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**1.0 GENERAL**

Model	CX-4400 / CX-4400 HP
Frequency Range	28.245-29.585MHz.
Emission Modes	AM/FM (A3/F3)
Frequency Control	Phase Lock Loop (PLL) synthesizer.
Frequency Tolerance	± 0.001 %.
Frequency Stability	± 0.005 %.
Operating Temperature Range	-30°C to +50°C.
Microphone	Dynamic PTT 500Ω
Input Voltage	13.8V DC
Current Drain : Transmit (AM full mod.)	< 5.0 A.
Current Drain : Receiver (Squelched)	≤ 0.25A.
(Max. audio output)	< 0.5A.
Antenna Connector	50 Ohms
Dimensions	7 7/8"(W) x 9 1/4"(D) x 2 3/8 (H)
Weight	5.0 lb.

**1.1 TRANSMITTER**

RF Power Output (AM/FM) : CX-4400	1W(L); 3.5W(M); 7W(H)
: CX-4400 HP	1W(L); 3.5W(M); 10W(H)
RF Transmit Modes	AM/FM.
AM Modulation	High and low level Class B, Amplitude Modulation.
Spurious Emissions	Better than -50 dB.
Audio Frequency Response	300 to 2500 Hz
Antenna Impedance	50 Ohms.
Output Indicators	Meter shows relative RF output power and receive signal. Transmit LED glows red when transmitter is in operation.

**1.2 RECEIVER**

Sensitivity For 10dB S/N (AM)	< 1 μV.
Sensitivity For 20dB S/N (FM)	< 1 μV.
IF Frequency	AM : 10.695 MHz 1st IF, 455 KHz 2nd IF.
Image Rejection	> 50 dB.
Adjacent Channel Selectivity	> -55 dB.
RF Gain Control	> 30 dB adjustable for optimum signal reception.
Automatic Gain Control (AGC) Figure Of Merit	50 mV for 10 dB Change in Audio Output.
Squelch	Adjustable; threshold less than 0.5 μV.
Noise Blanker	RF type.
Audio Output Power	2.5W@ 10% Distortion
Audio Frequency Response	300 to 2500 Hz.
Built-in Speaker	8 Ohms, 5 Watts
External Speaker (Not Supplied)	8 Ohms; disables internal speaker when connected.

(SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE)

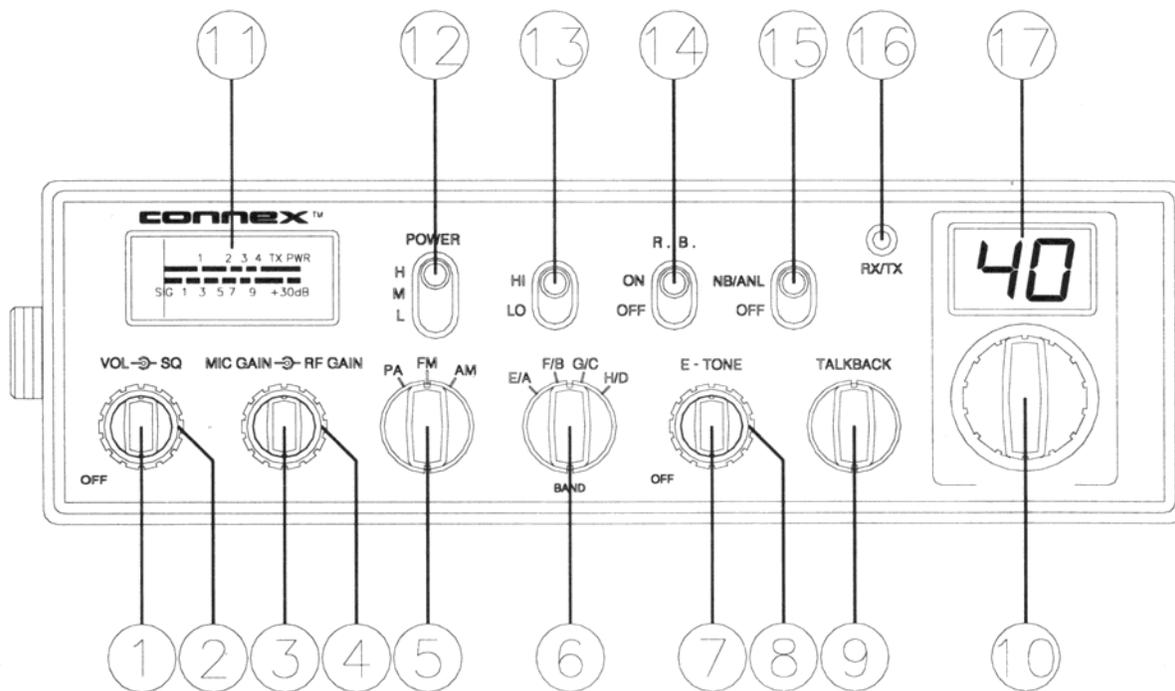


Figure 2-1 Front Panel

**2.0 INTRODUCTION**

This section explains the basic operating procedures for the CX-4400 / CX-4400 HP mobile transceiver.

**2.1 CONTROL AND CONNECTIONS**

**2.1.1 FRONT PANEL**

Refer to the above Figure 2-1 for the location of the following controls.

**1. ON/OFF VOLUME CONTROL**

This knob controls the volume and the power to the radio. To turn the radio on, rotate the knob clockwise. Turning the knob further will increase the volume of the receiver.

