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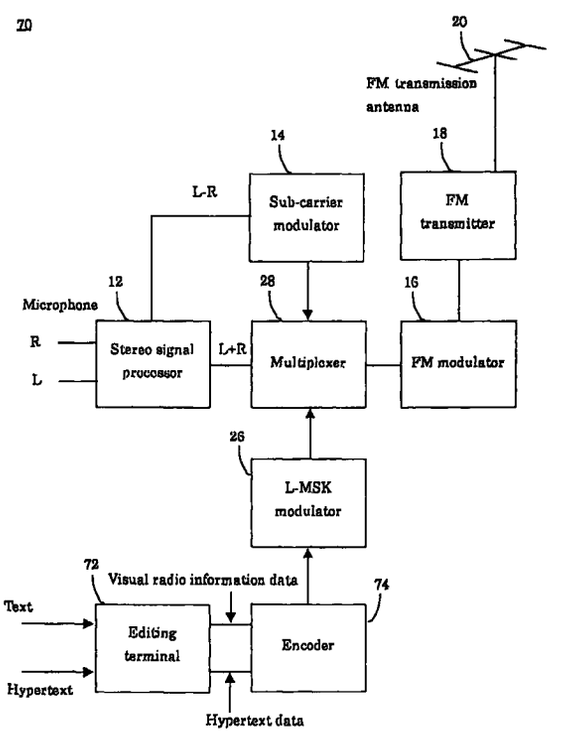
(54) Data broadcasting system via FM channels using frequency multiplexing

(57) The invention provides a data broadcasting system via FM radio channel that enables transmission of a large amount of hypertext data including images with high quality. A voice signal is transmitted through the stereo signal processor (12), the sub-carrier modulator (14), the FM modulator (16), the FM transmitter (18), and the FM transmission antenna (20). The visual radio information data and the hypertext data are edited at the editing terminal (72), and encoded at the encoder (74). The encoded data is modulated by the L-MSK modulator (26), and multiplexed with voice signal at the multiplexer (28). A specified code is used to identify the hypertext data. The hypertext data is received by a receiver (80), as shown in Fig.9, and stored in a huge capacity storage device. The stored information is easily retrieved and viewed whenever, necessary.

Fig.5



EP 0 883 257 A2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

The invention field is in FM multiplexing broadcast system by using the vacant frequency space of FM band.

Description of the Prior Art

The construction of the visual radio information system is shown in Fig. 1. The voice is input from right and left microphones. In the transmission circuit 10, the signals R and L from the right and left sides are input to the stereo signal processor 12. The stereo signal processor 12, generates the signal (L-R) and the signal (L+R). As shown in Fig. 2, the signal (L+R) is used as the main channel between 0 to 15KHz and the signal (L-R) that is modulated by a sub-carrier modulator 14, is used as sub-channel between 23 to 53KHz. There is a pilot signal of 19KHz between the main channel and the sub-channel. The complex signal of the main channel, the sub-channel and the pilot signal is modulated by an FM modulator 16, and transmitted by the FM transmitter 18, through the FM transmission antenna 20.

The data containing visual radio information is multiplexed with voice signals. The information data, such as traffic information, weather report, sporting results, news, voice program information, are transmitted on the visual radio information channel. The broadcasting data is created at the editing terminal 22, and encoded into the data frame which includes 272 blocks shown in Fig. 3 by using the DARC (Data radio channel) standard at the encoder 24. The 288-bit block consists of 16-bit codes using as the block identification, 176-bit data packet, 14-bit CRC (Cyclic redundancy check) codes and 82-bit error correcting codes. The data frame is modulated by L-MSK (Level controlled minimum shift keying) at the modulator 26, and multiplexed at the multiplexer 28. The modulated signal is multiplexed with a voice signal on the upper vacant frequency space of the FM spectrum as shown in Fig. 2.

