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Hunt

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(54) **RADIO COMMUNICATION SYSTEM WITH REQUEST RE-TRANSMISSION UNTIL ACKNOWLEDGED**

(75) Inventor: **Bernard Hunt**, Redhill (GB)

(73) Assignee: **Koninklijke Philips Electronic N.V.**, Eindhoven (NL)

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(58) **Field of Search** 370/328, 329, 370/336, 337, 345, 343, 230, 347, 346; 455/434, 451, 435.3, 471, 435; 714/748

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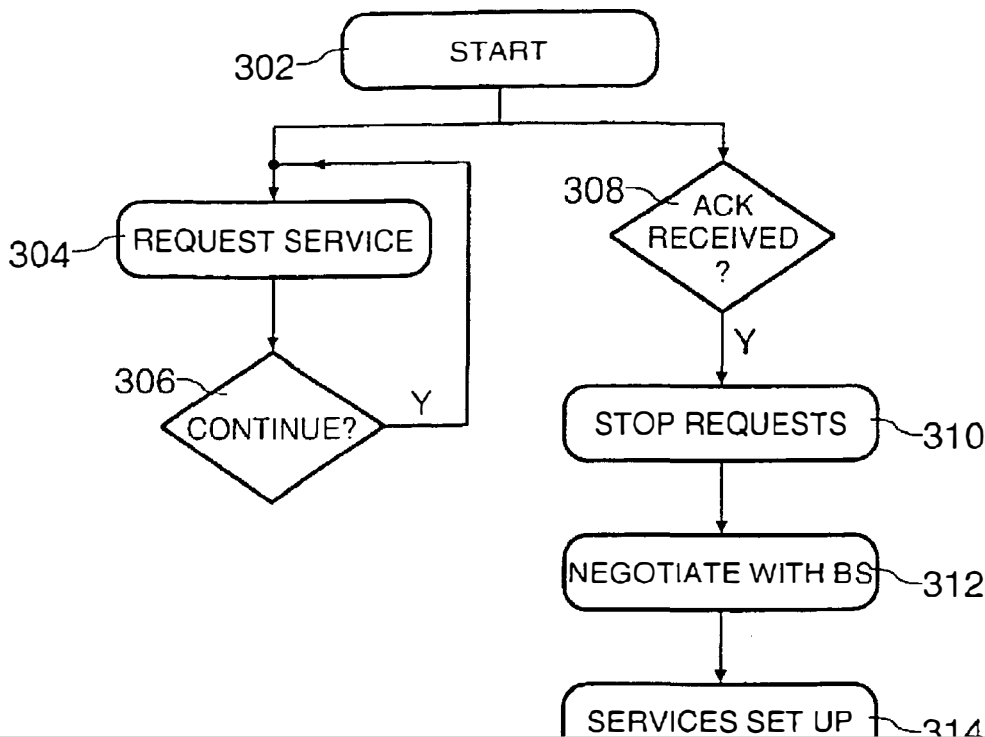
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(57) **ABSTRACT**

