

Description

FIELD OF INVENTION

This invention relates to cellular mobile radio systems having radio channels for transmitting digital or digitized information between base and mobile stations by transmitting digitally modulated radio signals in time multiplex. More precisely the invention relates to a handover method whereby the responsibility for communication with a mobile having a connection established on a radio channel is handed over from one base station to another target base station. The invention also relates to a base station and mobile station comprising means for communication and handoff.

BACKGROUND OF THE INVENTION

In cellular mobile radio systems it is fundamental that a mobile with an established connection on a radio channel should be able to maintain the established connection when moving from one cell served by one base station to another cell served by another base station. It is also highly desirable that a mobile with an established connection on a radio channel shall be able to maintain the established connection when moving within the same cell and the radio channel used is subject to increased interference. The process by which a mobile can be able to maintain an established connection when moving within the cells of a cellular radio system is generally called handoff.

In general a radio communication is only possible when the desired information carrying radio signals have a sufficient signal strength at the receiver and are sufficiently strong in relation to noise and interfering radio signals at the receiver. The minimum strength of course depends on the particular features of the system, e.g. the kind of modulation and receiver used. In order to make sure an established connection may continue on an intended radio channel between a mobile and an intended base station a hand-off process comprises some kind of measurements on radio signals at the intended base and/or mobile station.

The first cellular mobile radio systems in public use were analogue systems for speech or other analogue information. The systems comprised multiple radio channels for transmitting analogue information between base and mobile stations by transmitting analogously modulated radio signals. In general the first cellular mobile radio systems had comparatively large cells. In general the signal measurements in the handoff process in such systems were performed by the base stations. One such system is the Nordic Mobile Telephone system NMT 450. Another known cellular mobile radio system of particular interest as a background to the present invention is the AMPS mobile radio system in USA.

Recently digital cellular mobile radio systems for public use have been designed. Digital cellular mobile radio systems comprise digital radio channels for transmitting digital or digitized analogue information between base and mobile stations by transmitting digitally modulated radio signals. Digital cellular mobile radio systems may offer substantial advantages over analogue cellular mobile radio systems. To achieve these advantages there are certain demands. In particular channel supervision must be frequent and the handoff process must be rapid and be allowed to be frequent in relation to old analogue systems.

One digital mobile radio system intended to be a common system for many European countries is the GSM system. In European countries already having an analogue cellular mobile system, the new digital GSM system is intended to be introduced as a new system independent of any old existing analogue system. The GSM system base and mobile stations have not been designed to be compatible with old existing systems but to give optimum performances in various aspects all by itself. Accordingly there has been a comparatively great freedom of choice in technical matters when designing the GSM system. In particular this is true with the handoff method in the GSM system. In the GSM system measurements for the purpose of handoff are done both by base and mobile station.

Contrary to introducing a new independent digital cellular mobile radio system like the GSM system in an area with an existing analogue cellular system, it has been proposed to introduce a digital cellular mobile radio system designed for cooperation with the existing analogue cellular mobile radio system. To obtain digital radio channels within the frequency band allotted to cellular mobile radio systems it is proposed to reserve a number of radio channels allotted to present analogue mobile radio systems and use them in the digital cellular mobile radio system. Due to the proposed design of the digital mobile radio system three or possibly six digital radio channels may use in time division multiplex the frequency band of one previous analogue radio channel. Accordingly replacing some analogue channels by multiple digital radio channels in time division may increase the total number of radio channels in the joint analogue and digital systems.

The present invention is directed to a handoff method in a dual mode cellular radio system of the above mentioned kind. Before making a hand-off, it is necessary to determine the best radio channel from a number of radio channels available from candidate base stations and to which the call in progress should be handed off. It is previously known by e.g. EP 0 241 954 A2 a method to measure the field strength or the signal strength of the candidate base stations in the mobile station and to give the result of the measurements to the home base station in order to decide which one of the candidate base stations has the best

radio channel for hand-off. This method is applied to a pure digital radio system and not as in the present invention to a dual mode radio system in which both analog and digital channels are available.

The intention is to gradually introduce the digital system and with time gradually increase the number of digital channels and decrease the number of analogue channels in the coexisting cellular systems. Analogue mobiles already in use shall be able to continue to use remaining analogue channels. New digital mobiles shall be able to use new digital channels. New dual-mode mobiles shall be able to use both remaining analogue channels and new digital channels. In such a system the handoff process for digital radio channels can not simply be selected to be identical with any handoff process for any digital system, e.g. the GSM system. The handoff process for digital channels must not interfere with the handoff process of the existing analogue system and must not require amendments of signals in the analogue system. There are special advantages if some control channels or signals from base stations may be used for various purposes in both the analogue and the digital system. The present invention aims at such a handoff method. The invention also aims at a base station and a mobile station comprising means or communication and performing such handover for digital channels.

SUMMARY OF THE INVENTION

This invention aims at a method of communication and a handoff method particularly suitable for a cellular mobile radio system comprising base stations, mobile stations, radio channels for transmitting analogue information between mobile stations and base stations by transmitting analogously modulated radio signals, radio channels for transmitting digital or digilized information between mobile and base stations by transmitting digitally modulated radio signals in time division multiplex, and control channels for transmitting control information between base and mobile stations.

One object of the present invention is to enable a handoff method for the digital part of a joint digital and analogue cellular mobile radio system, the hand-off method not interfering with the analogue part of the joint cellular mobile radio system.

Another object of the present invention is to enable a handoff method for a new digital cellular mobile radio system to be used in coexistence with an old analogue cellular mobile radio system, whereby the digital system may use base station control channels or signals of the analogue system with minimum amendment of control signals in the analogue system.

Yet another object of the present invention is to achieve a communication and handoff method for digital radio channels in a cellular mobile radio system

where the burden of measurements of radio signal strength and quality are shared by mobile and base stations.

Still another object of the present invention is to achieve a handoff method for a cellular mobile radio system having both analogue and digital radio channels whereby dual-mode mobiles can easily change from a digital to an analogue radio channel in connection with handoff.

The invention also has the object of providing means for convenient handoff for connections on digital communication channels sharing radio channels in time division multiplex.

In brief a handoff method according to the present invention normally comprises the following steps for time division multiple access communication channels:

At setup of a connection, the base station responsible for the communication with a particular mobile station transmits to the mobile station information on a particular radio channel and a particular time slot identifier code to be used for the connection and a plurality of selected radio channels. After handoff, the new base station responsible for the communication transmits to the particular mobile station a new plurality of selected radio channels.

The mobile station transmits the particular time slot identifier code with radio signals in each time slot of the digital communication channel of the connection during the course of the connection.

The particular mobile station measures the strength of radio signals received on the selected radio channels and the signal strength on the digital communication channel used for the connection of the mobile station.

The particular mobile station transmits regularly to the responsible base station results of measurements of signal strength at the particular mobile station.

The base station responsible for the communication with the particular mobile station measures the signal strength on the digital communication channel used for the connection of the mobile station.

The results of the measurements done at the responsible base station and the received results from the particular mobile station are processed and analyzed and compared with criteria for handoff.

A target base station assumed suitable for being responsible for the communication with the particular mobile station is determined when, according to the processing and analyzing and comparing, a handover ought to be done. The target base station is supplied with information on radio channel and time slot identifier code of the digital communication channel of the established connection of the particular mobile station and is requested to measure signal strength on the digital communication channel.

The supplied information on radio channel and

time slot identifier code is used at the target base station for finding the digital communication channel of the established connection of the particular mobile station and measuring signal strength on the digital communication channel.

The target base station reports the results of the measurements of signal strength on the digital communication channel.

A decision is then made whether the handoff shall be performed in view of the report from the target base station and the target base station and the particular mobile station are informed when the handoff shall be performed and what radio channel and time slot identifier code to be used by the particular mobile station for the established connection after the handoff.

After the particular mobile station has received information that handoff shall be performed, the time slot identifier code is used by the particular mobile station to find the correct time slots and the particular mobile station thereafter transmits radio signals comprising the time slot identifier code on the radio channel.

After receiving information that a handoff shall be performed and information on radio channel and time slot identifier to be used by the particular mobile station, the target base station checks the appearance of radio signals comprising the time slot identifier code on the radio channel.

Finally the selected target base station reports to the mobile switching centre the results of the checking of the new particular code in radio signals received by the target base station.

THE DRAWINGS

Figure 1 illustrates part of a cellular mobile radio system with cells, a mobile switching centre, base stations and mobile stations.

Figure 2 illustrates a plurality of radio channels within a frequency band and use of some radio channels in a cellular mobile radio system according to figure 1.

Figure 3 illustrates use of radio channels according to figure 2 for control channels, analogue communication channels and time division multiplex digital communication channels in a cellular mobile radio system according to figure 1.

Figure 4 illustrates bursts separated by guard spaces on a radio channel used for digital communication channels in time division multiplex according to figure 3 in a cellular mobile radio system according to figure 1.

Figure 5 illustrates a base station in a cellular mobile radio system according to figure 1 with radio channels used according to figures 2 to 4.

Figure 6 illustrates a mobile station in a cellular mobile radio system according to figure 1 for commu-

nication with a base station according to figure 5 on control and digital communication channels according to figures 2 to 4.

DETAILED DESCRIPTION OF EMBODIMENTS

Figure 1 illustrates ten cells C1 to C10 in a cellular mobile radio system. Normally a method and means according to the invention are implemented in a cellular mobile radio system comprising many more cells than ten. However for the purpose of explaining the invention ten cells may be sufficient.