The receiver construction is shown in Fig. 4. The receiver circuit 40, consists of an FM receiving antenna 42, and a RF (Radio frequency) receiver 44. The received signal is amplified and detected at the RF receiver 44. The voice signal is demodulated from the multiplexed signal at the voice demodulator 46. The signal of right side is output to a speaker through the right amplifier 48, and the signal of left side is output to a speaker through the left amplifier 50.

The multiplexed data is demodulated at the data demodulator 52. Data transmission error is detected and corrected at the error corrector 54. Finally, the text data including simple graphics is shown on the display 56.

However, the visual radio information system described above is very simple, which only enables the broadcast of small amounts of text data and the display of text with a format of 15.5 characters x 2 to 4 lines. Although several new dimensions for displaying more information are proposed, such as 15.5 characters x 8 lines, 31 characters x 16 fines, 40 characters x 19 lines, the system only enables the display of formatted information. The received information cannot be stored or retrieved. The current system can not transmit a large amount of information data such as homepages on Internet webs.

Multimedia broadcast has expanded rapidly since the earthquake happened in Japan of January 17, 1995. The broadcast information is now expected to include emergency notification, survivor confirmation, local area community information, public information, news, weather report, sporting results, business channel, and every kind of information provided on the Internet. Those kinds of information cannot presently be provided by the existing visual radio information system.

SUMMARY OF THE INVENTION

The main purpose of this invention is to provide a data broadcast system at a low cost for transmitting a large amount of information data to include images with high quality via FM broadcast equipment.

This invention is a data broadcasting system that broadcasts hypertext data with an identification code by utilizing the vacant frequency space on the FM band. On the receiver side, the received hypertext data is first identified by its identification code and then stored in a storage device. The stored data can be viewed on a browser whenever, convenient.

The hypertext data can be broadcast together with visual radio information data either by time dimension transmission or mix transmission.

The hypertext data is distinguished from visual radio information by identification code. The identified hypertext data is stored in a storage device. The stored data can be directly retrieved and displayed as necessary, whenever.

At the case of time dimension transmission, the hypertext data can be transmitted at different times with visual radio information data. For instance, visual radio information data is transmitted during the day and the hypertext data is transmitted at night. Certainly hypertext data may be alternately transmitted with visual radio information after a small interval. It is also possible to transmit both hypertext data and visual radio information data at mixed.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a block diagram illustrating a prior art construction of transmission circuit for the visual radio information system.

Fig.2 is a diagram illustrating the spectrum of FM stereo broadcast including multiplexed data.

Fig.3 is a diagram illustrating the data frame construction for the data encoding of FM multiplex broadcast.

Fig.4 is a block diagram illustrating a prior art receiver circuit of visual radio information broadcast.

Fig.5 is a block diagram of the transmission circuit of this invention.

Fig.6 is a diagram illustrating the data packet of visual radio information broadcast.

Fig.7 is a diagram illustrating the data packet prefix shown in Fig.6.

Fig.8 is the code table defining the identification code for hypertext data broadcast.

Fig.9 is a block diagram of a receiver circuit of this invention.

DESCRIPTION OF THE PREFERED EMBODIMENT

The sample construction of the invention system is shown in Fig. 5. The transmission circuit 70, consists of a stereo signal processor 12, a sub-carrier modulator 14, FM modulator 16, a FM transmitter 18, a FM transmission antenna 20, an L-MSK modulator 26, and a multiplexer 28, similar to a prior art visual radio information system. A voice signal is transmitted through the FM transmitter and the FM transmission antenna.

The editing terminal 72, editing hypertext data and visual radio information data is included in the circuit, 70. This editing terminal 72, is not only used for editing visual radio information, but also used for editing a large amount of hypertext information including images, such as Internet information, emergency information, public information, and so on. HTML (Hypertext markup language) is used in the editing.

The data packet included in the data frame shown in Fig. 3 consists of 32-bit prefix and 144-bit data block in the visual radio information system as shown in Fig. 6. The prefix consists of 4-bit service identification, 1-bit complex identification, 1-bit information ending flag, 2-bit update flag, 14-bit data group number and 10-bit data packet number as shown in Fig. 7.

