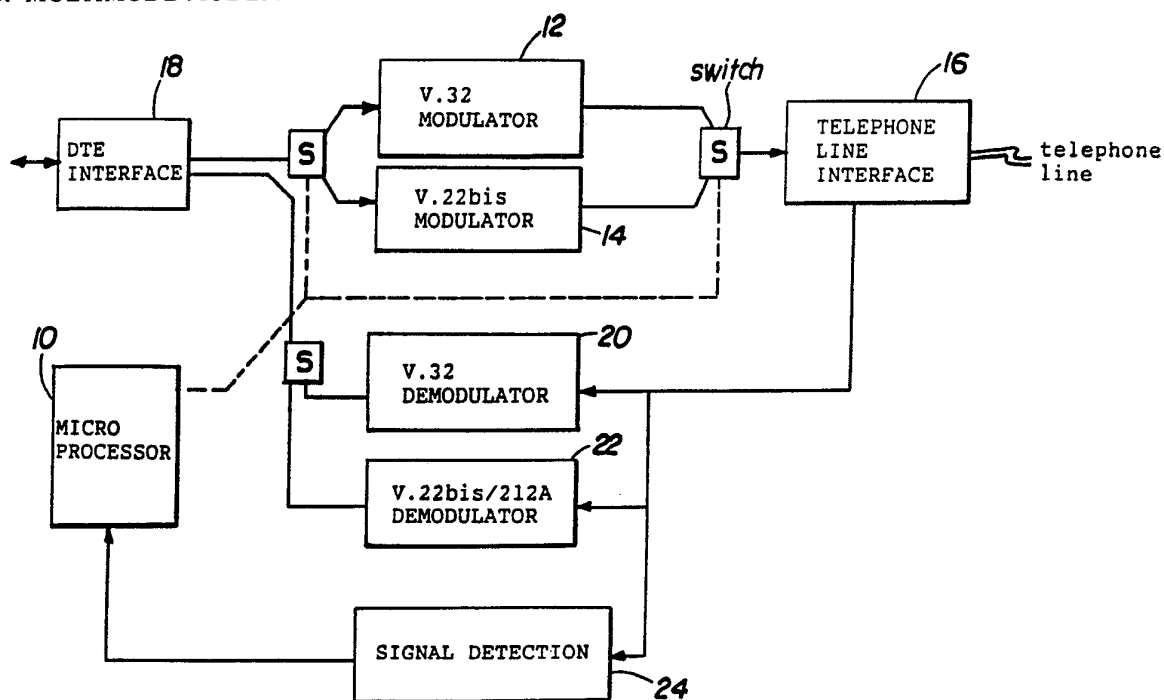




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>4</sup> :</b>  <b>H04B 1/38</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 89/11183</b>  <b>(43) International Publication Date:</b> 16 November 1989 (16.11.89)
<b>(21) International Application Number:</b> PCT/US89/02017 <b>(22) International Filing Date:</b> 10 May 1989 (10.05.89) <b>(30) Priority data:</b> 192,952                      12 May 1988 (12.05.88)                      US <b>(71) Applicant:</b> CODEX CORPORATION [US/US]; 20 Cabot Boulevard, Mansfield, MA 02048 (US). <b>(72) Inventor:</b> GRESZCZUK, John, A. ; 475 Beech Street, Roslindale, MA 02131 (US). <b>(74) Agent:</b> FEIGENBAUM, David, L.; Fish & Richardson, One Financial Center, Suite 2500, Boston, MA 02111-2658 (US). <b>(81) Designated States:</b> AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK, FI, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO,		SE (European patent).  <b>Published</b> <i>With international search report.</i>

**(54) Title:** MULTIMODE MODEM**(57) Abstract**

A multimode modem for communicating with a variety of modem types employing differing initial handshake signals includes plural modulators (12, 14) which send a sequence of signals corresponding to the variety of modem type handshake signals, the sequence terminating when a handshake signal detector (24) receives an appropriate response identifying a particular one of the modem types. In a preferred embodiment, the multimode modem (10, 12, 14, 16, 18, 20, 22, 24) is adapted to interwork with V.32 and V.22bis and V.22 modems on the public switched telephone network.

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MULTIMODE MODEMBackground of the Invention

This invention relates to multimode modems.

It is desirable for a modem to be able to  
5 interwork with V.32 and with V.22bis and V.22 modems on  
the public switched telephone network. It is also  
desirable that the modem automatically select the data  
rate and mode in which to operate. Further, any  
interworking procedure of the multimode modem should be  
10 compatible with various implementations of both  
standards.

