TRC-469
CB TRANSCEIVER
Catalog Number: 21-1527
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1. SPECIFICATIONS

GENERAL:
- Transmitter/Receiver: Frequency synthesizing circuit with digital phase-locked loop
- Communicating frequencies: 26.965 MHz to 27.405 MHz (all 40 channels)
- Operating voltage: 11–16V DC (positive or negative ground)
- Temperature and Humidity Range: -20°C to +60°C and 10% to 90%
- Transmitter/Receiver switching: Electronic (diode switching)
- Antenna: 52 ohm (coaxial connector)
- Microphone: 600 ohm Dynamic Type
- Speaker: 8 ohm, 2 Watt
- Size: 2-3/16” x 6-1/4” x 9” (HWD) (approx.) (5.5 x 16 x 22.7 cm [HWD])
- Weight: 5 lbs. (approx.) (2.3 kg)
- Accessories: DC Cord with in-line Fuse, Microphone and Microphone Hanger and Mounting Brackets

STANDARD TEST CONDITIONS:
- Battery supply voltage: 13.8V DC
- Modulation: 1000 Hz, 30%
- Audio output power: 500 mW
- Audio output load: 8 ohm
- Antenna impedance: 50 ohm (non-inductive load)
- Ambient conditions:
  - Temperature: 25°C ±5°C
  - Humidity: 50% to 70%

TRANSMITTER:

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<tr>
<th></th>
<th>UNIT</th>
<th>NOMINAL</th>
<th>LIMIT</th>
</tr>
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<td>W</td>
<td>4 (Max.)</td>
<td>3.6 – 4.0</td>
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<td>AMC Range 50% – 100% Mod</td>
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<td>Modulation Frequency Response (-6 dB)</td>
<td>dB</td>
<td>-6</td>
<td>-6 ± 3 dB</td>
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<td>a. Lower Frequency 450 Hz</td>
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<tr>
<td>b. Upper Frequency 2500 Hz</td>
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<td>-6</td>
<td>-6 ± 3 dB</td>
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<td>Microphone Sensitivity 1 kHz 50% Mod</td>
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<td>2</td>
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<td>Modulation Distortion at 1 kHz 80% Mod</td>
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<td>RF Power Output Uniformity Ch. to Ch.</td>
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<td>0.5</td>
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<td>Modulation Capability Positive/Negative</td>
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<td>80/85</td>
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<td>a. at no Modulation</td>
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<td>1550</td>
<td>2000</td>
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<td>b. at 80% Modulation</td>
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<td>Unit</td>
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<td>Sensitivity for 10 dB S/N</td>
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<td>AGC Figure of Merit 50 mV</td>
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<td>Overload AGC 50 mV – 1 V</td>
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<td>+6</td>
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<td>Squelch Sensitivity at Threshold</td>
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<td>Squelch Sensitivity at Tight</td>
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<td>Adjacent Channel Selectivity a. at ±10 kHz</td>
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<td>60</td>
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<td>Spurious Radiation</td>
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<td>60</td>
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<td>Spurious Response Attenuation a. 455/2 kHz</td>
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<td>Image Rejection Ratio a. -910 kHz</td>
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<td>IF Rejection Ratio a. 10.695 MHz</td>
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<td>Cross Modulation</td>
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<td>50</td>
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<td>Desensitization (3 dB Desens.) at 100 µV</td>
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<td>Audio Power Output a. Maximum</td>
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<td>4</td>
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<td>b. 10% THD</td>
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<td>3</td>
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<tr>
<td>Audio Frequency Response (-6 dB) b. 450 Hz</td>
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<td>-6</td>
<td>-6 ± 3 dB</td>
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<td>THD at 500 mW Audio Output a. Input 1 mV</td>
<td>%</td>
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<td>4</td>
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<tr>
<td>b. 50% Mod</td>
<td>%</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>c. 80% Mod</td>
<td>%</td>
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<td>8</td>
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<tr>
<td>Signal-to-Noise Ratio at 1000 µV</td>
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<td>45</td>
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<td>RF Gain Control Range</td>
<td>dB</td>
<td>40</td>
<td>30</td>
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<td>S-Meter Sensitivity at &quot;S9&quot;</td>
<td>µV</td>
<td>100</td>
<td>50 – 200</td>
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<tr>
<td>Oscillator Drop-out Voltage</td>
<td>V</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Battery Drain a. at no signal</td>
<td>mA</td>
<td>250</td>
<td>600</td>
</tr>
<tr>
<td>b. at Max. AF Output</td>
<td>mA</td>
<td>800</td>
<td>1500</td>
</tr>
</tbody>
</table>

