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(71) Applicant: **TELEFONAKTIEBOLAGET LM ERICSSON (publ)** [SE/SE]; S-126 25 Stockholm (SE).

(72) Inventors: **LINDHEIMER, Christofer**; Köpenhamnsgatan 26, S-164 42 Kista (SE). **BALACHANDRAN, Kumar**; 302 Ravenstone Drive, Cary, NC 27511 (US). **MOLNÖ, Johan**; Kungsklippan 12 III, S-112 25 Stockholm (SE).

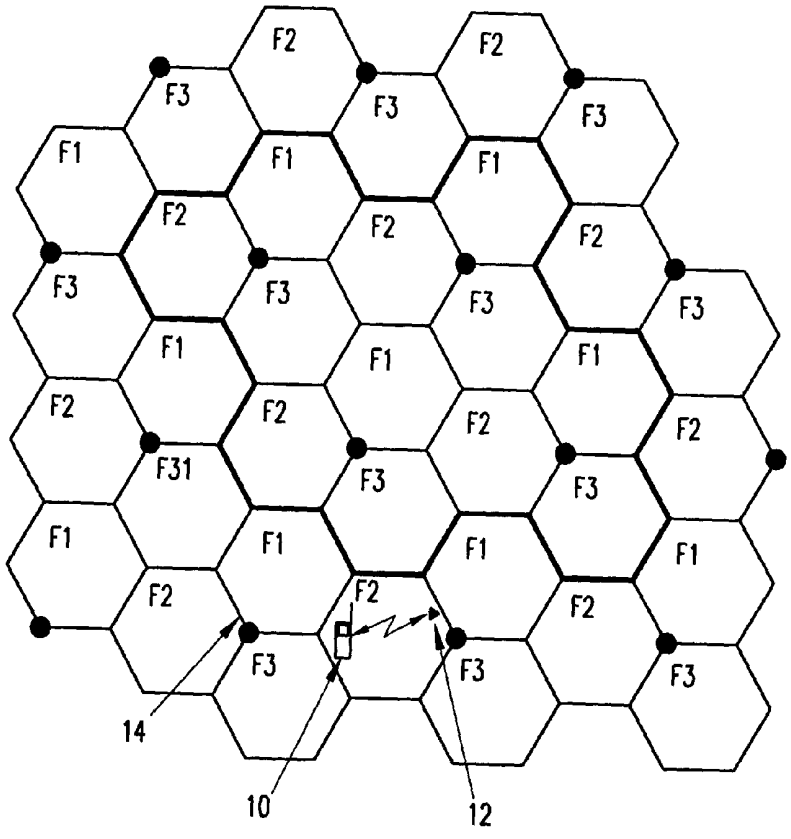
(74) Agent: **MAGNUSSON, Monica**; Ericsson Radio Systems AB, Patent Unit Radio Access, S-164 80 Stockholm (SE).

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(54) Title: METHOD AND APPARATUS FOR SUSTAINING CONVERSATIONAL SERVICES IN A PACKET SWITCHED RADIO ACCESS NETWORK



(57) Abstract: In a packet switched system used for speech communication, a user (10) entering a silent period, start to transmit silence descriptor information (SID). According to the invention, a speech user (10) is not allocated the same resources for transmission of SID as for the speech communication. Instead, the user (10) is, upon entering a silent period, reallocated to a SID communication channel, shared between a number of different users (10) in silent mode. The resources used for speech may then be more advantageously utilized for other speech users (10), and is not occupied for SID transmission only. In an alternate embodiment of the invention, when a mobile station (10) is in silent mode, it receives and transits associated signaling information on the same transmission resources as those used for the SID transmissions.

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METHOD AND APPARATUS FOR SUSTAINING CONVERSATIONAL SERVICES IN A PACKET SWITCHED RADIO ACCESS NETWORK

CROSS REFERENCE TO RELATED APPLICATION

This application is related to an application entitled "Method and System for Fast Access to an Uplink Channel in a Mobile Communications Network" (Docket No. 34647-413USPT, Serial No. 09/527,415, filed March 17, 2000, and an application entitled "Method and System for Fast Access to an Uplink Channel in a Mobile Communications Network" (Docket No. 34647-00412 Serial No. 09/568451), filed May 9, 2000. The applications are incorporated by reference herein.

BACKGROUND OF THE INVENTION

The present, invontion generally relates to wireless communication. More specifically. the invention relates to a method and apparatus for multiplexing real-time users in a packet switched radio communication system.

There is presently ongoing a paradigm shift in telecommunication. Historically, the telecommunications industry has been focusing on voice communication over fixed lines or radio communication links like, e.g., cellular telephony systems like Global System for Mobile communication (GSM). Communication has typically been transmitted in a circuit switched manner, i.e., with dedicated connections between users or end nodes. Circuit switched communication requires continuous allocadon of physical transmission resources, or communication channels, for the whole duration of a connection, regardless of the actual use of the connection.

With the explosive growth of Internet traffic however, the focus has shifted towards more efficient ways of transferring data communication in a telecommunication network. Packet switched communication protocols has been developed, e.g., General Packet Radio Service (GPRS) to be used together with GSM and the Time Division Multiple Access (TDMA) system compliant to the TIA/EIA-136 standard. The advantage with these packet switched communication protocols is that there is no need to have physical transmission resources reserved for users that are

not making use of it. For example, a user may share a transmission resource with one or several other users and occupy the resource only when there is user data to send. If there is no data to send during certain periods, other users may utilize the transmission resources. This is a more efficient way of allocating users onto physical channels than the circuit switched strategy, where a user is always a sole owner of a communication channel.

With the identification of packet switched methods as being an efficient way of transferring data, the next step is basically a step back. The focus is again on voice, but it is also a step forward in that the aim is now set on voice over packet switched communication, or more generally, real-time services over packet switched communication channels. With this and other aims, there will be a large variety of services carried over packet switched communication channels, services with completely different demands in terms of delay, delay variations (jitter) and error rates. For example, a web browsing session may not suffer seriously from being slightly delayed, it is however important that the transfer is error free. For voice communication, it is basically the other way around; a voice conversation is extremely sensitive to delay and delay variations but may perhaps tolerate a non-zero error rate and still provide acceptable quality.

In the Universal Mobile Telecommunications System (UMTS), there are four proposed classes defined to further characterize different services and the respective Quality of Service (QoS) demands: conversational, streaming, interactive and background. One main distinguishing factor between these classes is delay related. The conversational class is intended for delay sensitive traffic, such as speech, while the background class is the most delay insensitive class. Conversational and streaming classes are intended to be used to carry real-time traffic flows and interactive and background classes are intended to carry, e.g., Internet applications like WWW-browsing, file transfer and e-mail services.

