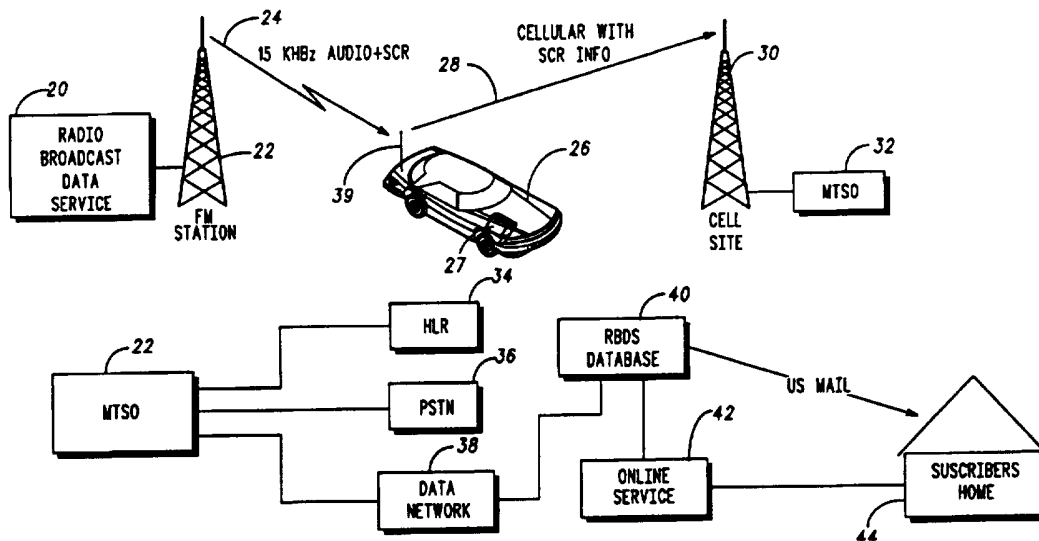




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: RADIO RECEIVING AND TRANSMITTING DEVICE AND METHOD OF RECEIVING AND TRANSMITTING RADIO SIGNALS



(57) Abstract

A radio receiving and transmitting device (27) includes a receiver (50) receiving a radio signal (24) carrying an audio and a data component, a memory (54) coupled to the receiver (50) and storing at least some data from the data component, and a transmitter (56) in communication with the memory (54). The transmitter (56) transmits at least some of the data in the memory (54) over a wireless communication system control channel. A method of accessing information via a wireless communication system comprising the steps of receiving a message including a wireless subscriber number and radio broadcast data at a communication unit within the wireless communication system, mapping the wireless subscriber number into a wireless subscriber computer network address; and transmitting the radio broadcast data and the computer address to a radio broadcast data system (20) in communication with the wireless communication system.

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RADIO RECEIVING AND TRANSMITTING DEVICE AND METHOD OF
RECEIVING AND TRANSMITTING RADIO SIGNALS

5

Field of the Invention

This invention relates generally to radio communication,
and more particularly to receiving data over a radio channel and
10 transmitting data over a wireless communication system control
channel.

Background of the Invention

15 Interactive communication devices allowing a user to
respond to information that is broadcast to many users, such as
interactive television, are gaining in popularity and have great
potential. Such devices advantageously allow a user to actively
participate and to communicate with the originator of the
20 broadcast.

Conventional FM radio communication currently supports
short message services that allow for radio broadcast messages to
be sent to many subscriber units. These subscriber units are
conventional radios with a display screen attached. However,
25 these messages are typically digital text messages to be displayed
on the subscriber unit's display screen. Users of the subscribed
units in an automobile do not interact well with the visual
messages displayed on a screen while they are driving.

Accordingly, there is a need for a method and apparatus for
30 allowing mobile users of subscriber units to interact with
received broadcast information.

