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RCI-2950, RCI2970 Service Manual

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RANGER
Communications, Inc.

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SPECIFICATIONS

GENERAL

Model	RCI-2950	RCI-2970
Frequency Range	28.0000-29.6999 MHz	28.0000-29.6999 MHz
Tuning Steps	100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz	100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz
Emission Types	USB, LSB(A3J), CW(A1), AM(A3), FM(F3)	USB, LSB(A3J), CW(A1), AM(A3), FM(F3)
Frequency Control	Phase-Locked-Loop Synthesizer	Phase-Locked-Loop Synthesizer
Frequency Tolerance	0.005%	0.005%
Frequency Stability	0.001%	0.001%
Temperature Range	0°C to 40°C	0°C to 40°C
Antenna Impedence	50Ω	50Ω
Microphone	400Ω, Dynamic PTT	400Ω, Dynamic PTT
Meter Function	RF Output, RX Receive Signal Strength Modulation, SWR Calibration, SWR	RF Output, RX Receive Signal Strength Modulation, SWR Calibration, SWR
Input Voltage	13.8 VDC	13.8 VDC
Dimensions	7¾"W x 10¾"L x 2⅜"H	7¾"W x 10¾"L x 3⅞"H
Weight	4 lbs. 3 oz.	7 lbs. 6 oz.

TRANSMITTER

RF Power Output	25W: USB/LSB 8W: CW 8W: AM/FM	100W: USB/LSB 50W: CW 50W: AM/FM
RF Transmit Modes	USB, LSB, CW, AM, FM	USB, LSB, CW, AM, FM
Antenna Connector	UHF Type, 50Ω	UHF Type, 50Ω
Modulation	16F3, A3E, J3E, A1A	16F3, A3E, J3E, A1A
Spurious Emissions	-50dB	-50dB
Carrier Suppression	-50dB	-50dB

RECEIVER

Sensitivity for 10dB SINAD	AM/CW: 0.5μV	AM/CW: 0.5μV
Sensitivity for 10dB SINAD	USB/LSB: 0.15μV	USB/LSB: 0.15μV
Sensitivity for 12dB SINAD	FM: 0.25μV	FM: 0.25μV
Image Rejection Ratio	-65dB	-65dB
AGC Figure of Merit	SSB/CW/AM: 80dB for 50mV for 10dB Change in Audio Output	SSB/CW/AM: 80dB for 50mV for 10dB Change in Audio Output
Audio Output Power @10% THD	2.5W	2.5W

***Specifications subject to change without notice.**

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SECTION 1
INTRODUCTION

1.0 INTRODUCTION

The Ranger RCI-2950/2970 is a solid-state, fully synthesized Amateur 10-meter mobile transceiver with full-band coverage from 28.0000 MHz to 29.6999 MHz and all-mode operation, including: FM, AM USB, LSB, CW and PA modes. The 10 most commonly used frequencies can be pre-programmed by the user for easy channel access.

1.1 RCI-2950 FEATURES

- 25 Watts of Output Power
- Full Band Coverage
- All Mode Operation
- Brightness Control
- CTCSS Encoder/Decoder (Optional)
- Repeater/Offset Switch
- Programmable Frequencies
- Built-in Dual VFO
- RIT (RX Incremental Tuning)
- Squelch
- Noise Blanker
- RF Gain Control
- RF Power Output Selector
- External Speaker Connection
- PA Mode
- LCD Display
- Multi-Function LCD Meter

1.2 RCI-2970 FEATURES

- 100 Watts of Output Power
- Full Band Coverage
- All Mode Operation
- Brightness Control
- CTCSS Encoder/Decoder (Optional)
- Repeater/Offset Switch
- Programmable Frequencies
- Built-in Dual VFO
- RIT (RX Incremental Tuning)
- Squelch
- Noise Blanker
- RF Gain Control
- RF Power Output Selector
- External Speaker Connection
- PA Mode
- LCD Display
- Multi-Function LCD Meter

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SECTION 2
OPERATION

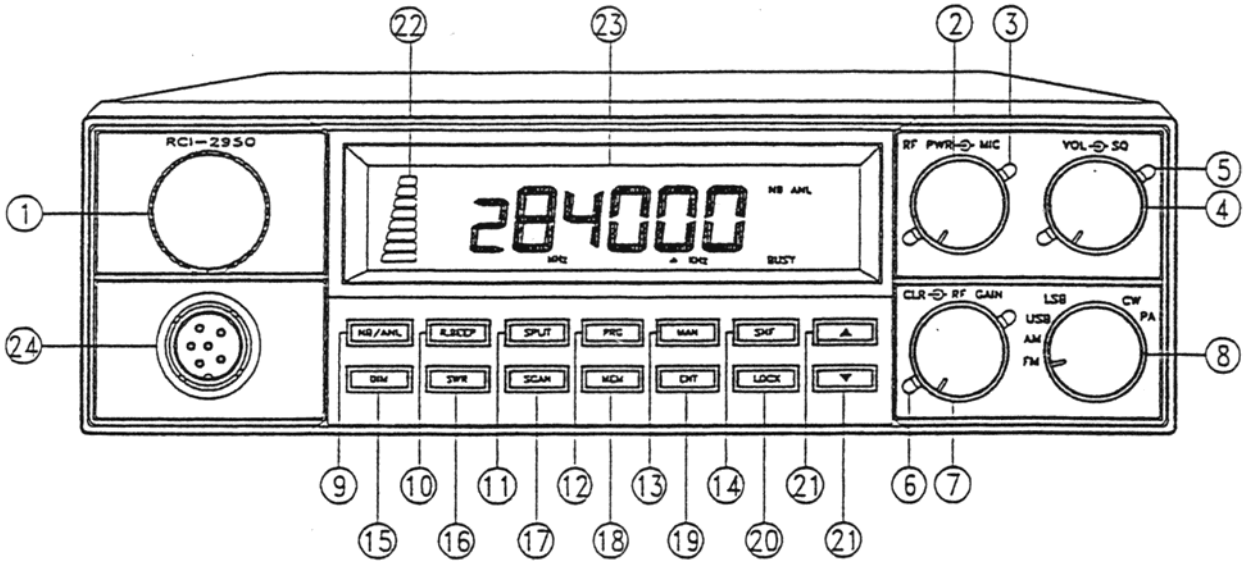

Figure 2.1 RCI-2950/2970 Controls and Connections

2.0 INTRODUCTION

This section explains the basic operating procedures for the RCI-2950/2970 Amateur 10 meter mobile transceiver.