**2. SQUELCH CONTROL**

This switch is used to eliminate background noise being heard through the receiver which can be disturbing when no transmissions are being received. To use this feature of your radio, gently turn the switch counterclockwise until the switch will not turn further. Then turn the switch clockwise until the background noise is just eliminated. If you turn the switch too far in a clockwise direction, you may not be able to hear weak transmissions.

### **3. MIC GAIN CONTROL**

Adjusts the microphone gain in the transmit and PA modes. This controls the gain to the extent that full talk power is available several inches away from the microphone. In the Public Address (PA) mode, the control functions as the volume control.

### **4. RF GAIN CONTROL**

This control is used to reduce the gain of the amplifier under strong signal conditions.

### **5. MODE SWITCH**

This control allows you to select one of the following operating modes : PA/FM/AM.

In the PA position, the radio acts as a public address amplifier. Your voice will come out of the speaker that is plugged into the PA. SP. jack on the rear panel. The radio does not operate when you are in the PA mode. In the FM/AM position, the PA function is disabled and the unit will transmit and receive on the speaker that is connected to the radio.

### **6. BAND SELECTOR**

This switch is used to select the band of operation (A-H).

### **7. ECHO SWITCH**

This control is used for echo effect.

### **8. TONE CONTROL**

This control is used to control the intervals of echo sound.

### **9. TALKBACK/OFF CONTROL**

Adjust this knob for desired volume of Talkback. This is used to monitor your own voice. For example, you could use this feature to compare different microphones.

### **10. CHANNEL SELECTOR**

This control is used to select a desired transmit and receive channel.

### **11. FRONT PANEL METER**

The Front Panel Meter allows the user to monitor signal strength and RF output power.

### **12. RF POWER SWITCH**

This switch is used to select the high (H), medium (M) or low (L) transmitting power.

### **13. BAND SWITCH**

This switch selects HI or LO band of operation

### **14. ROGER BEEP SWITCH**

When the Roger Beep is on, the radio transmits an audio tone at the end of your transmission to indicate that transmission has ended. As a courtesy to others, use the Roger Beep only when necessary.

### **15. NB/ANL/OFF SWITCH**

In the NB/ANL position, the RF Noise Blanker and the Automatic Noise Limiter in the audio circuits are also activated. The Noise Blanker is very effective in eliminating repetitive impulse noise such as ignition interference.

## 16. TX/RX LED

The red LED indicates the unit is in the transmit mode. The green LED indicates the unit is in receive mode.

## 17. CHANNEL DISPLAY

The channel display indicates the current selected channel.

### 2.1.2 REAR PANEL

Figure 2-2 represent the location of the following connections :

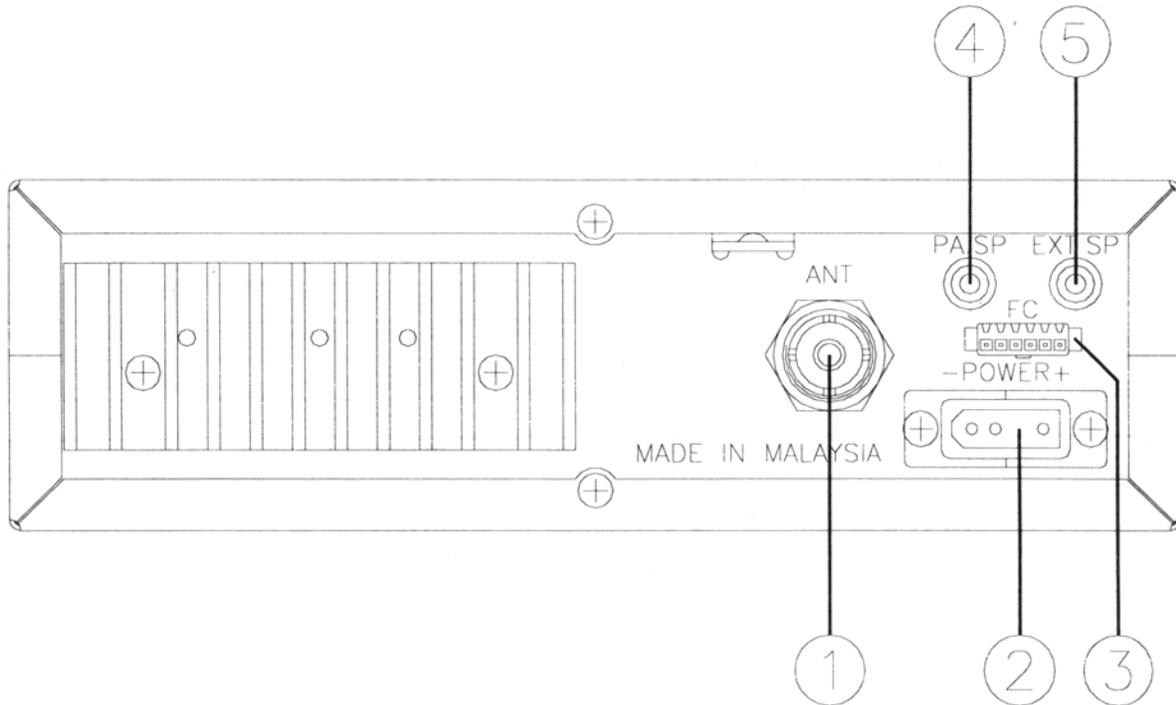


Figure 2-2 Rear Panel

#### 1. ANTENNA

This jack accepts 50 ohms coaxial cable with a PL- 259 type plug.

