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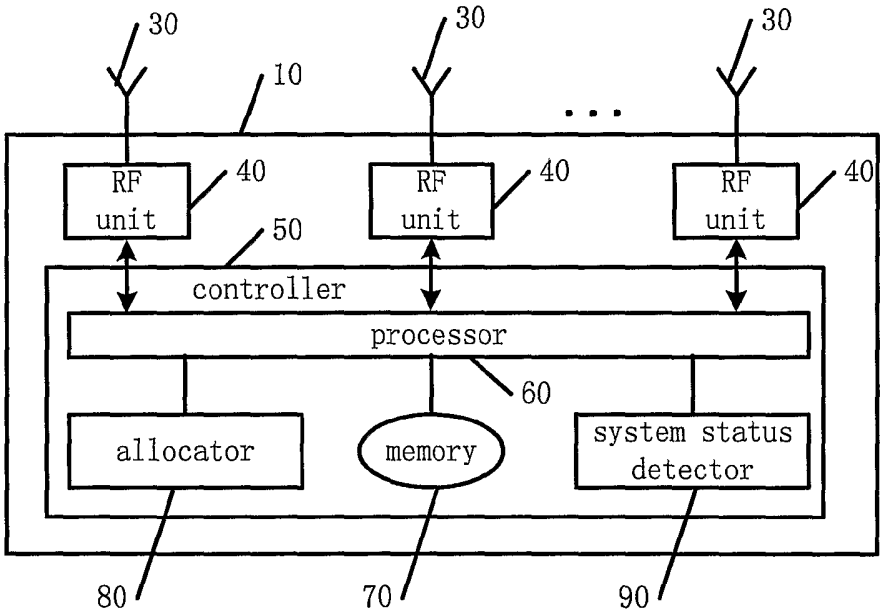


(57) Abstract: A wireless communication system, comprises a plurality of transceivers, receiving and transmitting RF signals (40); a plurality of RF processing units (60), processing said received signals or signals to be transmitted by said transceivers; RF resources allocator, detecting (90) information contained in received signals from a uplink on the types of different wireless communication schemes which are requested to access, and allocating (80) RF resources shared by said different wireless communications schemes according to said detected information.

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# METHOD AND DEVICE FOR RADIO RESOURCE ALLOCATION IN MULTI-STANDARD WIRELESS COMMUNICATION SYSTEMS

## Field of the Invention

The present invention relates to multi-standards wireless communication systems; and, more particularly, to method and apparatus for allocating RF resources in multi-standard communication systems.

## Background of the Invention

With the development of mobile communication systems, more and more communication standards (i.e.wireless communication schemes) came into emergence, e.g., GSM, IS-95 and CDMA, which belong to the second generation (2G) communication scheme, GPRS and TSM, which belong to the from-2G-to-3G communication scheme, TD-SCDMA, W-CDMA and cdma2000, which fall into the third generation (3G) communication scheme, and even WLAN, another popular wireless communication scheme, and etc.

According to the regulation of ITU, mobile communication systems with different wireless communication schemes are required to transmit data using carriers in different frequency bands. However, with the rapid development of communication services, various wireless communication schemes appeared, i.e. different wireless communication schemes may transmit data using different carriers within the same frequency band. Typically, TSM

communication scheme proposed by CWTS (China Wireless Communication Standard group) shares the same frequency band with TD-SCDMA communication scheme.

TD-SCDMA is a TDD-mode communication scheme to transmit data with SCDMA (synchronous code division multiple access) technology, while TSM is designed as an evolving communication scheme from existing communication system with GSM communication scheme to the communication system with TD-SCDMA communication scheme. As an interim communication scheme, TSM communication scheme shares the same frequency band with TD-SCDMA communication scheme to transmit data.

When a communication system is evolving from TSM communication scheme to TD-SCDMA communication scheme, TSM subscribers and TD-SCDMA subscribers experience constant changes, i.e., in the prologue of the evolution, TSM subscribers account for the majority, with the evolution going along TSM subscribers decrease and TD-SCDMA subscribers increase gradually, and TSM subscribers only account for a minority while TD-SCDMA subscribers constitute the majority in the epilogue of the evolution. Distinct changes in the structure of TSM subscribers and TD-SCDMA subscribers require different frequency resources, therefore the limited frequency resources need to be allocated dynamically among

co-existing wireless communication schemes, so as to achieve rational allocation and reuse of RFresources.

## Summary of the Invention

It is, therefore, an object of the present invention to provide a method and an apparatus for allocating RF resources in multi-standard wireless communication systems, which capable of dynamically allocating limited RF resources to co-existing wireless communication schemes according to the requirements.

Another object of the invention is to provide a method and an apparatus for allocating RF resources in multi-standard wireless communication systems, which capable of statistically configuring the RF resources shared by co-existing wireless communication schemes to improve the utilization of spectrum, in the long evolving process.