The service identification is 4-bit code b1, b2, b3 and b4. As shown in Fig. 8 the 4-bit code is used to identify the transmission mode, such as mode 1, mode 2, and so on. The code [0 0 0 0] is not used in the visual radio information system so it can be used to identify the hypertext data in the invention system.

The hypertext data and the visual radio information data edited at the editing terminal 72, are encoded to data frames at the encoder 74. In the mixed transmission, both hypertext data and visual radio information data are encoded in the same data frame. The created data frames are transmitted to the L-MSK modulator 26, and multiplexed with voice signal at the multiplexer 28. Finally, the multiplexed signal is transmitted by the FM transmitter 18.

As shown in Fig. 9, the receiver 80 receives the multiplex signal including voice, visual radio information and hypertext data. The receiver 80, consists of several functional blocks as follows: a FM receiving antenna 42, a RF receiver 44, a voice demodulator 46, a right amplifier 48, a left amplifier 50, right and left speakers, a data demodulator 52, a error corrector 82, a storage device of visual radio information data 84 and a display of visual radio information 56. The voice signal is processed same as a visual radio information system and output to right and left speakers.

The error correction of data is first processed at the error correcror 82. Then the visual radio information or the hypertext data is identified by the identification code. The visual radio information data is stored in the storage device of visual radio information data 84, and is shown on the display of visual radio information 56.

The hypertext data is stored in the storage device of hypertext data 86. It is viewed on the high resolution display 88, and also can be retrieved whenever, convenient. The hypertext may be printed by a connected printer 90.

The mixed transmissions of visual radio information and hypertext data have three combinations. The first is transmission only of hypertext data. The second is the mixed transmissions of hypertext data and visual radio information data at a mixed rate. The third is time dimensional transmission. In the case of time dimensional transmission, hypertext data is alternately transmitted with visual radio information data on separate pages with varying content. It is also possible to transmit visual radio information data during the day and transmit hypertext data at night. In any case, hypertext data is encoded by defining its identification code b1, b2, b3 and b4 as [0 0 0 0]. This code is used to distinguish hypertext data from visual radio information data. Notification for hypertext data broadcasts, such as a message reading "Hypertext data is broadcasting" can be carried within visual radio information. It is useful to notify listeners of hypertext data broadcast on visual radio information receivers. The combination notification is also effective in checking conditions like reflection, phasing and noise.

This system enables transmissions of hypertext data and visual radio information data at the rate of 16Kbps by using the vacant frequency space on FM band. As one page of hypertext with 20 KB is transmitted in 30 seconds, 56 MB or about 2,800 pages of hypertext may be transmitted per 24 hours of operation on the day. If a hard disk with a capacity of 1.2GB is used as the storage device, 20 days of the received data can be stored. The huge amount of data can be easily retrieved from the hard disk whenever, necessary.

The effect of the invention is that not only visual radio information data can be transmitted, but also a large amount of hypertext data can be transmitted by the same system. The necessary information can be retrieved and viewed whenever as the data is stored in

a storage device. Hypertext data is distinguished from the visual radio information data by an identification code. The visual radio information data is viewed on the usual receiver. The hypertext data is stored in a huge hard disk and it is viewed on a browser. The invention is primarily directed to the effective use of the vacant frequency space of FM band.

Claims

1. A multiplex data broadcasting system via FM radio in which a large amount of hypertext data encoded (74) by a specified identification code for distinguishing from a visual radio information data is transmitted (18), and at a receiver side (44), the hypertext data identified by the identification code is stored in a storage device (86) and viewed by a browser on a display (56).

2. A multiplex data broadcasting system in accordance with claim 1, in which the hypertext data is simultaneously transmitted with the visual radio information data and/or VICS (Vehicle information and communication system) data by time dimension or mixed transmission method.

3. A receiver that enables reception of hypertext data or both hypertext data and visual radio information data or VICS data described in claim 2.

