



**Rockwell
International**

instruction book

310Z-2 FM Exciter

**Commercial Telecommunications Group
Rockwell International
Broadcast and Transmission Test Products
P.O. Box 10462
Dallas, Texas 75207**

Printed in United States of America

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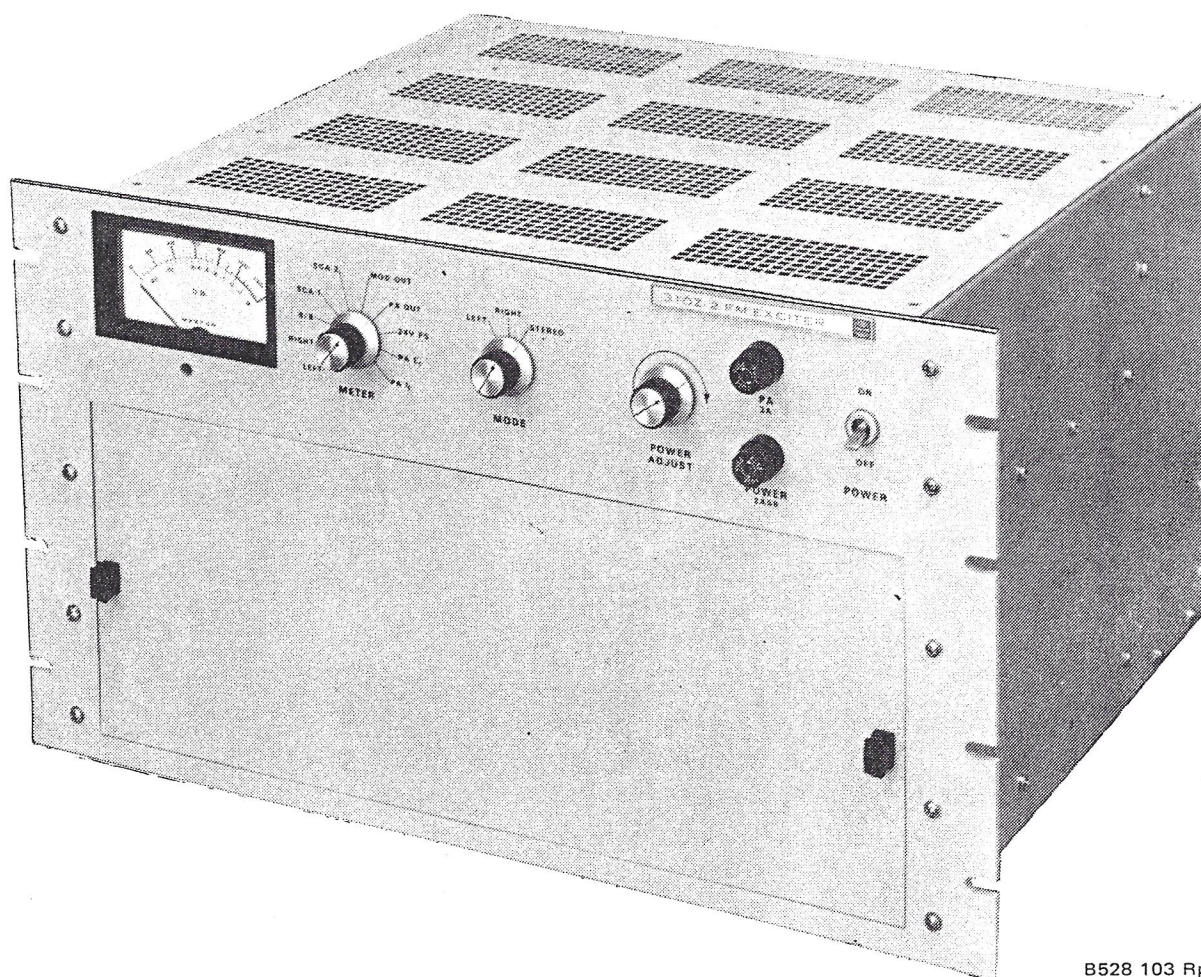
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Figure 1-1. 310Z-2 FM Broadcast Exciter.

1.1 INTRODUCTION

The solid-state 310Z-2 FM broadcast exciter (figure 1-1) provides a frequency-modulated signal in the 88- to 108-MHz range (exact frequency as specified by the customer) for further amplification and transmission. The exciter can be adjusted manually to provide maximum output of 20 watts and is prewired to accept three optional plug-in modules. The optional 786W-1 SCA Generators enable background music to be transmitted at either 41 kHz or 67 kHz multiplexed on an FM broadcast. The optional 786V-1 Stereo Generator allows broadcasting compatible time-division multiplex stereo. In addition, the optional 785E-1 STL (studio transmitter link) Interface Card can be substituted for the 786V-1 Stereo Generator to interface the 310Z-2 with common composite STL systems or other systems requiring an external baseband input to the modulator.

1.2 PHYSICAL DESCRIPTION

The 310Z-2 exciter is 483 mm (19 in.) wide, 267 mm (10.5 in.) high, and 381 mm (15 in.) deep, weighs approximately 18 kg (40 lb) and is designed for mounting a standard 483-mm (19-in.) equipment rack. Controls and power supply components are mounted on the chassis. A card cage secured to the chassis provides receptacles for the five plug-in circuit cards that contain most of the circuits. A removable front panel provides access to the cards. Connectors for the rf signal output and for the ac power input as well as the terminal strip for audio inputs are located on the back of the exciter. Built-in shielding prevents radiation and interference.

1.3 FUNCTIONAL DESCRIPTION

The functional units of the 310Z-2 FM Exciter are an FM modulator and an rf amplifier. In addition, a stereo generator and one or two sca (subsidiary communication authorization) generators are optional units that may be included as part of the 310Z-2. Each of these major functional units is constructed as a plug-in module, and the 310Z-2 is prewired so that the stereo generator and the sca generator plug-in modules can be added at any time.

When the 310Z-2 is used only for monaural broadcasts (without the optional sca generators or stereo generator), the audio input is applied to the baseband input of the FM modulator through the required audio processing circuits. A carrier frequency oscillator is modulated to full deviation by the input. This FM signal is also applied to the AFC system, which maintains the oscillator output frequency at carrier frequency.

When the stereo generator is used, the exciter functions the same as described above with the exception that left and right audio inputs are applied to the stereo generator through separate preemphasis networks. These audio signals are multiplexed to provide the baseband signal, which is filtered and applied to the FM modulator. When an sca generator is used, the sca audio input is amplified and used to frequency-modulate a 41- or 67-kHz subcarrier oscillator. The FM sca output is filtered and applied to the FM modulator.

1.4 OPTIONAL EQUIPMENT

The 786V-1 Stereo Generator, 785E-1 STL Interface Card, and 786W-1 SCA Generators are customer options. Table 1-1 lists several 310Z-2 FM exciter features and indicates optional modules or cards required for each feature.

1.5 TECHNICAL CHARACTERISTICS

The technical characteristics for the 310Z-2 are listed below, and have been divided into five groups: (1) generator characteristics that apply to all 310Z-2 exciters, (2) those characteristics that apply to the 310Z-2 when it is used for monaural FM, (3) those characteristics that apply to the 310Z-2 when it is used for stereo FM with the 786V-1 Stereo Generator, (4) those characteristics that apply to the 310Z-2 when it is used for sca transmission with the 786W-1 SCA Generator, and (5) those characteristics that apply to the 310Z-2 when it is used for composite stereo STL transmission with the 785E-1 STL Interface Card.

1.5.1 General

| | |
|----------------------------------|--|
| Ambient Temperature Range: | 0° to 55°C (32° to 131°F) |
| Ambient Humidity Range: | Up to 95% |
| Maximum Altitude: | 2300 m (7500 ft) |
| Input Power Requirement: | 117/234 volts ac, ±10%, single-phase, 50/60 Hz |
| RF Power Output: | 0 to 20 watts |
| Output Impedance: | 50 to 70 ohms, unbalanced |
| Output Frequency Range: | 88 to 108 MHz, crystal-controlled (crystal installed and exciter adjusted at factory to meet customer requirement) |
| Carrier Frequency Stability: | Within ±500 Hz with ac line voltage of ±10% and temperature range of 0° to +55°C (32° to 131°F) |
| Harmonic and Spurious Radiation: | <p>Any emission appearing on a frequency removed from the carrier by between 120 and 240 kHz is attenuated at least 30 dB below the level of the unmodulated carrier.</p> <p>Any emission appearing on a frequency removed from the carrier by more than 240 kHz up to and including 600 kHz is attenuated at least 35 dB below the level of the unmodulated carrier.</p> <p>Any emission appearing on a frequency removed from the carrier by more than 600 kHz is attenuated at least 80 dB below the level of the unmodulated carrier, with the exception of harmonics of the rf carrier.</p> |

Table 1-1. 310Z-2 FM Exciter Special Features and Customer Options.

| FEATURE | OPTIONAL MODULES OR CARDS REQUIRED | | |
|---|------------------------------------|---------------------------|-------------------------|
| | 786V-1 STEREO GENERATOR | 785E-1 STL INTERFACE CARD | 786W-1 SCA GENERATOR(S) |
| Monaural broadcasting (no options required) | | | |
| Monaural broadcasting with sca | | | X |
| Stereo broadcasting | X | | |
| Stereo broadcasting with sca | X | | X |
| Composite STL | | X | |
| Composite STL with sca | | X | X |

Type of Modulation: Direct frequency modulation

Modulating Frequencies: 20 Hz to 100 kHz

FM Noise Level: 65 dB below 100% modulation

AM Noise Level: 55 dB below carrier level

1.5.2 Monaural FM

Audio Input Impedance: 600 ohms balanced

Audio Input Levels:

Monaural +10 \pm 2 dB mW for 100% modulation

SCA -10 to +15 dB mW adjustable from 0% to 10% modulation

Frequency Response: Standard 75-microsecond preemphasis; others optional

Distortion: Not more than 0.25% thd (total harmonic distortion)

Not more than 0.25% imd (intermodulation distortion)

general description

1.5.3 Stereo FM With 786V-1

| | |
|--|---|
| Audio Input Impedance: | 600 ohms balanced |
| Audio Input Levels: | +10 \pm 2 dB mW for 100% modulation |
| Frequency Response: | Standard 75-microsecond preemphasis for both right and left channels; others optional |
| Distortion: | Not more than 0.5% thd for 50-Hz to 15-kHz audio modulation, Not more than 0.5% imd |
| Stereophonic Subcarrier and Pilot Carrier Phasing: | Phase difference between the stereophonic sub-carrier and pilot carrier is within the limits required for channel separation of more than 35 dB with audio-modulating frequencies of 50 Hz to 15 kHz. |
| Stereo Channel Separation: | At least 35 dB, 50 Hz to 15 kHz |
| Crosstalk: | At least 45 dB below either single-channel level |
| 38-kHz Stereo Subcarrier Suppression: | 45 dB below 90% modulation of the main carrier |
| Pilot Carrier Frequency: | 19 kHz \pm 2 Hz |
| Pilot Carrier Level: | Adjustable from 0% to 12% modulation of main carrier |

1.5.4 SCA FM With 786W-1

| | |
|---|--|
| Audio Input Impedance: | 600 ohms, balanced |
| Audio Input Level: | -10 to +15 dB mW, adjustable from 0% to 10% modulation |
| SCA Subcarrier Center Frequency: | 67 kHz or 41 kHz |
| SCA Frequency Modulation of Main Carrier: | Adjustable from 0% to 30% |
| SCA Generator Center Frequency Stability: | Within \pm 0.5% |
| Frequency Response: | Standard 75-microsecond preemphasis |

FM Noise Level: Less than -55 dB

Distortion: 1.0% for 50 Hz to 5 kHz with 3.5-kHz deviation
2.0% for 50 Hz to 5 kHz with 7.5-kHz deviation

Crosstalk: Crosstalk from main channel and stereo sub-channel into the sca channel shall be 50 dB below 10% modulation of the main channel. Reference: 4.0-kHz sca deviation.

1.5.5 Composite Stereo STL With 785E-1

External Baseband Input: 3.5 V p-p into 4700 ohms when used with 785E-1 STL Interface Card

External Telemetry Input: 1 V rms 20 to 30 Hz, when used with 786W-1 SCA Generator

2.1 GENERAL

Remove all packing material carefully. Check equipment against shipping invoices and records. Inspect the unit for damaged or missing components. Check for free movement of front panel controls. Any claims for damage should be filed promptly with the transportation agency. If such claims are to be filed, all packing material must be retained. Store the factory shipping container for future use.

2.2 PREINSTALLATION

Make sure that all plug-in filters and cards are securely plugged in. Refer to Section 6, Parts List for locations.

| |
|------|
| NOTE |
|------|

If the 786V-1 Stereo Generator is not to be installed, filter FL1 is not required.