Another object of the invention is to provide a method and an apparatus for allocating RF resources among multi-standard wireless communication systems, which capable of making expected configurations to the RF resources shared by co-existing wireless communication schemes to improve the utilization of spectrum, in the prologue and the epilogue of the evolution.

To meet the object above, a method for allocating RF resources among

multi-standard wireless communication systems, as proposed in the present invention, comprising:

(a) detecting a plurality of received signals from a uplink, wherein said signals contain information on the types of the different wireless communication schemes which are requested to access; and

(b) allocating the radio RF resources shared by said different communications schemes according to said detected information.

To achieve the object above, an apparatus for allocating RF resources among multi-standard wireless communication systems, as proposed in the present invention, comprising:

a status detector, detecting a plurality of received signals from a uplink, wherein said signals contain information on the types of the different wireless communication schemes which are requested to access; and

a resource allocator, allocating the RF resources shared by said different communications schemes according to said detected information.

To attain the object above, a wireless communication system, as proposed in the present invention, comprising:

a plurality of transceivers, receiving and transmitting RF signals;

a plurality of RF processing units, processing said received signals or signals to be transmitted by said transceivers;

RF resources allocator, detecting the information contained in received

signals from a uplink on the types of the different wireless communication schemes which are requested to access, and allocating RF resources shared by said different communications schemes according to said detected information.

## Brief Description of the Drawings

Further description to the invention will be given below, in conjunction with the accompanying figures, wherein:

Fig. 1 diagrams the structure of a cellular communication system;

Fig. 2 depicts the structure of each cell of the cellular communication system in Fig. 1;

Fig. 3 illustrates the structure of a base station/node of each cell in Fig. 2;

Fig. 4 is the flow chart of the expected configuration method 1;

Fig. 5 is the flow chart of the expected configuration method 2;

## Detailed Description of the Preferred Embodiments

This invention provides a method and an apparatus for dynamically allocating RF resources to co-existing wireless communication schemes in a base station, according to different requirements of the co-existing wireless communication schemes. In the following embodiments of a wireless communication system where TSM and TD-SCDMA wireless communication schemes co-exist, the method and apparatus have different

characteristics when applied in said co-existing wireless communication schemes during different evolving phases.

Descriptions will respectively be presented, in conjunction with the accompanying drawings, to the method and apparatus for statistical configuration of the shared RF resources, as provided in the invention, during the evolving process, and the method and apparatus for expected configuration of the shared RF resources, as provided in the invention, during the prologue and the epilogue of the evolving process, in the communication system where TSM and TD-SCDMA wireless communication schemes co-exist.

As shown in Fig. 1, A, B, C, D, E and Z represent 6 cells, which constitute a mobile communication system where cell Z is the center cell and cell A-E are adjacent cells of cell Z.

As shown in Fig. 2, every cell in Fig. 1 contains a base station 10 (namely Node B), and one or many mobile terminals 20.

Fig. 3 demonstrates the structure of the base station 10 of a cell in Fig.2. As shown in Fig. 3, the base station 10 includes N antennas 30 for receiving and transmitting RF signals, N RF units 40 and a controller 50, wherein:

Every RF unit 40 is composed of a transceiver, a modulator and a demodulator. An input/output of the transceiver is coupled to the corresponding antenna 30 to receive RF signals from antenna 30 or transmit

RF signals via antenna 30, an output of the transceiver is coupled to an input of said demodulator to demodulate the received RF signals, and an input of the transceiver is coupled to the output of said modulator to send the modulated signals to antenna 30 for transmitting. Every RF unit 40 has its own RF carriers to transmit data.

Said controller 50 comprises a processor 60, an allocator 80, a memory 70 and a system status detector 90, wherein said processor 60 is coupled to another input/output of the transceiver in each said RF units 40, to receive signals from each RF units 40, at the same time said processor 60 communicates with allocator 80, memory 70 and system status detector 90, more particularly, status detector 90 detects the types of the wireless communication schemes which are requested to access, according to the signals from processor 60; when used to store information on RF resources allocation in multi-standard wireless communication systems, memory 70 is also used to record the number of the requests for accessing each of the wireless communication schemes detected by status detector 90 in a certain period, if the base station chooses the method of statistical configuration of RF resources; resource allocator 80 dynamically allocates RF resources shared by said TSM and TD-SCDMA wireless communication schemes, according to the number of the requests for accessing each of the different wireless communication schemes recorded by the memory in statistical

configuration method, or according to the types of the wireless communication schemes detected by status detector 90 and the information on RF resources allocation stored in the memory; then processor 60 controls and adjusts the RF carriers in RF unit 40 according to instructions from resource allocator 80.

Detailed descriptions as follows will be respectively given to said statistical configuration method and expected configuration method, according to different evolving phases of TSM and TD-SCDMA communication schemes.