Fig.1 PRIOR ART

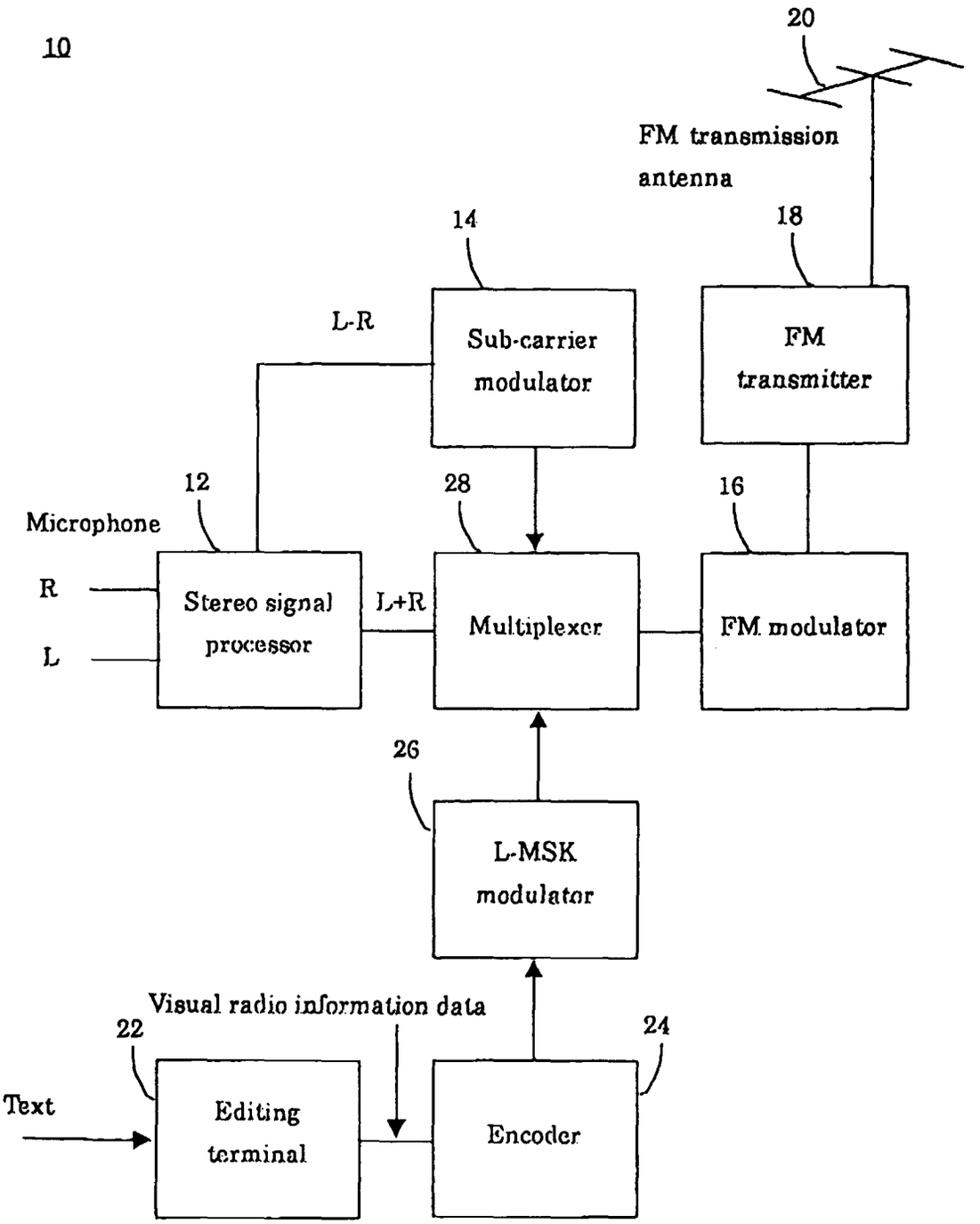


Fig.2

