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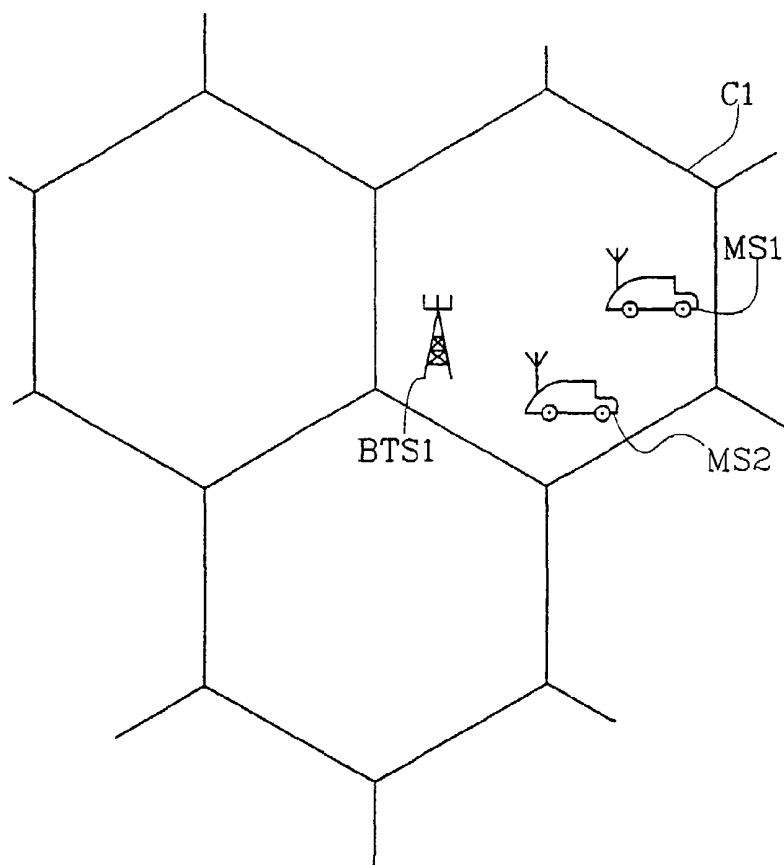
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(54) Title: METHOD FOR ALLOCATING CHANNELS IN A CELLULAR TELECOMMUNICATIONS NETWORK



(57) Abstract: The invention presented refers to a method for improving the quality of service in a mobile telecommunications system that utilises General Packet Radio Services (GPRS). The invention is also useful in other types of data networks that utilise packet-switched traffic, for example, the next generation mobile telecommunications system UMTS. Improvements in the quality of service are made through a number of new operator-specific parameters being defined, which provide a better possibility for checking and controlling the quality of service within a certain area or for a certain user. These parameters are then used in a channel allocation algorithm by the operator in order to provide the user with a better service. Thus, with this invention, the operator can fulfil the promised quality of service, both at the user and area levels, in a better way.



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Method for allocating channels in a cellular  
telecommunications network

**TECHNICAL AREA**

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The present invention pertains to the area of mobile telecommunications systems. More precisely, the invention constitutes a method pertaining to operator-specific additional services in a cellular mobile telecommunications system with an add-on for packet data.

10

The invention relates especially but not exclusively to a method for allocating idle capacity in a mobile telecommunications system of the type Global System for Mobile communication (GSM), together with the packet data option General Packet Radio Services (GPRS).

15

**STATE OF THE ART**

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In a digital mobile telecommunications system that utilises TDMA, information is transferred between radio nodes and one or more mobile stations, where the payload information may be composed of speech information in the case of a speech connection, or data in the case of a data connection. Figure 1 shows an example of such a system with a radio node BTS1 communicating with two mobile stations MS1 and MS2 that are located in a certain cell C, which is controlled by the node BTS1.

25

Transmission is performed over allocated radio channels within certain frequency bands that are divided into two parts: the uplink when the MS sends to the radio node; and downlink when the radio node sends to the MS.

30

An example of a digital TDMA system is GSM, the standard for which describes a packet data option that introduces packet data into the GSM network. This technology is called GPRS and implies data traffic being sent using packet-switched technology instead of circuit-switched technology, as is the case for GSM without the

packet data option. With GPRS in a GSM network, higher data rates are offered along with the possibility for the user to be connected to the data network all the time.

- 5 In a GSM network with GPRS, the radio channels are utilised efficiently by the GPRS terminal only using the radio channel when it is sending or receiving data – the remainder of the time it is silent and allows other terminals to use the channel. The radio channel allocated for GPRS (the Packet Data Channel or PDCH) may be of two types:

10

A Dedicated PDCH that is used exclusively for GPRS. The number of Dedicated PDCHs in each cell is determined by the operator, conditional on the traffic load or wanted capacity. This type of channel guarantees that there is always capacity for GPRS in a cell.

15

On Demand PDCH, which can be released for incoming circuit-switched calls in a loaded cell. On this type of channel, circuit-switched traffic always has precedence and GPRS traffic cannot be always guaranteed.

20

Figure 2 shows an example of how a set of two radio channels RF1 and RF2 can have time slots allocated for both circuit-switched and packet-switched traffic. On RF1, time slots 2, 3 and 4 are allocated for circuit-switched traffic, i.e., speech traffic. On RF2, time slots 5 and 6 are allocated for circuit-switched traffic, while time slots 1, 2, 3, and 4 on RF2 are allocated for packet-switched traffic. On RF1, two

25 time slots 5 and 6 are additionally allocated for On Demand PDCH, that is, they are used when needed for circuit-switched traffic, which has precedence, but can also be used for packet-switched traffic if they are idle. Finally, time slots 0 and 1 on RF1 are allocated for signalling.

For a terminal to be able to utilise GPRS, it needs primarily to carry out a two-step procedure, on the one hand to inform the operator that the user of the terminal intends to utilise GPRS, and on the other in order to obtain an IP address to be able to send and receive data. The first step is GPRS Attach, which means that a logical  
5 link is created between the terminal and the affected Serving GPRS Support Node (SGSN). The SGSN is the node that manages the transport of incoming and outgoing IP packets to and from terminals within its service area, that is, the SGSN service area.

