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(21) International Application Number: PCT/SE99/01343 (22) International Filing Date: 6 August 1999 (06.08.99) (30) Priority Data: 19983638 7 August 1998 (07.08.98) NO (71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE). (72) Inventors: FJÖRTOFT, Jarle; Hoff Terrasse 3, N-0275 Oslo (NO). COLBAN, Erik; Borgestadveien 5B, N-0875 Oslo (NO). (74) Agent: ERICSSON RADIO SYSTEMS AB; Common Patent Dept., S-164 80 Stockholm (SE).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: METHOD FOR IMPROVING SERVICE LEVEL SELECTION IN A COMMUNICATION NETWORK SYSTEM The diagram illustrates a communication network system. On the left, a 'MOBILE STATION' is shown with a signal tower icon. A double-headed arrow connects it to a 'CELLULAR GSM NETWORK' represented by a horizontal line with arrows at both ends. This network is connected to a box labeled 'MSC/VLR WITH IWF'. This box is then connected to a circle labeled 'PSTN/ISDN/IP NETWORK'. Below the circle, a horizontal line with arrows at both ends is labeled 'FIXED NETWORK'.		
(57) Abstract The present invention relates to a method for improving service level selection in a communication network system, in which an interworking function (IWF) is arranged between a user terminal (MS) and the network(s) in question, and wherein High Speed Circuit Data (HSCD) are specified, and for the purpose of making this selection in a more expedient manner and allow the user to allocate bandwidth in a more flexible and dynamic way, it is according to the present invention suggested that the interworking function (IWF) is used for signalling to the user terminal (MS) when a change in level selection may be useful.		

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METHOD FOR IMPROVING SERVICE LEVEL SELECTION IN A COMMUNICATION NETWORK SYSTEM

Field of the invention

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The present invention relates to a method for improving service level selection in a communication network system, of the type as stated in the preamble of the enclosed patent claim 1.

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More specifically the invention relates to High Speed Circuit Switched Data (HSCSD) calls in GSM.

Technical Background

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The Problem Area

During a non-transparent HSCSD call, the mobile station (MS) may (depending on negotiated parameters at call setup) request the network to add or remove one or more traffic channels used for the transmission (usually referred to a service level up and downgrading). This can be used to release channels during periods of the call when a small amount of data is transmitted through the mobile network, and to allocate more channels when the data flow increases.

In order to use this mechanism efficiently, the MS must know how much data is passing through the fixed network, see Figure 1. Briefly put, if the data transmission rate in the fixed network is less than the total capacity of the allocated channels in the mobile network (i.e., the air interface user rate, AIUR), the MS should initiate a service level downgrading, if it is more, it should initiate an upgrading.

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In order to know when to initiate up and downgrading, the MS must "see" beyond the mobile network; more specifically beyond the Interworking Function (IWF), see Figure 1. In

the current implementations of GSM, the MS can get an indication that the data rate in the fixed network is low compared to the AIUR. In the downlink direction, this is done by looking at the amount of data it receives and, in the uplink direction, through use of flow control. However, there are no similar indications that the data rate in the fixed network is high compared to the AIUR, meaning that the MS should initiate a service level upgrading.

10 Known solutions

If the data transmission rate in the fixed network is constant and data are not compressed, the data transmission rate is known to the mobile user through the parameters negotiated at call setup. If data are compressed on the mobile leg only, the mobile user may examine the compression factor, which may vary.

If the data transmission rate in the fixed network is unpredictable, e.g., the fixed network is an IP network, the mobile user may guess when to upgrade. For instance, he may guess that an upgrade is useful immediately after starting to download a large file. He may also occasionally request an upgrade and, if that has no effect, request a subsequent downgrade.

Another solution is to let the IWF initiate the upgrading.

Problems with known solutions

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Examining the compression factor may be intricate to implement.

Transmission of a large file does not necessarily mean that an upgrading will have any effect since the fixed network may be congested.

35

Upgrading and downgrading are relatively extensive and slow processes and unnecessary upgrades should be avoided. Depending on the operator's charging policy, the user may have to pay extra for each channel in use.

