

MESSAGE TRANSMISSION BY A MULTICHANNEL SYNCHRONOUS SELECTIVE CALL COMMUNICATION SYSTEM

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Field of the Invention

This invention relates to multichannel synchronous selective call communication systems. In particular, this invention relates to, but is not necessarily limited to, message transmission by a multichannel synchronous selective call communication system having overlapping coverage areas and a method thereof.

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Background of the Invention

A multichannel synchronous selective call communication system provides messages to selective call receivers or pagers on different carrier signals or channels transmitted at predetermined times. Conventionally, such a communication system has a coverage area for each of the different channels. Hence, the channel of a coverage area in which a pager operates has to be monitored by the pager so that messages can be received accordingly. Typically, the pager has a list of channels to monitor for messages within each coverage area of the communication system.

An example of a multichannel synchronous selective call communication system is Motorola's FLEX™ roaming system. In the FLEX™ roaming system, users have to register their FLEX™ pagers to operate in different coverage areas. Registration typically requires, for example, a telephone call to the service provider supporting the operation of these FLEX™ pagers. Generally, a registered channel refers to the channel of a coverage area within which a user intends to be located to receive messages. Information is then given to the service provider on where and when the registration is required. Thereafter, a registration confirmation message is transmitted to the FLEX™ pagers requesting the registration. At any time before the end of a time period specified by the registration, users can also cancel the registration. When a registration is

cancelled by a user, a registration cancellation message is sent to the user's pager.

Determining which channel to monitor is critical as messages can be missed as a result of inappropriate monitoring. This can be a problem
5 when the multichannel synchronous selective call communication system has coverage overlaps. In such coverage overlaps, a pager will be in range of two or more channels that may have messages for the pager. This problem is further compounded in situations when a registration confirmation message or a registration cancellation message is not
10 received by the pager.

Hence, improvements can be made for message transmission within coverage overlaps of multichannel synchronous selective call communication systems. These improvements are so that pagers will not miss messages due to inappropriate monitoring of channels caused by not
15 receiving registration confirmation messages or registration cancellation messages or by not monitoring other higher priority channels in a coverage overlap.

20 Summary of the Invention

It is an object of this invention to provide a multichannel synchronous selective call communication system and a method for message transmission thereof.

25 According to one aspect of the invention, there is provided a multichannel synchronous selective call communication system having a plurality of coverage areas, said communication system comprising:

30 a receiver to receive a message for a selective call receiver;

at least one transmitter in each of said coverage areas to transmit said message on at least one channel, said channel being associated with a registration for said selective call receiver; and

35 a controller, coupled to said receiver and said transmitter, said controller being adapted to control one or more other transmitters to

transmit said message on one or more other channels, said other channels being selected from a list of channels associated with said selective call receiver based on coverage overlaps between said coverage areas and at least one time period derived from said registration.

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Preferably, said communication system can further comprise one or more timers, said controller being coupled to said timers to monitor said time period.

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Suitably, said controller can be further adapted to determine remaining time with said timers in said time period when said registration is cancelled.

Preferably, said controller can be further adapted to control said other transmitters to transmit said message based on said remaining time.

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Suitably, said list of channels can include a priority index for each of said channels.

Preferably, said controller can be further adapted to control said other transmitters to transmit said message based on said priority index.

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Suitably, said communication system can further comprise a memory to store said time period, said list of channels and indicia associated with said coverage overlaps.

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According to another aspect of the invention, there is provided a method for message transmission in a multichannel synchronous selective call communication system having a plurality of coverage areas, said method comprising the steps of:

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receiving a message for a selective call receiver;

transmitting said message on at least one channel, said channel being associated with a registration for said selective call receiver; and

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controlling one or more other transmitters to transmit said message on one or more other channels, said other channels being selected from a list

of channels associated with said selective call receiver based on coverage overlaps between said coverage areas and at least one time period derived from said registration.

5 Preferably, said step of controlling can comprise the step of monitoring said time period.

 Suitably, said step of monitoring can comprise the step of determining remaining time in said time period when said registration is cancelled.
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 Preferably, said step of controlling can comprise the step of controlling said other transmitters to transmit said message based on said remaining time.

15 Suitably, said step of controlling can comprise the step of determining said transmission based on a priority index for each of said channels.

 Preferably, said step of controlling can comprise the step of determining indicia associated with said coverage overlaps.
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Brief Description of the Drawings

 In order to describe the invention and to put it into practical effect,
25 reference will now be made to a preferred embodiment as illustrated with reference to the accompanying drawings in which:

 FIG. 1 shows a multichannel synchronous selective call communication system having three coverage areas in accordance with a preferred embodiment of the invention; and
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 FIGs. 2a and 2b are detailed flow diagrams of a method for message transmission in the multichannel synchronous selective call communication system of FIG. 1.
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Detailed Description of the Invention

In this detailed description, Motorola's FLEX™ roaming system is used only as an example of a multichannel synchronous selective call communication system.

