(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 June 2001 (07.06.2001)

PCT

(10) International Publication Number
WO 01/41478 A1

(51) International Patent Classification[7]: H04Q 7/26, 7/30

(21) International Application Number: PCT/SE00/02352

(22) International Filing Date:
28 November 2000 (28.11.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/454,323 3 December 1999 (03.12.1999) US

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

(72) Inventors: BODIN, Stig, Roland (deceased). GRANBERG, Olof, Axel; Turevägen 6A, S-191 47 Sollentuna (SE).

(74) Agent: NORIN, Klas; Ericsson Radio Systems AB, Common Patent Department, S-164 80 Stockholm (SE).

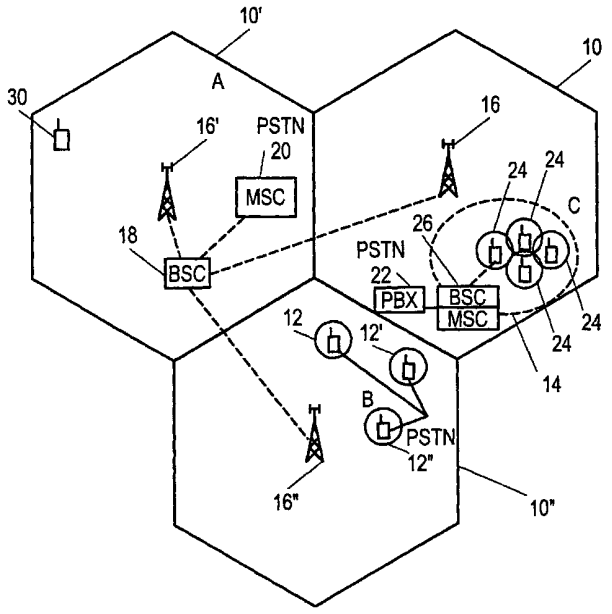
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, 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, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SYSTEM AND METHOD FOR SUPPORTING PUBLIC SUBSCRIBERS IN A PRIVATE COMMUNICATION NETWORK



(57) Abstract: Systems and methods for enabling a public network subscriber to access the public network through a private network, to which the subscriber does not belong, are disclosed. A base station controller associated with a private network receives an access request message from a remote terminal. A determining module associated with the private network base station controller or the private network mobile services switching center determines whether the remote terminal belongs to the private network. If the remote terminal does not belong to the private network, then the private network base station controller forwards the access request message to the public network.

WO 01/41478 A1

SYSTEM AND METHOD FOR SUPPORTING PUBLIC SUBSCRIBERS IN A PRIVATE COMMUNICATION NETWORK

BACKGROUND

The present invention relates to a system and method, in a communication network, for allowing a base station sub-system (BSS) to establish communication connections through more than one mobile switching center (MSC). More particularly, the present invention relates to a system and method for allowing a base station controller (BSC) associated with a private network to establish a communication connection through the private network's MSC or through a MSC associated with a public communication network.

Public cellular communication networks (public land mobile networks) are commonly employed to provide voice and data communications to a plurality of subscribers drawn from the general population. For example, analog cellular radiotelephone systems, such as AMPS, ETACS, NMT-450, and NMT-900, have been deployed successfully throughout the world. Digital cellular radiotelephone systems such as IS-136 and IS-95 in North America, the Personal Digital Cellular (PDC) system in Japan and the pan-European GSM system have been introduced. Some of these systems are described in Balston, et al., Cellular Radio Systems, published by Artech House, Norwood, Mass., 1993.

Recently, private radio communications networks for residential and business areas have been developed that use the same air-interface as the public cellular network, but are not integrated into the overlaying public cellular network. In this sense, these private networks are not micro or pico networks since there is no direct connection between these private systems and the public cellular network. For example, for residential usage, private base stations can be used as described in

U.S. Pat. No. 5,428,668 which only connect to the public switched telephone network (PSTN) or integrated services digital network (ISDN) which are wired networks. Private business or office networks may include one or more radio base stations connected to at least one base station controller and mobile services switching center, which may be connected to a PBX to provide access to the public switched telephone network. In GSM, a feature referred to as Support of Localized Service Area (SoLSA) allows network operators to provide defined subscribers exclusive access to parts of the network. See, GSM TS 02.43 and TS 03.73. The SoLSA feature enables network operators to create private networks that may offer a different set of services (e.g., a different feature set) than the services offered by the public network. Because the network is private, users of the public network cannot access the private network.

It may be desirable to allow users of the public network to share the resources and radio infrastructure of the private network. Particularly in densely populated urban areas, many public networks are operating at or near full capacity. Adding additional capacity to the public network is relatively expensive. Private networks represent a source of unused capacity that may enable network operators to expand network capacity in a cost-effective fashion. However, existing systems do not allow public network subscribers to access the public network through a private network to which they do not subscribe.

Accordingly, there is a need for systems and methods for allowing subscribers to a public network to access the public network through a private network.

SUMMARY

The present invention addresses these and other needs by modifying the operation of BSCs and MSCs so that remote terminals that access a BSC are routed to an appropriate MSC. In one aspect, the invention may be used to enable a remote terminal to access a public network using the network infrastructure of a private network to which the remote terminal is not a subscriber. In this manner, the invention allows operators of public networks to use the capacity of private networks associated with their networks to expand the capacity of the public network.

In one aspect, the invention provides a method for providing a remote terminal with access to a public network via a private network. The invention comprises the steps of receiving, at a base station controller in the private network, an access request message from the remote terminal, determining whether the remote terminal is a subscriber in the private network, and in response to a negative determination, transmitting the access request message from the private network to a mobile services switching center in the public network.