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Summary of the Invention

5 The present invention addresses this need by providing a radio receiving and transmitting device, a method of accessing information via a wireless communication system, a method of receiving a first radio signal and transmitting a second radio signal, and a communication unit within a wireless communication system. The radio receiving and transmitting
10 device includes a receiver receiving a radio signal carrying an audio and a data component, a memory coupled to the receiver and storing at least some data from the data component, and a transmitter in communication with the memory. The transmitter transmits at least some of the data in the memory over a wireless
15 communication system control channel. Preferably, the radio signal is a frequency modulated radio signal and the data component is preferably carried by a sub channel authorization channel.

The method of accessing information via a wireless
20 communication system includes the steps of receiving a message including a wireless subscriber number and radio broadcast data at a communication unit within the wireless communication system, mapping the wireless subscriber number into a wireless subscriber computer network address, and transmitting the radio
25 broadcast data and the computer address to a radio broadcast data system in communication with the wireless communication system. The method of accessing information via a wireless communication system includes the steps of receiving a first radio signal carrying an audio and a data component, storing at
30 least some data from the data component within a memory, and transmitting a second radio signal carrying at least some of the data from the memory over a wireless communication system control channel.

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The communication unit within a wireless communication system includes a base station including a receiver, a controller responsive to the receiver, and a radio broadcast interface responsive to the controller. The receiver receives a message
5 including a wireless subscriber number and radio broadcast data. The controller maps the wireless subscriber number into a wireless subscriber computer address. The radio broadcast interface transmits the radio broadcast data and the computer address to a radio broadcast data system in communication with
10 the wireless communication system.

The invention itself, together with its intended advantages will best be understood by reference to the following detailed description, taken in conjunction with the accompanying
15 drawings.

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Brief Description of the Drawings

FIG. 1 is a block diagram illustrating a preferred
5 embodiment of an interactive radio and cellular system.

FIG. 2 is a block diagram illustrating the subscriber unit of
FIG. 1.

FIG. 3 is a block diagram illustrating the mobile telephone
switching office of FIG. 1.

10 FIG. 4 is a block diagram illustrating the radio broadcast
data station of FIG. 1.

Detailed Description of the Preferred Embodiments

15 FIG. 1 shows a preferred embodiment of an interactive
radio and cellular system. The system includes a radio broadcast
data system 20, an FM station 22, a subscriber unit 27 located
within an automobile 26, a cell site 30, and a mobile telephone
switching office (MTSO) 32. The MTSO 32 is connected to a public
20 switch telephone network (PSTN) 36, a data network 38, and a
database 34, such as a conventional cellular home location
register (HLR) database. The data network 38 is connected to a
radio broadcast data system (RBDS) database 40 and is connected
to an online service 42. The online service 42 interconnects the
25 RBDS database 40 and a computer within the home 44 of the
subscriber registered as owning the subscriber unit 27.

The RBDS 20 is preferably a digital data system to be
modulated on FM radio stations. The FM station 22 is a well
known FM radio broadcast station used to broadcast standard FM
30 radio signals. The data network 38 is preferably a packet type
network such as the internet, the RBDS database 40 preferably
includes a standard general database, such as those available
from Tandem Computers, and the online service 42 is preferably
a standard online service such as those provided by Compuserve

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or America Online Corp. The cell site 30 is preferably a standard analog or CDMA type cell site, preferably a Supercell® 9600 from Motorola, and the MTSO 32 is preferably a Motorola mobile telephone switching office such as an EMX2500™. The MTSO 32 is
5 preferably a wireless communication system such as a time division multiple access, frequency division multiple access, or code division multiple access communication system.

The FM station 22 transmits a radio signal 24 that is preferably a frequency modulated (FM) signal having a
10 kilohertz component and a subchannel data component. The subchannel data component is preferably a subchannel authorization (SCA) channel which is transmitted at 67 kilohertz and 92 kilohertz of traditional FM broadcast systems. The 15 kilohertz channel carries voice, music, or other audio information.

15 The subscriber unit 27 within the automobile 26 receives the radio signal 24 via an antenna 29. The subscriber unit 27 demodulates data carried over the SCA channel and stores the data into a memory 54 within the unit 27.