10 The second step is PDP context activation, which means that the affected Gateway GPRS Support Node (GGSN) is informed that the terminal exists and where it is. The GGSN is the node that manages the interface between a GPRS network and external IP networks. PDP context activation can be done at any time, for example, long before data is actually going to be sent, since the user does not use any radio  
15 resources as long as he/she is not sending or receiving data. PDP context activation can be any length of time, for example, several days, based entirely on the user's requirements, the limitations of the terminal or any other factor that limits the time.

This activation can be likened to logging on to a network; the terminal thereby obtains an IP address, static or dynamic, which means that thereafter it can begin to  
20 send and receive data via IP packets.

For the user to then be able to utilise the data services (with varying requirements for data rate and delay of data packets) offered by the operators, a number of attributes for quality of service have been standardised, described in the GSM standard  
25 (GSM 02.60, GSM 03.60):

Service Precedence is divided into three different classes that indicate the priority that a specific service, and the packets belonging to that service, have. A service

with lower priority risks losing data packets during overloads in the network, which means that data packets with higher priority having precedence in the network.

5 Delay is divided into four classes that define the delay that is acceptable in the network.

Reliability is divided into three classes that define the probability of data packet loss, corrupt data packets, duplicates of data packets and data packets in the wrong order.

10

Peak Data Rate specifies the highest data rate that can be expected in the network during one entire PDP context.

15

Mean Data Rate specifies the mean data transfer rate that can be expected in the network during one entire PDP context.

## SUMMARY OF THE INVENTION

20 One problem in mobile telecommunications systems of the type GPRS is that the attributes defined in the GSM standard for quality of service in GPRS are not really sufficient to maintain the promised quality of service.

25 Another problem is that the attribute for mean data rate defined for GPRS is calculated for one entire PDP context, which is the entire time that a user has an IP allocated to him/her. The problem is that a PDP context can be several days long, which does not give any reliable indicator of the actual mean data rate during the active time, and thereby creates problems for carrying out channel allocation efficiently.

The purpose of the invention presented here is to arrive at algorithms for channel allocation during the utilisation of a certain, defined quality of service in the communications system, and in this way to achieve a more efficient utilisation of the available capacity in the system.

5

In accordance with the invention, idle capacity is allocated in the communications system in order to counteract a measured mean data rate becoming less than a certain value for acceptable data rate. This is done by investigating whether or not the stated parameters are affected if the channels are de-allocated in favour of new terminals in the system.

10

The benefits of the invention are that it becomes easier to maintain the promised quality of service with the help of the new parameters.

15 Another benefit is that it also makes it easier to manage the quality of service at both the area and user levels.

Additional benefits are that the operator gets improved possibilities for dimensioning the GPRS network and controlling a channel allocation algorithm better, in order to be able to live up to his promise to guarantee a certain grade of quality of service.

20

The invention will now be described in greater detail with the help of the submitted forms of execution and with reference to the attached drawing.

## 25 **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 shows a communications system of known design with nodes and terminals.

30 Figure 2 shows an example of how a set of radio channels can be allocated.

Figure 3 shows an example of a flow chart for use by the invention.

Figures 4 a-d show another example of a flow chart for use by the invention.

5

## DESCRIPTION OF PREFERRED EMBODIMENTS

The method according to the invention is intended for a communications system that handles packet-switched data transport. An example of such a system is the mobile telecommunications system GSM with the packet data option GPRS. Such a system comprises one or more radio nodes and one or more mobiles that communicate with one another over a given radio channel.

10

The new parameters introduced into a communications system, for example GPRS, are described as follows:

15

Minimum Acceptable Mean throughput during Active Time (MAMAT), which defines the minimum acceptable data rate during the time a user is active. This parameter is determined by the operator and can be set at either the user or area level, where the area, for example, may constitute a mobile cell or a LAN.

20

Mean throughput during Active Time (MAT) defines the mean data rate during the time a user is active. This can be calculated as the mean value of a number of measured values during a certain period of time, here called the active time.

25

T-Window, which is the number of active times (time periods) during which MAT is calculated. This means that T-Window is the number of values for data rate used for mean value calculation of MAT.



This then gives two parameters (MAMAT, T-Window), which are determined by the operator; and a third (MAT), which is calculated. Furthermore, different users can have different MAMAT and T-Window values. Different areas, such as mobile cells, can have different MAMAT values for one and the same user, and MAMAT  
5 can also be different for the uplink and downlink, respectively, for the same user. These alternatives/options can be used by the operator to achieve the required quality of service.

The active time T is the time during which you measure a MAT value for a user or  
10 area. Preferably, the active time T corresponds to the time that a user is active, that is, the time during which he/she sends or receives data. But it can also be defined in other ways, for example, as a factor of the user's previous usage, or simply a certain time period determined by the operator.

15 The data rate included in the new parameters can be either the useful data rate or the raw data rate. Raw data rate is the actual data rate without taking into account the bit error rate (BER). On the other hand, the useful data rate can be defined as the raw data rate multiplied by the BER, i.e., the final payload data that the user actually receives.

20 In that the new parameters MAT, MAMAT and T-Window are defined, it is possible to manage and maintain promised quality of service. This is done by calculating a user's MAT value and then comparing it with a defined MAMAT value. By doing this, you get a measure of whether or not the promised quality of service level is  
25 being provided.

An example of how the invention can be used is when an operator decides on a MAMAT value of 20 kbit/s for User A and 50 kbit/s for User B. User A then receives 45 kbytes which takes 15 seconds. User B receives, on three separate occasions, 10 kbytes taking 4 seconds, 100 kbytes taking 30 seconds, and 30 kbytes tak-  
30

ing 10 seconds. These transmissions may have appeared to work well for the user, but in a calculation of MAT, User A gets a MAT value of 24 kbit/s  $((45/15)*8)$  and User B gets a MAT value of 23.5 kbit/s  $((10/4)+(100/30)+(30/10)*8)/3$ . When these MAT values are compared to the MAMAT values however, they show that the operator is not fulfilling the promised quality of service for User B, and therefore needs to allocate more capacity to him.