As voice communication involves constraints on delay, it does not tolerate the sharing of a transmission resource. or physical channel, as liberally as the fundamentals of packet switched communication allow. It is necessary to introduce priority for voice users over, e.g., a background user on the same channel, such that

the real-time aspects of the voice connection may be maintained.

In an exernplary voice call, there are typically periods of silence in one direction when the other direction speaks, and vice versa. With circuit switched radio communication connections, it is possible to utilize these silent periods and decrease the output power from the transmitter while a voice stream from a speech coder is paused. This will mean a system gain in terms of less interference. The physical communication channels, e.g., in terms of frequency, timeslot or code is however still occupied. There may however be even more to gain if other users could be multiplexed onto the same physical channel during these speech pauses. By using packet switched methods for transferring voice communication of the conversational class, it will become possible to more efficiently make use of the transmission resources while in a period of speech silence. One way to do this is to allocate the resources to a best effort user, e.g., of the background or interactive class, while in a silence period and maintain the high priority for the conversational class user. Thus, it will be easy to, as soon as a silence period is interrupted by a speech period, prioritize allocation of the conversational class again. With this flexible method of allocating shared resources, it will be possible to allocate more users than the number of available transmission resources or channels. If there is a high number of transmission resources, it may even be possible to allocate more voice users than the number of channels, assuming that it is highly unlikely that all users need transmission resources at the same time. This strategy is usually referred to as statistical multiplexing.

For the Adaptive Multi-Rate (AMR) speech coder structure of GSM, as in many other speech coders designed for circuit switched connections, the silent periods discussed above are not completely transmission free, i.e., the transmission resources are still utilized. During a silent period, when no speech is processed, the speech coder generates what can be referred to as a Silence Descriptor (SID). This silence descriptor is transmitted according to some repetition rate in order to generate "comfort noise" in the receiving end. It is typically the case in a voice communication that there is no *complete* silence, and to "simulate" the noise usually present in the surroundings of the "silent speaker". SIDs are transmitted with a certain repetition

rate. The SIDs defined for circuit switched speech are traditionally transmitted on the same physical resource as the regular voice communication.

If a packet switched system is considered, the silent periods should optimally enable allocation of other users onto the physical communication channel, e.g., background or interactive class users. It would of course be possible to do this and still transmit SIDs from a conversational user also. However, if one consider utilizing a communication channel for more than one conversational user in one way or another (e.g., statistical multiplexing), the SID transmissions that are continuously repeated with some repetition pattern will pose a problem, since a continuous allocation for e.g., another real-time user will be impossible. There is thus a need to develop and prepare techniques to more efficiently allocate resources and allow a more flexible scheduling, than what is possible with the presently used SID techniques.

SUMMARY OF THE INVENTION

In one aspect of the present invention, allocation of conversational users that are in a silence period is made on a single predetermined communication channel. All users that are allocatiod on one of a certain number of predetermined channels for traffic communication and that are in a silent period are re-allocated to the single predetermined communication channel for SID transmissions. Thus, the resources on the channels used for e.g., conversational transmission is not used for SID transmissions, but may instead be utilized by allocating another user thereon. As soon as a user enters a silent period in one direction, a reallocation. to the shared SID transmission resources takes the user away from the resources used for the, e.g., conversational transmission.

In another, aspect of the present invention a Packet Slow Associated Control Channel (PSACCH) is allocated to share transmission resources with the SID transmissions. The PSACCH is allocated in a certain repetition pattern on the same physical communication channels as the SID transmissions, such that users receiving SID transmissions also receive PSACCH transmissions with a certain repetition rate.

In another aspect of the present invention, when leaving a downlink (in the direction from the base station to the mobile station) silence- or pause period, the first

data block, e.g., containing speech data, is transmitted together with a channel allocation on the same communication channel, utilizing the same transmission resources as for the previously mentioned SID and PSACCH transmissions. This will advantageously handle allocation delays in the downlink, that would otherwise be introduced in the beginning of an active period. The SIDs associated with other users, that would normally be transmitted on the transmission resources that instead is used for a first data and allocation block are delayed until transmission resources are available again on the "SID/PSACCH" communication channel.

In yet another aspect of the present invention, downlink transmission resources are made available, such that, when stealing SID resources for a first data and allocation block, the SID is displaced and transmitted during a sequence of one or more periods on the same channel, that are not part of any repetitive SID or PSACCH transmission.

In yet another aspect of the present invention, uplink allocation of SID transmissions on a shared resource is made by assigning to a user in a silent period, a periodic repetition starting from a certain frame number and optionally a frame number offset.

BRIEF DESCRIPTION OF THE DRAWINGS

Features, objects and advantages of the present invention will become apparent to those skilled in the art by reading the following detailed description where references will be made to the appended figures in which;

FIGURE 1 illustrates an exemplary cellular system where a base station is responsible for providing ratio communication to a certain geographical area.

FIGURE 2 illustrates a timeslot and frame divisioning according to GSM specification.

FIGURE 3 illustrates how SID blocks from different users in the downlink are multiplexed onto one common SID communication channel and how users leaving silence periods are allocated to speech communication resources according to one embodiment of the present invention.

FIGURE 4 illustrates procedures in the mobile station when in a downlink

silent period on the SID communication channel, according to one embodiment of the present invention.

FIGURE 5 illustrates procedures in the network side for the downlink SID communication channel according to the present invention.

FIGURE 6 illustrates how SID blocks from different users in the uplink are multiplexed onto one common SID communication channel according to one embodiment of the present invention.

FIGURE 7 illustrates procedures in the mobile station when in an uplink silent period on the SID communication channel, according to one embodiment of the present invention.

FIGURE 8 illustrates a SID communication channel where PSACCH transmissions are multiplexed with SID transmissions according to another embodiment of the present invention.

FIGURE 9 illustrates an exemplary cellular system and a mobile station including means for supporting SID and PSACCH allocations according to the present invention.

DETAILED DESCRIPTION

The invention will now be described making references to a GPRS/EGPRS based cellular packet data communication system and extensions and variants thereof, as briefly described in the background. It should be understood that the invention is not limited to these types of systems. In general, all TDMA based systems where real-time applications are transmitted over a packet switched channel may be considered.

Figure 1 illustrates an exemplary cellular system where a base station, 12, is responsible for providing radio communication possibilities to a certain geographical area. A mobile station, 10, may move between areas served by different base stations and communicate with different base stations, 14, dependent upon its position. In Figure 1, a cellular pattern based on 3 frequencies or 3 frequency groups are illustrated, F1, F2 and F3. This is usually referred to as a 3 reuse pattern and indicate that there is a 3-repetition of frequencies, or, that a frequency is only used once every third cell. There are of course other ways to arrange the distribution of a number of

frequencies for a group of cells, e.g., with other repetition patterns like 1, 9, 12 and 21.

