Abstract:

The invention relates to a method for commissioning a radio network apparatus for data transfer of a mining vehicle. Information for facilitating the commissioning of a radio network is pre-configured in the radio network apparatus, and the radio network apparatus is arranged to activate base stations installed in the operating region of the mining vehicle by using at least part of the pre-configured information. The method comprises receiving base station identification data from the base stations and indicating to a user those base stations among the pre-configured base stations that are connected to a control device. The activation of the base stations as part of the radio network system is controlled in response to a user input and by using at least some of said pre-configured settings.
FIELD OF THE INVENTION

The invention relates to radio network solutions for mining vehicles and, more particularly, to arranging the commissioning of a radio network system.

BACKGROUND OF THE INVENTION

Modern mining technology comprises automatic and/or remote-controlled working machines, which may be monitored and/or controlled from either the ground surface or underground control stations. Such working machines are mainly various drilling, loading and transport machines. This makes it possible to improve the working environment of the personnel, in particular. A reliable telecommunication system must be arranged between the working machines and one or more devices in the control station, used for monitoring and/or controlling the working machines.

Data transfer for mobile working machines is typically arranged by means of a wireless connection. A required number of base stations are located along the route of a mobile working machine so that it is possible to transfer information, such as control information to the working machine and video images to the control station, between the working machine and the control station continuously. The working machine comprises a terminal for receiving, and typically also for transmitting, at least a radio signal.

Wireless connections may be implemented by proprietary data transfer methods or standardized data transfer techniques. For instance, WLAN (Wireless Local Area Network) techniques standardized by the IEEE (The Institute of Electrical and Electronics Engineers), such as IEEE 802.11 based technology, may be used.

Typically, data transfer solutions in terms of both network topology and configurations are planned and implemented depending on the case by a solution customised for each production environment such that a telecommunication network expert is required. Customised radio network implementations thus require special expertise and time for planning, installing and commissioning a network.
BRIEF DESCRIPTION OF THE INVENTION

It is an object of the invention to develop an improved solution for arranging a radio network for data transfer of mining vehicles. The object of the invention is achieved by an apparatus, method and device that are characterised by what is defined in the independent claims. Some preferred embodiments of the invention are set forth in the dependent claims.

According to an aspect of the invention, information for facilitating commissioning of a radio network is pre-configured in at least part of the apparatus and the apparatus is arranged to activate base stations installed in the operating region of the mining vehicle by using at least part of said pre-configured information, wherein an installation order is defined for the base stations, and a radio channel to be used in each base station is pre-configured in the apparatus, and a control device is arranged to receive, during commissioning of the radio network, base station identification data from base stations installed in the operating region of the mining vehicle, to indicate to a user those base stations among the pre-configured base stations that are connected to the control device on the basis of the received identification data, to receive a user input for activating a base station connected to the control device, and to activate one or more base stations as part of the radio network system in response to said input and by using at least some of said pre-configured settings.

According to a preferred embodiment of the invention, a device-specific address, an identifier indicating the installation order and a radio channel to be used in the base station are pre-configured for each base station in the apparatus. The apparatus is arranged to control the selection of a radio channel for the base station on the basis of the pre-configured radio channel information.

The present arrangement provides the advantage that there is provided a ready pre-configured radio network apparatus entity for data transfer of mining vehicles and suitable for use in different production environments. With the developed solution, commissioning of radio networks becomes easier and faster, which also allows a quicker start of production activities in the operating region of the mining vehicle. Other advantages of the invention and embodiments thereof appear from the following detailed description.
BRIEF DESCRIPTION OF THE FIGURES

The invention will be described in greater detail in connection with preferred embodiments and with reference to the accompanying drawings, in which:

Figure 1 shows a mining vehicle; and

Figure 2 illustrates a telecommunication system according to an embodiment of the invention for arranging data transfer for a mining vehicle; and

Figure 3 illustrates a method according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The present radio network apparatus is suitable for use in data transfer associated with mobile mining equipment required in mining, such as various mobile rock drilling, loading and transport machines. This type of mobile mining equipment is referred to as mining vehicles in the following. Particularly transport devices often move a long way, wherefore a plurality of base stations are required along the route. The scope of application of the invention is not restricted to the telecommunication system described in the following, but may also be applied to other types of systems used for data transfer of mining vehicles. It is also to be noted that a mining vehicle may generally refer to various rock excavation machines used in a surface or underground operating region, which means that the present radio system may also be placed at least partly in surroundings other than an underground mine.