2.1 CONTROLS AND CONNECTIONS

(1) **FREQUENCY SELECTOR:** This control is used to select a desired transmit and receive frequency. It enables you to tune across the entire frequency range of the transceiver.

(2) **RF POWER CONTROL:** This control enables you to adjust RF power continuously over the range of 1 watt through 25 watts (RCI-2970: 10 watts through 100 watts.)

(3) **MIC GAIN CONTROL:** This control adjust the microphone gain in the transmit and PA modes. This feature is designed for use in a high-ambient noise environment or to maximize talk power.

(4) **ON/OFF VOLUME CONTROL:** Turn clockwise to apply power to the radio and to set the desired listening level.

(5) **SQUELCH CONTROL:** This control is used to control or eliminate receiver background noise in the absence of an incoming signal. For maximum receiver sensitivity, it is desired that the control be adjusted only to the point where the receiver background noise is eliminated. Turn the control fully counterclockwise, then slowly turn clockwise until the receiver noise disappears. Any signal to be received must now be lightly stronger than the average received noise. Further clockwise rotation will increase the threshold level which a signal must overcome in order to be heard. Only strong signals will be heard at a maximum clockwise setting.

(6) **RF GAIN CONTROL:** This control is used to reduce the gain of the RF amplifier under strong receive conditions.

(7) **CLARIFIER CONTROL.** This control is used to fine tune the received signal for the maximum clarity in SSB or CW mode. It can adjust the receive frequency about +/- 500 Hz, but does not affect the transmit frequency or the frequency display.

(8) **MODE SWITCH:** This switch allows you to select one of the six following operating modes: FM, AM, USB, LSB, CW and PA.

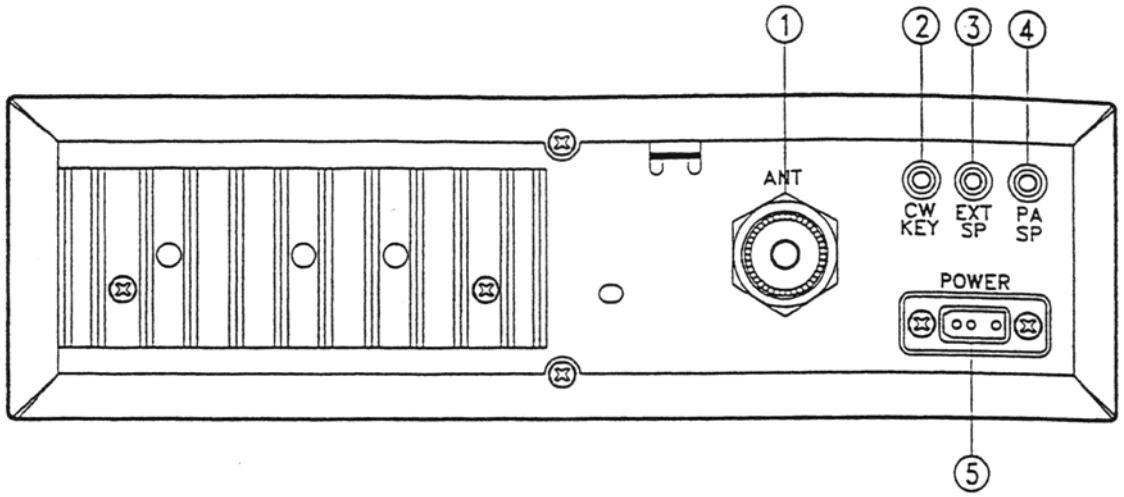

Figure 2.2 RCI-2950/2970 Rear Panel Connectors

(9) **NB/ANL BUTTON (NB/ANL):** The noise blanker is very effective in eliminating repetitive impulse noise such as ignition interference. In the ANL position, the automatic noise limiter in the audio circuits is activated.

(10) **ROGER BEEP BUTTON (R BEEP):** This button activates the ROGER BEEP Circuit when its function is selected. The ROGER BEEP is a short beep that is transmitted when the PTT button on the microphone is released. It is used to identify the end of the transmission.

(11) **SPLIT BUTTON (SPLIT):** This control activates the offset frequency function. It causes the transmit frequency to be offset either above or below the receive frequency by a user programmable amount to allow operation of the RCI-2950/2970 on an FM Repeater.

(12) **PROGRAM BUTTON (PRG):** This button is used to program operating or scanning frequencies into memory. See the OPERATION section of the manual for further details.

(13) **MANUAL BUTTON (MAN):** This is used to return the unit to manual mode.

(14) **SHIFT BUTTON (SHF):** This is used to select 100 Hz, 1 kHz, 10 kHz, 100 kHz or 1 MHz frequency steps.

(15) **DIM BUTTON (DIM):** This button adjusts the display backlighting in four different steps to best match the environment.

(16) **SWR BUTTON (SWR):** This control is used to check SWR.

(17) **SCAN BUTTON (SCAN):** This is used to scan frequencies in each band segment. The OPERATION segment of this manual provides detailed information on using the SCAN control.

(18) **MEMORY BUTTON (MEM):** This button is used to program memory channels. Detailed information on how to use this control is provided in the OPERATION section of this manual.

(19) **ENTER BUTTON (ENT):** This is used to program frequencies in memory. See the OPERATION section of this manual for more information on using this control.

(20) **LOCK BUTTON (LOCK):** This button is used to lock a selected frequency. Press it to activate the switch. In this position, it disables the Frequency Selector Control, up/down buttons on the front control panel and remote up/down buttons on the microphone. Repressing the switch will unlock the frequency.

(21) **UP/DOWN SELECTOR (▲▼):** These buttons are used in conjunction with the shift key to move the frequency upward or downward to select a desired frequency.

(22) **METER:** This meter indicates received signal strength, transmitter RF output power and SWR level.

(23) **LCD DISPLAY:** The LCD displays the frequency selected, functions and memory channel.

(24) **MIC JACK:** Accepts 6 pin female connector with a type Philmore T616C or Calrad 30445 style connector.

2.2 REAR PANEL CONNECTORS

(1) **ANTENNA:** This jack accepts 50Ω coaxial cable with a PL259 type plug.

(2) **CW KEY:** This is used for Morse Code operation. To operate this mode, connect a CW key to this jack, and place the MODE switch in the CW position.