In another aspect, the invention provides a communication system that comprises a public cellular communication network comprising a plurality of cells, each cell including a base station operatively connected to at least one base station controller and at least one mobile services switching center. Associated with the public network is a private network comprising at least one base station operatively connected with at least one private network base station controller and at least one private network mobile services switching center. The communication system also includes a determining module for determining, in response to an access request from a remote terminal, whether the remote terminal is a subscriber to the private network, and a messaging module for transmitting to the public cellular communication network the access request message from the remote terminal when

the remote terminal is not a subscriber to the private network.

According to a further aspect, the invention provides a private network for communication with remote terminals that comprises at least one base station for transceiving electromagnetic signals with remote terminals, at least one base station controller connected to the base station, and at least one mobile services switching center. The private network further includes a determining module for determining, in response to an access request message from a remote terminal, whether the remote terminal is a subscriber to the private network, and a messaging module for transmitting the access request message to a public network mobile services switching center.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will become more apparent upon reading the following detailed description in conjunction with the following drawings, in which:

FIG. 1 is a schematic illustration of a portion of a wide area cellular network including private radio communications networks within the coverage area of the wide area cellular network;

FIG. 2 is a schematic illustration of a private network and a portion of a public network overlaying the private network;

FIG. 3 is a flowchart illustrating a method of operating a network according to aspects of the invention;

FIG. 4 is a flowchart illustrating, in greater detail, a method of operating a network according to aspects of the invention; and

FIG. 5 is a flowchart, similar to the flowchart of FIG. 4, illustrating a method of operating a network according to aspects of the invention.

DETAILED DESCRIPTION

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. For purposes of understanding the present invention, and not by way of limitation, the wide area cellular network will be described based on the GSM cellular system standard. It will be recognized, however, that the particular channel access technique is not critical to the present invention. The invention may be embodied in different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will convey the invention to those skilled in the art.

Referring now to FIG. 1, an operating environment of the present invention will be described. In one aspect, the present invention relates to remote terminals and methods for using the same within public cellular networks such as advanced cellular phone systems, for example, in order to increase capacity in densely populated areas. Public cellular networks are typically designed around macrocells 10, 10', 10" covering cells with radii which may be in the order of a few kilometers. Macrocells 10, 10', 10" define the cellular structure of the wide area cellular network or PLMN as is well known and will be understood by one of ordinary skill in the art.

Macrocells 10, 10', 10" of the public cellular network include at least one base station 16, 16', 16", and the base stations may be co-located at the vertex of the three cells shown. Base stations 16, 16', 16" are typically connected via a wired infrastructure as is known to those of ordinary skill in the art. As illustrated in FIG.

1, the wired infrastructure includes base station controller 18 and mobile services switching center 20. The particulars of the infrastructure of the wide area cellular network will not be discussed further herein except to note that the wired infrastructure of the wide area cellular network also includes a connection to the PSTN providing the PLMN access to the PSTN switch (not shown) or, alternatively, to an ISDN. When a subscriber to the public network travels between cells, the user's remote terminal connection may be handed off between base station 16, 16', 16" depending upon the remote terminal's signal strength at the respective base station, traffic conditions, and interference conditions. When the user travels into a geographic region served by a different mobile services switching center (e.g., when the user is roaming), the user's terminal is registered with a visitor location register (VLR) associated with the particular region. In this manner, a subscriber to a public network can access the network from locations other than the user's "home" location.

Also illustrated in FIG. 1 are office private radio communications network 14 and residential private radio communications network 12, 12', 12". Residential network 12, 12', 12" may include a private base station such as those described in U.S. Pat. No. 5,428,668, which is incorporated herein by reference as if set forth in its entirety. Residential network 12, 12', 12" and office network 14 are private radio communications networks which have wire line connections to the PSTN via a PSTN switch or exchange (not shown) and/or to an ISDN wired network. Accordingly, office network 14 and residential network 12, 12', 12" have an associated wire line number by which they communicate over the public switched telephone network (or ISDN).

As illustrated in FIG. 1, office network 14 is a private radio communications network which connects to the PSTN via private branch exchange (PBX) 22. Office

network 14 further includes base stations 24. Base stations 24 are connected to a base station controller 26, which is connected to a mobile services switching center. Office network 14 and base stations 24 typically are not controlled by the wide area cellular network as they are not a coordinated part of the wide area cellular network. In addition, signaling through the PSTN line to PBX 22 may create problems when a call on the PSTN line is in progress. For purposes of the present invention, the distinctions between office and residential private radio communications networks are not critical, and the invention will be described herein with reference to private radio communications network 14. However, it is to be understood that the benefits of the present invention can be obtained regardless of the type of private radio communications network. Network procedures for accommodating roaming are known to those skilled in the art.

In certain circumstances it may be desirable to allow a subscriber to the public network, exemplified by cells 10, 10', 10", to access the public network using the network infrastructure of a private network, even if the public network subscriber is not a subscriber to the private network. FIG. 2 is a schematic depiction of a private network adapted to allow a remote terminal that is not a subscriber to the private network to access a public network using the resources of the private network. In one embodiment, the private network is constructed in accordance with the GSM architecture. Referring to FIG. 2, the infrastructure of private network 210 includes a private base station sub-system including at least one base transceiver station (BTS), 222a, and may include additional BTSs (e.g., 222b, 222c) and at least one base station controller (BSC) 224, which is connected to a private network MSC 230. BSC 224 includes a messaging module 226 for transceiving messages with private network MSC 240. Private network MSC 230 includes also a messaging module 232 and a determining module 234 for determining whether a remote

terminal is a subscriber to private network 210. A memory module 240, comprising a Home Location Register (HLR) and a Visitor Location Register (VLR), is connected to the private network MSC 230. Private network 210 may include an Authentication Center (AuC) or may use a public network's AuC. The private network MSC 230 may be connected directly to the PSTN, or may access the PSTN through a PBX, as illustrated in FIG. 1. Private network 210 may further comprise a plurality of private remote terminals 250 that are registered as subscribers to the private network 210. It will be appreciated that various network elements (e.g., MSC, BSC, BTS) may be combined into a single network node.

