ERICSSON

EDACS™ VOTER EQUIPMENT

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SCOPE

This document gives an overview of the Enhanced Digital Access Communications System (EDACS) Voter and provides general descriptions of the Voter components. Detailed descriptions of the individual equipment making up the voter can be found in separate technical manuals.

GENERAL

In many systems, particularly where low-power portable radios are used, the talk-out range of the base station is much greater than the talk-in range of the portables. This problem can be corrected by placing extra satellite receivers in geographically dispersed locations over the required coverage area, allowing at least one receiver to receive signals from the low-power radios. The satellite receivers are connected to a central point by rf paths or by telephone lines. Received signals are compared and the best received signal is forwarded on to a dispatcher and/or a repeater. The unused received signals are ignored. Comparison of the received signals is usually performed continuously so as to always be forwarding the best signal. The practice of continuously comparing and selecting one received path from an available field of several is generally called voting.

EDACS

In the EDACS voting system (Figure 1) both analog voice and digital data are transmitted over the system. Analog voting is used for clear voice transmissions. Digital voting is used for digitized voice and digital signalling.

A voter system includes the control site (both transmit and receive), a number of receive-only satellite sites, and a centrally located digital/analog voter. The system is connected with phone lines or microwave links. Two pairs are required to transfer both data and voice. Each data line must be 3002 grade or equivalent. The voice pair must be at least a voice grade line, however, the use of data grade lines for the voice pair is recommended.

The satellite sites and the control site receive signals on their rf ports and relay these signals to their corresponding digital receiver. The digital voter and the analog voter then work in parallel to vote digital and analog signals. The selector relays the voted digital messages and allows the analog voter to relay voted audio back to the control site. The GETCs provide the control functions to route voice and data appropriately at each location.

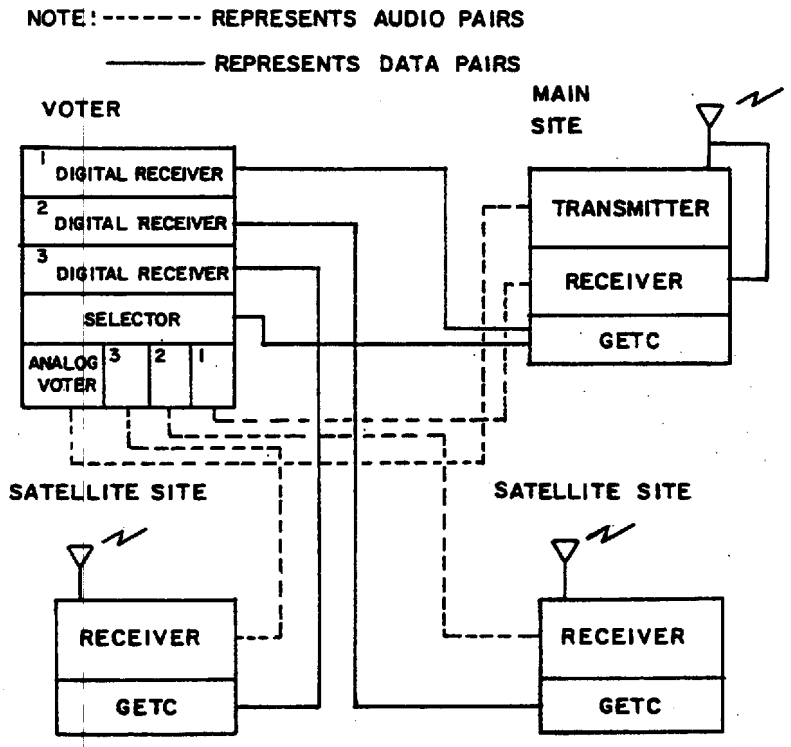
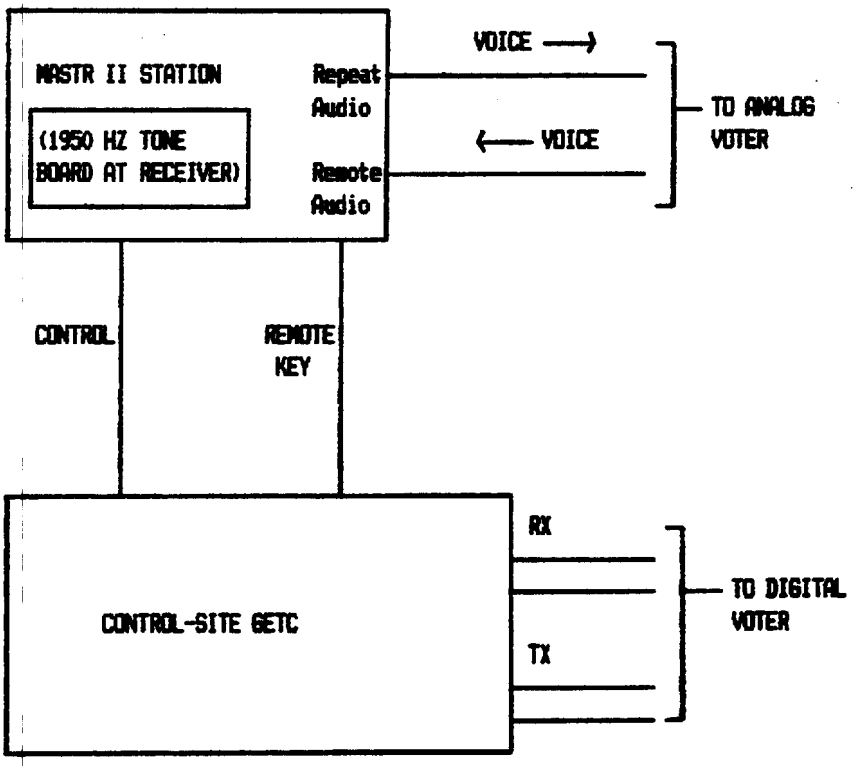


FIGURE 1 EDACS VOTING SYSTEM DIAGRAM

CONTROL SITE

Control site equipment (Figure 2) in the voting system is basically the same as in a non-voted EDACS. In a voted system, the control site maintains additional phone line communication paths with the voter. The control site must have a 1950 Hz tone board. The station communicates in full duplex with the voter over voice and data paths.



NOTE: EQUIPMENT REPEATED FOR EACH CHANNEL

FIGURE 2 - CONTROL-SITE EQUIPMENT (SINGLE CHANNEL)

The voice paths are connected to the back of the station control shelf. Repeater audio is available at the line audio pair connected to the voter, and audio from the voter is connected to the remote duplex audio input pair. In a typical application where the voter is near the station, the data paths to and from the voter are separate lines with signals at RS-232 levels.

The Control Site GETCs (those that control the rf transmit function of the EDACS system) configure themselves for either voted or single-site operation. The GETC configuration is based on the presence or absence of a clear-to-send (CTS) signal (a response from the GETC request-to-send (RTS) signal), and on the presence of continuous messaging from the voter. Once the GETCs are configured for voted operation, all working-channel messages received locally by the control-site GETCs are simply passed down to the voter. Messages received from the voter determine the GETC's call operation. Messages received by the control site's control channel are acted upon immediately, and redundant messages are discarded. If the stream of messages from the voter cease, the control site GETCs revert to a mode where they act upon locally received messages immediately, yet continue to transmit all locally received messages to the voter. If no CTS signal is received, then the control site GETCs operate in single-site mode.

Analog voice is also routed through the voter before it is repeated by the control site. In working-channel mode when the control site receives the radio's handshake dotting, it sends a key message and then begins sending received audio to the voter. (The key message tells the digital receiver to unsquelch its receiving unit.) Audio received from the voter on the remote phone line is routed to the transmitter.