Figure 2 illustrates the time division specified for a GSM frequency. Every GSM frequency is divided into 8 different timeslots, where each timeslot form a communicatio channel for a circuit switched GSM connection. The downlink and uplink are identical in timeslot divisioning but separated in frequency. At least one timeslot on one frequency in each cell, e.g., TN0, is, in the downlink direction, allocated for common control channel broadcast transmissions. The corresponding uplink timeslot is usually used for random access, i.e., a way to make the system aware of a mobile user's request for a communication channel. This is illustrated in Figure 2, where timeslot 0, TN0, is shaded. The different timeslot transmissions are repeated in what is referred to as frames. There are several Important frame repetition patterns in GSM, one being the 52-frame pattern illustrated in Figure 2. The chronological order at which transmission occur is, e.g., frame 0 (TN0-TN7)-frame 1 (TN0-TN7)-frame 2 (TNC-TN7)..., etc. A speech frame in GSM is 20 ms. When the speech coder and tha channel coder have processed the speech frame the resulting number of bits corresponds to what can be carried over the air in four full bursts on a timeslot.

The packet switched modes designed for GSM, GPRS and EGPRS, are in many ways similar to GSM. For example, the timeslot structure and frame divisioning are identical to GSM for the traffic channels. This means that much of what is specified for voice transmission over GSM circuit switched communication channels, may also hold for voice transmission over GPRS packet switched communication channels. For example, a speech period may still be 20 ms. A 20 ms period in GPRS corresponds to the transmission of four frames and for one timeslot in GPRS and EGPRS this is often referred to as a block period, or block for short.

There are several different speech codecs developed for GSM, the most recent being the Adaptive MultiRate (AMR) speech codec. This speech codec has an adaptive output of speech information bits. When these bits are combined with an adaptive portion of channel coding the total number of bits adds up to a constant number, i.e., constant gross rate. For example, with a very good channel quality, there is no need to use a large amount of channel coding bits. The transmitted bits may instead comprise a larger amount of channel coding bits. The transmitted bits may

instead comprise a larger amount of speech information. For a poor quality, more protection is needed, and channel coding bits are required, at the cost of speech codec information. However, the gross bit rate over the air, i.e., speech codec information + channel coding bits, does not vary with the AMR codec in GSM. This quality adaptation may be performed on speech
frame basis and results in higher perceived quality.

A similar strategy to the GSM AMR is also being considered for voice communication over a packet switched channel, like a GPRS or EGPRS channel.

Considering now the SID transmissions for voice connections in silent mode for GSM AMR as an exemplary case. In the AMR coder, the SID occupies every eighth block. This means that, for circuit switched voice communication, 7/8 of a communication channel (i.e., timeslot) is unused during silent periods. In a packet switched communication system, it would be advantageous to utilize the resources for other users during this 7/8 of the time. A user, U1, engaged in a voice connection, is allocated downlink transmission resources on timeslot number 3, TN3, for transmission of speech information. When user U1 enters a period of silence in the speech flow, for example after a sentence, awaiting an answer in the other direction, a Voice Activity Detector (VAD) detects the start of a silent period. In GSM, this VAD triggers a decrease of output transmission power on TN3, since there is no speech information to send. The
transmission of SIDs also starts with the VAD indication of a silent period. For GSM AMR, the SID blocks are transmitted with a 160 ms repetition cycle.

According to one aspect of the present invention, in order to enable, e.g., a GSM AMR like approach a so for GPRS, a packet switched SID communication channel is defined. The packet switched SID communication channel has similar functionality to the circuit switched SID channel in GSM, although with a multiplexing method that intelligently utilizes the more liberal multiplexing techniques allowed in a packet switched system.

The downlink direction of the SID communication channel is illustrated as TN0 in Figure 3. According to the invention, the SID transmissions are not transmitted on the same channel as the speech blocks. Instead, SID transmissions, e.g.,

SID(l) for user U1, are transmitted on a separate SID communication channel. This is illustrated in Figure 3. Thus, upon entering a silent period by receiving a first SID(l) on TN3, user U1 is reallocated to the SID communication channel on TN0 and may there start to receive SID blocks periodically. The advantage of re-allocating a silent user, is that TN3 in the downlink becomes available for other continuous communication flows. For example, If a user U2 is about to leave the downlink SID channel upon entering a speech period, user U2 may be allocated to TN3 for its next speech period. This is illustrated in Figure 3, showing that user U1, after receiving the first SID(1) on TN3, switches to the SID communication channel TN0 while user U2, ending a silent period, receives a first speech block on the SID communication channel containing a reallocation indication to TN3.

Figure 3 illustrates an exemplary SID communication channel that handles *N-m* different users in silent periods simultaneously. *N* corresponds to the repetition rate of SID transmissions, e.g., in GSM with AMR speech codec, 160 ms. *m* corresponds to a number of blocks that are not allocated in any repetitive SID transmissions. The *m* spare blocks are reserved for use when a user leaves a silent period.

For example, when user U2 starts to receive speech data in the downlink again after a silent period, there is a need to allocate resources for speech Information transmission. According to one embodiment of the present invention, a base station transmits the first speech block after a silent period on the SID communication channel, as illustrated in Figure 3. An MS in a downlink silent mode always listens to the SID communication channel and thus receives the first speech block intended for it. The first speech block after a silent period may be coded with less speech information bits, if necessary, to allow transmiss on of an allocation indication included in the first speech block transmitted on the SID communication channel. To be able to allocate resources for the second and following speech blocks, the first speech block may contain a message, such that a user U2 is informed where the following downlink speech block will be sent. After having received the first speech block on the SID communication channel, the user leaves this channel and moves to the channel indicated in the allocation message, in this example TN3, where subsequent blocks may be received.

By transmitting the first speech block, along with an allocation indication, reserved resources for SID transmissions may be "stolen". Since a first speech block advantageously is transmitted without any delay, it is possible that it "steals" resources from some other users SID transmission flow. For example, user U2, listening to SIDs SID(2) may receive a first speech block in a position usually used for SID transmissions to a user U3, receiving SID(3). This is handled such that any of the last *m* spare blocks in the repetition pattern may take care of the SID(3) transmission instead, since this is not as delay sensitive as the first speech block to user U2. The last *m* blocks are thus used for transmitting "stolen" SIDs. Occasionally, the first speech blocks will be transmitted in one of these *m* blocks, if the downlink communication resumes during that period.

Note that when a speech user is reallocated from a speech communication channel, it may also receive its *first* SID block on the speech communication channel.

The allocation messages, although illustrated for the downlink in figure 3, may also reallocate uplink communication.