According to the preferred embodiment, the data includes a
20 telephone number. The subscriber unit 27, upon detecting a subscriber command from a user, transmits the data received from the SCA channel, such as the telephone number, to the cell site 30 over an air interface 28. A suitable air interface is described by cellular standard IS-54. However, it should be
25 understood that the present invention may be used with other air interfaces and is not limited to any particular air interface.

The data received at the cell site 30 is transmitted to the MTSO 32. The MTSO 32 receives a message including a wireless subscriber number and radio broadcast data. The MTSO 32 in
30 conjunction with the HLR 34 maps the received wireless subscriber number into a wireless subscriber computer network address. The MTSO 32 transmits the radio broadcast data and the computer network address to the RBDS database system 40 via the data network 38. The RBDS database 40 reads

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information contained therein based on the radio broadcast data from the MTSO 32 and sends the information from the data base 40 to a computer located at the computer network address. The information from the RBDS database 40 is preferably sent to the
5 computer at the subscriber's home 44 using the online service 42. Instead of providing a computer address, the MTSO 32 may alternatively provide a subscriber's home street address. In this case the information from the RBDS database 40 may be sent to the subscriber's home using a postal service, such as U.S. mail.

10 FIG. 2. illustrates a preferred embodiment of the subscriber unit 27. The subscriber unit 27 includes an FM receiver 50, a processor 52, a transmitter 56, a memory 54, a first antenna 29, and a second antenna 52. The FM receiver 50 is connected to the memory 54 via an interface 58. The memory 54 is connected to
15 the processor 52 which is connected to the transmitter 56. The transmitter 56 is connected to the second antenna 52. The FM receiver 50 receives the FM broadcast signal 24 from the antenna 29. In a preferred embodiment, a tuner 60 is connected to the FM receiver 50 allowing a subscriber to select a desired FM
20 channel.

In the preferred embodiment, the FM receiver 50 and the tuner 60 are well known automobile FM radio components such as those found in well known FM radios made by many manufacturers such as Sony Corp. The processor 52, memory 54,
25 transmitter 56, and antenna 52, are components within a cellular telephone such as a Motorola MicroTac™ cellular phone. The interface 58 is preferably a FM radio to data transfer system, such as a simple wired connection between the memory 54 and the receiver 50.

30 At the interface 58, the FM radio receiver 50 receives the SCR digital data that is associated with the audio information that is being broadcast to the listener of the radio station. The processor 52 may be programmed by those skilled in the art to insure that the data is transferred correctly.

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During operation, the SCA channel within the broadcast signal 24 received by the receiver 50 via the antenna 29 is demodulated and then stored into the memory 54. Upon a subscriber command such as when a subscriber dials a special button, preferably (*R) indicating a request to interface with the radio, the processor 52 reads at least some of the data from the memory 54, performs processing on the data, and then sends the processed data information to the transmitter 56. The transmitter 56 in turn transmits at least some of the data previously stored in the memory 54 over the second antenna 52 toward the cell site 30.

FIG. 3 shows a preferred embodiment of the MTSO 32. The MTSO 32 includes a base station 70, a controller 74, and a radio broadcast interface 76. The base station 70 includes at least one receiver 72 connected to an antenna 78. The base station 70 is connected to the controller 74 which is in turn connected to the radio broadcast interface 76. The radio broadcast interface 76 is connected to the RBDS database 40. The base station 70 is preferably a Motorola SC9600® type base station, and the controller 74 and radio broadcast interface 76 are components within a Motorola EMX2500™ mobile switch. The controller 74 preferably includes a processor such as a Motorola 68030 processor.

Within the broadcast interface 76, information is transferred from the processor in the controller 74 to the radio broadcast interface 76. The interface 76 is preferably connected to one of two data systems. In a particular embodiment, the interface 76 is connected to the PSTN 36. In this embodiment, the data from the RBDS database 40 is a telephone number. When the user presses send on the cellular phone, the telephone number is used to complete a call from the user to a location where further information is available.

Alternatively, the interface 76 may be a packet network such as the internet. In this alternative embodiment, the HLR 34

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is interrogated to receive the subscriber's internet address. An internet message is sent to the RBDS database 40 along with the SCR data information. This information is used as an index to determine what information should be sent to the home of the subscriber 44. Delivery in this embodiment may be through U.S. mail if the information is in video or other physical form or the information may be delivered through the online service 42 if the information is in digital form.