Figure 1 shows a mining vehicle 1, in this example a loading vehicle with a bucket in front for transporting and loading excavated material. The mining vehicle 1 comprises a movable carrier 2 with several wheels 3, of which at least one is a drive wheel that is driven by a motor 4 through transmission 5. Transmission 5 usually comprises a gearbox 6 and required cardan shafts 7, differential gear and other power transmission members for transmitting the rotation torque from the motor 4 to the drive wheels. The mining vehicle 1 is also equipped with a control system that comprises at least one vehicle control device 8 that is arranged to control actuators in the mining vehicle 1 for the purpose of controlling and driving the vehicle.

The mining vehicle 1 may further comprise at least one data transfer unit 9 or a terminal, by which a data transfer connection can be established for
the control device 8 to a radio access network 10 in the mine and further via the radio access network 10 to devices 12 of a control system 11 for the mine. The radio access network 10 comprises a plurality of base stations 13, which are in connection with at least the control system 11 but may also be in connection with one another. It is to be noted that in this application the term ‘base station’ refers to a radio unit. It is possible that one physical device, which may also in some connections be called a base station, comprises a plurality of radio units, i.e. an individual physical device may comprise a plurality of base stations shown in Figure 1. The control system 11 for the mine and the related devices may be located in a control station, which may be arranged outside the mine.

The mining vehicle 1 may be manned, in which case it has a control cabin 14 for the operator. On the other hand, the mining vehicle 1 may be unmanned. An unmanned mining vehicle may be remote-controlled from a separate control station on the basis of, for example, video images formed by a video camera 15, or it may deal with an automatically controlled mining vehicle provided with its own navigation system.

The mining vehicle 1 may comprise means for determining its location. Location data may be transmitted via the radio access network 10 to the control system 11 for the mine. By using the location data the control system 11 for the mine may monitor the moving of the mining vehicle 1 in the mine. Control commands can be transmitted from the control system 11 to the vehicle 1 and at least status information, possibly also video and/or audio data and a safety signal, can be transmitted from the vehicle 1 to the control system 11.

Figure 2 illustrates more specifically a data transfer system according to an embodiment for data transfer of a mining vehicle, such as the mining vehicle 1 of Figure 1. The radio network apparatus comprises a plurality of base stations AP1 - 4, 13a - 13d and at least one control device 20.

The apparatus in connection with the base station 13a - d typically comprises one or more radio terminals, an antenna, an interface to a wired network, and a power supply unit provided with a protective casing that gives a sufficient protection under the mining conditions. It is to be noted that at least some of these devices in connection with the base stations may be separated from one another, for example antenna(s) may be located separately from other base station devices.
The mining vehicle 1 includes a mobile terminal MT 9, which is connected to the control system 8 typically comprising a plurality of control units. Examples of control units in which data transfer may be arranged via the terminal 9 include a safety system, a video transmitter unit, a navigation control unit, a monitoring unit. However, it is clear that these are only some examples of operational and/or structural units possibly used in mining vehicles. For example, the terminal 9 may be connected in an internal data transfer system of the mining machine to a switch, to which control units of the mining vehicle 1 are connected.

According to an embodiment, WLAN technology is applied to data transfer between the terminal 9 and the base stations 13 (typically referred to as WLAN access points). In the present embodiment, data transfer utilises IEEE 802.11 based technology, such as 802.11a/b/g/n. The scope of application of the invention is not bound to any specific radio technology, but the radio network apparatus may be arranged to alternatively or additionally support some other radio technology, such as Wimax technology based on IEEE 802.16 specifications. The IEEE 802.11 specifications specify both the physical layer protocols and the MAC layer protocols for data transfer over the radio interface. For instance, Ethernet data transfer may be used between the wireless network 10 and the control system 11, whereby the devices 13a - d and the telecommunication units 20 to 24 implement at least one of the physical layers and MAC layers according to the IEEE 802.3 specification. The internal data transfer of the mining vehicle may also be based on the Ethernet protocol, for instance, or on the use of a vehicle bus protocol, such as CAN (Controller Area Network).