As an example, referring to FIGs. 2 and 3, when a private remote terminal 250 (e.g., a remote terminal that is a subscriber to private network 210) enters the geographic region served by private network 210, private remote terminal 250 determines the need for a location updating, and in response, transmits an access request message, in this case a location update request on a control channel. At step 310, the location update request is received by at least one private network BTS (e.g., 222a) and transmitted to BSC 224, and then to private network MSC 230. At step 320, determining module 234 references memory module 240 to determine whether private remote terminal 250 is a subscriber to private network 210. In response to an affirmative determination, at step 330, private remote terminal 250 is registered in the private network and allowed to use the services defined in private network 210.

According to the present invention, private network BSC 224 and private network MSC 230 are adapted to allow a remote terminal 252 that is not a subscriber to private network 210 to use the infrastructure of private network 210 to access an overlying public network. In brief, when a public remote terminal 252 (e.g., a remote terminal that is not a subscriber to private network 210) enters the

geographic region served by private network 210, public remote terminal 252 determines the need for a location updating, and in response, transmits an access request message, in this case, a location update request on a control channel. At step 310, the location update request is received by at least one private network BTS (e.g., 222a) and transmitted to BSC 224, and then to private network MSC 230. At step 320, determining module 234 references memory module 240 to determine whether public remote terminal 252 is a subscriber to private network 210. In response to a negative determination, at step 340, private network MSC 230 transmits a reject message to private network BSC 224 indicating that public remote terminal 252 is not a subscriber to the private network 210. In response to the reject message from private network MSC 230, at step 350, private network BSC 224 transmits the access request message, i.e., the location update request from public remote terminal 252 to a MSC 260 associated with a public network.

Public network MSC 260 treats the location update request in the same fashion as if it originated from a public network BSC. Accordingly, at step 360, remote terminal 252 may then be registered in the VLR of memory module 270 associated with public network MSC 260. From the perspective of the public network, remote terminal 252 is treated as if it were roaming in the public network 250. The services available to remote terminal 252 are defined by public network MSC 260 and memory module 270.

Procedures similar to the location updating procedure described above will be undertaken when a user initiates a call from remote terminal 252, or when remote terminal 252 is paged for a terminating call. Determining module 234 of private network MSC 230 references private network memory module 240 to determine whether remote terminal 252 is a subscriber with private network 210. In response to a negative determination, private network MSC 230 transmits a reject message to

private network BSC 224, which then directs the access request message to public network MSC 260.

An important aspect of the present invention is providing a BSC with the ability to interact with more than one MSC. Traditionally, in a GSM architecture, a BSC interacts with a single MSC. In the present invention, operation of the BSC and the MSC is modified to allow the BSC to communicate with more than one MSC. FIG. 4 is a flowchart illustrating a method of operating a BSC such that the BSC can communicate with more than one MSC. More particularly, FIG. 4 illustrates a procedure by which BSC 404 can register a remote terminal and route its calls through one of a plurality of MSCs. The procedures set forth in FIG. 4 are useful when the remote terminal is identified to the network by its International Mobile Subscriber Identity (IMSI).

Referring to FIG. 4, upon receipt of an access request message from the remote terminal (e.g., a location update message, an incoming call, or a call origination), at step 410, BSC 404 establishes a signal connection (in a GSM system this is realized with an SCCP connection) with MSC_a 402 and transmits the access request message (in a GSM system this message is a BSSMAP complete L3 information message) to MSC_a (step 412). The access request message includes, among other things, the remote terminal's IMSI. At step 414, the access request message is saved in a memory associated with BSC 404. At step 416, MSC_a checks a memory module to determine whether the remote terminal is a subscriber authorized to use the network to which MSC_a belongs. If the remote terminal is an authorized subscriber, then standard GSM procedures are followed to allow the remote terminal to access the network through MSC_a (step 418). If the remote terminal is not a subscriber, then at step 420 MSC_a transmits a REROUTE message to BSC 404. The REROUTE message in a GSM system may be encoded as a Base

Station System Mobile Application Protocol (BSSMAP) message. When BSC 404 receives the REROUTE message, BSC 404 establishes a SCCP connection with MSC_b 406 (step 422). At step 424, BSC 404 transmits a copy of the access request message to MSC_b 406, which then may register the remote terminal for service in accordance with standard GSM procedures.

In an alternate embodiment, BSC 404 is operatively connected to a memory module such that BSC 404 can determine whether the remote terminal is an authorized subscriber. BSC 404 can include its own memory module or can access the memory module associated with MSC_a using a suitable data connection. If BSC 404 performs a test to determine whether the remote terminal is a subscriber with the network to which MSC_a belongs, then BSC 404 can establish the signalling connection and send the access request message to MSC_a only for subscribers to the network to which MSC_a belongs.

In certain circumstances, e.g., when roaming, the remote terminal uses a Temporary Mobile Subscriber Identity (TMSI) assigned in an external Location Area (LA) as identification, rather than an IMSI. To determine whether the remote terminal is a subscriber in a particular network, the network must request the IMSI from the remote terminal. FIG. 5 is a flowchart that illustrates a method for operating a network according to aspects of the invention when the remote is identified by a TMSI, rather than an IMSI.