A 1950 Hz tone is inserted onto the audio line by the control site. The tone is present at all times, except when the channel is assigned and both carrier and low-speed data are present. A tone detection circuit at the analog voter mutes this audio path whenever the 1950 Hz tone is present.

SATELLITE SITE

The major components at the satellite site are shown in Figure 3. Control- and working-channel rf signals are fed from the antenna to the control channel monitor mobile and the multicoupler. The multicoupler feeds the working channel receivers. Each channel receiver is connected to a GETC shelf as shown in Figure 4. The control-channel receiver is connected to a buffer board, which interfaces via a serial link to the receiver GETCs. The buffer board buffers outbound control-channel data received by the control-channel receiver and sends the data to each receiver over the serial link. Loss of control-channel data is also detected by the buffer board.

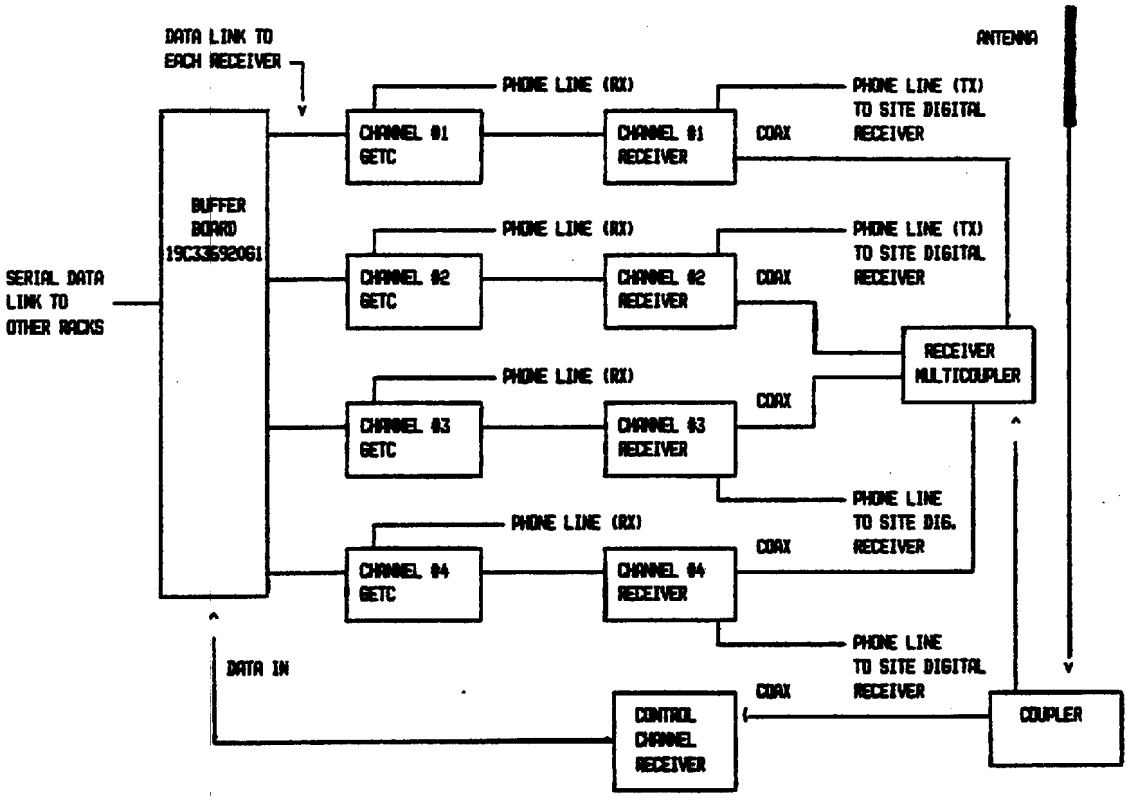


FIGURE 3 - FOUR-CHANNEL SATELLITE RECEIVER SITE

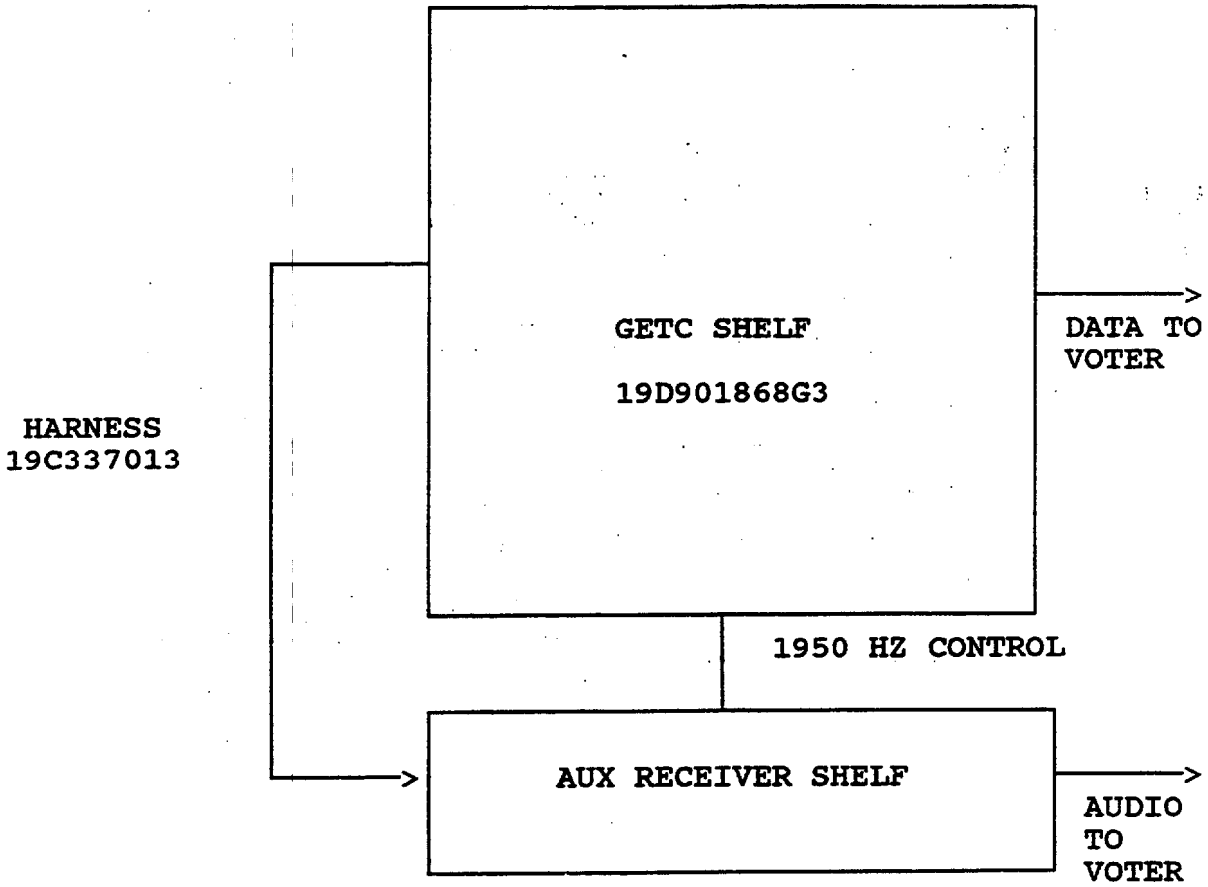


FIGURE 4 - SATELLITE SITE AUXILIARY RECEIVER

The main function of a satellite receiver is to receive and validate inbound messages and pass them to the voter as well as receive audio. The voter discards duplicate messages and votes analog and digital voice. The satellite site receives outbound control channel messages from its control channel monitor which provides operating mode, call type, and timing information. Timing information reduces the inbound control-channel message detection falsing rate.