2.3 WIRING

2.3.1 Audio Input Connections

Use only balanced 600-ohm audio inputs to the 310Z-2. Use only twisted, shielded pairs for input cables. (See figure 2-1.)

- a. Monaural Inputs - Connect the monaural audio input line to TB1-1 and TB1-3. Connect the cable shield to TB1-2. (See figure 2-1.)
- b. Stereophonic Inputs - Connect the left channel audio input line to TB1-1 and TB1-3. (See figure 2-1.) Connect the cable shield to TB1-2. Connect the right channel audio input line to TB1-4 and TB1-6. Connect the cable shield to TB1-5. Be sure that the 786V-1 Stereo Generator is plugged into the 310Z-2.
- c. SCA Inputs - Connect the SCA-1 (41-kHz) audio input to TB1-7 and TB1-9. Connect the cable shield to TB1-8. Connect the SCA-2 (67-kHz) audio input to TB1-10 and TB1-12. Connect the cable shield to TB1-11. Be sure that the 786W-1 SCA Generator is plugged into the 310Z-2. Set the 786W-1 METER switch to 3.5 kHz or 7.5 kHz, depending on the deviation to be used. Set the 786W-1 MUTE ENABLE switch to ON.
- d. Composite STL Input - Connect the output of the STL receiver to B/B IN jack J2 on the rear of the exciter. This connection should be made with RG-58A/U or RG-223 coaxial cable. Check to see that the 785E-1 STL card is installed in the A3 card position and that filter FL1 is removed from its socket.

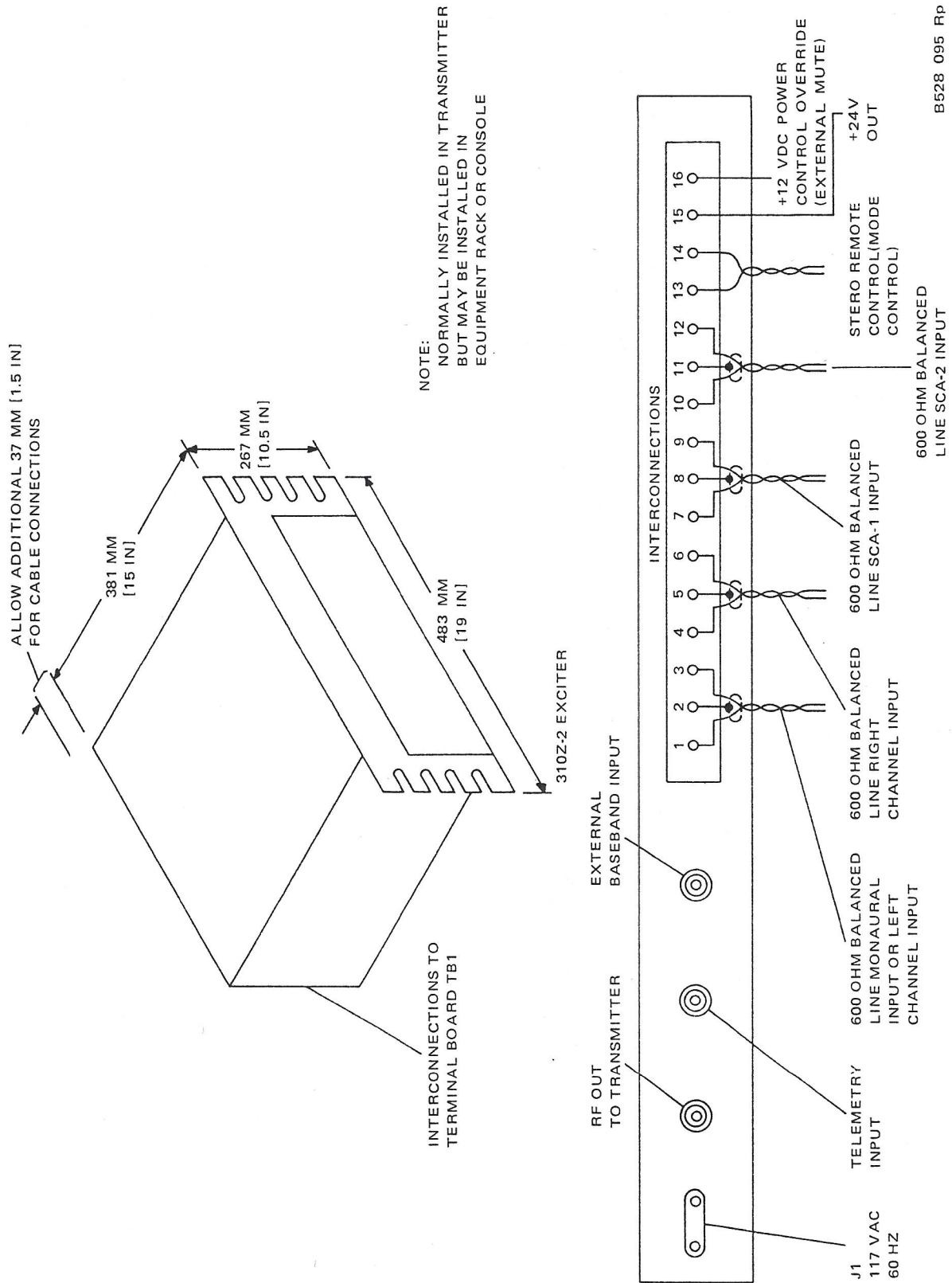


Figure 2-1. 310Z-2 FM Exciter, Outline Dimensions and Installation Details.

- e. \Radio Remote Control Telemetry Input - Connect the telemetry output of the remote control unit to TELE IN jack J3 on the rear of the exciter. This connection should be made with RG-58A/U or RG-223 coaxial cable. Check to see that a 67-kHz 786V-1 SCA Generator is installed in the A2 card position.

2.3.2 Stereo Remote Control

If stereo remote control is desired, connect the leads from the station remote control system to TB1-13 and TB1-14 (ground). A normally closed contact must be provided for stereo operation.

2.3.3 RF Output

Connect a coaxial cable from the transmitter rf input to the exciter RF OUT jack, J1.

2.3.4 Input Power

Connect the ac line cord between P1 on the exciter and 117 volts ac.

CAUTION

Do not operate the 310Z-2 exciter without a load connected to the rf output, and do not operate the exciter over any extended period of time into a vswr greater than 2:1. To guard against such operation, steps should be taken during installation, as outlined in paragraph 2.3.5.

2.3.5 Power Control Override

A dc voltage source (+12 volts) should be connected to TB1-16 to protect the exciter output transistors when no plate voltage is present in the transmitter. This dc voltage is applied to the power regulator card to reduce the exciter output power to a safe level.

If the override voltage is not available directly from the transmitter with which the exciter is being used, the voltage provided at TB1-15 of the exciter may be connected through a relay so that it is applied whenever plate voltage is removed from the power amplifier stage in the transmitter.

2.4 INITIAL CHECKS

The 310Z-2 exciter is carefully adjusted and inspected at the factory and no special tests or adjustments are required upon installation. However, once the exciter has been installed, the transmitter should be checked to ensure that it is operating properly.

2.5 OUTPUT FREQUENCY CHANGE

The output frequency of the 310Z-2 is crystal controlled and can be changed to any desired frequency between 88 and 108 MHz. To change the exciter frequency, refer to paragraph 5.8.

3.1 GENERAL

Only the three front panel switches and the meter on the front panel of the exciter are used during normal operation. Refer to figure 3-1 for control and indicator locations and to table 3-1 for control and indicator descriptions. After the exciter has been placed in operation, it is necessary only to check meter indications (table 3-2) from time to time to ensure that the exciter is operating properly.

3.2 NORMAL TURN-ON PROCEDURE

- a. Place POWER switch to ON.
- b. Set MODE switch to LEFT, RIGHT, or STEREO, depending on the type of modulation desired.

3.3 ALTERNATE TURN-ON PROCEDURE

When the 310Z-2 is used in a Collins transmitter that has automatic-sequencing circuits, the POWER switch is normally left in the ON position and the exciter is turned on and off by the power-sequencing circuits of the transmitter.

3.4 STEREO/MONAUROAL REMOTE SWITCHING

When it is desired to switch the exciter from monaural to stereo from a remote location, a stereo on/off switch is connected between pins 13 and 14 of terminal board TB1. This switch will then control relay K1 so that remote switching can be used as long as the MODE switch is in either the LEFT or RIGHT position. The STEREO position overrides the remote stereo OFF position. The selected LEFT or RIGHT line will then serve as a feed for monaural operation.

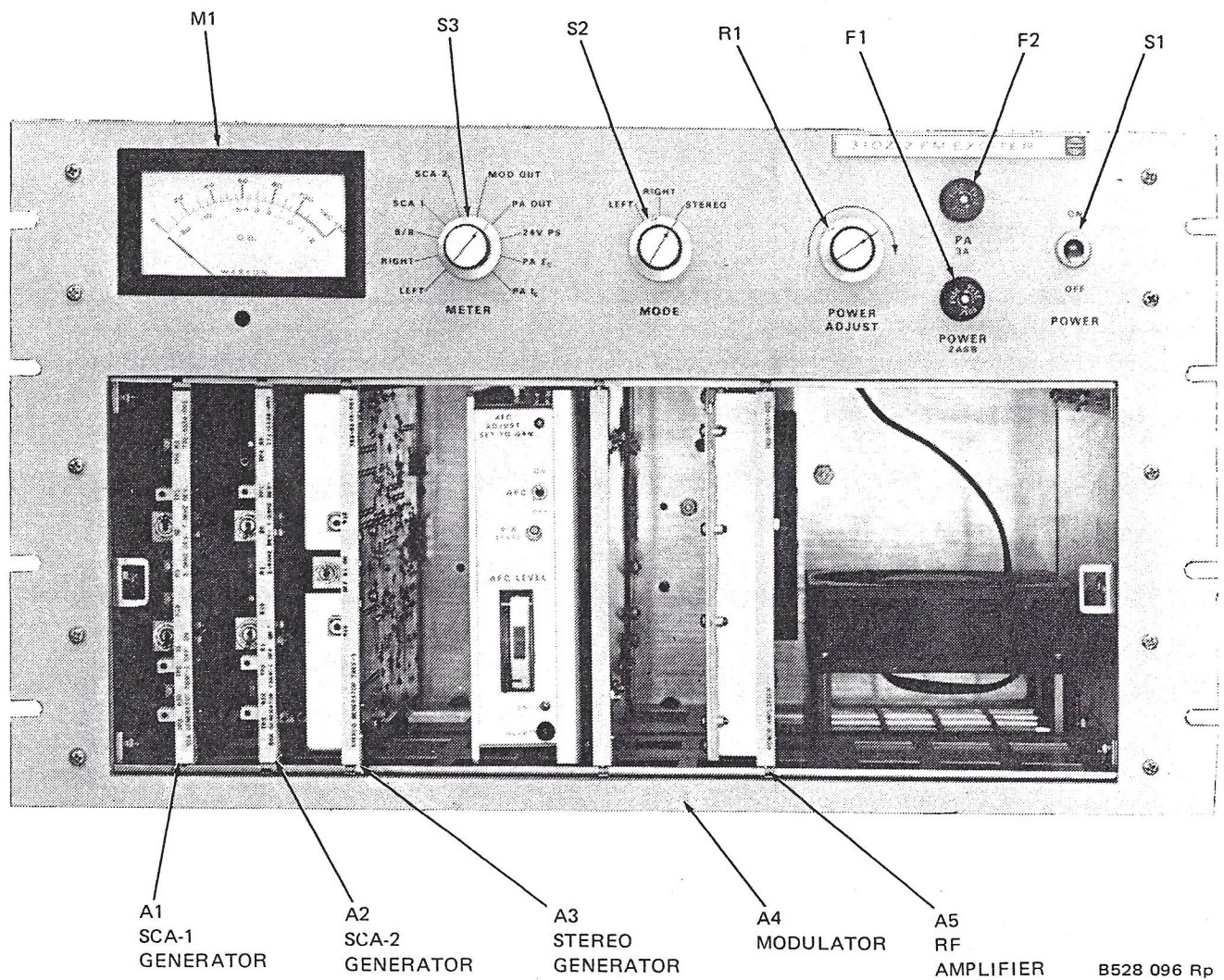


Figure 3-1. 310Z-2 FM Exciter, Front Panel Controls and Indicators.