#### 2. POWER

This connector accepts 13.8V DC power cable with built-in fuse. The power cord provided with the radio has a black and red wire. The black goes to negative and the red goes to positive.

#### 3. F.C.

This connector is used for an external frequency counter which indicates the frequency of the selected channel.

#### 4. PA. SP.

This jack is for PA operation. Before operating, you must first connect a PA speaker ( 8 ohms, 4W ) to this jack.

#### 5. EXT. SP.

This jack accepts 4 to 8 ohms, 5 watts external speaker. When the external speaker is connected to this jack, the built-in speaker will be disabled.

### 2.1.3 FREQUENCY CHART

CHANNEL	A BAND(MHz)	B BAND (MHz)	C BAND (MHz)	D BAND (MHz)
1	29.145	28.315	28.765	29.215
2	29.155	28.325	28.775	29.225
3	29.165	28.335	28.784	29.235
4	29.185	28.355	28.805	29.255
5	29.195	28.365	28.815	29.265
6	29.205	28.375	28.825	29.275
7	29.215	28.385	28.835	29.285
8	29.235	28.405	28.855	29.305
9	29.245	28.415	28.865	29.315
10	29.255	28.425	28.875	29.325
11	29.265	28.435	28.885	29.335
12	29.285	28.445	28.905	29.355
13	29.295	28.465	28.915	29.365
14	29.305	28.475	28.925	29.375
15	29.315	28.485	28.935	29.385
16	29.335	28.505	28.955	29.405
17	29.345	28.515	28.965	29.415
18	29.355	28.525	28.975	29.425
19	29.365	28.535	28.985	29.435
20	29.385	28.555	29.005	29.455
21	29.395	28.565	29.015	29.465
22	29.405	28.575	29.025	29.475
23	29.435	28.605	29.055	29.505
24	29.415	28.585	29.035	29.485
25	29.425	28.595	29.045	29.495
26	29.445	28.615	29.065	29.515
27	29.455	28.625	29.075	29.525
28	29.465	28.635	29.085	29.535
29	29.475	28.645	29.095	29.545
30	29.485	28.655	29.105	29.555
31	29.495	28.665	29.115	29.565
32	29.505	28.675	29.125	29.575
33	29.515	28.685	29.135	29.585
34	29.525	28.695	29.145	29.595
35	29.535	28.705	29.155	29.605
36	29.545	28.715	29.165	29.615
37	29.555	28.725	29.175	29.625
38	29.565	28.735	29.185	29.635
39	29.575	28.745	29.195	29.645
40	29.585	28.755	29.205	29.655

## FREQUENCY CHART

CHANNEL	E BAND (MHz)	F BAND (MHz)	G BAND (MHz)	H BAND (MHz)
1	28.245	28.695	29.145	28.315
2	29.255	28.705	29.155	28.325
3	28.265	28.715	29.165	28.335
4	28.285	28.735	29.185	28.355
5	28.285	28.745	29.195	28.365
6	28.295	28.755	29.205	28.375
7	28.305	28.765	29.215	28.385
8	28.315	28.785	29.235	28.405
9	28.335	28.795	29.245	28.415
10	28.345	28.805	29.255	28.425
11	28.355	28.815	29.265	28.435
12	28.365	28.835	29.285	28.455
13	28.395	28.845	29.295	28.465
14	28.405	28.855	29.305	28.475
15	28.415	28.865	29.315	28.485
16	28.435	28.885	29.335	28.505
17	28.445	28.895	29.345	28.515
18	28.455	28.905	29.355	28.525
19	28.465	28.915	29.365	28.535
20	28.485	28.935	29.385	28.555
21	28.495	28.945	29.395	28.565
22	28.505	28.955	29.405	28.575
23	28.535	28.985	29.435	28.605
24	28.515	28.965	29.415	28.585
25	28.525	28.975	29.425	28.595
26	28.545	28.995	29.445	28.615
27	28.565	29.005	29.455	28.625
28	28.575	29.015	29.465	28.635
29	28.585	29.025	29.475	28.645
30	28.595	29.035	29.485	28.655
31	28.605	29.045	29.495	28.665
32	28.615	29.055	29.505	28.675
33	28.625	29.065	29.515	28.685
34	28.635	29.075	29.525	28.695
35	28.705	29.085	29.535	28.705
36	28.645	29.095	29.545	28.715
37	28.655	29.105	29.555	28.725
38	28.675	29.115	29.565	28.735
39	28.745	29.125	29.575	28.745
40	28.755	29.135	29.585	28.755

## **2.2 MICROPHONE**

The receiver and transmitter are controlled by the push-to-talk switch on the microphone. Press the switch and the transmitter is activated, release switch to receive. When transmitting, hold the microphone two inches from the mouth and speak clearly in a normal voice. The radio comes complete with a low impedance (500 ohm) dynamic microphone.