When operating as a working channel, the working-channel satellite receiver GETCs monitor the outbound control channel messages on the Backup Serial Link (BSL). The working-channel satellite receiver GETCs search for the corresponding inbound message on the rf port. When the expected signal is detected, the message and associated voice audio (digital or analog) is relayed to the voter.

The satellite site also controls a 1950 Hz tone which is sent over the line by the channel receiver whenever the satellite site has no call in progress. This causes the analog voter to mute the receiving unit. The tone is removed upon receipt of a key message or low-speed signalling from a radio unit. The tone is turned back on upon receipt on an unkey message, or if either carrier or low-speed signalling goes away.

Control Channel Monitor

The control channel monitor at the satellite site is a mobile radio which monitors the outbound control-channel messages from the control site. This radio receives and validates the slotted outbound control messages. The messages are sent through the buffer board onto the serial link at 19.2 kilobaud to all satellite receiver GETCs located at the site.

Satellite Site GETC

The GETC shelf at the satellite receiver site receives digital messages and analog data. The GETC then sends these data on to the voter. In a voted system, there is a corresponding digital receiver (GETC) for every channel receiver (see Figure 4). The digital receivers serve different functions depending on the type of call in progress.

VOTER SITE EQUIPMENT

The voter consists of a digital voter and an analog voter. Both of these voter components are explained in the following paragraphs.

Digital Voter

A digital voter channel is comprised of multiple digital receiver GETCs (Figure 5) and one selector GETC. There is one digital receiver at each receiver site. RF messages received by the satellite sites are sent to their corresponding digital receiver GETCs. The digital receivers transfer messages to the selector. The selector discards redundant messages and transmits the other messages on to the control site GETC.

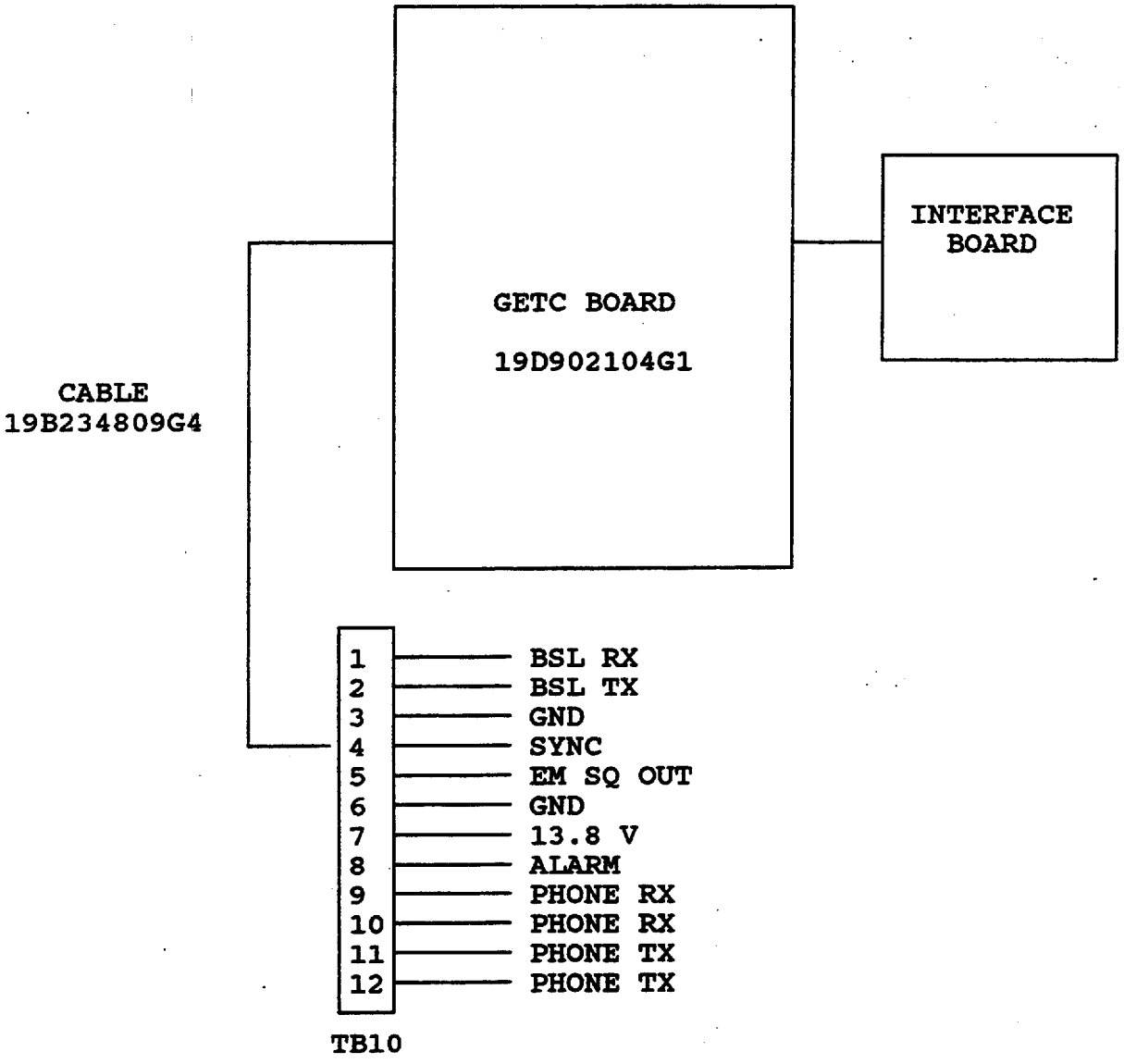


FIGURE 5 - DIGITAL RECEIVER (GETC)

In working-channel mode voting responsibility is turned over to the analog voter (once the digital portion is received) for any clear voice message. During Voice Guard, the digital receivers do bit error rate (BER) calculation on the digital data stream to determine the best signal.

Selector

The selector GETC shelf (Figure 6) receives the outputs from the digital receivers via the backup serial link and relays them to the control site. The selector performs different functions depending on the type of call in progress.

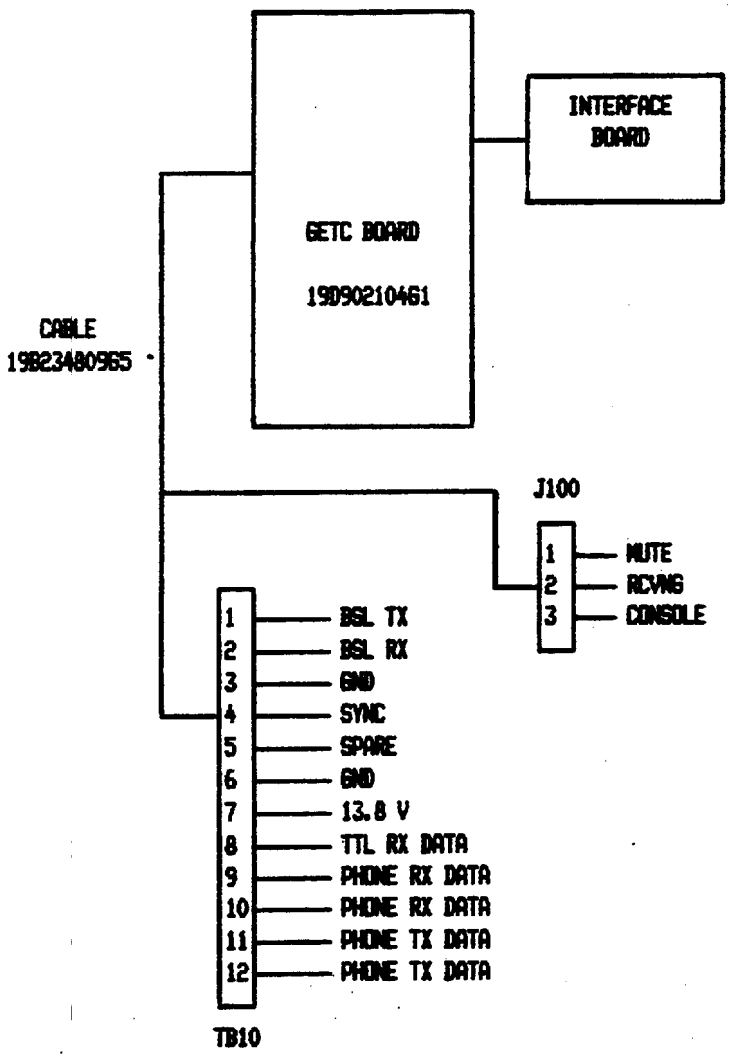


FIGURE 6 - VOTER SELECTOR (GETC)