Table 3-1. 310Z-2 FM Broadcast Exciter, Front Panel Controls and Indicators.

| REF DES | CONTROL OR INDICATOR | FUNCTION |
|---------|----------------------|---|
| S1 | POWER | Controls the application of primary power to the exciter. |
| S2 | MODE | Selects either the left audio input to be broadcast monaurally (LEFT), or the right audio input to be broadcast monaurally (RIGHT), or the left and right audio inputs to be broadcast stereophonically (STEREO). |
| S3, M1 | METER | Meter M1, in conjunction with function switch S3, permits monitoring of the various audio inputs and dc parameters from the 310Z-2 exciter. Refer to table 3-2. |
| R1 | POWER ADJUST | Adjusts power output of exciter. |

Table 3-2. Test Meter Indications

| POSITION OF METER SWITCH S3 | FUNCTION | METER INDICATION |
|-----------------------------|-------------------------------------|---|
| LEFT | Left channel modulation | Semi-peak reading meter responds to peak audio level in manner similar to modulation monitor. |
| RIGHT | Right channel modulation | Same |
| B/B | Baseband output of stereo generator | Same |
| SCA-1 | 41-kHz sca modulation | Calibration at 100% determined by setting of S2 on 786W-1 in A1 card position. |
| SCA-2 | 67-kHz sca modulation | Same as SCA-1 except card A2 |
| MOD OUT | Modulator rf output | Relative rf output of modulator. Reads 50% to 100% as noted on individual data sheet. |

Table 3-2. Test Meter Indications (Cont).

| POSITION OF METER SWITCH S3 | FUNCTION | METER INDICATION |
|--------------------------------|---|---|
| PA OUT | Power amplifier rf output | Relative rf output of power amplifier. Calibration controlled by R2 on 310Z-2 main frame. Set for 100% under normal power output and load conditions. |
| 24V PS | Output of fixed power supplies of main frame | Reads combined output of fixed 24-volt power supplies. Normally reads 85% to 115%. Reads 40% to 60% when either supply inoperative. |
| PA Ec | Power amplifier collector voltage | Reads relative collector voltage to driver and power amplifier transistors. Consult data sheet for normal readings. |
| PA Ic | Power amplifier collector current | Reads relative collector current to driver and power amplifier transistors. Consult data sheet for normal readings. |

4.1 GENERAL

The 310Z-2 exciter produces a frequency-modulated output for driving a power amplifier in an FM broadcast transmitter. The 310Z-2 employs the direct method of frequency modulation. The optional 786V-1 Stereo Generator produces signals that meet all FCC requirements for stereophonic broadcasting. The optional 786W-1 SCA Generator produces an FM subcarrier for broadcasting background music under an FCC Subsidiary Communications Authorization.

4.2 BLOCK DIAGRAM DISCUSSION

Refer to figure 4-1 (simplified block diagram), figure 7-1 (detail block diagram), and figure 7-2 (main frame schematic) during the following discussion. The major circuits of the 310Z-2 are contained on plug-in modules; and as shown on figure 4-1, these modules are the major blocks of the 310Z-2 exciter. When an exciter is used for monaural broadcasting without the optional modules, the monaural input is normally applied to the audio-processing circuits and then directly to the modulator module as the baseband signal. Since the remaining circuits operate the same for either monaural or stereophonic and sca broadcasting, the block diagram discussion covers a complete exciter with the optional modules.

The left and right audio input signals are applied through the audio frequency circuits as the modulation input to the balanced modulator of the stereo generator. These signals modulate two 38-kHz subcarrier signals that are 180° out of phase. As a result, the 38-kHz carrier is canceled so that the modulator output consists of only the two modulation frequencies and the desired modulation sidebands of the carrier frequency. One component is directly proportional to the sum of the two audio signals ($L + R$), and the other component is a double-sideband signal ($L - R$). The output from the balanced modulator is combined with the 19-kHz pilot carrier. Signal generation within the stereo generator is described in paragraph 4.3.

The output from the stereo generator is passed through a 53-kHz low-pass filter and then combined with the output from the sca generator (if used) to produce the baseband signal. The 19-kHz pilot carrier is derived in the stereo generator by routing one of the 38-kHz subcarrier signals to a divide-by-2 circuit to produce the 19-kHz pilot carrier, which is phase-locked to the 38-kHz signals. The baseband signal is then applied to the modulator.

The sca audio inputs are applied to an audio transformer in the sca generators, routed through a preemphasis network, amplified, and used to frequency-modulate the carrier frequency of the subcarrier. The audio input is also monitored by a carrier mute circuit, which removes the sca output whenever the audio input drops below the selected mute level.

4.3 STEREO GENERATOR A2

The 786V-1 Stereo Generator performs the conversion of stereophonic input signals to an output that conforms to the standards approved by the FCC for transmission of stereophonic signals. To provide a realistic stereo effect, the 786V-1 maintains the difference in time delay and signal amplitude from the sound source to both the right and left channel microphones through the entire stereo system. Channel separation, which is the isolation between the two channels, is held to greater than 35 dB by the 786V-1 to enhance the stereo effect to the listener. The following paragraphs discuss stereophonic signal generation and the principles of operation of the 786V-1 Stereo Generator. Refer to figure 7-4 for a schematic diagram of the 786V-1 Stereo Generator.

4.3.1 Signals Required

The FCC requires that stereophonic FM broadcast signals be compatible, which means that the signals may be detected by either a monophonic or stereophonic receiver. To satisfy this and other requirements of the FCC, the signals and frequencies generated must be as shown in figure 4-2. In monophonic receivers only, the $L + R$ (left plus right) audio frequency component of the signal, called the main channel, is used. The $L - R$ (left minus right) component of the baseband signal, called the subchannel, is a difference signal only and is composed of sidebands of a 38-kHz suppressed subcarrier. This difference component and the 19-kHz pilot carrier signal are reduced by the deemphasis network of the monophonic receiver.

In FM stereophonic receivers, all signals shown in figure 4-2 are detected and used. The $L - R$ subchannel and $L + R$ main channel signals are mixed, added, and subtracted to separate them into left and right audio signals. The 19-kHz pilot carrier signal is doubled in the receiver to regenerate the 38-kHz suppressed subcarrier, which is used to demodulate the stereo signal. By this means, proper phase relationship is maintained between main channel and subchannel frequencies and between the left and right audio channels.

After the $L + R$ and $L - R$ signals have been generated, any interaction or exchange of information between the main channel ($L + R$) and the subchannel ($L - R$) represents crosstalk, which deteriorates the signals and has the effect of adding noise. In stereo transmitting systems, crosstalk must be kept at least 40 dB below either signal-channel level.

To maintain 30-dB channel separation, as required by the FCC, for the condition of an input into one channel only, the main channel and stereo subchannel signals must have equal peak amplitude, within approximately 0.3 dB, and the envelope of the subchannel signal must cross the zero level simultaneously with the main channel signal, within approximately $\pm 3^\circ$.

4.3.2 Method of Signal Generation in 786V-1 Stereo Generator

The 786V-1 generates the spectrum of signals shown in figure 4-2 by the time-division multiplex method. The basic system operating principle is shown in figure 4-3. The left and right audio channels are switched into the link (used alternately) at a 38-kHz rate. If the receiver switching rate is synchronized with the transmitter switching rate, the original left and right audio signals are detected. In the receiver the frequency of the 19-kHz pilot carrier is doubled to synchronize the receiver to the transmitter. It is important that the switching frequency in both the stereo generator and the receiver be of the same phase to retain the identity of the left and right audio signals. In the 786V-1 generator

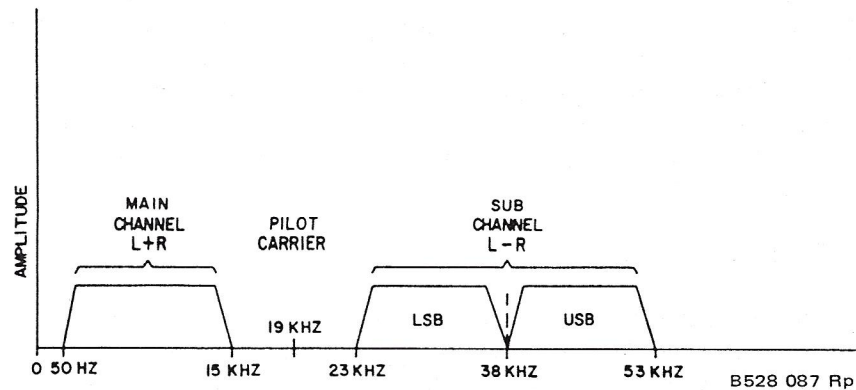


Figure 4-2. Spectrum of Signals in Stereo Baseband Audio.

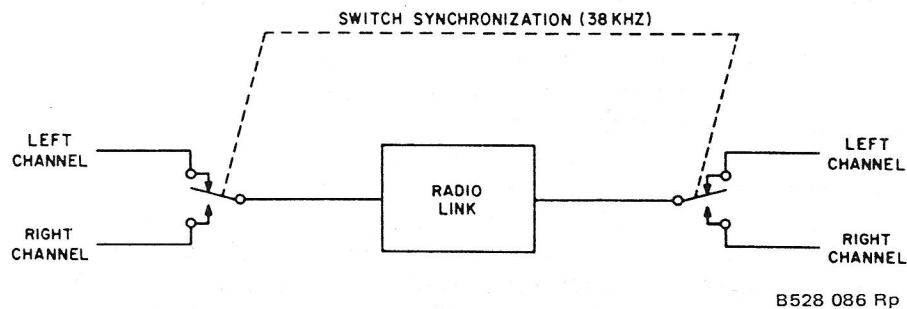


Figure 4-3. Elementary Time-Division Multiplex System.

a crystal-controlled oscillator is used to generate a 76-kHz signal. This 76-kHz signal is divided by 2 in a micrologic flip-flop circuit; and by using both the logic 1 and the logic 0 outputs of the flip-flop, two 38-kHz square waves are obtained that will be exactly 180° out of phase. One of the 38-kHz square-wave signals is used to trigger another micrologic flip-flop (A4) to obtain a phase-locked 19-kHz pilot carrier signal.

To generate the baseband stereo signals, the 786V-1 Stereo Generator utilizes the basic circuits and functions of a balanced modulator. Refer to figure 4-1, the exciter block diagram, for component relationship and signal flow; refer to figure 7-4, the stereo generator schematic, for circuit detail. Although transistors Q2 and Q5 and their associated circuits function as a balanced modulator, several additional considerations affect the overall operation of the circuits to produce the desired stereo output signal. Separate input channels couple the two different modulating audio signals, L and R (left and right), to the modulator. Emitter follower Q1 applies the right audio signal to the balanced modulator, and emitter follower Q4 couples the left audio signal to the balanced modulator. The 38-kHz subcarrier signals are applied to the balanced modulator transistor switches, Q3 and Q6. Because the two 38-kHz signals are of opposite phase, modulator transistors Q2 and Q5 are switched on and off at 38 kHz. Furthermore, when the outputs from Q2 and Q5 are combined, the subcarrier signals cancel and the 38-kHz subcarrier does not appear in the

output signal. Transistor Q2 conducts during one half-cycle of the subcarrier frequency, and during this half-cycle one excursion of the square wave is modulated by the audio signal in the right channel. During the next half-cycle of the subcarrier, Q5 conducts and the next excursion of the square wave is modulated by the audio signal in the left channel. As stated previously, the 38-kHz subcarrier signals are balanced out in the modulator, and only the two modulating audio frequencies and the desired modulation sidebands of the carrier frequency are combined in the output.

4.3.3 Analysis of Signals Generated

It can be demonstrated by mathematical analysis that if a square wave is modulated alternately by two audio signals, two significant components are in the resultant signal. One component is directly proportional to the sum of the two audio signals ($L + R$), and the other component is a double-sideband (DSB) signal centered on the switching frequency or subcarrier frequency (38 kHz). Mathematical analysis in detail is hardly within the scope of this manual. One other fact derived from such analysis is necessary, however, to an understanding of the 786V-1 operation. Because the peak amplitude of the fundamental sine-wave components of a square wave is $4/\pi$ times the peak amplitude of the square wave itself, the $L - R$ component mentioned above is $4/\pi$ times the $L + R$ component.

To make $L + R = L - R$, as required by the FCC, small portions of the L and R signals are added directly in the 786V-1, shunted around the balanced modulator through R9, R25, R16, and C13, and added to the modulator output.