**PUBLIC ADDRESS:**

| Microphone Sensitivity for 4 W                                        | mV   | 4       | 10         |
| Output Power at 1 kHz                                                  |      |         |            |
| Power Output a. Maximum                                                | W    | 5       | 4          |
| b. 10% THD                                                             | W    | 4       | 3          |
| Audio Freq. Response (-6 dB) b. 450 Hz                                  | dB   | -6      | -6 ± 3 dB  |
| b. 2500 Hz                                                             | dB   | -6      | -6 ± 3 dB  |
| Battery Drain a. at no signal                                          | mA   | 300     | 700        |
| b. at Max. AF Output                                                   | mA   | 1000    | 1500       |
2. DISASSEMBLY INSTRUCTIONS

TO REMOVE TOP AND BOTTOM COVER (Figure 1 & 2):
Remove 4 screws from each side and a screw from top. Remove 2 screws from rear of the chassis. Slide top and bottom cover toward rear of the chassis and remove.

TO REMOVE FRONT PANEL (Figure 3):
Remove 2 screws from each side.
3. BLOCK DIAGRAM
4. CIRCUIT DESCRIPTIONS

PLL CIRCUIT:
The PLL circuit used in TRC-469 consists of 7 major parts: Voltage Controlled Oscillator (VCO), 1/N Divider, Phase Detector, Low Pass Filter, Reference Oscillator (10.24 MHz), 1/2048 divider and Code Converter ROM (Read Only Memory).

The VCO is an oscillator which controls oscillation frequency in accordance with input voltage change. The VCO output is mixed with a signal in the transmitter or receiver circuitry. A portion of the VCO frequency is fed through TR14 Buffer Amp and then added to TR15. This frequency is mixed with a 15.36 MHz frequency then goes to IC4 (1/N divider).

"N" for the 1/N divider is determined by Channel Selector Switch whose output is selected by a Code Converter ROM.

As shown in the frequency chart, N is different between transmit and receive modes since only one crystal is used with this PLL circuitry.

The output from the 1/N divider is fed to Phase Detector. On the other hand, the frequency from the Reference OSC, 10.24 MHz, is divided to 5 kHz by 1/2048 divider and applied to another input of Phase Detector.
The Phase Detector detects the difference of these two input signals and produces a voltage which controls the VCO frequency.

The Low Pass Filter integrates the output of the Phase Detector which controls the VCO frequency and the 1/N divider produces a 5 kHz frequency. Thus the Phase Detector receives two input signals (both 5 kHz). It compares the phase difference between the two, generating an error voltage, which acts on the VCO to bring the two frequencies exactly in-phase. When this condition occurs, the PLL circuit is locked.

Fvco (the Frequency of the VCO) is changeable in 10 kHz increments, by varying the program divide ratio, N.

For example, the divide ratio, N is programmed to 273 for channel No. 1 Transmit; therefore Fvco is calculated as follows:

\[
F_{vco} = 15,360 + 5 \times 273 = 15,360 + 1,365 = 16,725 \text{ (kHz)}
\]

In the same manner, Fvco for channel No. 2 through No. 40 is determined as shown in Table A.

Transmitter Local Oscillator
The Transmitter local oscillator frequency of 10.240 MHz is produced by IC4 oscillator, IC4 and crystal, X’tal 1.

Channel Selection Program
The divide ratio of the Programmable Frequency Divider in IC4 is determined through the Code Converter and Transmit/Receive mode switch in IC4 by the voltage supplied to the program input terminals, Pin No. 1 through Pin No. 6 of IC4.

The program input voltage for Pins 1 through 6 is supplied from the Channel Selector switch according to the Channel Number.

The Transmit/Receive mode switch in IC4 changes the divide ratio of the Programmable Divider by changing Pin 9 voltage (High level for Receive, Low level for Transmit), to produce a 455 kHz change in VCO frequency when changing between the two modes.

When changing between Receive and Transmit modes, a varactor diode in the VCO IC, IC3, is switched in or out, respectively.

The bias voltage on this varactor is so designed that the VCO control voltage does not change when switching between modes, thus reducing lock-up time.

Table A shows Frequency Chart of Fvco and Divide Ratio vs. Antenna Frequency, and Program input data.

CIRCUIT FOR DETERMINING FREQUENCY:

Output Frequency of the Transmitter
Transmit frequency, Ft, is taken from the output of the Transmitter Mixer IC1.

One of the inputs of IC1 is the 1st local frequency, Fvco, which is produced by the PLL Local Oscillator circuit. The other input is the transmitter local oscillator frequency of 10.240 MHz produced by IC4.

