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(54) Title: FILE TRANSFER IN PRIVATE MOBILE RADIO

(57) Abstract: A method for the transfer of a file in a private network to several recipients, said method comprising the steps, in which -the message sender dissects and encodes the file into one or more segments fitting in a single message and to be transmitted in the form of several messages - the message sender transmits the several segments fitting in a single message in the form of an array of group messages, which are transmitted in a private network in a single radio transmission to several recipients - the message recipients receive the group text messages, whereby the program means installed in a terminal unit identify said array of group text messages as a file transfer and compile and decode the same for a transferable file.



WO 2010/136645 A1

FILE TRANSFER IN PRIVATE MOBILE RADIO

The invention relates to the transfer of a file conducted in PMR (Private Mobile Radio, Professional Mobile Radio) networks or standalone networks to
5 several recipients.

TETRA is the most widely used PMR network standard in Europe. This application deals with the operation of Tetra networks, but the invention is also useful in connection with most other PMR networks, such as Tetrapol
10 and P25.

The TETRA network is a time division multiplexing network. The radio path between a base station and terminal devices is very narrow in terms of its capacity and the number of available simultaneous speech or data channels
15 is limited. This is partly compensated for by the possibility of a group call, whereby a single channel or time interval enables transmission of one message at a time from a single speaker or message sender to several recipients in such a way that just one radio channel is used within the range of each base station and thereby several recipients receive the call, the radio
20 path not being burdened more than in the case of a single call. It is similarly possible to send a text message along a system control channel to a group, the single message transmitted along a radio path being received by several terminal units at a time. Even with a low-level radio capacity, this enables a sensible communication to be maintained within a group. In addition, the
25 TETRA network provides a possibility of operating without a base station, directly from one terminal unit to another.

Since the radio path is a major bottleneck for data transmission, sending for example picture messages to several recipients has not been deemed
30 possible. A picture message or other file must be transmitted to each terminal unit separately by conducting the data transfer over a data link, whereby the base station becomes blocked for a long time should the same

base station be used by several recipients. Because the TETRA network has no knowledge of a multicast feature for data channels or packet data along a radio path, the file must be transmitted several times along the radio path between a base station and a terminal unit, resulting in network congestion.

- 5 The current standard does not recognize multicast data transmission functional at radio network level, although the terminal units could support an IP multicast operation, between the base station and the terminal unit there is no addressing mechanism for several recipients' packets or data stream, such that the packets or data stream would only be sent once along
- 10 the radio path to several recipients. The only form of group communication recognized by the TETRA standard between a base station and a terminal unit or between two terminal units comprises group text messages and group calls. Text messages can also be communicated in multiple segments the same way as in a GSM network. Still, in the event that a file is
- 15 transmitted to several recipients, it is only a notice of the transmission which is sent as a text message, the actual file being retrieved by using a data link. As a consequence, the group-transmitted file transfer results in an overload condition of the base stations or an extremely slow file transfer in the event that there are several recipients within the range of a single base station.
- 20 This is the practical reason why the transmission of a file conducted in a TETRA network to several recipients has been deemed impossible to implement because of a narrow data transfer capacity.

- The prior technology is represented for example by patent publication
- 25 GB2443320A, describing transmission of IP data in a TETRA network. The publication does not teach the use of group messages for making the use of a radio band more efficient.

- It is a goal of the invention to enable transmission of data, particularly data
- 30 produced by applications, to several recipients in a private mobile radio network without subjecting the network to an excessive load. Another goal is

a high error tolerance capability and implementability in existing networks and terminal units.

The operation according to a preferred embodiment of the invention is based
5 on conducting a file transfer by using SDS group messages known to the
network. SDS group messages are text messages, which are transmitted by
a network within the range of a base station to several recipients over a
control channel at one time. According to the invention, the transmitting
server computer, or the terminal unit operating in a network, transmits over
10 a TETRA network several group text messages, such that a file is encoded
into a plurality of successive text messages and to at least one of these
messages is attached a title tag, on the basis of which the recipients are able
to compile and decode the transmitted file from the plurality of messages.
The file to be transferred can be for example a picture, which enables
15 sending for example a wanted picture to several recipients, or enables
sending for example a chart or a map image in support of leading an
operation.