The control device 20 controls the radio network apparatus and, particularly, the commissioning of the radio network system implemented by the radio network apparatus by using at least some of the functions that will be described in more detail in the following. A functionality of the control device 20 may be implemented by, for example, a general-purpose processor of a data processing device, where a computer program stored in the internal or external memory of the control device 20 is executed. The computer program comprises code for implementing at least some of the features relating to commissioning and controlling a radio network system and illustrated in the following and in connection with Figures 2 and 3. It is also possible to use hardware so-
lutions or a combination of hardware and software solutions for implementing the inventive functions.

In the embodiment to be described next, the control device 20 is a server device. Such a server 20 may further be connected via the data transfer system of the operating region to other units or networks 23, 24, such as via a switch to the control system 11 for the mine. The server 20 may be connected to, for instance, one or more operator workstations used for controlling the mine automation system, a control unit of the safety system of the mine automation system, and/or other control or data transfer devices, such as a router device. However, it is to be noted that the data transfer apparatus may be implemented in various ways differing from the present embodiment, such as by using different devices for controlling the radio network system and for transferring data between the control system 11 used during production activities and the radio network. It is also to be noted that, in the case of a control device, the functions described in the following with reference to the server 20 need not necessarily be implemented in one physical device and/or operational unit, but functions illustrated in the following may be implemented in two or more devices and/or operational units. For instance, a specific functional block may be implemented for one or more phases illustrated in Figure 3.

A ready configured radio network apparatus delivery has now been developed and can be taken into use without network planning in the operational region, requiring special knowledge. Each delivery may comprise a standard radio network apparatus assembly and configuration that may be used in different operating regions. The delivery may comprise at least one server 20 controlling the radio network, and a specific number of base stations 13a to 13d. In the example of Figure 2, the radio network implementation is based on using at least one switch 21, which may also be a part of the radio network apparatus delivery.

At least part of the radio network apparatus is pre-configured for facilitating the mounting and commissioning. According to an embodiment, at least device-specific addresses, such as addresses of the base stations and/or the server 20, are pre-configured in at least part of the apparatus. On the basis of the device-specific addresses of the base stations 13, the server 20 is arranged to at least control one or more base stations 13 connected thereto to be activated as part of the radio network system in response to said input. The
server 20 may also be arranged to detect the base stations connected to the system on the basis of the base station specific addresses.

According to an embodiment, a radio channel to be used in each base station and a base station specific base station identifier for each base station, which is bound to the device-specific address of the base station and indicates the installation order, are pre-configured in the apparatus. This kind of pre-configured radio network assembly is easy to install and commission in the operating region. When the base stations have a predetermined installation order and the successive base stations have radio channel frequency ranges that are preferably far from one another, it is possible to reduce potential interference in data transfer.

The server 20 is arranged to indicate to the user those base stations that are connected to the server, and to receive user inputs to activate the base stations connected to the server. The server 20 is also arranged to use at least part of the pre-configured information for arranging the activation of at least some of the base stations 13a-d that are comprised in the radio network apparatus, installed in the operating region of the mining vehicle and selected by the user. Thus, only some of the base stations of the present radio network apparatus may be taken into use, and it is easier for the user to activate base stations. In the following, various complementary and/or alternative embodiments, which may also be combined in various ways, are illustrated in more detail.

According to an embodiment, the pre-configured apparatus also comprises at least one terminal 9 for the mining vehicle 1. An identifier or address, such as a network address, which is also stored in the server 20, may also be pre-configured for the terminal 9. Other information or settings may also be pre-configured for the terminal 9. The apparatus entity to be delivered to the operating region may also comprise other devices and/or functions, the operation of which may be controlled by information pre-configured in the apparatus. Control information relating to the commissioning of the radio network apparatus of the server 20 may also be pre-configured. For example, the identifiers of the base stations belonging to the apparatus delivery may be pre-stored in the memory of the server 20.

