

TELEPHONE APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a cordless telephone apparatus, and more particularly to a digital cordless telephone apparatus which receives signals intermittently transmitted from base stations of a private telephone system and a public telephone system (for example, PHS) with different timings and at different frequencies in order that the apparatus can be used in the both systems.

Description of the Related Art

This type of digital cordless telephone apparatus waits for an incoming call in a receiving mode in which an incoming signal from a base unit can be received in a service area of the base unit of a private telephone system, and the apparatus waits for an incoming signal in a receiving mode in which an incoming call from a base station of a public telephone system can be received when the apparatus moved into a service area of the public telephone system.

For example, according to Japanese patent laid-open publication No. Hei 7-087565, if a calling code of the private system can not be read when the apparatus operates in the receiving mode of the private system, the mode is automatically switched to the receiving mode of the public system after a predetermined time lapses. Further,



according to Japanese patent laid-open publication No. Hei 8-079829, the mode is set to the receiving mode of the private system if the apparatus receives a signal from the public base station or a signal from the private base station and there is a private base station which is capable of performing communication when a power supply of the apparatus is turned on or it is detected that the apparatus is out of communication area, while it is set to the receiving mode of the public system if communication with the private base station is impossible but that with the public base station is possible.

In the former conventional example described above, however, since the mode is switched to the receiving mode of the public system when a predetermined time lapses after a calling code of the private system fails to be read, an error for detecting an incoming signal from the base station occurs. Furthermore, in the latter example, there is not described the relationship between a receiving timing and a retrieving timing when retrieving signals from the private base station and the public base station, and an error for detecting an incoming signal may be likely to occur.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a digital cordless telephone apparatus being capable of switching a receiving mode of a private system and that of a public system so as not to generate an error for detecting



an incoming signal without being adversely affected by frequencies and timings of the private system and the public system.

To this end, the present invention executes signal retrieval of the other telephone system for changing over the receiving mode in a period between the current receiving timing and the next receiving timing in the receiving mode.

Further, when changing over to the receiving mode of the other telephone system, the changeover operation is performed in a period between current receiving timing and the next receiving timing of that telephone system.

Preferably, the present invention comprises: a circuit for judging the quality of reception in the current receiving mode, i.e., a private receiving mode in which a signal which is intermittently transmitted from a base station of a private telephone system with a predetermined timing is intermittently received or a public receiving mode in which a signal which is intermittently transmitted from a base station of a public telephone system with a predetermined timing is intermittently received; a circuit for retrieving a signal of the other telephone system when the quality of reception is degraded; and a circuit for switching to the receiving mode of the other telephone system in accordance with a result of retrieving the signal of the other telephone system the quality of reception, the signal retrieval circuit retrieving a signal of the other



telephone system in a period other than a receiving timing in the current receiving mode. In addition, the receiving mode switching circuit switches the receiving mode in a period other than a timing for receiving a signal from the other telephone system.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects, features and advantages of this invention will become more fully apparent from the following detailed description taken with the accompanying drawings in which:

Fig. 1 is a view showing an example of the structure of a digital cordless telephone system;

Fig. 2 is a block diagram showing a preferred embodiment according to the present invention;

Fig. 3 is a flowchart showing the operation of a reception controller illustrated in Fig. 2; and

Fig. 4(a)-4(c) are timing charts showing the operation of the reception controller illustrated in Fig. 2.

In the drawings, the same reference numerals denote the same structural elements.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment according to the present invention will now be described with reference to the accompanying drawings.

Fig. 1 shows an example of the structure of a digital cordless telephone system, in which a digital cordless



telephone apparatus 1 moved from a service area of a base station 2 of a private system to a service area of a base station 3 of a public system and it is positioned in an area 4 where the service areas of the both systems overlap one on another. For example, the private system has such a configuration as that a base unit connected with an exchange or the like through a wire line is placed in a home and a portable unit connected with the base unit through a wireless line is included. Further, in the public system, a portable unit which is connected using a wireless line with a base station provided outside is included.

The digital cordless telephone apparatus 1 enters the receiving mode for receiving an incoming signal from the base station 2 of the private system and waits for an incoming call in a service area of the base station 2. When the apparatus moved into the service area of the base station 3 of the public system, the apparatus 1 is automatically switched to the receiving mode for receiving an incoming signal from the base station 3 and waits for an incoming call. The receiving mode is switched in the area 4.

Fig. 2 is a block diagram of the digital cordless telephone apparatus according to a preferred embodiment of the present invention.

In Fig. 2, a radio section 11 is controlled by a reception controller 12 in order to intermittently receive a



signal sent from the base stations of the private telephone system and the public telephone system. A private receiving mode controller 13 sets the receiving mode for intermittently receiving a signal with a timing for intermittently transmitting an incoming signal from the base station of the private system and controls this mode. A public receiving mode controller 14 sets the receiving mode for intermittently receiving a signal with a timing for intermittently transmitting an incoming signal from the base station of the public system and controls this mode. A receiving mode changeover switch 16 is controlled by the reception controller 12 and selects either the private receiving mode 13 or the public receiving mode 14.