- 5 The problem with letting the network initiate the upgrading is that this may interfere with the user's wishes. The user may want to control the upgrading more strictly due to, e.g., extra charges in connection with upgrading.

10 **Further prior art**

From WO 96/10305 (Nokia Telecommunications Oy) there is known a data transmission method in a time division multiple access mobile communication system. The mobile communication network can dynamically adjust the channel configuration assigned to the data call within the limits of a minimum and a maximum requirement, depending on the varying allocation level of the network recourses. This functionality is, in relation to GSM standards, referred to as a minimum value of 1 and a maximum value determined by the BC-IE parameters mTCH (maximum number of TCH). In other words, such a network may initiate upgrading and downgrading, but is limited to the interval 1-mTCH. Said standards also allow the user to change the mTCH parameter during a call, i.e. a so called user initiated service level upgrading and downgrading.

However, this prior art does not give any instructions for giving a user terminal, and more specifically a mobile station, a "hint" about increasing the value of said mTCH.

Objects of the invention

An object of the invention is thus to provide a method wherein the service level upgrading and downgrading can be affected in a far more effective and expedient manner, as compared with prior art.

Another object of the present invention is to provide a method for improving service level selection making it possible for the mobile user to allocate bandwidth in a more flexible way, especially for circuit switched data calls in a mobile network.

Still another object of the present invention is to provide a method wherein it is possible for the mobile user to allocate required bandwidth more dynamically, for thereby reducing costs involved therein.

Yet another object of the invention is to provide a method by which the upgrading and downgrading of number of traffic channels used can be made at any time during a call, and more selectively depending on the required transmission capacity.

Still another object of the present invention is to provide a method which can be used in an advantageous manner in network communication systems having a bursty traffic, for example in connection with internet and intranets.

Brief summary of the invention

The above objects are achieved in a method as stated in the preamble, which according to the present invention is characterised by the features as stated in the characterising clause of the enclosed patent claim 1.

Generally, the solution according to the present invention is to let the Interworking Function (IWF) signal to the mobile user when an upgrade or downgrade may be useful.

Further features and advantages of the present invention, as well as the implementation thereof, will appear from the following description taken in conjunction with the appending drawings, as well as from the attached patent claims.

Brief disclosure of the drawings

Figure 1 is a schematic drawing illustrating the general layout of a communication network system, wherein the present invention can find its application.

Figure 2 illustrates Radio Link Protocol header formats modified to comply with an example of an embodiment of the present invention.

Figure 3 is a block diagram illustrating an embodiment of an interworking function with buffer monitoring, in accordance with the present invention.

Detailed description of embodiments

In Figure 1 there is illustrated an embodiment of a communication network system wherein the present invention can be embodied. Although the following description is made in relation to this example of a communication network system comprising a mobile station and an associated cellular GSM network communicating with a fixed network, for example a PSTN, ISDN or IP network, through an MSC/VLR with Interworking Function (IWF), it is to be understood that the present invention can be used also in other cellular radio network systems, and satellite networks where the principles of High Speed Circuit Switched Data are specified.

Now, referring to the enclosed Figure 2 a more specific embodiment of the present invention will be discussed in more detail.

The proposed solution to the problem is to let the IWF signal to the mobile user when an upgrade may be useful. Setting the last bit in the Radio Link Protocol (RLP) information or supervisory frame header (currently spare) to 1, can be used to signal this, See Figure 2. The 1 is repeated in subsequent information and supervisory frames until up-

grading takes effect (i.e. the IWF is transmitting RLP frames towards the MS on at least one additional channel) or until the IWF no longer recommends an upgrade.

5 The IWF can use the status of the buffers between the protocols on the mobile side and the protocols on the fixed network side to base its suggestion for upgrading, see Figure 3. If the transmit buffer in the downlink direction, i.e. towards the mobile station, is filling up, it means
10 that the data rate is higher on the fixed network side than on the mobile side. The IWF signals to the MS to upgrade if e.g., the buffer is more than 50% full, or alternatively, if the buffer fill level is increasing above a certain rate. If the receive buffer, in the uplink direction i.e.
15 from the mobile station, is empty or getting empty at a fast rate, this means that the data rate is higher on the fixed network side than on the mobile side. The IWF signals to the MS to upgrade if, e.g., the receive buffer is empty and it is receiving no or very few idle frames from the MS.