The sum of these frequencies determines the transmit frequency as follows:

\[
F_t = F_{vco} \div 10.240 \text{ (MHz)}
\]

PLL Local Oscillator
Fvco, the output frequency of the VCO (Voltage Controlled Oscillator), IC3, is fed to one of the inputs of the PLL Mixer, TR15.

The offset frequency, Fstd, 15.360 MHz (10.240 MHz \div 2 \times 3) is fed to another input of TR15.

The input frequency to the Programmable Divider, F1, is calculated as follows:

\[
F_1 = F_{vco} + F_{std} \text{ (15.360 MHz)}
\]

F1 is fed to the Programmable Divider in the PLL IC, IC4 and divided by N, through the Programmable Divider.

The 10.240 MHz frequency produced by the Reference Oscillator in IC4 is divided by 2,048 (the Reference Frequency Divider in IC4) and the resultant frequency, F2, is:

\[
F_2 = 10.240 \text{ MHz} \div 2,048 = 5 \text{ kHz}
\]

The output frequency of the Programmable Divider is compared with F2 at the Phase Detector in IC4. When the frequency and phase of these two signals are precisely the same, the PLL circuit is "locked".

Therefore, Fvco is determined by the following formula.

\[
F_{vco} = F_{std} \text{ (15,360 kHz)} + 5 \times N \text{ (kHz)}
\]
CIRCUIT FOR PREVENTION OF UNAUTHORIZED FREQUENCY EMISSION:

This Transceiver has a built-in circuit which prevents transmission of unauthorized frequencies during the time when the PLL circuit is not locked or when the Channel Selector switch is between channels.

When the PLL circuit is not locked or the program data input is not for channel 1 – 40, pin 15 in IC4 produces a low level digital control signal. This signal is fed to the base of RF signal Disable Transistor, TR 16 (INSTANT STOP).

When the Channel Selector is switched from one channel to another, it may produce a non-valid input (other than data required for channels 1 – 40). However, between channels, the Channel Selector produces a control signal at ground potential, and this signal is fed to the base of RF signal Disable Transistor, TR 16.

In either case, when the base of TR16 is at low level, TR16 will not conduct and thus reduces the supply voltage to the Amplifier stage inside IC1 to zero. This eliminates the RF signal output, and prevents any transmission on unauthorized frequencies.

**TABLE A: FREQUENCY CHART OF Fvco AND DIVIDE RATIO N**

<table>
<thead>
<tr>
<th>Antenna Frequency (MHz)</th>
<th>Channel Number</th>
<th>For Transmit Divide Ratio N</th>
<th>F1 (kHz)</th>
<th>VCO Frequency (MHz)</th>
<th>Divide Ratio N</th>
<th>F1 (kHz)</th>
<th>VCO Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna Frequency (MHz)</td>
<td>Channel Number</td>
<td>For Transmit Divide Ratio N</td>
<td>F1 (kHz)</td>
<td>VCO Frequency (MHz)</td>
<td>Divide Ratio N</td>
<td>F1 (kHz)</td>
<td>VCO Frequency (MHz)</td>
</tr>
<tr>
<td>26.965</td>
<td>1</td>
<td>273</td>
<td>1,365</td>
<td>16.725</td>
<td>182</td>
<td>910</td>
<td>16.270</td>
</tr>
<tr>
<td>26.975</td>
<td>2</td>
<td>275</td>
<td>1,375</td>
<td>16.735</td>
<td>184</td>
<td>920</td>
<td>16.280</td>
</tr>
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<td>26.985</td>
<td>3</td>
<td>277</td>
<td>1,385</td>
<td>16.745</td>
<td>186</td>
<td>930</td>
<td>16.290</td>
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<td>27.005</td>
<td>4</td>
<td>281</td>
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<td>16.765</td>
<td>190</td>
<td>950</td>
<td>16.310</td>
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<td>27.015</td>
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<td>1,415</td>
<td>16.775</td>
<td>197</td>
<td>960</td>
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<td>980</td>
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<td>1,000</td>
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<td>16.640</td>
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<td>1,745</td>
<td>17.105</td>
<td>258</td>
<td>1,290</td>
<td>16.650</td>
</tr>
<tr>
<td>27.355</td>
<td>35</td>
<td>351</td>
<td>1,755</td>
<td>17.115</td>
<td>260</td>
<td>1,300</td>
<td>16.660</td>
</tr>
<tr>
<td>27.365</td>
<td>36</td>
<td>353</td>
<td>1,765</td>
<td>17.125</td>
<td>262</td>
<td>1,310</td>
<td>16.670</td>
</tr>
<tr>
<td>27.375</td>
<td>37</td>
<td>355</td>
<td>1,775</td>
<td>17.135</td>
<td>264</td>
<td>1,320</td>
<td>16.680</td>
</tr>
<tr>
<td>27.385</td>
<td>38</td>
<td>357</td>
<td>1,785</td>
<td>17.145</td>
<td>266</td>
<td>1,330</td>
<td>16.690</td>
</tr>
<tr>
<td>27.395</td>
<td>39</td>
<td>359</td>
<td>1,795</td>
<td>17.155</td>
<td>268</td>
<td>1,340</td>
<td>16.700</td>
</tr>
<tr>
<td>27.405</td>
<td>40</td>
<td>361</td>
<td>1,805</td>
<td>17.165</td>
<td>270</td>
<td>1,350</td>
<td>16.710</td>
</tr>
</tbody>
</table>
AMC (Automatic Modulation Control) CIRCUIT:

The modulation control used in the TRC-469 functions as follows: Modulation signals from the mic are amplified by TR19 and IC2 and fed to the Transmitter's final RF Amplifier stage through Modulation Transformer T1.

The level shift diode D19 (an 8-volt Zener diode) "shifts" any voltage that exceeds a predetermined level and this voltage is fed to the base of TR20 through D17 rectifier diode.

When the modulation signal from the mic increases past this predetermined voltage level, D17 applies a voltage to TR20, which causes base current flow. This reduces the equivalent C-E resistance of TR20. Note that R110 and TR20 C-E resistance forms a voltage divider for the audio signal applied to TR19 Mic Amp. Thus this circuitry effectively limits the level of modulation. VR5 sets the predetermined level which causes D17 to conduct.

RF (Radio Frequency) ATTENUATOR CIRCUIT:

This unit incorporates an RF attenuator circuit using P-I-N diodes; The Equivalent RF resistance of a P-I-N diode is controlled by the current which flows into the diode. Thus any receiver audio distortion caused by excess input signal from the antenna or cross modulation caused by RF gain can be prevented by these P-I-N diodes.

Since reverse-AGC is used with this Transceiver, the voltage on the AGC line becomes lower with strong antenna input signals (with no input signal, approximately 1.4 volts appears on the AGC line).

Furthermore, with no input signal, current from the AGC line flows into the base of TR1 which turns TR1 "on", causes collector current I₁ to flow and thus D23 will not conduct; therefore, no current will flow into D1 and D2 P-I-N diodes. As a result, there is no attenuation of the input signal from the antenna.

With a strong input signal, the voltage on the AGC line decreases which turns TR1 "off" and decreases I₁ current, which increases the collector voltage of TR1, current I₂ will flow through D23, and current I₃ will flow into D1 and D2 P-I-N diodes. Thus, the equivalent RF resistance of P-I-N diodes will drop and the excess input from the antenna to TR2 will be bypassed by these diodes.

In addition to the above, the attenuation level is controlled by changing VR1 (RF Gain) manually, which causes I₄ current to flow, which varies the attenuation level of D1.
5. ALIGNMENT INSTRUCTIONS

CHASSIS LAYOUT—ALIGNMENT POINTS:
ALIGNMENT OF PLL PORTION:

1. Test Equipment Required
   a. Oscilloscope (0 — 50 MHz)
   b. Frequency Counter (0 — 50 MHz)
   c. DC Volt Meter (10 Volts maximum, 100K ohm/Volt)
   d. 50 ohm Load
   e. DC Power Supply (13.8 V/2-Amp)

2. Alignment Procedure (See Pages 7 and 11)

<table>
<thead>
<tr>
<th>Step</th>
<th>Preset to</th>
<th>Connections</th>
<th>Adjustment</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Receiver mode, Channel 40</td>
<td>Oscilloscope to secondary of L21 (TP4)</td>
<td>L21</td>
<td>Adjust L21 for the maximum indication on Oscilloscope.</td>
</tr>
<tr>
<td>2</td>
<td>Same as step 1</td>
<td>Frequency Counter to secondary of L21 (TP4)</td>
<td>VC1</td>
<td>Adjust VC1 to obtain 10.240 MHz indication.</td>
</tr>
<tr>
<td>3</td>
<td>Same as step 1</td>
<td>Frequency Counter to Pin 22 of IC4 (TP3)</td>
<td>L19</td>
<td>Adjust L19 to obtain 15.360 MHz indication.</td>
</tr>
<tr>
<td>4</td>
<td>Same as step 1</td>
<td>DC Volt Meter to Pin No. 4 of IC3 (TP2)</td>
<td>L18</td>
<td>Adjust L18 to obtain approx. 3.50V reading.</td>
</tr>
<tr>
<td>5</td>
<td>Same as step 1</td>
<td>Frequency Counter to secondary of L17 (TP1)</td>
<td>VC1</td>
<td>Adjust VC1 for 16.710000 MHz.</td>
</tr>
</tbody>
</table>