The selector passes messages associated with clear voice and special call as they are received from the digital receivers. Status messages are sent periodically, provided no other digital messages need to be sent.

When a Voice Guard call is placed, the selector is responsible for combining the voted data frames from the digital receivers. The voted frames are sent out as a continuous stream to the control site.

During all types of calls, the selector must control the analog voter appropriately. If the selector receives an unkey, a drop message, or two status messages in a row with no low-speed data, it mutes the audio output of the analog voter. The selector also mutes the analog voter any time it detects a phone line or BSL failure. If a valid message requiring clear audio is received, the analog voter is un-muted after the message has been sent to the control site.

Analog Voter

The analog voter (voting selector) is made up of a shelf with individual receiver modules, a speaker/power supply module (see Figure 7). The voting selector provides continuous voting for satellite receivers and selects the receiver with the best audio quality. The selected audio is amplified and applied to the selector speaker and to the phone lines.

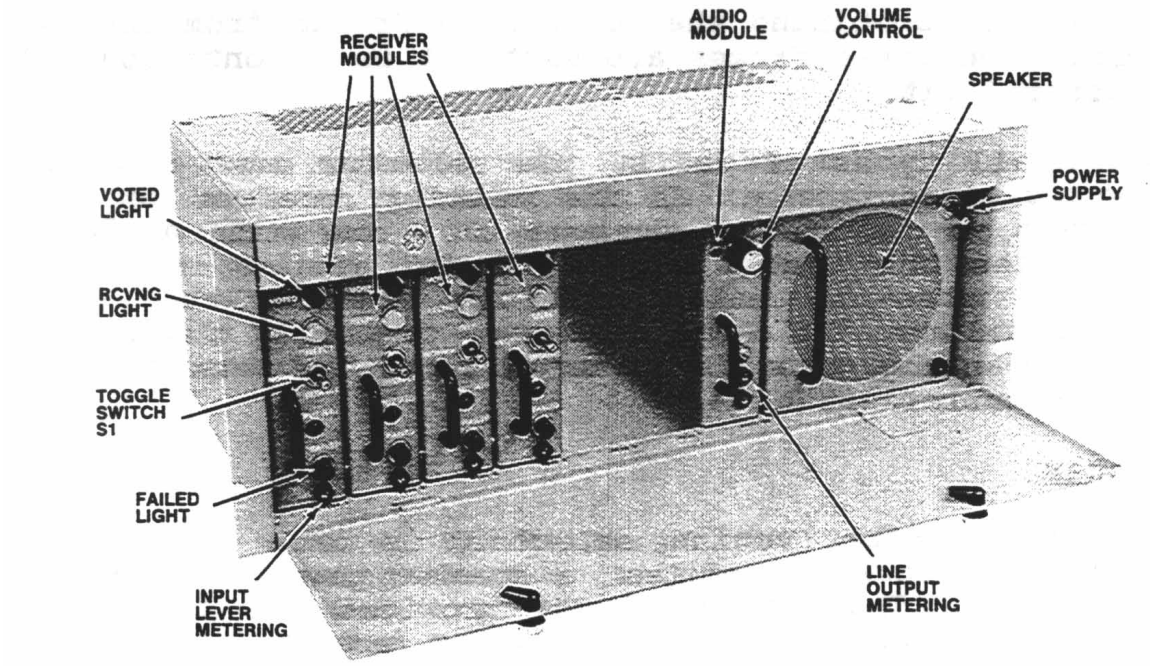


FIGURE 7 - ANALOG VOTER

A complete description of the analog voter can be found in LBI-30002, Maintenance Manual for Voting Selector Panel.

CONSOLE INTERFACE BOARD (19D438451G1)

The console interface board is mounted behind the analog voter and contains a 2175 Hz tone generator, a 2175 Hz tone detector, and line interfaces. This board allows routing of voted and console audio with the proper Secur-it/hold tone. Further information on this board can be found in the separate maintenance manual.

BUFFER BOARD (19C336920)

The Buffer board is located in the Satellite Receiver rack and interfaces between the control-channel receiver and the GETC shelves. The board monitors the data stream of control-channel messages and outputs an alarm if one or both of the data streams is missing. Further information on this board can be found in the separate maintenance manual.

VOTER INTERFACE BOARD (19D438470G3)

The Voter Interface Board does the level shifting necessary to allow the GETCs to control the E & M squelch of the associated analog receiver. Additional information on the Voter Interface Board can be found in the separate maintenance manual.

GETC INDICATOR DEFINITIONS

Each GETC shelf has a row of seven LED indicators across the front panel. The pattern of lit indicators shows the function or state of the GETC. The following sections describe the indicator states for different GETC applications within the voter system. Detailed information on the GETC shelf assembly can be found in the separate GETC maintenance manual.

CONTROL SITE GETC

A list of indicators and their functions for the control-site GETC are listed in Table 2.

TABLE 2 - CONTROL-SITE GETC INDICATORS

INDICATOR	DESCRIPTION
L1	BSL (BACKUP SERIAL LINK) INDICATOR - illuminated when communication is occurring on the BSL, such as in failsoft operation. When the indicator is off, GETC communications occur over the site controller serial link(s).
L2	REMOTE KEY - Indicates remote phone line audio is being routed to the transmitter.
L3	SYNTHESIZER LOAD (800 MHz only) - normally off.
L4	SYNTHESIZER LOAD (800 MHz only) - normally off.
L5	SYNTHESIZER LOAD (800 MHz only) - normally off.
L6	LOW SPEED DATA ENABLED - used with indicator L7 to indicate control channel mode. Unassigned working channel has LED off. Assigned voice channel has LED on.
L7	HIGH SPEED/VOICE PATH INDICATOR - illuminated when GETC is transmitting high-speed data. Indicator is off when repeating clear voice on working channel.

The various operating states for the Control site GETC are listed in Table 3. The pattern of illuminated indicators identify the operating state. Operating states listed in Table 3 are for normal trunking.

TABLE 3 - NORMAL TRUNKING STATES

MODE	INDICATORS ON						
	L1	L2	L3	L4	L5	L6	L7
WC IDLE							X
WC ASSIGNED CLEAR VOICE						X	
WC ASSIGNED DATA/VG						X	X
WC ASSIGNED REMOTE CLEAR VOICE		X				X	
WC ASSIGNED REMOTE DATA/VG		X				X	X
CONTROL CHANNEL						X	X

NOTES

X = INDICATOR ON
VG = VOICE GUARD
WC = WORKING CHANNEL

Operating states for the Control site GETC during failsoft operation are listed in Table 4.