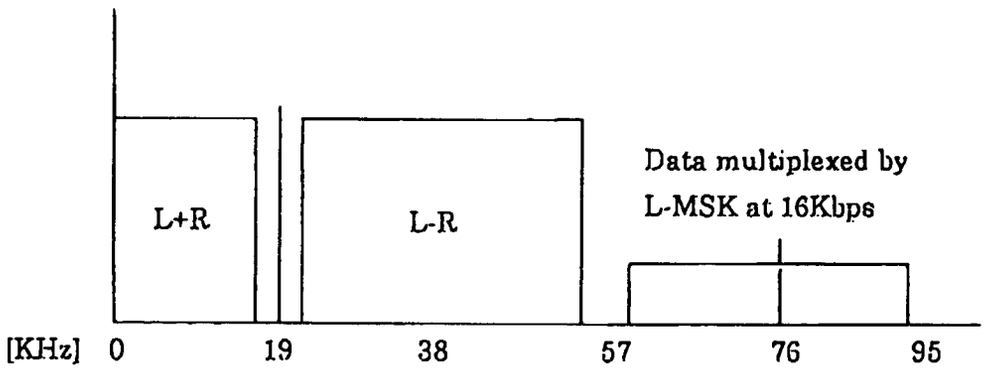
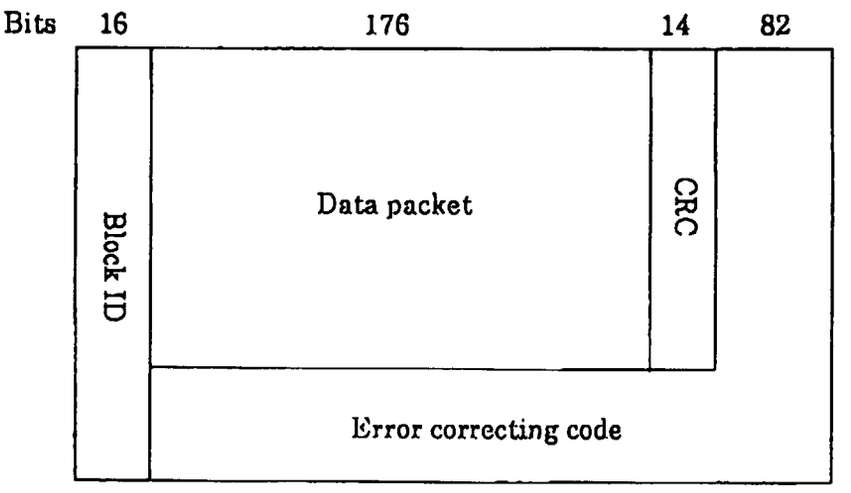