The sender of a message dissects the transmitted file into segments suitable
20 for transmission in the form of group text messages, for example in the form
of SDS messages in a TETRA network. This is performed for example with a
program means according to the invention. In addition, to the messages is
attached a required title tag, at least a file-transmission specifying label or
sequence number to at least one of the messages to be transmitted and a
25 label or a sequence number specifying each segment of the text message, on
the basis of which the messages are organized in successive order prior to
decoding the file. The sequence number for successive segments can be for
example an integer a single byte or half a byte in length. Preferably, the
name of a file, and the description to be sent along with a file, are
30 transmitted in just one title message which is generally first to be
transmitted. Since a TETRA network provides no guarantee regarding a
transmission delay, nor regarding the incoming order of messages, the first

sent message is not necessarily the one first obtained by the recipient.

Hence, the terminal unit, after receiving a title message, is possibly forced to compile a file also from messages arrived prior to the title message, which is why the messages must carry for example a sequence number, providing a basis for the terminal unit to identify segments of each file from among the messages coming from a single sender. The number of sequence numbers may also be more than one, whereby the segments of each file can be numbered individually and the messages are distinguished from each other by means of a second sequence number or a title tag.

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The method according to the invention enables sending a picture the size of a passport photo for a display presentation typically by means of about 12 successive SDS messages of about 140 bytes in length. As opposed to currently available data transfer technology, in which each terminal unit opens an IP- or circuit switched data channel for the retrieval of a picture or other file, the system according to the invention enables transmission of files to several recipients without blocking the network. The 12 SDS messages needed for the transmission of a picture file result in a reasonably minor burden on the control channel in comparison to the situation that each group transmission recipient within the range of a base station would open his/her own packet- or circuit-switched communication for a retrieval of the file. The opening of each data or packet communication burdens both data and control channels, whereby the several separately opened data links for sending one and the same file also congest the control channel as long as there are several recipients within the range of one and the same base station.

In order to implement a method of the invention according to a TETRA network operating embodiment, a terminal unit must be provided with a program means capable of compiling and decoding a transferable file from several SDS messages. Transmission requires that a server, a gateway device, or a terminal unit be provided with a program means capable of

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dissecting and encoding the file into several group text messages to be transmitted successively.

5 The TETRA network itself does not require any modifications, the system and method according to the invention using the group messages of a TETRA network as such, and the method according to the invention being usable in all TETRA standard complying networks equipped for the transmission of standard complying SDS group text messages. The method is also usable in
10 any other network equipped with a transmission feature operating across a radio path, the method being limited neither to a TETRA network nor to SDS messages.

A terminal unit and terminal unit software of the invention operable in a TETRA network are characterized in that the terminal unit or the software is
15 provided with means for the reception of several successive SDS text messages and for compiling a file encoded therein.

A preferred TETRA network embodiment for a transmission program of the invention is characterized by means which encode a file to be transmitted
20 into several successive SDS messages, and by means for the transmission of several successive SDS messages in the form of a group text message to several recipients.

It is also possible to design a terminal unit or a computer device for
25 connecting the same to a network which uses group speech messages of a TETRA or some other PMR network. In this case, however, a speech encoder in the transmitting device and a speech decoder in the receiving device must be replaced with a program means, which encodes into the speech channel not the speech but the data of a discussed file. This enables sending
30 preferably larger amounts of data but, on the other hand, the implementation requires a modification in the firmware of a receiving terminal unit so as to enable storing the speech data or sending it to the

disposal of a file decoding application. Except for terminal units and transmission encoding, the use of a speech channel is similarly transparent in terms of the actual PMR network, the modification being only needed for file transmitting and receiving devices. Thus, the above-described embodiment
5 enables supplying several recipients with a message in an existing TETRA network by using a group call in a speech channel for the transfer of a file.