(3) **EXTERNAL SPEAKER:** This jack accepts a 4 to 8Ω, 5 Watt external speaker. When the external speaker is connected to this jack, the built-in speaker will be disabled.

(4) **PA SPEAKER:** An 8Ω, 4 Watt PA speaker may be connected to this jack for PA operation. Place the MODE selector switch in the PA position for this operation.

(5) **POWER:** Accepts 13.8 VDC power cable which is supplied with a built-in fuse.

2.3 MICROPHONE

(1) **PTT SWITCH:** Use the Push-to-Talk switch to control the transmit and receive function of the radio. Push to transmit and release to receive.

(2) **REMOTE UP/DOWN SWITCH:** An operating frequency can be incremented or decremented simply by pushing either of these buttons.

2.4 RCI-2950/2970 OPERATION

2.4.1 Channel Selection

Frequency selection for the RCI-2950/2970 is simple. Select a desired operating frequency by rotating the Frequency Selector, or using the (▲) Up and (▼) Down buttons on the front panel or the microphone. Press the LOCK button to lock into the selected frequency. This will disable the Frequency Selector and the up/down buttons on the front panel and the microphone. Repressing the LOCK button unlocks the frequency.

Use the SHF button to step frequency in either 100 Hz, 1 kHz, 10 kHz, 100 kHz or 1 MHz increment when you select a band segment. The frequency step is indicated by a small triangle directly under the corresponding digit on the frequency display.

2.4.2 Mode Selection

To select an operating mode on your RCI-2950/2970, simply rotate the MODE selector and place it in the desired operating mode position.

FM/AM/USB or LSB modes are for your voice communications. In the CW position, you can transmit CW if you have connected an external key to the accessory jack provided on the back of the radio. In the PA position, the radio can be used as a PA. Before operating in PA mode, you must first connect a PA speaker (8Ω, 4 Watt) to the jack provided on the back of the radio.

2.4.3 RF Power Control

This feature allows the adjustment of the RF output power continuously over the range of 1W through 25W (RCI-2970: 10W through 100W).

2.4.4 Receive Scanning

Receive scanning allows you to find active frequencies in the entire band segment. To begin scanning, slowly turn the Squelch control clockwise until the receiver noise disappears. Press the Scan button. The unit should start scanning from the lower to the higher frequencies. Pressing the Scan button again will change the direction of scanning. Each time you press the Scan button, "SCAN+ or "SCAN-" will be displayed on the LCD display. The radio will stop on any active frequency for the entire duration of the transmission. When the transmission stops, the RCI-2950/2970 will wait approximately 2 seconds before it resumes scanning. If you want to deactivate Scan mode while it is scanning, press the MAN (manual) button or turn the Squelch control counterclockwise until you hear the receiver noise. The Manual button will disable Scan function.

2.4.5 Split Function

This function enables you to offset the transmit and receive frequencies for FM repeater operation. The transmitter frequency can offset either higher or lower than the receive frequency. To split frequencies, press the MAN button and the Split button to select either +/- split frequency. If the + split is selected, the transmit frequency will be higher than the receiver frequency. If - split is selected, the transmit frequency will be lower than the receive frequency. Refer to section 4.3 for Split Programming Instructions.

2.4.6 Memory Function

The RCI-2950/2970 can store up to 10 most frequently used frequencies (from 0 to 9). To program a frequency into memory, follow the procedure described below:

(1) Press the MAN button.

(2) Press the PRG button.

(3) Press the MEM button ("MEMORY" and "0" should appear on the left-hand side of the LCD display). Pressing the MEM button will advance the channel number from "0" to "9".

(4) Select the desired frequency you wish to store in memory.

(5) Press the ENT button.

(6) Repeat the same procedure to program other memory channels.

2.4.7 Memory Channel Scanning

You can scan and select any of these 10 preset frequencies by following the procedure described below:

(1) Press the MAN button.

(2) Press the MEM button.

(3) Slowly turn the Squelch knob clockwise until the receiver noise disappears.

(4) Press the Scan button. The unit will scan from lower to higher frequencies. When you press the button again, it will scan from higher to lower frequencies.

(5) To stop scanning a certain channel, press the MAN button, or turn the Squelch knob counterclockwise until you hear the receiver noise.

2.4.8 Meter

The meter built into your RCI-2950/2970 on the left hand side of the LCD display provides the following information:

(1) **S/RF Meter:** In transmit mode, it provides a visual indication of transmit output power, and received signal strength on the receive mode.

(2) **SWR Meter:** In order to achieve maximum radiated power, it is important that your antenna be in good condition, properly adjusted and matched to your transceiver.

The built-in SWR (Standing Wave Ratio) meter allows you to measure your antenna condition. To operate this function, connect your antenna to the transceiver antenna connector, set the mode switch to AM and adjust the MIC Gain to minimum. Select a frequency near the middle of the band you plan to use most. Activate the SWR function and press the PTT button on the microphone. A bar on the meter is an indication of the antenna matching. If there is no bar, it indicates that your antenna system is perfectly matched. The less bar, the better matched. If several bars appear, your antenna needs adjusting.

2.4.9 CTCSS-Optional

The RCI-2950/2970 can operate with CTCSS frequencies for accessing repeaters, with an optional CTCSS (Continuous Tone Coded Squelch System) encoding device installed. For more information, contact your local dealer or Ranger Communications Customer Service Department.

