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(54) **BROADCAST ENCODING SYSTEM AND METHOD**

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(51) Int. Cl.^{7} **H04B 1/66**
(52) U.S. Cl. **375/240**; 375/253
(58) Field of Search 375/240, 245, 375/246, 253, 254, 132; 714/752, 755, 758; 704/203, 212, 226

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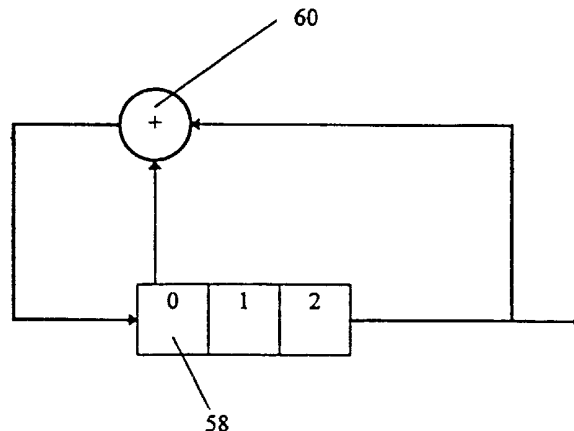|			
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(57) **ABSTRACT**

An encoder is arranged to add a binary code bit to block of a signal by selecting, within the block, (i) a reference frequency within the predetermined signal bandwidth, (ii) a first code frequency having a first predetermined offset from the reference frequency, and (iii) a second code frequency having a second predetermined offset from the reference frequency. The spectral amplitude of the signal at the first code frequency is increased so as to render the spectral amplitude at the first code frequency a maximum in its neighborhood of frequencies and is decreased at the second code frequency so as to render the spectral amplitude at the second code frequency a minimum in its neighborhood of frequencies. Alternatively, the portion of the signal at one of the first and second code frequencies whose spectral amplitude is smaller may be designated as a modifiable signal component such that, in order to indicate the binary bit, the phase of the modifiable signal component is changed so that this phase differs within a predetermined amount from the phase of the reference signal component. As a still further alternative, the spectral amplitude of the first code frequency may be swapped with a spectral amplitude of a frequency having a maximum amplitude in the first neighborhood of frequencies and the spectral amplitude of the second code frequency may be swapped with a spectral amplitude of a frequency having a minimum amplitude in the second neighborhood of frequencies. A decoder may be arranged to decode the binary bit.

39 Claims, 9 Drawing Sheets

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FIGURE 1

40

Input audio block $v(t)$ with 512 samples

42

Multiply by window function $w(t)$

44

Compute Fast Fourier Transform $\Im\{w(t)v(t)\}$

Data Bit Position

46

Select frequencies f_1 and f_0 for modulation

48

Analyze neighborhoods

Data Bit Value

56

Boost and Attenuate to get $\Im_m\{v(t)w(t)\}$

62

Compute Inverse Transform $\Im_m^{-1}\{v(t)w(t)\}$

64

Coded output:

$$v_o(t) = v(t) + (\Im_m^{-1}\{v(t)w(t)\} - v(t)w(t))$$
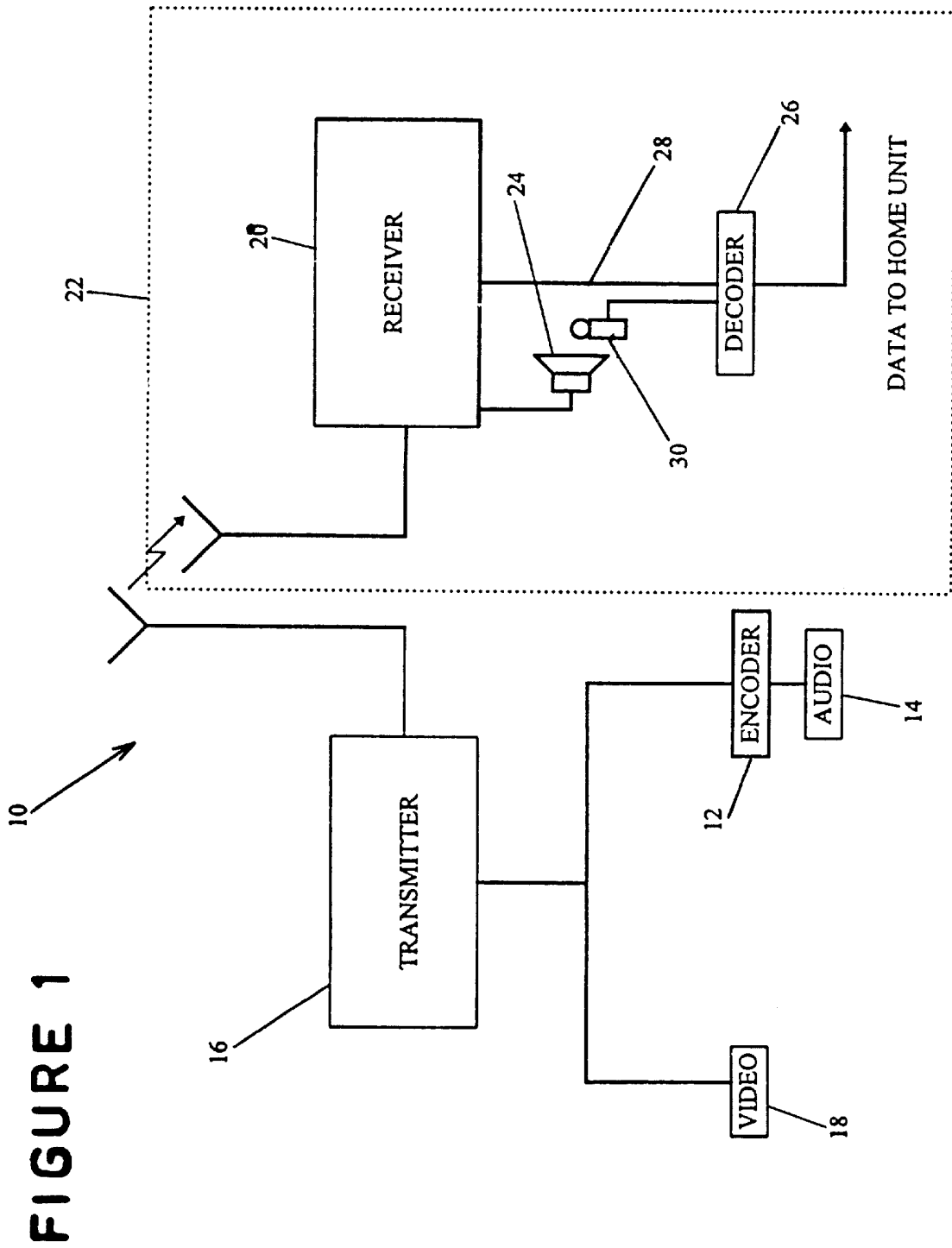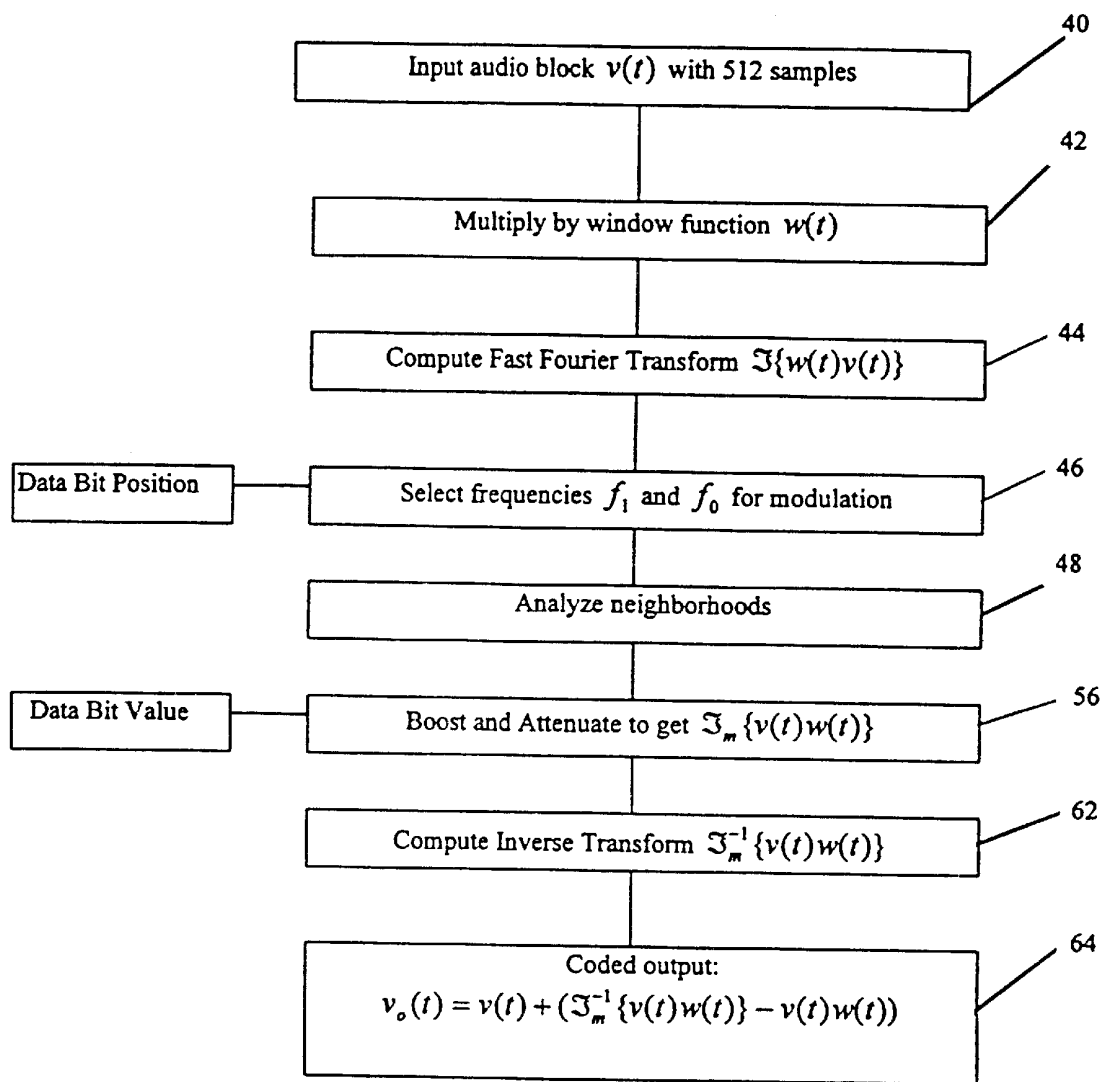