**Statistical configuration method**

Generally speaking, the evolution from TSM communication scheme to TD-SCDMA communication scheme is a long-term procedure, which could last several years. In this case, subscribers of the two wireless communication schemes won't change dramatically during the procedure, so the configuration of RF resources can be done at intervals, for example every other month.

Resource allocator 80 reallocates RF carriers in each cell according to the number of the requests for accessing each of TSM wireless communication scheme and the number for TD-SCDMA wireless communication scheme recorded by memory 70 within an interval, wherein

the number recorded by memory 70 is the total traffic load number of each of the two wireless communication schemes within the whole interval. Before the next interval starts, memory 70 will be cleared to record the number of the requests for accessing each of TSM and TD-SCDMA wireless communication schemes detected by status detector 90 in the next interval.

Two embodiments will be offered to display the statistical configuration method, wherein allocator 80 dynamically allocates RF resources according to the number of the requests for accessing each of said wireless communication schemes.

**Embodiment 1:**

When needing to configure RF resources after an interval, allocator 80 first accesses memory 70 to inquire the number of the requests for accessing each of the two wireless communication schemes detected by status detector 90 within the interval, and calculates the ratio R of the number of the requests for accessing TSM communication scheme to the number of the requests for accessing TD-SCDMA communication scheme. Afterwards, assumed that the number of RF carriers in a cell is N, allocator 80 allocates the number of carriers for TSM communication scheme as N1, and that of TD-SCDMA communication scheme as N2, where N1+N2=N, and calculates the value of N1/N2. Allocator 80 allocates several sets of N1 and N2 (N1 and N2 should be kept no less than 1 so as to guarantee the two wireless communication

schemes accessible), and acquires the value of N1/N2 of every set of N1 and N2, and then according to the calculated ratio R, allocator 80 picks the value of N1/N2 which is closest to R, and allocates the N RF carriers to the two TSM and TD-SCDMA wireless communication schemes .

For example, the number is 3.4Erl for TSM wireless communication scheme and 8.5Erl for TD-SCDMA wireless communication scheme and N=8, then R=0.4. If 2 RF carriers are allocated to TSM wireless communication scheme and 6 to TD-SCDMA wireless communication scheme, it can be obtained that N1/N2=0.3333. If 3 RF carriers are allocated to TSM wireless communication scheme and 5 to TD-SCDMA wireless communication scheme, it can be gotten that N1/N2=0.6. As above, allocator 80 should choose the first RF carriers allocation , which is closer to R.

**Embodiment 2:**

In embodiment 1, allocator 80 uses the number of the requests for accessing each of TSM and TD-SCDMA wireless communication schemes within the whole interval to calculate the traffic ratio R. However, the most important data is the data from rush hour of the interval which is most related to the block rate, so in embodiment 2 a slight revision can be taken to embodiment 1, i.e. instead of the number of the requests within the whole interval, only the number of the requests from rush hour of the interval is used to calculate the ratio R, and others are the same as embodiment 1.

**Expected Configuration method**

In the prologue of evolution, TD-SCDMA subscribers will be much fewer than TSM subscribers. In this case, it will be very inefficient if RF carriers for TD-SCDMA wireless communication scheme are still reserved in each cell. Embodiment 1 of the expected configuration method in this invention is introduced to solve this problem.

**Embodiment 1:**

According to the expected configuration method, all RF carriers in a cell will be allocated to TSM wireless communication scheme. a RF carrier will be allocated to TD-SCDMA wireless communication scheme only in the following cases:

(1) A TD-SCDMA subscriber sends a connection request in the cell;

(2) A TD-SCDMA subscriber moves from an adjacent cell to the cell and sends a handover request in the cell.

As the expected configuration method shown in Fig.4, in a cell, when there is no connection from any TD-SCDMA subscriber, all RF carriers are allocated to TSM wireless communication scheme (S1). When a TD-SCDMA subscriber in the cell sends a request for connection or handover (S10), the base station in the cell will first judge whether there are RF resources available for TD-SCDMA wireless communication scheme (S20), the RF resources will be allocated to said request if there are RF resources available

for TD-SCDMA wireless communication scheme (S30), if there are no RF resources available for TD-SCDMA wireless communication scheme, it will judge whether there are RF carriers available (S40), if there are RF carriers available , a RF carrier will be allocated to TD-SCDMA wireless communication scheme(S50) and then the RF resources corresponding to the RF carrier will be allocated to said request (S60), if there are no RF carriers available, the request will be rejected (S70) and the request will be terminated (S1001).

Once all communications of TD-SCDMA wireless communication scheme in the cell end, i.e. once there is no connection of TD-SCDMA wireless communication scheme in said cell, the RF carriers occupied by TD-SCDMA wireless communication scheme will be reallocated to TSM wireless communication scheme.