Development of the FCC required signal in the 786V-1 may also be demonstrated by an analysis of the waveforms generated. Figure 4-4 represents the circuit operation when the inputs to each of the audio channels (L and R) are identical sine waves. On one half-cycle of the square-wave switching frequency (subcarrier frequency), Q5 conducts and the L signal is utilized (or sampled). On the next half-cycle, Q2 conducts and the R signal is utilized. Expressing the same action in a different way, on one half-cycle of the switching frequency an excursion of the subcarrier square wave is modulated by the left channel audio signal; and on the next half-cycle the next excursion of the subcarrier square wave is modulated by the right channel audio signal. As may be seen in figure 4-4, the 38-kHz subcarrier switching frequency is balanced out, and with equal sinewave input to both audio channels ($L - R = \text{sine wave}$) no sidebands are generated. The spikes shown on the composite sine wave in the third illustration of figure 4-4 are caused by imperfect switching and must be filtered out. The output of the modulator is then a sine wave identical to the original sine-wave input in either channel ($L - R$ or $[L + R]/2$). Equal sine-wave input seldom occurs in an actual broadcast but is shown here for analysis.

Figure 4-5 shows the balanced modulator output when $L = 1$ and $R = 0$. The output of the balanced modulator is an audio component plus DSB components centered on the switching frequency, and odd harmonics. When the odd harmonics are filtered out by a phase-linear low-pass filter, the third waveform results. The audio component is then increased by $4/\pi$ and the fourth illustration results.

Figure 4-6 shows the time-division multiplex signal when $L = -R$, or $L + R = 0$, and $L - R = 2L$ (or $2R$). The composite waveform from the balanced modulator is shown in the third illustration. This waveform is composed of equal but opposite audio components, DSB components centered on the switching frequency, and odd harmonics. The audio components balance out; and when the odd harmonics are removed by filtering, the waveform in the fourth illustration results. This waveform is a DSB signal, which equals $L - R$ as required.

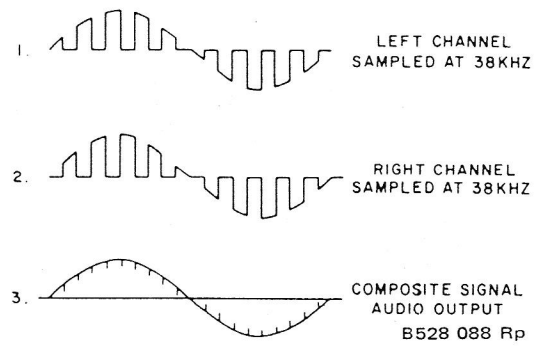


Figure 4-4. Balanced Modulator Output When $L + R = 2$; $L - R = 0$.

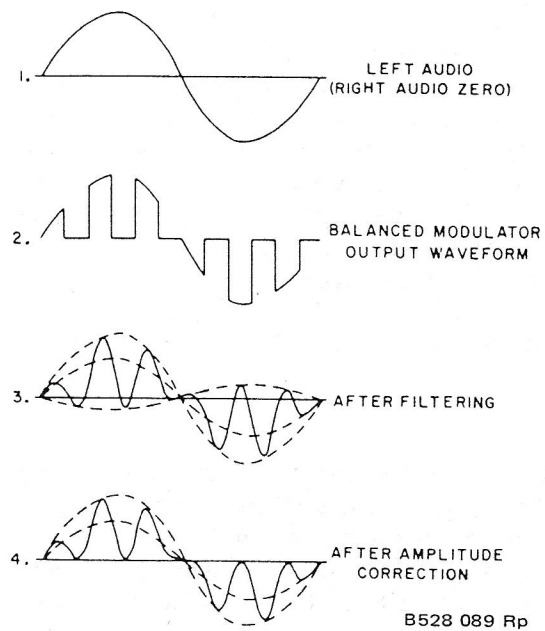


Figure 4-5. Balanced Modulator Output When $L + R = 1$; $L - R = 1$.

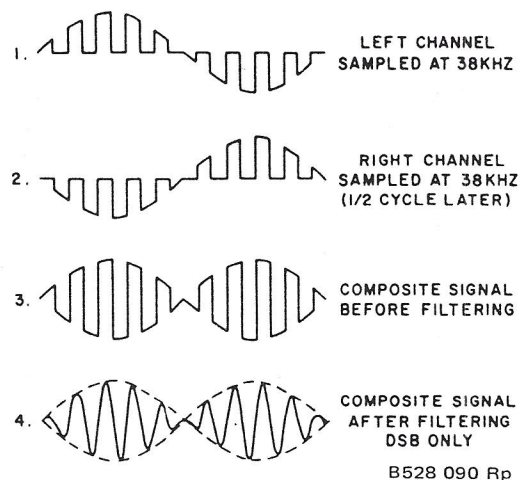


Figure 4-6. Balanced Modulator Output When $L + R = 0$; $L - R = 2$.

Perhaps the relationship of the $L + R$ and $L - R$ signals should be noted again here in connection with the above analysis. The $L + R$ main channel component of the composite signal represents the sound that would be heard if only one microphone is used for input, and it is also the sound that would be heard from a microphonic receiver tuned to a stereo broadcast. The $L - R$ component is a difference signal only. It may be a positive value, may be equal to zero, or may be a negative value (in the case where R is greater than L). When the composite signal is detected in a stereo receiver that is exactly synchronized with the transmitter, the $L + R$ component is split and routed to both left and right audio channels in the receiver. The $L - R$ difference signal is split also, and in effect is added to the left channel audio component and subtracted from the right. The result is $(L + R)/2 + (L - R)/2 = L$ in the left channel, and $(L + R)/2 - (L - R)/2 = R$, in the right channel. In this way the receiver gives a perfect reproduction of the stereo input to the transmitter.

4.3.4 Circuit Analysis

Both left and right audio signals are fed through preemphasis networks in the exciter before application to the right and left audio inputs of the stereo generator, connector pins 13 and 29, (figure 7-4). Within the generator the left and right audio channels are identical. The audio signals are fed through 15-kHz low-pass filters (FL1 and FL2), which sharply attenuate frequencies above 15 kHz. From FL1, capacitor C1 couples the right audio signal to the base of emitter follower Q1 and then to the modulator at the junction of resistors R9 and R10. The right channel audio signal is divided so that the signal through R9 adds to the left channel signal and the signal through R10 modulates the 38-kHz subcarrier. A similar circuit couples the left audio signal to emitter follower Q6 and to the other side of the balanced modulator at the junction of resistors R25 and R26. The signal through R25 adds to the right channel signal (through R9) and is routed around the modulator to increase the $L + R$ component of the modulator output. Variable resistor R16 provides a control for the amplitude of the $L + R$ component to control channel separation.

The 38-kHz subcarrier signals for the balanced modulator are produced from the output of the 76-kHz oscillator, transistor Q7 and its associated circuits. The oscillator frequency is controlled by crystal Y1, and after amplification by amplifier Q8 the 76-kHz signal triggers a flip-flop (micrologic A1). By using both the logic 1 and the logic 0 from this flip-flop, two 38-kHz signals are obtained that are 180° apart in phase. The output signals from flip-flop A1 are first amplified by the inverters (micrologics A2 and A3) and then applied to the modulator through transistor switches Q3 and Q6. Capacitor C26 helps maintain balance between Q3 and Q6 and improves the switching operation. The 38-kHz signals combine with the right and left channel audio signals at the base of Q2 and Q5 respectively. As a result, Q2 and Q5 alternately conduct at a 38-kHz rate and produce the stereo signals, which are coupled through C12. The 38-kHz output from micrologic inverter A3 triggers micrologic flip-flop A4. With both the set side (pin 1) and the reset side (pin 3) of the flip-flop grounded, the flip-flop functions as a complementary flip-flop. Thus, the output from the logic 1 side (pin 7) is a 19-kHz signal that is phase-locked to the 38-kHz subcarrier signals. The 19-kHz pilot carrier signal is routed through the PILOT CARRIER switch (S1) to a filter network (C29, C23, L2, and C24), which removes the undesired third harmonic of 19 kHz. From the filter the signal is fed through potentiometer R49, which provides control of the pilot carrier amplitude, through capacitor C14 and a resistor network to the output of the balanced modulator.

Bypass capacitors C25 and C4 provide an ac ground for any signal through Q3 when the transistor conducts. Similar capacitors (C27 and C11) perform the same function in relation to Q6. Potentiometers R12 and R28 provide a means for adjusting the sideband suppression. Of special importance in this circuit is suppression of the 76-kHz harmonics of the 38-kHz subcarrier. The L - R double-sideband signal from the balanced modulator and the 19-kHz pilot carrier signal are combined, and capacitor C12 couples the combined signal to the multiplex output, connector pin 16. The L + R amplitude correction (from R16 through C13) adds to the signal coupled through C12, to form the composite stereo baseband signal at the multiplex output.

4.4 SCA GENERATOR A1/A2

4.4.1 General

Signals from the 786W-1 SCA Generator become part of the audio baseband signal that is used to modulate the carrier. The subcarrier oscillator is a free-running multivibrator, which generates a 67-kHz center frequency that is frequency modulated by the sca audio input signal. During normal stereo broadcast operation, modulation is limited to ± 3.5 -kHz deviation to avoid interference with the stereo frequencies in the baseband signal. During monophonic broadcasts, ± 7.5 -kHz deviation is used. The modulation output from the oscillator is filtered to remove unwanted harmonics. Refer to figure 4-1, the exciter simplified block diagram, for component relationship and signal flow; refer to figure 7-3, sca generator schematic for circuit detail.

4.4.2 Circuit Analysis

The sca audio input is applied to the sca generator through connector pins 17 and 19 (figure 7-3). The main signal path is through T1 to audio amplifier Q2, but a portion of the input signal is also applied through S2 to the sca audio input of the vu meter, and through the mute level control (potentiometer R1) to the carrier mute circuits.

Modulation level control R3 selects the sca audio input level, which is coupled through C1 to impedance-matching emitter follower Q1. A standard 75-microsecond preemphasis network (consisting of R7, R8, and C3) and capacitor C4 couple the input signal to audio amplifier Q2. Capacitor C30 and switch S2 couple the amplified audio signal to the modulation input of the vu meter. Switch S2 selects the correct attenuation (R46 or R47) of the modulation input signal to provide a 0-vu indication for either 3.5-kHz or 7.5-kHz frequency deviation. The audio signal used to modulate the subcarrier frequency is applied through CR1 to the subcarrier oscillator circuit. Transistors Q4 through Q7 and their associated circuits comprise the astable multivibrator circuit that generates the 67-kHz center frequency subcarrier. Deviation of the subcarrier frequency, as adjusted by modulation level R3, is within the range selected (± 3.5 kHz or ± 7.5 kHz). The modulated rf output from the oscillator is coupled through C10 and R3 to the base of amplifier Q8.

The carrier mute circuit is connected to the collector circuit of amplifier Q8 through MUTE ENABLE switch S1. Whenever the carrier mute circuit is being used (normally) and the audio input level drops below the level selected by MUTE LEVEL control R1, the output from the sca generator is grounded at the collector of Q8. Positive pulses that are normally applied to the base of Q12 are removed, and Q12 is turned off. As a result, C27 charges through R43 toward +20 volts; and when a potential of +10 volts is reached (in 3 seconds), diode CR9 breaks down and a positive voltage is applied to the base of Q13. Consequently, the collector of Q13 is at ground potential and this ground is applied through S1 to the collector of Q8.

Assuming that the input level is greater than the threshold level selected by MUTE LEVEL control R1, the modulated signal from the subcarrier oscillator is amplified by the direct-coupled amplifier (Q8 and Q9) and applied through CR7, R32, and R51 to the filter network. Capacitors C12 through C21 and inductors L1 through L3 comprise a 2-section band-shaping filter that removes the unwanted harmonics of the 67-kHz subcarrier. Capacitor C22 couples the filtered signal to emitter follower Q10, which provides a low output impedance to feed the SCA subcarrier signal through capacitor C23 and connector pin 43 to the input of the FM modulator card of the exciter.

4.5 FM MODULATOR A4

The FM modulator is a direct FM modulator operating at carrier frequency. A phase-lock automatic frequency control system controls the output frequency within very tight tolerances. Refer to figure 7-5, modulator schematic, for circuit details.

Transistor Q1 is operated class A as a Clapp oscillator with inductor L5 as the oscillator tank coil. The frequency of oscillation is determined by L5 and the net capacitive reactance formed by CR3, CR4, CR5, CR6, C4, C15, C7, C8 and C9. Elements CR3, CR4, CR5 and CR6 are voltage-variable capacitors, or varicaps, whose terminal capacitance is an inverse function of applied voltage. Varicaps CR3 and CR4 are operated with a fixed dc bias as modulators. The bias is adjustable by R5 and is set for best linearity in final test. Varicaps CR5 and CR6 are operated with two independent bias voltages chosen in a manner such that the devices cannot be forward biased. The more positive of the two voltages is controlled by AFC ADJUST control R7 and is used as a fine frequency or phase adjustment for the modulator. The lower of the two voltages is derived from the phase detector loop filter or from a fixed dc voltage for test purposes.