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SECTION 3
ALIGNMENT

FIGURE 3.1 RCI-2950/2970 MIC. WIRING

1. GROUND	SHIELD
2. AUDIO	YELLOW
3. TRANSMIT	RED
4. RECEIVE	BLACK
5. CHANNEL UP	WHITE
6. CHANNEL DOWN	BLUE

FIGURE 3.2 TURNER 4-WIRE MIC. WIRING

1. GROUND	SHIELD
2. AUDIO	WHITE
3. TRANSMIT	BLACK
4. RECEIVE	N/C
5. CHANNEL UP	N/C
6. CHANNEL DOWN	N/C

FIGURE 3.3 TURNER 6-WIRE MIC. WIRING

1. GROUND	SHIELD & RED
2. AUDIO	WHITE
3. TRANSMIT	BLUE
4. RECEIVE	N/C
5. CHANNEL UP	N/C
6. CHANNEL DOWN	N/C

FIGURE 3.4 ASTATIC 4-WIRE MIC. WIRING

1. GROUND	SHIELD
2. AUDIO	WHITE
3. TRANSMIT	RED
4. RECEIVE	N/C
5. CHANNEL UP	N/C
6. CHANNEL DOWN	N/C

FIGURE 3.5 ASTATIC 6-WIRE MIC. WIRING

1. GROUND	SHIELD & BLUE
2. AUDIO	WHITE
3. TRANSMIT	RED
4. RECEIVE	N/C
5. CHANNEL UP	N/C
6. CHANNEL DOWN	N/C

FIGURE 3.6 PALOMAR MIC. WIRING

1. GROUND	SHIELD & BLACK
2. AUDIO	RED
3. TRANSMIT	WHITE
4. RECEIVE	N/C
5. CHANNEL UP	N/C
6. CHANNEL DOWN	N/C

FIGURE 3.7 INTERNAL ALIGNMENT POINTS

VR1	AM RECEIVE METER CAL
VR2	SSB RECEIVE METER CAL
VR3	SSB SQUELCH THRESHOLD
VR4	AM SQUELCH THRESHOLD
VR7	CARRIER BALANCE
VR8	TRANSMIT METER CAL
VR11	DRIVER BIAS
VR12	ALC (SSB HIGH POWER)
VR13	AM CARRIER (HIGH POWER)
VR14	AMC
VR15	AM CARRIER (LOW POWER)
VR16	ALC (SSB LOW POWER)
VR21	TX FREQUENCY ADJUSTMENT
VC1	10.240 CRYSTAL TRIMMER (X1)
VC2	10.240 CRYSTAL TRIMMER (X2)
L27	AM FREQUENCY ADJUSTMENT
L28	LSB FREQUENCY ADJUSTMENT
L29	USB FREQUENCY ADJUSTMENT

3.0 INTRODUCTION

The following steps are required to re-align the RCI-2950/2970. ***CAUTION:*** Alignment should only be attempted by personnel trained in RF product testing and alignment.

3.1 PLL SYNTHESIZER/OSCILLATOR FREQUENCY ALIGNMENT

Set radio controls as follows:

Frequency:	**28.0000 MHz**
Mic Gain:	**Fully counter clockwise**
RF Power:	**Fully clockwise**
RF Gain:	**Fully clockwise**
Clarifier:	**12 o'clock**
Volume On/Off:	**On**
Squelch:	**Fully counter clockwise**
Mode Selector:	**FM**

(1) Connect a digital voltmeter to jumper J13. Adjust L17 for a reading of 2.2 VDC ±0.1.

(2) Connect a digital voltmeter to pin 3 of IC7. Adjust L21 for 1.2 VDC ±0.1.

(3) Connect a frequency counter to L61 and adjust VC1 for 10.240 MHz ±10 Hz.

(4) Connect a 50Ω dummy load to the antenna connector.

(5) Connect a frequency counter to pin 3 of IC14. Ensure that the clarifier is precisely at the 12 o'clock position. Adjust VC2 for 10.240 MHz ±10 Hz. Key the transmitter and adjust VR21 for 10.240 MHz ±10 Hz.

(6) Connect a frequency counter to the cathode of D45. Put mode selector on AM. Key the transmitter and adjust L27 for 10.6950 MHz ±10 Hz.

(7) Adjust VR7 fully clockwise. Leave the frequency counter connected to D45. Put the mode selector on USB. Key the transmitter and adjust L29 for 10.6925 MHz ±10 Hz.

(8) Put the mode selector in LSB. Key the transmitter and adjust L28 for 10.6972 MHz ±10 Hz. Return VR7 to approximately the middle of rotation.

(9) Put the mode selector in AM. Connect X10 probe to pin 13, IC17. Check the frequency counter for 5.930 MHz.

(10) Set the oscilloscope for 50nS (.05μS) per division on the sweep selector and 10mV per division on the vertical input. Connect X10 probe to IC17 pin 13 and very carefully adjust L24 and L25 for the best waveform.

3.2 RECEIVER ALIGNMENT

(1) Put the mode selector on FM, the RF gain fully clockwise, Clarifier at 12 o'clock and the frequency at 28.0300 MHz.

(2) Connect an FM signal generator to the antenna connector. Set the modulation for ±3 kHz, output level at 0.5μV.

(3) Connect a SINAD meter to the external speaker jack, adjust the volume control to approximately 10 o'clock.

(4) Connect an X10 probe to the cathode of D12. Set oscilloscope sweep selector for 1mS per division and vertical input selector for 10mV per division.

(5) Adjust L8 for the best SINAD reading and the least distorted wave form on the scope. Do not try tuning this coil for the maximum, as this will result in degraded receiver performance.

(6) Adjust L9, L11, L12, L13, L14, L4, L3, L5 and L6 for maximum on scope. Reduce generator level if necessary, so as not to exceed vertical height on scope.

(7) Adjust L6 and L5 for best SINAD.

(8) Put the mode selector on LSB. Signal generator to 28.0290 MHz, modulation off, output level at 0.5μV. Tune L15 and L16 for maximum waveform on scope.

3.3 TRANSMITTER ALIGNMENT

RCI-2970 LEVELS ARE SHOWN IN [ ]

(1) Connect an audio generator to pin 2 and ground (pin 1) of the Mic connector. The Mic gain should be fully counterclockwise. Set generator for 30mV RMS, 1 kHz sinewave.

(2) Adjust VR14 fully counterclockwise.

(3) Adjust VR12 fully counterclockwise.

(4) Connect a wattmeter and 50Ω dummy load to the antenna connector. Set the wattmeter for 30W scales ***[100W]***.

(5) Key the transmitter and slowly increase the Mic gain until you obtain approximately 10W. Adjust L19, L48, L47, L46 and L43 for maximum reading on the wattmeter. Reduce Mic gain if necessary to maintain about 10 to 15W on wattmeter ***[40-50W]***.

(6) Increase the Mic gain to maximum (fully clockwise). Key transmitter and adjust L34 for maximum power output. Power will typically be 30-35W ***[100-120W]***.

(7) With the Mic gain still maximum on LSB, key the transmitter and adjust VR12 for 25W ***[100W]***.

(8) Put the mode selector on AM. Key the transmitter with no modulation applied and adjust VR13 for 10W ***[50W]***.

(9) With the mode selector still on AM, re-connect 1 kHz audio the generator to radio and key transmitter. With Mic gain at maximum, adjust VR14 for 90% modulation. Use the modulation meter or oscilloscope with RF sampler ***[85%]***.