In the epilogue of evolution, the case reverses totally. Almost all subscribers are of TD-SCDMA wireless communication scheme, except for very few TSM subscribers. In this case, it can be very inefficient if RF carriers are still reserved for TSM communication in each cell. Embodiment 2 of the expected configuration method of this invention is introduced to solve this problem.

**Embodiment 2:**

According to said expected configuration method, all RF carriers in a

cell will be allocated to TD-SCDMA wireless communication scheme except for the following cases where one RF carrier will be allocated to TSM wireless communication scheme:

(1) A TSM subscriber sends a connection request in the cell;

(2) A TSM subscriber moves from an adjacent cell to the cell and sends a handover request in the cell.

As the expected configuration method shown in Fig.5, in a cell, when there is no connection from TSM subscribers, all RF carriers are allocated to TD-SCDMA wireless communication scheme (S1). When a TSM subscriber in the cell sends a request for connection or handover (S100), the base station in the cell will first judge whether there are RF resources available for TSM wireless communication scheme (S200), if there are RF resources available for TSM wireless communication scheme, the RF resources will be allocated to said request (S300), if there are no RF resources available for TSM wireless communication scheme, it will judge whether there are RF carriers available (S400), if there are RF carriers available, a RF carrier will be allocated to TSM wireless communication scheme(S500) and then the RF resources corresponding to the RF carrier will be allocated to said request (S600), if there are no RF carriers available, the request will be rejected (S700) and the request will be terminated (S1001).

Once all communications of TSM wireless communication scheme end

(S1000), i.e. once there is no connection of TSM wireless communication scheme in the cell, the RF carriers occupied by TSM wireless communication scheme will be reallocated to TD-SCDMA wireless communication scheme.

In fact, we will designate the most of the RF carriers by statistical configuration method and reserve a few carriers for expected configuration method to accommodate the rapid variation of the number of subscribers in different wireless communication schemes.

**Beneficial Use of the Invention**

As to the method and apparatus provided by the present invention for allocating RF resources in multi-standard wireless communication systems, because the resource allocator of the apparatus can timely allocate RF resources shared by co-existing wireless communication schemes according to the number of the requests for accessing each of the different wireless communication schemes detected by the status detector, therefore, the method and apparatus can dynamically allocate limited RF resources to co-existing wireless communication schemes.

As to the method and apparatus provided by the present invention for allocating RF resources in multi-standard wireless communication systems, because the method and apparatus can employ statistical configuration method, expected configuration method, or their combination, according to

different evolving phases of the communication system and different ratio of traffic requirements, accordingly, the method and apparatus can realize rational configuration of RF resources shared by co-existing wireless communication schemes, thus to increase the utilization of limited RF resources.

Of course, while the invention has been shown and described with respect to the preferred embodiment, it will be understood by those skilled in the art that the RF resource allocation method for multi-standard wireless communication systems provided in this invention may not be limited to the commmunication system with TSM or TD-SCDMA communication scheme, but also applicable to the communication systems with other wireless communication schemes.

It will also be understood by those skilled in the art that various improvements can be made to the RF resource allocation method for multi-standard wireless communication systems released in this invention. Therefore, the scope of the invention to be protected needs to be determined by what is claimed.

What's claimed is:

1.A method for radio RF resources allocation in multi-standard wireless communication systems, comprising:

(a) detecting a plurality of received signals from a uplink, wherein said signals contain information on the types of the different wireless communication schemes which are requested to access; and

(b) allocating the radio RF resources shared by said different communications schemes according to said detected information.

2.The method of claim 1, wherein step (b) further includes:

(b1) carrying out a statistic of the information on the requests for accessing each of said different wireless communication schemes in a set interval; and

(b2) allocating said RF resources shared by said different wireless communication schemes according to said statistic of the set interval.

3.The method of claim 2, wherein said information on the requests for accessing each of said different wireless communication schemes includes the number of the requests for accessing each of said different wireless communication schemes.

4.The method of claim 3, wherein in step (b2), the allocation of said RF resources is realized by calculating the ratio of the number of the requests for accessing each of said different wireless communication schemes.

5.The method of any of claims 2-4, wherein in step (b1), said statistic is achieved by carrying out a statistic of said information on the requests for accessing each of said different wireless communication schemes within the set whole interval.

6.The method of any of claims 2-4, wherein in step (b1), said statistic is achieved by carrying out a statistic of said information on the requests for accessing each of said different wireless communication schemes within rush hours of the set interval.

7.The method of claim 1, wherein step (b) further includes:

(b2) judging whether there are RF resources available for the requests for accessing said different wireless communication schemes; and

(b3) allocating said available RF resources to said requests, if there are RF resources available for said requests.

8.The method of claim 1, wherein step (b) further includes:

(b1) pre-allocating said RF resources to a specific communication scheme;

(b2) judging whether there are RF resources available for the requests for accessing the different wireless communication schemes, if the different wireless communication schemes are not the specific communication scheme; and

(b3) allocating said available RF resources to said requests, if there are RF resources available for said requests.