An interworking procedure has been described  
which, for the multimode answer modem, involved sending  
the initial tone for the V.32 procedure (AC) and the  
15 initial tone for the V.22bis procedure (UNSCR1 at 1200  
bps) simultaneously. See, "A Proposed Appendix to  
Recommendation V.32: Interworking Procedure With  
V.22bis and V.32 Modems", delayed contribution to D-30  
to CCITT Study Group XVII, April 1986.

20 As described in this D-30 document, handshaking  
tones for both V.32 and V.22bis modulation modes are  
transmitted; because the total power is restricted, the  
tones for each modulation method are less powerful than  
the normal single-mode interworking. This power  
25 restriction poses a potential problem after a multimode  
modem has detected the modulation method of the other  
modem and needs to remove the other tones and increase  
the power of the correct signalling tones. A modem  
designed to V.22bis or V.32 and not to operation with a  
30 multimode procedure as described in the D-30 document  
might not operate properly through this transition.  
Further, a modem constructed to conform only to V.32,  
might not reject the additional tones used by a

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multimode modem to sense for a V.22bis modulation mode. As such, there is a possibility that a multimode modem built upon the algorithm described in the document D-30 might not operate with some implementations of V.32.

5                   Summary of the Invention

          The multimode modem according to the invention for communicating with a variety of modem types employing differing initial handshake signals includes a multimode modem which sends a sequence of signals  
10 corresponding to the variety of modem type handshake signals, the sequence terminating when the multimode modem receives an appropriate response identifying a particular one of the variety of modem types. In a preferred embodiment, the multimode modem is adapted to  
15 interwork with V.32 and V.22bis and V.22 modems on the public switched telephone network.

          The multimode modem of the invention utilizes a sequential technique to detect the modulation method of another modem with which to communicate. This technique  
20 defines an initial operating procedure in which the initial tones of the V.32 and then V.22bis standards are tried sequentially instead of simultaneously (or in parallel) as described in the D-30 document. The training procedure, after first seeing the initial tone,  
25 will meet the respective modem standards and thus will be much more robust to the method of implementation of the respective single mode modems. Furthermore, the sequential technique of the present invention may be more accurate than the parallel algorithm described in  
30 the D-30 document. This procedure can also be used after the initial connection to change the operating modes from the current mode to one of the other modes it is capable of supporting.

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Brief Description of the Drawing

Fig. 1 is a block diagram of the multimode modem disclosed herein;

Fig. 2 is a block diagram of the signal  
5 detection block of Fig. 1;

Figs. 3a and 3b are schematic illustrations of a multimode call training sequence according to the invention; and

Figs. 4a and 4b illustrate multimode answer  
10 training sequences.

Description of the Preferred Embodiment

The present invention is a modification of a single mode V.32 Model 2260 modem manufactured by the Codex Corporation of Canton, Massachusetts. This modem  
15 includes a microprocessor chip, Model 6809 manufactured by the Motorola Corporation. The software driving this microprocessor was modified in the implementation of the preferred embodiment of the present invention.

The multimode modem of the invention  
20 incorporating both V.32 and V.22bis modes of operation can interwork at 9600 and 4800 bits per second with a V.32 modem and at 2400 and 1200 bits per second with a V.22bis modem and at 1200 bits per second with a V.22/212a modem, automatically selecting the correct  
25 mode.

The multimode modem of the invention is shown in Fig. 1. A microprocessor 10 controls the functionality of the other blocks. The microprocessor 10 selects either a V.32 modulator 12 or a V.22bis  
30 modulator 14 to connect to a telephone line interface 16 and to a DTE interface 18. The microprocessor 10 also selects which of demodulators 20 and 22 to use on the input signal and to connect to the DTE interface 18. The signal detection apparatus 24 provides information

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to the microprocessor 10 as to the type of signal being received. The apparatus 24 can determine if any of the following signals are present: 600 Hz and 3000 Hz tones (AC), an 1800 Hz tone (AA), a 2250 Hz tone, a 2225 Hz tone, a V.22bis modulated alternating sequence (SI), a V.22bis modulated scrambled 1's pattern, or if no signal is present, as shown in Fig. 2. The microprocessor 10 selects the type of modulation to be used and the signal to be sent by the modem. As the calling modem it will not activate either modulator until it has determined the mode of operation to follow. The operation of a calling multimode modem will now be described in conjunction with Figs. 3a and 3b. After connecting to a line the multimode modem will initially remain quiet.