The modulator circuits are temperature compensated by capacitors C7, C8 and C9 to reduce drift. Isolation from the load is enhanced by a T-pad consisting of resistors R18, R19, and R20. Buffer stage Q2 is operated at approximately 500 milliwatts. The collector circuit is coupled to the load through a Pi network consisting of L8, C24, and C25. A resistive pad consisting of R26, R27, and R28 further isolates load variations from the modulator circuits. An rf sample is derived from the buffer through C22, clipped by diodes CR10 and CR11, and then coupled to U1, a high-speed ECL (emitter-coupled logic) binary divider. The output of the divider is amplified and shaped in an amplifier composed of Q3, Q4 and associated circuits and applied to complementary-MOS divider U2. Divider U1 divides the carrier frequency input by a factor of 16 while divider U2 divides its input by 1024 for a total division of 16,384.

The reference crystal is enclosed in an oven at 75° centigrade and operates at 1/64 of carrier frequency. The reference oscillator is an untuned device consisting of integrated circuit U5 and associated components. A vernier frequency adjustment is included in the form of a screwdriver adjustment, C38, accessible from the front panel. The capacitor provides sufficient adjustment range to compensate for aging of the crystal.

The output of the oscillator is divided by a factor of 128 in divider U4 and further divided by a factor of 2 in one-half of divider U3. The other half of U3 is a simple flip-flop that acts as a phase detector. The device is clocked by the divided reference frequency signal at a rate 1/256th of the crystal frequency. The flip-flop is then reset by a narrow pulse derived from the divided modulator output signal. The large division ratio of the modulator divider effectively removes the phase shift associated with the frequency modulation process. The resultant phase deviation at the output of the divider is a very small fraction of the available phase detector range at the lowest modulating frequency of interest.

The output of phase detector U3B is a rectangular phase with a duty cycle that is a function of the time difference of the input clock and reset pulses; hence, a function of the phase angle between the modulator and reference oscillator zero crossings. This pulse is amplified by transistor Q7 and filtered by a network consisting of R53, R54, C33, and C34 to reject the comparison frequency and retain the dc component of the pulse. This dc voltage is displayed on meter M1 as an aid in initial setup and maintenance. A green band is shown on the meter as a recommended operating range, and the meter is set by the AFC ADJUST control R7, a front panel adjustment.

The dynamic characteristics of the loop are established by a loop filter consisting of R15, R16, C10, and C11. The time constants are chosen for best compromise between minimum lock acquisition time and minimum disturbance of low-frequency phase response of the modulator system.

If phase-lock is lost, the input frequencies to the phase detector will be unequal and a beat note will appear at the output of the detector. This beat note is ac coupled from amplifier Q8 to a 3.5-kHz low-pass filter and further amplified by amplifier Q9. A series of constant-amplitude pulses with a repetition rate proportional to the difference frequency appear at Q9 collector. These pulses are rectified and used to turn on transistor Q5, which activates ALARM lamp CR16 and turns off transistor switch Q6. Switch Q6 applies a dc bias to the power amplifier regulator, which squelches the exciter rf output, thus preventing off-frequency operation. A charging current is applied to the AFC loop filter causing capacitor C10 to charge to a value much greater than its normal value. Four-layer diode CR18 conducts when this charge reaches a certain value and discharges C10 to a value much lower

than its normal value. The charging current then slowly recharges C10 and sweeps the oscillator frequency through its normal operating frequency. When the correct frequency is reached, the loop is locked and the charging current is removed. At this time ALARM lamp CR16 is extinguished and the dc bias is removed from the pa power supply allowing normal operation to resume. This circuit allows much faster lock acquisition and more optimum loop time constants for the application to be employed.

Transistors Q10, Q11 and associated components are used to provide a "soft" turn-on and turnoff for the crystal oven heater to minimize transients in the modulator. The circuit is straight forward with Q10 operating as a current amplifier and Q11 operating as a saturated switch.

4.6 AUDIO/REGULATOR CARD A7

Audio preemphasis for both monaural and stereo operating modes is obtained from feedback shaping in a pair of high-gain, integrated circuit, operational amplifiers. Both channels are fed from balanced 600-ohm lines through H pads and transformers to eliminate effects of uneven source impedances. The left channel response is determined by components R57, R58, R59, R60, C20, C21, and C22. All are fixed low tolerance components. Right channel response is determined by similar components with the addition of three vernier elements R41, R45, and R42, which allow trimming overall gain, mid-frequency and high-frequency gain, respectively to permit matching of response of both channels to a very high degree. This is done to minimize linear crosstalk in the stereo mode, which results from uneven gain and phase tracking of the left and right channels.

Variable resistor R30 provides a vernier setting of monaural gain to permit matching that mode to stereo operation.

Relay K1 is included to permit selection of stereo or monaural operation either locally or by remote control.

4.7 785E-1 STL INTERFACE CARD A3

The 785E-1 STL Interface Card provides an interface between commonly used composite STL systems or other operating modes such as quadraphonic operation requiring an external baseband input to the modulator. The 785E-1 provides input processing and the necessary gain and phase linearity to accommodate these systems. Refer to figure 7-7. A bridging input of approximately 4700 ohms is provided in a differential input configuration to avoid any degradation of signal-to-noise ratio through ground loops. An adjustable common mode rejection control, R4, is provided to minimize hum. A high frequency phase adjustment, C7, is provided to compensate for minor phase degradation at high frequencies due to receiver and transmitter bandwidth limitation.

Integrated circuit U1 is a low-noise wideband operational amplifier connected as a balanced differential input amplifier. A complementary symmetry power booster stage composed of transistors Q1 and Q2 raises the load impedance to a value suitable for U1. An output pad consisting of R16 and R17 reduces the output level of the amplifier to approximately 200 mV required by the modulator. Capacitor C7 provides a minor phase adjustment at the high end of the spectrum to compensate for phase errors in the system.

4.8 RF AMPLIFIER A5

The rf amplifier card of the 310Z-2 contains a broadband, solid-state, 3-stage rf amplifier. The FM signal from the rf mixer is amplified to provide an rf output power level of 10 to 20 watts. Refer to figure 7-6 for circuit details.

The first amplifier stage (Q1, figure 7-6) receives the FM input signal (through jack J1) and operates as a class A amplifier, using 20-volt dc power supplied through filter FL1. The second and third stages (Q2 and Q3) operate as class C amplifiers so that greater efficiency is obtained. All three amplifier stages are set for gain saturation, which is permissible with an FM input signal and provides higher efficiency. Both Q2 and Q3 use a variable 10- to 26-volt dc power input through FL2. The rf output power level of the amplifier (adjustable from 10 to 20 watts) is controlled by the level of this variable dc power, which is adjustable by the POWER ADJUST control mounted on the front panel. The rf amplifier output is coupled through J2 to J1 on the exciter main chassis.

4.9 POWER SUPPLIES

Three power supplies are used in the 310Z-2 exciter. Two are fixed, regulated supplies capable of supplying 24 volts at approximately 700 mA each. One is a variable supply for the rf amplifier. The variable supply supplies up to 26 volts at approximately 2 amperes. All three power supplies are derived from a common, power transformer, rectifier, and filter system. Separate regulators are utilized for each function.

Regulators U1 and U2 are each fixed 24-volt 3-terminal regulators, which supply the basic exciter requirements. Regulator U1 supplies power to the audio and meter amplifier circuits, A1 card, and A4 card. Regulator U2 supplies power to the A2 card, A3 card, and the fixed voltage requirements of the A5 card.

Power for the driver and rf amplifier stages is supplied by an adjustable regulated power supply. This supply consists of an integrated circuit regulator (U2 on the A6 card) and associated components. The regulator supplies base bias voltage for current amplifier transistor Q1, which in turn supplies series pass transistor Q2. The power supply incorporates foldback current limiting to prevent damage to components in the event of short circuits. Overvoltage protection is provided by scr Q7 on the A6 card. Zener diode VR1 sets the point at which the scr fires. This circuit prevents possible damage to the power amplifier transistors in the event of failure of the regulator circuit. When the threshold is exceeded, the scr fires placing a short circuit across the pa power supply. If there is a failure of regulator transistor Q2, then fuse F2 will blow. If the trouble is of a transient nature only, the scr will fire and cause the power supply to go into the current-limiting mode. In this case, simply turning the power supply off and then on will restore proper operation.

Two external control inputs are provided for remote power control and muting purposes. Transistor Q10 on the A6 card serves as an inverter amplifier. The alarm circuit of the modulator supplies a fixed output voltage under alarm conditions, which is coupled to the base of transistor Q10 causing it to saturate and remove the base driver to the power transistors, thus muting the rf output of the exciter.

External mute input, TB1-16, is provided for external power control or muting purposes. It is coupled to the inverting input of regulator U2 on the A6 card. Full or partial muting of the power output is possible by adjustment of the applied voltage.

4.10 METER AMPLIFIER

The peak voltmeter circuit is contained on audio/regulator card A7 and is used to monitor the following audio levels in the 310Z-2:

Left audio level

Right audio level

Stereo generator baseband output

SCA-1 modulation

SCA-2 modulation

The peak voltmeter circuit is an automatic slideback peak voltmeter type that determines the peak voltage of the complex waveforms monitored by the meter. A basic slideback voltmeter operates by reverse-biasing a diode to a point where the incoming signal can no longer switch on the diode. The reverse dc bias voltage is then equal to the incoming peak voltage (disregarding the intrinsic standoff voltage of the diode). The automatic slideback voltmeter operates in a similar manner by taking the signal voltage that is conducted through the reverse-biased diode, amplifying the signal, rectifying it, and applying the resultant dc as a reverse bias to the diode. The diode will conduct until the dc reverse bias from the amplifiers cuts off diode conduction.

Grounded emitter amplifier Q1 amplifies the wideband complex waveform and feeds it to emitter follower amplifier Q2. The resultant signal is applied to peak detector Q2. At the instant that the first half-cycle of the input complex waveform appears on the base of Q2, the transistor conducts, causing the base signal to appear across load resistor R14. Capacitor C7 couples the signal to peak amplifier Q4. The signal output from Q4 is fed to rectifier Q5, which rectifies the signal and charges capacitor C10 in the negative direction. Capacitor C10 averages the negative output from Q5 into a negative dc potential that appears at the base of feedback bias amplifier Q6. With this negative bias present at the base of PNP transistor Q6 the transistor conducts, increasing the voltage drop across resistor R21. This drives the emitter of Q2 in the negative direction, biasing the transistor to the point where only a small signal peak is conducted by Q2. This reduces the signal voltage across load resistor R14 when the succeeding half-cycles of the wideband input waveform arrive at the base of the peak detector transistor. Due to the gain of transistor stages Q2 and Q4, any conduction of transistor Q2 causes the voltage at the base of Q6 to be sustained at a level that permits Q2 to conduct only during a small portion of the signal peaks. The voltage at the collector of Q2 is then proportional to the peak voltage of the complex wideband waveform. In positions 1 through 5, meter switch S3 connects this voltage through dropping resistor R23 to the front panel meter.

5.1 GENERAL

The 310Z-2 FM Broadcast Exciter, which contains all solid-state circuits, has been carefully inspected and adjusted at the factory by skilled technicians using special test equipment. Therefore, the 310Z-2 should not be readjusted as part of routine maintenance procedures, but instead should be readjusted only after trouble has definitely been traced to misadjustment. When the 310Z-2 is readjusted, adjustments should be performed in accordance with the procedures outlined in paragraph 5.6 using the recommended test equipment listed in table 5-1.

To ensure peak performance and maximum service life, a regular schedule of routine maintenance should be carried out. For the 310Z-2 this routine maintenance should consist only of cleaning and inspecting, and should occasionally include a check of the minimum performance standards for the 310Z-2 in accordance with paragraph 5.7.

| |
|---------|
| CAUTION |
|---------|

The 310Z-2 exciter should not be operated without a load connected to the rf output, and should not be operated over any extended period of time into vswr greater than 2:1.

5.2 CLEANING

Clean the 310Z-2 whenever a perceptible quantity of dust accumulates at any point inside the equipment. A solvent consisting of the following mixture may be used as a cleaning material.

Methylene chloride, 25 percent

Perchloroethylene, 5 percent

Drycleaning solvent, 70 percent by volume

Use the following procedure:

- a. Remove dust from chassis, panels, and components with a soft-bristled brush.
- b. Clean flat surfaces and accessible areas with a lintless cloth moistened with solvent, removing any foreign matter adhering to the equipment. Dry with a clean, dry, lintless cloth.
- c. Wash switch contacts and the less accessible areas with solvent lightly applied with a small soft-bristled brush.