TABLE 4 - FAILSOFT STATES

MODE	INDICATORS ON						
	L1	L2	L3	L4	L5	L6	L7
WC IDLE	X						X
WC ASSIGNED CLEAR VOICE	X					X	
WC ASSIGNED DATA/VG	X					X	X
WC ASSIGNED REMOTE CLEAR VOICE	X	X				X	
WC ASSIGNED REMOTE DATA/VG	X	X				X	X
CONTROL CHANNEL	X					X	X
CONVENTIONAL FAILSOFT IDLE	X					X	X
CONVENTIONAL FAILSOFT ASSIGNED	X					X	
CONVENTIONAL FAILSOFT ASSIGNED REMOTE	X	X				X	

NOTES

X = INDICATOR ON
VG = VOICE GUARD
WC = WORKING CHANNEL

SATELLITE-SITE GETC

A list of indicators and their functions for the satellite-site GETC are listed in Table 5.

TABLE 5 - SATELLITE-SITE GETC INDICATORS

INDICATOR	DESCRIPTION
L1	READY - GETC is functioning and ready to send and receive messages.
L2	CONTROL/WORKING CHANNEL INDICATOR - illuminated when GETC is operating in the working-channel mode. Off when the GETC is in the control-channel mode.
L3	NOT USED
L4	CHANNEL ALARM - illuminated during a test call and remains on if the channel has failed.
L5	NOT USED
L6	NOT USED
L7	NOT USED - Not used in standard system but operational in simulcast.

The various operating states for the Satellite Site GETC are listed in Table 6. The pattern of illuminated indicators identify the operating state.

TABLE 6 - SATELLITE SITE GETC NORMAL TRUNKING STATES

MODE	INDICATORS ON						
	L1	L2	L3	L4	L5	L6	L7
WC IDLE	X						X
WC ASSIGNED	X					X	X
CONTROL CHANNEL	X	X				X	

NOTES

X = INDICATOR ON
WC = WORKING CHANNEL
L3 THRU L4 INDICATE SYNTHESIZER LOADING (800 MHZ)
L4 INDICATES TEST CALL FAILURE

DIGITAL-RECEIVER GETC

A list of indicators and their functions for the digital-receiver GETC are listed in Table 7.

TABLE 7 - DIGITAL-RECEIVER GETC INDICATORS

INDICATOR	DESCRIPTION
L1	READY - Software ready indicator.
L2	CONTROL CHANNEL INDICATOR - lights when this channel is a control channel. Default mode is working channel (indicator off). Also, illuminated when digital receiver is receiving Voice Guard frames from the satellite site receiver.
L3	VOICE GUARD - lights when transmitting Voice Guard data to selector.
L4	ENABLED - indicates digital receiver mode power up enabled by the selector. (If the Digital Receiver is reset without the Selector going through a power-up poll, the indicator will be off. This does not affect the operation of the Digital Receiver.)
L5	Lights when Voice Guard call has a bit error code in the range of 0-3%.
L6	Lights during a Voice Guard call when the bit error rate is between 3 and 4.5%.
L7	On during a Voice Guard call with a bit error rate greater than 4.5%.

NOTE

If the digital receiver detects a phone line failure, L3 will flash at a half-second rate until line integrity is restored. A failure is determined by lack of activity on the phone line for eight seconds or more while no call is in progress. System site IDs are sent during inactive periods to track line integrity.

SELECTOR GETC

A list of indicators and their functions for the selector GETC are listed in Table 8.

TABLE 8 - SELECTOR GETC INDICATORS

INDICATOR	DESCRIPTION
L1	READY - GETC is functioning and ready to send and receive messages.
L2	CONTROL CHANNEL INDICATOR - illuminates when this channel is a control channel. Default mode is working channel (indicator off).
L3	VOICE GUARD - used in VoiceGuard applications to indicate VoiceGuard data is being transmitted to the control site. Also, lights when a message is transmitted to the control site.
L4	NOT USED
L5	SELECTOR INDICATOR - illuminates when GETC is operating as a selector.
L6	NOT USED
L7	TRANSMITTING - illuminated during a message transmit to the control site.

ANALOG VOTER INDICATORS

The analog voter consists of six receiver modules and one audio module per shelf. The receiver modules have three indicator lights and the audio module has no indicators. The receiver indicators are described below in Table 9.

TABLE 9 - ANALOG VOTER INDICATORS

INDICATOR	DESCRIPTION
VOTED (GREEN)	Indicates which site is the voted site whose audio is being repeated.
RECNG (YELLOW)	Indicates the site is receiving audio which will be voted. Controlled by 1950 Hz tone or GETC.
FAILED (RED)	Indicates a phone line integrity problem after approximately 15 seconds of failure. This indicator is disabled during long data transmissions, as data appears as a failure to the detect circuitry.

GETC CONFIGURATION

On each GETC shelf there are three eight-section DIP switches. These switches must be set correctly on each shelf to insure correct system operation. In some cases, failure to configure the switches correctly will result in loss of the use of the associated site. Note that the settings will be different from one shelf to the next, even if these shelves are performing the same system function, i.e. digital receiver. Switch settings for GETCs used in voter applications are described here, additional information is available in the GETC Maintenance Manual.

MAIN AND SATELLITE SITE GETC SWITCH SETTINGS

The function for each of the control-site GETC switches is described in this section.

SWITCH 1

Sections 1 thru 7 -- Sets transmitter frequency for 800 MHz applications.

Section 8 -- Used with input P1.6 to determine if shelf is operating as main or satellite site. Place the switch in the closed position if the GETC is used at the control site. Place the switch in the open position if the GETC is used at a satellite site.

SWITCH 2

Sections 1 thru 4 -- Sets transmitter frequency.

Section 5 -- Open disables conventional failsoft.

Section 6 -- When open, enables (failsoft only) Voice Guard message trunking (VoiceGuard applications only). When closed, enables Voice Guard transmission trunking (VoiceGuard applications only).

Section 7 -- When open, enables (failsoft only) emergency message trunking. When closed, enables emergency transmission trunking.

Section 8 -- RF transmit data invert.

SWITCH 3

Sections 1 thru 5 -- Used to define channel address (Table 10). Each control site shelf at a site has unique channel address.

Section 6 -- Used when channel 27 is selected (see SPECIAL FUNCTION).

Section 7 -- Sets polarity of Control Channel re-sync pulse to Digital Sync Card in microwave multiplex. The switch is set to OPEN for SIMULCAST and CLOSED for single-site operation.

Section 8 --

CONTROL SITE: Forced failsoft is enabled when open.

SATELLITE SITE: Open sets power-up in Working Channel mode. Closed sets power-up in Control Channel mode.

GETC CHANNEL NUMBER SWITCH SETTINGS

Switch 3, sections 1 thru 5 are used to set the channel number for the control- or satellite-site GETC. These channel numbers are used by the Site Controller and System Manager when defining the system. Table 10 lists the available channel numbers and their associated switch settings.

