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Bottoms et al.

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[54] **SIMULTANEOUS ANALOG AND DIGITAL COMMUNICATION APPLICATIONS**

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[73] Assignee: **AT&T Corp.**, Murray Hill, N.J.

[*] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,440,585.

[21] Appl. No.: **76,520**

[22] Filed: **Jun. 14, 1993**

[51] Int. Cl.⁶ **H04B 1/38**

[52] U.S. Cl. **375/222; 375/261; 379/93**

[58] Field of Search **375/8, 5, 39, 38; 379/93, 97, 98, 99**

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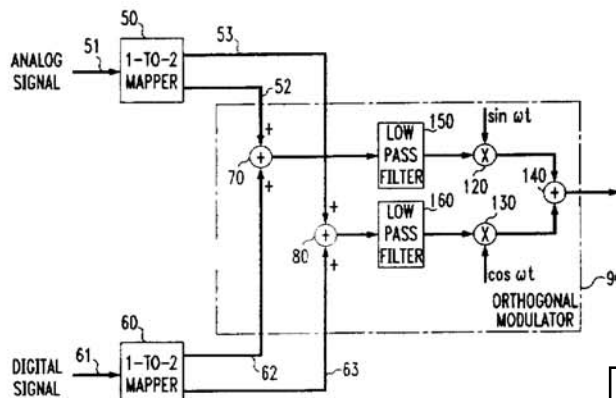
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[57] **ABSTRACT**

A number of arrangements and methods that achieve concurrent communication of analog information and digital information. In general terms, when the communication channel is viewed as a multi-dimensional space, the digital information signal is divided into symbols, and the symbols are mapped onto the signal space with a preset distance between them. The analog signal, generally limited in magnitude to less than half the distance separating the symbols, is converted to component signals and added (i.e., vector addition) to the symbols. The sum signal is then transmitted to the receiver where the symbols are detected and subtracted from the received signal to yield the analog signal components. The transmitted analog signal is recreated from those components. Arrangements utilizing the above principles are applications where systems that include a digital port can benefit from an analog communication channel, and conversely, where systems that include an analog port can benefit from a digital communication channel.