For each cell C1 to C10 there is a base station B1 to B10 with the same number as the cell. Figure 1 illustrates base stations situated in the vicinity of cell centre and having omnidirectional antennas. The base stations of adjacent cells may however be collocated in the vicinity of cell borders and have directional antennas as is well known to those skilled in the art.

Figure 1 also illustrates ten mobile stations M1 to M10 movable within a cell to another cell. Normally a method and means according to the invention are implemented in a cellular mobile radio systems comprising many more mobile stations than ten. In particular the mobile stations are normally many times as many as the base station. However for the purpose of explaining the invention ten mobile stations may be sufficient.

Also illustrated in Figure 1 is a mobile switching centre MSC. The mobile switching centre illustrated in Figure 1 is connected to all ten illustrated base stations by cables. The mobile switching centre is connected by cables also to a fixed public switching telephone network or similar fixed network with ISDN facilities. All cables from the mobile switching centre to base stations and cables to the fixed network are not illustrated.

In addition to the mobile switching centre illustrated there may be another mobile switching centre connected by cables to other base stations than those illustrated in Figure 1. Instead of cables other means may be used for base to mobile switching center communication, e.g. fixed radio links.

The cellular mobile radio system illustrated in Figure 1 comprises a plurality of radio channels for communication. The system is designed both for analogue information, e.g. speech, digitized analogue information, e.g. digitized speech, and pure digital information, e.g. pure data. In this application the term connection is used for a communication channel between a mobile station and another mobile station in the same system or another system or a fixed telephone or terminal in a fixed network connected to the cellular mobile radio system. Thus a connection may be a call where two persons talk to each other but may also be a data communication channel where computers exchange data.

Figure 2 illustrates somewhat simplified a plural-

ity of radio channels RCH1 to RCH2N withing a frequency band. A first group of radio channels RCH1 to RCHN are used in the cellular mobile radio system for transmission of radio signals from base stations to mobile stations. A second group of radio channels RCHN+1 to RCH2N are used in the cellular mobile radio system for transmission of radio signals from mobile stations to base stations.

Some of the radio channels are used for control channels. Normally each base station has at least one control channel. Normally a control channel is not used for transfer of information on a connection but for monitoring and control of mobiles during setup of a connection, maintaining an established connection and handoff of an established connection. In Figure 3 is illustrated how the radio channel RCHf all the time is used for a control channel CCHk while the radio channel RCHg all the time is used for a control channel CCHr.

Some of the radio channels are used for analogue communication channels. Normally analogue communication channels are used for connections where analogue information is exchanged, e.g. telephone calls where two persons talk to each other. Normally one analogue communication channel is required for each such connection. When a radio channel is used for an analogue communication channel the information on the connection is transmitted with analogously modulated radio signals. In addition to the information on the connection the analogue communication channel may also be used for associated information, e.g. a supervisory audio tone. In figure 3 is illustrated how the radio channel RCHa all the time is used for an analogue communication channel ACHi while the radio channel RCHb all the time is used for an analogue communication channel ACHv. Normally each base station has at least one radio channel used for analogue communication channel.

Some of the radio channels are used for digital communication channels. Normally digital communication channels are used for connections where digital or digitized information is exchanged, e.g. data or digitized speech. The radio channels used for digital communication channels are divided into time slots and the time slots are grouped in frames. The time slots are allotted to digital communication channels whereby multiple digital channels share a common radio channel in time division multiplex. In figure 3 is illustrated a radio channel RCHc having three time slots in each frame F. A first of the time slots is allotted to the digital communication channel DCH4, a second of the time slots is allotted to the digital communication DCH5 and the third of the time slots is allotted to the digital communication channel DCH6. Thus the radio channel RCHc is used for three digital communication channels. Figure 3 also illustrates how the radio channel RCHd is used for three digital communication channels DCH7, DCH8 and DCH9 in

a corresponding way.

In figure 3 the frames F of radio channels RCHc and RCHd have three time slots. Depending on the required bandwidth of the various digital communication channels it is conceivable to have less slots in a frame, e.g. two slots, or to have more slots in a frame, e.g. six slots. When the digital communication channels are used for connections where digitized speech is exchanged, six time slots may give too poor speech quality when the radio channel bandwidth is 30 kHz.

On a radio channel used for digital communication channels the base or mobile station transmits a time slot identifier code with the radio signals at least in every time slot used for a connection. On a particular radio channel, e.g. RCHc, the time slot identifier codes in different time slots are different. Thus the time slot identifier code TI1 is transmitted in the first time slot of radio channel RCHc allotted to digital communication channel DCH4. The time slot identifier code TI2 is transmitted in the second time slot of radio channel RCHc allotted to digital communication channel DCH5. The time slot identifier code TI3 is transmitted in the third time slot allotted to digital communication channel DCH6. Neither base nor mobile station transmits any frame synchronisation signal on the radio channel.

The same time slot identifier codes may be used on two or more radio channels, possibly all radio channels. Figure 3 illustrates how the time slot identifier TI1 is transmitted in the first time slot of radio channel RCHd allotted to digital communication channel DCH7. The time slot identifier code TI2 is transmitted in the second time slot of radio channel RCHd allotted to digital communication channel DCH8. The time slot identifier code TI3 is transmitted in the third time slot of radio channel RCHd allowed to digital communication channel DCH9. Thus the time slot identifier code does not alone identify the channel but identifies the time slot in a frame. It is conceivable to have one set of time slot identifier codes TI1 to TI3 for channels with three slot frames F and have a different set of time slot identifier codes TI4 to TI9 for six slots frames whereby the time slot identifier code also may indicate the number of slots in a frame of the radio channel.

On a radio channel used for digital radio channels is also transmitted a digital voice colour code with the radio signals at least in each time slot used for a connection. On a particular radio channel the same digital voice colour code is transmitted with the radio signals in different time slots. Figure 3 illustrates the transmission of the same digital voice colour code VC1 in all time slots of the radio channel RCHc. Normally the same digital voice colour code is used for all radio channels to and from a particular base station, e.g. the digital voice colour code VC1 is used for all radio channels to and from base station B1.

Some adjacent base stations may use the same

digital voice colour code e.g. base stations B2, B6 and B7 may use the same digital voice colour code as base station B1. Other base stations use a different digital voice colour code, e.g. base stations B4, B5, B9 and B10 all use the digital colour code VC4. Still other base stations use another different digital voice colour code, e.g. base stations B3 and B8 use the digital voice colour code VC7.

The radio signals on a radio channel used for time division multiplex digital communication channels are transmitted in bursts. Figure 4 illustrates a burst in a time slot separated by guard spaces from the end of the preceding burst and the beginning of a succeeding burst in adjacent time slots.

A transmitted burst comprises at least a time slot identifier code, abbreviated TI, and a digital voice colour code, abbreviated VC, and normally also information to be forwarded to the other part of the connection as well as connection or channel associated information for control or monitoring purposes.

The time slot identifier code is a binary word of many bits, e.g. 26 bits. It is well known to those skilled in the art that there is a need for receiver synchronisation in time division multiple access radio communication systems. For this purpose it is well known to transmit synchronisation words or patterns in each burst and to transmit particular frame synchronisation words or patterns from a master or base station to a slave or mobile station. Preferably the time slot identifier code according to the present invention may also be used for synchronisation of receiver to transmitter.

Theoretically there exist a number of uncorrelated binary multi bit words, e.g. 26 bit words, which may be used as different synchronisation words. According to the present invention one unique time slot identifier code and synchronisation word is required for each time slot in a frame on the channel. For the purpose of both time slot identification and synchronisation the time slot identifier code words are to be chosen for minimum correlation between each other and between themselves except for correlation to themselves in phase. Thus a first time slot identifier code used to identify the first time slot of a frame according to the present invention and to synchronize receiver to transmitter shall exhibit low correlation to an identical code when substantially out of phase but exhibit high correlation to an identical code when substantially in phase. A second time slot identifier code used to identify the second time slot of a frame and to synchronize receiver to transmitter shall also exhibit low correlation to an identical code when out of phase but exhibit high correlation to an identical code when substantially in phase. All other time slot identifier codes used on the channel should also exhibit low correlation to an identical code when out of phase but exhibit high correlation to an identical code when in phase. Any time slot identifier code used on the channel

should also exhibit low correlation to any other time slot identifier code used on the channel irrespective of phase relationship, i.e. of in phase or out of phase. Selecting time slot identifier codes in this way means that the implementation of time slot identifier codes according to the present invention does not require any dedicated bits for the time slot identifier codes.

Once the requirements on time slot identifier codes are given, one skilled in the art will be able to select proper time slot identifier codes without any inventive activity. However for the convenience of those not skilled in the art the following eight 26 bit words are given as examples of possible time slot identifier codes for an eight slot frame:

code for time slot 1:

(0,0,1,0,0,1,0,1,1,1,0,0,0,0,1,0,0,1,0,1,1,1)

code for time slot 2:

(0,0,1,0,1,1,0,1,1,1,0,1,1,1,0,0,0,1,0,1,1,0,1,1,1)

code for time slot 3:

(0,1,0,0,0,0,1,1,1,0,1,1,1,0,1,0,0,1,0,0,0,0,1,1,1,0)

code for time slot 4:

(0,1,0,0,0,1,1,1,1,0,1,1,0,1,0,0,0,1,0,0,0,1,1,1,1,0)

code for time slot 5:

(0,0,0,1,1,0,1,0,1,1,1,0,0,1,0,0,0,0,0,1,1,0,1,0,1,1)

code for time slot 6:

(0,1,0,0,1,1,1,0,1,0,1,1,0,0,0,0,0,1,0,0,1,1,1,0,1,0)

code for time slot 7:

(1,0,1,0,0,1,1,1,1,0,1,1,0,0,0,1,0,1,0,0,1,1,1,1,1,1)

code for time slot 8:

(1,1,1,0,1,1,1,1,0,0,0,1,0,0,1,0,1,1,1,0,1,1,1,0,0,0)

When there are less than eight time slots in a frame on the radio channel less than all of the given code words may be used. However there may be advantages in using other than the given code words when there are only three time slots in a frame.