Referring to FIG. 5, upon receipt of an access request message from the remote terminal (e.g., a location update message, an incoming call, or a call origination), at step 510, BSC 504 establishes a signal connection with MSC_a 502 and transmits the access request message to MSC_a (step 512). The access request message includes, among other things, the remote terminal's TMSI. At step 514, the access request message is saved in a memory associated with BSC 504. At step 515,

MSC_a requests the IMSI from the remote terminal, which may be forwarded from the remote terminal to MSC_a over a control channel. At step 516, MSC_a checks a memory module to determine whether the remote terminal is a subscriber authorized to use the network to which MSC_a belongs. If the remote terminal is an authorized subscriber, then standard GSM procedures are followed (including requesting again the IMSI) to allow the remote terminal to access the network through MSC_a (step 518). If the remote terminal is not a subscriber, then at step 517 MSC_a again requests the IMSI from the remote terminal and at step 520 MSC_a transmits a REROUTE message to BSC 504. The REROUTE message in a GSM system may be encoded as a Base Station System Mobile Application Protocol (BSSMAP) message. When BSC 504 receives the REROUTE message, BSC 504 establishes a signalling connection with MSC_b 506 (step 522). At step 524, BSC 504 transmits a copy of the access request message to MSC_b 506, which may register the remote terminal for service in accordance with standard GSM procedures. The purpose of the second IMSI request (step 517) is to avoid a "send sequence number mismatch" error when messages after the Complete L3 information message from the remote terminal are received in the MSC_b 506. It will be appreciated that the second IMSI request could be made by either MSC_a 502 or by BSC 504. Other procedures could be used to achieve the same result.

In an alternate embodiment, BSC 504 is operatively connected to a memory module such that BSC 504 can determine whether the remote terminal is a subscriber. BSC 504 can include its own memory module or can access the memory module associated with MSC_a using a suitable data connection. If BSC 504 performs the test to determine whether the remote terminal is a subscriber with the network to which MSC_a belongs, then BSC 504 can establish the signaling connection and send the access request message to MSC_a only for subscribers to the

network to which MSC_a belongs.

In another embodiment of the invention, upon initial registration with a network, the remote terminal can be assigned a TMSI that indicates which MSC should provide service to the remote terminal. By way of example, TMSI codes in a particular range may be allocated to MSC_a, while TMSI codes in a different range may be allocated to MSC_b. In this manner, the BSC may route inquiries from the remote terminal based on the TMSI code, thereby reducing the computation required to determine which MSC should manage the remote terminal's communication.

The present invention has been described in the context of providing access to a public network through a private network. It will be appreciated that even public networks are "private", in that one must subscribe to a network service to obtain access to the network. In this regard, the present invention may be considered as providing systems and methods for providing access to a first network through a separate, second network. The first and second networks may each be public networks.

The present invention is described above with reference to particular embodiments, and it will be readily apparent to those skilled in the art that it is possible to embody the invention in forms other than those described above. The particular embodiments described above are merely illustrative and should not be considered restrictive in any way. The scope of the invention is determined given by the following claims, and all variations and equivalents that fall within the range of the claims are intended to be embraced therein.

What is claimed is:

1. A method for providing a remote terminal with access to a public network via a private network comprising the steps of:

receiving, at a base station controller in the private network, an access request message from the remote terminal;

determining whether the remote terminal is a subscriber in the private network; and

in response to a negative determination, transmitting the access request message from the private network to a mobile services switching center in the public network.

2. A method according to claim 1, wherein the step of determining whether the remote terminal is a subscriber in the private network comprises:

referencing a memory location associated with a private network base station controller.

3. A method according to claim 1, wherein the step of determining whether the remote terminal is a subscriber in the private network comprises:

referencing a memory location associated with a mobile services switching center in the private network.

4. A method according to claim 3, further comprising the steps of:

generating, at a mobile services switching center in the private network, a signal that indicates whether the remote terminal is a subscriber in the private network; and

in response to a negative indication, transmitting to the base station controller in the private network a message indicating that the access request message from the mobile terminal should be routed to a mobile services switching center in the public network.

5. A method according to claim 1, wherein the step of determining whether the remote terminal is a subscriber in the private network comprises:

establishing a signal connection between the base station controller in the private network and a mobile services switching center in the private network; and

transmitting the access request message from the base station controller in the private network to a mobile services switching center in the private network.

6. A method according to claim 5, further comprising the step of:

storing a copy of the access request message in a memory location associated with the base station controller in the private network.

7. A method according to claim 1, wherein the public network receives the access request message from the remote terminal, which was transmitted by the private network, and responds to the access request message as if it had been received directly by the public network.

8. A communication system comprising:

a public cellular communication network comprising a plurality of cells, each cell including a base station operatively connected to at least one base station controller and at least one mobile services switching center;

a private network comprising at least one base station, operatively connected

with at least one private network base station controller and at least one private network mobile services switching center;

a determining module for determining, in response to an access request message from a remote terminal, whether the remote terminal is a subscriber to the private network; and

a messaging module for transmitting to the public cellular communication network the access request message from the remote terminal when the remote terminal is not a subscriber to the private network.

9. A communication system according to claim 8, wherein:

the private network base station controller comprises a memory module for storing identification codes associated with subscribers to the private network; and

the determining module operates on circuitry in the private network base station controller.

10. A communication system according to claim 8, wherein:

identification codes associated with subscribers to the private network are stored in a memory module associated with the private network mobile services switching center; and

the determining module operates on circuitry in the private network mobile services switching center.

11. A communication system according to claim 8, wherein:

in response to an access request message from a remote terminal, the determining module generates a signal that indicates whether the remote terminal is a subscriber to the private network.

12. A communication system according to claim 8, wherein:

in response to a signal from the determining module indicating that a remote terminal is not a subscriber to the private network, the messaging module establishes a connection with a mobile services switching center associated with the public network.

13. A private network for communication with remote terminals, comprising:

at least one base station for transceiving electromagnetic signals with remote terminals;

at least one base station controller connected to the base station;

at least one mobile services switching center;

a determining module for determining, in response to the access request message from a remote terminal, whether the remote terminal is a subscriber to the private network; and

a messaging module for transmitting the access request message to a public network mobile services switching center when the remote terminal is not a subscriber to the private network.

