DATA SET 112A-TYPE

DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section covers in general terms the physical and functional description as well as the operating procedures for Data Set (DS) 112A-type. Information concerning the Bell System or customer-provided terminal is not included. For a detailed description of the DS, refer to SD- and CD-1D168-01.

1.02 Data Set 112A-type is a portable, half-duplex (HDX) or full-duplex (FDX), frequency-shift-keyed (FSK), serial set designed for low-speed (300 baud for HDX operation and 150 baud for FDX operation) data transmission. It may be used in conjunction with a portable, mobile, or fixed teletypewriter (TTY) or any similar customer provided terminal (CPT) as an originate-only station. A typical data system station arrangement using Data Set 112A-type is shown in Fig. 1.

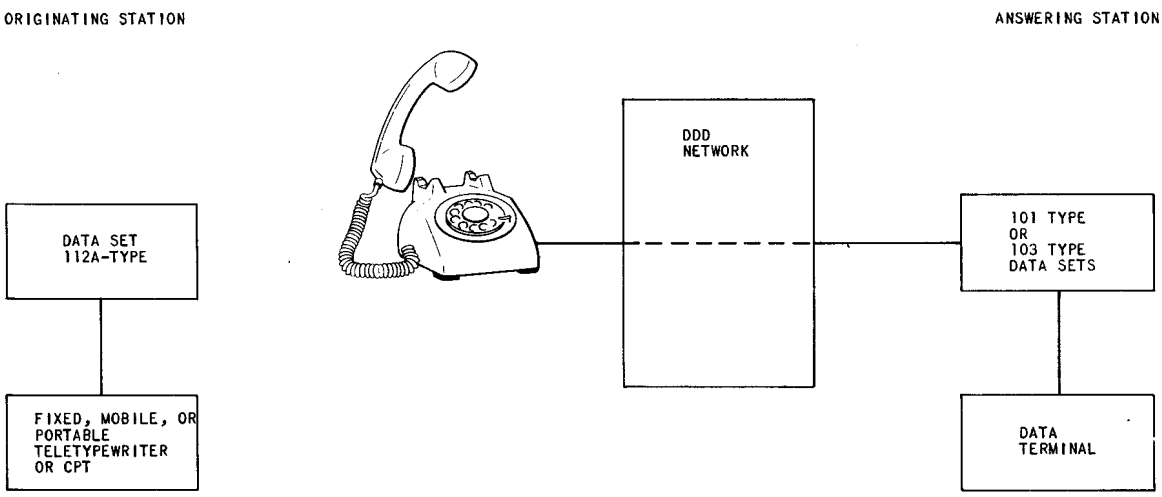

Fig. 1—Typical Data Systems Station Arrangement Line

1.03 The DS is coupled to the transmission facility acoustically rather than electrically. This may be accomplished by using those telephone handsets which are part of the 300 series, 500 series, and TRIMLINE® telephone sets. Operation of the DS is the same regardless of the handset used.

1.04 The DS input and output connections to the data terminal are interfaced with circuitry

which conforms to the Electronic Industries Association (EIA) specification RS-232-B. Power required for the DS is +16 to +24 and -16 to -24 volts dc. It is supplied either by the data terminal via the interface cable or by the 2012B transformer assembly.

1.05 Two types of the Data Set 112A-type are available for use according to the dc power source obtainable. Data Set 112A L1 (Fig. 2) is for use when the data terminal is capable of supplying the dc power necessary to operate the DS. Data Set 112A L1/2 (Fig. 3), equipped with a cable, connector, and 2012B transformer, is for use when the data terminal is not capable of supplying the dc voltages. Data Set 112A L1/2 can also be used when the dc voltages are available from the data terminal by disconnecting the 2012B transformer assembly.

Fig. 2—Data Set 112A L1

2. PHYSICAL DESCRIPTION

2.01 Data Set 112A-type (Fig. 2 and 3) is 12.88 inches wide, 9.20 inches deep, 4.60 inches high, and weighs 6.25 pounds. Control lamps and keys consist of a DATA lamp, a DATA/TEST key, and an HDX/FDX key.