PLL TEST EQUIPMENT SETUP

![Diagram of test equipment setup]
ALIGNMENT OF TRANSMITTER PORTION:

1. Equipment Required
   a. VTVM (full scale: 1V DC with RF Probe)
   b. RF Output Power Meter
   c. Turnable Field Strength Meter
      (Wave Meter or Spectrum Analyzer)
   d. Frequency Counter (0 — 30 MHz)
   e. DC Power Supply (13.8V/2—Amp)
   f. 50 ohm Load and Attenuator
   g. Oscilloscope (0 — 30 MHz)
   h. AF Oscillator

2. Procedure (See Page 11)

<table>
<thead>
<tr>
<th>Step</th>
<th>Preset to</th>
<th>Conditions</th>
<th>Alignment</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX Mode, No Modulation, Channel 19</td>
<td>RF Output Power Meter to ANT. Jack J101. VTVM to TP5</td>
<td>L15,16,17, 21</td>
<td>Adjust for a maximum indication on VTVM.</td>
</tr>
<tr>
<td>2</td>
<td>Same as step 1</td>
<td>RF Output Power Meter to ANT. Jack J101</td>
<td>L11,13,14</td>
<td>Adjust for a maximum indication on RF Output Power Meter.</td>
</tr>
<tr>
<td>3</td>
<td>Same as step 1</td>
<td>Same as step 2</td>
<td>L11</td>
<td>Adjust to obtain Nominal 3.8 W of RF Output Power.</td>
</tr>
<tr>
<td>4</td>
<td>Same as step 1</td>
<td>Tunable Field Strength Meter to Ant. Jack (J101) through a suitable load and attenuator (Use Spectrum Analyzer if available)</td>
<td>L8</td>
<td>Adjust for minimum 2nd Harmonic Output.</td>
</tr>
<tr>
<td>5</td>
<td>Repeat above adjustments, until no further change can be noted.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>TX Mode, Ch19, 1 kHz 100mV applied to Mic Input for MOD</td>
<td>Audio Generator to Pin 4 of Microphone Jack (J3). Oscilloscope to ANT. Jack (J101) through a suitable load and attenuator</td>
<td>VR5</td>
<td>Adjust for 95% Modulation.</td>
</tr>
<tr>
<td>7</td>
<td>Same as step 1</td>
<td>RF Output Power Meter to Ant. Jack J101</td>
<td>VR4</td>
<td>Check that RF Output Power Meter reads 3.8W, then adjust VR4 so that the Transceiver’s Meter just approaches the 4 mark.</td>
</tr>
<tr>
<td>8</td>
<td>TX Mode, No Modulation, All channels</td>
<td>Frequency Counter to Ant. Jack (J101) through a suitable load and attenuator</td>
<td></td>
<td>Check Frequency of all channels.</td>
</tr>
</tbody>
</table>

TRANSMITTER TEST EQUIPMENT SETUP

[Diagram of transmitter test equipment setup]
ALIGNMENT OF RECEIVER PORTION:

1. Equipment Required
   a. Signal Generator (27 MHz Band, 1000 Hz, 30% AM Modulation, Output Impedance = 50 ohm)
   b. Audio VTVM
   c. Oscilloscope
   d. Dummy Load (8 ohms, 5 watts, resistive)
   e. DC Power Supply (13.8 V, 2 Amp.)

2. Procedure (See page 11)

<table>
<thead>
<tr>
<th>Step</th>
<th>SG Connection: Frequency</th>
<th>Preset to</th>
<th>Audio VTVM</th>
<th>Adjustment</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To Ant. Connector (J101)</td>
<td>Channel 19 Volume: Max. Squelch: Min.</td>
<td>To EXT. SPK. Jack (J2)</td>
<td>L1,2,3,4,5,6,7</td>
<td>Adjust for a max. Audio Output</td>
</tr>
<tr>
<td>2</td>
<td>Same as step 1</td>
<td>Same as step 1</td>
<td>Same as step 1</td>
<td>VR1</td>
<td>Adjust for 2 V output with SG level of 0.3 µV</td>
</tr>
<tr>
<td>3</td>
<td>Same as step 1</td>
<td>Volume: Max. Squelch: Max.</td>
<td>Same as step 1</td>
<td>VR2 (Squelch)</td>
<td>Adjust for 2 V output with SG output level of 1000 µV.</td>
</tr>
<tr>
<td>4</td>
<td>Same as step 1</td>
<td>Same as step 1</td>
<td>Same as step 1</td>
<td>VR3</td>
<td>Adjust for a reading of S-9 on the Transceiver’s S-meter with SG output level of 100 µV.</td>
</tr>
</tbody>
</table>