In addition to the above-mentioned device-specific addresses, radio channel settings and base station identifier, other information and settings affecting the operation of the radio network system and used in the apparatus for
commissioning the radio network system may also be pre-configured in the apparatus. For example, one or more of the following may be pre-configured in the apparatus: system configuration parameters, such as a service set identifier (SSID) of the WLAN system, encryption settings, such as WPA (Wi-Fi Protected Access) encryption settings and information, other base station specific and/or mobile terminal 9 specific settings, such as radio transmission power. It is also possible that other than radio network specific settings and information are pre-configured in the apparatus, for example IP network settings.

When the present radio network apparatus needs to be installed in a new operating region, the first step is to install the base stations 13a - d pre-configured from the radio network apparatus delivery and the required cabling in such a manner that the base stations will be set in a predetermined order. The base stations 13a - d are installed simply in their predetermined installation order, for instance in an order AP1, AP2, AP3, etc. with reference to Figure 2. The identifier indicating the installation order is preferably marked directly in a base station casing.

The base stations 13a - d should be installed in such a manner that there is a line-of-sight between the successive base stations, which enables an optimal radio network installation and makes it possible to avoid or at least diminish the need for relocating antennas. According to an embodiment, a base station 13a - d comprises at least two directional antennas, both of which are directed towards the next base station in the tunnel. The delivery may also include appropriate instructions for placing and directing the base stations, also with respect to distances between the locations. With the present arrangement, it is possible to avoid or at least diminish the need for operating site specific radio network plans requiring a telecommunication expert. It is easy to build a wireless network covering the entire operating range and no expertise in telecommunication technology is required from the installer.

After a required number of pre-configured base stations 13a - d, the server 20 and the necessary data transfer means, such as cabling and switches 21, have been installed, the radio network system can be activated by means of a pre-configured network management tool.

According to an embodiment, the server 20 is arranged to implement a configuration application of the radio network apparatus, and access is provided thereto over a data transfer network by one or more computers. Through the configuration application, at least functions relating to the com-
missioning of the radio network apparatus may be provided, but it may also be arranged to provide functions relating to the monitoring and maintenance of the radio network. Thus, the commissioning or monitoring of the radio network system is not restricted to the use of any specific device, such as a workstation in the mine system. According to an embodiment, the server 20 may be provided with a remote configuration connection. The configuration application may be used in such a manner that a connection is established with the address of the server 20 from the computer 25 connected either directly via the unit 24 or via other networks. According to an embodiment, access to the server 20 and the configuration application is provided over an IP network, in which case the connection to the configuration application may be established from the computers 25 connected to the IP network on the basis of the IP address of the server 20.

However, the control of the server 20 functions and the radio network system may also alternatively be arranged in other ways, such as directly via a display connected to the server 20 and input means. It is also to be noted that the use of the configuration application may also be arranged by any computer of the mine system provided with appropriate software and user interface or via a computer locally connected to the server 20 for this purpose.

According to an embodiment, the server 20 comprises a web server functionality and the user interface of the configuration application is implemented as network pages that may be loaded on a browser. The configuration application is arranged to transmit status information on at least some of the radio network apparatus components to the browser as one or more network pages. The configuration application is also arranged to form and transmit a network page, through which at least some of the settings of the radio network apparatus can be changed. In this case, the configuration application may be used by a computer comprising a general-purpose browser, and no special programs, for instance, need be installed in the computer in order to use the configuration application. This kind of solution is also easy to use, and the same user interface may be used in each system delivery.

However, it is to be noted that, instead of the implementation based on network pages used by a browser, the configuration application may also be implemented by other types of techniques. The control unit 20 may be arranged to operate as a server and to provide access to the configuration application (or the configuration application) preferably for general-purpose com-
puters without requiring any special measures or devices. The configuration
application may generally be, for instance, an application downloaded or exe-
cuted over the network and utilising a current or future telecommunication pro-
tocol.

Figure 3 illustrates in a simplified manner and in accordance with an
embodiment main steps in post-installation commissioning of a radio network
system used for data transfer of a mining vehicle. Features presented in con-
nection with Figure 3 may be implemented in, for example, a browser-operated
configuration application of the server 20 without, however, being restricted
thereto in any way.

In step 30, the configuration application is activated. According to
an embodiment, the configuration application transmits a log-in page for inquir-
ing user name and password. One or more user accounts have been pre-
configured in the configuration application, and by using the identifiers of these
accounts the configuration application may be activated in a new operating
region. If, on the basis of the user name and password check, the user has a
right to use the configuration application, a main page can be opened, where
the user may select different functions.