Data sent by the transmitter 56 over the antenna 52, preferably in the form of a message, is received at the antenna 78 and recovered by the receiver 72. This data is passed on to the controller 74 for further processing. Such processing may include appropriate mapping of the received data to recover an address of the subscriber registered as owner of the subscriber unit 27 by using the HLR database 34. The processed data including radio broadcast data and the subscriber's address is then sent to the radio broadcast interface 76 which in turn transmits the processed data to the RBDS database 40.

FIG. 4 shows a preferred embodiment of the RBDS database 40 system. The RBDS database 40 includes a database 80, a computer network interface 82, a computer having a computer network address 88, and an FM broadcast unit 86. The database 80 is connected to the FM broadcast unit 86 and is connected to the computer network interface 82. The computer network interface 82 is connected to the computer 88 preferably through an online service 90 or other standard computer network connection.

The database 80 is preferably a standard UNIX® (UNIX is a registered trademark of AT&T) computer system from Tandem Inc. The computer network interface 82 is a standard computer communication interface such as used by the internet. The computer 88 is typically a well known personal computer with a modem connection. The FM broadcast unit 86 is a well known radio transmission device used in FM radio broadcasting stations.

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The database 80 receives radio broadcast data and an address 94 from the MTSO 32. The database 80 produces information 92 based on the radio broadcast data and address message 94. The computer network interface 82 routes the
5 information 92 to the computer 88 located at the appropriate address.

The FM broadcast unit 86 transmits an FM signal 24 including an audio component and a data component. The data component is preferably transmitted over the SCA channel. The
10 data transmitted by the FM broadcast unit 86 is read from the database 80 prior to transmission.

The above described preferred embodiment has many benefits. For example, a user may receive further product information or services while listening to the radio by only
15 pressing a single key. An example would be if a radio listener hears an advertisement for pizza, the listener may press (*R) on his mobile phone in the car. Digital information that is sent over the SCA channel is loaded into the memory 54 within the mobile phone and is transferred to the base station 70. The base station
20 70 then sends the information to the controller 74 which determines that the received information is from the FM radio system. Since the received information is associated with a telephone number, the MTSO 32 routes the call to the PSTN 36. The telephone number is associated with the pizza company and
25 the radio listener is then connected to the pizza company representative. After connection, the listener may then receive further information from the pizza company representative. To eliminate requiring the subscriber to press the (*R) key, voice recognition may be used in the mobile phone. Using voice
30 recognition has the advantage of increasing driver safety while the driver is responding to the radio messages.

Further advantages and modifications of the above described apparatus and method will readily occur to those skilled in the art. The invention, in its broader aspects, is

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therefore not limited to the specific details, representative apparatus, and illustrative examples shown and described above. Various modifications and variations can be made to the above specification without departing from the scope or spirit of the present invention, and it is intended that the present invention
5 cover all such modifications and variations provided they come within the scope of the following claims and their equivalents.

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Claims

What is claimed is:

5

1. A radio receiving and transmitting device comprising:
a receiver receiving a radio signal carrying an audio and a
data component;
a memory coupled to the receiver and storing at least some
10 data from the data component; and
a transmitter in communication with the memory and
transmitting at least some of the data in the memory over a
wireless communication system control channel.

15

2. The device of claim 1, wherein said radio signal
comprises a frequency modulated radio signal.

20

3. The device of claim 1, wherein said data component is
carried by a sub channel authorization channel.

25

4. The device of claim 1, further comprising a radio
tuner for selecting a desired radio signal and detecting the audio
component within the selected radio signal.

5. The device of claim 1, further comprising an interface
coupling said receiver and said memory.

30

6. A method of accessing information via a wireless
communication system comprising the steps of:

receiving a message including a wireless subscriber number
and radio broadcast data at a communication unit within the
wireless communication system;

mapping the wireless subscriber number into a wireless
subscriber computer network address; and

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transmitting the radio broadcast data and the computer network address to a radio broadcast data system in communication with the wireless communication system.