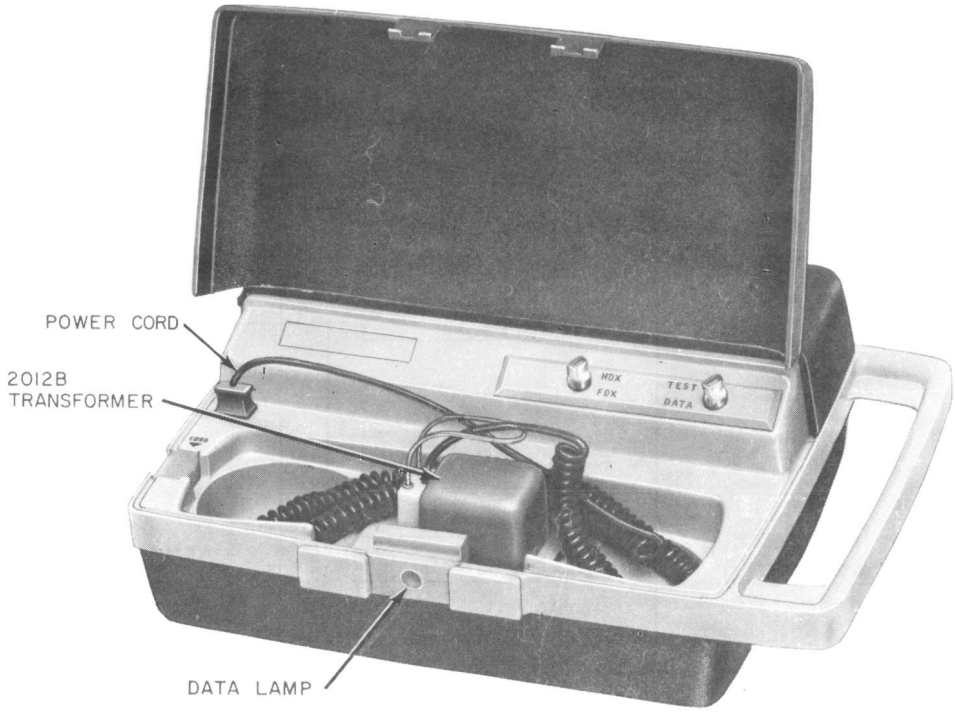

Fig. 3—Data Set 112A L1/2

3. FUNCTIONAL DESCRIPTION

General

3.01 The frequencies used by Data Set 112A-type along with the corresponding binary state of each are shown in Table A. Since the DS is an originate-only type, it will always receive data in the f_2 band and transmit data in the f_1 band (Fig. 4).