In the example above, the parameter T-Window corresponds to 1 for User A, i.e., one active time of 15 seconds that forms the mean value. For User B, T-Window corresponds to 3, i.e., three active times of 4, 30 and 10 seconds, respectively, that form the mean value.

In addition, the grade of quality of service can be described as a measure of the grade of guaranteed data rate or another variable quantity. This means that if an operator offers 100% quality of service it means guaranteed quality of service to all GPRS users, anywhere, anytime. If the grade of quality of service is 0% on the other hand, it means that all GPRS traffic is best effort. Another example is where the operator offer a grade of quality of service of 90%, which means that for 90% of the time, the quality of service is guaranteed, while the remainder of the time, best effort only is offered.

The grade of quality of service together with the new parameters can then be used by operators when the network is going to be dimensioned. At this time, the operator sets MAMAT and T-Window values at the area or user level. Being able to set the parameters at the area level allows the operator to set lower tolerances within areas that are often overloaded. Furthermore, a static counter that specifies the proportion or the number of users whose MAT values are less than their MAMAT values, or the proportion of the active time that a user's MAT is less than his MAMAT. This then gives the operator better support for being able to investigate whether the grade

of quality of service goals are being met, or if the network needs to be re-dimensioned.

5 The new parameters also allow the possibility of introducing a channel allocation algorithm to assist in allocating or de-allocating GPRS-specific time slots. The purpose of the algorithm is to increase or decrease the number of time slots used for GPRS when the need arises. This need might be, for example, increased demand on the data rate or a user who is going to connect a speech call, which has higher priority because it is circuit-switched and has precedence in radio channels of the type  
10 On Demand PDCH.

The algorithm for channel allocation can be divided into several different parts, for example, one part that handles new terminals arriving in the area, such as a new mobile that comes into a cell, or a new user who logs onto a network; and one part  
15 that handles already visible terminals in the area.

Figure 3 shows a flow chart for the management of already visible terminals in the system. This procedure can be carried out as required or continuously in accordance with a discretionary schedule. The first step 10 is to check if there are any terminals  
20 whose MAT values are less than their MAMAT values. If this is not the case (NO), the algorithm begins again at the beginning and checks all terminals again. However, if there is a terminal (YES) that has a MAT value less than the MAMAT, one proceeds to the next step 11 which checks to see if there is any idle time slot that can be allocated for packet-switched data traffic, i.e., an idle Dedicated PDCH or  
25 idle On Demand PDCH. This also includes free space in time slot that is already being used by another GPRS user, since several users can share a single time slot in GPRS. If there is idle capacity (YES), step 12 is executed in which the time slot is allocated to the terminal for use by that terminal. Thereafter the algorithm returns to the first step of checking all the terminals again. However, if no idle time slot for

packet-switched traffic is found (NO), one returns directly to the first step without any action.

Figures 4 a-d show a flow chart for the management of new terminals arriving in the system. Figure 4 shows the first step 20 which is a new terminal wanting admittance to the system. The second step checks if the terminal is requesting packet-switched traffic. If this is not the case (NO), the next step 22 is executed, which checks to find out if 2 or more time slots are being requested by the terminal. If the terminal is not requesting this (NO), step 23 is executed, which checks if there is a free time slot that can be allocated for circuit-switched traffic. If there is (YES), the time slot is allocated in step 28 for the terminal's usage, since it had requested a circuit-switched service. If, on the other hand, there is not free time slot (NO), step 24 is executed, which checks if there are any time slot allocated as On Demand, which is used for packet-switched traffic. If there is none (NO) the terminal is blocked in step 27, but if there is one (YES), step 25 is executed, which checks if any user will get a MAT value that is less than his MAMAT value if an On Demand time slot is de-allocated in favour of circuit-switched traffic. If there is such a user (YES), the new terminal is blocked in step 27, but if this is not expected to happen (NO), the allocated time slot for packet-switched traffic is de-allocated in step 26 and then allocated in step 28 for circuit-switched traffic.

In step 22 in Figure 4a, if two or more time slots are requested (YES), the number of time slots is assumed to be x, step 40 in Figure 4c is executed, which checks if HSCSD fixed services are being requested. If this is so (YES), step 41 is executed, which checks if there are x number of free time slots for circuit-switched traffic. If there are (YES), the free time slots are allocated in step 46 to circuit-switched traffic. On the other hand, if there are none (NO), step 42 checks if there are allocated On Demand time slots, which are used for packet-switched traffic. If there are none of these either (NO), the terminal is blocked in step 45. If, however, there are allocated On Demand time slots used for packet-switched traffic (YES), step 43 checks

if any user will get a MAT value less than his MAMAT value if an On Demand time slot is de-allocated in favour of circuit-switched traffic. If there is such a user (YES), the new terminal is blocked in step 45, but if this is not expected to occur (NO), the time slot allocated for packet-switched traffic is de-allocated in step 44  
5 and then you return to step 41 to continue searching for the requested number of free time slots x.

In step 40 in Figure 4c, if HSCSD is not requested (NO), step 50 is executed instead, which checks if there are x number of free time slots for circuit-switched traffic. If there are (YES), the time slots are allocated for circuit-switched traffic in step 10 57. If, on the other hand, there are none (NO), step 51 checks if there are allocated On Demand time slots used for packet-switched traffic. If there are none (NO), the number of requested time slots is decreased by one in step 54 and then step 55 checks that x is not equal to zero. If x is zero (YES), the terminal is blocked in step 15 56, otherwise (NO) you go back to step 50. If, on the other hand, there are allocated On Demand time slots used for packet-switched traffic (YES), step 52 checks if any user will get a MAT value less than his MAMAT value if an On Demand time slot is de-allocated in favour of circuit-switched traffic. If such a user exists (YES), step 54 mentioned above is executed and thereafter step 55. If there is no such user 20 (NO), an On Demand time slot is de-allocated in step 53 to then you return to step 50 to search for x number of free time slots.