A method of operating a radio communication system in which secondary stations use dedicated time slots to request services from a primary station. A secondary station wishing to request a service sends a request in every time slot allocated to it until it receives an acknowledgement from the primary station. The primary station can use combining techniques on multiple time slots to identify the presence or absence of a request from a secondary station with improved accuracy.
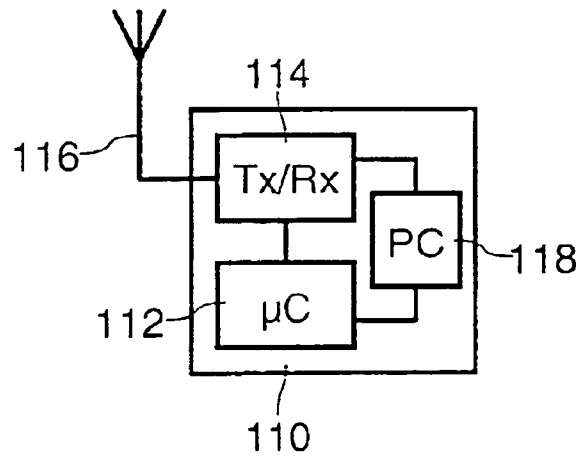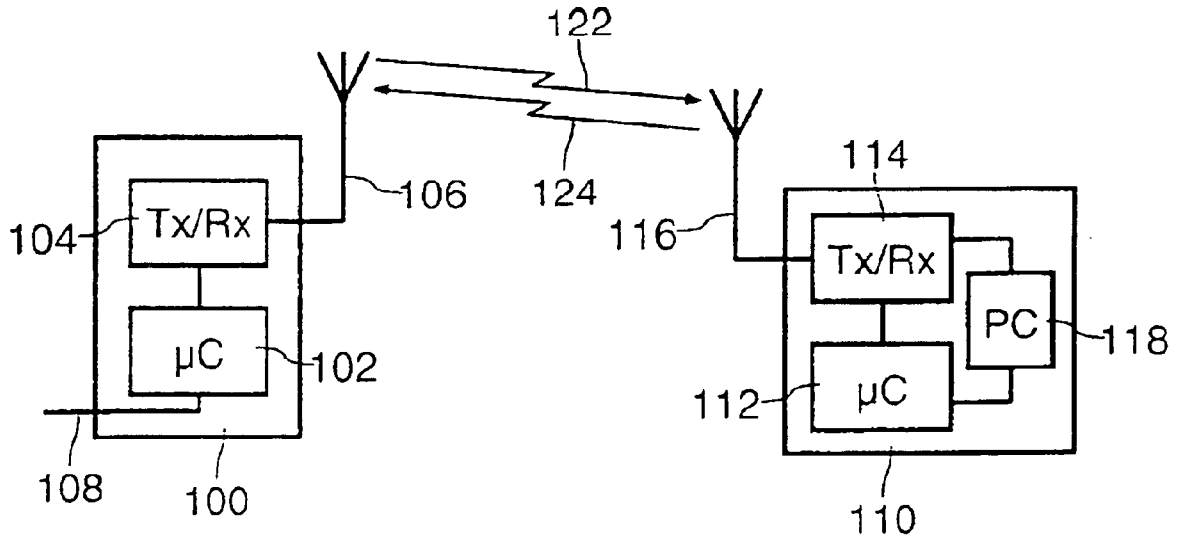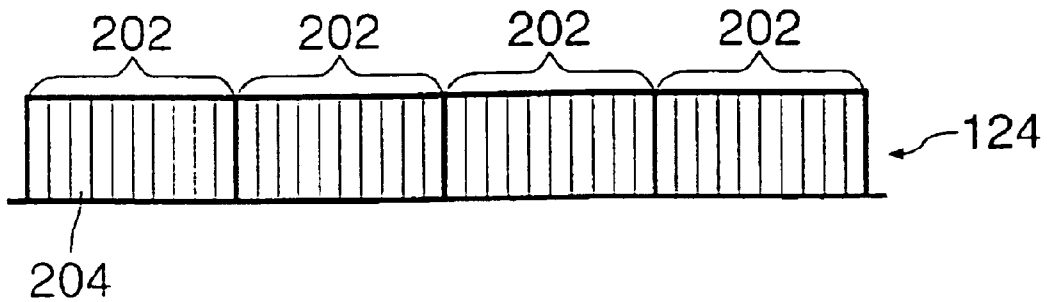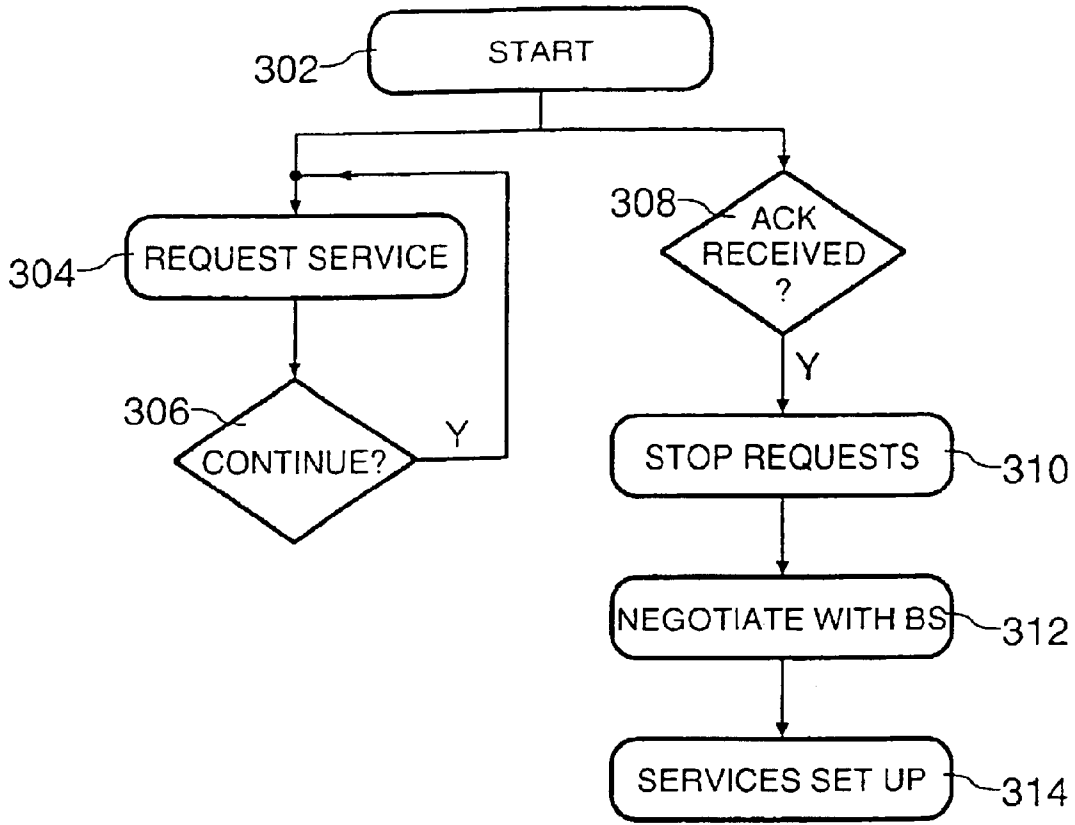
18 Claims, 3 Drawing Sheets