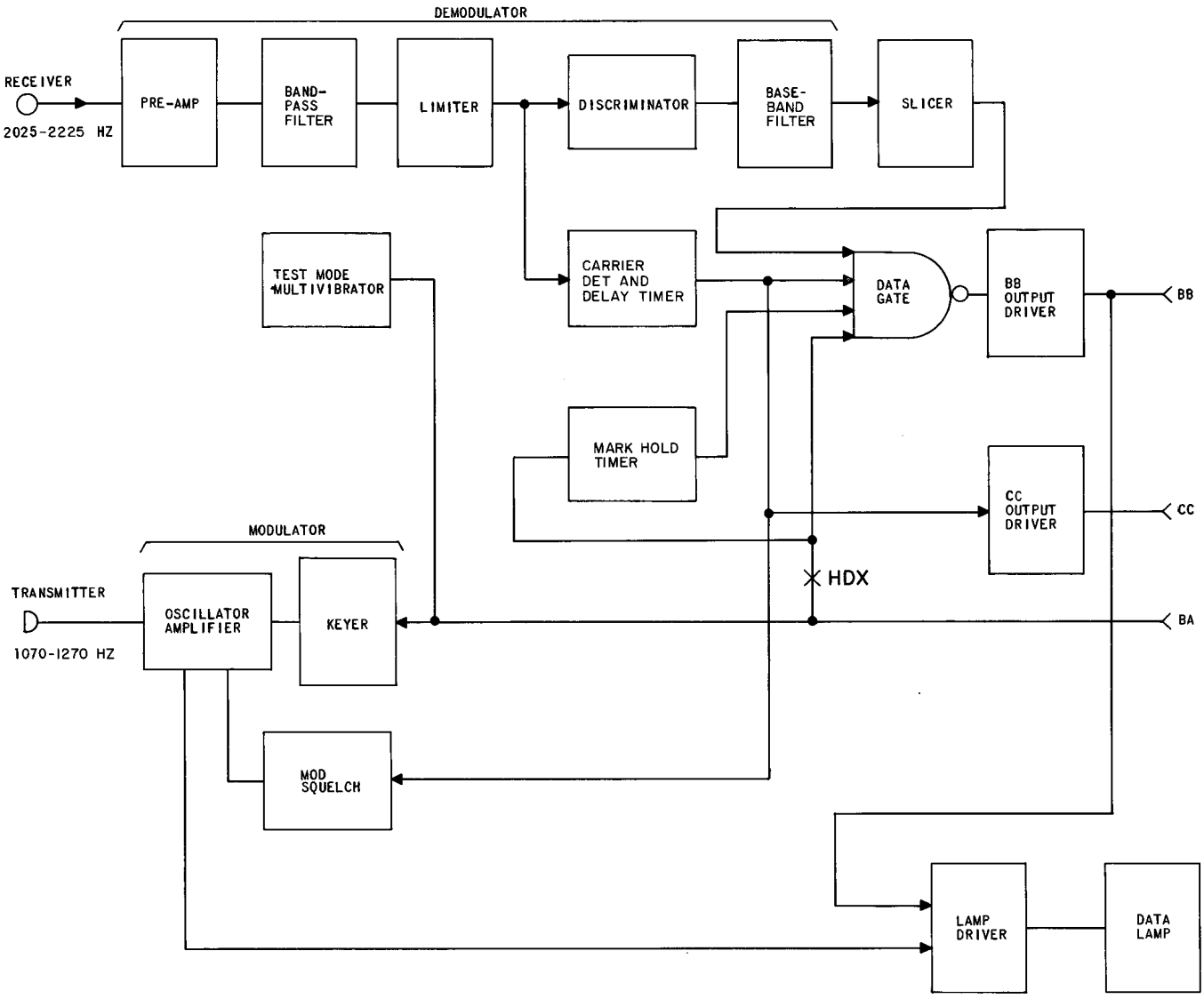

Fig. 4—Block Diagram of Data Set 112A-Type (Data Mode)

Handshaking Sequence

3.02 When a call has been originated (4.01 and 4.02) the called station, on answering the call, transmits an f_2 mark signal onto the line. The f_2 mark signal disables the echo suppressors in the transmission facility, therby permitting simultaneous bidirectional transmission of carrier. The received f_2 mark signal is acoustically coupled to the high-gain preamplifier which provides a voltage gain of 50 dB. This stage of amplification compensates for the high signal loss due to the acoustical coupling from the line to the DS.

3.03 From the preamplifier, the signal is presented to the bandpass filter. The filter will pass signals within the band of 2025 Hz to 2225 Hz. This provides rejection of received out-of-band signals. The output of the filter is coupled to the limiter which in turn feeds the discriminator and the carrier detector/delay timer.