It is further possible to modify the operation of an actual TETRA network in such a way that the multicast or broadcast transmission of IP packets to
10 several recipients would be conducted along a radio path between base station units or terminal units by addressing the same to several recipients. This would also enable a better-than-present load management and data transfer prioritization for the network. However, the current TETRA standard does not support other than the SDS and speech communication multicast
15 operation in a radio path. This is why it is most preferred that the transfer of a file for several recipients with present-day networks be conducted by means of SDS messages as described above.

The application designer has no control over the operation of an actual base
20 station network, which is why terminal unit applications and data network applications in a present-day TETRA network are forced to operate on top of the presently available features at least until the use of a radio path for data transfer is improved. It would be beneficial to determine a mode of data transfer, in which the multicast messages are transmitted from a base station
25 or a terminal unit as a data transfer addressed to several recipients the same way as the group call is now working. In this case, each base station is able to buffer the transmission of data to terminal units within its own range with a possibility of giving speech a priority. A data call or a data packet transfer for several recipients would also enable, for example during the operation,
30 the transfer of a picture directly from one terminal unit to others, whereby, for example prior to the penetration into a hazardous space, the first to establish a visual contact can send a picture in the form of a data broadcast

transmission to other terminal units present within the audio range of the same group, and possibly by way of the base station, also to a command center. This way, the important information can be transferred to several recipients in a single procedure directly from terminal to terminal, putting the
5 radio path to efficient overall use. In practice, it is futile to send a majority of IP protocol title tags into a radio path, since the PMR network in any case addresses the data to group members only and there are just a few necessary protocols, whereby it is futile to send most of the title tags of IP packets into a radio path. As a matter of fact, the IP packets cannot be
10 completed until after receiving the same from a radio path, such that the radio path is only used for sending an amount of information absolutely necessary for compiling the packets.

The above-described transfer of a file conducted by means of text messages
15 can be carried out preferably as a java program, which can be uploaded into a terminal unit without making other modifications in the hardware or firmware of terminal units. The method according to the invention can also be implemented by means of a terminal unit firmware modification or by means of a special terminal unit, whereby the transfer of a file is managed
20 by means of data encoded into the data stream of a group call to be transmitted in a speech channel. Even in this case, the infrastructure of a TETRA network remains otherwise unchanged and, as far as the network is concerned, the transfer of a file equals to the transfer of speech, whereby the terminal unit application manages the reception and transmission of
25 multicast data economically to several recipients in existing TETRA networks without modifications to the network itself.

The solution according to the invention accomplishes the transfer of a picture sufficient for example for the transfer of a mugshot even to a large number
30 of recipients in a standard time. According to tests, the transmission and reception of typically required 12 SDS messages takes about 14 seconds irrespective of the number of recipients. In the event that the control

channel of a base station has become congested for other reasons, this particular base station will naturally slow down the file transfer as messages settle in a queue.

The program means according to the invention, such as a program receiving
5 and compiling SDS messages, for example a java application, does not preferably acknowledge a successful receipt as a default value, because, in the event that there are a large number of recipients, the network would become overloaded by acknowledgements of receipt. The unsuccessful reception is preferably followed by waiting a randomly set period of time
10 prior to a retransmission request. The time period can be for example within the range of 1 to 20 seconds, whereby, in the case of a large number of recipients, the time is preferably extended for example by a request supplied by means of a title tag transmitted in the message, or by using a group size for establishing a randomly selected maximum time.

15 Thus, the sender can retransmit a missing or faulty file segment either as a group transmission or to a single recipient also as a single message in the likelihood that a group message would burden the network more than a single message. In the event of several fault reports arriving in quick
20 succession, it is likely that the message or a segment thereof is worth sending in the form of a group message even before the expiry of a random maximum time and, on the other hand, if just one fault report arrives during the maximum waiting time, there is no use to send a group message.

25 Should the network be capable of informing a sender about base stations used by the terminal units, this knowledge can be utilized in deciding the mode of retransmission. In case a lot of retransmission requests have arrived, the entire message can be sent again in the form of a group transmission. Thus, preferably, the retransmission is evident from a title tag
30 of the message, whereby the recipients learn not to send a retransmission request for missing or faulty segments of the previous message prior to receiving the retransmission in its entirety. Preferably in the context of a

retransmission, the recipient can use the data of both transmissions for the compilation and error correction of a file.