## **2.3 OPERATION**

### **2.3.1 PROCEDURE TO RECEIVE**

1. Be sure that power source, microphone and antenna are connected to the proper connectors before going to the next step.
2. Turn unit on by running **VOL.** knob clockwise on transceiver.
3. Set the **VOL.** to a comfortable listening level.
4. Set the **MODE** switch to the desired mode.
5. Listen to the background noise from the speaker. Turn the **SQ** knob slowly clockwise until the noise just disappears. Leave the control at this setting. This **SQ** is now properly adjusted. The receiver will remain quiet until a signal is actually received. Do not advance the control too far or some of weaker signals will not be heard.
6. Set the **CHANNEL** selector switch to the desired channel.
7. Set the **RF GAIN** control fully clockwise for maximum receive gain.

### **2.3.2 PROCEDURE TO TRANSMIT**

1. Select the desired channel of transmission
2. Set the **MIC GAIN** control fully clockwise.
3. If the channel is clear, depress the push-to-talk switch on the microphone and speak in a normal voice.

## **2.4 ALTERNATE MICROPHONES AND INSTALLATION**

For best results, the user should select a low impedance dynamic type microphone or a transistorized microphone. Transistorized type microphones have a low output impedance characteristic. The microphones must be provided with a four-lead cable. The audio conductor and its shielded lead comprise two of the leads. The third lead is for transmit control and the fourth is for receive control. The microphone should provide the functions shown in schematic below (Figure 2-3).

### 4 WIRE MIC CABLE

Pin Number	Mic Cable Lead
1	Audio Shield
2	Audio Lead
3	Transmit Control
4	Receive Control

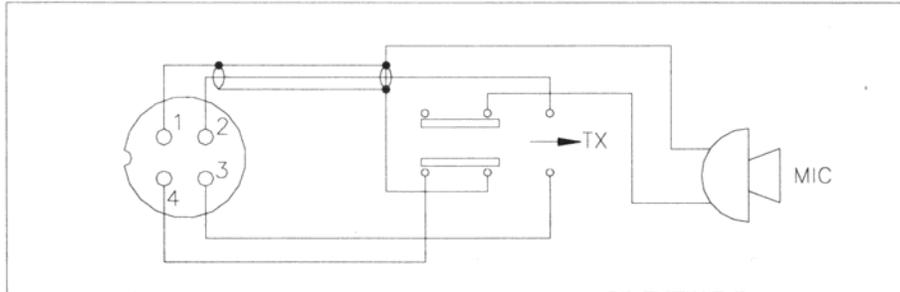


Figure 2-3 Transceiver Microphone Schematic

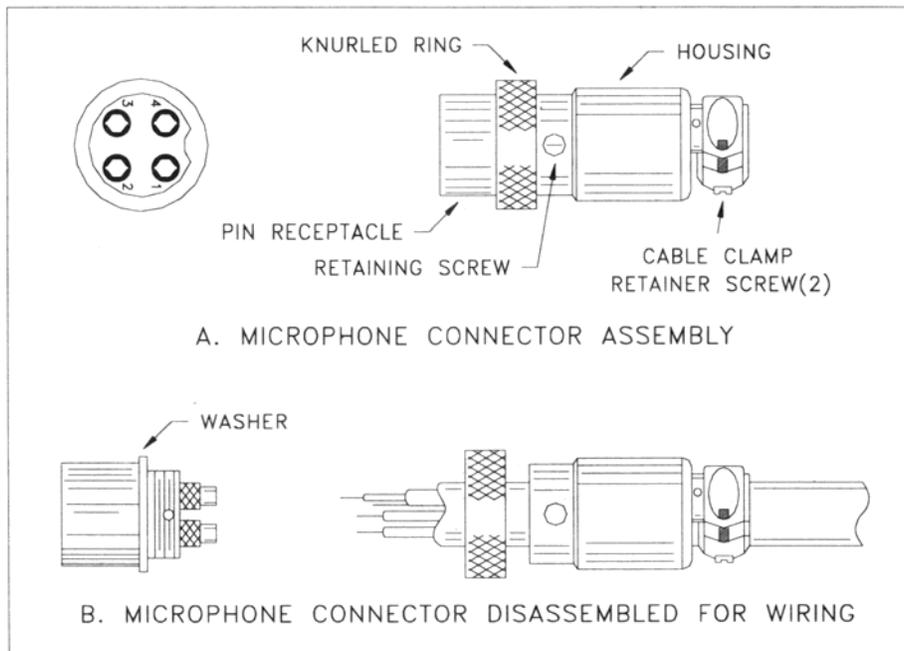


Figure 2-4 Microphone Plug Wiring

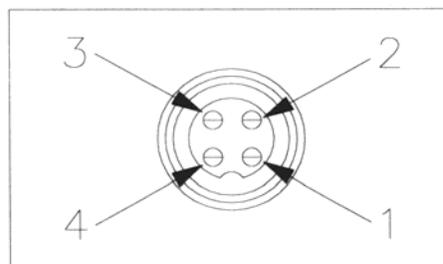


Figure 2-5 Microphone plug pin numbers viewed from rear of pin receptacle.

### **3.0 INTRODUCTION**

This section explains the technical theory of operation for the CX-4400 / CX-4400 HP mobile transceiver.

### **3.1 PLL CIRCUIT**

The Phase Lock Loop (PLL) circuit is responsible for developing the receiver's first local oscillator signal and the transmitter's exciter signal. The PLL circuit consists primarily of IC2, IC3, IC4, IC5 Q25, Q27, Q28, Q29 and Q61. The PLL circuit is programmed by the user's rotary channel switch GPS-0501. The switch allows GPS-0501 to communicate the correct binary data information to the programmable divider inside of IC3. IC3 then controls the VCO (Voltage Controlled Oscillator), to oscillate on the correct frequency. This signal is fed either into the receiver's first mixer (for receive operation) or the transmitter's mixer (for transmit operation).