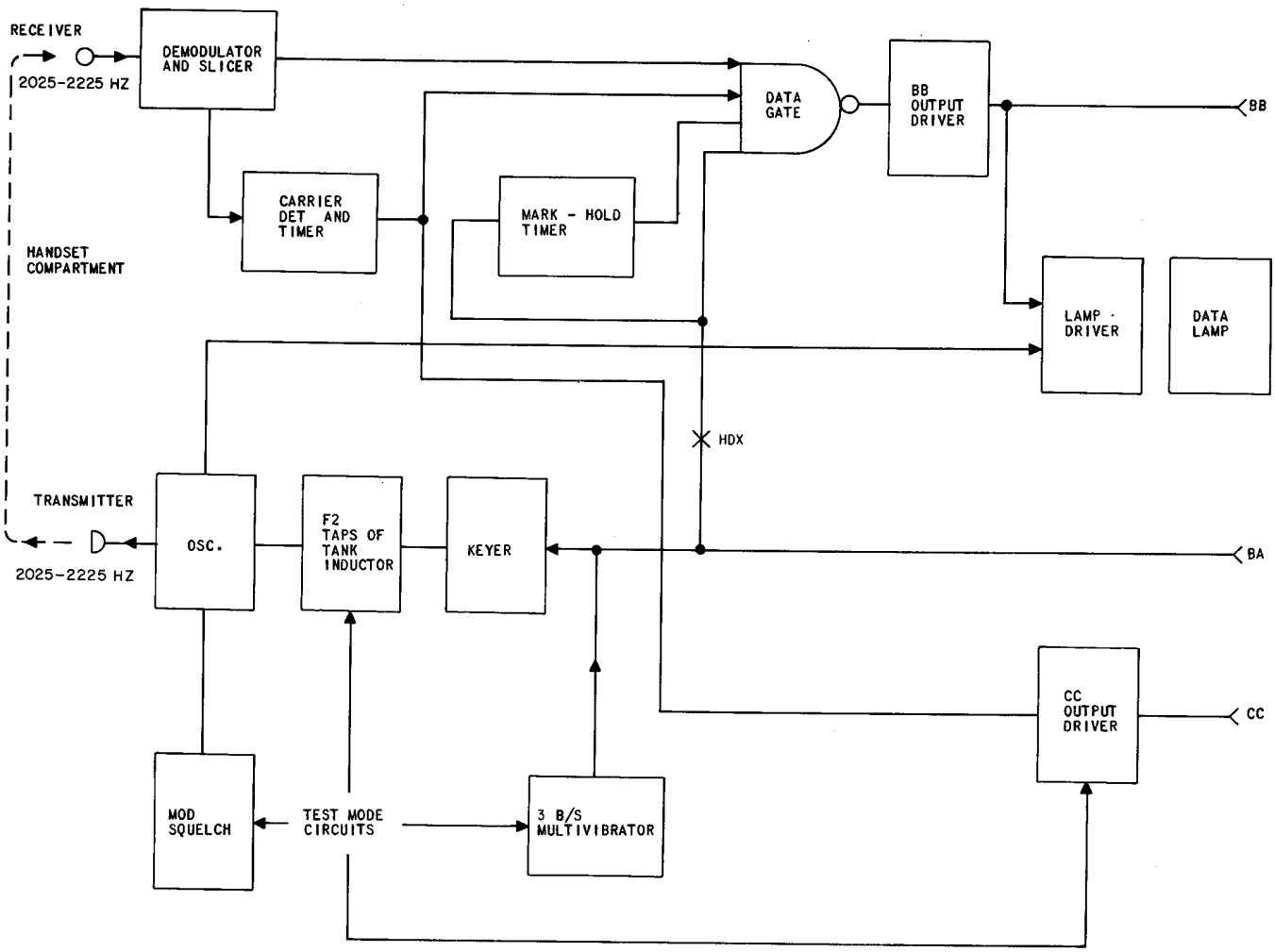

Fig. 5—Block Diagram of Data Set 112A-Type (Test Mode)

3.04 The carrier detector sensitivity is set for a nominal telephone line signal input of -40 dBm. When the f_2 mark signal level is -40 dBm or greater, it will trigger the delay timer. The timer provides a 3.5-second delay to allow the attendant to secure the telephone handset inside the DS compartment. The output of the timer simultaneously controls the modulator, data gate, and CC output driver.

3.05 When the timer has timed out, the following occurs:

(a) The CC output driver is enabled, thereby turning on the CC (data set ready) lead to inform the data terminal that the DS is ready to send or receive data.