Figure 4 illustrates the procedure to be followed on the mobile terminal side when the downlink is in a silent period, and is therefore allocated on a downlink SID channel. In 42, the mobile decodes all the SID blocks, even those intended for other users. The mobile only updates its SID information when blocks with a matching address are decoded. As long as the decoded blocks are identified as SID blocks, this procedure continues, 44. At one point, when the silent period for a connection is terminated in the downlink, the system will send, in the first occurring SID position, a first data (e.g., speech) block in the downlink, together with a channel allocation description, 46. A mobile will make a check in an address field to identify if the speech block has a matching address or if it is intended for another user. If it is intended for another user, the mobile ignores the block and the procedure continues. If the address is matching with that of the mobile, it will leave the silent mode, decode the speech block and move to a new communication channel, e.g., timeslot/frequency as indicated in a channel allocation description, and continue to receive downlink speech blocks on the new channel, 48.

Figure 5 illustrates the network side of the downlink SID allocation according

to the present invention. A scheduler continuously receives SID information, 50, and schedules this on the SID communication channel according to a predetermined repetition pattern. If there is no "first speech block" to any of the users in silent mode on the SID channel, the scheduler will not map any information to the last *m* spare blocks in the repetition cycle. If there are a "first speech block" arriving, this will be immediately scheduled an transmitted and, if an outstanding SID is deprioritized in this procedure, this SID will be sent in one of the *m* spare blocks. With the above described handling of the SID transmissions, it is possible to multiplex speech users in the downlink in a more efficient way than if the SID transmissions were allocated in the same way as for circuit switched voice communication, on the same communication channel as the speech blocks. Utilizing the present invention, implementation of statistical multiplexing for real time users will be facilitated.

Turning now to figure 6, an exemplary uplink SID allocation corresponding to the downlink described for Figure 3 is illustrated. The uplink SID communication channel does however not include any scheduled spare blocks, corresponding to the *m* spare blocks described for the downlink. This is explained by the fact that the uplink resources are allocated to a number of distributed mobile users and it is difficult to control and redirect uplink SID transmissions to other blocks than those reserved for a certain user. After having ended a speech period in the uplink, a user U 1 moves to the common uplink SID communication channel where the periodic transmission of SID (1) starts. The periodicity of the SID transmissions can be indicated in an allocation message at call setup, or in the SID allocation message transmitted in the beginning of a silent period. Note that the allocation messages, although indicated for the uplink in figure 6, may also reallocate downlink communication.

Figure 7 illustrates the MS procedure for uplink handling of silent periods on the SID communication channel. The SID number indicates which SID block the user is allocated when in a silent period. When the silent period has started, the transmitter part of the MS analyzes the content, 70, of the output from the speech codec and if it contains SID, the SID is sent on the allocated SID channel block, 72. (Note that the *first* SID in the uplink is transmitted together with a SID reallocation request on the speech communication channel, e.g., TN3 as illustrated in figure 6.) If the content is

a "first speech block" after a silent period, the MS may immediately request an uplink allocation via, e.g., a random access channel. After the uplink allocation is given, the MS initiates uplink transmission on the new uplink communication channel, 76.

For the uplink SID communication channel, the network receives SID transmissions according to the scheduled allocation and forwards them to respective packet switch connection end users or nodes. Should the network receive an access request from a user in a silent period, top priority is given to an uplink allocation for that user. The access burst may be sent on a random access channel which may either be allocated on another physical channel than the uplink SID communication channel, or alternatively share resources with the SID communication channel. It should be noted that since it is the base station that determines the allocation even for the uplink, there may be some additional delay experienced when leaving the uplink silent period.

According to another aspect of the present invention, the SID transmission resources may be shared with transmission of signalling, or control, information. In the present GSM system, a signalling channel called Slow Associated Control Channel, SACCH, is defined. This channel is typically used for, e.g., transmission of measurement reports and system information messages. It is defined for both the up- and the downlink. A variant of this circuit switched SACCH is also needed for a real-time session over a packet switched connection. This packet switched SACCH is hereafter referred to as PSACCH.

In a silent period, it is possible to allow the SID transmissions to share transmission resources with the PSACCH transmissions to or from a mobile station. For example, in GSM AMR, the normal rate for SID blocks is 160 ms, i.e., SID information is updated each 160 ms period. This high repetition rate is important since the SID blocks also contain adaptation information for the AMR codec. The normal period for a SACCH transmission is 480 ms, and this could also be used for a PSACCH. With the described SID communication channel, it is possible to allow for a maintained PSACCH transmission period and lower the update rate of SID information to alternating periods 160 and 320 ms. This is illustrated in figure 8, where each 3rd SID transmission is replaced with an PSACCH transmission (it should be noted that other ways of allocating PSACCH every 3rd block are possible and figure

8 only shows an exemplary alternating method). Thus, according to this aspect of the invention, the PSACCH transmissions does not need to be allocated any additional transmission resources than those used for SID transmissions. The blocks carrying the PSACCH information can also hold AMR adaptation information for the purpose of a continuous AMR update.

Figure 9 illustrates a GPRS communication system according to several embodiments of the present invention. A real time user 90 may communicate with the fixed part of the cellular system via a serving base station 92. The serving base station may host a scheduler, 94, for the physical channels utilized in the base station's coverage area. The base station is connected to a Base Station Control node, BSC, 96, which in turn is connected to a Serving GPRS Support Node, SGSN, 98, serving one or several BSCs. The SGSN is typically the node controlling the packet flow to and from the different base stations, via the BSCs. Another GPRS support node is a Gateway GPRS Support Node, 99, connected to e.g., Internet or other external networks (not illustrated). The scheduler, 94, is in this example located in the base station, but may alternatively be housed in any other network node. Scheduling functionality may also be split between different nodes in the system. The scheduler, 94, will control the allocation of SID blocks onto a SID communication channel. Different users, carrying different temporary identities, will be allocated to repetition patterns according to the methods described previously. For the downlink, the scheduler, 94, will schedule SID transrrissions and, at occurrence, replace SID transmissions with a "first speech block" transmission instantly upon arrival. The scheduler, 94 will also allocate resources from the *m* spare blocks to send outstanding SID transmissions. Similarly, in mobile station 90, transmission means 91 are included. The transmission means 91 is responsible for transmitting SID blocks in the uplink according to the repetition pattern indicated by the network for uplink SID transmissions. When a SID and an PSACCH information flow is multiplexed according to one embodiment of the present invention, the transmission means 91 is responsible for transmitting the PSACCH and SID transmissions according to the allocation scheme as indicated by the network.

Additionally, according to one aspect of the present invention, the scheduler,

94, include means for allocating resources to PSACCH transmissions on 9 SID communication channel at a certain repetition rate, and replace SID transmissions to users in silent periods with PSACCH transmissions.

Although the present invention has been described with examples from a packet switched communication system ccmpliant to the GPRS/GSM specifications, it should be noted that the solutions presented is equally well applicable to any other packet switched data communication system with the same or similar structure and functionality. The specific embodiments should therefore be considered exemplary rather than limiting the scope of the invention. The invention should rather be defined by the following claims:

What is claimed:

1. In a packet switched mobile communication system at least used for transmission of delay sensitive information and where at least one type of delay sensitive information contains speech information, said delay sensitive information being transmitted on a first communication channel identified by a certain physical transmission resource, a method for communicating silence descriptor (SID) information, where said SID information is associated with communication of said delay sensitive information on said first communication channel, said method comprising the step of:

transmitting said SID information on a second communication channel identified by a certain physical transmission resource, different from the certain physical transmission resource of said first communication channel.