FIG. 1

FIG. 2

302 — START

304 — REQUEST SERVICE

306 — CONTINUE?   Y

308 — ACK RECEIVED ?

Y

STOP REQUESTS — 310

NEGOTIATE WITH BS — 312

SERVICES SET UP — 314
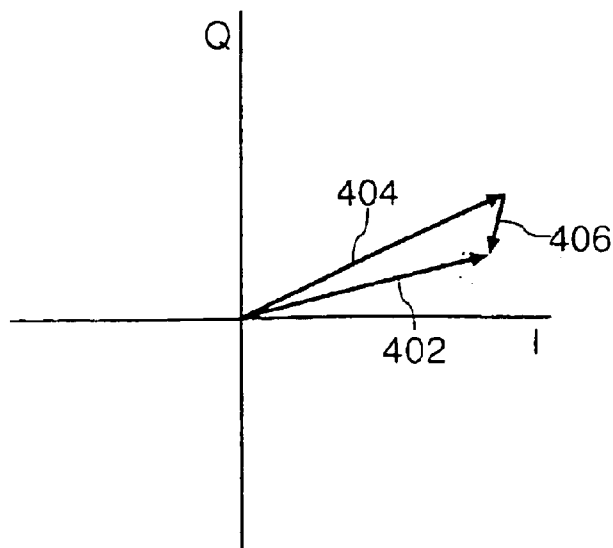
FIG. 3

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404

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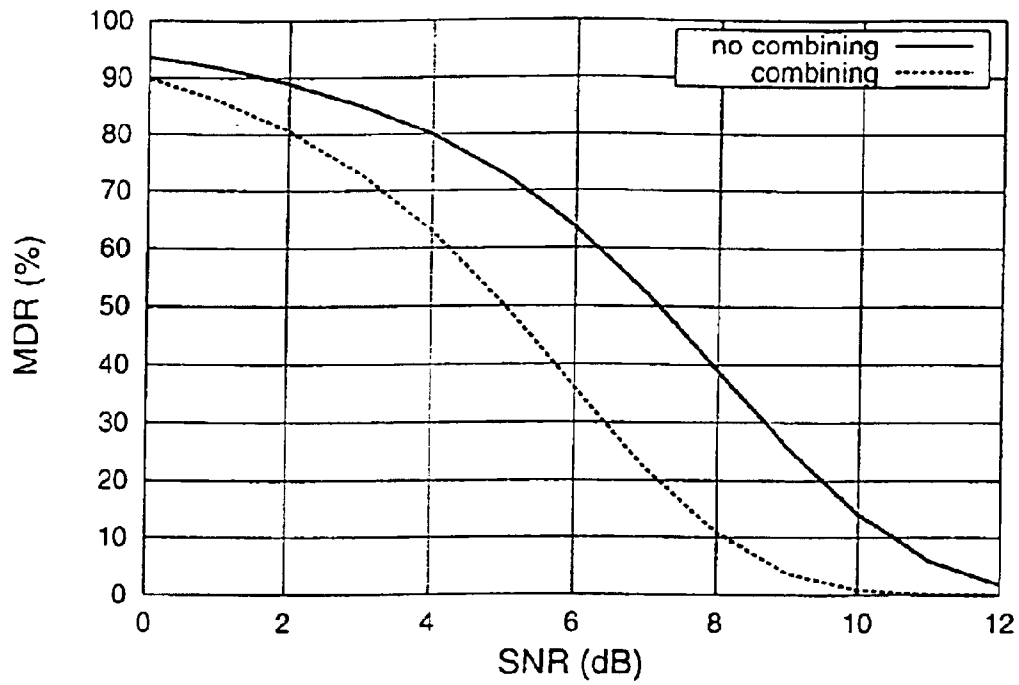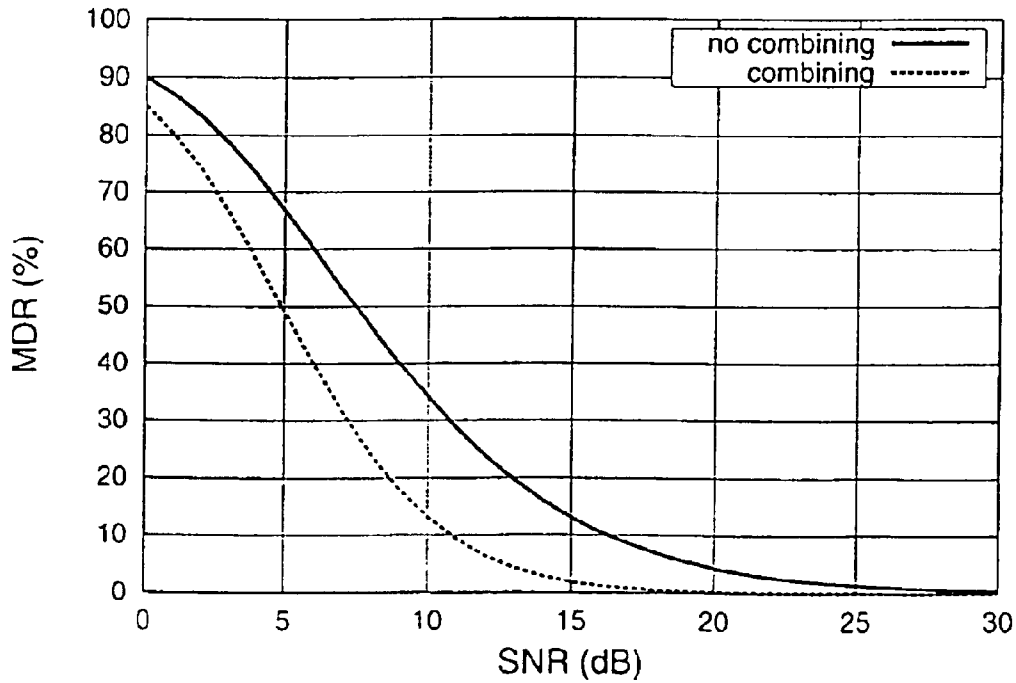
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FIG. 4

FIG. 5

FIG. 6

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RADIO COMMUNICATION SYSTEM WITH REQUEST RE-TRANSMISSION UNTIL ACKNOWLEDGED

FIELD OF THE INVENTION

The present invention relates to a method of operating a radio communication system, and further relates to such a system and to primary and secondary stations for use in such a system. While the present specification describes a system with particular reference to the emerging Universal Mobile Telecommunication System (UMTS), it is to be understood that such techniques are equally applicable to use in other mobile radio systems.