FIGURE 2
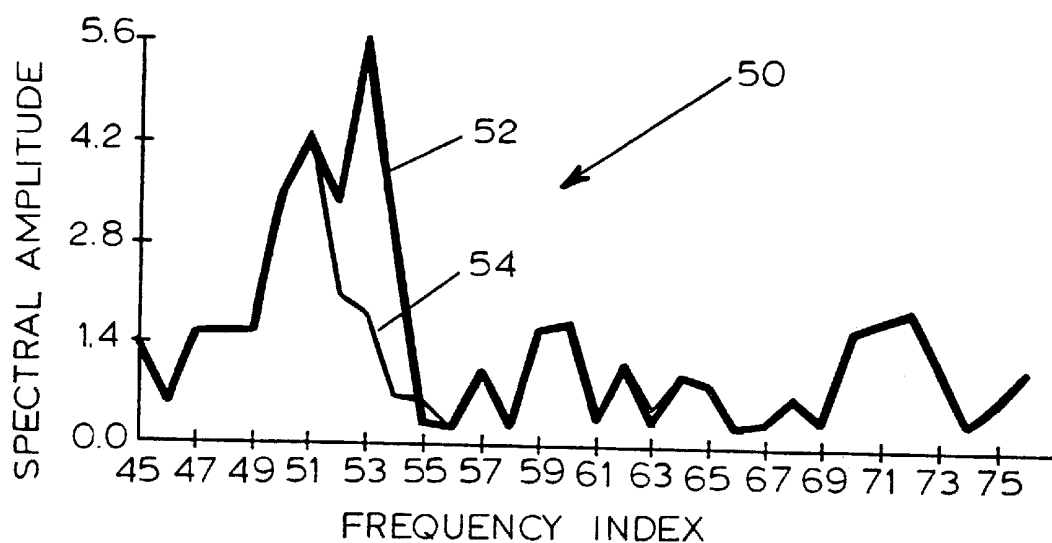
FIGURE 3

DOCKET ALARM

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