In step 21 in Figure 4a, if a packet-switched service is requested (YES), step 30 in Figure 4b is executed, which checks if any user's MAT value will become less than his MAMAT value if the new terminal is added to the system. If there is no such 25 user (NO), capacity is allocated in step 34 for the new terminal in a completely free time slot or a time slot with idle capacity where the terminal shares the time slot with other users. If, on the other hand, there is any user whose MAT value would become less than MAMAT value (YES), step 31 is executed, which checks if there

are free time slots that can be allocated for packet-switched traffic. If there are no free time slots (NO), the terminal is blocked in step 32, but if there is a free time slot (YES), it is allocated in step 33 for use by packet-switched traffic and then in step 34, space is made for the terminal in the system.

5

The invention is naturally not limited to the embodiments described above and in the drawings, but can be modified within the framework of the enclosed patent claims. For example, the invention can even be applied to local data networks (LAN), Ethernet-based networks, a large TCP/IP-based network, or a mobile UMTS  
10 networks of the WCDMA type, for example, where mobile users may use high data rates and associated applications. The invention is additionally useful in other mobile systems such as Personal Digital Cellular (PDC) and Digital Advanced Mobile Phone System (D-AMPS) and all other communications systems that can bear data traffic.

## CLAIMS

1. A method in a communications system comprising a number of nodes that  
5 communicate with terminals, wherein communication occurs in part or in whole by packet-switched traffic, in order to allocate idle capacity, **characterised** in that the allocation is effected in order to maintain the grade of quality of service in the system.
2. A method in a communications system comprising a number of nodes that  
10 communicate with terminals, wherein communication occurs in part or in whole by packet-switched traffic, in order to allocate a free channel to a terminal in circuit-switched traffic, in dependence of the grade of quality of service in the system, and where at least one channel is requested by the terminal, **characterised** by the steps:  
a) investigating (23; Fig. 4a) if a free channel is available for the circuit-switched  
15 service  
b) investigating (24) if an On Demand channel is free where no channel as described in a) is free;  
c) investigating (25) if the stated quality of service is ruined if the stated channel as described in b) is de-allocated; and  
20 d) if this is not the case, de-allocating (26) the stated channel and thereafter allocating (28) the now free channel to the requesting terminal.
3. A method according to Claim 2, **characterised** in that if b) is not the case, or alternatively, if c) is the case, the terminal is blocked (27) from the system.  
25
4. A method in a communications system comprising a number of nodes that communicate with terminals, wherein communication occurs in part or in whole by packet-switched traffic, in order to allocate a free channel to a terminal in packet-switched traffic (GPRS), in dependence of the grade of quality of service in the system  
30 and where at least one channel is requested by the terminal,  
**characterised** by the steps:  
a) investigating (30; Fig. 4b) if the stated quality of service is ruined if a new terminal is added to the system;

b) if this is not the case, allocation (34) of a packet-switched channel for the terminal.

5. A method according to Claim 4, **characterised** by that if a) is the case, the following steps are executed:

- 5 c) investigating (31; Fig. 4b) if there is a free channel for the packet-switched service;  
d) allocation (33) of the free channel for the packet-switched service if c) is the case;  
and  
e) allocation (34) to the terminal of the allocated channel for the packet-switched service.

10

6. A method according to Claim 5, **characterised** by that if c) is not the case, the terminal is blocked (32) from the system.

7. A method in a communications system comprising a number of nodes that  
15 communicate with terminals, wherein communication occurs in part or in whole by circuit-switched traffic, in order to allocate a free channel to a terminal in circuit-switched traffic, in dependence of the grade of quality of service in the system, and where at least two channels are requested by the terminal,

**characterised** by the steps:

- 20 a) investigating (50; Fig. 4d) to see if a free channel is available for the circuit-switched service;  
b) investigating (51) if an On Demand channel is free in the case that no channel as in a) is free;  
c) investigating (52) if the stated quality of service is ruined if the stated channel as in  
25 b) is de-allocated; and  
d) if c) is not the case, de-allocation (53) of the stated channel and return to investigating (50) to see if there is a free channel available.

8. Procedure as described in Patent Claim 7, **characterised** by that if b) is not the  
30 case, or alternatively that c) is the case, the following steps are executed:  
e) reduction (54) of the number (x) of channels requested by one;  
f) investigating (55) if the number (x) of channels requested is zero;



g) if f) is not the case, return to investigating (50) to see if there are free channels available.

9. A method according to Claim 8, **characterised** in that if f) is the case, the terminal  
5 is blocked (56) from the system.

10. A method in a communications system comprising a number of nodes that communicate with terminals, it being understood that communication occurs in part or in whole with circuit-switched traffic, in order to allocate a free channel to a terminal  
10 in circuit-switched traffic, in dependence of the grade of quality of service in the system, and where at least two channels and HSCSD fixed services are requested by the terminal,

**characterised** by the steps:

a) investigating (41; Fig. 4c) if a free channel is available for the circuit-switched  
15 service;  
b) investigating (42) if an On Demand channel is free in the case that no channel as in a) is free;  
c) investigating (43) if the stated quality of service is ruined if the stated channel as in b) is de-allocated; and  
20 d) if c) is not the case, de-allocating (44) the stated channel and thereafter return to investigating (41) if a free channel is available.

11. A method according to Claim 10, **characterised** by that if a) is the case, allocate  
(46) the required number of free channels.  
25

12. A method according to any one of the Claims 10-11, **characterised** by that if b) is not the case, or alternatively if c) is the case, bar (45) the terminal from the system.

13. A method according to any one of the Claims 1-11, **characterised** by that  
30 allocation of idle capacity is effected in order to prevent the mean data rate (MAT) during the active time (T) from dropping below a defined value for the minimum acceptable data rate (MAMAT).