9.The method of claims 7 or 8, wherein step (b2) and (b3) are executed in following condition:

subscribers send said connection requests for accessing said different wireless communication schemes.

10.The method of claims 7 or 8, wherein step (b2) and (b3) are executed in following condition:

subscribers which carry out cell handover send said handover requests for accessing said different wireless communication schemes.

11.The method of claims 7 or 8, wherein step (b3) further includes:

(i) judging whether there are RF carrier available for said requests, if

there are no RF resources available for said requests for accessing said wireless communication schemes; and

(ii) allocating said available RF carrier to said wireless communication schemes, if there are RF carriers available for said requests, and allocating the corresponding RF resources to said requests.

12.The method of claim 11, wherein step (ii) further includes:

when the communications employing said wireless communication schemes ends , said RF carriers allocated to said requests are released.

13.The method of claim 11, wherein step (ii) further includes:

if there are no RF carriers available for said requests, said requests are rejected.

14.The method of claim 1, said wireless communication schemes include at least two of following: IS-95, CDMA, GSM, TSM, GPRS, TD-SCDMA, W-CDMA cdma 2000 and WLAN.

15.A device for RF resources allocation in multi-standard wireless communication systems, comprising:

a status detector, detecting a plurality of received signals from a uplink,

wherein said signals contain information on the types of the different wireless communication schemes which are requested to access; and

a resource allocator, allocating the RF resources shared by said different communications schemes according to said detected information.

16.The device of claim 15, wherein said resource allocator allocates said RF resources according to a statistic of the information on the requests for accessing each of said different communications schemes in a set interval.

17.The device of claim 16, wherein said information on the requests for accessing each of said different communications schemes includes the number of the requests for accessing each of said different communications schemes.

18.The device of claim 17, wherein said resource allocator realizes said RF resources allocation by calculating the ratio of the number of the requests for accessing each of said different wireless communication schemes.

19.The device of any of claims 16-18, wherein said statistic is achieved by carrying out a statistic of said information on the requests for accessing each of said different wireless communication schemes within the set whole

interval.

20.The device of any of claims 16-18, wherein, said statistic is achieved by carrying out a statistic of said information on requests for accessing each of said different wireless communication schemes within rush hours of the set interval.

21.The device of claim 15, wherein said RF resources allocation executed by said resource allocator includes:

(b) judging whether there are RF resources available for the requests for accessing said different wireless communication schemes; and

(c) allocating said available RF resources to said requests, if there are RF resources available for said requests.

22.The device of claim 15, wherein said RF resources allocation executed by said resource allocator includes:

(a) pre-allocating said RF resources to a specific communication scheme;

(b) judging whether there are RF resources available for the requests for accessing the different wireless communication schemes, if the different wireless communication schemes are not the specific communication scheme; and

(c) allocating said available RF resources to said requests, if there are RF resources available for said requests.

23.The device of claims 21 or 22, wherein step (b) and (c) are executed in following condition:

subscribers send said connection requests for accessing the different wireless communication schemes.

24.The device of claims 21 or 22, wherein step (b) and (c) are executed in following condition:

subscribers which carry out cell handover send said handover requests for accessing the different wireless communication schemes.

25.The device of claims 21 or 22, wherein said RF resources allocation executed by said resource allocator includes:

judging whether there are RF carriers available for said requests for accessing the different wireless communication schemes, if there are no RF resources available for said requests; and

allocating said available RF carriers to the different wireless communication schemes, if there are RF carriers available for said requests, and allocating the corresponding RF resources to said requests.

26.The device of claim 25, wherein said RF resources allocation executed by said resource allocator includes:

when the communications employing said different wireless communication schemes end, said RF carriers allocated to said requests are released.

27.The device of claim 25, wherein said RF resources allocation executed by said resources allocator includes:

if there are no RF carriers available for said requests, said requests are rejected.

28.The device of claim 15, said different wireless communication schemes include at least two of following: IS-95, CDMA, GSM, TSM, GPRS, TD-SCDMA, W-CDMA, cdma 2000 and WLAN.

29.A wireless communication system, comprising:

a plurality of transceivers, receiving and transmitting RF signals;

a plurality of RF processing units, processing said received signals or signals to be transmitted by said transceivers;

RF resources allocator, detecting the information contained in received signals from a uplink on the types of the different wireless communication schemes which are requested to access, and allocating RF resources shared by

said different communications schemes according to said detected information.

30.The system of claim 29, wherein said RF resources allocator allocates said RF resources according to a statistic of the information on the requests for accessing each of said different wireless communication schemes within a set interval.

31.The system of claim 30, wherein said information on the requests for accessing each of said different wireless communication schemes includes the number of the requests for accessing each of said different wireless communication schemes.

