ABSTRACT

Methods and apparatus are provided for preventing a third party from listening to a conversation between at least two participants on a telephone. The telephone generates an audio stimulus signal that is presented through a secondary speaker. The audio stimulus signal may be, for example, pseudorandom noise or a cancellation signal. According to one aspect of the invention, the telephone ensures that the audio stimulus signal does not significantly impair the conversation for the at least two participants. To prevent the third party from listening to the local portion of the conversation, the audio stimulus signal is subtracted from the received signal prior to presenting the received signal to the user. To prevent the third party from listening to the remote portion of the conversation, the audio stimulus signal is subtracted from the received signal.

20 Claims, 4 Drawing Sheets
METHODS AND APPARATUS FOR PREVENTING A THIRD PARTY FROM OVERHEARING A TELEPHONE CONVERSATION

FIELD OF THE INVENTION

The present invention is related to techniques for ensuring private telephone conversations, and more particularly, to methods and apparatus for preventing a third party from overhearing a telephone conversation.

BACKGROUND OF THE INVENTION

In today’s mobile society, people increasingly have private telephone conversations in public settings. Even in many office environments, a number of people do not have a private office and their telephone conversations are subject to being overheard. A need therefore exists for methods and apparatus for preventing a third party from overhearing a telephone conversation.

SUMMARY OF THE INVENTION

Generally, methods and apparatus are provided for preventing a third party from listening to a conversation between at least two participants on a telephone. The telephone generates an audio stimulus signal that is presented through a secondary speaker. The audio stimulus signal may be, for example, pseudorandom noise or a cancellation signal. According to one aspect of the invention, the telephone ensures that the audio stimulus signal does not significantly impair the conversation for the at least two participants.

To prevent the third party from listening to the local portion of the conversation, the audio stimulus signal is subtracted from the received signal prior to presenting the received signal to the user. In this manner, the telephone owner should not hear anything.

A more complete understanding of the present invention, as well as further features and advantages of the present invention, will be obtained by reference to the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates an eavesdropper attempting to listen in on a local portion of a telephone conversation;

FIG. 2 illustrates a technique for preventing the eavesdropper of FIG. 1 from overhearing the local portion of the telephone conversation in accordance with the present invention;

FIG. 3 is a schematic block diagram of a telephone incorporating features of the present invention to prevent an eavesdropper from listening to the owner’s side of the telephone conversation;

FIG. 4 illustrates an eavesdropper attempting to listen in on a remote portion of a telephone conversation;

FIG. 5 illustrates a technique for preventing the eavesdropper of FIG. 4 from overhearing the remote portion of the telephone conversation in accordance with the present invention; and

FIG. 6 is a schematic block diagram of a telephone incorporating features of the present invention to prevent an eavesdropper from listening to the remote portion of the telephone conversation.

DETAILED DESCRIPTION

FIG. 1 illustrates an eavesdropper 130 attempting to listen in on a telephone call conducted by an owner 110 of a telephone 120. In particular, in the embodiment of FIG. 1, the eavesdropper 130 is attempting to listen to the owner’s side 115 of the telephone conversation (i.e., to the words spoken by the telephone owner 110). The eavesdropper 130 is physically in the vicinity of the telephone owner 110. The telephone 120 may be embodied, for example, as a cellular telephone, a cordless telephone, or a standard wired telephone. It is thus noted that while the present invention is illustrated in the context of a cellular telephone, the present invention can be applied to any telephone type, as would be apparent to a person of ordinary skill.

According to one aspect of the invention, shown in FIG. 2, the eavesdropper 130 is prevented from overhearing the telephone conversation, by introducing a secondary speaker 215 to the telephone 120. The secondary speaker 215 allows a stimulus 220, such as pseudorandom noise or a cancellation signal, to be generated. As shown in FIG. 2, the voice signal 210 of the telephone owner 110 is received by a mouthpiece (i.e., a microphone) of the telephone 120. In addition, the stimulus 220 is generated by the secondary speaker 215. The cancellation signal is generally an audio signal that is of equal yet opposite magnitude to the voice signal 210 of the telephone owner 110, so that the net effect experienced by the eavesdropper 130 is no signal at all.

In this manner, the eavesdropper 130 will hear the combination 320 of the generated stimulus 220 and the voice signal 210 of the telephone owner 110. In the case of pseudorandom noise, the eavesdropper 130 will not be able to distinguish the voice signal 210 of the telephone owner 110 from the noise 220. In the case of a cancellation signal, the cancellation signal 220 will cancel the voice signal 210 of the telephone owner 110 from the noise 220 and the eavesdropper 130 should not hear anything.

As discussed hereinafter, the telephone 120 knows the generated stimulus 220, and can therefore subtract the stimulus 220 from the voice signal 210 of the telephone owner 110, to thereby isolate the voice signal 210 of the telephone owner 110 for transmission to the remote party (not shown) of the telephone conversation. FIG. 3 is a schematic block diagram of a telephone 300 incorporating features of the present invention to prevent an eavesdropper 130 from listening to the owner’s side 115 of the telephone conversation.