Fig.3



272 blocks

Fig.4 PRIOR ART

40

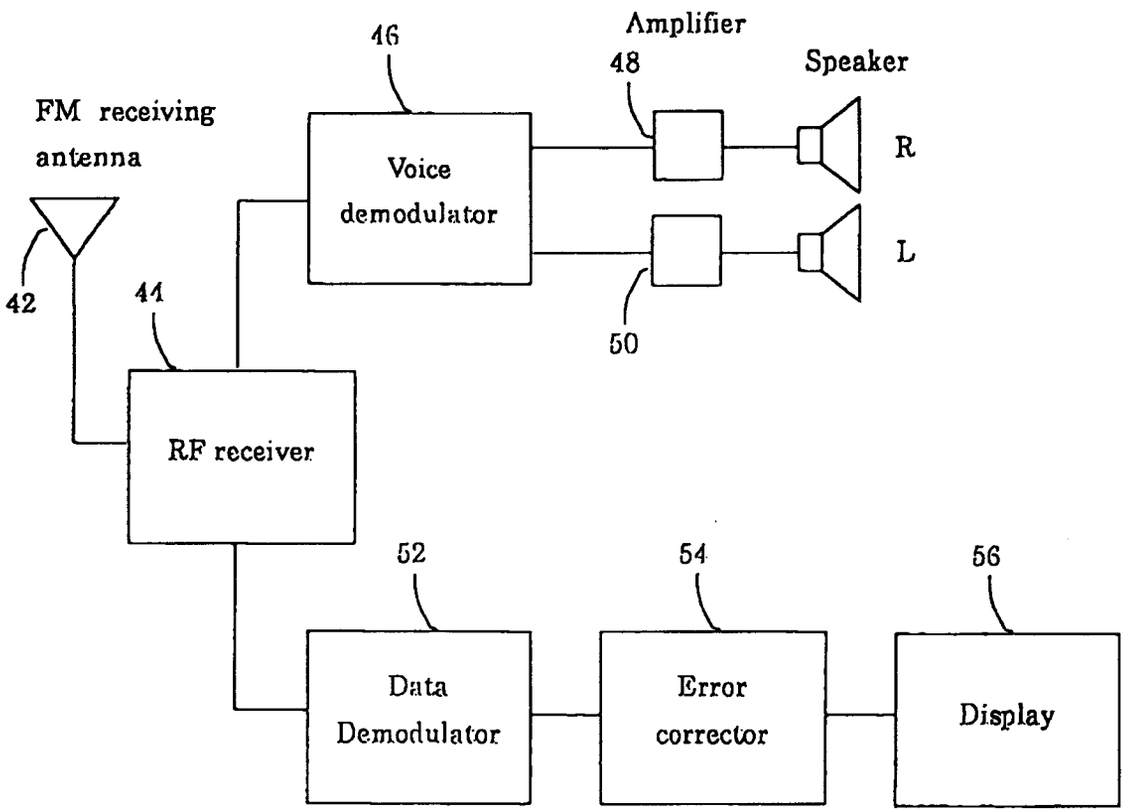


Fig.5

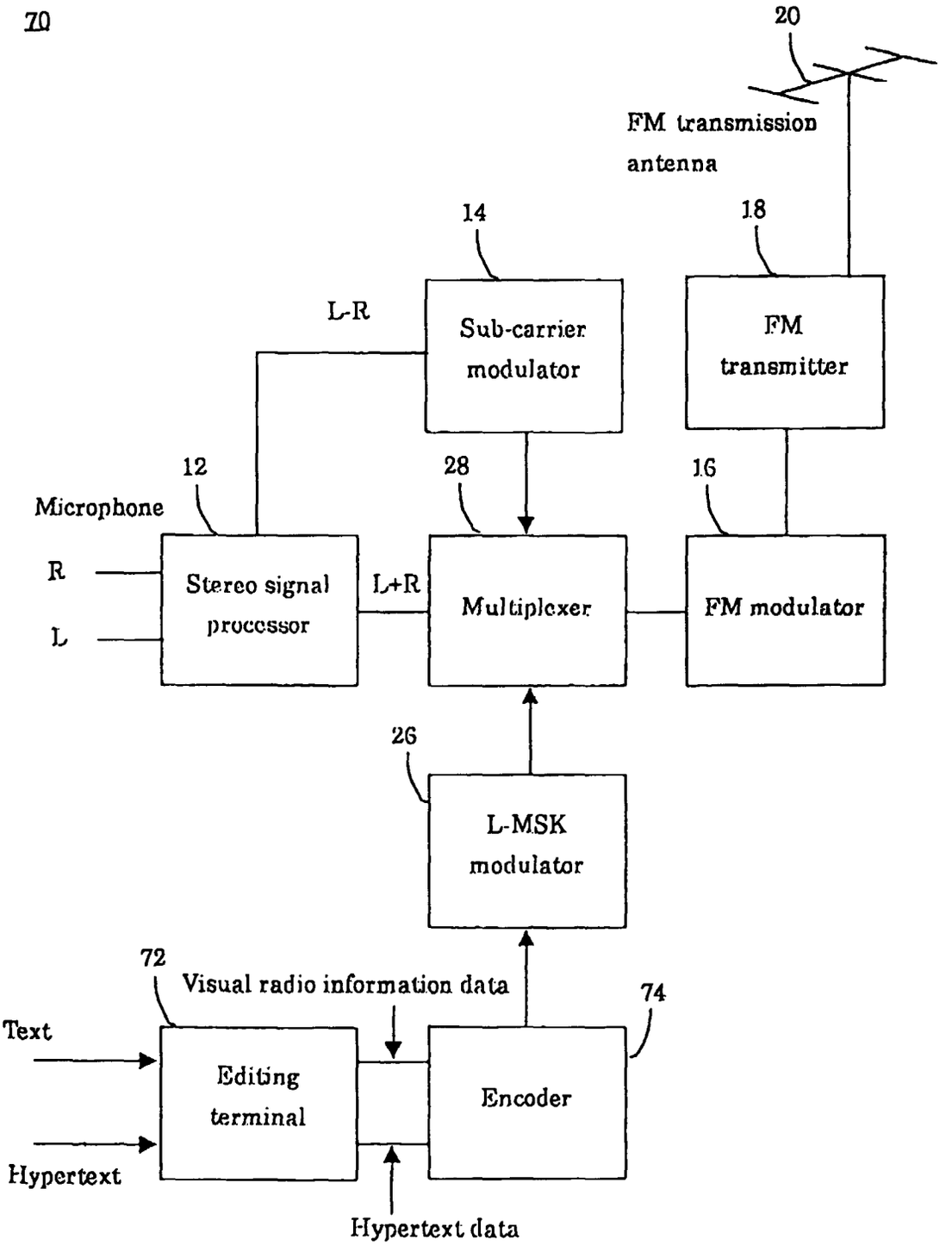

70
20
FM transmission antenna
14
18
L-R
Sub-carrier modulator
FM transmitter
12
28
16
Microphone
R
L
Stereo signal processor
L+R
Multiplexer
FM modulator
26
L-MSK modulator
72
Visual radio information data
74
Text
Editing terminal
Encoder
Hypertext
Hypertext data