FIG. 1

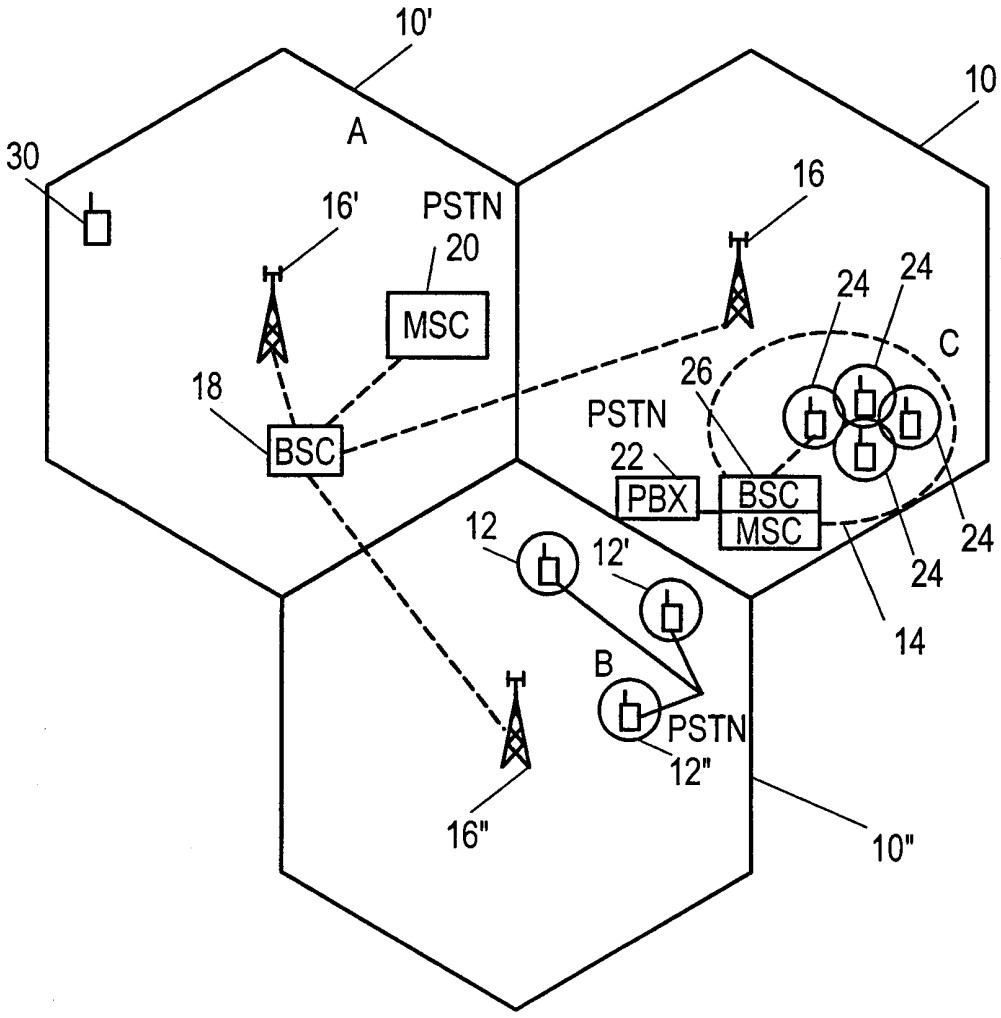
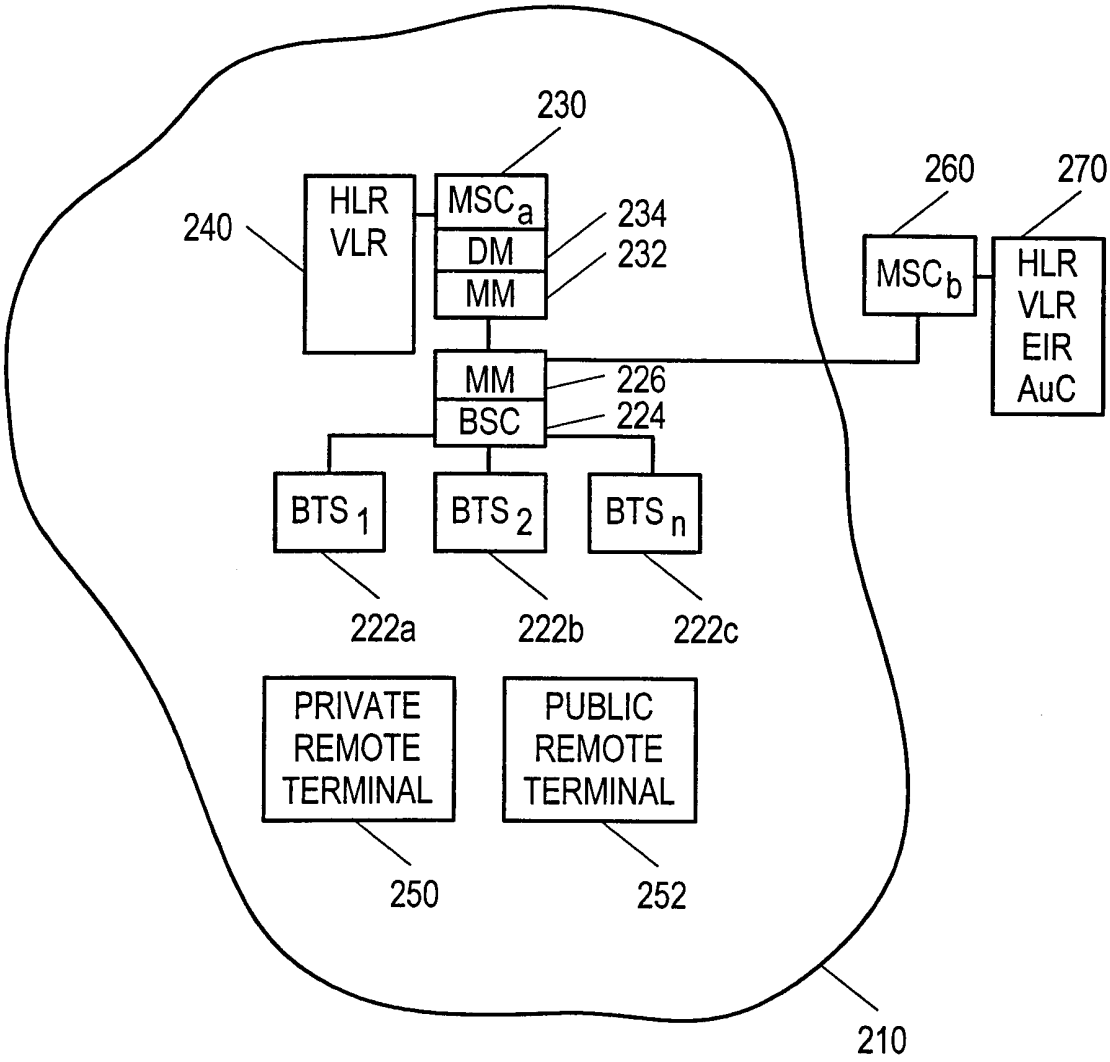

