16. Vehicle audio message management system as claimed in claim 1, wherein said system further includes a speech synthesis device arranged for converting non-audio sources into audio sources.

17. A vehicle characterized in that it includes an audio message management system as the one claimed in any one of claims 1-16.

18. Method for managing audio messages in a vehicle by selecting when to emit different types of audio messages from at least one audio source, said different types of audio messages having a predetermined presentation order based on predetermined priority levels corresponding to the different types of audio messages, characterized by:

- if input, related to at least one audio message that is to be prevented from being emitted, is given to the system by a vehicle operator, selecting an audio message to be emitted from a queue of at least one audio message waiting to be emitted, wherein the selection is based on said input.

19. Method as claimed in claim 18, wherein said method further includes the step of indicating, using an indicator, that at least one audio message is waiting to be emitted.

20. Method as claimed in claim 18, wherein said input is generated in an input device including at least one of the following signal generating entities in the group: one button, more than one buttons, rocker switch, scrolling device, joystick.
21. Method as claimed in claim 20, wherein a specific action of said at least one signal generating entity generates an input signal ordering the selecting means to skip the currently emitted audio message and emit the first audio message in said queue.

22. Method as claimed in claim 20, wherein a specific action of said at least one signal generating entity generates an input signal ordering the selecting means to skip the currently emitted audio message and at least one of said audio messages in said queue, thereafter emitting the first audio message in said queue not being skipped.

23. Method as claimed in claim 20, wherein a specific action of said at least one signal generating entity generates an input signal ordering the selecting means to not emit a certain type of audio message.

24. Method as claimed in claim 20, wherein a specific action of said at least one signal generating entity generates an input signal ordering the selecting means to not emit a certain type of audio message during a time period.

25. Method as claimed in any one of claims 23-24, wherein, if the audio source from which said type of audio message not to be emitted originates is connected to the system using a signaling bus, said audio source is via said signaling bus ordered to delay the presentation of said type of audio message.

26. Method as claimed in claim 20, wherein a specific action of said at least one signal generating entity generates an input signal ordering the selecting means to not emit a certain type of audio message from that moment on.

27. Method as claimed in claim 20, wherein a specific action of said at least one signal generating entity generates an input signal ordering the selecting means to return to an audio message previously being emitted or higher up in said queue.
28. Method as claimed in claim 18, wherein said presentation order is reset to said predetermined presentation order after a session or a chosen time period.

29. Computer program, characterised in code means, which when run in a computer causes the computer to execute the method according to any of the claims 18-28.

30. Computer program product including a computer readable medium and a computer program according to claim 29, wherein said computer program is included in the computer readable medium.

31. Computer program product according to claim 30, characterised in that said computer readable medium consists of one or more from the group: ROM (Read-only Memory), PROM (Programmable Read-Only Memory), EPROM (Erasable PROM), Flash memory, EEPROM (Electrically Erasable PROM).
Fig. 5
Start

Input present?

Yes

Select audio message to emit based on input

No
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

[Classification system followed by classification symbols]

**B. FIELDS SEARCHED**

[Minimum documentation searched (classification system followed by classification symbols)]

**IPC: B60R, G06F, H04B, H04R**

[Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched]

**SE, DK, FI, NO classes as above**

**Electronic database consulted during the international search (name of database and, where practicable, search terms used)**

**EPO-INTERNAL, WPI DATA, PAJ**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<tr>
<th>Category</th>
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<tr>
<td>Y</td>
<td>EP 1460769 A1 (PHONAK COMMUNICATIONS AG), Zz Sept 2004 (22.09.2004), paragraph [0007]-[0013], [0028]; [0034]-[0036]; [0039]</td>
<td>1, 2, 4-7, 9-15, 17-31</td>
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<tr>
<td>Y</td>
<td>WO 2005055046 A1 (VOLVO TECHNOLOGY CO), 16 June 2005 (16.06.2005), page 5, line 30 - page 8, line 36; page 11, line 32 - page 13, line 5; page 25, line 16 - line ZZ</td>
<td>1, 2, 9-15, 17, 18, 28-31</td>
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<tr>
<td>Y</td>
<td>WO 03054480 A1 (ROBERT BOSCH GMBH), 3 July 2003 (03.07.2003), page 3, line 5 - line 24; page 5, line 20 - page 7, line 9; page 12, line 13 - page 13, line 3</td>
<td>1, 2, 4-7, 9-14, 17-31</td>
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search: 2 April 2008

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EOiB1/20 (2006.01)
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Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.
<table>
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<th>Application No.</th>
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