TABLE 10 - CHANNEL NUMBER SWITCH SETTINGS

CH #	GETC SWITCH 3 DIP SWITCH SECTION (LSB) 1	2	3	4	5 (MSB)	CH #	GETC SWITCH 3 DIP SWITCH SECTION (LSB) 1	2	3	4	5 (MSB)
0	C	C	C	C	C	16	C	C	C	C	O
1	O	C	C	C	C	17	O	C	C	C	O
2	C	O	C	C	C	18	C	O	C	C	O
3	O	O	C	C	C	19	O	O	C	C	O
4	C	C	O	C	C	20	C	C	O	C	O
5	O	C	O	C	C	21	O	C	O	C	O
6	C	O	O	C	C	22	C	O	O	C	O
7	O	O	O	C	C	23	O	O	O	C	O
8	C	C	C	O	C	24	C	C	C	O	O
9	O	C	C	O	C	25	O	C	C	O	O
10	C	O	C	O	C	26	C	O	C	O	O
11	O	O	C	O	C	27	O	O	C	O	O
12	C	C	O	O	C	28	C	C	O	O	O
13	O	C	O	O	C	29	O	C	O	O	O
14	C	O	O	O	C	30	C	O	O	O	O
15	O	O	O	O	C	31	O	O	O	O	O

O = open switch position (1)
C = closed switch position (0)

VOTER

Switch setting for voter applications are described in this section.

DIGITAL RECEIVER GETC SWITCH SETTINGS

The function for each of the digital receiver GETC switches is described in this section.

SWITCH 1

Sections 1 thru 6 -- Set transmit window slot number (see Table 13).

Section 7 thru 8 -- Not used.

SWITCH 2

Sections 1 thru 8 -- Not used.

SWITCH 3

Sections 1 thru 6 -- Not used.

Section 7 -- Used to define GETC mode. The closed position places the GETC in the digital-receiver mode.

Section 8 -- Not Used

SELECTOR SWITCH SETTINGS

The function for each of the selector GETC switches is described in this section.

SWITCH 1

Sections 1 thru 8 -- Not used.

SWITCH 2

Sections 1 thru 8 -- Not used.

SWITCH 3

Sections 1 thru 6 -- Not used.

Section 7 -- Used to define shelf mode. When this switch is open, the GETC is placed in the selector mode.

Section 8 -- Not Used

GETC MODE SWITCH SETTINGS

The operating mode of the GETC is identified by the setting of GETC Switch 3, section 7. Table 12 lists the switch settings for the various GETC operating modes.

TABLE 12 - GETC MODE SWITCH SETTINGS

GETC MODE	S7
DIGITAL RECEIVER	C
SELECTOR	O

O = open switch position (1)
C = closed switch position (0)

GETC TIMING WINDOW SWITCH SETTINGS

After a digital receiver GETC takes control of the sync line, it waits a specific time before making a transmission on the BSL. This time delay prevents collisions on the BSL. Delay time is set using GETC switch 1, sections 1 thru 6. The switch settings for each available channel are listed in Table 13.

TABLE 13 - GETC TRANSMIT SLOT TIMING

CH #	GETC SWITCH 1 DIP SWITCH SECTION (LSB) 1	2	3	4	5	6 (MSB)	CH #	GETC SWITCH 1 DIP SWITCH SECTION (LSB) 1	2	3	4	5	6 (MSB)
0	C	C	C	C	C	C	32	C	C	C	C	C	O
1	O	C	C	C	C	C	33	O	C	C	C	C	O
2	C	O	C	C	C	C	34	C	O	C	C	C	O
3	O	O	C	C	C	C	35	O	O	C	C	C	O
4	C	C	O	C	C	C	36	C	C	O	C	C	O
5	O	C	O	C	C	C	37	O	C	O	C	C	O
6	C	O	O	C	C	C	38	C	O	O	C	C	O
7	O	O	O	C	C	C	39	O	O	O	C	C	O
8	C	C	C	O	C	C	40	C	C	C	O	C	O
9	O	C	C	O	C	C	41	O	C	C	O	C	O
10	C	O	C	O	C	C	42	C	O	C	O	C	O
11	O	O	C	O	C	C	43	O	O	C	O	C	O
12	C	C	O	O	C	C	44	C	C	O	O	C	O
13	O	C	O	O	C	C	45	O	C	O	O	C	O
14	C	O	O	O	C	C	46	C	O	O	O	C	O
15	O	O	O	O	C	C	47	O	O	O	O	C	O
16	C	C	C	C	O	C	48	C	C	C	C	O	O
17	O	C	C	C	O	C	49	O	C	C	C	O	O
18	C	O	C	C	O	C	50	C	O	C	C	O	O
19	O	O	C	C	O	C	51	O	O	C	C	O	O
20	C	C	O	C	O	C	52	C	C	O	C	O	O
21	O	C	O	C	O	C	53	O	C	O	C	O	O
22	C	O	O	C	O	C	54	C	O	O	C	O	O
23	O	O	O	C	O	C	55	O	O	O	C	O	O
24	C	C	C	O	O	C	56	C	C	C	O	O	O
25	O	C	C	O	O	C	57	O	C	C	O	O	O
26	C	O	C	O	O	C	58	C	O	C	O	O	O
27	O	O	C	O	O	C	59	O	O	C	O	O	O
28	C	C	O	O	O	C	60	C	C	O	O	O	O
29	O	C	O	O	O	C	61	O	C	O	O	O	O
30	C	O	O	O	O	C	62	C	O	O	O	O	O
31	O	O	O	O	O	C	63	O	O	O	O	O	O

O = open switch position (1)
C = closed switch position (0)

PHONE LINES AND TEST TONE LEVELS

The following paragraphs provide information on the characteristics of phone lines used in a voted system.

SYSTEM ALIGNMENT LEVEL.

The System Alignment Level is the maximum level that can be put through the phone lines without limiting. The telephone company will specify the system alignment level. The level will be specified in Volume Units (VU), test tone, or TLP. A volume unit (VU) is average voice which is generally considered to be 10 dB below system alignment level. Test tone is normally given in dBm and is equal to the system alignment level.

NOTE

> Some telephone companies refer to average voice as test tone. These telephone companies have a figure that is called TLP. The TLP level is 3 dB above the system alignment level referred to in this document. In a number of cases the user will provide wires within the building or a complex of buildings. Normally, these wires are short and involve very little loss. If this is the case, a system alignment level of 10 dBm is appropriate.

PHONE LINE GRADES

All phone lines carrying data must be type 3002 data-grade lines without additional conditioning. There is a separate system alignment level for data-grade lines and voice-grade lines.

Type 2000 voice grade lines are sufficient for voice channels with the following exception. The 1950 Hz tone must arrive at the voter at a level not less than -30 dBm. This can cause difficulties. For instance, if you order a voice grade line and don't specify the loss, you would normally get a line with 10 dB of loss at 1000 Hz. The 1950 Hz loss will normally be 8 dB more than at 1000 Hz. By adding the 4 dB long-term variation and the 3 dB short-term variation the worst case 1950 Hz loss would be 25 dB. It then follows that you cannot send any lower than -5 dBm. If the phone company will not allow you to send continuous tone as high as -5 dBm, then you will have to ask for a lower loss circuit or add conditioning.

RECOMMENDATIONS FOR VOTING

Whenever possible, order voice lines for a voting system that have the same type with similar characteristics. This will help prevent changes in pitch and intensity as a signal is voted between sites.

VOTER/STATION ALIGNMENT

This procedure is for use as a guide to aligning an EDACS in the field. This procedure may also be used as a test for some of the important parameters associated with the stations and GETCs.

PRELIMINARY SETUP

1. Turn the DELAY TIMER on the Repeater Control board counterclockwise to its minimum value.

2. Turn the LIMIT TIMER on the Repeater Control board clockwise to its maximum value.

3. For 800 MHz only. Be sure switches S1-1 thru S1-7 and S2-1 thru S2-4 on the GETC are set properly for the station transmit frequency. See the GETC application manual for information on setting these switches.

4. Set switches S3-1 thru S3-5 on the GETC for the proper channel number.

EQUIPMENT REQUIRED

- Audio Oscillator, HP 204D or similar
- Digital Multimeter (with dB scale), Fluke 8050A or similar
- Signal Generator, HP 8640B or similar
- Communication System Analyzer, IFR FM/AM-1200S or similar

TEST PROCEDURE

Perform the following tests in sequence.