Table 5-1. Required Test Equipment.

| ITEM | MANUFACTURERS DESIGNATION |
|------------------------------------|---|
| Wideband FM modulation monitor | Collins 900C-3, part no. 758-5812-001 |
| Distortion and noise meter | Hewlett-Packard 334A |
| Audio vtm | Hewlett-Packard 400L |
| Vtm | Hewlett-Packard 410B |
| Wattmeter | Sierra 164B with 181A/250 plug-in element |
| Stereo test circuit | Fabricated per figure 5-3 |
| Low-distortion af signal generator | Hewlett-Packard 306A |
| Oscilloscope | Tektronix 581A |
| Vertical amplifier | Tektronix type 81 |
| Crosstalk test circuit | Fabricated per figure 5-6 |
| FM frequency monitor | Collins 54N-1 |
| SCA monitor | Collins 900F-1 |

- d. Use a burnishing tool on relay contacts if contacts are corroded or pitted. Apply solvent lightly to relay contacts with a small soft-bristled brush. Dry with a clean, dry, soft-bristled brush.
- e. Use a dry, oil-free jet of air to remove any dust accumulated on the modules, circuit cards, in the card cage, or on components located in the area above the cage.

5.3 LUBRICATION

No lubrication is required.

5.4 INSPECTION

Perform periodic visual inspection of the 310Z-2 at least once each month. Inspect all metal parts for rust, corrosion, and general deterioration. Check circuit cards, wiring, and components for signs of overheating. Check the blower and cabinet fan for normal operation. Check all operating controls for smoothness of operation. Check all connections.

5.5 TEST EQUIPMENT REQUIRED

The test equipment listed in table 5-1, or its equivalent, is required to perform the adjustment and test procedures given in this section.

5.6 ALIGNMENT AND ADJUSTMENT

The maintenance controls for the 310Z-2 that are referenced in the following procedures are shown on figure 5-1 and their function is described in table 5-2.

| |
|---------|
| CAUTION |
|---------|

Do not attempt to make any adjustment to the 310Z-2 unless trouble has been definitely traced to misadjustment and the recommended test equipment is available.

5.6.1 Power Supply Checks and Adjustments

- a. Remove exciter from transmitter or equipment rack, remove rear cover, and connect equipment as shown in figures 5-2 and 5-3.
- b. Measure voltage across C3. It should be between 22.5 and 25.5 V dc.
- c. Measure voltage across C5. It should be between 22.5 and 25.5 V dc.
- d. Connect vtvm across XA5-26 and place POWER switch to ON.
- e. Vtvm indication should be between +10 and +26 V dc.
- f. Mark position of POWER ADJUST control (R1), and then turn it fully clockwise. Vtvm should indicate +24 to +27 V dc.
- g. Turn POWER ADJUST control fully counterclockwise and ensure that vtvm indicates +6 to +10 V dc.
- h. Return POWER ADJUST control to its original position, place POWER switch to OFF, and remove vtvm.
- i. Replace rear cover.

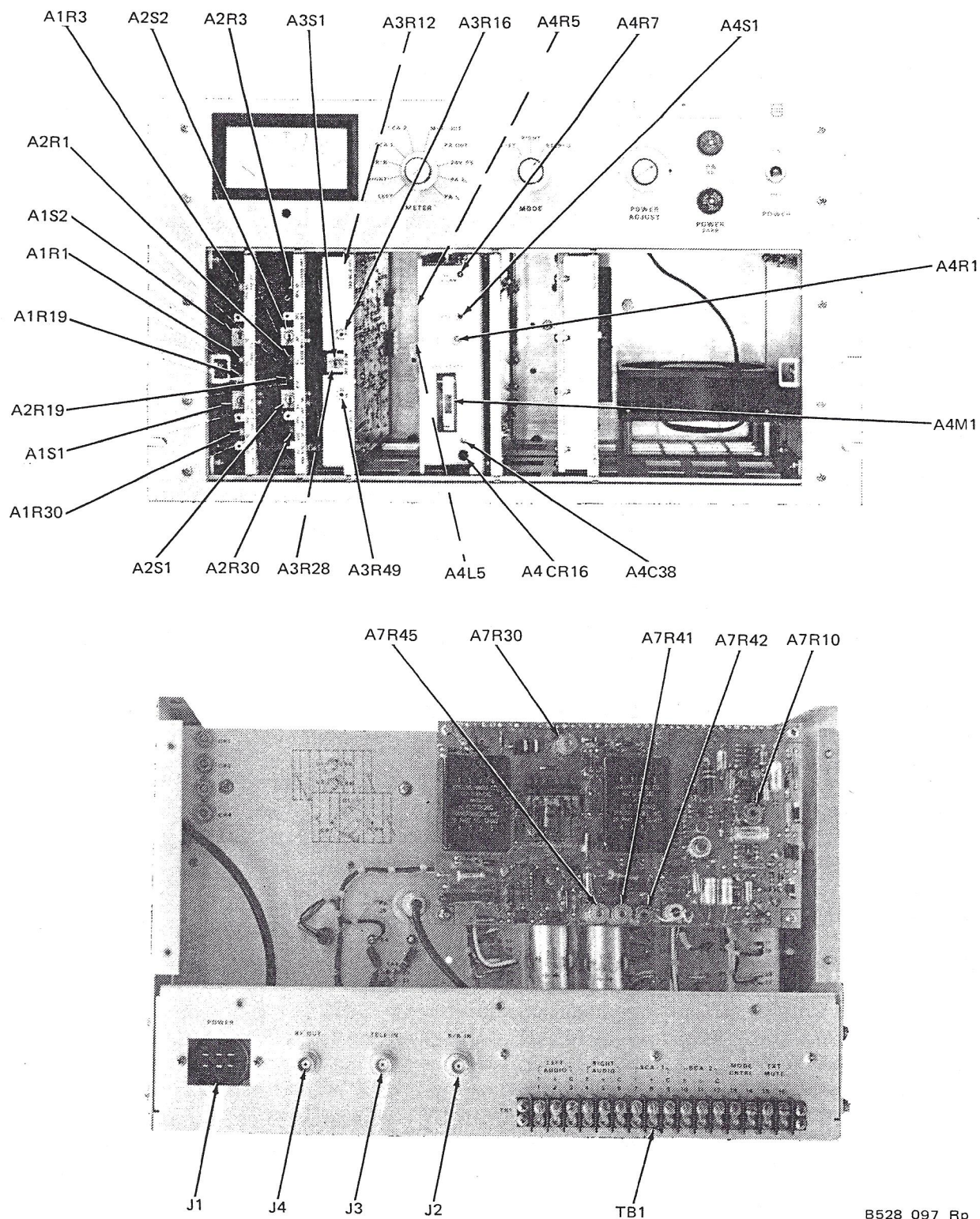
5.6.2 Modulator Tests

5.6.2.1 AFC Adjustment

Check to see that meter M1 on the modulator module A4 reads in the green area. If not, adjust the AFC ADJUST potentiometer A4R7 so that meter is in the green area. If it cannot be adjusted to the green area, remove the modulator from the card cage and place it on the extender module. Remove the cover and carefully adjust A4R7 to the center of its range (five turns from end stop) then carefully adjust oscillator card A4L5 to center the meter in the green portion of the range. Check adjustment of the AFC ADJUST potentiometer to see that it has control of the meter and that the alarm light is extinguished. Reinstall the cover and replace the module in the card cage.

5.6.2.2 Frequency Adjustment

Adjust FREQ ADJUST capacitor C38 for assigned frequency.



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Figure 5-1. 310Z-2 FM Exciter, Maintenance Controls.

Table 5-2. Maintenance Controls.

| CONTROL | FUNCTION |
|---|--|
| 786W-1 SCA Generator Card A1/A2 | |
| R3 - modulation level | Sets the sca audio input levels to the sca modulator. |
| R1 - mute level | Sets the minimum audio level that will activate the sca subcarrier mute circuit. |
| R30 - output level | Sets the sca subcarrier output level. |
| R19 - frequency | Sets the sca subcarrier frequency. |
| S1 - mute enable | ON position enables mute circuit to remote the 67-kHz sca oscillator output when there is no sca audio input. OFF position disables mute circuit for maintenance. |
| S2 - 7.5-KHZ DEV/3.5-KHZ DEV sca deviation switch | 7.5-KHZ position causes the front panel meter to indicate 0 vu when S3 is in the corresponding SCA-() position and sca subcarrier deviation is 7.5 kHz. 3.5-KHZ position causes the front panel meter to indicate 0 vu when S3 is in the corresponding SCA-() position and sca subcarrier deviation is 3.5 kHz. |
| 786V-1 Stereo Generator Card A3 | |
| R12 - sideband suppression | Sets the switching point of Q3. |
| R28 - sideband suppression | Sets the switching point of Q6. |
| R16 - channel separation | Sets the level of the L + R signal from Q1 and Q4 applied to the multiple output to give proper levels for good stereo channel separation. |
| R49 - pilot carrier level | Sets the level of the 19-kHz pilot carrier applied to the multiplex output. |
| S1 - pilot on/off switch | Switches the 19-kHz pilot carrier to the multiplex output. |
| Modulator Card A4 | |
| R1 - B/B LEVEL | Adjusts baseband modulation sensitivity. |
| R7 - AFC ADJUST | Adjusts free-running frequency of modulator. |

Table 5-2. Maintenance Controls (Cont).

| CONTROL | FUNCTION |
|-----------------------------------|---|
| C38 - FREQ adjust | Sets exciter center frequency. |
| S1 - AFC ON/OFF | Disables AFC system for test purposes. |
| R5 - mod bias | Sets bias voltage on modulator diodes for best linearity. |
| L5 - oscillator frequency | Sets coarse frequency modulator. |
| CR16 - ALARM | Provides out-of-lock indication for AFC circuit. |
| M1 - AFC LEVEL meter | Displays AFC voltage. |
| Audio/Meter Regulator Card A7 | |
| R30 - monaural gain vernier | Matches monaural mode to stereo operation |
| R10 - meter amplifier adjust | Adjusts meter deflections by 10 percent |
| R41 - overall gain vernier | Allows matching of both stereo channels |
| R45 - mid-frequency gain vernier | Same. |
| R42 - high-frequency gain vernier | Same. |

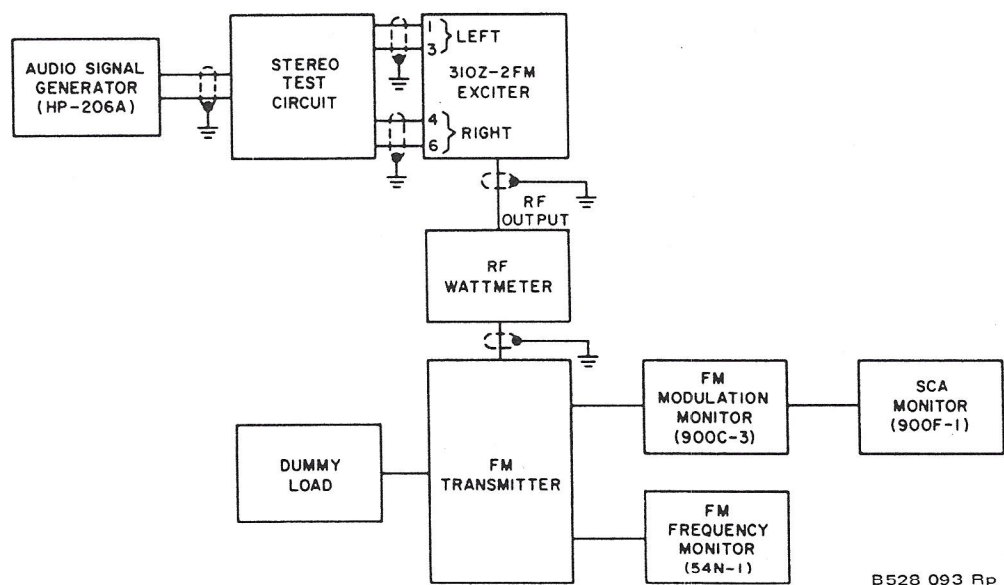


Figure 5-2. Test Equipment Connections to 310Z-2 for Adjustment and Test Procedures.