RECEIVER TEST EQUIPMENT SETUP

UNIT WILL NOT TURN ON
1. Defective Power Switch
2. Blown Fuse
3. Defective Power Switch
4. Defect in Power Supply circuitry

NO RECEIVE SOUND
1. Defective external speaker jack
2. Bad contact in the microphone jack
3. Bad PTT switch in the microphone
4. Unlocked PLL circuitry
5. Defect in Squelch circuitry
6. Defective PA-MON-CB switch

NO TRANSMIT
1. Defective Microphone jack
2. Defective PTT switch on Microphone
3. Off-tuned main or local Oscillator
4. Defective PA-MON-CB switch

NO TX MODULATION
1. Defective microphone and/or circuitry
2. Defect in Modulation circuitry
FOR MORE HINTS, SEE BELOW (Also Refer to Pages 7-10):

NO TRANSMIT

A. Connect current meter in series with power cable and check the current reading for transmit mode:
   If current reads more than 1 ampere (but less than 2 A.), it means the final output transistor is OK, so check for bad contacts or short circuits between PC Board and Antenna Connector. If current reads less than 0.5A: it indicates there is no drive to Final Transistor, so check drive or early RF stages.

B. Defective PLL?
   Check if voltage at the emitter of TR16 is less than 3 Volts. If less than 3V then PLL is unlocked or Channel Selector Switch is between Channels. If more than 3V then PLL is OK.

C. Short Circuit in Transmitter Circuitry?
   Voltage at emitter of TR21 should be less than 7 Volts (TX mode) should increase to more than 7 Volts in RX mode.

D. If voltage reading is more than 7 Volts at the collector of TR18, problem is not here. If voltage of more than 2 Volts is measured between R101 and D16, then check microphone circuitry or D16 diode.

E. If RF voltage (27 MHz) is more than 200 mV P-P at TP-5, previous stages are OK.

NO RECEIVE

Before trouble shooting, be sure that Squelch Control is fully CCW and microphone is connected.

A) Connect Signal Generator to antenna and see if Signal Strength Meter (S meter) deflects:
   S meter deflects:
   Antenna through IF stage should be all right; check the circuit through ANL, Squelch and Audio amplifier. During the deflection of S meter, negative voltage should be present at cathode of D6 diode if Detector circuit is normal.

S meter does not deflects:
   To determine whether PLL is OK, check following:
   1. A frequency in the range of 16 MHz should be present at TP-1 (0.5V P-P or more).
   2. The frequencies shown on page 11 should be correct when Channel Selector Switch is changed from CH 1 through CH 40.
   3. A frequency of 10.24 MHz should be present at TP 4 (0.2V P-P or more). If PLL is OK, then check circuitry through TR6, TR5, TR4, TR3, TR2 and TR1.

B) Check whether Audio stage operates: Connect Speaker to PA Speaker Jack and set PA-CB switch to PA position. If click noise is audible when PTT switch is pressed, Audio Stage is OK. If no click noise, IC2 Audio Amplifier is defective or bad T-1 Transformer. (Transformer DC resistance should be approximately 0.5 ohm for both primary and secondary windings.)

C) Defective Audio Power IC?
   If voltage reading at pin 10 = 7V (VCC/2), IC2 should be all right.

D) Squelch is on all the time
   TR7 is defective if voltage at the collector of TR8 is more than 5 volts. If reading is less than 2 volts, check TR9 circuitry and/or Squelch control’s ground connection for cold solder.

NO CHANNEL LED LIGHT

If one particular channel does not light, check Flexible Printed Circuit Board or LED itself or Channel Selector Switch.

If no channel lights, check D16 diode or socket for Flexible Printed Circuit Board.

NO TX MODULATION

If receiver operates correctly but with no modulation on TX, then problem should be TR19, TR20 or short circuit in the microphone circuitry, since audio power IC2 is used for both TX and RX modes.
PLL CIRCUIT TROUBLESHOOTING HINTS (also Refer to Page 7):

No good

Check whether there is RF voltage on TP1.

Yes

Check whether there is RF voltage (0.2Vp-p) on Pin 2 of IC3.

No

Check whether voltage reading on Pin 1 of IC3 is approx. 5.1 volts.

No

Defective IC3, L18 open or poor soldering.

Yes

Defective TR22, L17 or poor soldering.

Defective Vcc line (5V).

Yes

Check whether there is RF output of approx. 0.2 V P-P at secondary of L19.