The multimode modem will be conditioned to detect one or two incoming tones at frequencies of 600 Hertz and 3,000 Hertz and an unscrambled ones V.22bis signal in the high channel (2250 Hertz). If 600 Hertz and/or 3,000 Hertz tones are received from an answering modem, the multimode modem will continue the handshake sequence in accordance with V.32 and commence transmission of a repetitive carrier state AA. If unscrambled ones at 1200 bits/second in the high band (as per V.22bis sections 2.1 and 2.4) is received from the answering modem, then the multimode modem will condition itself for operation in accordance with V.22bis, transmitting in the low band and receiving in the high band. The handshake sequence will be completed in accordance with V.22bis (section 6.3.1.1.1 or 6.3.1.2.1).

As the answer modem, the V.32 initial training sequence is sent first and if there has been no response after a time period, the V.22bis initial training sequence is sent. Since the V.32 signal is the first one sent, two multimode modems will interwork in the

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V.32 mode, which is the highest, and hence the most desirable rate. The operation of an answering multimode modem will now be discussed in conjunction with Figs. 4a and 4b. After connecting to the line, the multimode  
5 modem will transmit the recommendation V.25 answer sequence. Then the modem will transmit alternate carrier states A and C. The multimode modem will be conditioned to detect an incoming tone at 1800 Hertz. If the 1800 Hertz tone is received from the calling  
10 modem, then the multimode modem will continue the training sequence in accordance with V.22 section 5.4.2. If there has been no signal received after a period of five seconds, then the multimode modem will cease transmitting AC and start to transmit a tone at  
15 2250 Hertz. The multimode modem will be conditioned to detect a V.22bis signal in the low channel as well as a tone at 1800 Hertz. If a low channel signal is received from the calling modem, then the multimode modem will condition itself to receive in the low channel and  
20 transmit in the high channel and continue the handshake sequence in accordance with V.22bis (section 6.3.1.1.2 or 6.3.1.2.2). If a tone at 1800 Hertz is received, then the multimode modem will cease transmitting the  
25 2250 Hertz tone and start transmitting alternating carrier states A and C, the multimode modem will attempt to follow the remainder of the V.32 training sequence.

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Claims

1. A multimode modem for communicating with a variety of modem types employing different initial handshake signals comprising:
  - 5       apparatus adapted to send a sequence of signals corresponding to the variety of modem type handshake signals, the sequence terminating when the multimode modem receives an appropriate response identifying a particular one of the variety of modem types; and
  - 10       apparatus to simultaneously determine the particular type of modem from the received signal.
2. The multimode modem of claim 1 wherein the variety of modem types include V.32 and V.22bis.
3. The multimode modem of claim 2 wherein the V.32 signal is the first one transmitted.
4. The multimode modem of claim 1 wherein the sequence of handshake signals is employed to change operating modes at some time after an initial connection.