20 In case an MS does not have this feature implemented (i.e., does not care about the last bit in the header of the information and supervisory frames), there is no impact. If an IWF does not have this feature implemented, but the MS
25 has, there may be some misunderstanding. In order to avoid this, the IWF transmits a specific sequence in the last bit position of the header of the k first information frames it sends to the MS, where k is e.g. the window size used downlink. In this way the MS can identify IWFs that support the
30 feature. Alternatively this capability can be negotiated between the MS and the IWF at the setup of the call by using existing RLP negotiation mechanisms.

ADVANTAGES

35 The functionality proposed in this invention disclosure makes it possible for the mobile user to allocate bandwidth in a more flexible way, for circuit switched data calls in

a mobile network. It makes it possible for the mobile user to allocate required bandwidth more dynamically, to reduce costs. An MS that implements the functionality described, will be able to upgrade and downgrade the number of traffic
5 channels used, depending on the required transmission capacity at any one time during a call. For access to Internet and Intranets this will be a big advantage as the characteristics of the traffic is bursty.

10 The proposed solution is simple to implement on the IWF side. The signal is also easily retrievable on the MS side. The actual handling of the signal depends on how intricate the logic for up and downgrading in the MS is. The MS may simply ignore it, follow the suggestion blindly, or balance
15 it against other criteria for up and downgrading. In any case the MS is in control. The time for the signal to reach the MS is also minimal (equal to the transmission delay between the IWF and the MS). The solution is also backward compatible, meaning that the solution will not have any impact
20 on an MS or IWF that does not implement this feature.

BROADENING

Alternative means of transmitting the information from the
25 IWF to the MS can be used, e.g., USSD. Although this may be more complicated, it may allow more information (e.g., how fast the buffers are filling up) to be passed between the IWF and the MS providing better grounds for the MS to make a decision on whether to upgrade or not.

30 The invention applies equally well to other cellular radio networks systems, and satellite networks where the principles of High Speed Circuit Switched Data are specified.

REFERENCES AND ABBRIVATIONS

HSCSD High Speed Circuit Switched Data Ref.

WO.9618248 and GSM 03.34 "Digital cellular telecommunica-
5 tions system (Phase 2+); High Speed Circuit Switched -
Stage 2 Service Description.

AIUR Air Interface User Rate Ref. GSM 04.21 "Digital cel-
lular telecommunications system (Phase 2+); Rate Adaption on
10 the Mobile Station-Base Station System (MS-BSS) Interface"

RLP Radio Link Protocol Ref. GSM 04.22 "Digital cellular
telecommunications system (Phase 2+); Radio Link Protocol
for data and telematic services on the Mobile Station- Base
15 Station System (MS-BSS interface and the Base Station Sys-
tem - Mobile service Switching Centre (BSS-MSC) interface"

IWF Interworking Function Ref. GSM 09.07 "Digital cel-
lular telecommunications system (Phase 2+); General Re-
20 quirements on interworking between the Public Land Mobile
Network (PLMN) and the Integrated Services Digital Network
(ISDN) or Public Switched Telephone Network (PSTN)

MS Mobile Station

25

USSD Unstructured Supplementary Service Data

GSM Global System for Mobile Communications

30 MSC Mobile Swiching Centre

VLR Visitor Lacation Register

PSTN Public Switched Telephone Network

35

IP Internet Protocol

P a t e n t c l a i m s

1. Method for improving service level selection in a communication network system, in which an interworking function (IWF) is arranged between a user terminal (MS) and the network(s) in question, and wherein High Speed Circuit Data (HSCD) are specified,
c h a r a c t e r i s e d i n that the interworking function (IWF) is used for signalling to the user terminal (MS) when a change in level selection may be useful.
2. Method as claimed in claim 1,
c h a r a c t e r i s e d i n that said signalling is affected by signalling a bit in the Radio Link Protocol (RLP) information or supervisory frame header to a certain logical level, especially by setting the last bit thereof to 1 for signalling upgrading.
3. Method as claimed in claim 1 or 2,
c h a r a c t e r i s e d by repeating the Interworking Function (IWF) signalling in subsequent information (IF) and supervisory frames (SF) until level change, especially upgrading, takes effect.
4. Method as claimed in claim 3,
c h a r a c t e r i s e d i n that said IWF is adapted to transmit RLP frames towards the user terminal (MS) on at least one additional channel, or until IWF no longer recommends a level change or upgrade.
5. Method as claimed in any of the preceding claims,
c h a r a c t e r i s e d i n that said IWF controls the status of the buffers between the protocols on a user terminal network (GSM network) and the protocols on a fixed network (PSTN/ISDN/IP network) for evaluating any initialisation of upgrading/downgrading.