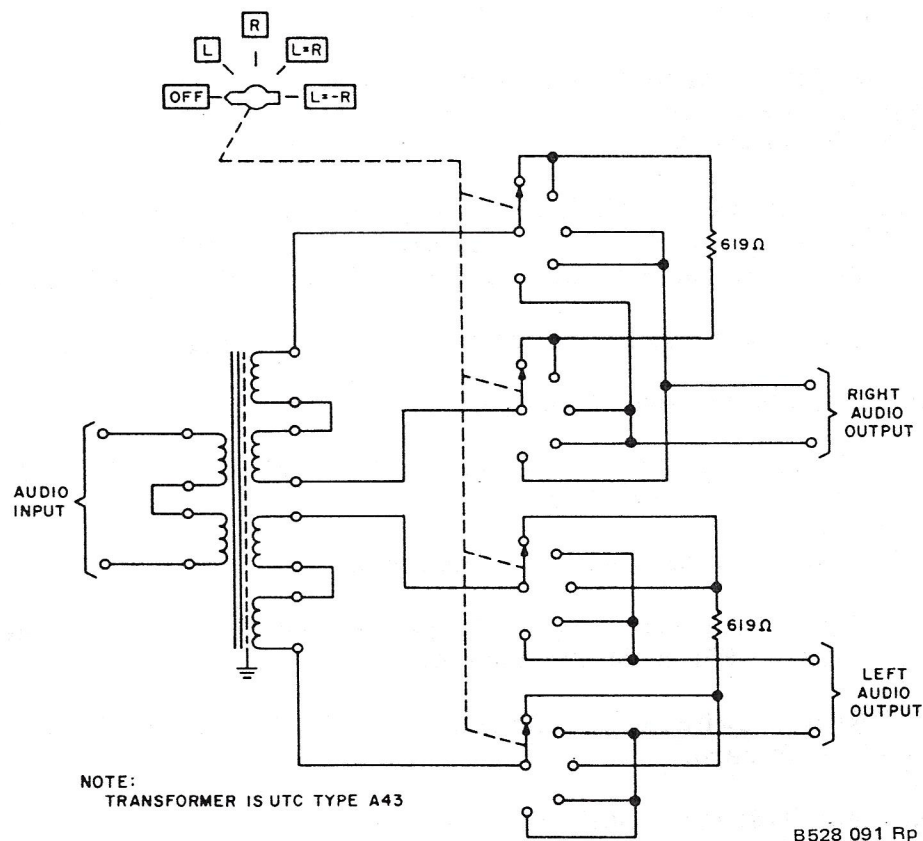


Figure 5-3. Stereo Test Circuit, Schematic Diagram.

5.6.3 Audio Adjustments - Preemphasis Tracking and Linear Crosstalk

Read and understand procedures for measurement of main and subchannel audio in modulation monitor instruction manual. Connect 310Z-2 exciter as shown in figure 5-2, and set S2 to stereo mode.

- Set A7R41, A7R42, and A7R45 to midrange.
- Set stereo selector to L = R and set audio oscillator for 100 percent total modulation with pilot switch off at 150 Hz.
- Set monitor to read L = -R or subchannel audio. Adjust A7R41 for minimum reading.
- Set audio oscillator to 1500 Hz and adjust oscillator for 100 percent total modulation. Read subchannel audio and adjust A7R45 for minimum reading.
- Readjust audio oscillator to 15 kHz and modulation to 100 percent total. Set monitor to read subchannel audio. Adjust A7R42 for minimum reading.
- Repeat steps b. through e. and optimize all three adjustments for best overall crosstalk.

- g. Repeat steps b. through e. without readjustment of A7R41, A7R42, and A7R45 feeding L = -R and reading main channel audio.
- h. Make minor readjustments to A7R41, A7R42, and A7R45 if necessary for best overall crosstalk measurements from subchannel to main channel and main channel to subchannel. They should exceed 45 dB for all frequencies from 50 Hz to 15 kHz.
- i. Set up exciter in STEREO mode and feed +10 dB mW at 400 Hz into the left channel. Turn on the 19-kHz pilot and adjust it to 9 percent. Read total modulation on the modulation monitor. Adjust B/B LEVEL control A4R1 on the modulator for 100 percent.
- j. Set exciter to left mono mode and adjust A7R30 for 100-percent modulation.

5.6.4 SCA Generator Output Level Adjustment

- a. With equipment connected as shown in figure 5-2, set MODULATOR METER switch on FM modulation monitor to SCA MOD.
- b. Place MUTE ENABLE switch (on sca generator card) to OFF.
- c. Adjust OUTPUT LEVEL control R30 for 10-percent modulation as indicated on the 0- to 30-percent scale on FM modulator monitor.
- d. Turn MUTE ENABLE switch to ON and note that indication on the FM modulation monitor decreases to zero.

5.6.5 SCA Generator Frequency Adjustment

- a. With equipment connected as shown in figure 5-2, turn stereo test circuit switch to OFF.
- b. Check the sca output frequency as indicated on the sca frequency monitor (Collins 900F-1 or equivalent).
- c. Adjust A1R19 until sca frequency monitor indicates 67 kHz.

5.6.6 Stereo Generator Adjustment

- a. Connect equipment as shown in figure 5-2.
- b. Set MODE switch on 310Z-2 front panel to STEREO.
- c. Set MODULATION METER switch on FM modulator monitor to TOTAL MOD.
- d. Place 19-kHz pilot carrier switch on stereo generator card to ON.
- e. Turn stereo test circuit (figure 5-3) switch to L position (left modulation only).
- f. Set audio oscillator (HP206A or equivalent) to 5000 Hz and adjust the output amplitude for 100-percent total modulation on FM modulation monitor.
- g. Read separation on monitor and adjust R16 on the stereo generator for best separation.

5.7 MINIMUM PERFORMANCE STANDARDS

The 310Z-2 should be tested in accordance with the following procedures after alignment and adjustment. In addition, the following tests should be used to determine if the 310Z-2 is operating properly. Table 5-3 lists those tests that are applicable to monaural, stereo, and SCA functions of the 310Z-2. If it is desired to test the 310Z-2 for monaural only, perform only those tests listed in table 5-3 for monaural, etc.

5.7.1 Output Frequency

- a. Connect the equipment as shown in figure 5-2, and turn stereo test circuit switch to OFF.
- b. Place POWER switch to ON and measure output frequency. Allow 10 minutes warmup.
- c. If the output frequency is incorrect (should be the customer-selected frequency of 88 to 108 MHz), readjust the frequency control on the FM modulator.

5.7.2 Output Power

- a. Connect equipment as shown in figure 5-2.
- b. Adjust OUTPUT POWER control until rf wattmeter indicates desired power output.

5.7.3 FM Noise

- a. Connect the equipment as shown in figure 5-2.
- b. Turn MODE switch on 310Z-2 to LEFT.
- c. Turn MODULATION METER switch on the FM modulation monitor to TOTAL MOD.
- d. Turn stereo test circuit switch to L.
- e. Set output of audio oscillator to 400 Hz and 100-percent modulation as indicated on the FM modulation monitor.
- f. Turn DECIBELS switch on FM modulation monitor to 0 and METER switch to MAIN CHAN AUDIO.
- g. Turn METER ADJUST control until 0 dB is indicated on FM modulation monitor front panel meter.
- h. Remove 400-Hz monaural input signal and turn the DECIBELS switch clockwise until a reading is observed on the meter.
- i. The main channel FM noise is the algebraic sum of the DECIBELS switch and the meter indication, and should be no more than -65 dB.
- j. Turn METER switch to SUB CHAN AUDIO.
- k. The subchannel FM noise is the algebraic sum of the DECIBELS switch setting and the meter indication, and it should be no more than -65 dB.

Table 5-3. Tests.

| MONAURAL (PARA NO.) | STEREO (PARA NO.) | SCA (PARA NO.) | TEST |
|------------------------|----------------------|-------------------|-----------------------------------|
| 5.7.1 | 5.7.1 | 5.7.1 | Output frequency |
| 5.7.2 | 5.7.2 | 5.7.2 | Output power |
| 5.7.3 | 5.7.3 | 5.7.3 | FM noise |
| 5.7.4 | | | Frequency response (monaural) |
| 5.7.5 | | | Harmonic distortion (monaural) |
| | 5.7.6 | | Frequency response (stereo) |
| | 5.7.7 | | Harmonic distortion (stereo) |
| | 5.7.8 | | Subcarrier suppression |
| | 5.7.9 | | Channel separation |
| | 5.7.10 | | Main-to-subchannel crosstalk |
| | 5.7.11 | | Subchannel-to-main crosstalk |
| | | 5.7.12 | Sca input test |
| | | 5.7.13 | Sca noise test |
| | | 5.7.14 | Sca mute test |
| | | 5.7.15 | Sca frequency response |

5.7.4 Frequency Response (Monaural)

- With the equipment connected as shown in figure 5-2, set the MOD switch on the 310Z-2 to LEFT and the stereo test circuit switch to L.
- Set the audio generator (HP206A or equivalent) for a frequency of 50 Hz.
- Adjust the output of the audio generator for 100-percent modulation as indicated on the FM modulation monitor.

- d. Vary the audio generator and maintain 100-percent modulation for frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz.
- e. Ensure that attenuator settings for each frequency are within the limits of the 75-microsecond preemphasis curve as defined by the FCC.

5.7.5 Harmonic Distortion (Monaural)

- a. Connect the equipment as shown in figure 5-2.
- b. Turn MODE switch on the 310Z-2 to the LEFT position.
- c. Turn MODULATION METER switch on the FM modulation monitor (900C-3) to TOTAL MOD and the DE-EMPHASIS switch to IN.
- d. Turn stereo test circuit switch to L.
- e. Set the audio oscillator (HP206A) to 50 Hz, and adjust the output amplitude for 100-percent total modulation on the FM modulation monitor.
- f. Turn MODULATION METER switch on FM modulation monitor to MAIN CHAN AUDIO.
- g. Connect distortion meter (HP334A or equivalent) to the DISTORTION METER jack on the FM modulation monitor.
- h. Ensure that the distortion meter indication is not more than 0.25 percent.
- i. Repeat steps e. through h. for modulating frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz.

5.7.6 Frequency Response (Stereo)

- a. With equipment connected as shown in figure 5-2, set the MODULATION switch on the 310Z-2 to STEREO and the stereo test circuit switch to LEFT.
- b. Turn on 19-kHz pilot.
- c. Repeat steps b. through e. of paragraph 5.7.4.
- d. Place STEREO TEST CIRCUIT switch to RIGHT.
- e. Repeat steps b. through e. of paragraph 5.7.4.

5.7.7 Harmonic Distortion (Stereo)

- a. With equipment connected as shown in figure 5-2, place PILOT CARRIER switch to ON.
- b. Turn MODE switch on 310Z-2 to STEREO.
- c. Turn MODULATION METER switch on 900C-3 to TOTAL MOD, and place DE-EMPHASIS switch to OUT.

- d. Set switch on stereo test circuit (figure 5-3) to L = R.
- e. Set audio oscillator (HP206A) to 50 Hz, and adjust output amplitude for 100-percent total modulation on 900C-3.
- f. Connect distortion meter (HP334A or equivalent) to LEFT AUDIO jack on the 900C-3.
- g. Measure and record total distortion for modulating frequencies of 50, 100, 400, 1000, 5000 and 7500 Hz. Maintain modulation on 900C-3 at 100 percent for all frequencies, and distortion should be not more than 0.5 percent.
- h. Connect distortion meter to RIGHT AUDIO jack on 900C-3 and repeat step g.

5.7.8 Subcarrier Suppression

- a. With equipment connected as shown in figure 5-2, place PILOT CARRIER switch to OFF.
- b. Ensure that there is no input to the SCA generator of the 310Z-2 exciter.
- c. Turn DECIBELS switch on FM modulation monitor to 0.
- d. Turn METER switch on FM modulation monitor to TOTAL MOD.
- e. Adjust the audio generator for a frequency of 15,000 Hz, and adjust the amplitude for 90-percent modulation indication on the FM modulation monitor.
- f. Turn METER switch on FM modulation monitor to MAIN CHAN AUDIO, and adjust METER ADJUST control until meter indicates 0 dB.
- g. Turn METER switch on FM modulation monitor to SUBCAR, and rotate the DECIBELS switch in a clockwise direction until a meter indication is observed.
- h. The setting of the DECIBELS switch indicates the subcarrier suppression; it should be at least -45 dB.

5.7.9 Channel Separation

It is recommended that the channel separation test be performed using the Collins 900C-3 FM Modulation Monitor.

- a. Connect equipment as shown in figure 5-2.
- b. Turn MODULATION switch on front panel of 310Z-2 to STEREO.
- c. Turn MODULATION METER switch on FM modulation monitor (900C-3) to TOTAL MOD.
- d. Place 19-kHz PILOT CARRIER switch A2A1 to ON.
- e. Turn stereo test circuit switch to L.