(b) The data gate, which was maintaining a mark-hold condition on the BB lead, is unclamped thereby placing the BB lead under the control of the slicer circuit.

(c) The modulator is unsquelched causing the DATA lamp to light and f_1 mark to be transmitted onto the telephone line.

3.06 The DATA lamp will remain lighted as long as the modulator is enabled and the output of the BB output driver remains in the mark state.

3.07 Upon receipt of the f_1 mark signal, the answering station will enter the data mode and both data sets are now ready to transmit or receive data. This exchange of the f_2 and f_1 mark

signals is commonly referred to as the "handshaking sequence".

Data Transmission

3.08 Data from the data terminal is applied to the BA (send data) lead which drives the DS keyer circuit. The keyer circuit shifts the frequency of the oscillaor-amplifier in the modulator in accordance with the binary state of the data being transmitted. The output of the oscillator-amplifier drives the magnetic transmitter and the transmitted data signal is acoustically coupled to the telephone line via the telephone handset. Local copy of the transmitted data is provided by the TTY.

3.09 When the transmitter is keyed, the nonlinear characteristics of the carbon transmitter create a significant amount of second harmonics which are within the receivers bandwidth. These harmonics are coupled back into the receiver via the telephone set and cause false data to appear at the slicer circuit output. When in the HDX mode, the mark-hold circuitry is provided to hold the BB lead in the mark state as long as data is being transmitted.

3.10 When a mark-to-space transition appears on the BA lead, it not only keys the modulator but also clamps the data gate which in turn provides the mark-hold condition at the BB lead. This action overrides any false data from the slicer circuit.

3.11 When the BA lead switches from space to mark, the data gate remains clamped in the mark-hold condition due to the triggering of the 10 millisecond monopulser in the mark-hold timer circuit. This causes any false data created by propagation delay in the receive circuitry to still be ignored.

3.12 When in the FDX mode, the mark-hold circuitry is disabled and the transmitter output signal is reduced so that second harmonic interference is less effective. This permits FDX capabilities (150 baud) for stronger receive signal levels.

Data Reception (Fig. 4)

3.13 The preamplifier, bandpass filter, and limiter treat the received data signal in the same manner as they did the f_2 mark signal during the "handshaking sequence" (3.02 and 3.03). The square wave output of the limiter is demodulated by the discriminator circuit and delivered to the baseband filter.

3.14 The baseband filter is a low-pass filter which separates the carrier signal from the baseband data signal. The output of the baseband filter is a bipolar analog signal centered about 0 volt. The high-gain slicer circuit converts the analog output of the filter into digital form and presents it to the data gate. When unclamped, the data gate inverts the output of the slicer circuit. The squared-up data signal is now of the proper polarity to drive the BB output driver which in turn drives the BB lead and gates the lamp driver. The DATA lamp flashes on and off in accordance with the incoming data signal.

Call Disconnect

3.15 A call can be disconnected by either transmitting a terminating command to which the answering station will respond or by depressing the telephone set switch hook.

3.16 When the originating station transmits a terminating command, the answering station will begin a 3-second disconnect interval. During this interval, the answering station transmits f_2 spacing signal causing the originating station TTY to run open for approximately 3-seconds. At the end of the 3-second disconnect interval, the answering station will disconnect and remove the f_2 signal. The absence of the f_2 signal will cause Data Set 112A-type to revert to the inoperative state which in turn will turn off the TTY and extinguish the DATA lamp. The telephone handset may now be removed from the DS compartment and replaced on the telephone set switch hook.

3.17 When the call is disconnected by depressing the telephone set switch hook, the removal of the f_2 signal will cause Data Set 112A-type to immediately revert to the inoperative state. Data Set 112A-type, being inoperative, will turn off the TTY and extinguish the DATA lamp. The telephone handset may now be removed from the DS compartment and replaced on the telephone set switch hook. The removal of the f_1 signal that was being transmitted to the answering station will cause the answering station to disconnect automatically.