10'
10
A
30
16'
PSTN
20
MSC
16
24
24
C
26
18
BSC
PSTN
22
PBX
BSC
MSC
24
24
12
12'
14
B
PSTN
12"
16"
10"

FIG. 2


230
240
HLR
VLR
MSC a
DM
MM
234
232
260
270
MSC b
HLR
VLR
EIR
AuC
MM
BSC
226
224
BTS 1
BTS 2
BTS n
222a
222b
222c
PRIVATE
REMOTE
TERMINAL
PUBLIC
REMOTE
TERMINAL
250
252
210

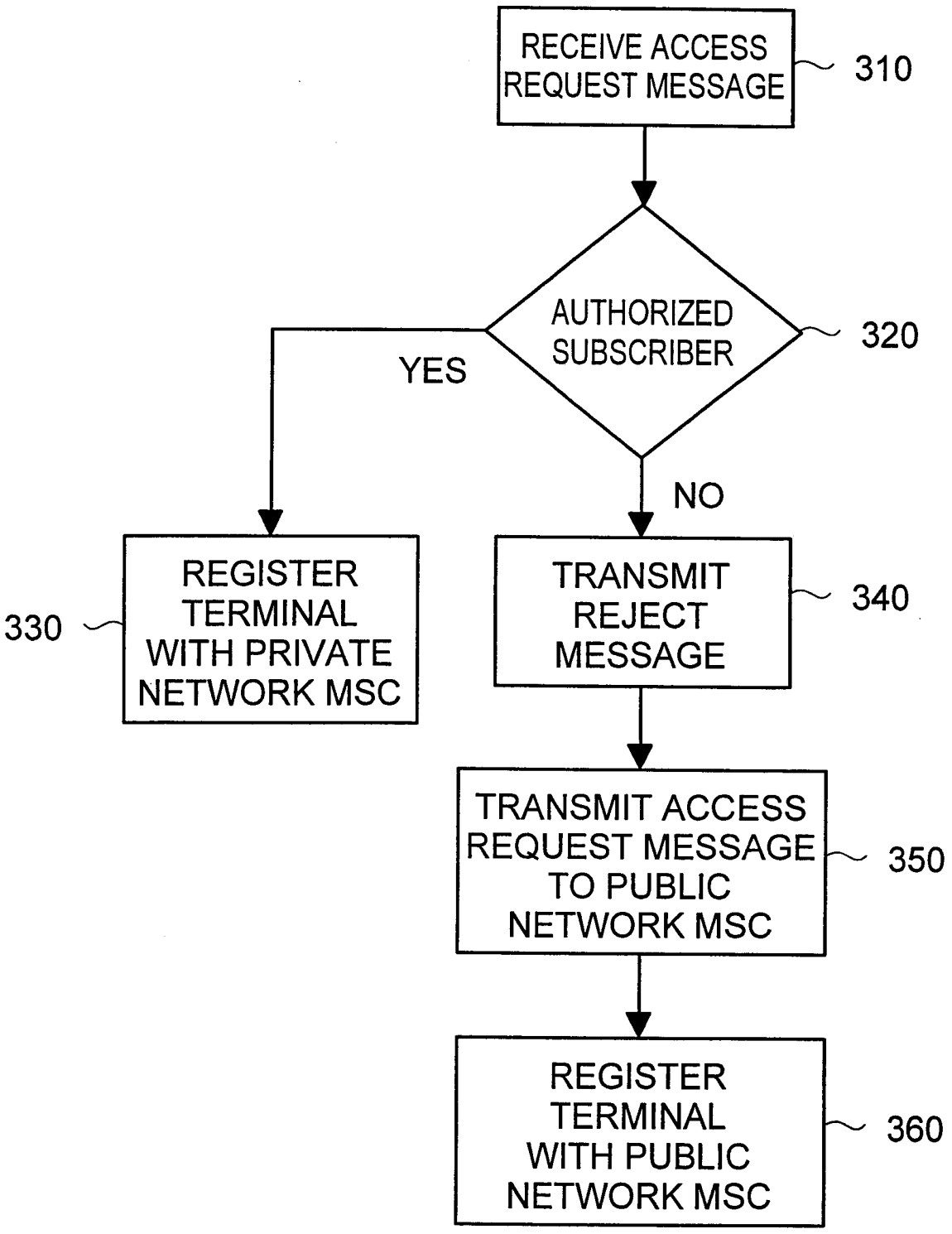

RECEIVE ACCESS REQUEST MESSAGE
310
AUTHORIZED SUBSCRIBER
320
YES
NO
REGISTER TERMINAL WITH PRIVATE NETWORK MSC
330
TRANSMIT REJECT MESSAGE
340
TRANSMIT ACCESS REQUEST MESSAGE TO PUBLIC NETWORK MSC
350
REGISTER TERMINAL WITH PUBLIC NETWORK MSC
360