Deviation Setting

1. Disconnect the GETC oscillator jumper J30 from position 2-3 (it may be placed in position 1-2 for storage).

2. Inject a 1 kHz tone at 33 mV rms (through a 22 uF capacitor) into the Mic Preamp input. Connect the + end of the capacitor to TB1201-4. Connect the audio generator to the - side of the capacitor and to TB1201-3. Set the LOCAL MIC control on the 10 Volt Regulator board to maximum (fully clockwise).

3. Key the transmitter by connecting the PTT lead (TB1201-2 on the backplane board) to ground.

4. Adjust the audio modulation limiting control on the exciter board (R104 for 400 MHz, R52 for 800 MHz) to produce 3750 Hz ±100 Hz deviation.

5. Unkey the transmitter and remove the input audio. Set the LOCAL MIC control on the 10 Volt Regulator board to its mid-range position.

Level Adjustments

1. Connect an on-frequency rf signal at a 100 microvolt level to the receiver antenna jack. Modulate this signal with a 1 kHz tone to produce a deviation of 3000 Hz.

2. Verify the transmitted tone is 1000 Hz and adjust the REP TX LEVEL on the Repeater Audio board to produce 3000 ±100 Hz deviation in the transmitted signal. Note: It may be required to turn the injected rf off and then back on to cause the station to transmit once the transmitter-limit timer has expired.

3. Establish a system alignment level. (See discussion of phone lines and system alignment levels.)

4. Terminate the four-wire receive audio output (TB1201-10 & 11 on the control shelf backplane board) with a 600-ohm load in parallel with a high-impedance audio level meter. (If attached in the system, this connection may already provide a 600-ohm load.) Adjust the LINE OUTPUT control on the control shelf Audio board for an output level 10 dB below the voice-grade telephone line system alignment level.

5. In a voting configuration, verify the presence of the 1000 Hz tone on the front jacks of the analog voter's receiver card. Connect the audio level meter to these front jacks and adjust the control to obtain a -20 dBm level.

6. In a voting configuration, connect the audio level meter to the station line input (TB1201-17 & 18). Switch off the main power supply to the digital voter. Verify that the appropriate analog receiver module's yellow and green lamps are lit.

NOTE

When the receiver module enters a failed condition (caused by it seeing a constant level), it may be necessary to force the selection of the main site receiver module or ground the FAILURE DISABLE jacks on the rear of the voter.

7. Adjust the control on the analog voter audio module to set the analog voter output level. The voter output should be 10 dB below the voice-grade telephone line system alignment level (measured at the line input of the station). Restore power to the voter GETCs.

8. Raise the input deviation to 5.0 kHz. Verify the output deviation is 3500 ±200 Hz.

9. Remove the input signal and verify that the station unkeys. Apply the input signal again and verify that the station keys.

10. Key the transmitter. Measure the transmitter output frequency. It must be within 500 Hz of the specified frequency or within ±1 ppm (whichever is less).

11. Key the transmitter. Measure the transmitter rf power output level. It must be 100 ±5 watts. If necessary, adjust the power control on the power amplifier assembly. Measure the power output of the combiner to be sure it is within the combiner specifications.

12. Disconnect the receiver test equipment.

Transmitter Compression And Deviation

1. Apply a 1000 Hz tone to the four-wire transmit audio input at TB1201-17 & 18 on the control shelf backplane board. Set the level 6 dB below the voice-grade telephone line system alignment level.

2. Connect an audio level meter to pin P8-6 with respect to chassis of the station receiver/exciter door. This point measures the level of the audio being fed to the transmitter.

3. Set the LINE INPUT level and the REM TX level on the control shelf Audio board to their maximum (fully clockwise) positions.

4. Key the transmitter with the REM PTT switch and note the meter reading. Continue to key the transmitter and slowly turn the LINE INPUT control in the counterclockwise direction until the level meter reads 1 dB lower. This sets the threshold level of the compression amplifier to about 5 dB below system alignment level. The normal system alignment level will operate about 5 dB into compression.

5. Turn the REM TX control fully counterclockwise, then while keying the transmitter, turn it slowly clockwise until the transmitter carrier is deviated 3000 Hz ±100 Hz.

6. Note the reading on the audio level meter. Continue to key the transmitter, and turn the REM TX control again in the clockwise direction until the audio level meter reading increases 6 dB. Confirm the transmitter carrier deviation does not exceed 3850 Hz.

7. Unkey the transmitter and disconnect all test equipment. Return GETC jumper J30 to its normal position (2-3) and re-connect all cables.

High-Speed Data Output Level

1. Force this channel to transmit high-speed data. This may be accomplished by turning all other channels off or configuring the channel as the control channel through the system manager. This may also be accomplished by making a Voice Guard transmission on the channel (if possible).

2. Confirm the deviation produced by the high-speed data is 3000 Hz (±100 Hz). If necessary, adjust R31 on the GETC board.

Low-Speed Data Output Level

1. Force this channel to assume operation as a working channel.

2. Key into this channel from a portable or mobile with no modulation.

3. Confirm the deviation produced by the low-speed data is 750 Hz (±100 Hz). If necessary, adjust the LOW SPEED MODULATION LEVEL (CHANNEL GUARD MODULATION LEVEL) control on the receiver/exciter door.

1950 Hz Level (Voter)

1. Terminate the four-wire receive audio output (TB1201-10 & 11 on the control shelf backplane board) with a 600-ohm load in parallel with a high-impedance audio level meter. (If attached in the system, this connection may already provide a 600-ohm load.)

2. Confirm the presence of a 1950 Hz tone at 10 dB below the voice system alignment level. If necessary, adjust the level control on the top of the 1950 Hz tone card.

Modem Level Adjustment (Voter)

This test sets the modem levels for a station remotely located from the voter in a voting configuration.

1. Set the level on J6-8 and J6-9 by adjusting R2 (PH TX ADJ) on the GETC. Adjust the level 10 dB below the data-grade line system alignment.

2. Adjust R2 on the applicable Digital Receiver GETC in the voter in a similar manner.

3. Adjust R1 (PH RX ADJ) on the GETC for 0.11 volt rms measured on U18-1.

4. Adjust R1 on the applicable Digital Receiver GETC in the voter in a similar manner.

SATELLITE RECEIVER FIELD ALIGNMENT PROCEDURE

SETUP

1. Be sure the "Voter Monitor" personality is loaded into Control Channel Mobile.

2. Set channel number on GETC switches S3-1 thru -5 per Table 10, Channel Number Switch Settings.

3. Close switch S1-8 on each GETC.

TX DATA OUT

4. Be sure 600-ohm phone line is connected to TB10-1 & 2 on the GETC. Either Rockwell Modem data or RS-232 data should be on the line. If Rockwell Modem data is used, set level with R2 (RED) on the GETC to 0 dBm or 10 dB below the system alignment level. If the satellite receiver is configured for RS-232 data, no level setting is required, but verify the presence of +/- 12V data level at TB10-1 & 2.

AUDIO OUT

5. Be sure 600-ohm phone line is connected to TB1-1 & 2 on the receiver.

6. Apply an on-frequency 100 microvolt RF signal from a signal generator thru the multicoupler, if present. Modulate the signal with 1000 Hz at 3 kHz deviation.

7. Hold the GETC RESET switch to kill the 1950 Hz tone.

8. Adjust the 1000 Hz line level at TB1-1 & 2 to 0 dBm or 10 dB below system alignment level with R936 on the Receiver System Board. Release the RESET switch.