32.The system of claim 31, wherein said RF resources allocator realizes said RF resources allocation by calculating the ratio of the number of the requests for accessing each of said different wireless communication schemes.

33.The system of any of claims 30-32, wherein said statistic is achieved by carrying out a statistic of said information on the requests for accessing each of said different wireless communication schemes within the set whole interval.

34.The system of any of claims 30-32, wherein, said statistic is achieved by carrying out a statistic of said information on the requests for accessing each of said different wireless communication schemes within rush hours of the set interval.

35.The system of claim 29, wherein said RF resources allocation executed by said RF resources allocator includes:

(b) judging whether there are RF resources available for the requests for accessing said different wireless communication schemes; and

(c) allocating said available RF resources to said requests, if there are RF resources available for said requests.

36.The system of claim 29, wherein said RF resources allocation executed by said RF resources resources allocator includes:

(a) pre-allocating said RF resources to a specific communication scheme;

(b) judging whether there are RF resources available for the requests for accessing the different wireless communication schemes, if the different wireless communication schemes are not the specific communication scheme; and

(c) allocating said available RF resources to said requests, if there are RF resources available for said requests.

37.The system of claims 35 or 36, wherein step (b) and (c) are executed in following condition:

subscribers send said connection requests for accessing the different wireless communication schemes.

38.The system of claims 35 or 36, wherein step (b) and (c) are executed in following condition:

subscribers which carry out cell handover send said handover requests for accessing the different wireless communication schemes.

39.The system of claims 35 or 36, wherein said RF resources allocation executed by said RF resources allocator includes:

judging whether there are RF carriers available for said requests for accessing the different wireless communication schemes, if there are no RF resources available for said requests; and

allocating said available RF carriers to the different wireless communication schemes, if there are RF carriers available for said requests, and allocating the corresponding RF resources to said requests.

40.The system of claim 39, wherein said RF resources allocation

executed by said RF resources allocator includes:

when the communications employing said different wireless communication schemes end, said RF carriers allocated to said requests are released.

41.The system of claim 39, wherein said RF resources allocation executed by said RF resources allocator includes:

if there are no RF carriers available for said requests, said requests are rejected.

42.The system of claim 39, said different wireless communication schemes include at least two of following: IS-95, CDMA, GSM, TSM, GPRS, TD-SCDMA, W-CDMA, cdma 2000 and WLAN.