FIG. 3

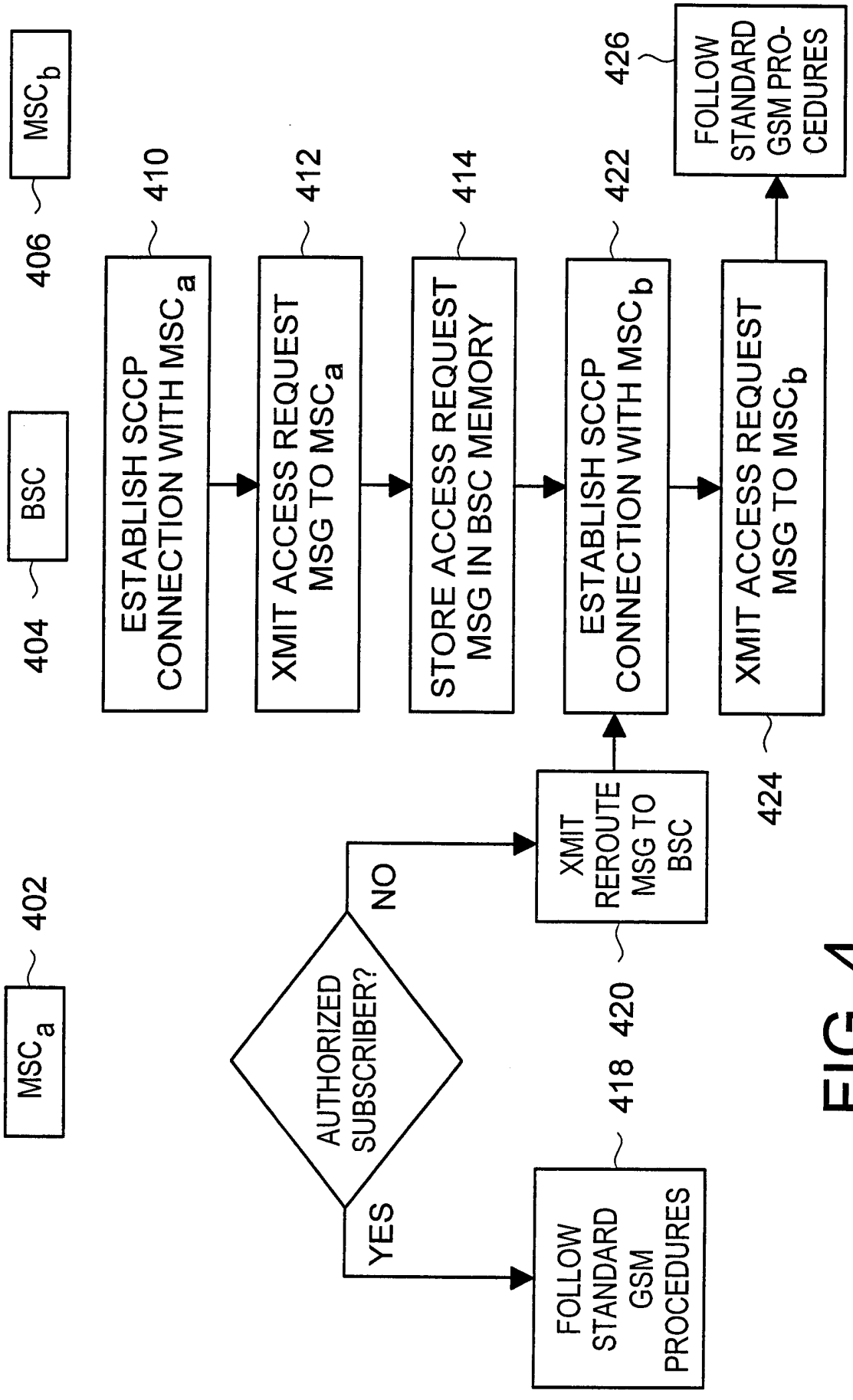

MSC$_a$
402
BSC
404
MSC$_b$
406
ESTABLISH SCCP CONNECTION WITH MSC$_a$
410
XMIT ACCESS REQUEST MSG TO MSC$_a$
412
STORE ACCESS REQUEST MSG IN BSC MEMORY
414
ESTABLISH SCCP CONNECTION WITH MSC$_b$
422
XMIT ACCESS REQUEST MSG TO MSC$_b$
424
FOLLOW STANDARD GSM PRO-CEDURES
426
AUTHORIZED SUBSCRIBER?
418
NO
YES
XMIT REROUTE MSG TO BSC
420
FOLLOW STANDARD GSM PROCEDURES