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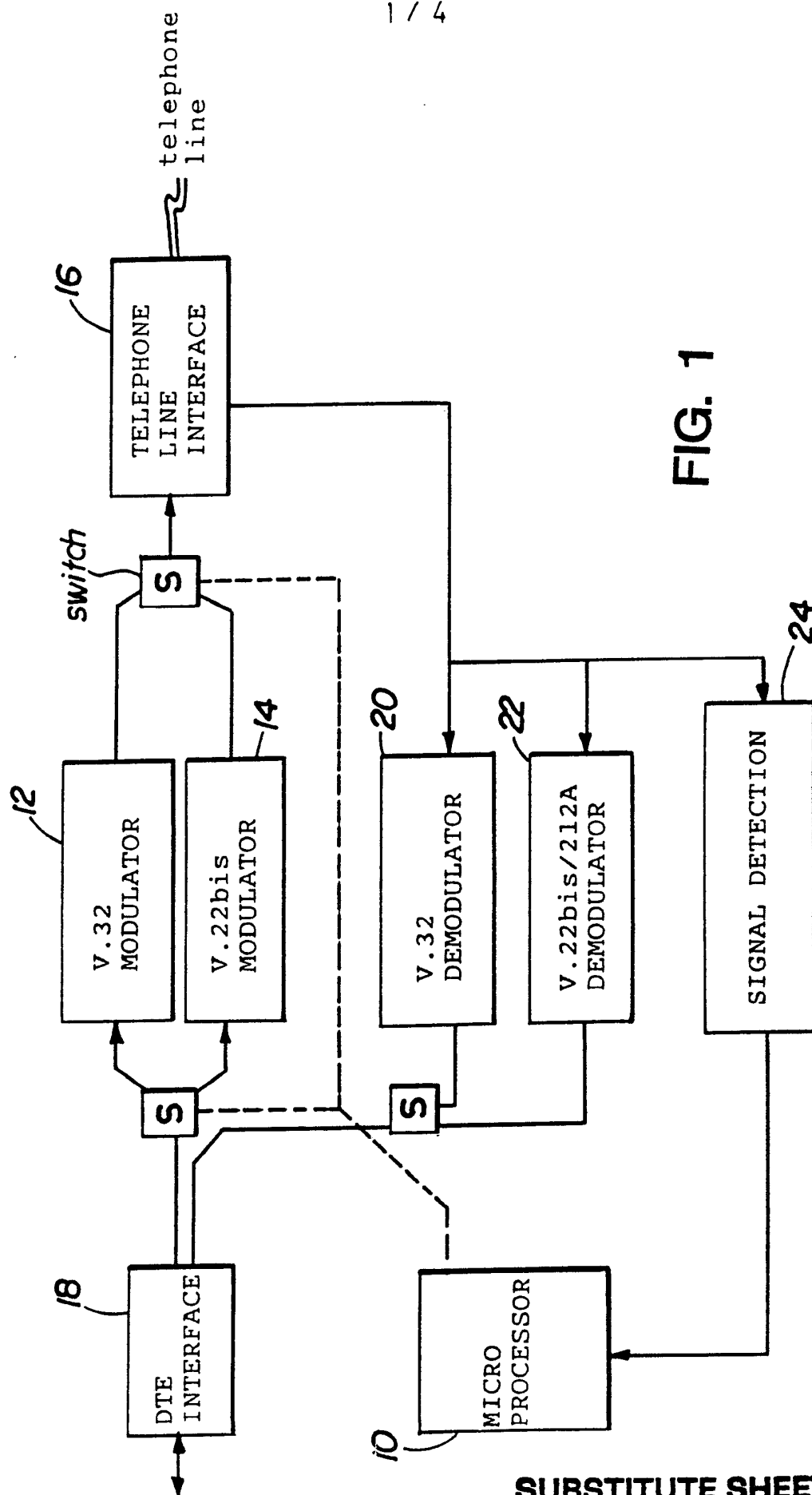