(10) Put the mode selector on FM. Key the transmitter and check for 4 kHz deviation ±0.5 kHz. There is no deviation adjustment provided in this radio. Simply check for sufficient transmit audio. Use the deviation meter or the service monitor.

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SECTION 4
PROGRAMMING

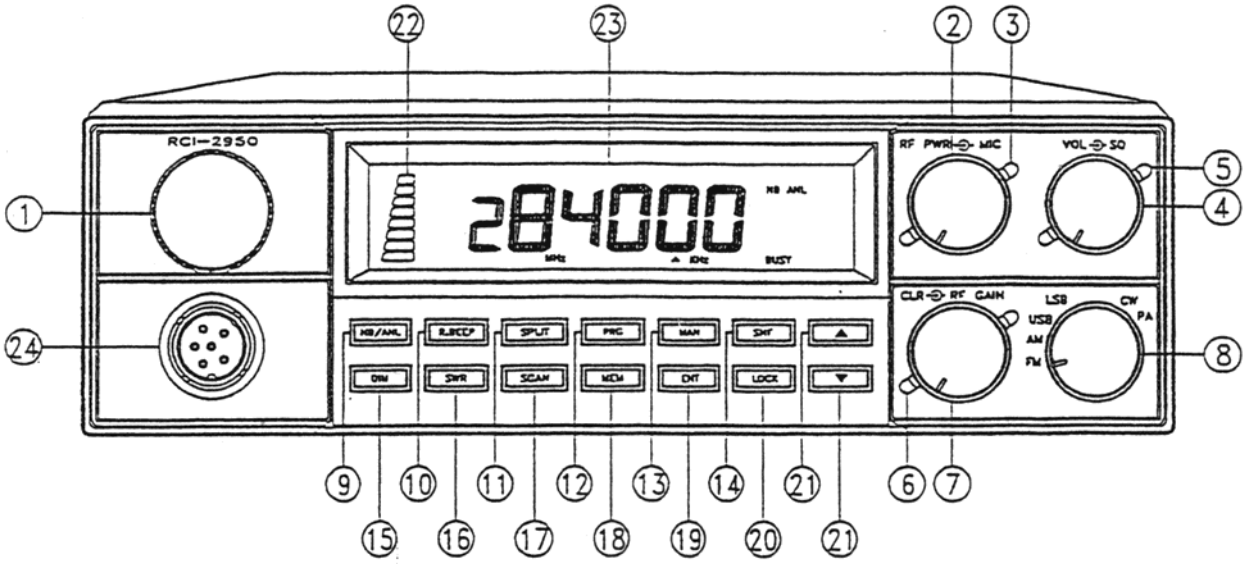

Figure 4.1 RCI-2950/2970 Controls and Connectors

4.0 INTRODUCTION

This section explains the basic programming procedures for the RCI-2950/2970 Amateur 10 meter mobile transceiver.

4.1 FREQUENCY SELECTION

Frequency selection in the RCI-2950/2970 can be accomplished using anyone of the three following methods:

(1) The first method of frequency selection is through the use of the **SHF** (Shift) key and the (▲) Up and (▼) Down arrows. To accomplish this, press the **SHF** button until the cursor arrow is positioned under the digit of the frequency that is to be changed, then use the (▲) Up arrow to increase the number. If a decrease in frequency is desired, press the (▼) Down arrow. Perform the steps described above for each digit of the frequency until the desired frequency is displayed in the LCD display window.

(2) The second method of frequency selection is accomplished using the **SHF** button and the frequency select knob located above the microphone jack. Use the **SHF** button in the manner described above to select the digit to be changed. Proceed to rotate the frequency select knob clockwise to increase the frequency. Rotate the frequency select knob counterclockwise to decrease the frequency.

(3) The third method of selecting the operating frequency of the radio is through the use of the **SHF** button and the Channel (▲) Up and (▼) Down buttons located on the microphone. Frequency selection by this method is accomplished in the same manner as with the (▲) Up and (▼) Down arrows on the key pad. The only difference is that the Channel Up and Down buttons on the microphone are used.

4.2 FREQUENCY SCANNING

Frequency scanning can be achieved using one of two methods: the first method involves the scanning of pre-programmed memory channels. The second method permits the user to scan all frequencies between a pre-set upper and lower scan limit. Both of the methods of the frequency scanning.

4.2.1 All Frequency Scanning

To allow all Frequency Scanning, One must first program the upper and lower scanning limits. The scan limits are simply the highest and lowest frequencies that will be scanned. To program these limits, perform the following steps:

(1) Press the **PRG** (Program) key.

(2) Press the SCAN key (**"PRG SCAN+"** should appear in the lower right corner of the display window).

(3) Using the **SHF** key and the (▲) Up and (▼) Down arrows, select the upper scan limit, then press **ENT**.

(4) Press the **SCAN** key again (**"SCAN-"** should appear in the display window).

(5) Using the **SHF** key and (▲) Up and (▼) Down arrows, select the lower scan limit, then press **ENT**.

The upper and lower scan limits have now been programmed. To activate the scan feature, return the radio to manual operation and press the **SCAN** button. If the display shows **"SCAN+"**, the radio will scan from the lower limit to the upper limit. If **"SCAN-"** is displayed, the unit will scan from the upper limit to the lower limit. To change from **SCAN+** to **SCAN-** or vice versa, press **SCAN**.

NOTE

When programmed, the upper and lower scan limits will also act as the upper and lower operating limits of the radio. The radio now cannot be programmed to operate above or below the scan limits.

4.2.2 Memory Scanning

The RCI-2950/2970 has 10 non-volatile (i.e. memory resident) memory locations which can be programmed with any available frequency within the operating band of the radio. The scan function of the unit can be programmed to scan these memory channels. The radio will then scan only those memory channels which have been programmed.

The first step in utilizing the memory scan function is to program the desired frequencies into the radio memory. This can be accomplished by performing the following steps:

(1) With the radio operating in the manual mode, press the **PRG** (Program) key.

(2) Press the **MEM** (Memory) key. **"PRG"** should be displayed in the lower right-hand corner of the LCD display window. In the upper left portion of the display, **"MEMORY"** should be displayed. Directly below **MEMORY**, a number between 0 and 9 will be displayed. This number represents the memory location currently being displayed. Pressing the **MEM** key will increase the memory counter to the next memory location and the contents of that memory location will be displayed.