6. Method as claimed in claim 5,
characterised in that by observation that
the transmit buffer in the downlink direction, i.e. towards
the user terminal (MS) is filling up, i.e. indicating
5 higher data rate on the fixed network side than on the user
terminal network side, said IWF is adapted to signal to the
user terminal (MS) in question to upgrade.

7. Method as claimed in claim 6,
10 characterised in that said IWF will signal
initiation of upgrading when said transmit buffer is filled
to a certain degree, for example 50 %, or alternatively
when the filling rate of said transmit buffer increases
above a certain value.

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8. Method as claimed in claim 5,
characterised in that by observation that
the receive buffer in the uplink direction, i.e. from the
user terminal (MS) is empty or becoming empty at a fast
20 rate, indicating that the data rate is higher on the fixed
network side than on the user terminal network side, said
IWF is adapted to signal to the user terminal (MS) in ques-
tion to upgrade.

25 9. Method as claimed in claim 1,
characterised in that said signalling is
effected by letting the IWF transmit a specific sequence in
the last bit position of the header in the k first informa-
tion frames which are sent to the user terminal (MS), k be-
30 ing some prearranged number.

10. Method as claimed in claim 1,
characterised in that said signalling is
made inherent in the negotiation between a user terminal
35 (MS) and an IWF at the set up of a call, for example by us-
ing existing RLP negotiation mechanism.

11. Method as claimed in claim 1,
c h a r a c t e r i s e d i n that transmission from IWF
to a user terminal (MS) is made by means of Unstructured
Supplementary Service Data (USSD).

5

12. Method as claimed in any of the preceding claims,
c h a r a c t e r i s e d i n that signalling is af-
fected in any appropriate network system, i.e. cellular ra-
dio networks systems, satellite networks, etc., wherein the
10 principles of High Speed Circuit Switched Data (HSCSD) are
specified.