The first step in commissioning the installed base stations is the ac-
tivation of the base stations as part of the radio network system. The configura-
tion application opens a radio network management view and starts to receive
31, either automatically or in response to a user input, identification data, ac-
cording to an embodiment IP addresses of base stations, from the base sta-
tions 13 connected to the system. The pre-configured base stations 13 are
thus arranged to transmit their network addresses or other identification data to
the server 20. On the basis of the received base station identification data and
the identification data pre-configured in the server, the server 20 determines 31
those base stations among the pre-configured base stations 13a - d that are
connected to the server 20, i.e. that are installed as part of the radio network
system.

The view to be displayed to the user is updated in such a manner
that the base stations detected to be connected to the server 20 are indicated
32 to the user. The user interface of the configuration application is arranged to
provide the user with a possibility to activate base stations 13a - d connected
to the server, and the application waits for a user input. For instance, a listing
of base stations installed in the radio network system may be displayed to the
user and, from a dialogue box in connection with the listing, the user may select one base station at a time or all the connected base stations for activation.

The configuration application receives inputs from the user for activating a base station and determines the base stations to be activated on the basis of the received inputs. The server 20 activates 33 the selected base stations as part of the radio network system immediately after the user input, not until all the available base stations have been selected to be activated, or when the user selects the activation of base stations. For each base station to be activated, the server 20 uses pre-configured information associated with the identifier of the respective base station. The server 20 may transmit a control request to the network addresses associated with the identifiers of the base stations 13 to be activated in order to establish a connection with the server 20, to establish a radio connection, and/or to initiate a radio connection standby. Each base station 13 to be activated receives from the server a request directed to its IP address, for example, and performs the activation function in accordance with the request. For instance, the base station 13 may start to use the radio channel determined for it.

After the activation of the base stations, one or more mobile terminals 9 may be activated 34 according to an embodiment, if the mining vehicle 1 is in the coverage area of the radio network system. The user may select the commissioning of a new terminal from the menu of the configuration application, and the server 20 may automatically perform the required configuration measures and establish a connection to the terminal 9 via a suitable, activated base station 13. If the terminal 9 can be configured, the user of the configuration application is indicated that a connection has been established with the mining vehicle.

It is to be noted that Figure 3 is only one example of implementing a functionality relating to commissioning and using pre-configured information of the radio network apparatus. According to another embodiment, step 31 is preceded by a step in which the server 20 starts establishing connections with the base stations connected to the system on the basis of pre-configured information, such as base station specific identifiers or addresses. The base stations 13 with which a connection is established successfully may be indicated 32 to the user.

It is to be noted that pre-configuration information relating to the commissioning of the radio network may be predetermined in the base stations
server 20 and/or some other device belonging to or connectable to the radio network apparatus. For example, setting information of base stations, such as radio channels, may be pre-configured directly in the base stations. According to an alternative embodiment, only a base station identifier and/or a device-specific address is/are pre-configured in each base station. Other configuration information of base stations, such as base station specific radio channels, is transferred in step 33, for example, from the server 20 to the base stations selected to be activated. Thus, base station specific pre-configured information may be stored in the memory of the server. It is also possible that part of the configuration information of the server 20 or the base stations 13 is determined according to the user input.

According to an embodiment, the apparatus, such as the server 20 as part of the configuration application, is arranged to implement a testing tool for analyzing the operation of the activated radio network. The testing tool may be used 35 immediately after step 34, for instance, i.e. after the components of the radio network system have been installed and activated. According to an embodiment, the radio network system may be tested on the basis of driving of the mining vehicle 1. In this case, the testing tool is arranged to receive information describing the radio connection quality while the mining vehicle 1 is driven. This information may be formed on the basis of radio signal measurements performed by the base station. The testing tool forms a view to be displayed to the user and updated to indicate the radio connection quality and the base station with which the terminal of the mining vehicle communicates. An example of available quality information is the signal level, but the testing tool may also be arranged to use other information describing the radio connection quality, such as bit error rate. For example, it is possible to separately indicate in the view, which is the minimum signal level that should be exceeded, or the base stations the signal level of which remains too low at some point of the driving route. Since this view may be presented as a simple signal strength diagram, for instance, no special knowledge of telecommunication technology is required for interpreting the test results.