FIG. 4

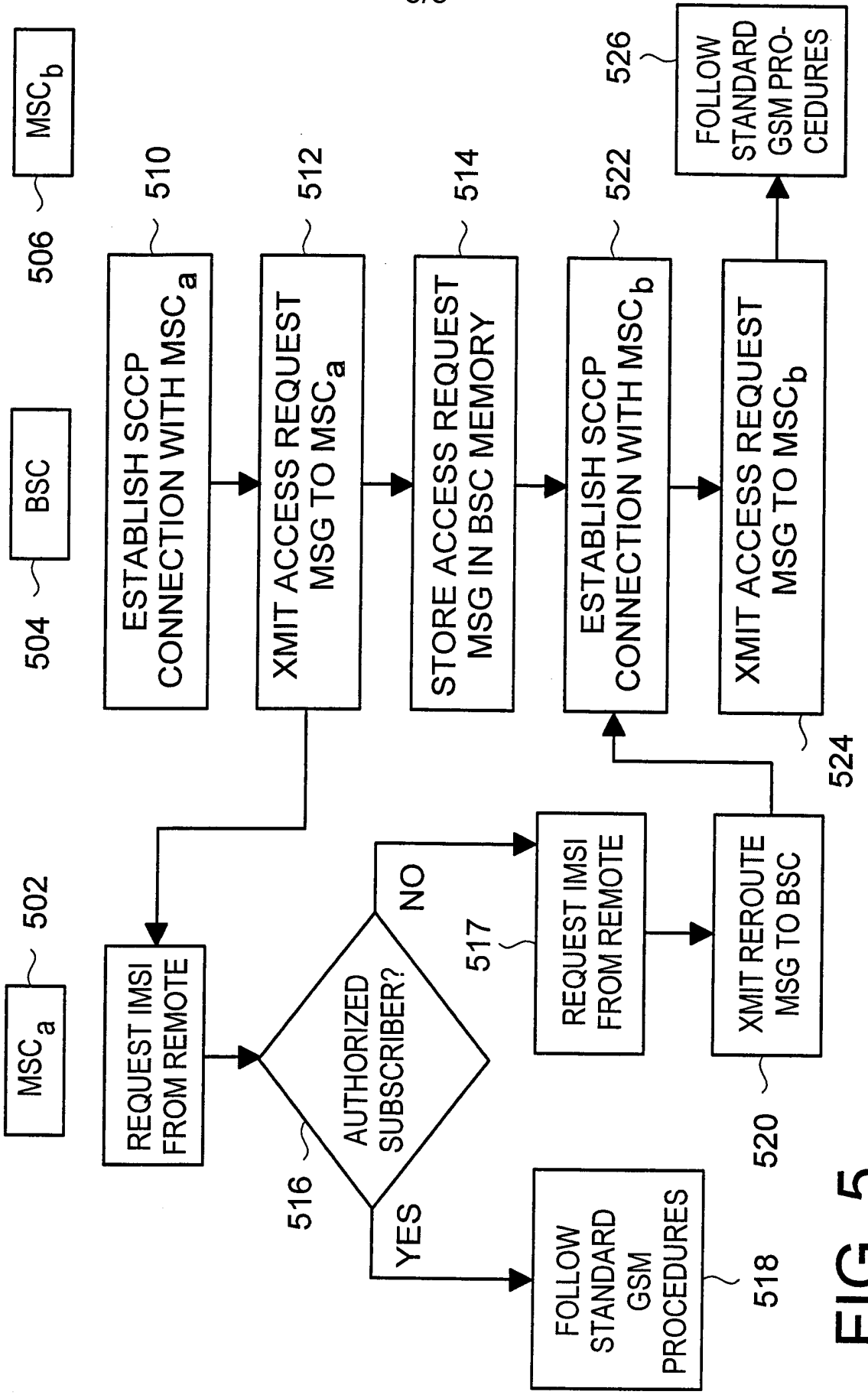

MSC$_b$
506
BSC
504
510
ESTABLISH SCCP CONNECTION WITH MSC$_a$
512
XMIT ACCESS REQUEST MSG TO MSC$_a$
514
STORE ACCESS REQUEST MSG IN BSC MEMORY
522
ESTABLISH SCCP CONNECTION WITH MSC$_b$
526
FOLLOW STANDARD GSM PRO-CEDURES
MSC$_a$
502
REQUEST IMSI FROM REMOTE
AUTHORIZED SUBSCRIBER?
516
NO
517
REQUEST IMSI FROM REMOTE
XMIT REROUTE MSG TO BSC
520
XMIT ACCESS REQUEST MSG TO MSC$_b$
524
YES
FOLLOW STANDARD GSM PROCEDURES
518

FIG. 5

INTERNATIONAL SEARCH REPORT

Intern. ial Application No
PCT/SE 00/02352

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/26 H04Q7/30

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 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	WO 96 35309 A (INTERWAVE COMMUNICATIONS INTER;WHITE TIMOTHY R ; LU PRISCILLA MARI) 7 November 1996 (1996-11-07) page 13, line 15 -page 19, line 23	1-13
X	US 5 870 677 A (TAKAHASHI KATSUMI ET AL) 9 February 1999 (1999-02-09) column 6, line 58 -column 7, line 5 column 7, line 45 -column 9, line 25	1,7-12

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

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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

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

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

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 April 2001	17/04/2001

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

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. ial Application No
PCT/SE 00/02352

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9635309 A	07-11-1996	US	5734699 A	31-03-1998
		US	5577029 A	19-11-1996
		AU	716535 B	24-02-2000
		AU	5726296 A	21-11-1996
		AU	716483 B	24-02-2000
		AU	5726696 A	21-11-1996
		AU	717297 B	23-03-2000
		AU	5853496 A	21-11-1996
		AU	714073 B	16-12-1999
		AU	5918896 A	21-11-1996
		CA	2219791 A	07-11-1996
		CA	2219792 A	07-11-1996
		CA	2219793 A	07-11-1996
		CA	2219879 A	07-11-1996
		CN	1196154 A	14-10-1998
		CN	1196157 A	14-10-1998
		EP	0824835 A	25-02-1998
		EP	0826291 A	04-03-1998
		EP	0826292 A	04-03-1998
		EP	0824832 A	25-02-1998
		TW	382871 B	21-02-2000
		US	5999813 A	07-12-1999
		WO	9635301 A	07-11-1996
		WO	9635310 A	07-11-1996
		WO	9635298 A	07-11-1996
		US	5818824 A	06-10-1998
		US	5887256 A	23-03-1999
		US	5953651 A	14-09-1999
		US	5842138 A	24-11-1998
		AU	717237 B	23-03-2000
		AU	5675496 A	21-11-1996
		CA	2219885 A	07-11-1996
		CN	1196156 A	14-10-1998
		EP	0829178 A	18-03-1998
		WO	9635311 A	07-11-1996
		US	5761195 A	02-06-1998
US 5870677 A	09-02-1999	US	6070081 A	30-05-2000