- 5 The file-transmitting program means can be a gateway computer, which is linked with a PMR network and for example with the data network of an authority. The transmitting program means may also be part of a terminal unit or an emergency center, an order dispatch center or the like.

Claims

1. A method for the transfer of a file in private network to several recipients, **characterized** by steps in which:

5

-the message sender dissects and encodes the file into one or more segments fitting in a single message and to be transmitted in the form of several messages

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- the message sender transmits the several segments fitting in a single message in the form of an array of group messages, which are transmitted in a private network in a single radio transmission to several recipients

- the message recipients receive the group text messages, whereby the program means installed in a terminal unit identify said array of group text messages as a file transfer and compile and decode the same for a

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transferable file.

2. A method as set forth in claim 1 for the transfer of a file, in which method the private network is a TETRA network, and the messages are SDS group messages.

20

3. A method as set forth in claim 1 for the transfer of a file, in which method the private network is a TETRA network and the program means in the terminal unit of a message recipient comprise a program in Java language.

25

4. A method as set forth in any of the preceding claims for the transfer of a file in a private network, **characterized** in that the method further comprises a step, in which the message recipients transmit an acknowledgement of receipt or a retransmission request after a variable or random time period for minimizing the network loading.

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5. A method as set forth in claim 4 for the transfer of a file in a private network, **characterized** in that, in the method, the start of a retransmission

stops the sending of retransmission requests until the retransmission has been completed and its success has been checked.

6. A method as set forth in claim 1 for the transfer of a file, in which method
5 the private network is a TETRA network and at least some of the transferable messages have been encoded to replace the voice data stream of a group call.
7. A program means for the transmission of a file to several recipients in a
10 PMR network, **characterized** in that the program means includes means for encoding, dissecting, and sending the data of a file in the form of several text messages or in the form of a group call, encoded for the mode of speech data, to several recipients.
- 15 8. A program means for receiving a file in a PMR network, **characterized** in that the program means includes means for decoding and compiling the data of a file from several group text messages.
- 20 9. A program means for receiving a file in a PMR network, **characterized** in that the program means includes means for decoding the data, which has been encoded into the speech channel of a group call, into a file instead of speech.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2010/050416

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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: H04L, H04Q, H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI, INSPEC, IPCOM, IEEE Xplore, ELSEVIER, IETF, ETSI, COMPDX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0028750 A2 (ERICSSON TELEFON AB L M) 18 May 2000 (18.05.2000) abstract; page 3, line 6 – page 4, line 29; page 6, lines 5-17; page 8, line 25 – page 9, line 6	1-9
X	GB 2443320 A (SEPURA LTD et al.) 30 April 2008 (30.04.2008) abstract; page 4, lines 3-6; page 6, lines 14-17; page 21, lines 20-25; page 22, lines 1-9; page 25, lines 16-20, cited in the description	1-9
A	WO 2006033643 A1 (CREATIVE TECH LTD et al.) 30 March 2006 (30.03.2006)	1-9
A	WO 9625815 A1 (PHILIPS ELECTRONICS NV et al.) 22 August 1996 (22.08.1996)	1-9
A	US 2004190468 A1 (SAIJONMAA, J.) 30 September 2004 (30.09.2004)	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"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

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Patent document cited in search report	Publication date	Patent family members(s)	Publication date
WO 0028750 A2	18/05/2000	JP 2002530024T T AU 1590200 A US 6400942 B1	10/09/2002 29/05/2000 04/06/2002
GB 2443320 A	30/04/2008	WO 2008050110 A1 EP 2087750 A1	02/05/2008 12/08/2009
WO 2006033643 A1	30/03/2006	CN 1753536 A	29/03/2006
WO 9625815 A1	22/08/1996	JP 9512411T T EP 0755600 A1	09/12/1997 29/01/1997
US 2004190468 A1	30/09/2004	WO 2004086791 A1	07/10/2004

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