FIG. 1

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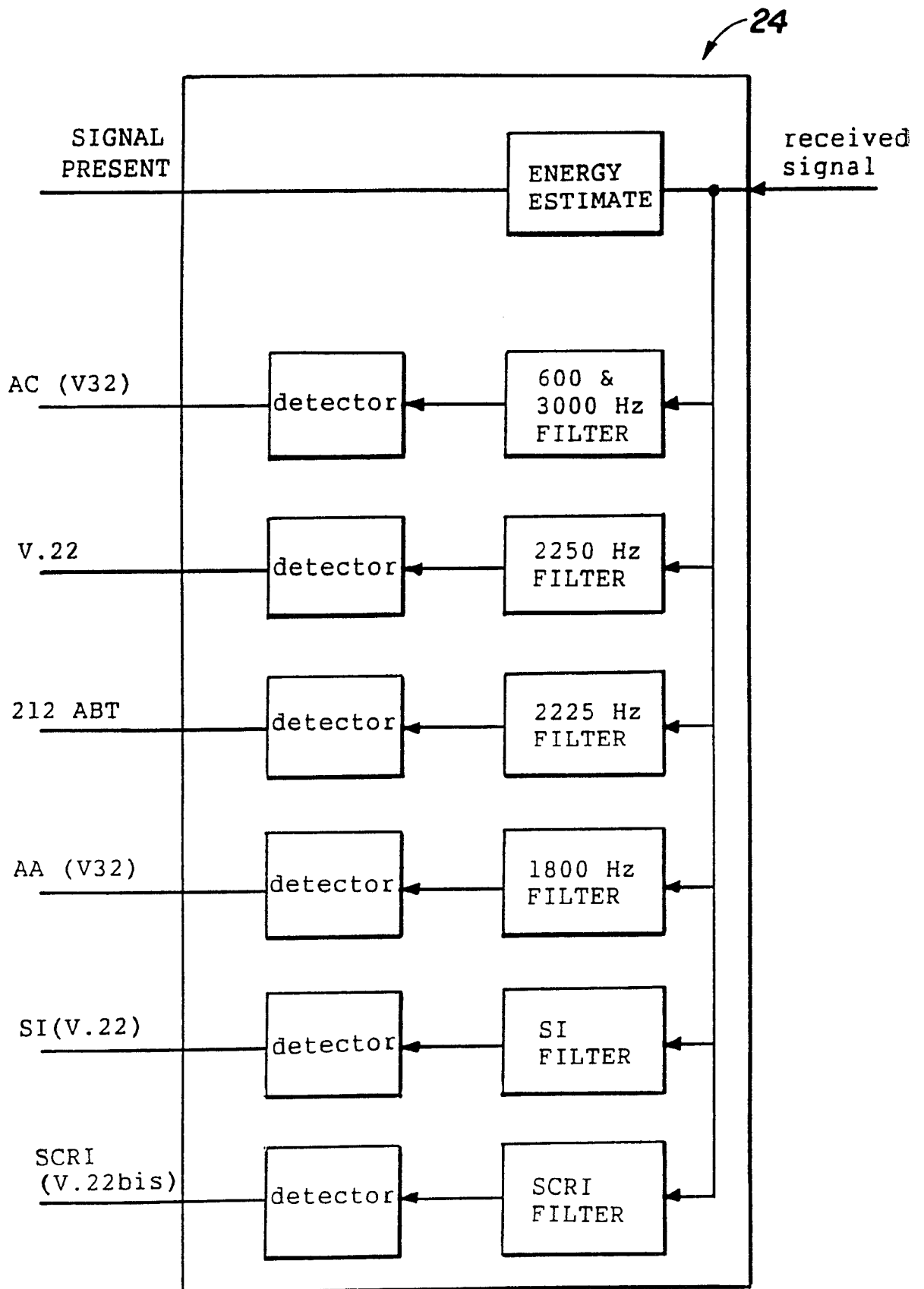


FIG. 2

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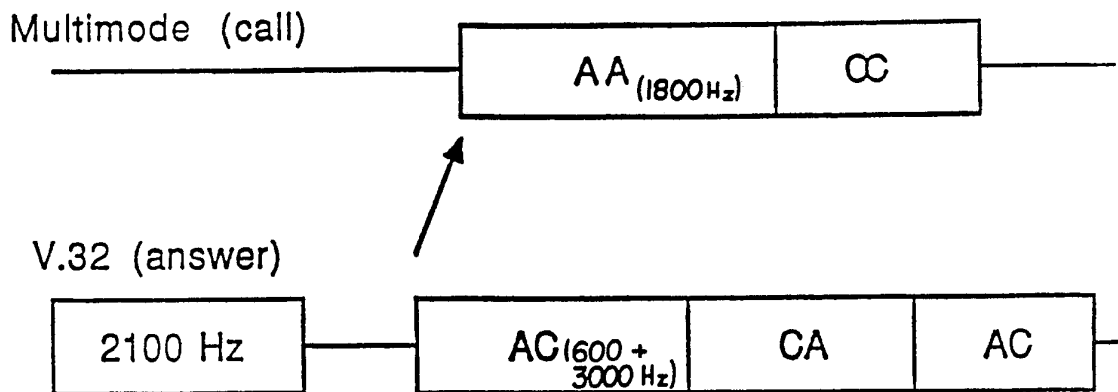