5 7. The method of claim 6, further comprising the steps of reading information from a database within the radio broadcast data system based on the radio broadcast data and sending the information to a computer located at the computer address.

10

8. The method of claim 6, further comprising the step of transmitting the radio broadcast data and the wireless subscriber number from the wireless subscriber unit over an air interface to the communication unit in the wireless communication system.

15

9. A method of receiving a first radio signal and transmitting a second radio signal comprising the steps of:
receiving a first radio signal carrying an audio and a data component;

20 storing at least some data from the data component within a memory; and

transmitting a second radio signal carrying at least some of the data from the memory over a wireless communication system control channel.

25

10. A communication unit within a wireless communication system comprising:

a base station including a receiver, said receiver receiving a message including a wireless subscriber number and radio broadcast data;

30

a controller responsive to the receiver, said controller mapping the wireless subscriber number into a wireless subscriber computer address; and

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a radio broadcast interface responsive to the controller, said radio broadcast interface transmitting the radio broadcast data and the computer address to a radio broadcast data system in communication with the wireless communication system.

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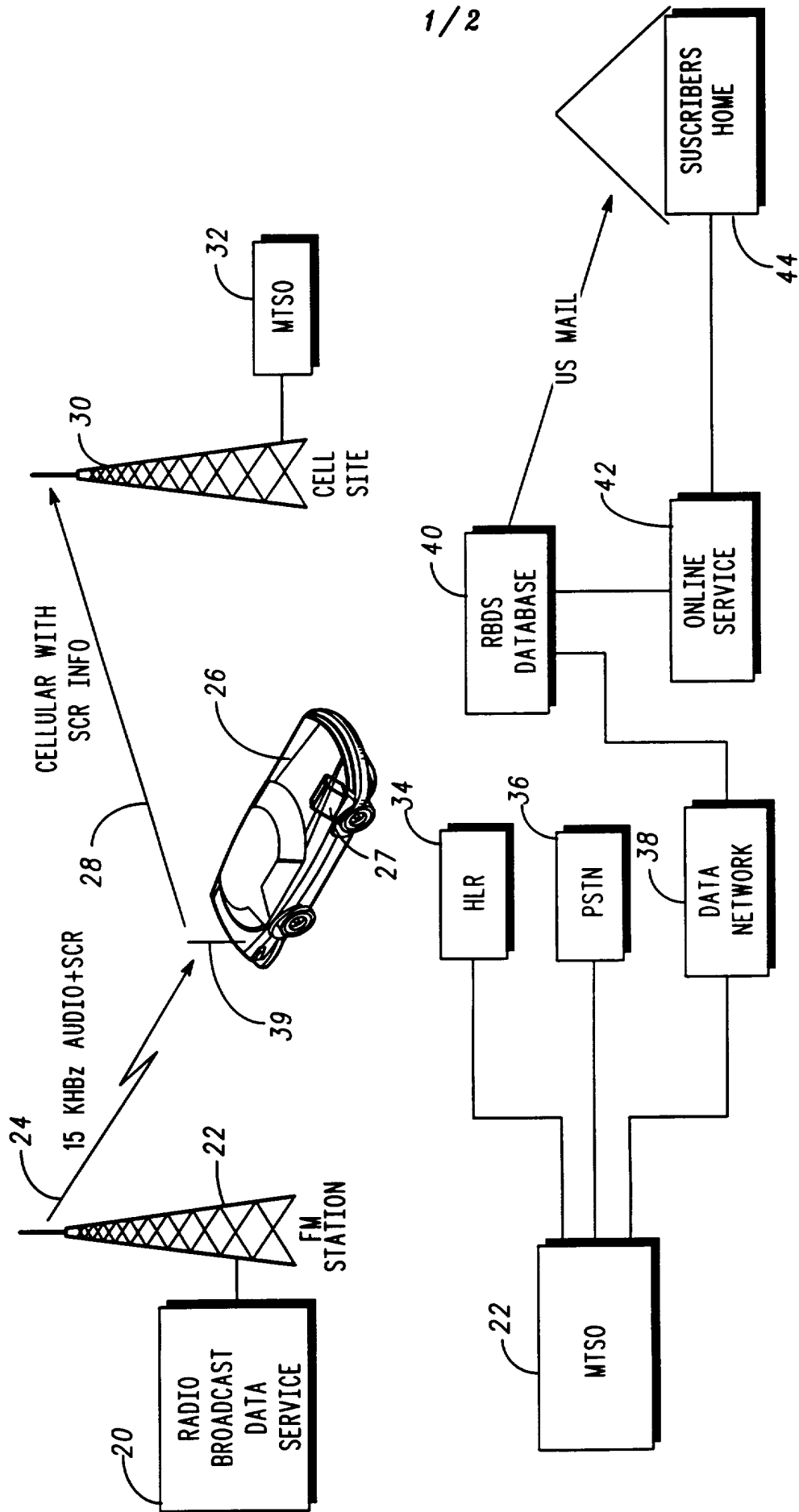
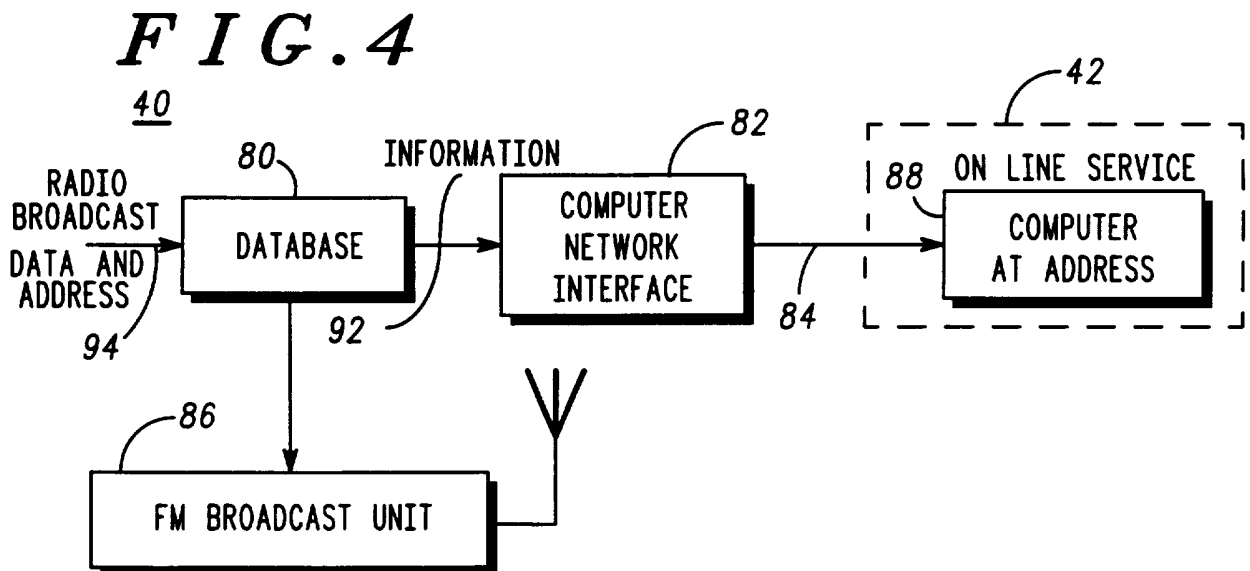
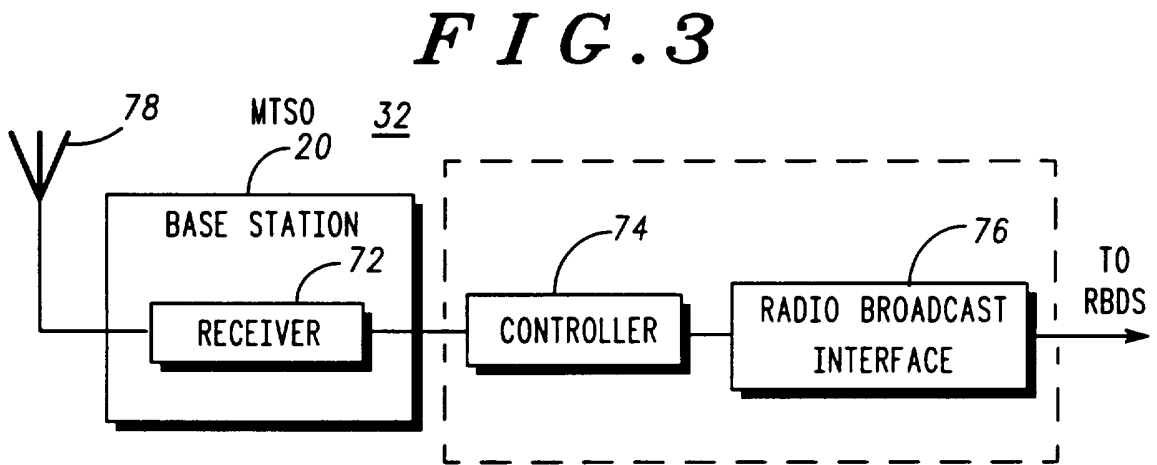
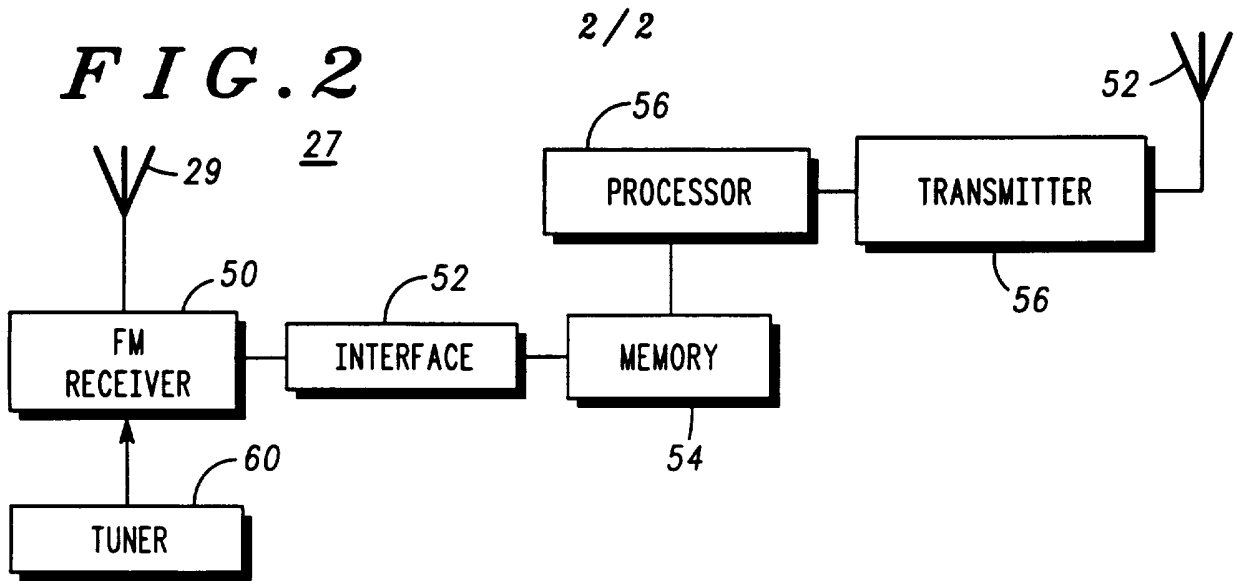


FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/11540

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04B 7/26
US CL :455/45, 53.1, 54.2, 89
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)

U.S. : 455/6.3, 33.1, 45, 53.1, 54.1, 54.2, 88, 89, 186.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| X | US, A, 5,303,393 (NOREEN et al) 12 April 1994, see entire document | 1-10 |
| A | US, A, 5,063,610 (ALWADISH) 05 November 1991, see figures 1 and 6 | 1-10 |

Further documents are listed in the continuation of Box C. See patent family annex.

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