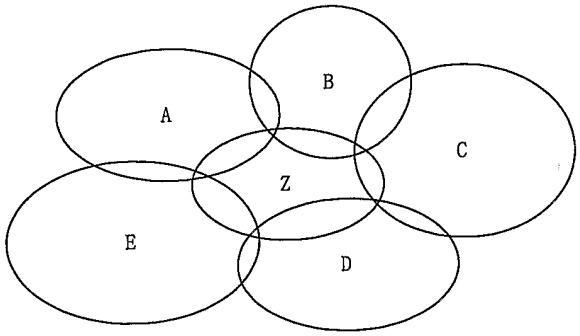


Fig. 1

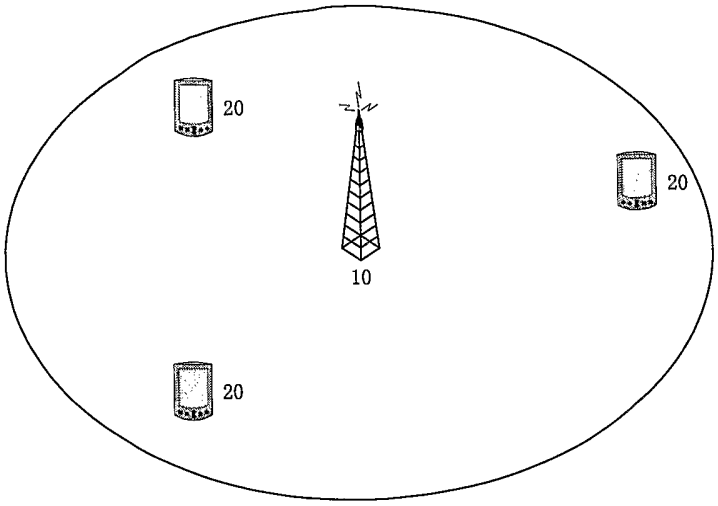


Fig. 2

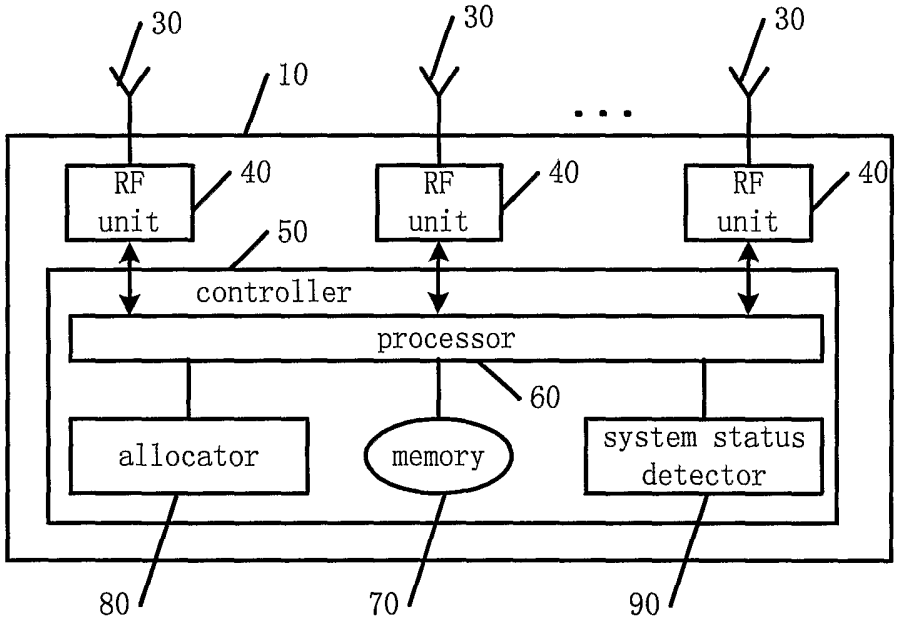
30
30
30
10
RF unit
40
RF unit
40
RF unit
40
50
controller
processor
60
allocator
memory
system status detector
80
70
90

Fig. 3

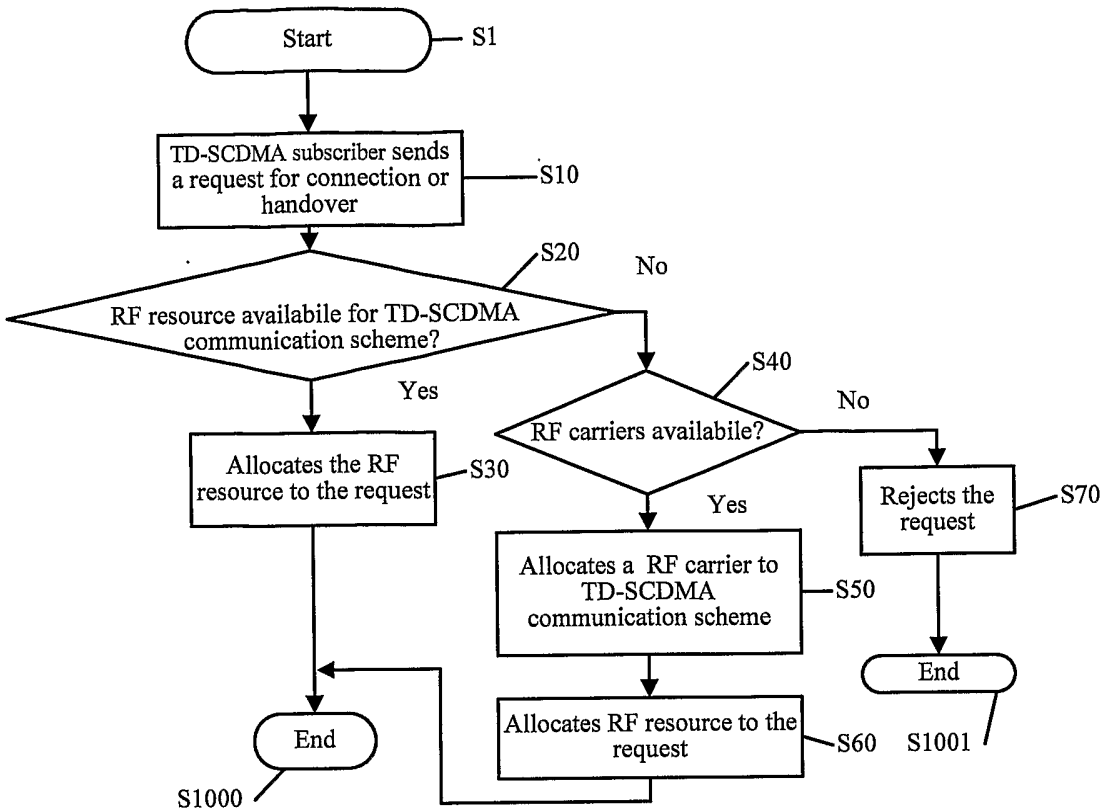
Start
S1
TD-SCDMA subscriber sends a request for connection or handover
S10
S20
No
RF resource availabile for TD-SCDMA communication scheme?
Yes
S40
RF carriers availabile?
No
Yes
Allocates the RF resource to the request
S30
Rejects the request
S70
Allocates a RF carrier to TD-SCDMA communication scheme
S50
End
S1001
Allocates RF resource to the request
S60
End
S1000