According to yet another embodiment, the control device 20 is arranged to operate as a network server providing a browser-based test application of the radio network apparatus. In this case, the testing application implemented in the server 20 forms at least one network page to be transmitted to the browser and indicating status of the activated radio network apparatus and
information about its operation, the information being determined in, for example, the above manner on the basis of the driving of the mining vehicle 1. The testing application may be, for instance, a part of the above-described configuration application or connected thereto.

According to an embodiment, the view of the configuration application shows the individual settings for the base stations 13 and the terminal(s) 9, which the user may change. These settings may include at least some of the above-mentioned settings, such as WLAN radio network specific settings. For example, the user may change the transmission signal strength setting after detecting after the testing that the signal level of a base station remains too low.

According to an embodiment, a radio network apparatus specific identifier is pre-configured for the radio network apparatus in order to separate the radio network apparatus from other radio network apparatuses. Many different radio network systems may thus be used in one and the same operating region and, for each base station 13 and terminal 9 belonging to a specific radio network system, an SSID of this radio network system has been defined. When the radio network apparatus is an IEEE 802.11 based WLAN network, the radio network apparatus specific identifier is a service set identifier. Since, according to an embodiment, the radio network apparatus specific identifier may be changed through the configuration application, the radio network apparatus identifier of the terminal 9 of the mining vehicle 1, for instance, may be changed easily when the purpose is to transfer the mining vehicle 1 and the terminal 9 to operate in a new operating site and radio network apparatus.

According to an embodiment, the radio network apparatus may also be connected to a safety system, for which one or more network settings have been pre-configured in the radio network apparatus. The safety system may comprise many different units, for instance, in connection with an operator station, in an operating region and in a mining vehicle, for each one of which network settings, such as a fixed IP address, may be defined. Settings may also be pre-configured for other units to be connected to the radio network apparatus.

According to yet another embodiment, the device-specific settings of the radio network apparatus may be stored from a network device, such as a base station 13, into the memory of the server 20, for example. The settings that were changed typically during the network testing in order to optimize the
network can thus be backed up and transferred easily to a substitutive network device, if the original network device becomes defective. The configuration application implemented by the server 20 may also be arranged to detect new devices added to the network and to notify the user of the new devices.

It is obvious to a person skilled in the art that, as technology advances, the basic idea of the invention may be implemented in many different ways. The invention and its embodiments are thus not restricted to the examples described above, but may vary within the scope of the claims.
CLAIMS

1. An apparatus for arranging data transfer for a mining vehicle, the apparatus comprising a plurality of base stations and a control device, characterized in that information for facilitating commissioning of a radio network is pre-configured in at least part of the apparatus and the apparatus is arranged to activate base stations installed in the operating region of the mining vehicle by using at least part of said pre-configured information, wherein an installation order is defined for the base stations, and a radio channel to be used in each base station is pre-configured in the apparatus, and the control device is arranged to receive, during the commissioning of the radio network, base station identification data from base stations installed in the operating region of the mining vehicle (31), to indicate to a user those base stations among the pre-configured base stations that are connected to the control device on the basis of the received identification data (32), to receive a user input for activating a base station connected to the control device, and to activate one or more base stations as part of the radio network system in response to said input and by using at least some of said pre-configured settings (33).

2. An apparatus as claimed in claim 1, wherein a device-specific address is pre-configured for each base station in the apparatus.

3. An apparatus as claimed in any one of the preceding claims, wherein the apparatus comprises a network server (20) arranged to provide a browser-based configuration application of the apparatus, the user interface of the configuration application being implemented as network pages loadable on a browser, and the configuration application being arranged to transmit to the server status information on at least some of the radio network apparatus components and a network page, through which at least some of the settings of the apparatus may be changed.

4. An apparatus as claimed in any one of the preceding claims, wherein the apparatus comprises at least one terminal for the mining vehicle, for which at least one terminal at least one network setting has been pre-configured.
5. An apparatus as claimed in any one of the preceding claims, wherein the apparatus is arranged to provide a testing tool for analysing the operation of the activated radio network, the testing tool being arranged:

- to receive information indicative of radio connection quality while the mining vehicle is driven, and
- to update a view to be displayed to the user to indicate the radio connection quality and the base station with which the terminal of the mining vehicle communicates.