FIG. 3a

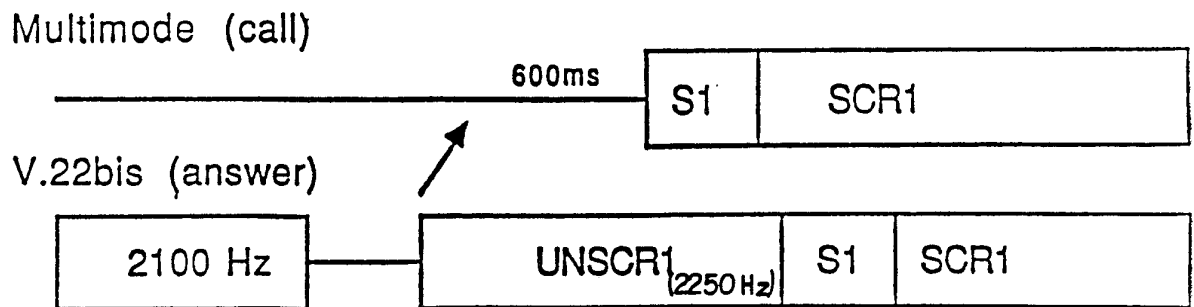


FIG. 3b

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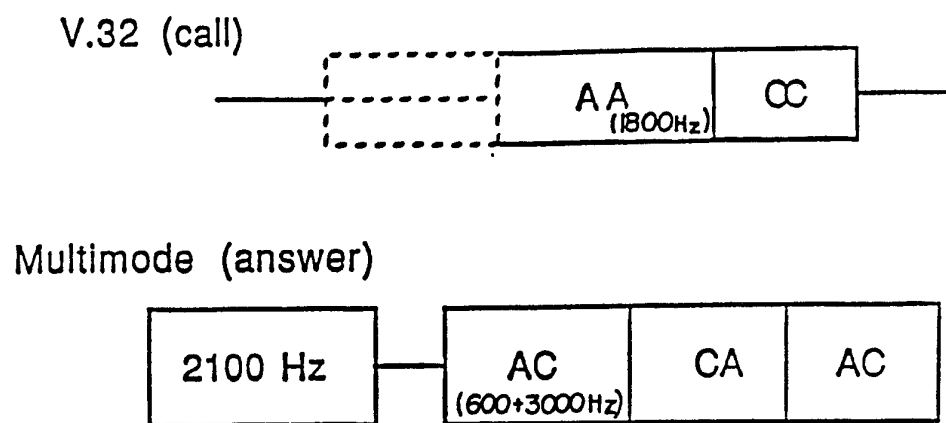


FIG. 4a

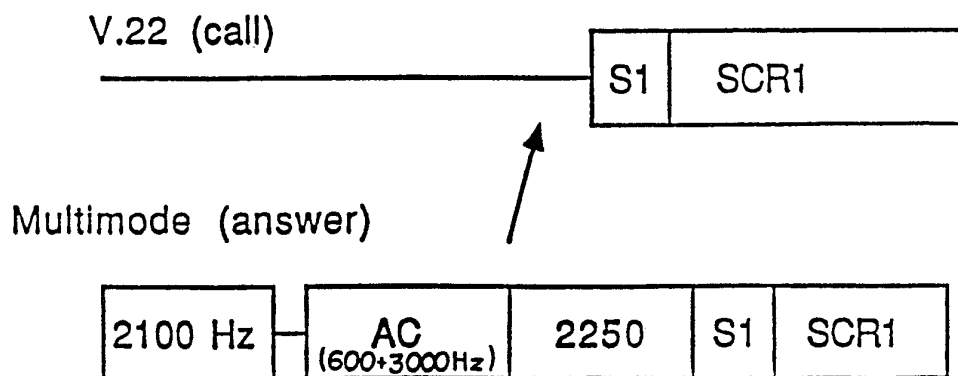


FIG. 4b

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# INTERNATIONAL SEARCH REPORT

International Application : **PCT/US89/02017**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
TNT CL 4      H04B 1/38		
U.S. CL      375/8		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
U.S.	375/ 7, 8, 9, 13, 36, 39, 121 ; 379/93, 97, 98 370/24, 31, 41, 43, 79, 110 ; 178/2R, 3	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>9</sup>		
Category, <sup>*</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X Y	US, A, 4,215,243 (Maxwell) 29 July 1980 See column 4, line 34 - column 6, line 10	<u>1, 4</u> 2, 3
Y	US, A, 4,262,360 (Bigo) 14 April 1981 See column 3, lines 10-21	2, 3
A	U S, A, 4,727,370 (Shih) 23 February 1988	
A,P	U S, A, 4,756,007 (Qureshi) 05 July 1988	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>*</sup> Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"Δ" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
31 July 1989		<b>29 AUG 1989</b>
International Searching Authority ISA/US		Signature of Authorized Officer <i>Benedict V. Safourek</i> Benedict V. Safourek

## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE<sup>1</sup>

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers \_\_\_\_\_, because they relate to subject matter<sup>12</sup> not required to be searched by this Authority, namely:

2. ☐ Claim numbers \_\_\_\_\_, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out<sup>13</sup>, specifically:

3. ☐ Claim numbers \_\_\_\_\_, because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING<sup>2</sup>

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

## Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.