It is of course conceivable to use binary time slot identifier codes having more or less than 26 bits. Longer code words offer some advantages but have the disadvantage of occupying more of the available space in a burst.

In the advanced mobile phone service system, abbreviated AMPS, there is a supervisory audio tone, abbreviated SAT, transmitted e.g. on analog communication channels. The reason for transmitting the SAT in AMPS is that in an interference limited mobile radio communication network there should be some means for the receiving entity (e.g. base station) to identify the transmitting entity (e.g. mobile station) or at least with high likelihood exclude interchange of transmitter entity without the need for continuous transmission of transmitter identity. The object of the digital voice colour code in a cellular mobile radio system according to the present invention is at least partly the same as that of SAT in AMPS. The number of different SATs is three in AMPS. The number of different digital voice colour codes in a cellular mobile radio system according to the present invention is preferably much higher than three, mainly to support a

proper introduction of discontinuous transmission. Preferably the digital voice colour code is a binary word having eight bits, enabling theoretically 256 different voice colour codes.

Discontinuous transmission is a power saving function in hand held mobile stations. The basic idea behind the function is that there is no need to have the mobile transmitter on when the mobile user is not talking or transmitting any data on a connection. In a cellular system with channel reuse limited by interference this implies that the carrier of a mobile party to a connection suddenly disappears at the base station receiver and the burst of a possible interfering mobile using the same radio channel and time slot suddenly appears alone on the radio channel at the base station responsible for the connection. If the bursts of such an interfering mobile do not comprise a different digital voice colour code than the burst of the silent mobile station party to the connection, the responsible base station party to the connection will not be able to distinguish the bursts of the interferer from those of the silent mobile actually party to the connection. Provided the signal strength of the interferer is sufficient the other party to the connection (not the silent mobile) will then overhear the conversation or data of the interferer. Accordingly the number of different digital colour codes should be high enough to guarantee that cells where the same radio channels are used and having the same colour code are at a distance from each other sufficient not to cause co-channel interference. In case discontinuous transmission is used the disturbing signal should not significantly exceed the level of noise. For this purpose an eleven bit colour code seems quite sufficient in normal cases. However the longer the colour code is the more space is required in the control channel in the connection setup and handoff procedures. Considering the possible load on control channels eight bit digital voice codes seems to be a good compromise.

A separate digital voice colour code requires space in a burst thus reducing the space available for speech or data on the connection. However the following implementation of voice code does not require any dedicated bits for the digital voice code in a burst on a digital communication channel.

At the transmitting side the digital voice colour code is added bit by bit modulo two to a field under error detection but without error correction within the information part of the burst after channel coding. On the receiving side the bursts in the time slots are deinterleaved and checked. This check is done by adding bit by bit the known digital voice colour code modulo two, as is done at the transmitting side, before channel decoding and error detection. If no error is found after adding the digital voice colour code modulo two the information part of the burst was sent from the expected transmitter and not from an interferer.

Figure 5 illustrates a base station in a cellular mobile radio system according to figure 1 with radio channels according to figures 2 to 4. The base station is designed for transmission and reception on a plurality of radio channels used for digital communication channels, analog communication channels and control channels. In figure 5 not all base station equipment for all channels is illustrated. Normally a base station has equipment for more channels, in particular analogue communication channels, as well as other equipment for power supply, maintenance etc. but the illustrated equipment is believed sufficient for the understanding of the present invention.

The base station is connected to a mobile switching centre by six trunks. A first incoming trunk for digital communication channels is connected to a digital trunk demultiplexor and interface DMU-D. A second incoming trunk for analog communication channels is connected to an analog trunk interface and demultiplexor DMU-A. A third incoming trunk for control channels and base station control information is connected to a trunk interface and control information demultiplexor DMU-C. A first outgoing trunk for digital communication channels is connected to a digital multiplexor and trunk interface MUX-D. A second outgoing trunk for analog communication channels is connected to an analog multiplexor and trunk interface MUX-A. A third outgoing trunk for control channels and base station information is connected to a control information multiplexor and trunk interface MUX-C.

For each of the outgoing radio channels used for digital communication channels the base station comprises digital channel coding means, DCC, connected to the digital trunk demultiplexor and interface, DMU-D, modulo two adding means, M2A, burst generation means, BG, modulator means, MOD, and power amplification means, PA, connected to an antenna. Two such outgoing radio channels share a digital voice colour code means, VCS, connected to their modulo two adding means. Two such outgoing radio channels also share a time slot identifier code means, TIS, connected to their burst generators.

For each of the outgoing radio channels used for analog communication channels the base station comprises analog transmission channel processing means, ATC, connected to an analog trunk interface and demultiplexor, DMU-A, modulator means, MOD, and power amplification means, PA, connected to an antenna.

For each of the outgoing radio channels used for control channels the base station comprises outgoing control channel processing means, CTC, connected to the trunk interface and control information demultiplexor, DMU-C, modulator means, MOD, and power amplification means, PA, connected to an antenna.

For each incoming radio channel used for digital communication channels the base station comprises

radio receiver means, REC, connected to an antenna, radio signal strength or level measuring means, SLM, analog to digital conversion means, A/D, multipath equalizer and burst synchronizing and time slot recognition and automatic frequency control means, EQ-AFC, modulo two adding means, M2A and digital channel decoder means, DCD, connected to a digital multiplexor and trunk interface, MUX-D.

Two incoming radio channels used for digital communication share digital voice colour code means, VCS, connected to their modulo two adding means. Two such incoming radio channels also share digital channel bit error measuring means, BEM, connected to their digital channel decoders, DCD.

For each incoming radio channel used for analog communication channels the base station comprises radio receiver means, REC, connected to an antenna, radio signal strength or level measuring means, SLM, and incoming analog channel processing means, ARC, connected to an analog multiplexor and trunk interface, MUX-A.

For each incoming radio channel used for control channel the base station comprises radio receiver means, REC, connected to an antenna, radio signal strength or level measuring means, SLM, and incoming control channel processing means, CRC, connected to the control information multiplexor and trunk interface, MUX-C.

All modulation means and radio receiver means are connected to frequency synthesizer means, FS. The frequency synthesizer means are controlled by a central processor CP. The CP also controls the DCCs, VCSs, BGs, EQ-AFCs, DCDs, BEM, ATC, ARC, CTC, CRC, and MUX-C. Preferably the central processor CP is not the only processor in the base station but other means may also comprise processors, in particular the ATC, ARC, CTC, CRC and EQ-AFCs.

The base station according to Figure 5 is intended for communication with mobile stations only having equipment designed for analog communication channels and control channels. The base station is also intended for communication with mobile stations only having equipment for digital communication channels and control channels. The base station is also intended for communication with dual mode mobile stations designed for communication on both analog and digital communication channels as well as control channels. Mobile stations designed only for analog communication channels may be of a kind well known to those skilled in the art and operate according to AMPS standard. Accordingly there is no need for disclosing such a mobile or its operation here.

Figure 6 illustrates a mobile station in a cellular mobile radio system according to Figure 1 for communication with a base station according to figure 5 on radio channels according to figures 2 to 4.

The mobile station comprises a microphone con-

nected to analog to digital speech coding means SC for coding speech or sound into a binary code with a bitrate or bandwidth less than 11kHz, preferably about 7 to 8 kHz. Connected to the speech coding means is channel coding means CC for interleaved error protecting coding of the digital information from the speech coder SC. The channel coder CC is connected to a modulo two adder MT1 for modulo two adding of a digital voice colour code to the digital information from the channel coder CC. The modulo two adding means MT1 are connected to a burst generator BR for collecting information to be transmitted in a burst and arranging the information including a time slot identifier code into a proper burst. When the mobile is used for data transmission on a connection or during connection setup the burst generator BR puts data and/or control information in the burst instead of digitized speech. Such information may be supplied from a keyboard DP via a microprocessor CPM and the channel coder CC or directly from the microprocessor CPM. A modulator MD is connected to the burst generator BR for receiving digital information to be modulated on a radio frequency carrier from a frequency synthesizer FS and be amplified in a power amplifier PW. The modulation method used may be continuous phase modulation or other types suitable for digital information transmission. The power amplifier PW is connected to an antenna via a duplexer DU and is controlled from the microprocessor CPM.

The mobile station also comprises a radio receiver RM connected to the duplexer DU, a radio signal strength or level measuring means RLM and analog to digital conversion means AP. The radio receiver comprises RF and IF stages with filter, demodulator etc. Means EQ for equalizing the digital communication channel and automatic frequency control and automatic gain control are connected to the radio receiver RM output and the input of a modulo two adder MT2. The modulo two adder MT2 adds a digital voice colour code modulo two to the digital information from the equalizer EQ. The modulo two adder output is connected to a channel decoder CD for deinterleaving and error detection and correction of digital information from the modulo two adder MT2. Means SD for converting digital information to analog information or speech are connected to the channel decoder CD and a loud-speaker.

When the mobile station is tuned to a radio channel used by a base station for control channel some of the equipment of the mobile station is not used, in particular not channel and speech decoder CC, CD. When control and monitoring information is transmitted from the base station on the control channel according to the AMPS standard the microprocessor CPM receives and interpretes signals from the analog to digital converter AD.