2. The method of claim 1, wherein said certain transmission resource of said second communication channel utilizes a combination of frequency and timeslot that is distinct from a combination of frequency and timeslot utilized by said certain transmission resource of said first communication channel.

3. The method of claim 1, wherein said second communication channel is used by more than one user for SID transmissions and where each user transmitting or receiving SID on said second communication channel is assigned a first repetition period.

4. The method of claim 1, wherein:

said transmitting comprises sequentially transmitting SID information to a plurality of users of the packet switched mobile communication system.

5. The method of claim 1, wherein:

said transmitting comprises repetitively transmitting SID information to a plurality of users of the packet switched mobile communication system.

6. The method of claim 1, wherein:

the step of transmitting SID information comprises sending SID information to a plurality of devices on the second communication channel, each of the plurality of devices being in a silent period.

7. The method of claim 1, further comprising:

transmitting PSACCH related information on the second communication channel.

8. The method of claim 1, wherein:

the transmitting of the SID information comprises transmitting the SID information to a user of the packet switched mobile communication system.

9. The method of claim 1, wherein:

the transmitting of the SID information comprises transmitting the SID information to a base station of the packet switched mobile communication system.

10. The method of claim 1, further comprising:

prior to transmitting the SID information, sending a first block of delay sensitive information in a time period reserved for transmitting the SID information; and

delaying the transmitting of the SID information so that the SID information is transmitted during a time period that is not reserved for transmitting SID information.

11. A mobile telecommunications system, comprising:

a packet data network including a packet data support node for routing data communications to and receiving data communications from a plurality of mobile stations located in an area served by the packet data support node; and

a radio network for transmitting data packets between said plurality of mobile stations and the packet data support node, wherein said radio network operates to:

detect a transmission of a silence descriptor (SID) in a first communication channel associated with a first mobile station; and

reallocate the first mobile station to a second communication channel following the detection of the SID associated with the first mobile station.

12. The mobile telecommunications system of claim 11, wherein:

the first and second communication channels are downlink communication channels.

13. The mobile telecommunications system of claim 11, wherein:

the first and second communication channels are uplink communication channels.

14. The mobile telecommunications system of claim 11, wherein said radio network further operates to:

detect a transmission of SIDs associated with a plurality of first mobile stations on one or more communication channels other than the second communication channel; and

reallocate the first mobile stations to the second communication channel following the detection of the SID associated with the first mobile station.

15. The mobile telecommunications system of claim 11, wherein said radio network further operates to:

periodically transmit SID information to the first user on the second communication channel.

16. The mobile telecommunications system of claim 11, wherein said radio network further operates to:

detect transmission of delay sensitive information associated with the first mobile station on the second communication channel; and

responsive to the detection of delay sensitive information on the second

communication channel, reallocate the first mobile station to another communication channel.

17. The mobile telecommunications system of claim 16, wherein:

the delay sensitive information is a block of delay sensitive information;

the mobile telecommunications system further operates to, prior to the reallocation of the first mobile station to a communications channel other than the second communications channel, transmit the block of delay sensitive information to the first mobile station on the second communications channel.

18. The mobile telecommunications system of claim 17, wherein:

the transmission of the block of delay sensitive information to the first mobile station occurs in a block of time reserved for transmitting SID information to a mobile station other than the first mobile station.

19. The mobile telecommunications system of claim 18, wherein the radio network further operates to:

transmit SID information to the mobile station other than the first mobile station on the second communications channel in a block that is not reserved for SID transmission to any mobile station.

20. The mobile telecommunications system of claim 16, wherein the radio network further operates to:

transmit a message to the first mobile station identifying the other communications channel to which the first mobile station is reallocated.

21. The mobile telecommunications system of claim 11, wherein:

the radio network comprises a base station.

22. The mobile telecommunications system of claim 11, wherein the radio network further operates to:

periodically transmit PSACCH information and SID information on the second communications channel.

23. A method of communicating information in a cellular telecommunications system, comprising:

detecting a transmission of a silence descriptor (SID) in a first communication channel associated with a first mobile station; and

reallocating the first mobile station to a second communication channel following the detection of the SID associated with the first mobile station.

24. The method of claim 23, wherein:

the first and second communication channels are downlink communication channels.

25. The method of claim 23, wherein:

the first and second communication channels are uplink communication channels.

26. The method of claim 23, further comprising:

detecting a transmission of SIDs associated with a plurality of first mobile stations on one or more communication channels other than the second communication channel; and

reallocating the first mobile stations to the second communication channel following the detection of the SIDs associated with the first mobile station.

27. The method of claim 23, further comprising:

periodically transmitting SIDs to the first user on the second communication channel.

28. The method of claim 27, further comprising:

detecting transmission of delay sensitive information associated with the first

mobile station on the second communication channel; and

responsive to the detection of delay sensitive information on the second communication channel, reallocating the first mobile station to another communication channel.

29. The method of claim 28, wherein:

the delay sensitive information is a block of delay sensitive information; and

the method further comprises, prior to the reallocation of the first mobile station to a communications channel other than the second communications channel, transmitting the block of delay sensitive information to the first mobile station on the second communications channel.

30. The method of claim 29, wherein:

the transmission of the block of delay sensitive information to the first mobile station occurs in a block of time reserved for transmitting SID information to a mobile station other than the first mobile station.

31. The method of claim 30, further comprising:

transmitting SID information to the mobile station other than the first mobile station on the second communications channel in a block that is not reserved for SID transmission to any mobile station.

32. The method of claim 28, further comprising:

transmitting a message to the first mobile station identifying the other communications channel to which the first mobile station is reallocated.

33. The method of claim 23, further comprising:

periodically transmitting PSACCH information and SID information on the second communications channel.