### **3.2 RECEIVER CIRCUIT**

The incoming receive signal come into the radio via the antenna and into the front end pre-amp consisting of Q17. The RF signal is fed into the mixer circuit of the Q18 & Q19 and then into the AM IF section of the receiver (depending on the mode of operation). The signal is then detected by either the AM detector or product detector and then fed to the audio amplifier section of the receiver and finally out to the speaker.

### **3.3 TRANSMITTER MODULATION CIRCUIT**

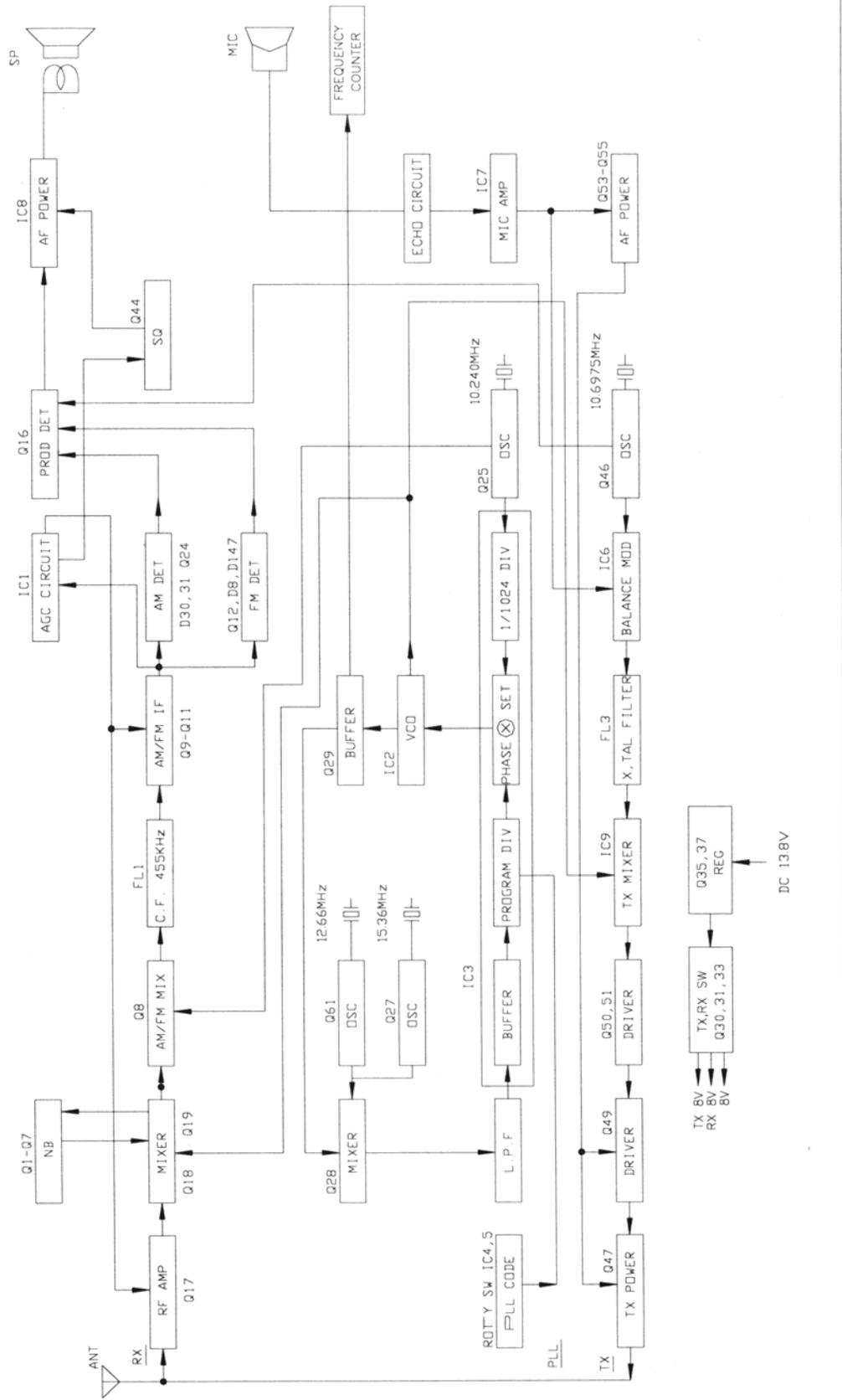
- (i) The transmitter modulation circuit modulates the low level RF signal from the PLL exciter circuit with the user's audio voice signal from the microphone. The audio from the microphone is then amplified and fed into the transmit amplifier circuit.
  
- (ii) If the transceiver is in the AM mode, the AF power amplifier modulates the last RF amplifier which produces a true amplitude modulated RF signal.