Except for the time slot identifier and the digital voice colour code and means for introducing, recog-

nizing and removing them from the flow of information, the mobile radio according to Figure 6 may operate on time division multiplex digital communication channels in a way similar to known digital mobile radio stations, e.g. of the kind disclosed in the GSM standard or in Ericsson Review No. 3, 1987.

Accordingly there is no need here to further describe in detail the overall operation or the detailed operation of the various means. Regarding the time slot identifier code and the digital voice colour code the mobile station comprises means TIC and DVC, respectively for storing all possible time slot identifier codes and digital voice colour codes to be used in communication with a base station. The microprocessor CPM receives instructions from the base station as to which codes to use in the particular connection and reads the codes from the stores and supplies the modulo two adders MT1, MT2 and burst generator BR with appropriate time slot identifier code and digital voice colour code.

When receiving radio signals from a base station synchronisation and recognition of a time slot identifier code is performed in the equalizer EQ in cooperation with the microprocessor CPM.

Measurement of bit error rate on an established connection is performed in the channel decoder CD in cooperation with the microprocessor CPM. Equalizers and methods of synchronisation and bit error measurement are well known to those skilled in the art. Accordingly there is no need here to further describe such methods or means for performing them.

The procedure for connection setup in a cellular mobile radio system according to Figure 1 with a base station according to Figure 5 and a mobile station according to Figure 6 may be similar to the corresponding procedure in AMPS when the channel to be used is an analog communication channel. However when the channel to be used for the connection is a digital communication channel according to Figures 3 and 4, the base station informs the mobile station not only on radio channel but also on time slot and digital voice colour code to be used. During the setup procedure, the base station also informs the mobile station of a plurality of radio channels, the signal strength of which is to be measured by the mobile. Normally this plurality of radio channels are the radio channels used for control channels by adjacent bases/cells. Depending upon the movement of the mobiles as well as other circumstances a new plurality of radio channels may be selected and corresponding information be transmitted to the mobile from the responsible base station during the course of the connection. During the course of a connection for which a digital communication channel is used the mobile measures the signal strength of signals on the given plurality of radio channels. Measurements may be done during time slots not used by the digital communication channel.

The mobile station also measures signal strength on the digital communication channel used for the established connection and the bit error rate on the established connection. The mobile station transmits results of its measurements, preferably averaged, frequently to the base station, preferably twice a second.

The base station also measures signal strength on the digital communication channel used for the established connection and the bit error rate on the established connection. The base station processes and analyzes the results of its own measurements and the measurements of the mobile station and compares with criteria for handoff. When according to the results and criteria a handoff is desirous the base station informs the mobile switching centre indicating at least one target base station assumed suitable for taking over the responsibility for the communication with the mobile.

The mobile switching centre requests the target base station (s) to measure signal strength on a radio channel in a time slot used by the mobile for the established connection. The mobile switching centre also informs the target base station on the digital colour code used by the mobile station.

The target base station (s) tunes a receiver to the radio channel indicated by the mobile switching centre and uses the time slot identifier code of the indicated time slot for burst synchronisation. The target base station checks the appearance of the digital colour code indicated by the mobile switching centre and measures the signal strength of the burst signals provided the digital colour code is correct. The target base station then transmits its results of signal strength measurement to the mobile switching centre. The target base station also informs the mobile switching centre on the result of the checking of the appearance of the digital colour code, that is whether the digital voice colour code appeared in the burst in the time slot of the radio channel.

The mobile switching centre determines whether handoff to a target base station should be performed taking the results of the signal strength measurements of the target base stations into account as well as other circumstances, e.g. traffic load.

When the mobile switching centre determines that handoff shall be performed it transmits to the responsible base station and target base stations information on the new radio channel, the new time slot and the new voice colour code to be used by the mobile station for the connection after handoff and the new radio channel to be used by target base station for the connection after handoff. The target base station starts transmitting radio signals comprising the time slot identifier code and the new digital voice colour code in the time slot of the radio channel to be used by the target base station for the connection after handoff.

The responsible base station forwards information on the new radio channel, new time slot and new digital colour code to the mobile. After receiving this information the mobile station tunes to the new radio channel to be used for the connection by the target base station and looks for the new time slot identifier code in received signals on the radio channel. The mobile station uses the new time slot identifier code in received signals for burst synchronisation. After synchronisation and tuning its transmitter to the new radio channel the mobile station begins transmitting bursts in the new time slot on the new radio channel. The new digital colour code is transmitted with each burst.

The target base station tunes a receiver to the new radio channel to be used for the connection by the mobile station and looks for the new time slot identifier code. The target base station uses the time slot identifier code for synchronisation. The target base station then looks for the new digital colour code in signals in the new time slot of the new channel. If the target base station identifies the new digital colour code in the bursts in the new time slot of the new radio channel this is reported to the mobile switching centre. The mobile switching centre then interprets the handoff as successful and acts accordingly. After successful handoff the former target base station now being the responsible base station informs the particular mobile station of a new plurality of radio channels, the signal strength of which is to be measured by the mobile station.

The intelligence and decision making in a mobile cellular system according to Figure 1 may be more or less centralized to the mobile switching centre or more or less decentralized to the base stations. In a decentralized system more or less of the functions of the mobile switching office during the handoff preparation and performance may instead be performed in the responsible and/or target base stations.

In the embodiment of the handoff method described above the responsible base station and mobile station use the same time slot identifier code and the same digital voice colour code. However, it is conceivable to use different time slot identifier at base and mobile stations for a particular connection.

In the embodiment of the handoff method described the mobile station measures signal strength on radio channels used for control channels by the base station. However, it is conceivable to request the mobile station to measure the signal strength on radio channels used for digital communication channels by the base station, in particular when there are no radio channels entirely used for control channels by base stations.

Claims

1. A method of handoff in a cellular mobile radio system including a mobile switching center (MSC), base stations (B1-B10) and mobile stations (M1-M8), said base stations communicating with the mobile switching center and said mobile stations communicating with the base stations over a plurality of radio channels, at least two (RCHc, RCHd; fig 3) of the radio channels being used for time division multiple digital access communication channels by transmitting (VCS, M2A, TIS, BG, MOD, PA; fig 5) channel information to a particular mobile station from a base station responsible for the communication with the particular mobile station at set-up of a connection on a digital communication channel and at handoff of a connection to a digital communication channel; measuring (RLM; fig 6) at the particular mobile station the strength of radio signals received on selected radio channels and the signal strength on the digital communication channel used by the mobile station for the connection; transmitting (CPM, BR, MD, PW, DU; fig 6) repeatedly from the particular mobile station to the responsible base station results of measurements of said signal strength at said particular mobile station; processing and analyzing (CP; fig 5) in the responsible base station results of measurements done and comparing with criteria for handoff; determining in said mobile switching center (MSC) a target base station assumed suitable for being responsible for the communication with the particular mobile station when, according to said processing, analyzing and comparing, a handoff ought to be done; and supplying the target base station with information about the established connection of the particular mobile station; characterized in that said channel information transmitted to a particular mobile station includes a particular time slot identifier code (TI1; fig 3), a particular digital voice colour code (VC1; fig 3) and a plurality of selected radio channels; and by transmitting (DVC, MTI, TIC, BR, MD, PW, DU; fig 6) from the particular mobile station to the target base station said particular time slot identifier code (TI1) and digital voice colour code (VC1) with radio signals in each time slot of the digital communication channel of the connection during the course of the connection, said information when supplying said target base station, implying identifying the radio channel, the particular time slot identifier code and the particular digital voice colour code of the digital communication channel;

The responsible base station forwards information on the new radio channel, new time slot and new digital colour code to the mobile. After receiving this information the mobile station tunes to the new radio channel to be used for the connection by the target base station and looks for the new time slot identifier code in received signals on the radio channel. The mobile station uses the new time slot identifier code in received signals for burst synchronisation. After synchronisation and tuning its transmitter to the new radio channel the mobile station begins transmitting bursts in the new time slot on the new radio channel. The new digital colour code is transmitted with each burst.

The target base station tunes a receiver to the new radio channel to be used for the connection by the mobile station and looks for the new time slot identifier code. The target base station uses the time slot identifier code for synchronisation. The target base station then looks for the new digital colour code in signals in the new time slot of the new channel. If the target base station identifies the new digital colour code in the bursts in the new time slot of the new radio channel this is reported to the mobile switching centre. The mobile switching centre then interprets the handoff as successful and acts accordingly. After successful handoff the former target base station now being the responsible base station informs the particular mobile station of a new plurality of radio channels, the signal strength of which is to be measured by the mobile station.

The intelligence and decision making in a mobile cellular system according to Figure 1 may be more or less centralized to the mobile switching centre or more or less decentralized to the base stations. In a decentralized system more or less of the functions of the mobile switching office during the handoff preparation and performance may instead be performed in the responsible and/or target base stations.

In the embodiment of the handoff method described above the responsible base station and mobile station use the same time slot identifier code and the same digital voice colour code. However, it is conceivable to use different time slot identifier at base and mobile stations for a particular connection.

In the embodiment of the handoff method described the mobile station measures signal strength on radio channels used for control channels by the base station. However, it is conceivable to request the mobile station to measure the signal strength on radio channels used for digital communication channels by the base station, in particular when there are no radio channels entirely used for control channels by base stations.