Referring now to FIG. 1, a FLEX™ roaming system 10 is shown having three coverage areas 11,12,13 in accordance with a preferred embodiment of the invention. A plurality of multichannel selective call receivers or pagers 14,15,16,17,18 is supported within FLEX™ roaming system 10. At least one transmitter is provided in each of coverage areas 11,12,13 to transmit messages to pagers 14,15,16,17,18. Shown in FIG. 1 are transmitters 19,20,21 for coverage areas 11,12,13 respectively. Each of transmitters 19,20,21 transmit messages within its respective coverage area on a respective carrier signal or channel 22,23 or 24. In coverage overlaps between coverage areas 11,12,13, messages can be received on more than one channel depending on the location of pagers 14,15,16,17 or 18. For example, pager 15 is in coverage overlap 25 between two coverage areas 11,12. Hence, a message sent to pager 15 can be transmitted and received on channel 22 or channel 23. As another example, pager 17 is in coverage overlap 26 between all three coverage areas 11,12,13. Pager 17 can therefore receive messages sent on channel 22, channel 23 or channel 24.

Also shown in FIG. 1 is a controller 27 coupled to a memory 28, a timer 29 and a receiver 30. Messages are received by receiver 30 from a message input means 31. Message input means 31 can be, for example, a communication device such as a telephone. Controller 27 also couples to control transmitters 19,20,21 in transmitting messages. Hence, a message can be provided to one or more of transmitters 19,20,21 to be transmitted using one or more of channels 22,23 or 24.

In operation, pagers 14,15,16,17 or 18 each has a list of channels on which messages can be received. Memory 28 stores this list of channels for each of pagers 14,15,16,17 or 18. Along with the list of channels, memory 28 also stores indicia associated with coverage overlaps between coverage areas 11,12,13. For FLEX™ roaming system 10, the indicia

would indicate, for example, that channel 22 overlaps with channels 23,24. In addition to the indicia, memory 28 further stores a priority index of each of channels 22,23 or 24 relative to each of pagers 14,15,16,17,18. The priority index of channels 22,23 or 24 for pager 14 may be different from
5 that of the other pagers 15,16,17 or 18.

In FLEX™ roaming system 10, each of pagers 14,15,16,17 or 18 can also be programmed to have channels to be of single channel behaviour. A pager programmed as such has to monitor a single highest priority channel within a coverage area. In a coverage overlap between this coverage area
10 and another coverage area, the pager has to monitor this single highest priority channel. Such a pager is not required to monitor other channels for messages simultaneously within the coverage overlap.

In FLEX™ roaming system 10, a registration to controller 27 has to be
15 made when a user of a pager wants to receive messages in a coverage area different from an existing one. The registration provides to controller 27 the coverage area and at least one time period. Thereafter, controller 27 monitors the time period to select one of transmitters 19,20, or 21 to thereby transmit messages received for the pager on a channel 22,23 or 24
20 corresponding to the coverage area.

Reference will now be made to a method 40 for message transmission in FLEX™ roaming system 10 in accordance with the invention. FIGs. 2a and 2b are detailed flow diagrams of method 40. In describing method 40,
25 it is assumed that registrations have been made by users.

In accordance with the steps of method 40, messages are processed by controller 27 starting at step 41. Thereafter, upon receiving a message for the pager at step 42 during the time period, controller 27 identifies the
30 channel so registered for the pager from memory 28 at step 43. This channel is then labelled channel X. The message is then transmitted on channel X at step 44. At decision step 45, controller 27 determines whether channel X overlaps with other channels from a list of channels for the pager.

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With a "No" from decision step 45, method 40 proceeds to decision step 46 in which controller 27 determines whether any more channels are

registered for the pager. For a "No" from decision step 46, method 40 returns to start step 41. However, it is possible for the user to register more than one channel during the time period. In such a situation, a "Yes" is provided from decision step 46 which then causes controller 27 to identify a
 5 next channel from memory 28 at step 47. This next channel is then labelled channel X and processed as describe in the steps above.