(3) Using the **SHF** key and the (▲) Up and (▼) Down arrows, enter the frequency to be stored in the memory location displayed. After the desired frequency has been entered, press **ENT**.

(4) Repeat steps 2 and 3 for all the memory locations to be programmed.

(5) After all desired memory locations have been programmed with frequencies, return the unit to the manual mode of operation by pressing the **MAN** key.

(6) To initiate memory scanning, press **MEM** and then press **SCAN**. As previously discussed, the display will show **"SCAN+"** or **"SCAN-"** to indicate whether the radio is scanning from the lowest or the highest memory location or vice versa.

(7) To return the radio to normal (non-scanning) operation, press the **MAN** key.

4.3 OFFSET FREQUENCY OPERATION

The RCI-2950/2970 has an offset or split frequency feature that will permit the radio to be operated in a half-duplex mode. This will allow the user to talk on FM repeaters operating in the 10 Meter band.

NOTE

The FM repeaters may require a subaudible (CTCSS) tone be transmitted to gain access to the repeater. The RCI-2950 is not factory-equipped with a CTCSS encoder/decoder.

The split frequency function offsets the transmitter frequency either above or below the receive frequency by a user programmable amount. In the following example, programming of a 100 kHz offset will be described. Before attempting to program the offset frequency, ensure that the radio is operating in the manual mode by pressing the **MAN** key.

(1) Press the **PRG** (Program) key.

(2) Press the **SPLIT** key. The LCD display window will display **"00000"** with **"PRG"** and **"SPLIT"** being displayed in the lower left hand corner.

(3) Using the **SHF** key and the (▲) Up and (▼) Down arrows as described earlier, program the display to read **"010000"**.

(4) Press **ENT**. A 100 kHz offset has now been programmed into the radio.

(5) Return the radio to manual operation by pressing the **MAN** key.

(6) Using the **SHF** key and the (▲) Up and (▼) Down arrows as described previously, set the radio for the desired receive frequency.

(7) Press **SPLIT**. In the lower right corner of the display, either **"SPLIT+"** or **"SPLIT-"** will be displayed. If **SPLIT+** is displayed, the transmitter will be offset 100 kHz above the receive frequency when keyed. If **SPLIT-** is displayed, the transmitter will be offset 100 kHz below the receive frequency.

NOTE

When the transmitter is keyed, the frequency display will change to show the frequency being transmitted.

(8) To return the radio to simplex operation (i.e., same transmit and receive frequency), Press the **MAN** key.

RANGER
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SECTION 5
BLOCK DIAGRAM DESCRIPTION

5.0 INTRODUCTION

(Refer to block diagram RCI-2950/2970 behind Section 5).

This section explains the description of the Block Diagram of the RCI-2950/2970. The Ranger RCI-2950/2970 is a solid-state, fully synthesized Amateur 10-meter mobile transceiver with full-band coverage from 28.0000 MHz to 29.6999 MHz and all-mode operation including: FM, AM, USB, LSB, CW and PA modes.

5.1 RECEIVER DESCRIPTION

The RF enters the receiver through the antenna, proceeds through a filter and into the first RF amplifier, Q18. The amplified signal then goes through a band pass filter and into the first mixer, Q19.

The RX signal is mixed with the first local oscillator (VCO1) at Q19. The output is the first IF of 10.6950 MHz for AM/FM, 10.6925 MHz +AF for USB, and 10.6975 MHz -AF for LSB. The signal is then filtered by L12, L13 and L14. At this point, the signal goes in one of two directions depending on the mode setting of the unit. The AM/FM signal gets filtered by FL2 and enters Q8 which mixes the 10.6950 MHz signal with the 10.240 MHz. This yields the second IF of 455 kHz which is filtered by FL1. The 455 kHz signal is filtered and amplified by Q9, L5, Q10, Q11 and L6.

The AM signal goes to the AM detector consisting of D34 and D35. The FM signal enters the FM detector, IC2. The SSB (Single Sideband) signal is filtered by a crystal filter (FL3). The signal is amplified by Q20, Q21, Q22 and Q23.

The sideband signal is mixed with a 10.6925 MHz signal for USB (Upper Sideband) and a 10.6975 MHz signal for LSB (Lower Sideband). The signals are mixed by Q16 resulting in an audio wave form.

The AGC amplifier (IC1) controls the squelch (Q17), Q8 (AM/FM mixer), Q20 (SSB IF), and the gain of Q18 (RF AMP). IC1 is quad op amplifier. The inputs come from Q23 (SSB IF), Q11 (AM/FM IF) and the squelch potentiometer (VR501).

5.2 PLL DESCRIPTION

The PLL (Phase-locked Loop) consists of two VCO's. The primary VCO (VCO1) is the reference local oscillator (LO) for the Transmit and Receiver sections. The secondary VCO (VCO2) is the reference as well as the 2.5 kHz offsets for USB (Upper Sideband) and LSB (Lower sideband). The primary VCO controls Frequency steps of 10 kHz, 100 kHz and 1 MHz.

5.2.1 VCO1 Description

VCO1 is controlled by IC17, which receives its data from the microprocessor on the logic board. IC17 samples the frequency from IC10, divides the signal and outputs the resulting waveform to a phase comparator (IC5). The signal is compared to a 10 kHz reference from IC11. The output of IC5 sends a control signal to D43 in the oscillator circuit, controlling the frequency of VCO1. The output signal of VCO1 is mixed at IC10 with a modified signal from VCO2. The output signal of IC10 is sent to IC17.

5.2.2 VCO2 Description

VCO2 controls frequency steps of 100 Hz and 1 kHz. When the unit is in USB or LSB, VCO2 shifts the LO +2.5 kHz and -2.5 kHz respectively. VCO2 consists of a loop much like VCO1 with the oscillator, amplifier and mixer combined into one IC (IC8). VCO2 mixes with 10.240 MHz in IC8 and outputs to IC17. IC17 divides this frequency and outputs into a phase comparator (IC7), where the signal is compared to a 10 kHz (X1, IC11) reference from IC11. The output of IC7 controls VCO2. VCO1 at the mixer (IC10). VCO2 changes by 100 kHz and 10 kHz steps at IC10. The output signal of VCO2 goes through a divide by 10 (IC12) and mixed with a 10.24 MHz (X2) reference. The signal is divided by 10 (IC13) once more and mixed with a 10.24 MHz (X2) reference. The output is the reference to VCO1 at the mixer (IC10).