Claims

1. A method of handoff in a cellular mobile radio system including a mobile switching center (MSC), base stations (B1-B10) and mobile stations (M1-M8), said base stations communicating with the mobile switching center and said mobile stations communicating with the base stations over a plurality of radio channels, at least two (RCHc,RCHd; fig 3) of the radio channels being used for time division multiple digital access communication channels by transmitting (VCS,M2A,TIS,BG,MOD,PA; fig 5) channel information to a particular mobile station from a base station responsible for the communication with the particular mobile station at set-up of a connection on a digital communication channel and at handoff of a connection to a digital communication channel; measuring (RLM; fig 6) at the particular mobile station the strength of radio signals received on selected radio channels and the signal strength on the digital communication channel used by the mobile station for the connection; transmitting (CPM,BR,MD,PW,DU; fig 6) repeatedly from the particular mobile station to the responsible base station results of measurements of said signal strength at said particular mobile station; processing and analyzing (CP; fig 5) in the responsible base station results of measurements done and comparing with criteria for handoff; determining in said mobile switching center (MSC) a target base station assumed suitable for being responsible for the communication with the particular mobile station when, according to said processing, analyzing and comparing, a handoff ought to be done; and supplying the target base station with information about the established connection of the particular mobile station; **characterized** in that said channel information transmitted to a particular mobile station includes a particular time slot identifier code (T11; fig 3), a particular digital voice colour code (VC1; fig 3) and a plurality of selected radio channels; and by transmitting (DVC,MTI,TIC,BR,MD,PW,DU; fig 6) from the particular mobile station to the target base station said particular time slot identifier code (T11) and digital voice colour code (VC1) with radio signals in each time slot of the digital communication channel of the connection during the course of the connection, said information when supplying said target base station, implying identifying the radio channel, the particular time slot identifier code and the particular digital voice colour code of the digital communication channel;



using (CP; fig 5) the supplied information on the radio channel and the particular time slot identifier code at the target base station for finding the digital communication channel of the established connection of the particular mobile station and for checking the appearance of particular digital voice colour code;

reporting (CP,VCS,M2A,BG,MOD,PA; fig 5) from the target base station to the mobile switching center (MSC) the results of the checking of the appearance of the particular digital voice colour code on the digital communication channel of the established connection;

deciding in the mobile switching center (MSC) whether the handoff shall be performed in view of the report from the target base station and informing the target base station and the particular mobile station if handoff shall be performed;

informing (CP,VCS,M2A,TIS,BG,MOD,PA; fig 5) by the responsible base station the particular mobile station on the new radio channels, new time slot identifier code (TI2) and the digital voice colour code (VC2) to be used by the particular mobile station and target base station for the established connection after handoff;

transmitting (CP,TIS,BG,MOD,PA; fig 5) from the target base station at least after receiving information from the mobile switching center (MSC) that handoff shall be performed, radio signals comprising the new time slot identifier code (TI2) on the radio channel to be used by the target base station for the connection after handoff;

using (TIC,CPM; fig 6) the new time slot identifier code in the mobile station at least after receiving at the particular mobile station information that handoff shall be performed, to find the correct time slot and transmitting (DVC,MTI,TIC,BR,MD,PW,DU; fig 6) from the particular mobile station radio signals comprising the new time slot identifier code (TI2) and digital voice colour code (VC2) on the new radio channel; and

after said receiving at the target base station information that handoff shall be performed and information on new radio channel and time slot identifier code to be used by the particular mobile station, checking (EQ-AFC,M2A,VCS,CP; fig 5) at the target base station the appearance of radio signals comprising both the time slot identifier code and the digital voice colour code on the new radio channel.

2. A method according to claim 1, characterized by the further steps of: measuring (BEM; fig 5) the bit error rates on the established connection on the digital communication channel both at the responsible base station and at the particular mobile station; and taking the results of the bit error rate measure-

ments into account when determining when a handoff ought to be done.

3. A method according to claim 1, characterized by the further steps of: selecting (CP; fig 5) digital voice colour code independently of time slot identifier code; transmitting (DVC,MTI,BR,MD,PW,DU; fig 6) the same digital voice colour code (VC1) with radio signals from at least two mobile stations served by the same responsible base station; and transmitting (DVC,MTI,BR,MD,PW,DU; fig 6) different digital voice colour codes (VC1,VC2) from at least two mobile stations using the same radio channel and time slot identifier code (TI1) but being served by different responsible base stations.
4. A method according to claim 1, characterized by the further steps of: measuring (REC,SLM; fig 5) at the base station responsible for the connection with the particular mobile station the signal strength on the digital communication channel used for the connection of the mobile station; taking (CP; fig 5) the results of signal strength measurements at responsible base station into account when determining whether a handoff ought to be done; measuring (REC,SLM; fig 5) at the target base station the signal strength on the digital communication channel of the established connection of the particular mobile station; reporting (CPB,VCS,M2A,BG,MOD,PA; fig 5) from the target base station the results of the measurements of signal strength on the digital communication channel; and taking (CP) the results of signal strength measurements at the target base station into account when determining whether the handoff shall be performed.
5. A method according to claim 1, characterized by that at least one of the selected radio channels is a radio channel used for a control channel by another base station than the responsible base station.
6. A method according to claim 4 characterized by the further steps of: at the particular mobile station, coding (CC; fig 6) the digital information to be transmitted in a binary error detecting code; adding (MTI; fig 6) to the coded binary information a binary coded digital voice colour code modulo two; transmitting (BR,MD,PW,DU; fig 6) the modulo two sum with the radio signals from the particular mobile station; and



- at the target base station, demodulating (REC; fig 5) the received radio signals to obtain binary coded information;
 adding (M2A; fig 5) the binary coded digital voice colour code to the binary coded information obtained from the received signals modulo two;
 decoding (DCD; fig 5) the modulo two sum at the target base station according to the error detecting code to detect possible errors; and
 using at the target base station the absence of error in the modulo two sum as an indication on the appearance of the digital voice colour code in the radio signals received.
7. A base station (B1-B10) in a cellular mobile radio system, said base station being connected to a mobile switching center (MSC) and communicating with mobile stations (M1-M9) over radio channels (RCHc, RCHd) for time division multiple access in time slots within frames of the radio channels, and including means (BG,MOD,PA; fig 5) for transmitting bursts of radio signals in time slots in frames on the radio channels and means (REC,A/D,EQ-AFC) for receiving bursts of radio signals in said time slots of frames on said radio channels;
 characterized by
 means (TIS) for storing at least as many different time slot identifier codes (TI1-TI3) as the number of time slots in a multi slot frame on the radio channels;
 means (BG) for incorporating in each burst transmitted from the base station one of the stored time slot identifier codes indicative of the time slot of the frame of the channel where the burst is transmitted but independent of the base identity and radio channel where the burst is transmitted;
 means (EQ-AFC) for synchronizing the receiving means to received bursts by using the time slot identifier codes of the received bursts;
 means (EQ-AFC) for identification of any of the predetermined time slot identifier codes when appearing in a received burst;
 and
 means (SLM) for measuring the signal strength of a burst on a radio channel in a time slot determined by a time slot identifier code.
8. A base station according to claim 7 further characterized by
 means (VCS) for storing a plurality of digital voice colour codes (VC1-VC3) independent of the time slot identifier codes (TI1-TI3);
 means (M2A) for incorporating in each burst transmitted from the base station one of the stored digital voice colour codes independent of the time slot identifier codes in the bursts and channel where the burst is transmitted; and
 means (M2A,VCS) for identification of any of the predetermined digital voice colour codes when appearing in a received burst.
9. A mobile station (M1-M9) for communication with base stations (B1-B10) in a cellular mobile radio system having radio channels (RCHc, RCHd) for time division multiple access communication channels in time slots within frames of the radio channels and including means (BR,MD,PW,DU; fig 6) for transmitting bursts of radio signals in time slots in frames on the radio channels and means (DU,RM,AD,EQ; fig 6) for receiving bursts of radio signals in said time slots of frames on said radio channels;
 characterized by
 means (TIC; fig 6) for storing at least as many different time slot identifier codes (TI1-TI3) as the number of time slots in a multi slot frame on the radio channels;
 means (CPM,BR; fig 5) for incorporating in each burst transmitted from the mobile station one (TI1) of the stored time slot identification codes indicative of the time slot of the frame of the channel where the burst is transmitted but independent of the mobile identity and radio channel where the burst is transmitted;
 means (EQ,CPM) for synchronizing the receiving means to received bursts by using the time slot identifier codes of the received bursts and for identification of any of the predetermined time slot identifier codes when appearing in a received burst;
 and
 means (RLM) for measuring the signal strength of a burst on a radio channel in a time slot determined by a time slot identifier code.
10. A mobile station according to claim 9 further characterized by
 means (DVC; fig 6) for storing a plurality of digital voice colour codes (VC1-VC3) independent of the time slot identifier codes (TI1-TI3);
 means (CPM,MT1; fig 6) for incorporating in each burst transmitted from the mobile station one of the stored digital voice colour codes independent of the time slot identifier codes in the bursts and channel where the burst is transmitted; and
 means (TIC,MT2; fig 6) for identification of any of the predetermined digital voice colour codes when appearing in a received burst.