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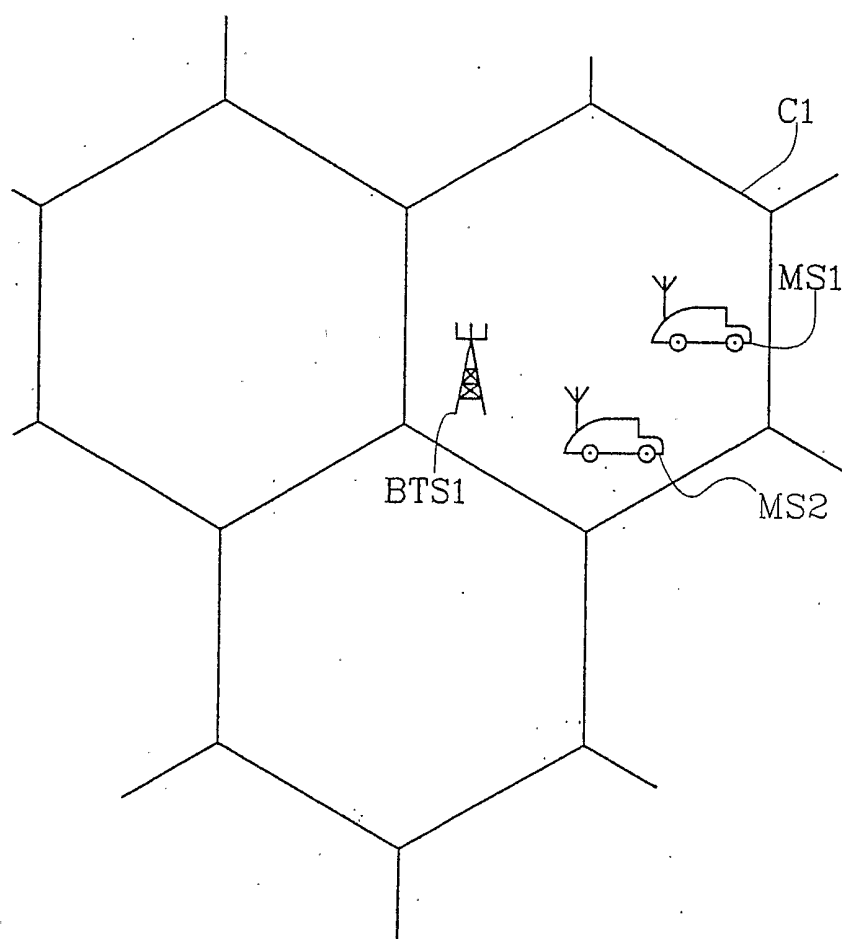


Fig.1

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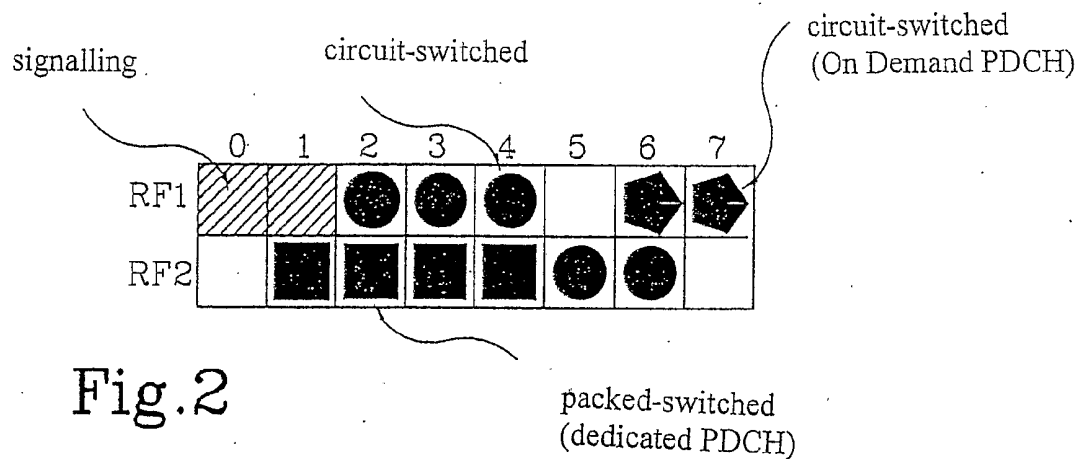