5.3 TRANSMITTER DESCRIPTION

The Transmit signal is produced by mixing 10.6950 MHz for AM/FM (10.6975 MHz for LSB and 10.6925 MHz for USB) with the local oscillator (LO) at the transmitter mixer (IC20). This signal is filtered and amplified by Q50 to Q59 and Q49 into the driver Q48. Q48 drives the finals Q46 and Q47. The finals are a direct coupled push-pull configuration. The signal is filtered before entering the antenna jack.

FM modulation is accomplished by amplifying the signal from the mic audio amplifier and using this signal to frequency modulate the reference oscillator X3 (10.6950 MHz), via the two varactor diodes in parallel with the crystal load. The crystal (X3) will shift its frequency by changing the voltage across the varactors (D8 and D111). This is accomplished thru the MIC Audio.

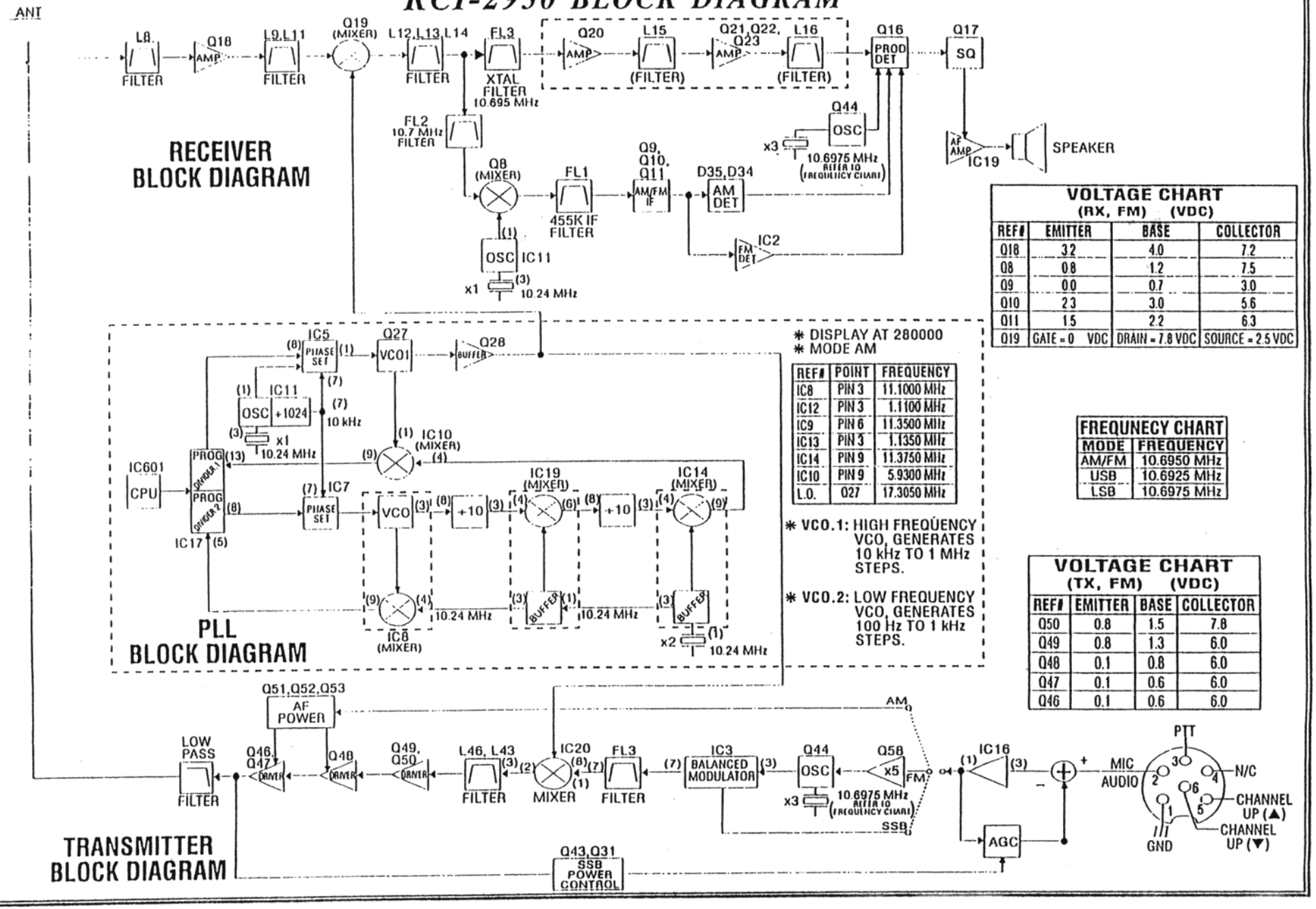
AM modulation is accomplished by changing the voltage supplied to the driver (Q48) and the finals (Q46, Q47). The power control circuit elements are Q51, Q52 and Q53. Q51 supplies the voltage, where Q52 and Q53 controls Q51. The Mic audio signal is amplified by IC16 and the output goes to Q52. Q52 and Q53 changes the bias of Q51; therefore, the TX output changes amplitude. When the unit is in the SSB (Single Sideband) mode, Q53 is biased to allow Q51 to pass full supply voltage.

SSB modulation is accomplished by mixing the Mic audio signal from IC16 with the reference frequency from X3 (10.6975 MHz for LSB and 10.6925 MHz USB) at the balanced modulator, IC3. The mixed signal is filtered by the crystal filter, (X3), and mixed with the LO at the mixer (IC20).

The primary elements for AM/FM/CW power control are Q51, Q52 and Q53, where Q51 supplies voltage to the finals and Q52-Q53 control the bias of Q51. The SSB power control circuit uses the AGC in the Mic amplifier circuit. The SSB power is fed back through Q43. The output of Q43 dictates the bias of Q31. The output from Q31 goes to the AGC control for MIC AMP (Q32). The limiting of AM modulation is also accomplished by Q32.

On the RCI-2970, Q46 is removed and a power amplifier is connected to the main PCB antenna port. The power amplifier is a class A push-pull configuration using a pair of 2SC2290 bipolar transistors. A relay is used to connect the antenna path directly to the main PCB in receive mode and the amplifier output in transmit mode.