Patentansprüche

1. Verfahren zur Verbindungsumschaltung in einem Zellularmobilfunksystem umfassend ein Mobil-



vermittlungszentrum (MSC), Basisstationen (B1-B10) und mobile Stationen (M1-M8), wobei die Basisstationen mit dem Mobilvermittlungszentrum kommunizieren und die mobilen Stationen mit den Basisstationen über eine Vielzahl von Funkkanälen kommunizieren, wobei wenigstens zwei (RCHc, RCHd; Figur 3) der Funkkanäle für Kommunikationskanäle mit digitalem Zugriff im Zeitmultiplexverfahren durch die folgenden Schritte verwendet werden:

Senden (VCS, M2A, TIS, BG, MOD, PA; Figur 5) von Kanalinformation an eine bestimmte mobile Station von einer für die Verbindung mit der bestimmten mobilen Station verantwortlichen Basisstation beim Aufbau einer Verbindung auf einem digitalen Kommunikationskanal und bei einer Verbindungsumschaltung einer Verbindung an einem digitalen Kommunikationskanal;

Messen (RLM; Figur 6) in der bestimmten mobilen Station die Stärke von auf ausgewählten Funkkanälen empfangenen Funksignalen und der Signalstärke auf dem durch die mobile Station für die Verbindung verwendeten digitalen Kommunikationskanal;

Senden (CPM, BR, MD, PW, DU; Figur 6) wiederholt von der bestimmten mobilen Station an die verantwortliche Basisstation Meßergebnisse der Signalstärke an der bestimmten mobilen Station; Verarbeiten und Analysieren (CP; Figur 5) in der verantwortlichen Basisstation von durchgeführten Meßergebnissen und Vergleichen mit Kriterien zur Verbindungsumschaltung;

Bestimmen in dem Mobilvermittlungszentrum (MSC) einer Zielbasisstation, die als geeignet angenommen wird, um für die Kommunikation mit der bestimmten mobilen Station verantwortlich zu sein, wenn entsprechend der Verarbeitung, Analyse und dem Vergleich eine Verbindungsumschaltung durchgeführt werden sollte; und

Versorgen der Zielbasisstation mit Information über die hergestellte Verbindung der bestimmten mobilen Station;

dadurch gekennzeichnet, daß

die an eine bestimmte mobile Station gesendete Kanalinformation einen bestimmten Zeitschlitz-Identifizierungscode (TI1; Figur 3), einen bestimmten Digitalsprachen-Farbcode (VC1; Figur 3) und eine Vielzahl von gewählten Funkkanälen umfaßt; und die folgenden Schritte vorgesehen sind:

Senden (DVC, MTI, TIC, BR, MD, PW, DU; Figur 6) von der bestimmten mobilen Station an die Zielbasisstation den bestimmten Zeitschlitz-Identifizierungscode (TI1) und den Digitalsprachen-Farbcode (VC1) mit Funksignalen in jedem Zeitschlitz des digitalen Kommunikationskanals der Verbindung während des Verlaufs der Verbindung, wobei die Information, wenn sie an die Ziel-

basisstation geliefert wird, die Identifikation des Funkkanals, den bestimmten Zeitschlitz-Identifizierungscode und den bestimmten Digitalsprachen-Farbcode des digitalen Kommunikationskanals impliziert;

Verwenden (CP; Figur 5) der zugeführten Information über den Funkkanal und den bestimmten Zeitschlitz-Identifizierungscode an der Zielbasisstation zum Auffinden des digitalen Kommunikationskanals der hergestellten Verbindung der bestimmten mobilen Station und zur Überprüfung des Auftretens eines bestimmten Digitalsprachen-Farbcodes;

Berichten (CP, VCS, M2A, BG, MOD, PA; Figur 5) von der Zielbasisstation an das Mobilvermittlungszentrum (MSC) der Ergebnisse des Überprüfens des Auftretens des bestimmten Digitalsprachen-Farbcodes auf dem digitalen Kommunikationskanal der hergestellten Verbindung; Bestimmen in dem Mobilvermittlungszentrum (MSC), ob angesichts des Berichts von der Zielbasisstation die Verbindungsumschaltung durchgeführt werden soll und Informieren der Zielbasisstation und der bestimmten mobilen Station, wenn eine Verbindungsumschaltung durchgeführt werden soll;

Informieren (CP, VCS, M2A, TIS, BG, MOD, PA; Figur 5) der bestimmten mobilen Station durch die verantwortliche Basisstation über die neuen Funkkanäle, den neuen Zeitschlitz-Identifizierungscode (TI2) und den Digitalsprachen-Farbcode (VC2), die durch die bestimmte mobile Station und die Zielbasisstation für die hergestellte Verbindung nach einer Verbindungsumschaltung verwendet werden sollen;

Senden (CP, TIS, BG, MOD, PA; Figur 5) von der Zielbasisstation wenigstens nach dem Empfangen von Information von dem Mobilvermittlungszentrum (MSC), das eine Verbindungsumschaltung durchgeführt werden soll, Funksignale umfassend den neuen Zeitschlitz-Identifizierungscode (TI2) auf dem Funkkanal, der durch die Zielbasisstation für die Verbindung nach einer Verbindungsumschaltung verwendet werden soll;

Verwenden (TIC, CPM; Figur 6) des neuen Zeitschlitz-Identifizierungscode in der mobilen Station wenigstens nach dem Empfang an der bestimmten mobilen Station von Information, daß eine Verbindungsumschaltung durchgeführt werden soll, um den richtigen Zeitschlitz zu finden und Senden (DVC, MTI, TIC, BR, MD, PW, DU; Figur 6) von der bestimmten mobilen Station Funksignale umfassend den neuen Zeitschlitz-Identifizierungscode (TI2) und den Digitalsprachen-Farbcode (VC2) auf dem neuen Funkkanal; und

nach dem Empfang an der Zielbasisstation der Information, daß eine Verbindungsumschaltung



- durchgeführt werden soll und von Information über den neuen Funkkanal und Zeitschlitz-Identifizierungscode, der durch die mobile Station verwendet werden soll, Überprüfen (EQ-AFC, M2A, VCS, CP; Figur 5) an der Zielbasisstation des Auftretens von Funksignalen, die sowohl den Zeitschlitz-Identifizierungscode als auch den Digitalsprachen-Farbcode auf dem neuen Funkkanal umfassen.
2. Verfahren nach Anspruch 1, gekennzeichnet durch die folgenden weiteren Schritte:
Messen (BEM; Figur 5) der Bitfehlerraten auf der hergestellten Verbindung auf dem digitalen Kommunikationskanal sowohl an der verantwortlichen Basisstation als auch an der bestimmten mobilen Station; und
Berücksichtigung der Ergebnisse der Bitfehlerratenmessungen, wenn bestimmt wird, wann eine Verbindungsumschaltung durchgeführt werden sollte.
 3. Verfahren nach Anspruch 1, gekennzeichnet durch die folgenden weiteren Schritte:
Wählen (CP; Figur 5) eines Digitalsprachen-Farbcodes unabhängig von einem Zeitschlitz-Identifizierungscode;
Senden (DVC, MTI, BR, MD, PW, DU; Figur 6) des gleichen Digitalsprachen-Farbcodes (VC1) mit Funksignalen von wenigstens zwei durch die verantwortliche Basisstation bedienten mobilen Stationen; und
Senden (DVC, MTI, BR, MD, PW, DU; Figur 6) von verschiedenen Digitalsprachen-Farbcodes (VC1, VC2) von wenigstens zwei mobilen Stationen, die den gleichen Funkkanal und Zeitschlitz-Identifizierungscode (TI1) verwenden, aber von unterschiedlichen verantwortlichen Basisstationen bedient werden.
 4. Verfahren nach Anspruch 1, gekennzeichnet durch die folgenden weiteren Schritte:
Messen (REC, SLM; Figur 5) an der für die Verbindung mit der bestimmten mobilen Station verantwortlichen Basisstation der Signalstärke auf dem digitalen Kommunikationskanal, der für die Verbindung der mobilen Station verwendet wird;
Berücksichtigung (CP; Figur 5) der Ergebnisse der Signalstärkenmessungen an der verantwortlichen Basisstation, wenn bestimmt wird, ob eine Verbindungsumschaltung durchgeführt werden soll;
Messen (REC, SLM; Figur 5) an der Zielbasisstation der Signalstärke auf dem digitalen Kommunikationskanal der hergestellten Verbindung der bestimmten mobilen Station;
Berichten (CPB, VCS, M2A, BG, MOD, PA; Figur 5) von der Zielbasisstation der Ergebnisse der
 5. Signalstärkenmessungen auf dem digitalen Kommunikationskanal; und
Berücksichtigen (CP) der Ergebnisse der Signalstärkenmessungen an der Zielbasisstation, wenn bestimmt wird, ob die Verbindungsumschaltung durchgeführt werden soll.
 5. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß wenigstens einer der gewählten Funkkanäle ein Funkkanal ist, der für einen Steuerkanal durch eine andere Basisstation als die verantwortliche Basisstation verwendet wird.
 6. Verfahren nach Anspruch 4, gekennzeichnet durch die folgenden weiteren Schritte:
an der bestimmten mobilen Station, Codieren (CC; Figur 6) der zu sendenden digitalen Information in einen binären Fehlerdetektionscode;
Addieren (MTI; Figur 6) zu der codierten binären Informationen einen binären codierten Digitalsprachen-Farbcode in Modulo-Zwei-Technik;
Senden (BR, MD, PW, DU; Figur 6) der Modulo-Zwei-Summe mit den Funksignalen von der bestimmten mobilen Station; und
an der Zielbasisstation, Demodulieren (REC; Figur 5) der empfangenen Funksignale, um eine binäre codierte Information zu erhalten;
Addieren (M2A; Figur 5) des binären codierten Digitalsprachen-Farbcodes zu der aus den empfangenen Signalen ermittelten binär codierten Information in Modulo-Zwei-Technik;
Decodieren (DCD; Figur 5) der Modulo-Zwei-Summe an der Zielbasisstation entsprechend dem Fehlerdetektionscode, um mögliche Fehler zu detektieren; und
Verwenden an der Zielbasisstation des Fehlens eines Fehlers in der Modulo-Zwei-Summe als ein Anzeichen über das Auftreten des Digitalsprachen-Farbcodes in dem empfangenen Funksignalen.
 7. Basisstation (B1-B10) in einem Zellularmobilfunksystem, wobei die Basisstation mit einem Mobilvermittlungszentrum (MSC) verbunden ist und mit mobilen Stationen (M1-M9) über Funkkanäle (RCHc, RCHd) für einen Zeitmultiplex-Zugriff in Zeitschlitzten innerhalb von Rahmen der Funkkanäle kommuniziert und eine Einrichtung (BG, MOD, PA; Figur 5) zum Senden von Bursts von Funksignalen in Zeitschlitzten in Rahmen auf den Funkkanälen und eine Einrichtung (REC, A/D, EQ-AFC) zum Empfangen von Bursts von Funksignalen in den Zeitschlitzten von Rahmen auf den Funkkanälen umfaßt;
gekennzeichnet durch
eine Einrichtung (TIS) zum Speichern von wenigstens sovielen unterschiedlichen Zeitschlitz-Identifizierungscodes (TI1-TI3) wie die Anzahl