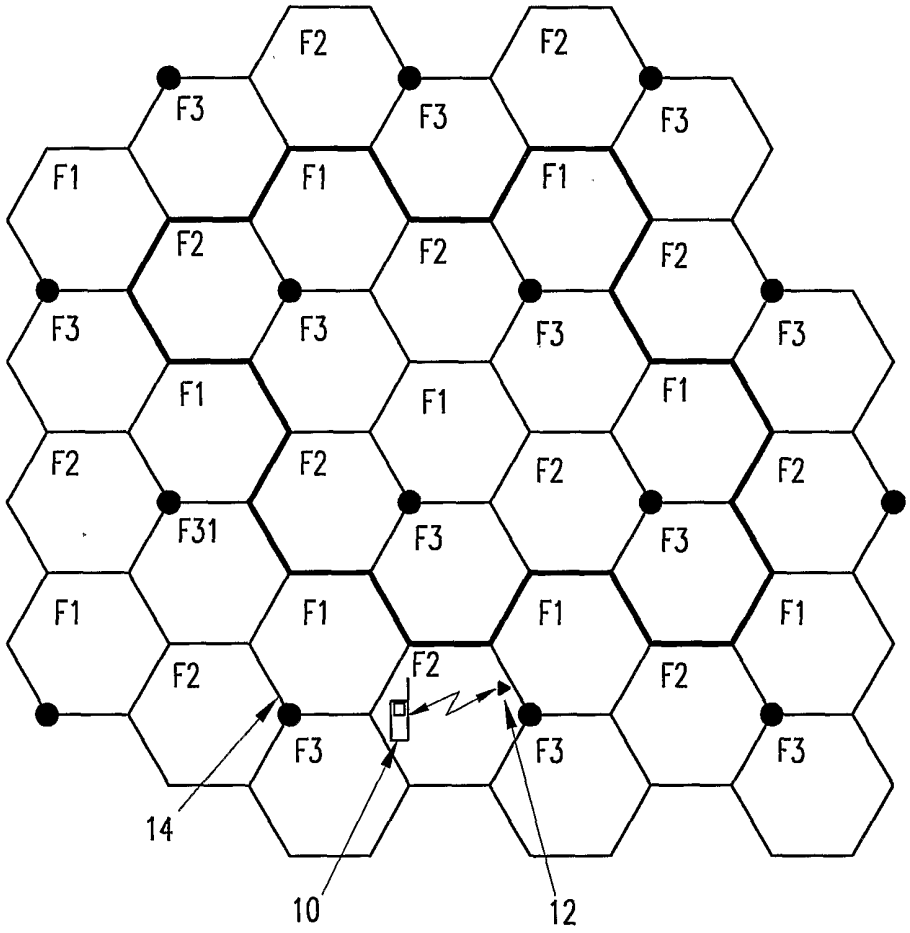

F2
F2
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F1
F1
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F2
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F2
F31
F3
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F1
F1
F2
F2
F2
F3
F3
F3
14
10
12

FIG. 1

	Timeslot							
Frame	TN0	TN1	TN2	TN3	TN4	TN5	TN6	TN7
0								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
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25								
26								
27								
28								
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51								

FIG. 2

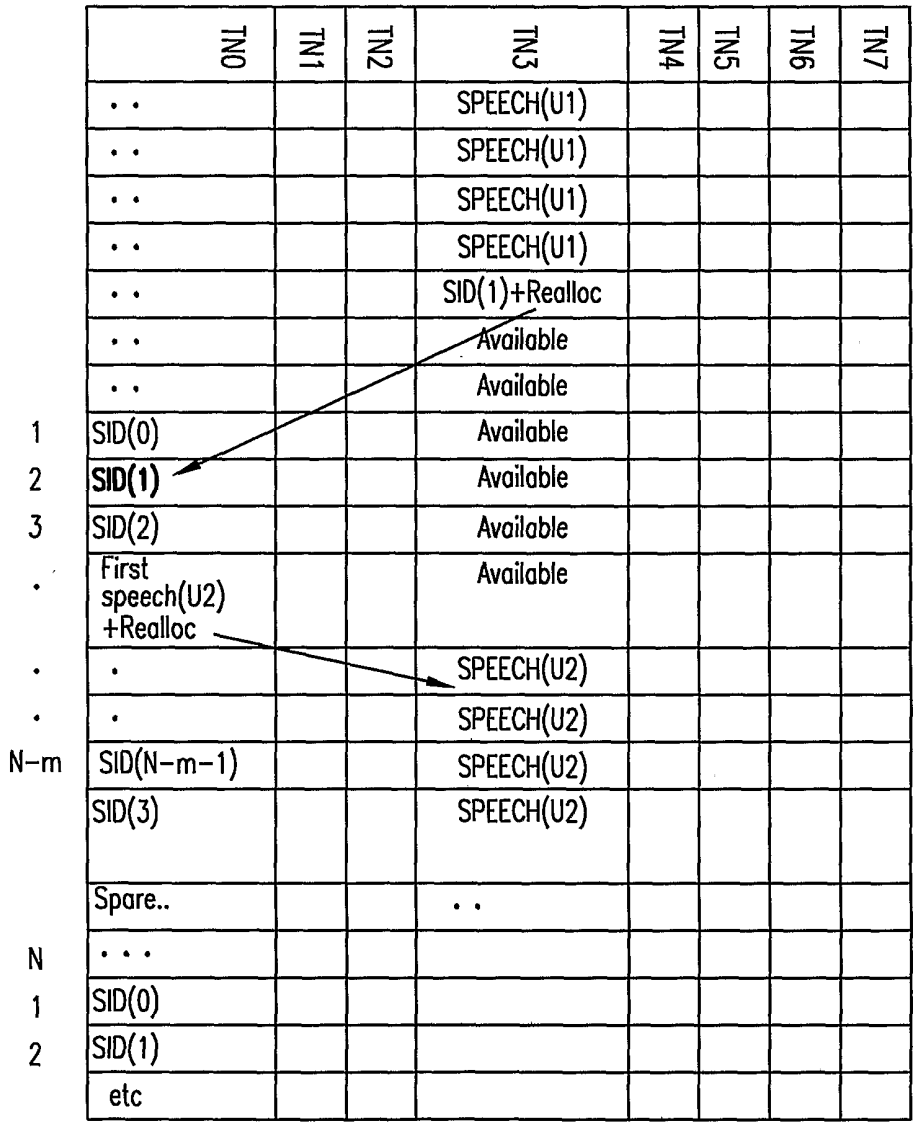

TN0
TN1
TN2
TN3
TN4
TN5
TN6
TN7
SPEECH(U1)
SID(1)+Realloc
Available
SID(0)
SID(1)
SID(2)
First speech(U2) +Realloc
SPEECH(U2)
SID(N-m-1)
SID(3)
Spare..
1
2
3
N-m
N
1
2