BACKGROUND OF THE INVENTION

In a radio communication system it is generally required to be able to exchange signalling messages between a Mobile Station (MS) and a Base Station (BS). Downlink signalling (from BS to MS) is usually realised by using a physical broadcast channel of the BS to address any MS in its coverage area. Since only one transmitter (the BS) uses this broadcast channel there is no access problem.

In contrast, uplink signalling (from MS to BS) requires more detailed considerations. If the MS already has an uplink channel assigned to it, for voice or data services, this signalling can be achieved by piggy-backing, in which the signalling messages are attached to data packets being sent from the MS to the BS. However, if there is no uplink channel assigned to the MS piggy-backing is not possible. In this case a fast uplink signalling mechanism should be available for the establishment, or re-establishment, of a new uplink channel.

In conventional systems, for example those operating to the Global System for Mobile communication (GSM) standard, fast uplink signalling is enabled by the provision of a random access channel using a slotted ALOHA or similar protocol. However, such a scheme works satisfactorily only with a low traffic load, and is not believed to be capable of handling the requirements imposed by third-generation telecommunications standards such as UMTS.

To meet these requirements one UMTS embodiment includes a dedicated signalling channel, which comprises frames including a time slot for each MS registered with the controlling BS. If a MS requires a service from the BS it transmits a request in its allocated slot then waits for an acknowledgement from the BS setting up the required service. Parameters which characterise the performance of the signalling channel include the false alarm rate (where the BS erroneously identifies a MS as requesting a service), the missed detection rate (where the BS does not detect a request from a MS), and the delay between a request for a service by the MS and the provision of that service by the BS.

SUMMARY OF THE INVENTION

An object of the present invention is to improve the efficiency of the method by which a MS requests resources from a BS.

According to a first aspect of the present invention there is provided a method of operating a radio communication system, comprising a secondary station transmitting a request for resources to a primary station in a time slot allocated to the secondary station, characterised by the secondary station re-transmitting the request in at least a

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This scheme improves the typical time for a response by the primary station to a request by a secondary station. Because there is no possibility of requests from different secondary stations colliding, a secondary station can retransmit requests in each allocated time slot. In contrast, in prior art systems a secondary station has to wait at least long enough for the primary station to have received, processed and acknowledged a request before it is able to retransmit.

Further, the primary station can improve the accuracy with which it determines whether a request was sent by a particular secondary station if the received signal strength is close to the detection threshold by examining the received signals in multiple time slots allocated to the secondary station in question.

According to a second aspect of the present invention there is provided a radio communication system comprising a primary station and a plurality of secondary stations, the primary station having means for allocating a time slot for a secondary station to transmit a request for resources to the primary station, characterised in that the secondary station has means for re-transmitting the request in at least a majority of its allocated time slots until it receives an acknowledgement from the primary station.

According to a third aspect of the present invention there is provided a primary station for use in a radio communication system, the primary station having means for allocating time slots to secondary stations for requesting resources, characterised in that the primary station has combining means for determining from a combination of received signals in a plurality of successive time slots allocated to the secondary station whether the secondary station has transmitted a request for resources.

According to a fourth aspect of the present invention there is provided a secondary station for use in a radio communication system including a primary station having means for allocating a time slot for the secondary station to transmit a request for resources to the primary station, characterised in that means are provided for re-transmitting the request in at least a majority of the allocated time slots until an acknowledgement is received from the primary station.

The present invention is based upon the recognition, not present in the prior art, that in a system having time slots allocated to a secondary station for requesting resources, improved performance can be obtained by the secondary station repeating the request until an acknowledgement is received.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:

FIG. **1** is a block schematic diagram of a radio communication system;

FIG. **2** illustrates a possible frame format for a dedicated uplink signalling channel;

FIG. **3** is a flow chart illustrating a method in accordance with the present invention of a mobile station requesting a service from a base station;

FIG. **4** is a complex phasor plot showing the output of a matched filter in a BS in the presence of noise;

FIG. **5** is a graph of missed detection rate (MDR) in percent against signal to noise ratio (SNR) in dB for a fixed signal magnitude, the solid line indicating results with no

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