von Zeitschlitzten in einem Mehrfachschlitzrahmen auf den Funkkanälen;
 eine Einrichtung (BG) zum Einbauen in jedem von der Basisstation gesendeten Burst einen der gespeicherten Zeitschlitz-Identifizierungscodes, die den Zeitschlitz des Rahmens des Kanals anzeigen, in dem der Burst übertragen wird, aber unabhängig von der Basisstationsidentität und des Funkkanals, in dem der Burst gesendet wird;
 eine Einrichtung (EQ-AFC) zur Synchronisation der Empfangseinrichtung auf empfangene Bursts durch Verwendung der Zeitschlitz-Identifizierungscodes der empfangenen Bursts;
 eine Einrichtung (EQ-AFC) zur Identifikation von jeden der vorbestimmten Zeitschlitz-Identifizierungscodes, wenn sie in einem empfangenen Burst auftreten; und
 eine Einrichtung (SLM) zum Messen der Signalstärke eines Bursts auf einem Funkkanal in einem Zeitschlitz bestimmt durch einen Zeitschlitz-Identifizierungscode.

8. Basisstation nach Anspruch 7, ferner gekennzeichnet durch:
 eine Einrichtung (VCS) zum Speichern einer Vielzahl von Digitalsprachen-Farbcodes (VC1-VC3) unabhängig von den Zeitschlitz-Identifizierungscodes (TI1-TI3);
 eine Einrichtung (M2A) zum Einbauen in jeden von der Basisstation gesendeten Burst einen der gespeicherten Digitalsprachen-Farbcodes unabhängig von den Zeitschlitz-Identifizierungscodes in den Bursts und dem Kanal, in dem der Burst gesendet wird; und
 eine Einrichtung (M2A, VCS) zur Identifikation von jedem der vorbestimmten Digitalsprachen-Farbcodes, wenn sie in einem empfangenen Burst auftreten.

9. Mobile Station (M1-M9) zur Kommunikation mit Basisstationen (B1-B10) in einem Zellularmobilfunksystem mit Funkkanälen (RCHc, RCHd) für Kommunikationskanäle mit Zeitmultiplex-Zugriff in Zeitschlitzten innerhalb von Rahmen der Funkkanäle und umfassend eine Einrichtung (BR, MD, PW, DU; Figur 6) zum Senden von Bursts von Funksignalen in Zeitschlitzten in Rahmen auf den Funkkanälen; und
 eine Einrichtung (DU, RM, AD, EQ; Figur 6) zum Empfangen von Bursts von Funksignalen in den Zeitschlitzten von Rahmen auf den Funkkanälen; gekennzeichnet durch
 eine Einrichtung (TIC; Figur 6) zum Speichern von wenigstens sovielen unterschiedlichen Zeitschlitz-Identifizierungscodes (TI1-TI3) wie die Anzahl von Zeitschlitzten in einem Mehrfachschlitz-Rahmen auf den Funkkanälen;
 eine Einrichtung (CPM, BR; Figur 5) zum Einbau-

en in jeden von der mobilen Station gesendeten Burst einen (TI1) der gespeicherten Zeitschlitz-Identifizierungscodes, der den Zeitschlitz des Rahmens des Kanals anzeigt, in dem der Burst gesendet wird, aber unabhängig von der Identität der mobilen Station und des Funkkanals, in dem der Burst gesendet wird;

eine Einrichtung (EQ, CPM) zur Synchronisation der Empfangseinrichtung auf empfangene Bursts durch Verwendung der Zeitschlitz-Identifizierungscodes der empfangenen Bursts und zur Identifikation von jedem der vorgegebenen Zeitschlitz-Identifizierungscodes, wenn sie in einem empfangenen Burst auftreten; und
 eine Einrichtung (RLM) zum Messen der Signalstärke eines Bursts auf dem Funkkanal in einem Zeitschlitz bestimmt durch einen Zeitschlitz-Identifizierungscode.

10. Mobile Station nach Anspruch 9, ferner gekennzeichnet durch:

eine Einrichtung (DVC; Figur 6) zum Speichern einer Vielzahl von Digitalsprachen-Farbcodes (VC1-VC3) unabhängig von den Zeitschlitz-Identifizierungscodes (TI1-TI3);

eine Einrichtung (CPM, MT1; Figur 6) zum Einbauen in jeden von der mobilen Station gesendeten Burst einen der gespeicherten Digitalsprachen-Farbcodes unabhängig von den Zeitschlitz-Identifizierungscodes in den Bursts und dem Kanal, in dem der Burst gesendet wird; und eine Einrichtung (TIC, MT2; Figur 6) zur Identifikation von jedem der vorgegebenen Digitalsprachen-Farbcodes, wenn sie in einem empfangenen Burst auftreten.

Revendications

1. Un procédé de transfert dans un système de radiocommunication mobile cellulaire comprenant un centre de commutation de service mobile (MSC), des stations de base (B1-B10) et des stations mobiles (M1-M8), les stations de base communiquant avec le centre de commutation de service mobile, et les stations mobiles communiquant avec les stations de base sur un ensemble de canaux hertziens, deux au moins (RCHc, RCHd; fig. 3) des canaux hertziens étant utilisés pour des canaux de communication numériques fonctionnant en accès multiple par répartition dans le temps, par

l'émission (VCS, M2A, TIS, BG, MOD, PA; fig. 5) d'une information de canal vers une station mobile particulière, à partir d'une station de base responsable de la communication avec la station mobile particulière, au moment de l'établissement d'une connexion sur un canal de communi-



cation numérique, et au moment du transfert d'une connexion vers un canal de communication numérique;

la mesure (RLM; fig. 6) à la station mobile particulière du niveau de signaux hertziens reçus sur des canaux hertziens sélectionnés, et le niveau de signal sur le canal de communication numérique qui est utilisé par la station mobile pour la connexion;

l'émission (CPM, BR, MD, PW, DU; fig. 6) répétée à partir de la station mobile particulière vers la station de base responsable, des résultats de mesures du niveau de signal à la station mobile particulière;

le traitement et l'analyse (CP; fig. 5), dans la station de base responsable, des résultats de mesures effectuées, et la comparaison avec des critères de transfert;

la détermination dans le centre de commutation de service mobile (MSC) d'une station de base de destination considérée comme appropriée pour être responsable de la communication avec la station mobile particulière lorsque, conformément au traitement, à l'analyse et à la comparaison précitées, un transfert doit être effectué; et

la fourniture à la station de base de destination d'une information concernant la connexion établie de la station mobile particulière;

caractérisé

en ce que l'information de canal qui est émise vers une station mobile particulière contient un code d'identificateur de créneau temporel particulier (TI1; fig. 3), un code de couleur d'information vocale numérique particulier (VC1; fig. 3) et un ensemble de canaux hertziens sélectionnés; et par

l'émission (DVC, MTI, TIC, BR, MD, PW, DU; fig. 6) à partir de la station mobile particulière, vers la station de base de destination, du code d'identificateur de créneau temporel (TI1) et du code de couleur d'information vocale numérique (VC1) particuliers, avec des signaux hertziens, dans chaque créneau temporel du canal de communication numérique de la connexion, au cours de la connexion, cette information, lorsqu'elle est fournie à la station de base de destination, identifiant le canal hertzien, le code d'identificateur de créneau temporel particulier et le code de couleur d'information vocale numérique particulier du canal de communication numérique;

l'utilisation (CP; fig. 5) de l'information fournie, concernant le canal hertzien et le code d'identificateur de créneau temporel particulier, à la station de base de destination, pour trouver le canal de communication numérique de la

connexion établie de la station mobile particulière, et pour contrôler l'apparition d'un code de couleur d'information vocale numérique particulier;

l'émission (CP, VCS, M2A, BG, MOD, PA; fig. 5) de la station de base de destination vers le centre de commutation de service mobile (MSC), d'un compte-rendu des résultats du contrôle de l'apparition du code de couleur d'information vocale numérique particulier sur le canal de communication numérique de la connexion établie;

la décision, dans le centre de commutation de service mobile (MSC), d'effectuer ou non le transfert, sur la base du compte-rendu provenant de la station de base de destination, et l'action consistant à informer la station de base de destination et la station mobile particulière si le transfert doit être effectué;

l'information (CP, VCS, M2A, TIS, BG, MOD, PA; fig. 5), par la station de base responsable, de la station mobile particulière en ce qui concerne les nouveaux canaux hertziens, le nouveau code d'identificateur de créneau temporel (TI2) et le code de couleur d'information vocale numérique (VC2) à utiliser par la station mobile particulière et la station de base de destination pour la connexion établie, après le transfert;

l'émission (CP, TIS, BG, MOD, PA; fig. 5) par la station de base de destination, au moins après la réception d'une information provenant du centre de commutation de service mobile (MSC) signalant que le transfert doit être effectué, de signaux hertziens comprenant le nouveau code d'identificateur de créneau temporel (TI2) sur le canal hertzien à utiliser par la station de base de destination pour la connexion, après le transfert;

l'utilisation (TIC, CPM; fig. 6) du nouveau code d'identificateur de créneau temporel dans la station mobile, au moins après la réception à la station mobile particulière d'une information signalant que le transfert doit être effectué, pour trouver le créneau temporel correct, et l'émission (DVC, MTI, TIC, BR, MD, PW, DU; fig. 6) par la station mobile particulière de signaux hertziens comprenant le nouveau code d'identificateur de créneau temporel (TI2) et le code de couleur d'information vocale numérique (VC2), sur le nouveau canal hertzien; et

après la réception à la station de base de destination d'une information signalant que le transfert doit être effectué, et d'une information concernant le nouveau canal hertzien et le nouveau code d'identificateur de créneau temporel à utiliser par la station mobile particulière, le contrôle (EQ-AFC, M2A, VCS, CP; fig. 5), à la station de base de destination, de l'apparition de signaux hertziens comprenant à la fois le code



d'identificateur de créneau temporel et le code de couleur d'information vocale numérique sur le nouveau canal hertzien.