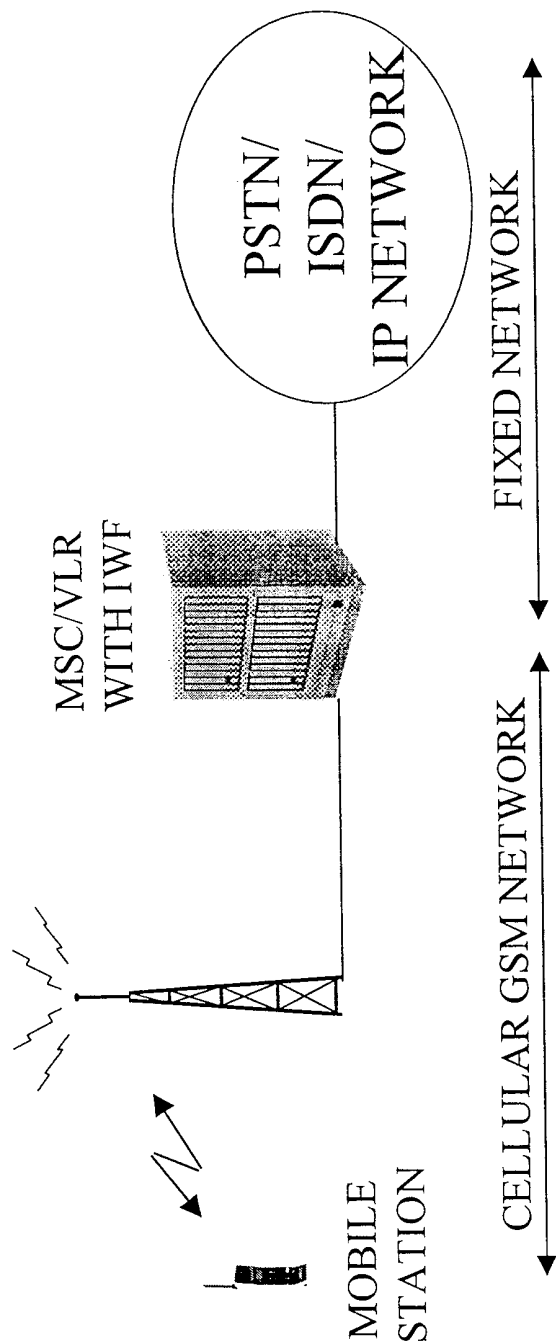


FIG.1

RLP VERSION 2 FRAME HEADERS

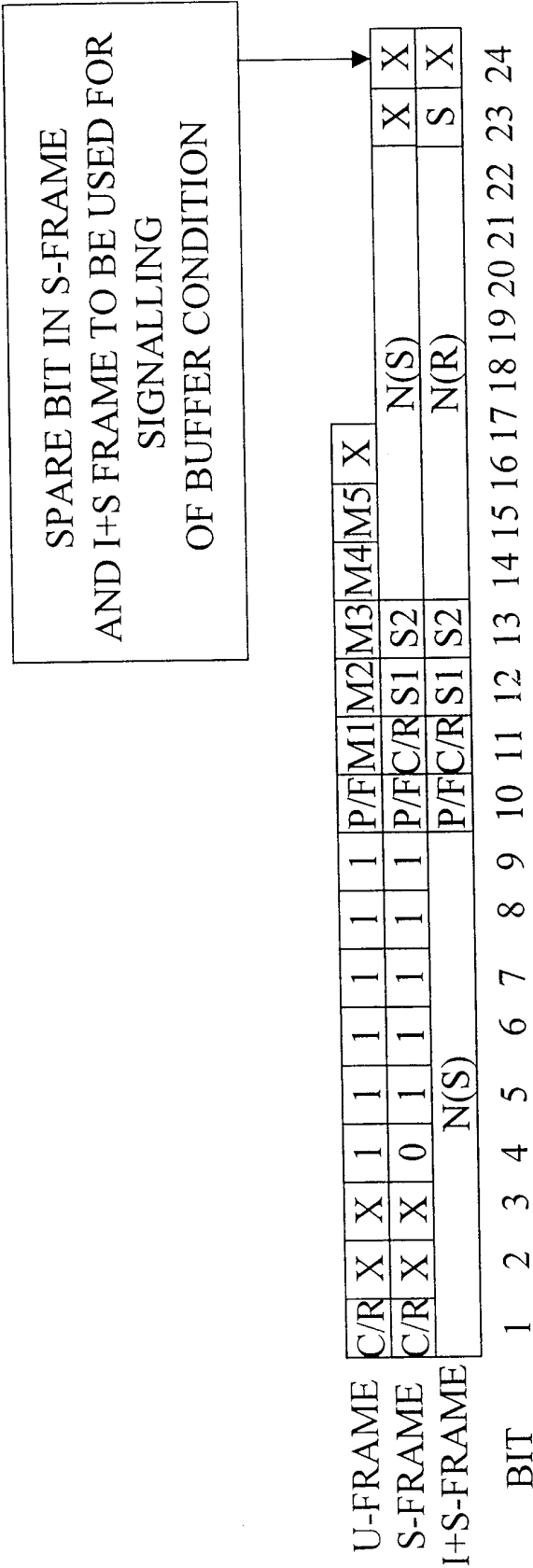


FIG.2

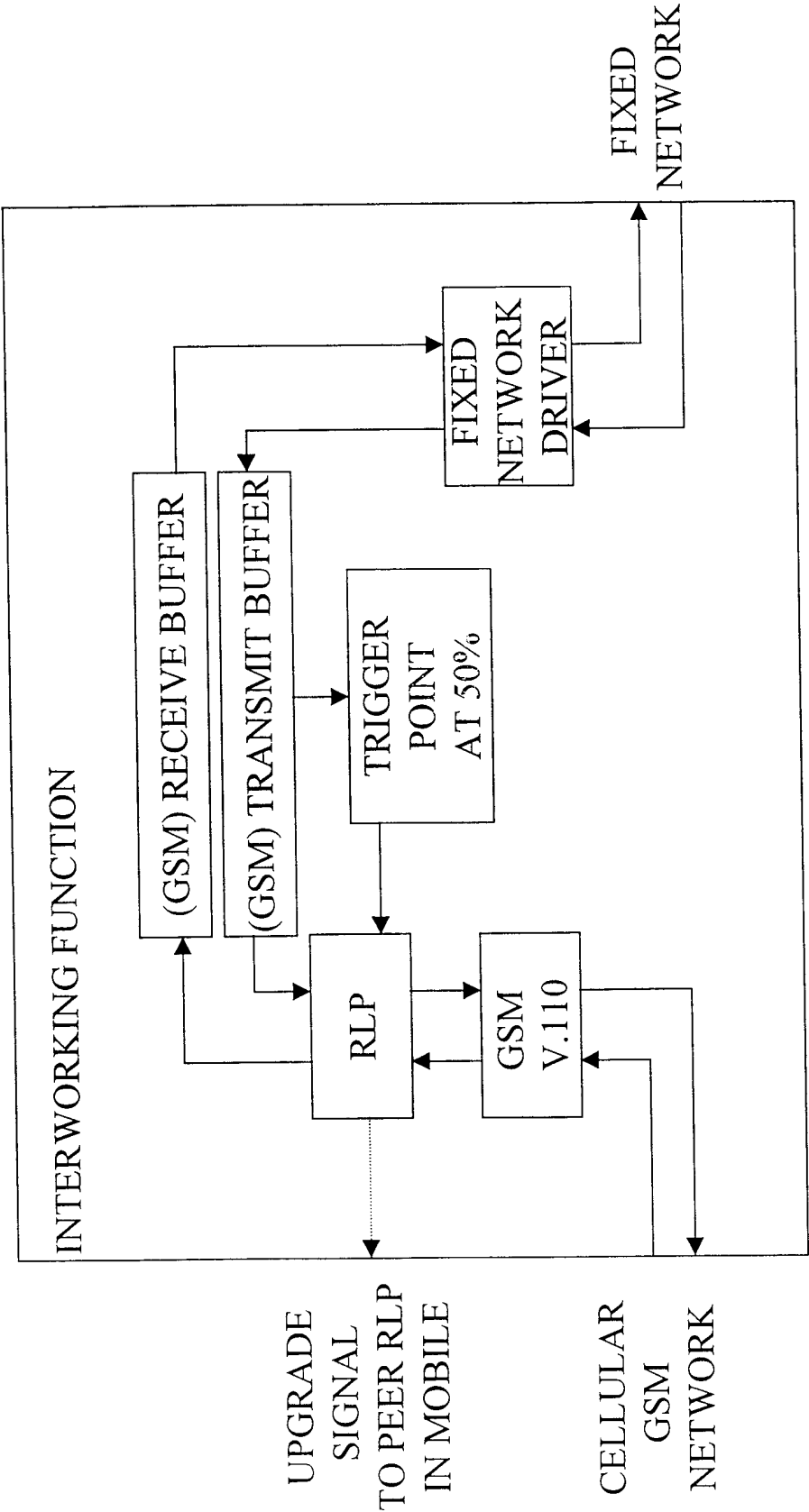


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/01343

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22, H04Q 11/04

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, H04B, 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.
A	EP 0652683 A2 (MITSUBISHI DENKI KABUSHIKI KAISHA), 10 May 1995 (10.05.95) --	1-12
A	WO 9618248 A2 (NOKIA TELECOMMUNICATIONS OY), 13 June 1996 (13.06.96) --	1-12
A	WO 9610305 A2 (NOKIA TELECOMMUNICATIONS OY), 4 April 1996 (04.04.96) --	1-12
A	US 5319638 A (HUI-AN LIN), 7 June 1994 (07.06.94) --	1-12

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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11 January 2000

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/01343

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9710684 A1 (NOKIA MOBILE PHONES LIMITED), 20 March 1997 (20.03.97) -- -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

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