FIG. 3

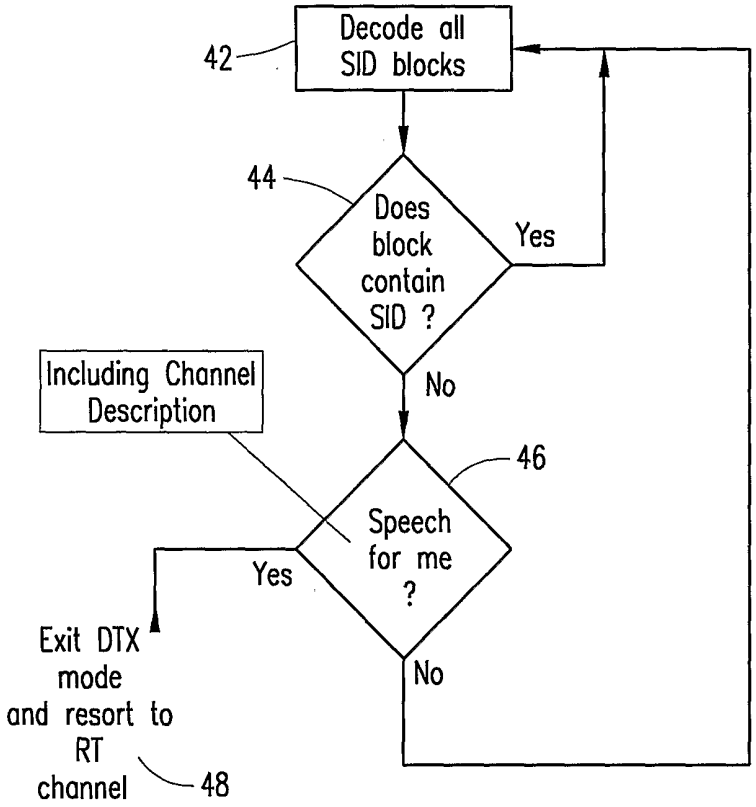

Decode all SID blocks
42
44
Does block contain SID ?
Yes
No
Including Channel Description
46
Speech for me ?
Yes
No
Exit DTX mode and resort to RT channel
48

FIG. 4

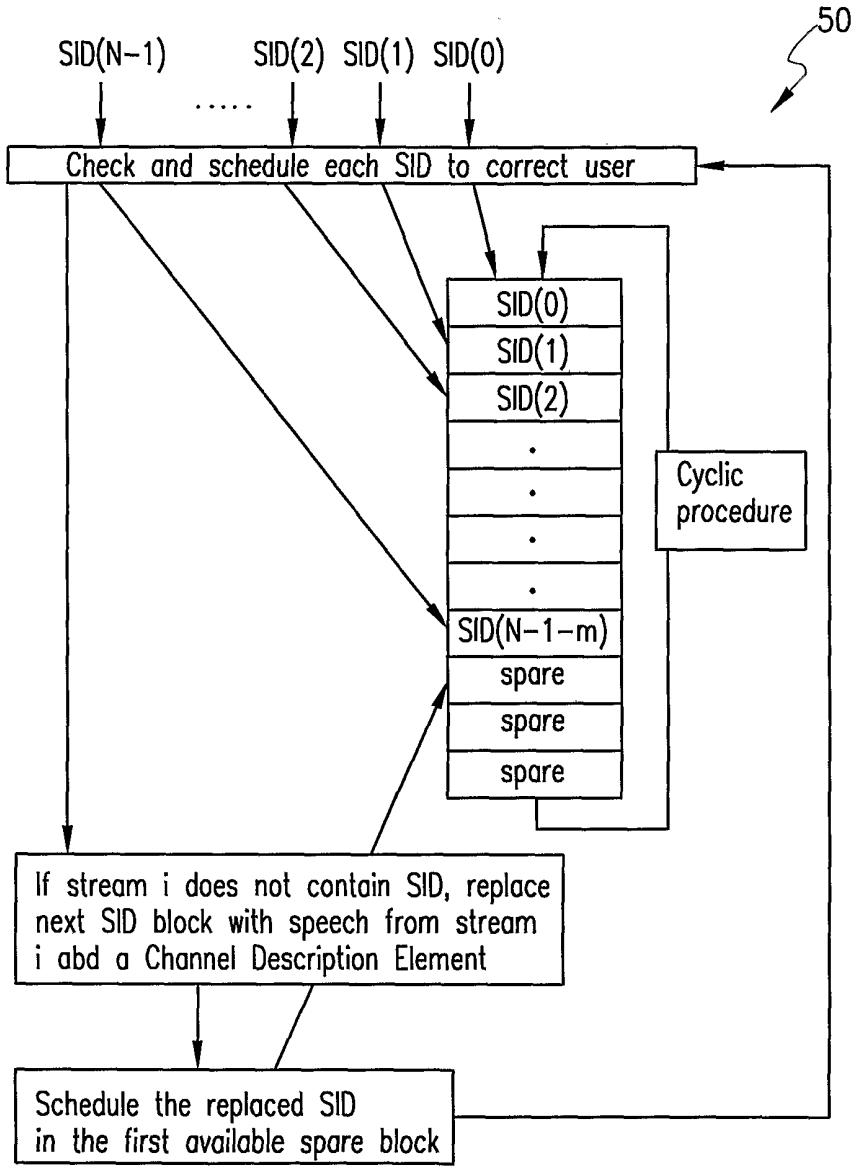

50
SID(N-1)
SID(2)
SID(1)
SID(0)
Check and schedule each SID to correct user
SID(0)
SID(1)
SID(2)
SID(N-1-m)
spare
spare
spare
Cyclic procedure
If stream i does not contain SID, replace next SID block with speech from stream i abd a Channel Description Element
Schedule the replaced SID in the first available spare block