### **3.4 TRANSMITTER AMPLIFIER CIRCUIT**

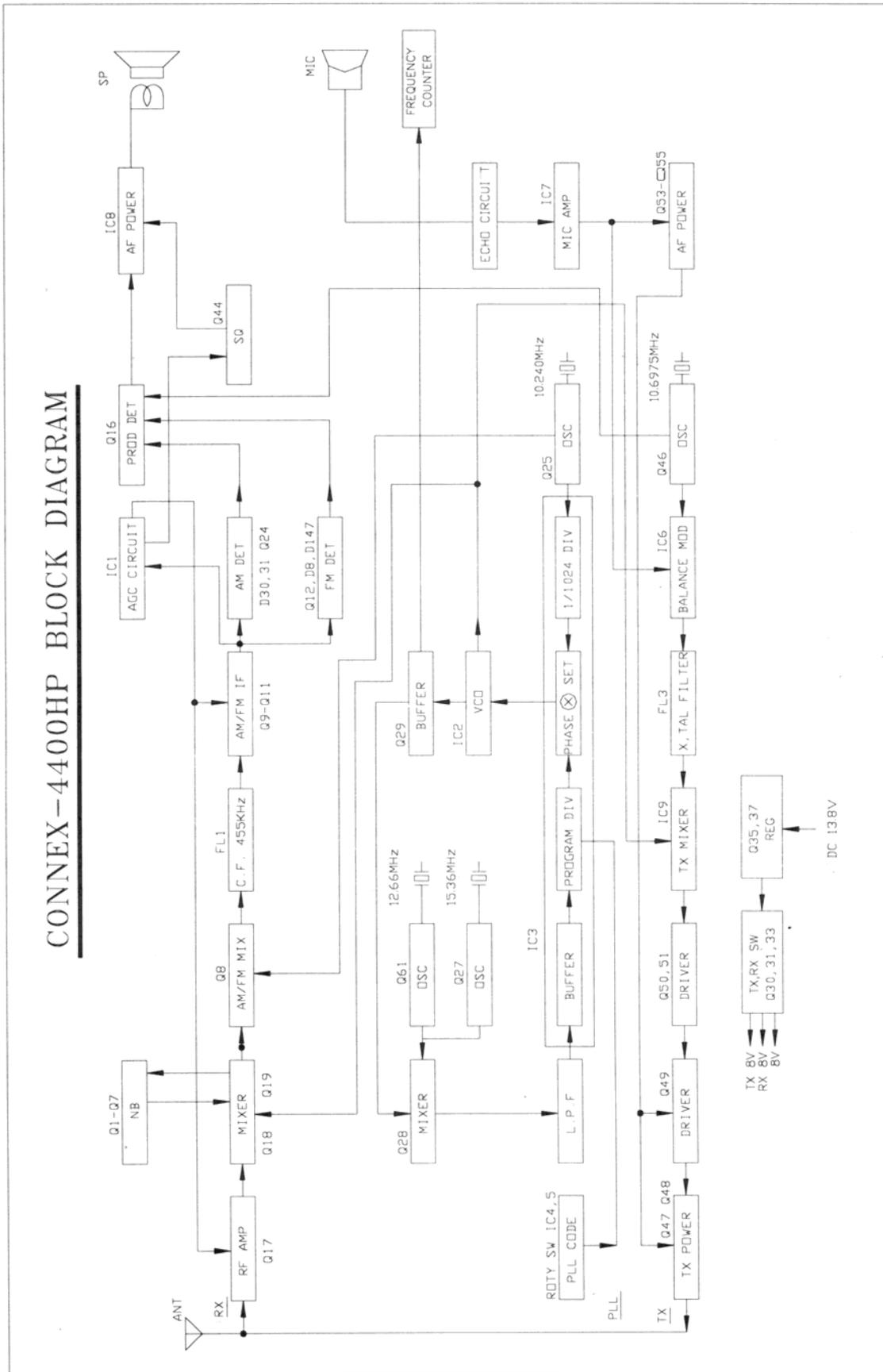
The transmitter takes the basic exciter signal from the TX mixer and amplifies it through a series of amplifiers consisting of Q50, Q51, Q49, Q47 and Q48 (only for CX-4400 HP) where it is sent out to the antenna connector.