From decision step 45, when channel X does overlap with other channels stored in the list of channels, method 40 continues to step 48.
 10 Retrieving one of the other channels which overlaps with channel X, controller 27 then labels it channel Y. Method 40 then processes channel Y in subsequent steps. At decision step 49, controller 27 determines whether channel Y is of a higher priority than registered channel X. This requires a comparison of the priority index of channels 22,23 or 24 for the pager. For
 15 example, if channel X is channel 22, then channel Y can be either channel 23 or channel 24. A "Yes" from decision step 49 requires controller 27 to control the transmitter for channel Y to transmit the message in its respective coverage area in step 50. When decision step 49 provides a "No", controller 27 checks at decision step 51 whether channel Y has equal
 20 priority with channel X and is of single channel behaviour. For a "Yes" to decision step 51, controller 27 controls the transmitter for channel Y to transmit the message in its respective coverage area in step 50. A "No" from decision step 51 requires controller to check at decision step 52 whether channel Y has a non-zero time period for a cancelled registration.

25 The cancelled registration is effected by the user who may not require messages to be sent to a specified coverage area before the time period ends. Hence, such a cancelled registration is likely to have remaining time in the time period or a non-zero time period. When decision step 52 provides a "Yes", controller 27 controls the transmitter for channel Y to
 30 transmit the message in its respective coverage area in step 50.

Following a "No" from decision step 52, method 40 proceeds to decision step 53 at which controller 27 checks whether any more channels overlaps with channel X. For a "No", method 40 returns to step 46. Otherwise, for a "Yes", method 40 proceeds to step 54 to get a next channel
 35 that overlaps with channel X from the list of channels. The next channel is then labelled channel Y and method 40 then processes this next channel from decision step 49 as described above.

Advantageously, method 40 optimally determines with a least number of message transmissions when a message is to be transmitted on other channels in coverage overlaps between coverage areas. Applying method
5 40, a pager operating within the coverage area of a registered channel can therefore receive the message on this channel or the other channels overlapping with it regardless of programmed channel priorities, missed registration confirmation messages or missed registration cancellation messages. In this way, overall channel capacity of FLEX™ roaming system
10 10 is increased by transmitting the least number of message transmissions to ensure message reception within the coverage area of the registered channel.

Although the invention has been described with reference to a
15 preferred embodiment, it is to be understood that the invention is not restricted to the preferred embodiment described herein.

Claims

We claim:

5 1. A multichannel synchronous selective call communication system having a plurality of coverage areas, said communication system comprising:

10 a receiver to receive a message for a selective call receiver;

 at least one transmitter in each of said coverage areas to transmit said message on at least one channel, said channel being associated with a registration for said selective call receiver; and

15 a controller, coupled to said receiver and said transmitter, said controller being adapted to control one or more other transmitters to transmit said message on one or more other channels, said other channels being selected from a list of channels associated with said selective call receiver based on coverage overlaps between said coverage areas and at
20 least one time period derived from said registration.

 2. The communication system as claimed in Claim 1 and further comprising one or more timers, said controller being coupled to said timers to monitor said time period.

25 3. The communication system as claimed in Claim 2 wherein said controller is further adapted to determine remaining time with said timers in said time period when said registration is cancelled.

30 4. The communication system as claimed in Claim 1 wherein said controller is further adapted to control said other transmitters to transmit said message based on said remaining time.

 5. The communication system as claimed in Claim 1 wherein said
35 list of channels includes a priority index for each of said channels.



6. The communication system as claimed in Claim 5 wherein said controller is further adapted to control said other transmitters to transmit said message based on said priority index.

5 7. The communication system as claimed in Claim 1 and further comprising a memory to store said time period, said list of channels and indicia associated with said coverage overlaps.

10 8. A method for message transmission in a multichannel synchronous selective call communication system having a plurality of coverage areas, said method comprising the steps of:

receiving a message for a selective call receiver;

15 transmitting said message on at least one channel, said channel being associated with a registration for said selective call receiver; and

20 controlling one or more other transmitters to transmit said message on one or more other channels, said other channels being selected from a list of channels associated with said selective call receiver based on coverage overlaps between said coverage areas and at least one time period derived from said registration.

25 9. The method as claimed in Claim 8 wherein said step of controlling comprises the step of monitoring said time period.

30 10. The method as claimed in Claim 9 wherein said step of monitoring comprises the step of determining remaining time in said time period when said registration is cancelled.

35 11. The method as claimed in Claim 8 wherein said step of controlling comprises the step of controlling said other transmitters to transmit said message based on said remaining time.

12. The method as claimed in Claim 8 wherein said step of controlling comprises the step of determining said transmission based on a priority index for each of said channels.



13. The method as claimed in Claim 8 wherein said step of controlling comprises the step of determining indicia associated with said coverage overlaps.

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14. A multichannel synchronous selective call communication system having a plurality of coverage areas and comprising a receiver, at least one transmitter and a controller substantially as described herein with reference to and as illustrated by the accompanying drawings.

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15. A method for message transmission in a multichannel synchronous selective call communication system substantially as described herein with reference to and as illustrated by the accompanying drawings.

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