Fig.2

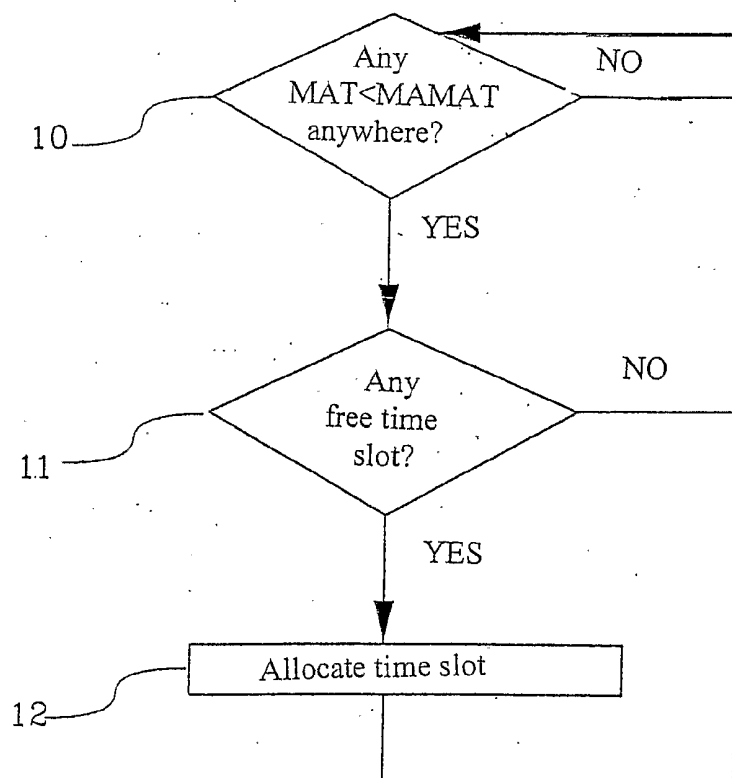
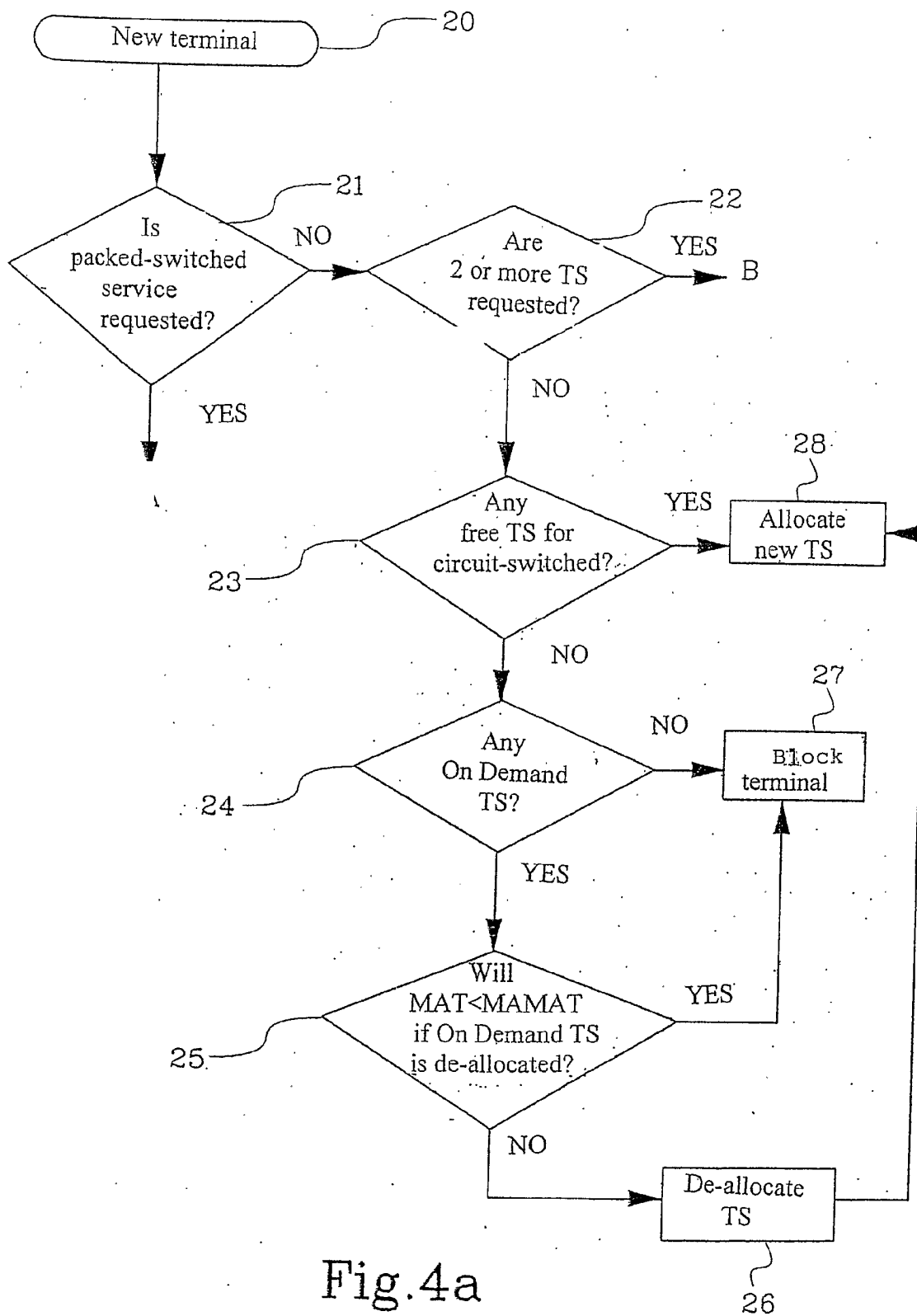