# CX-4400 BLOCK DIAGRAM

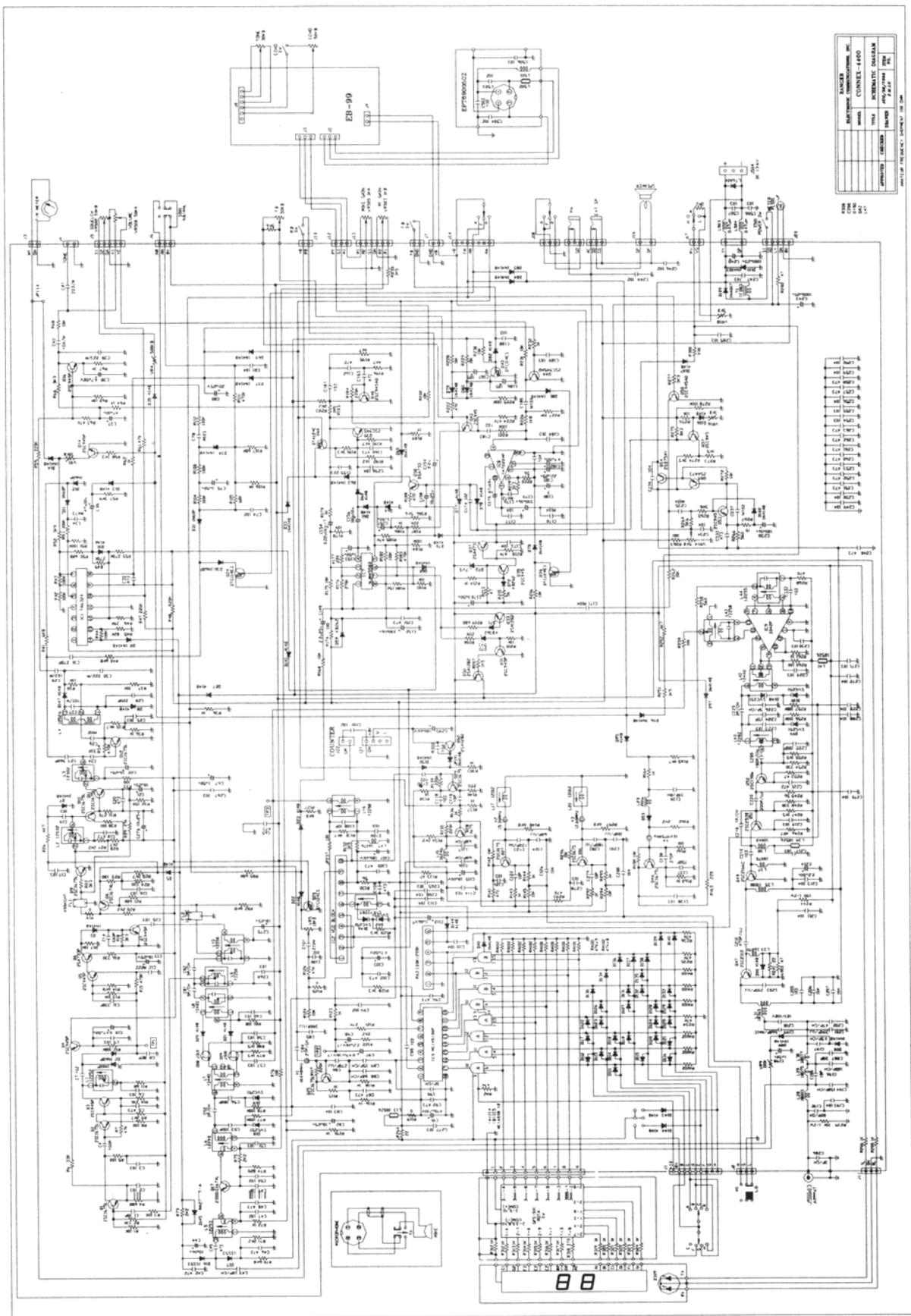
## CONNEX-4400 BLOCK DIAGRAM



# CX-4400 HP BLOCK DIAGRAM



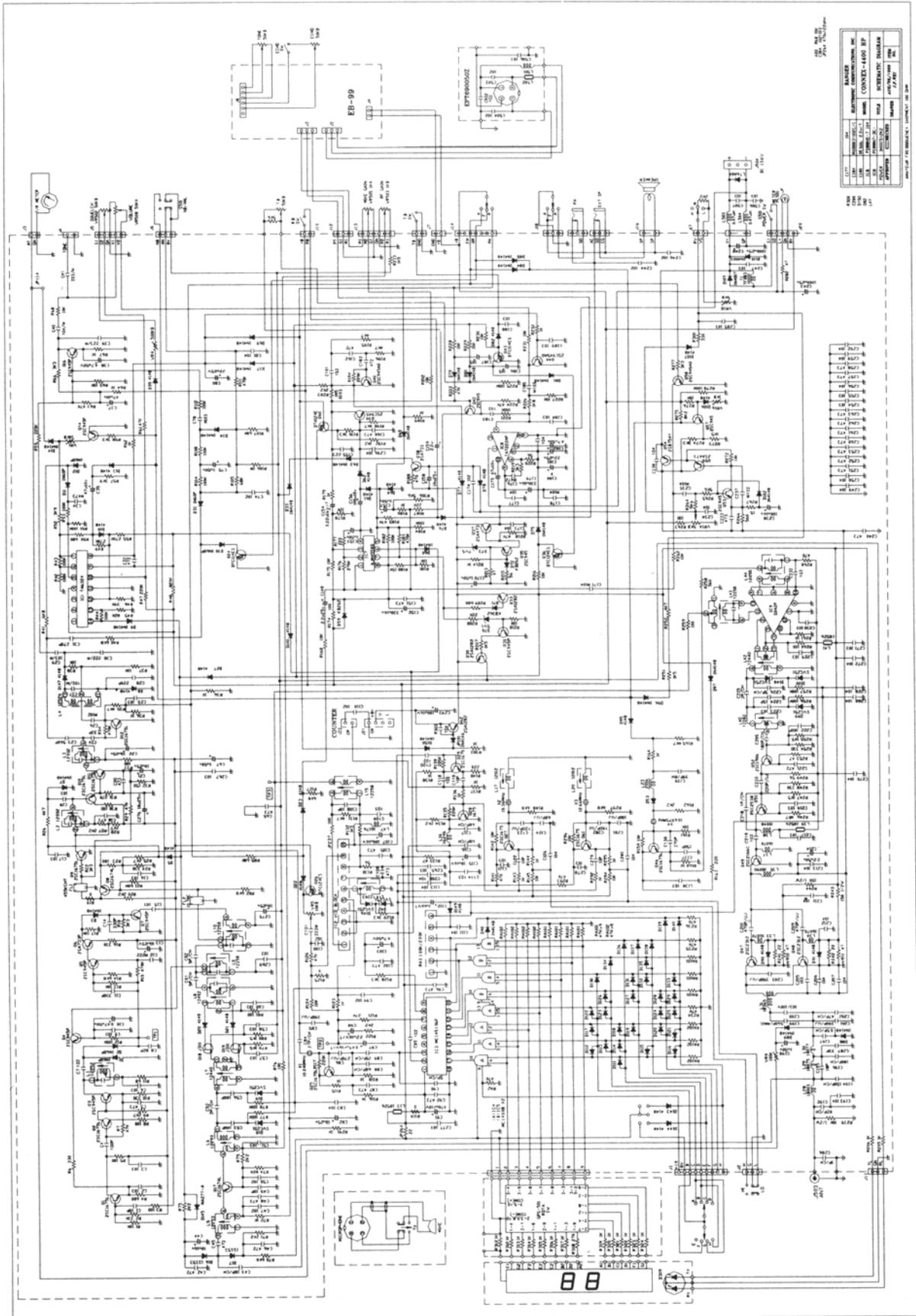
# CX-4400 SCHEMATIC DIAGRAM



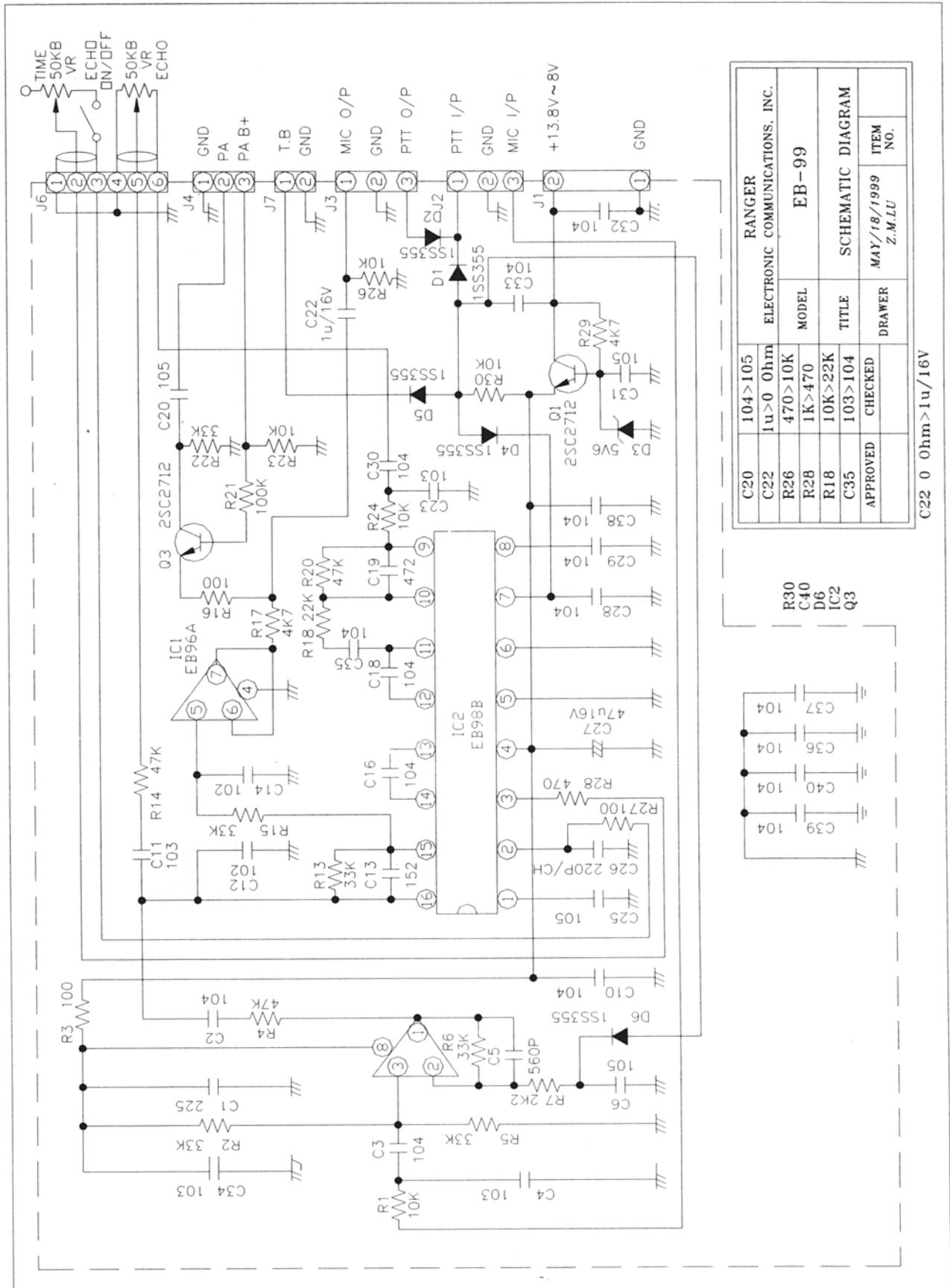
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 APPROVED BY: [ ]  
 DATE: [ ]

# CX-4400 HP SCHEMATIC DIAGRAM



# CX-4400/CX-4400 HP EB-99 SCHEMATIC DIAGRAM



RANGER		ELECTRONIC COMMUNICATIONS, INC.	
MODEL		EB-99	
TITLE		SCHEMATIC DIAGRAM	
APPROVED	CHECKED	DRAWER	ITEM NO.
		MAY/18/1999	Z.M.LU

C22 0 Ohm > 1u/16V