16 Claims, 18 Drawing Sheets



IVI LLC EXHIBIT 2009
XILINX V. IVI LLC

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FIG. 1

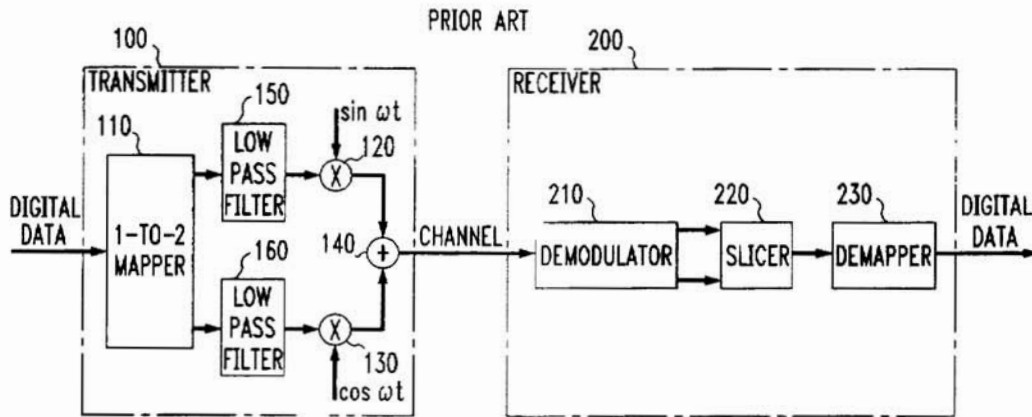


FIG. 2

PRIOR ART

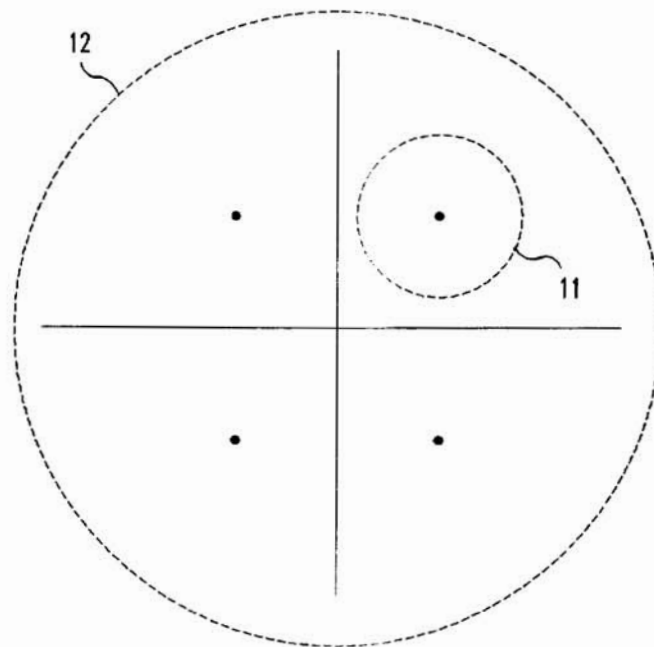


FIG. 3



FIG. 4

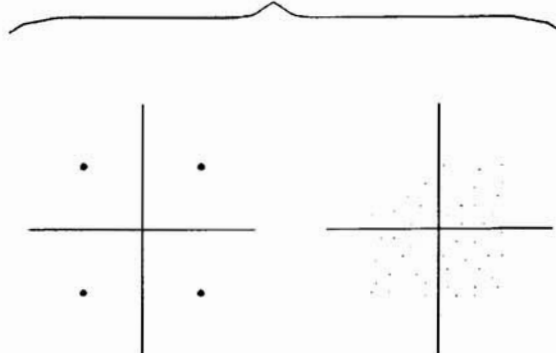


FIG. 5

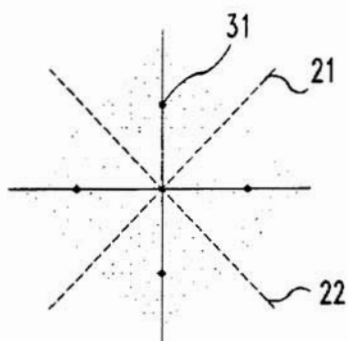


FIG. 6

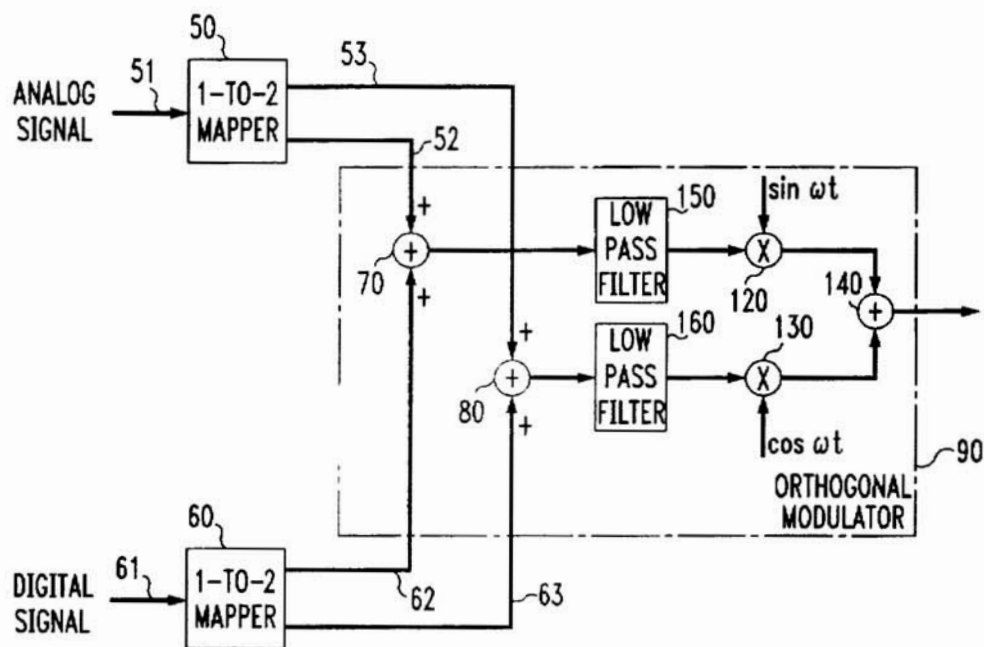
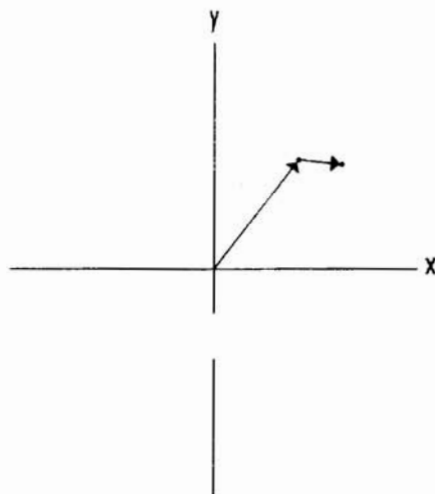


FIG. 7



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