Fig. 4

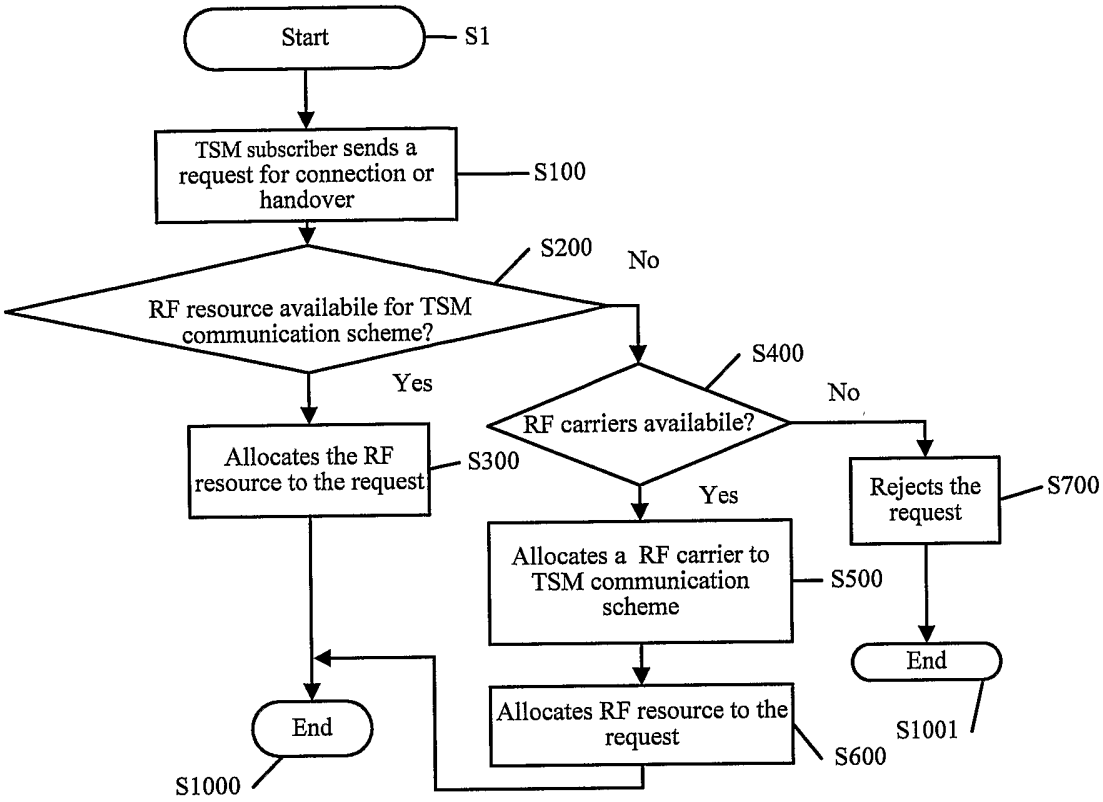
Start
S1
TSM subscriber sends a request for connection or handover
S100
S200
No
RF resource availabile for TSM communication scheme?
Yes
S400
RF carriers availabile?
No
Allocates the RF resource to the request
S300
Yes
Rejects the request
S700
Allocates a RF carrier to TSM communication scheme
S500
End
S1001
End
S1000
Allocates RF resource to the request
S600

Fig. 5

# INTERNATIONAL SEARCH REPORT

PCT/IB 03/06128

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/36

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5 732 076 A (KETSEOGLOU THOMAS J ET AL) 24 March 1998 (1998-03-24) | 1,7-13, 15, 21-27, 29,35-41 |
| Y | abstract<br>column 2, line 57-66<br>column 3, line 5-35<br>column 6, line 28-50<br>column 22, line 52 -column 23, line 66<br>column 24, line 66 -column 26, line 20<br>column 31, line 15 -column 32, line 34 | 2-6, 16-20, 30-34 |

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[X] Further documents are listed in the continuation of box C.

[X] 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 |
|---|---|
| 4 May 2004 | 17/05/2004 |

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

# INTERNATIONAL SEARCH REPORT

PCT/IB 03/06128

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
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| Y | page 2, line 16-18<br>page 5, line 24-26<br>page 8, line 10-26<br>page 9, line 9-36<br>page 14, line 8-14<br>page 16, line 33 -page 17, line 14<br>page 17, line 34 -page 18, line 12<br>page 20, line 8-16<br>page 25, line 5 -page 26, line 14<br>page 26, line 28-31; claim 13 | 2-6, 16-20, 30-34 |
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PCT/IB 03/06128

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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| | | US 2003050070 A1 | 13-03-2003 |
| WO 0228135 A | 04-04-2002 | WO 0228135 A1 | 04-04-2002 |
| | | EP 1321007 A1 | 25-06-2003 |