No

Defective TR15 or poor soldering.

Yes

Defective TR14 or IC3 or poor soldering.

No

Check whether there is RF output of 5.120 MHz on Pin 10 of IC4.

Yes

Defective L19 or poor soldering.

Defective Crystal, or IC4 or poor soldering.

Check whether each Channel Frequency matches the frequency indicated in Frequency Chart.

Yes

Check whether BCD programs on Pin 1 thru 6 of IC4 are as specified in the Chart.

No

Defective Switch. Defective Flexible PCB or Connector J4.

Yes

Check for RF signal of 0.9 ~ 1.8 MHz on TP3.

No

Check whether voltage is 3.5 volts on TP2 at CH40.

Yes

Defective IC4.

No

Check whether there is approx. 1.8 volts at CH1 and 3.5 volts at CH40 on TP2.

Yes

Check whether voltage is 3.5 volts on TP2 at CH40.

No

Check whether voltage reading on Pin 1 thru 6 of IC4 are as specified in the Chart.

Yes

Check whether there is RF voltage (0.2Vp-p) on Pin 2 of IC3.

No

Check whether there is RF output of approx. 0.2 V P-P at secondary of L19.

Yes

Defective TR15 or poor soldering.

No

Check whether there is RF signal of 16 ~ 17 MHz at collector of TR14.

Yes

Defective TR13 or poor soldering.

No

Check whether there is RF signal of 16 ~ 17 MHz at collector of TR14.

Yes

Defective TR14 or IC3 or poor soldering.

No

Check whether there is Output of 5.120 MHz on Pin 10 of IC4.

Yes

Defective TR13 or poor soldering.

No

Check whether there is RF signal of 16 ~ 17 MHz at collector of TR14.

Yes

Defective TR14 or IC3 or poor soldering.

No

Check whether there is Output of 5.120 MHz on Pin 10 of IC4.

Yes

Defective TR13 or poor soldering.

No

Check whether there is RF voltage (0.2Vp-p) on Pin 2 of IC3.
7. IC, TRANSISTOR, DIODE & LED LEAD IDENTIFICATION

IC-1 TA7310P

IC-2 MB3710

IC-3 UHIC006

IC-4 KM5624

TR-1,7,9,13,16,19,20
2SC458

TR-12
2SC2076

TR-3,4,5,6,14,15,22
2SC460

TR-8,17,18
2SA844

TR-2
2SC1342

TR-10
2SC2029

TR-11
2SC2029

L-101
LR0702R

D-9,10,12,15,16,24
1S2076

D-1,2
MC301

D-11,22
SR1K1

D-5,6,7,8,17,18,25
1N60AM

D-3,4
1N60P

D-20,21,19 XZ086
D-13,23 XZ051
D14 BZ052

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ANODE

CATHODE
8. IC & COMPOUND PARTS INTERNAL DIAGRAMS

IC-1, TA7310P

IC-2, MB3710

IC-3, UHIC006

IC-4, KM5624

CC-1 HA-003

RR-2,3 HA-013

RR-1 HA-014

C1 C2 C3 C4

1 2 3 4 5

0.01 x 4

14 12 11 10 9 8

R1 R2 R3 R4 R5 R6 R7

1 2 3 4 5 6 7

IK x 7

R1 R2 R3 R4 R5 R6

C 1 2 3 4 5 6

3.3K x 6
9. FLEXIBLE P.C. BOARD (TOP VIEW)

10. SWITCH P.C. BOARD (ANL, PA-MON-CB)
11. MAIN P.C. BOARD (TOP VIEW)
12. MAIN P.C. BOARD (BOTTOM VIEW)
13. ADDITIONAL PARTS ON THE BOTTOM
The 4th paragraph should be as follows:
For example, the divide ratio, $N$ is programmed to $283$ for channel No.1 Transmit, therefore $F_{vco}$ is calculated like this;

$$F_{vco} = 15.360 + 5 \times 283 = 15.360 + 1415 = 16.775 \text{ (kHz)}$$

In the same manner, $F_{vco}$ for channel No.2 through No.18 is determined as shown in Table A.

The 2nd and 3rd paragraphs should be as follows:
When the PLL circuit is not locked or the program data input is not for channel 1 – 18, pin 15 in IC4 produces a low level digital control signal. This signal is fed to the base of RF signal Disable Transistor, TR-16 (INSTANT STOP).

When the Channel Selector is switched from one channel to another, it may produce a non-valid input (other than data required for channels 1 – 18). However, between channels, the Channel Selector produces a control signal at ground potential, and this signal is fed to the base of RF signal Disable Transistor, TR16.