FIG. 5

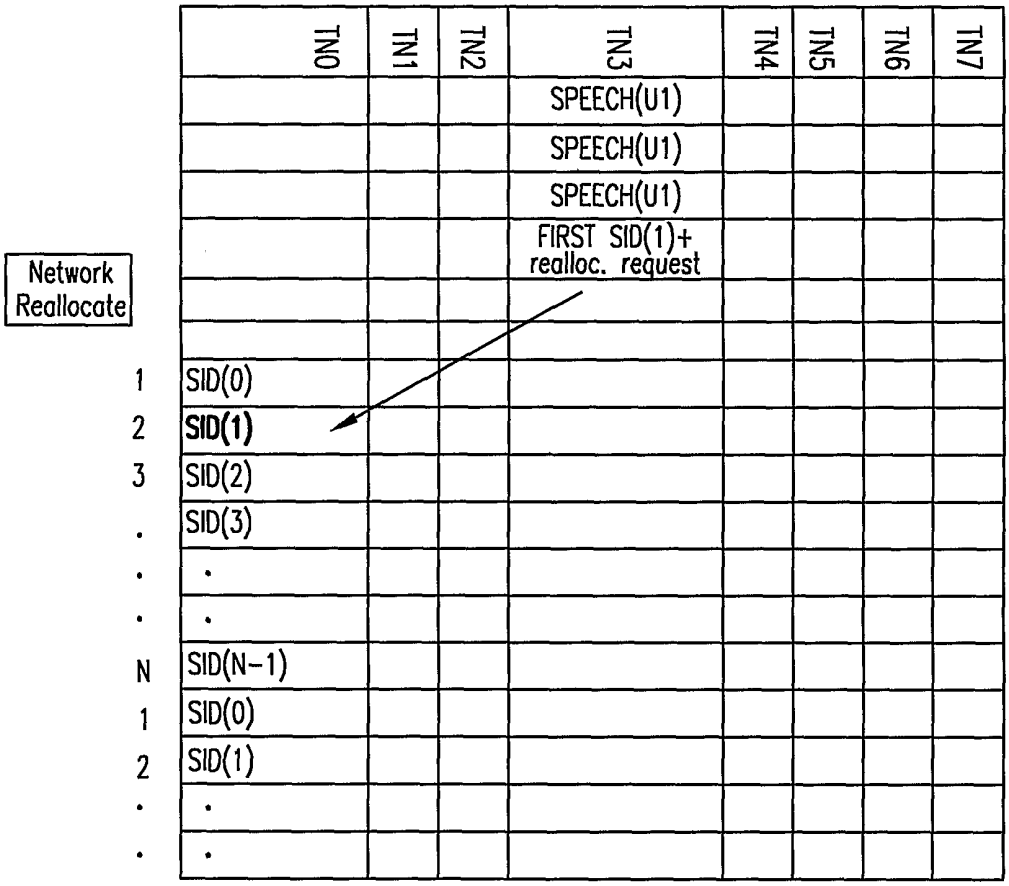

Network Reallocate
TN0
TN1
TN2
TN3
TN4
TN5
TN6
TN7
SPEECH(U1)
SPEECH(U1)
SPEECH(U1)
FIRST SID(1)+ realloc. request
1
SID(0)
2
SID(1)
3
SID(2)
SID(3)
N
SID(N-1)
1
SID(0)
2
SID(1)

FIG. 6

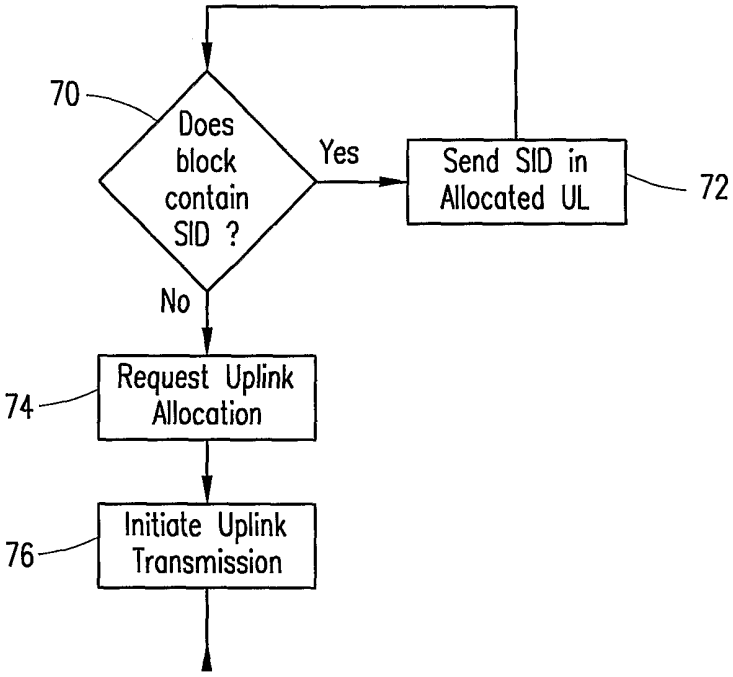

70
Does block contain SID ?
Yes
Send SID in Allocated UL
72
No
Request Uplink Allocation
74
Initiate Uplink Transmission
76

FIG. 7

TNO	1	2	3	4	5	6	7
SID(0)							
SID(1)							
PSACCH(2)							
• • •							
• • •							
• • •							
SID(0)							
PSACCH(1)							
SID(2)							
• • •							
• • •							
• • •							
PSACCH(0)							
SID(1)							
SID(2)							
• • •							
• • •							
• • •							
SID(0)							
SID(1)							
PSACCH(2)							

FIG. 8

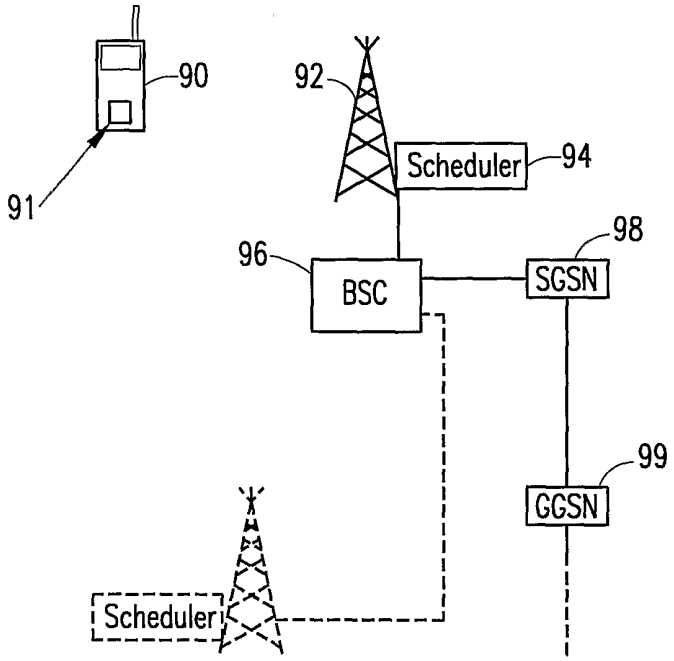


FIG. 9

INTERNATIONAL SEARCH REPORT

Inte nal Application No
PCT/SE 01/01024

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/56 H04Q7/22 H04Q7/38

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L H04Q

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 872 982 A (NOKIA MOBILE PHONES LTD) 21 October 1998 (1998-10-21) page 7, line 10 -page 8, line 23 ---	1,11,23
P,X	EP 1 006 695 A (NOKIA MOBILE PHONES LTD) 7 June 2000 (2000-06-07) page 7, line 58 -page 11, line 24 ---	1-33
A	GUO Q ET AL: "AGGRESSIVE PACKET RESERVATION MULTIPLE ACCESS USING SIGNATURES" IEEE INTERNATIONAL SYMPOSIUM ON PERSONAL, INDOOR AND MOBILE RADIO COMMUNICATIONS, 18 September 1994 (1994-09-18), XP002027584 page 1247, right-hand column, line 17 -page 1249, left-hand column, line 29 -----	1,11,23

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 October 2001	29/10/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lõpez Pérez M-C.

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INTERNATIONAL SEARCH REPORT

ormation on patent family members

Int ıal Application No
PCT/SE 01/01024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0872982 A	21-10-1998	US 6249681 B1	19-06-2001
		EP 0872982 A1	21-10-1998
EP 1006695 A	07-06-2000	FI 982577 A	28-05-2000
		AU 1563300 A	19-06-2000
		BR 9915676 A	25-09-2001
		EP 1006695 A1	07-06-2000
		WO 0033498 A2	08-06-2000
		JP 2000174820 A	23-06-2000