2. Un procédé selon la revendication 1, caractérisé par les étapes supplémentaires suivantes :

on mesure (BEM; fig. 5) les taux d'erreurs de bit sur la connexion établie sur le canal de communication numérique, à la fois à la station de base responsable et à la station mobile particulière; et

on tient compte des résultats des mesures de taux d'erreurs de bit au moment où on détermine qu'un transfert doit être effectué.

3. Un procédé selon la revendication 1, caractérisé par les étapes supplémentaires suivantes :

on sélectionne (CP; fig. 5) un code de couleur d'information vocale numérique, indépendamment du code d'identificateur de créneau temporel;

on émet (DVC, MTI, BR, MD, PW, DU; fig. 6) le même code de couleur d'information vocale numérique (VC1) avec des signaux hertziens provenant d'au moins deux stations mobiles desservies par la même station de base responsable; et

on émet (DVC, MTI, BR, MD, PW, DU; fig. 6) des codes de couleur d'information vocale numériques différents (VC1, VC2) à partir d'au moins deux stations mobiles utilisant le même canal hertzien et le même code d'identificateur de créneau temporel (TI1), mais qui sont desservies par des stations de base responsables différentes.

4. Un procédé selon la revendication 1, caractérisé par les étapes supplémentaires suivantes :

on mesure (REC, SLM; fig. 5) à la station de base responsable de la connexion avec la station mobile particulière, le niveau de signal sur le canal de communication numérique qui est utilisé pour la connexion de la station mobile;

on tient compte (CP; fig. 5) des résultats des mesures de niveau de signal à la station mobile responsable, lorsqu'on détermine si un transfert doit être effectué;

on mesure (REC, SLM; fig. 5) à la station de base de destination le niveau de signal sur le canal de communication numérique de la connexion établie de la station mobile particulière;

on émet (CPB, VCS, M2A, BG, MOD, PA; fig. 5) à partir de la station de base de destination un compte-rendu des résultats des mesures de

niveau de signal sur le canal de communication numérique; et

on tient compte (CP) des résultats des mesures de niveau de signal à la station de base numérique, lorsqu'on détermine si le transfert doit être effectué.

5. Un procédé selon la revendication 1, caractérisé en ce que l'un au moins des canaux hertziens sélectionnés est un canal hertzien qui est utilisé pour un canal de commande par une station de base autre que la station de base responsable.

6. Un procédé selon la revendication 4, caractérisé par les étapes supplémentaires suivantes :

à la station mobile particulière, on code (CC; fig. 6) l'information numérique à émettre avec un code binaire de détection d'erreur;

on additionne modulo deux (MTI; fig. 6) à l'information binaire codée un code de couleur d'information vocale numérique codé en binaire;

on émet (BR, MD, PW, DU; fig. 6) la somme modulo deux avec les signaux hertziens, à partir de la station mobile particulière; et

à la station de base de destination, on démodule (REC; fig. 5) les signaux hertziens reçus, pour obtenir une information codée en binaire;

on additionne modulo deux (M2A; fig. 5) le code de couleur d'information vocale numérique codé en binaire à l'information codée en binaire qui est obtenue à partir des signaux reçus;

on décode (DCD; fig. 5) la somme modulo deux, à la station de base de destination, conformément au code de détection d'erreur, pour détecter des erreurs possibles; et

on utilise à la station de base de destination l'absence d'erreur dans la somme modulo deux à titre d'indication de l'apparition du code de couleur d'information vocale numérique dans les signaux hertziens reçus.

7. Une station de base (B1-B10) dans un système de radiocommunication mobile cellulaire, cette station de base étant connectée à un centre de commutation de service mobile (MSC) et communiquant avec des stations mobiles (M1-M9) sur des canaux hertziens (RCHc, RCHd) pour l'accès multiple par répartition dans le temps, dans des créneaux temporels dans des trames des canaux hertziens, et comprenant des moyens (BG, MOD, PA; fig. 5) pour émettre des salves de signaux hertziens dans des créneaux temporels dans des trames sur les canaux hertziens, et des moyens (REC, A/D, EQ-AFC) pour recevoir des salves de signaux hertziens dans les créneaux temporels de trames sur les canaux



hertziens;

caractérisé par

des moyens (TIS) pour enregistrer au moins autant de codes d'identificateur de créneau temporel différents (TI1-TI3) qu'il y a de créneaux temporels dans une trame à créneaux temporels multiples sur les canaux hertziens;

des moyens (BG) pour incorporer dans chaque salve émise par la station de base l'un des codes d'identificateur de créneau temporel enregistrés indiquant le créneau temporel de la trame du canal dans lequel la salve est émise, mais indépendamment de l'identité de la base et du canal hertzien dans lequel la salve est émise;

des moyens (EQ-AFC) pour synchroniser les moyens de réception sur des salves reçues, par l'utilisation des codes d'identificateur de créneau temporel des salves reçues;

des moyens (EQ-AFC) pour l'identification de codes quelconques parmi les codes d'identificateur de créneau temporel prédéterminés, lorsqu'ils apparaissent dans une salve reçue; et

des moyens (SLM) pour mesurer le niveau de signal d'une salve sur un canal hertzien dans un créneau temporel qui est déterminé par un code d'identificateur de créneau temporel.

8. Une station de base selon la revendication 7,

caractérisé en outre par

des moyens (VCS) pour enregistrer un ensemble de codes de couleur d'information vocale numérique (VC1-VC3) indépendants des codes d'identificateur de créneau temporel (TI1-TI3);

des moyens (M2A) pour incorporer dans chaque salve émise par la station de base l'un des codes de couleur d'information vocale numérique enregistrés, indépendants des codes d'identificateur de créneau temporel dans les salves et du canal dans lequel la salve est émise; et

des moyens (M2A, VCS) pour l'identification d'un code quelconque parmi les codes de couleur d'information vocale numérique prédéterminés, lorsqu'il apparaît dans une salve reçue.

9. Une station mobile (M1-M9) prévue pour la communication avec des stations de base (B1-B10) dans un système de radiocommunication mobile cellulaire comportant des canaux hertziens (RCHc, RCHd) pour des canaux de communication à accès multiple par répartition dans le temps, dans des créneaux temporels dans des trames des canaux hertziens, et comprenant des moyens (BR, MD, PW, DU; fig. 6) pour émettre des salves de signaux hertziens dans des créneaux temporels dans des trames sur les canaux hertziens, et des moyens (DU, RM, AD, EQ; fig. 6) pour recevoir des salves de

signaux hertziens dans les créneaux temporels de trames sur les canaux hertziens;

caractérisée par

des moyens (TIC; Fig. 6) pour enregistrer au moins autant de codes d'identificateur de créneau temporel différents (TI1-TI3) qu'il y a de créneaux temporels dans une trame à créneaux temporels multiples sur les canaux hertziens;

des moyens (CPM, BR; Fig. 5) pour incorporer dans chaque salve émise par la station mobile un code (TI1) parmi les codes d'identificateur de créneau temporel enregistrés, indiquant le créneau temporel de la trame du canal dans lequel la salve est émise, mais qui est indépendant de l'identité du mobile et du canal hertzien dans lequel la salve est émise;

des moyens (EQ, CPM) pour synchroniser les moyens de réception sur des salves reçues, en utilisant les codes d'identificateur de créneau temporel des salves reçues, et pour l'identification de codes quelconques parmi les codes d'identificateur de créneau temporel prédéterminés, lorsqu'ils apparaissent dans une salve reçue; et

des moyens (RLM) pour mesurer le niveau de signal d'une salve sur un canal hertzien dans un créneau temporel qui est déterminé par un code d'identificateur de créneau temporel.

10. Une station mobile selon la revendication 9,

caractérisé en outre par

des moyens (DVC; fig. 6) pour enregistrer un ensemble de codes de couleur d'information vocale numérique (VC1-VC3), indépendants des codes d'identificateur de créneau temporel (TI1-TI3);

des moyens (CPM, MT1; fig. 6) pour incorporer dans chaque salve émise par la station mobile l'un des codes de couleur d'information vocale numérique enregistrés, indépendant des codes d'identificateur de créneau temporel dans les salves et du canal dans lequel la salve est émise; et

des moyens (TIC, MT2; fig. 6) pour l'identification de codes quelconques parmi les codes de couleur d'information vocale numérique prédéterminés, lorsqu'ils apparaissent dans une salve reçue.