Refer to the attached revision of TABLE A: FREQUENCY CHART OF $F_{vco}$ AND DIVIDE RATIO N.

The frequencies in the WAVE FORM IC4, pin No.22 should be $R_x = 960 \text{ kHz} \sim 1170 \text{ kHz}$, $T_x = 1415 \text{ kHz} \sim 1625 \text{ kHz}$. 

The channel number in step 1 and 6 should be Channel 10.
2. ALIGNMENT PROCEDURE
   Step 1, SG Connection Frequency: 27.125 MHz, Preset to: Channel 10.

6. TROUBLESHOOTING HINTS
   S METER DOES NOT DEFLECTS: The channel No.40 in item 2 should read as channel 18.

Page 16
   The first and third clauses from top-right hand side should be as follows:
   Check whether there is approx. 1.8 volts at CH 1 and 2.5 volts at CH18.
   Check whether voltage is 2.5 volts on TP2 at CH18.

7. IC, TRANSISTOR, DIODE & LED LEAD IDENTIFICATION:
   The type number of IC-4 should be KM5626, Lead designation is same as KM5624.

8. IC & COMPOUND PARTS INTERNAL DIAGRAMS
   The type number of IC-4 should be KM5626 and refer to the revised block diagram attached.
   The resistor compound parts RR-1, HA-014 and RR-2, HA-013 should be deleted.

Pages 19 through 23
   Refer to the revised parts layout attached.

15. ELECTRICAL PARTS LIST
   Delete C-102, Ceramic Capacitor

Page 27
   Add C-202 Ceramic Capacitor, 0.01μF 25V K SL... CKGZ511030
   Add C-203 Ceramic Capacitor, 0.01μF 25V K SL... CKGZ511030
   Read type number of IC-4 as IC, KM5626 .................. DDEY139001

Page 30
   Add R-201 Carbon Film Resistor, 1K-ohm 1/8W J... RFPZ181024
   Add R-202 Carbon Film Resistor, 1K-ohm 1/8W J... RFPZ181024
   Read type number of S-201 Rotary Switch as SR-198
   ... SSRY198001

16. MECHANICAL PARTS LIST
   Add Pan Head Screw 3 x 8 for TR11 ...................... MZSS123008

Page 34
   Delete Bracket for Meter, F.C.C. Plate and Binding Screw M3 x 6 for speaker.
   Add:
   Spring Washer 2.6 diameter ............................... MZSN510026
   Hexagonal Nut M2.6 ......................................... MZSN430026
   Name Plate(rear of the chassis) ......................... MDNP405640
   Binding Screw M2.6 x 6 ................................. MZSN192606
### TABLE A: FREQUENCY CHART OF Fvco AND DIVIDE RATIO N

<table>
<thead>
<tr>
<th>Antenna Frequency (MHz)</th>
<th>Channel Number</th>
<th>For Transmit</th>
<th>For Receive</th>
<th>Program input data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Divide Ratio (N)</td>
<td>F1 (kHz)</td>
<td>VCO Frequency (MHz)</td>
</tr>
<tr>
<td>27.015</td>
<td>1</td>
<td>283</td>
<td>1.415</td>
<td>16.775</td>
</tr>
<tr>
<td>27.025</td>
<td>2</td>
<td>285</td>
<td>1.425</td>
<td>16.785</td>
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</tr>
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<td>1.455</td>
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</tr>
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<td>293</td>
<td>1.465</td>
<td>16.825</td>
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<td>6</td>
<td>297</td>
<td>1.485</td>
<td>16.845</td>
</tr>
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<td>7</td>
<td>299</td>
<td>1.495</td>
<td>16.855</td>
</tr>
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<td>8</td>
<td>301</td>
<td>1.505</td>
<td>16.865</td>
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<td>27.115</td>
<td>9</td>
<td>303</td>
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<td>305</td>
<td>1.525</td>
<td>16.885</td>
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<td>1.575</td>
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<td>27.185</td>
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<td>16.945</td>
</tr>
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<td>16</td>
<td>319</td>
<td>1.595</td>
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<td>27.205</td>
<td>17</td>
<td>321</td>
<td>1.605</td>
<td>16.965</td>
</tr>
<tr>
<td>27.225</td>
<td>18</td>
<td>325</td>
<td>1.625</td>
<td>16.985</td>
</tr>
</tbody>
</table>

**Notes:**
- **H**: High Level (More than 3.5V DC)
- **L**: Low Level (Less than 1.0V DC)

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### IC4, KM5626

![IC4 KM5626 Diagram](image-url)
9. FLEXIBLE P.C. BOARD (TOP VIEW)

10. SWITCH P.C. BOARD (ANL, PA-MON-CB)