RCI-2950 BLOCK DIAGRAM



REF#	POINT	FREQUENCY
IC8	PIN 3	11.1000 MHz
IC12	PIN 3	1.1100 MHz
IC9	PIN 6	11.3500 MHz
IC13	PIN 3	1.1350 MHz
IC14	PIN 9	11.3750 MHz
IC10	PIN 9	5.9300 MHz
L.O.	Q27	17.3050 MHz

VOLTAGE CHART (RX, FM) (VDC)

REF#	EMITTER	BASE	COLLECTOR
Q18	3.2	4.0	7.2
Q8	0.8	1.2	7.5
Q9	0.0	0.7	3.0
Q10	2.3	3.0	5.6
Q11	1.5	2.2	6.3
Q19	GATE = 0 VDC	DRAIN = 7.8 VDC	SOURCE = 2.5 VDC

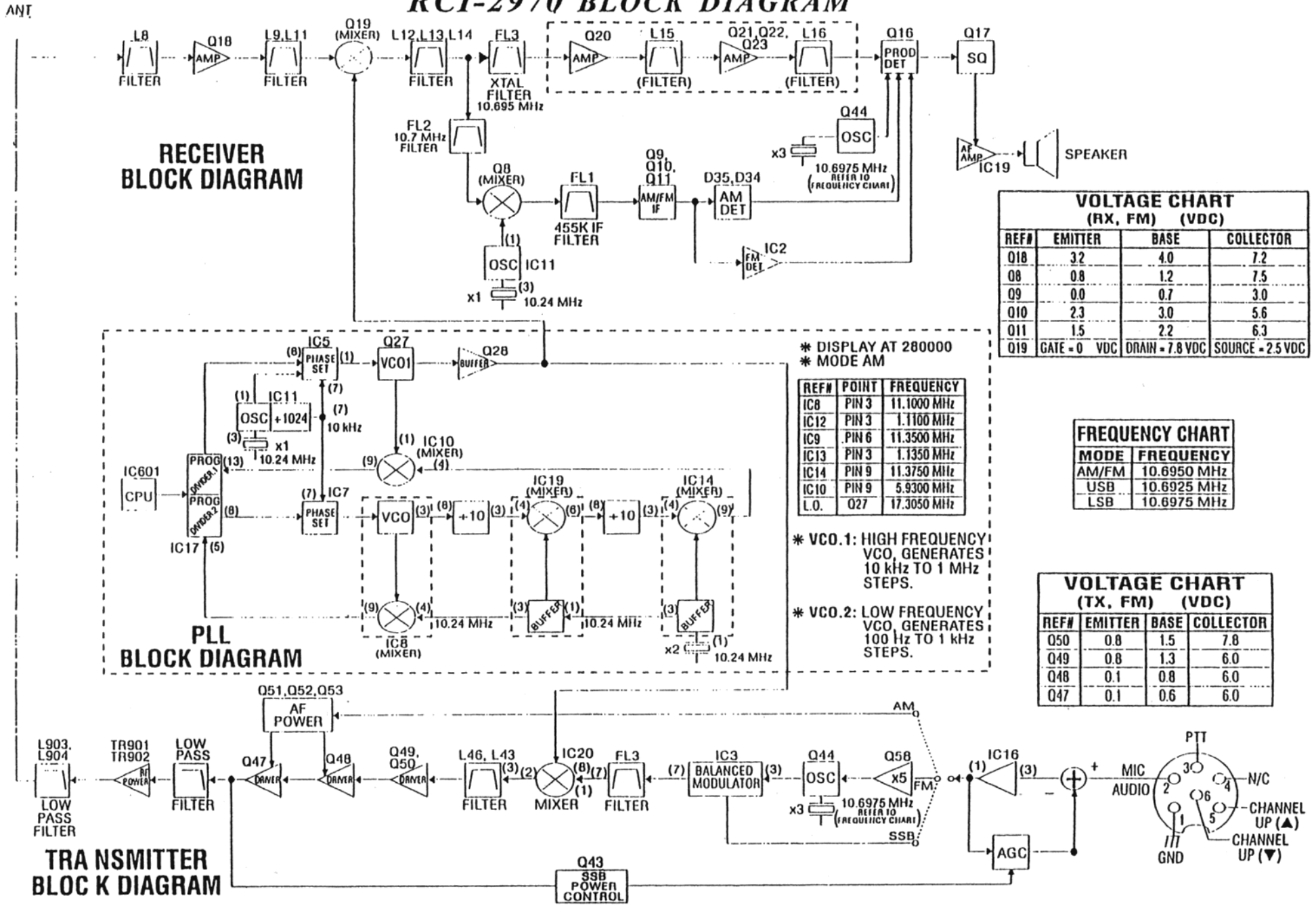
FREQUNECY CHART

MODE	FREQUENCY
AM/FM	10.6950 MHz
USB	10.6925 MHz
LSB	10.6975 MHz

VOLTAGE CHART (TX, FM) (VDC)

REF#	EMITTER	BASE	COLLECTOR
Q50	0.8	1.5	7.8
Q49	0.8	1.3	6.0
Q48	0.1	0.8	6.0
Q47	0.1	0.6	6.0
Q46	0.1	0.6	6.0

RCI-2970 BLOCK DIAGRAM



VOLTAGE CHART (RX, FM) (VDC)

REF#	EMITTER	BASE	COLLECTOR
Q18	3.2	4.0	7.2
Q8	0.8	1.2	7.5
Q9	0.0	0.7	3.0
Q10	2.3	3.0	5.6
Q11	1.5	2.2	6.3
Q19	GATE = 0 VDC	DRAIN = 7.8 VDC	SOURCE = 2.5 VDC

REF#	POINT	FREQUENCY
IC8	PIN 3	11.1000 MHz
IC12	PIN 3	1.1100 MHz
IC9	PIN 6	11.3500 MHz
IC13	PIN 3	1.1350 MHz
IC14	PIN 9	11.3750 MHz
IC10	PIN 9	5.9300 MHz
L.O.	Q27	17.3050 MHz

FREQUENCY CHART

MODE	FREQUENCY
AM/FM	10.6950 MHz
USB	10.6925 MHz
LSB	10.6975 MHz

VOLTAGE CHART (TX, FM) (VDC)

REF#	EMITTER	BASE	COLLECTOR
Q50	0.8	1.5	7.8
Q49	0.8	1.3	6.0
Q48	0.1	0.8	6.0
Q47	0.1	0.6	6.0