1950 HZ LEVEL

9. Remove the RF signal. Set the 1950 Hz level per PREFERRED METHOD or ALTERNATE METHOD found in the ADJUSTMENT PROCEDURE section of LBI-30002. The 1950 Hz tone level will be approximately -3 dBm at the satellite site.

NOTE

> In normal operation, the MAJOR ALARM light on the Mobile Buffer board is OFF, L1 & L7 are lit on all GETCs, L2 will be lit on one GETC (control channel).

VOTER FIELD ALIGNMENT PROCEDURE

SETUP

1. Be sure audio and data inputs to the voter from the satellite sites and from the main site are present at usable levels.

2. Set the switches on each digital receiver and selector GETC. Refer to the GETC CONFIGURATION section.

RECEIVE DATA LEVEL

3. Using R1 (GREY), set the receive data level on all GETCs receiving Rockwell modem data to 0.11 volts rms at U18-1. Check for the presence of data at TP107 on all GETCs.

OUTPUT DATA LEVEL

4. Be sure 600-ohm phone line is connected to TB10-11 & 12 on the selector GETC. If the selector communicates with the main site via a Rockwell modem, set the output data level with R2 (RED) to 0 dBm or 10 dB below system alignment level at TB10-11 & 12. If RS-232 is used, check for the presence of ±12V data at TB10-11 & 12.

RECEIVE AUDIO

5. Set the analog voter receive audio level on each receiver module per PREFERRED METHOD or ALTERNATE METHOD found in the ADJUSTMENT PROCEDURE section of LBI-30002.

OUTPUT AUDIO LEVEL

6. Set the voter output audio level to 0 dBm or 10 dB below system alignment level with R10 on the front of the Analog Voter audio module.

SYSTEM CHECKOUT

7. Check each channel for proper operation on clear and private calls. See the GETC INDICATOR DEFINITIONS section for correct light activity.

8. Check that the console can override voted repeat audio and that both levels are equal. The voted audio should remain at the console speaker even during preempt.

9. Test each channel for 1950 Hz drop as follows. Key a radio on each channel, then turn the radio power off without unkeying. The voter channel should return to the idle state in about two seconds. Check each channel's operation as a control channel.

TROUBLESHOOTING PROCEDURE

CHECKS AFTER INSTALLATION

1. Check all GETC jumpers, especially:

   P11 on J11-1 & 2 and P12 on J12-1 & 2 for modem communication.

   P11 on J11-2 & 2 and P12 on J12-2 & 3 for RS-232 communication.

2. Check all GETC switch settings.

3. Check for receive data at TP107 of each GETC.

4. Check for transmit data at TP105 of each GETC. Data looks like dotting with an occasional "blip."

5. Check for proper levels at voter, station, and satellite sites.

6. Check all required modifications.

GENERAL TROUBLESHOOTING

	SYMPTOM	POSSIBLE CAUSES
1.	No relay pickup when console keys.	2175 Hz detector on Console Interface Board.
2.	No console preempt.	a. Check Console Interface Board b. Check jumper J2 on CIB.
3.	Improper console operation.	a. Check for 2175 Hz tone. b. Check Console Interface Board and wiring at C.O.R.
4.	2175 Hz tone heard on the air.	Check 2175 Hz filter in station control panel.
5.	No 1950 Hz drop.	Check connections from the Analog Voter to the Selector (RCVNG).
6.	No audio to voter.	a. Check phone line connections and punch blocks. b. If analog voter yellow light off, check satellite receiver data. The digital receiver must see un-squelch to turn on yellow light.

7.	No data to voter.	a. Check phone line and punch block. b. Check for low modem data level and position of GETC jumpers J11 & 12.
8.	No audio from voter.	Check MUTE line.
9.	Repeat audio when analog voter is disabled.	a. Check R65 (62K) on audio board in station control panel. b. Secur-it tone board BR wire from H8 to H9 must be cut.
10.	Modem fails to recover data.	Out of range receive level. Set to 400 mVp-p at U18-1 of GETC.
11.	Control channel indications different between station and voter.	Check wiring.
12.	Voting wrong audio.	a. If high-frequency noise is present, check C36 on analog voter modules. b. No 1950 Hz from the satellite receiver.
13.	1950 Hz comes up slowly.	Check that C11 and CR7 are removed from the voting tone board.

14.	Analog voter yellow light on when GETC power is off.	1950 Hz tone missing.
15.	COR relay chatters.	Open line to console or one side of line grounded.
16.	Occasional missed message or trouble with special call or telephone interconnect.	Check GETC slot timing switch settings.
17.	Occasional loud chirps after an inbound call. Observe which Analog Voter RX module was selected occurred.	L1 on Rx module needs re-tuning or tone detector circuit is faulty or 1950 Hz off frequency (± 5 Hz OK). Detector should pick up within 15 ms after tone is applied. To re-tune detector, put Rx module on extender cable. With 1950 Hz on the line, adjust the core of L1 for maximum tone level on card edge pin 2.

SATELLITE RECEIVER TROUBLESHOOTING

1.	No control channel indication on any satellite receiver.	a. Control channel mobile not programmed correctly. b. Check control channel mobile and multicoupler.
2.	MAJOR ALARM light on at mobile buffer board.	Not receiving data from control channel mobile.
3.	Wrong receiver is control channel.	Incorrect switch settings.
4.	All GETCs reset momentarily.	Control channel mobile has lost data.

5.	All GETC lights off.	a. Check GETC power. b. Check position of GETC switch S1-8.

SELECTOR PROBLEMS

	SYMPTOM	POSSIBLE CAUSES
1.	L1 not lit.	a. No power to GETC shelf. Check cables and 5-volt regulator. b. Check EEPROM and Microprocessor. c. Check position of PROM jumper J61.
2.	L2 blinking.	Check phone line input to GETC shelf.
3.	L2 not lit and L5 blinking during a Voice Guard call.	Backup Serial Link (BSL) failure.
4.	L2 not lit and L5 not continuously lit during a Voice Guard call.	GETC in wrong mode. Check J13 and software version.
5.	L4 and L5 not lit.	Check position of DIP switch 3, section 5.
6.	L5 flashing at a 500 millisecond rate or flashing erratically.	Backup Serial Link (BSL) failure. Check operation of Digital Receivers, connector J8, position on J13, and cabling.

7.	L5 flashing at a 1-second rate or flashing erratically.	Phone line failure. Check phone lines, position on J11 and J12, and modem line level settings. Check modem (if present) or J9 if modem not used.

DIGITAL RECEIVER PROBLEMS

1.	L1 not lit.	a. No power to GETC shelf. Check power cables and 5-volt regulator. b. Check EEPROM and Microprocessor. c. Check position of PROM jumper J61.
2.	L2 not on during a Voice Guard call.	a. L6 and L7 not on at corresponding satellite site. b. Phone line failure (L4 will be flashing). c. Modem line levels incorrect d. Incorrect software version.
3.	L4 and L5 not lit.	Check position of DIP switch 3 section 6.
4.	L5 flashing at a 500 millisecond rate or flashing erratically.	Backup Serial Link (BSL) failure. Check operation of Selector, connector J8, position on J13, and cabling.
5.	L4 flashing at a 1-second rate or flashing erratically.	Phone line failure. Check phone lines, position on J11 and J12, and modem line level settings. Check modem (if present) or J9 if modem not used.

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This addendum corrects a part number for the Voter Interface Board.

On Page 3 (Table of Contents), the listing should read:

On Page 17, the title for the Voter Interface Board should read:

VOTER INTERFACE BOARD (19D438719G1)

ERICSSON
Ericsson GE Mobile Communications Inc
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