6. An apparatus as claimed in any one of the preceding claims, wherein a radio network apparatus specific identifier is pre-configured for the apparatus to separate the apparatus from other radio network apparatuses.

7. A method for commissioning a radio network apparatus for data transfer of a mining vehicle, the radio network apparatus comprising a plurality of base stations and a control device, characterized in that information for facilitating the commissioning of a radio network is pre-configured in at least part of the radio network apparatus and the radio network apparatus is arranged to activate base stations installed in the operating region of the mining vehicle by using at least part of said pre-configured information, wherein an installation order is defined for the base stations, and a radio channel to be used in each base station is pre-configured in the apparatus, the method comprising:

- receiving, during the commissioning of the radio network, base station identification data from base stations installed in the operating region of the mining vehicle (31),
- indicating to a user those base stations among the pre-configured base stations that are connected to the control device on the basis of the received identification data (32),
- receiving user inputs for activating a base station connected to the control device, and
- controlling the activation of one or more base stations as part of the radio network system in response to said input and by using at least some of said pre-configured settings (33).

8. A method as claimed in claim 7, wherein a device-specific address is pre-configured for each base station in the radio network apparatus.

9. A method as claimed in claim 7 or 8, wherein a network server (20) provides a browser-based configuration application of the radio network
apparatus, the user interface of the configuration application being loaded on a browser as network pages, and comprising transmitting to the server status information on at least some of the radio network apparatus components and a network page, through which at least some of the settings of the radio network apparatus may be changed.

10. A method as claimed in any one of claims 7 to 9, comprising receiving information indicative of radio connection quality while the mining vehicle is driven, and updating a view to be displayed to the user to indicate the radio connection quality and the base station with which the terminal of the mining vehicle communicates.

11. A control device (20) for a radio network system for arranging data transfer of a mining vehicle, characterized in that the control device (20) is arranged to execute the steps of the method defined in any one of claims 7 to 10.

12. A computer program, characterized in that it comprises computer program code means arranged to execute the steps of the method defined in any one of claims 7 to 10, when said program is executed in a computer.
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Activation of configuration tool of radio network apparatus of mining vehicle

Receive identification data from base stations and determine available base stations

Indicate selectable base stations of radio network system on the basis of user input and pre-configured information

Activation of base stations of radio network system on the basis of user input and pre-configured information

Activation of mobile terminal(s)

Testing of radio network system and use thereof for data transfer

FIG. 3
### A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04W, H04L, H04B, H04Q

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

FI, SE, NO, DK

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

EPO-Internal

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>

* Special categories of cited documents:
  
  "A" document defining the general state of the art which is not considered to be of particular relevance
  
  "E" earlier application or patent but published on or after the international filing date
  
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  
  "O" document referring to an oral disclosure, use, exhibition or other means
  
  "P" document published prior to the international filing date but later than the priority date claimed
  
  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  
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## INTERNATIONAL SEARCH REPORT
### Information on patent family members

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<tbody>
<tr>
<td></td>
<td></td>
<td>ZA 9504385 A</td>
<td>29/01/1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 1154195 A</td>
<td>09/07/1997</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2191449 A 1</td>
<td>07/12/1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 2557295 A</td>
<td>21/01/1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 708751 B B2</td>
<td>12/08/1999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AT 275805T T</td>
<td>15/09/2004</td>
</tr>
<tr>
<td>US 2008159244 A 1</td>
<td>03/07/2008</td>
<td>ZA 200707906 A</td>
<td>25/02/2009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EA 200701697 A 1</td>
<td>28/02/2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2006086906 A 1</td>
<td>24/08/2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2597507 A 1</td>
<td>24/08/2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 2006215969 A 1</td>
<td>24/08/2006</td>
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<td></td>
<td>AT 436132T T</td>
<td>15/07/2009</td>
</tr>
<tr>
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<td>EP 2238758 A 2</td>
<td>13/10/2010</td>
</tr>
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CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

**H04W 88/00** (2009.01)
**H04W 84/12** (2009.01)
**H04L 12/28** (2006.01)