Fig.3

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4/6

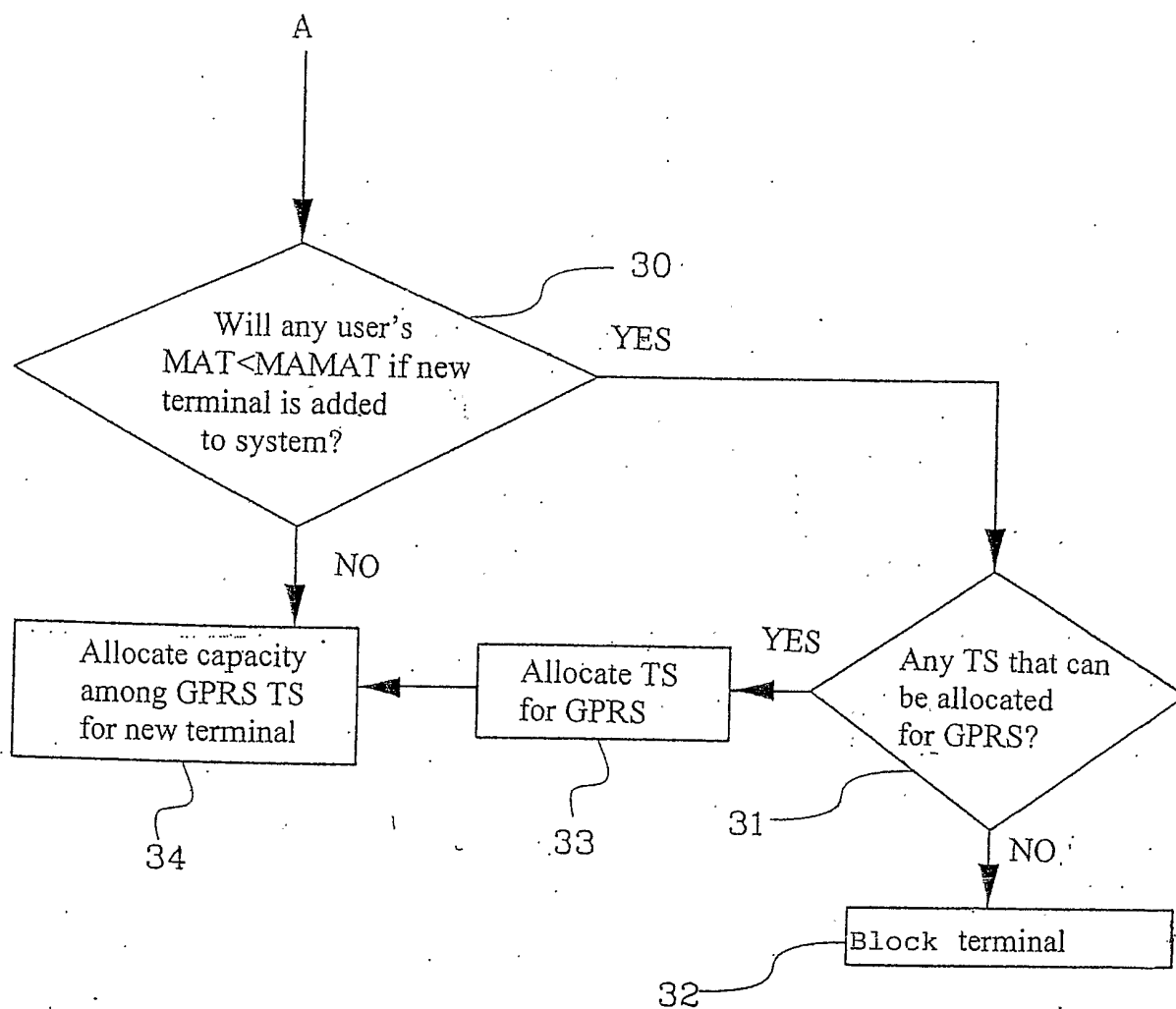


Fig.4b

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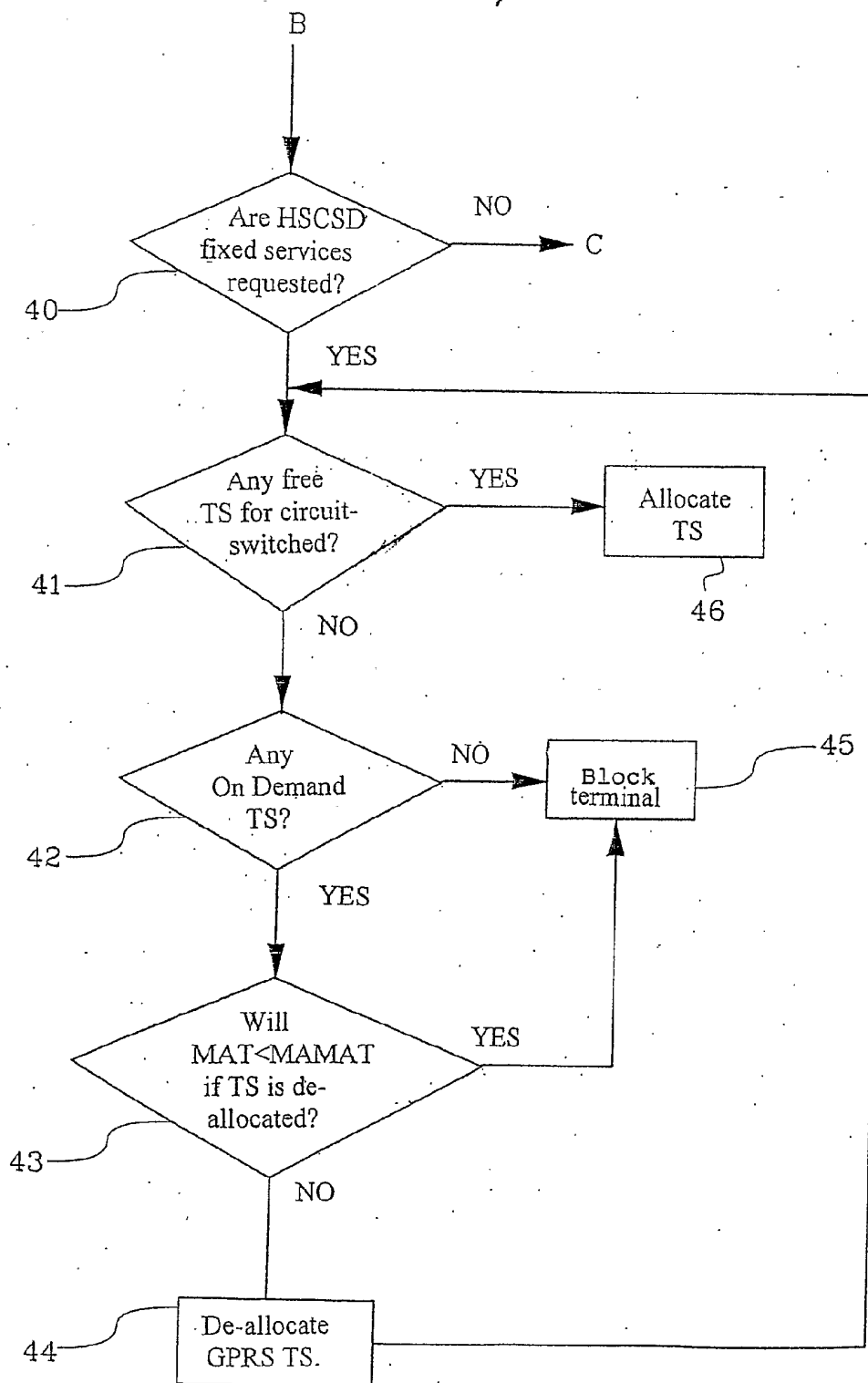