Fig.6

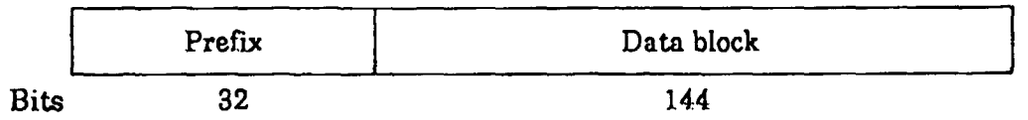


Fig.7

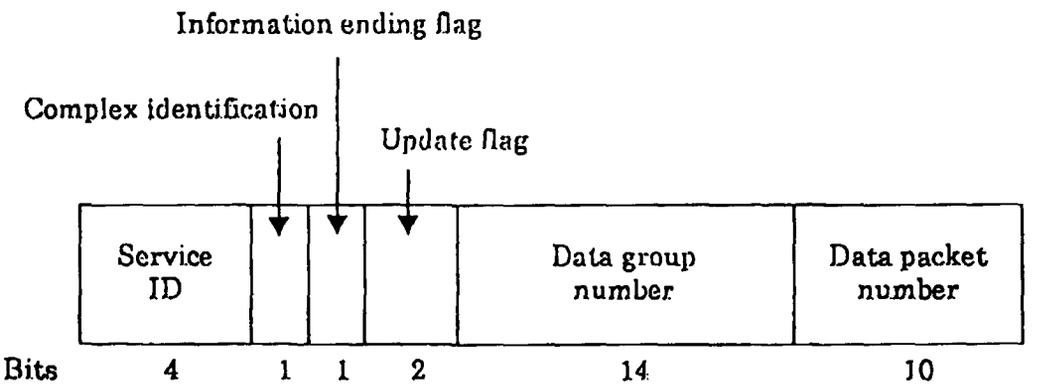
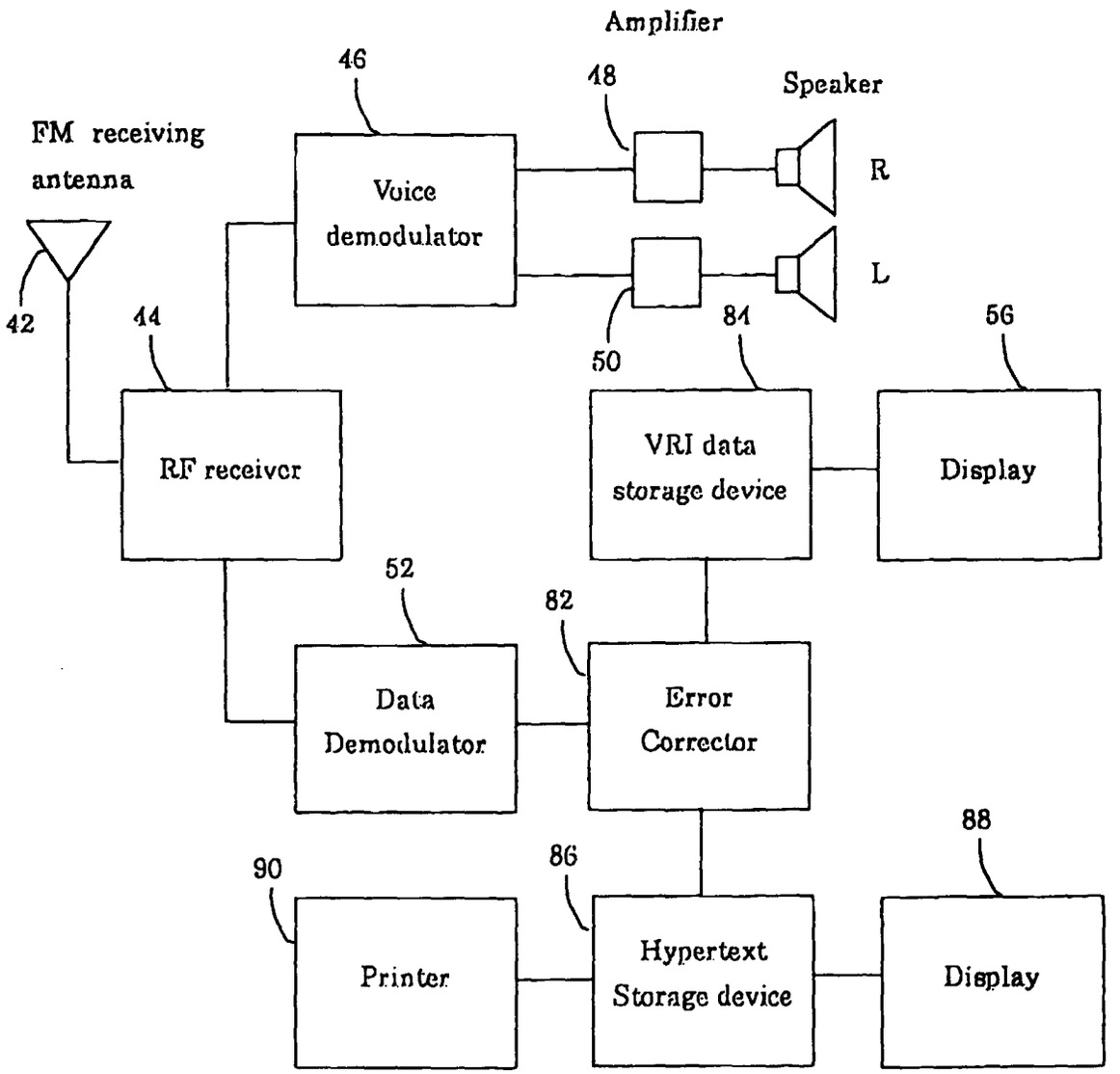


Fig.8

B1 b2 b3 b4		Service ID
0 0 0 0	0	Hypertext data proposed in this invention
1 0 0 0	1	Transmission mode 1
0 1 0 0	2	Transmission mode 2
1 1 0 0	3	Transmission mode 3
□	□	□
1 0 1 1	D	Supplement information
0 1 1 1	E	Spare information
1 1 1 1	F	Management information

Fig.9



VRI:Visual radio information