A retrieval mode controller 15 sets a mode for retrieving a signal of the other telephone system in advance when switching the receiving mode and controls this mode. For example, when receiving a signal in the private receiving mode, the receiving frequency is set for a signal supplied from the base station of the public telephone system. A retrieval changeover switch 17 is controlled by the reception controller 12 and selects either the receiving mode controller or the retrieval mode controller 15. At the same time it supplies the received output from the radio section 11 to either an incoming signal detector 18 or a signal retriever 19. Here, the received output from the radio section 11 is fed to the signal retriever 19 when the

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retrieval mode controller 15 is selected, and the received output from the radio section 11 is supplied to the incoming signal detector 18 when the receiving mode controller is selected. The signal retriever 19 detects a timing for receiving a receive signal and informs the reception controller 12 of the detected timing.

A reception quality judging section 20 detects a reception level of the receive signal and judges the quality of reception based on a mean value of the reception levels. Obtaining the mean value in this manner can eliminate the erroneous judgment caused due to fading or the like.

The operation of the reception controller 12 will now be described with reference to Figs. 3 and 4. It is assumed that the apparatus moves from the service area of the private system to the service area of the public system and operates in the private receiving mode.

Fig. 3 is a flowchart showing the operation of the reception controller 12. Fig. 4 is a timing chart showing the operation of the reception controller 12.

Incoming signals transmitted from the base stations of the private system and the public system are intermittently sent at different frequencies f_1 and f_2 and with different timings (periods T_1 and T_2) as shown in Fig. 4(a), respectively. Each of the periods T_1 and T_2 is approximately one second. The digital cordless telephone apparatus 1 performs intermittent reception with the



system for switching the receiving mode which is executed in a period between the current receiving timing and the next receiving timing in the receiving mode does not adversely influence the current reception, and hence the receiving mode can be switched between the private system and the public system without causing an error for detecting the incoming signal.

Further, in case of changing over to the receiving mode of the other telephone system, the error for detecting the incoming signal of the other telephone system can be avoided by switching the mode in the period between the receiving timing and the next receiving timing of the other telephone system.

While the invention has been described with reference to a specific embodiment thereof, it will be appreciated by those skilled in the art that numerous variations, modifications, and embodiments are possible, and accordingly, all such variations, modifications, and embodiments are to be regarded as being within the spirit and scope of the invention.





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CLAIMS

1. An apparatus for selecting one of base stations which intermittently transmit incoming signals with timings different in accordance with respective base stations in order to switch to a receiving mode in which the incoming signals are intermittently received with the timing, the apparatus characterized by utilizing a period other than the timing for receiving the incoming signals to perform signal retrieval and receiving mode switching.
2. An apparatus capable of being used in both a private telephone system and a public telephone system, comprising: means for judging the quality of reception in the current receiving mode, i.e., a private receiving mode for intermittently receiving a signal which is intermittently transmitted from a base station of the private telephone system with a predetermined timing or a public receiving mode for intermittently receiving a signal which is intermittently transmitted from a base station of the public telephone system with a predetermined timing; means for retrieving a signal of the other telephone system when the quality of reception is deteriorated; and means for switching to the receiving mode of the other telephone system in accordance with a result of retrieving a signal of the other telephone system and the quality of reception, the signal retrieving means performing retrieval of a signal of the other telephone system within a period other than the





receiving timing in the current receiving mode.

3. The apparatus according to claim 2, wherein the receiving mode switching means switches the receiving mode within a period other than the timing for receiving a signal of the other telephone system when the quality of receiving a signal of the other telephone system is better than that in the current receiving mode.

4. The apparatus according to claim 2, wherein the means for judging the quality of reception makes judgment based on a mean value of the reception levels.

5. The apparatus according to claim 2, wherein the apparatus is a digital cordless telephone.

6. A method for controlling an apparatus for selecting one of base stations which intermittently transmit incoming signals with timings different in accordance with respective base stations in order to switch to a receiving mode in which the incoming signals are intermittently received with the timing, the method characterized in that signal retrieval and receiving mode switching are performed by utilizing a period other than the timing for receiving the incoming signal.

7. A method for controlling an apparatus which can be used in both a private system and a public telephone system, the method comprising the steps of: judging the quality of reception in the current receiving mode, i.e., a private receiving mode for intermittently receiving a signal which





is intermittently transmitted from a base station of the private telephone system with a predetermined timing or a public receiving mode for intermittently receiving a signal which is intermittently transmitted from a base station of the public telephone system with a predetermined timing; retrieving a signal of the other telephone system when the quality of reception is deteriorated; and switching to the receiving mode of the other telephone system in accordance with a result of retrieving a signal of the other telephone system and the quality of reception, thereby performing retrieval of a signal of the other telephone system within a period other than the receiving timing in the current receiving mode.