Test Mode (Fig. 5)

3.18 When the DS is switched to the test mode (4.04), the DATA lamp will be lighted and f_2 tone will be heard switching alternately from mark to space at a rate of three bits per second. The data lamp will remain lighted for 3.5 seconds or approximately ten alternations of the f_2 tone and then begin to flash off and on in accordance with the switching f_2 tone. While the DS is in the test mode, the CC lead will be in the off condition, thereby inhibiting the data terminal. This provides a means of quickly checking whether the DS is operating properly.

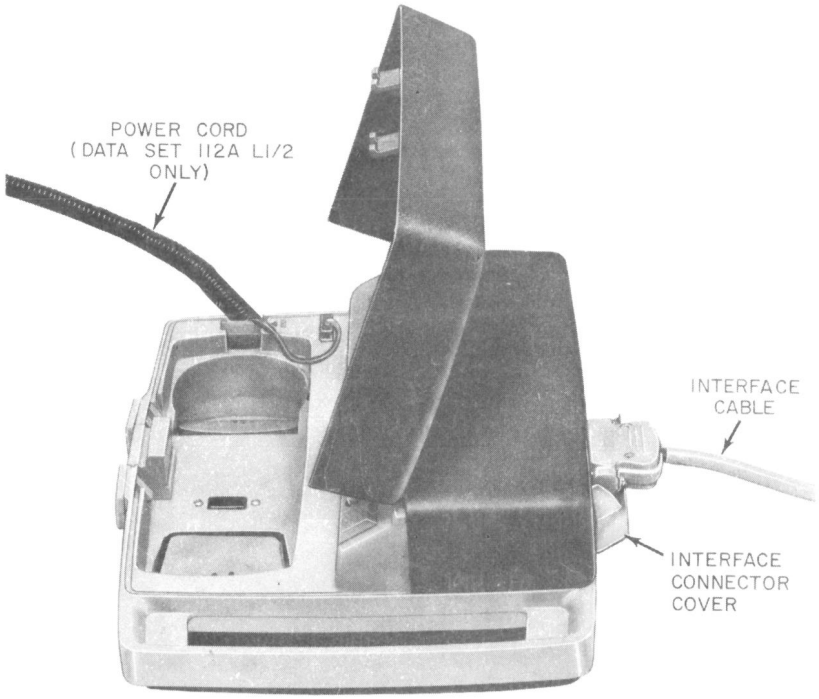

Fig. 6—Data Set 112A-Type Connections

4. OPERATION

Call Origination

Note: Before attempting to originate a call, it should be verified that the Data Set 112A-type is connected as shown in Fig. 6.

4.01 When originating a call, precondition the DS by unlatching and opening the DS telephone handset compartment. After verifying that the DATA/TEST switch is in the DATA position and the appropriate position for the HDX/FDX switch has been selected, remove the telephone handset from the switch hook and dial the number of the station it is desired to contact. Between 1 and 1.5 seconds after the answering station trips ringback, it will transmit an f_2 mark signal.

4.02 Immediately upon hearing the f_2 mark signal, the telephone handset must be placed in the DS telephone handset compartment (Fig. 7 and 8), and the handset compartment top closed and latched. When the DATA lamp lights, the system is ready for data transmission.

Call Disconnect

4.03 A call can be disconnected in either of two ways as follows:

(a) A terminating command is sent from the originating station and when the DATA lamp is extinguished, the telephone handset is removed from the DS compartment and replaced on the telephone set switch hook.

(b) The switch hook of the originating station telephone set is depressed, and the telephone handset is removed from the DS compartment and replaced on the telephone set switch hook.

Test Mode

4.04 In order to enter the test mode, the DATA/TEST key must be operated to the TEST position and the DS compartment cover closed and latched.

Fig. 7—Data Set 112A L1 With Telephone Handset in Place

Fig. 8—Data Set 112A L1/2 With Telephone Handset in Place

TABLE A

FREQUENCY ALLOCATION

BAND	BINARY STATE	FREQUENCY
f_1	Mark	1270 Hz
	Space	1070 Hz
f_2	Mark	2225 Hz
	Space	2025 Hz