As shown in FIG. 3, a mouthpiece 315 (i.e., a microphone) of the telephone 300 receives a signal 310 that comprises the voice signal 210 of the telephone owner 110 and the stimulus 220 generated by the secondary speaker 215. A codec 320 encodes the signal 310, in a known manner, and applies the encoded signal to a first input of a subtractor 322. In addition, in accordance with the invention, a pseudorandom noise generator 340 (or a voice canceller) generates the stimulus 220. The stimulus 220 is encoded by a codec 345 and presented by the secondary speaker 215. In addition, the pseudorandom noise generator 340 applies the stimulus 220 to a second input of the subtractor 322. In this manner, the known generated stimulus 220 can be subtracted from the voice signal 210 of the telephone owner 110, to thereby isolate the voice signal 210 of the telephone owner 110 for transmission to the remote party (not shown) of the telephone conversation.
Thus, the voice signal 210 of the telephone owner 110 is processed by a transmit baseband stage 325, an RF upconverter 330 and a duplexer 350, in a known manner beyond the scope of the present invention, for transmission on an antenna 355. The receive branch of the telephone 300 comprises an RF down converter 360, receive baseband stage 365, codec 370 and an earpiece 380, in a conventional manner.

FIG. 4 illustrates an eavesdropper 430 attempting to listen in on a telephone call conducted by an owner 410 of a telephone 420. In particular, in the embodiment of FIG. 4, the eavesdropper 430 is attempting to listen to the remote side 415 of the telephone conversation (i.e., to the words spoken by the remote participant, to thereby isolate the received voice signal of the remote participant, comprising:

3. The method of claim 1, wherein said audio stimulus signal is pseudorandom noise.

4. The method of claim 1, wherein said third party is attempting to listen to a local portion of said conversation.

5. The method of claim 4, wherein said ensuring step further comprises the step of subtracting said audio stimulus signal from a signal captured by a microphone of said telephone.

6. The method of claim 4, wherein said ensuring step further comprises the step of subtracting said audio stimulus signal from a signal received by said telephone.

7. The method of claim 6, wherein said ensuring step cancels feedback of said audio stimulus signal received by a user of said telephone.

8. The method of claim 7, wherein said subtracting step cancels feedback of said audio stimulus signal from a user of said telephone.

9. A telephone that prevents a third party from listening to a conversation between at least two participants on a telephone, comprising the steps of:

a. generating an audio stimulus signal; and
b. presenting said audio stimulus signal through a secondary speaker on said telephone.

c. ensuring said audio stimulus signal does not significantly impair said conversation for said at least two participants; and

d. presenting said audio stimulus signal through a secondary speaker on said telephone.

We claim:

1. A method for preventing a third party from listening to a conversation between at least two participants on a telephone, comprising the steps of:

a. generating an audio stimulus signal;

b. presenting said audio stimulus signal through a secondary speaker on said telephone.

2. The method of claim 1, wherein said audio stimulus signal is pseudorandom noise.

3. The method of claim 1, wherein said audio stimulus signal is a cancellation signal.

4. The method of claim 1, wherein said third party is attempting to listen to a local portion of said conversation.

5. The method of claim 4, wherein said ensuring step further comprises the step of subtracting said audio stimulus signal from a signal captured by a microphone of said telephone.

6. The method of claim 4, wherein said ensuring step further comprises the step of subtracting said audio stimulus signal from a signal received by said telephone.

7. The method of claim 6, wherein said ensuring step cancels feedback of said audio stimulus signal received by a user of said telephone.

8. The method of claim 7, wherein said subtracting step cancels feedback of said audio stimulus signal from a user of said telephone.

9. A telephone that prevents a third party from listening to a conversation between a user of said telephone and a remote participant, comprising:

a. a microphone for capturing an audio signal;

b. a signal generator for generating an audio stimulus signal; and

c. a subtractor for subtracting said audio stimulus signal from said audio signal to isolate a voice signal of a user of said telephone for transmission to said remote participant; and

a secondary speaker for presenting said audio stimulus signal.

10. The telephone of claim 9, further comprising a primary speaker for presenting a voice signal of said remote participant to said user of said telephone.

11. The telephone of claim 9, wherein said audio stimulus signal is pseudorandom noise.
12. The telephone of claim 9, wherein said audio stimulus signal is a cancellation signal.

13. The telephone of claim 12, wherein said cancellation signal prevents said third party from hearing said audio signal.

14. The telephone of claim 9, wherein said third party is attempting to listen to said voice signal.

15. A telephone that prevents a third party from listening to a conversation between a user of said telephone and a remote participant, comprising:
   a) an input for receiving a received signal from said remote participant;
   b) a signal generator for generating an audio stimulus signal;
   c) a subtractor for subtracting said audio stimulus signal from said received signal to isolate a voice signal of said remote participant;
   d) a primary speaker for presenting said voice signal of said remote participant to said user of said telephone; and
   e) a secondary speaker for presenting said audio stimulus signal.

16. The telephone of claim 15, further comprising a microphone for capturing an audio signal.

17. The telephone of claim 15, wherein said audio stimulus signal is pseudorandom noise.

18. The telephone of claim 15, wherein said audio stimulus signal is a cancellation signal.

19. The telephone of claim 15, wherein said third party is attempting to listen to said voice signal.

20. The telephone of claim 15, wherein said subtractor cancels feedback of said audio stimulus signal received by said user of said telephone.