Fig.4c

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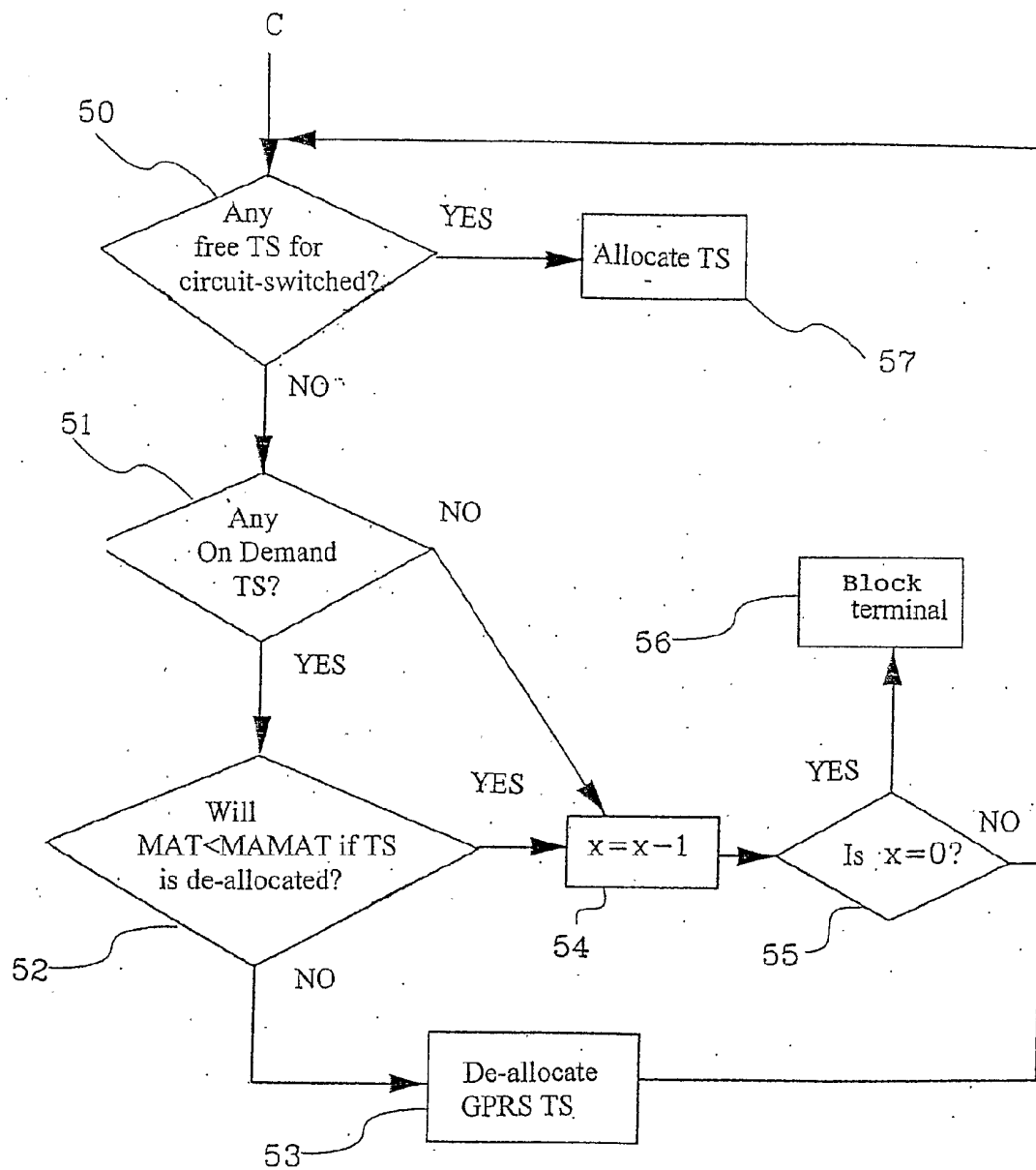


Fig.4d

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 01/02511

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22, H04L 12/56

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)

IPC7: H04Q, H04L

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

SE,DK,FI,NO classes as above

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

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0010334 A (NOKIA MOBILE PHONERS LTD), 24 February 2000 (24.02.00), page 5, line 30 - page 6, line 4, claims 1,7,10, abstract	1,4-6
A	page 5, line 30 - page 6, line 4, claims 1,7,10, abstract	2,3,7-13
	--	
Y	WO 0001186 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 6 January 2000 (06.01.00), page 3, line 19 - page 5, line 7, figure 2, claims 1,10,12, abstract	1-12
A	page 3, line 19 - page 5, line 7, figure 2, claims 1,10,12, abstract	13
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 01/02511

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5729534 A (JOKINEN ET AL), 17 March 1998 (17.03.98), column 1, line 65 - column 3, line 5, figure 1, claims 1-20, abstract	1-12
A	column 1, line 65 - column 3, line 5, figure 1, claims 1-20, abstract --	13
Y	EP 0632672 A2 (INTERNATIONAL BUSINESS MACHINES CORPORATION), 4 January 1995 (04.01.95), column 3, line 34 - line 56, figures 8,9a,9b, claim 1, abstract	1-12
A	column 3, line 34 - line 56, figures 8,9a,9b, claim 1, abstract --	13
Y	EP 0755164 A2 (NEC CORPORATION), 22 January 1997 (22.01.97), page 2, line 15 - line 21, figure 1, abstract	1-12
A	page 2, line 15 - line 21, figure 1, abstract -- -----	13

## INTERNATIONAL SEARCH REPORT

Information on patent family members

28/01/02

International application No.

PCT/SE 01/02511

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	0010334	A	24/02/00	AU	5166199 A	06/03/00
				EP	1104610 A	06/06/01
				FI	105641 B	00/00/00
				FI	981728 A	27/03/00
WO	0001186	A1	06/01/00	AU	731124 B	22/03/01
				AU	1897999 A	05/07/99
				AU	5073599 A	17/01/00
				BR	9815173 A	10/10/00
				CN	1315124 T	26/09/01
				EP	1025306 A	09/08/00
				EP	1090525 A	11/04/01
				NO	20002952 A	11/08/00
				SE	9802295 A	27/12/99
US	5729534	A	17/03/98	AU	692036 B	28/05/98
				AU	4392796 A	07/08/96
				CN	1168216 A	17/12/97
				DE	19543845 A	11/07/96
				FI	2058 U	22/08/95
				FI	950097 A,V	10/07/96
				FR	2729269 A,B	12/07/96
				GB	2296844 A,B	10/07/96
				GB	9600378 D	00/00/00
				IT	1281596 B	20/02/98
				IT	MI960017 D	00/00/00
				JP	3155010 B	09/04/01
				JP	10512724 T	02/12/98
				NL	1002023 A,C	00/00/00
				RU	2153240 C	20/07/00
				SE	9600060 A	10/07/96
				WO	9622665 A	25/07/96
EP	0632672	A2	04/01/95	JP	2868178 B	10/03/99
				JP	7058809 A	03/03/95
				US	5694548 A	02/12/97
EP	0755164	A2	22/01/97	AU	701487 B	28/01/99
				AU	5468996 A	09/01/97
				JP	9018435 A	17/01/97
				US	5638371 A	10/06/97