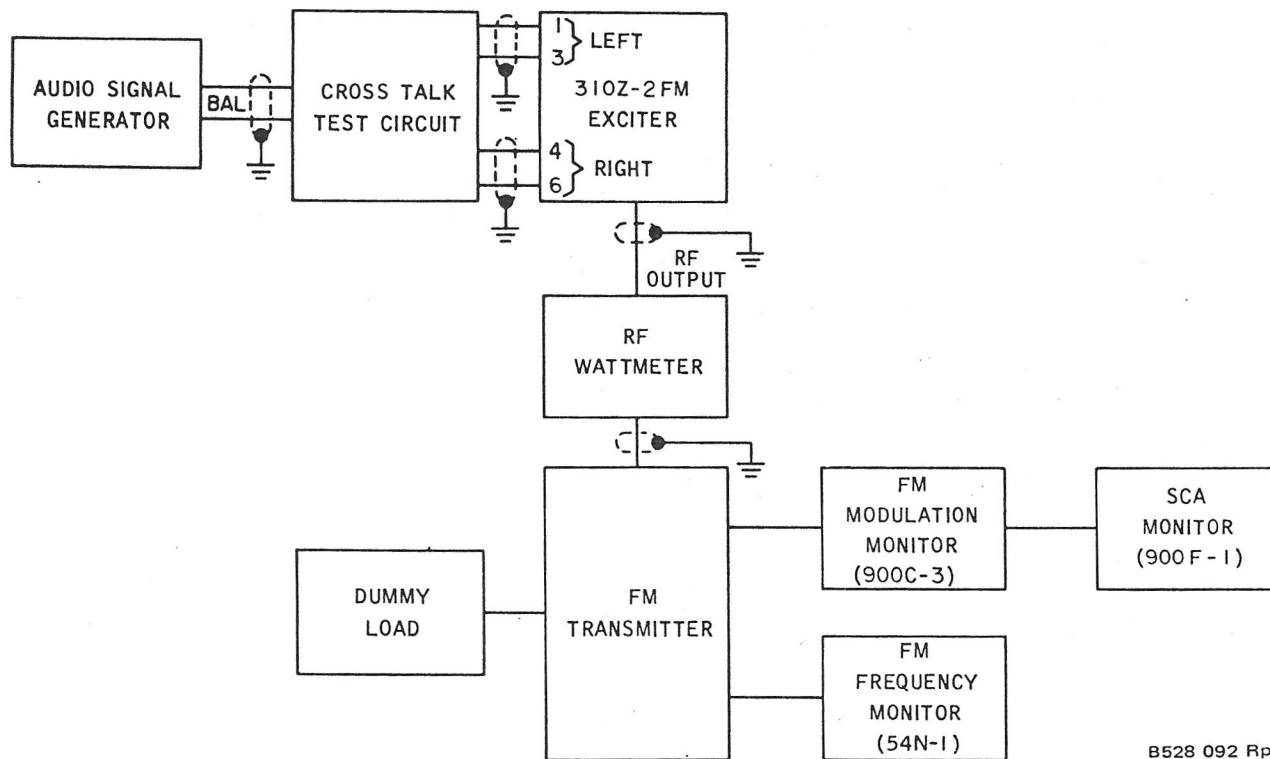
- f. Set audio generator (HP206A) to 5000 Hz, and adjust output amplitude for 100-percent total modulation on FM modulation monitor.
- g. Set METER switch on front panel of FM modulation monitor to LEFT AUDIO.
- h. Set DECIBELS switch on front panel of FM modulation monitor to 0, and turn METER ADJUST control until an indication of 0 dB is obtained on the front panel meter.
- i. Switch from left channel modulation to right channel modulation, and turn DECIBELS switch in a clockwise direction until an indication is observed on the front panel meter.
- j. Adjust A3R16 for best channel separation indicated on meter. The channel separation is the algebraic sum of the DECIBELS switch setting and the meter indication.
- k. Repeat steps f. through j. for frequencies of 50, 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz, except do not readjust A3R16.
- l. To obtain channel separation measurements with audio applied to the right channel and measurements taken in the left channel, repeat steps e. through i. and substitute left for right and right for left where these instructions are indicated, but do not readjust A3R16.

5.7.10 Main Channel to Subchannel Nonlinear Crosstalk

- a. Connect the equipment as shown in figure 5-4. The crosstalk test circuit shown on figure 5-5 must be fabricated for this test.
- b. Set the crosstalk test circuit switch to MAIN and the FREQ RANGE SELECT switch to 50/400.
- c. Turn the MODULATION switch on the 310Z-2 to STEREO.
- d. Adjust the audio generator (HP206A or equivalent) to a frequency of 50 Hz, and adjust the output level for 90-percent main channel modulation as indicated on the FM modulation monitor.
- e. On the FM modulation monitor, place the METER switch to MAIN CHAN AUDIO, turn the DECIBELS switch to 0, and turn the METER ADJUST control until 0 dB is indicated on the meter.
- f. Turn METER switch to SUB CHAN AUDIO, and turn DECIBELS switch clockwise until an indication on the front panel meter of the FM modulation monitor is observed.
- g. Turn adjustments on crosstalk test circuit until a null is observed on the FM modulation monitor meter.

NOTE

These adjustments are critical and require special attention to achieve the proper null.



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Figure 5-4. Test Equipment Connections to 310Z-2 for Crosstalk Test.

- h. Crosstalk is the algebraic sum of the DECIBELS switch setting and the meter indication. The main channel into subchannel crosstalk should be not more than -50 dB from 50 to 15,000 Hz.
- i. Repeat the above procedure for frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz. Ensure that the proper frequency range is selected by the FREQ RANGE SELECT switch of the crosstalk test circuit.

5.7.11 Subchannel to Main Channel Nonlinear Crosstalk

- a. With the test equipment connected as shown in figure 5-4, set the crosstalk test circuit switch to SUB and the FREQ RANGE SELECT switch to 50/400.
- b. Adjust the audio generator (HP206A or equivalent) to a frequency of 50 Hz, and adjust the output level for 90-percent subchannel modulation as indicated on the FM modulation monitor.
- c. Turn METER switch to MAIN CHAN AUDIO, and turn DECIBELS switch clockwise until an indication is observed.

5.7.12 SCA Input Test

- a. With the equipment connected as shown in figure 5-2, place the MODULATION METER switch on the FM modulation monitor to SCA MOD.

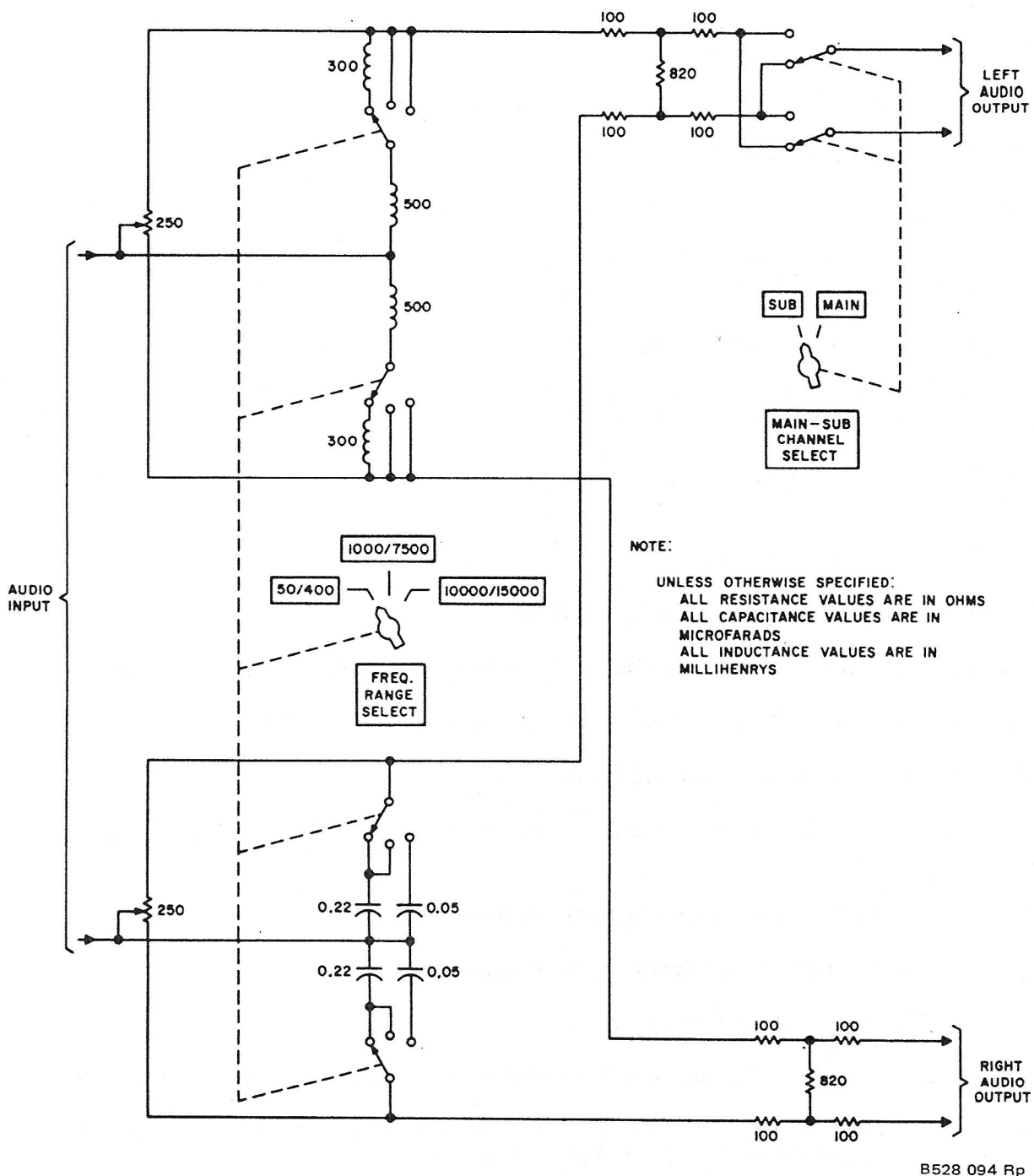


Figure 5-5. Nonlinear Crosstalk Test Circuit, Schematic Diagram.

- b. Place MUTE ENABLE switch (on sca generator card) to OFF.
- c. Place POWER switch to ON, and adjust SCA OUTPUT LEVEL control A1R30 for an indication of 10-percent modulation on the 0- to 30-percent scale on the meter of the FM modulation monitor.

5.7.13 SCA Noise Test

- a. With equipment connected as in figure 5-2, place MUTE DISABLE switch to OFF.
- b. Connect audio generator (HP206A) to sca input terminals of exciter.
- c. Set the audio generator for a frequency of 400 Hz and an output level of +10 dB mW.
- d. Connect ac voltmeter (HP403B) across the audio output (TB1-1 and TB1-2) of the sca modulation monitor (900F-1).
- e. Record the 400-Hz reference signal level as indicated on the ac voltmeter.
- f. Remove the sca input signal from the 310Z-2 exciter, and increase the sensitivity of the ac voltmeter until a reading is indicated.
- g. The difference between the levels recorded in steps e. and f. should be not less than 55 dB.

5.7.14 SCA Mute Circuit Test

- a. Connect equipment as shown in figure 5-2.
- b. Connect audio signal generator (HP206A) to terminals TB1-10 and TB1-12.
- c. Place PILOT CARRIER switch on stereo generator card to OFF.
- d. Turn stereo test circuit switch to OFF.
- e. Adjust audio signal generator connected to terminals TB1-10 and TB1-12 for 400 Hz at 6 dB mW.
- f. Turn MUTE LEVEL control A1R1 fully counterclockwise.
- g. Observe the sca subcarrier level on the sca monitor.
- h. Place MUTE ENABLE switch to ON.
- i. After a few seconds, note that the sca subcarrier level is still indicated on sca monitor.
- j. Remove input to sca generator card, and observe that sca subcarrier indicated on sca monitor is (decreased to zero) within 3 to 4 seconds.
- k. Adjust audio signal generator for 400 Hz at 6-dB mW input to exciter.

- l. Adjust attenuator on signal generator to reduce input level 30 dB.
- m. Observe the sca subcarrier on sca monitor, and ensure that is still present after 3 to 4 seconds indicating that mute circuit did not cut off carrier.
- n. Remove audio signal generator.

5.7.15 SCA Frequency Response

- a. With equipment connected as in figure 5-2, place the pilot carrier switch on stereo generator card to OFF.
- b. Connect audio generator (HP206A) to sca input terminals TB1-7 and TB1-9 (21 kHz) or TB1-10 and TB1-12 (67 kHz) of exciter.
- c. Turn stereo test circuit switch to OFF.
- d. Turn METER switch on sca modulation monitor (900F-1) to sca modulation monaural mode.
- e. Set audio generator frequency to 50 Hz, and adjust output amplitude for 3.5-kHz deviation on the sca modulation monitor.
- f. While maintaining 3.5-kHz deviation, vary the audio generator frequency to 100, 400, 1000, and 5000 Hz. The audio generator attenuator settings for each frequency should follow the 75-microsecond preemphasis curve as specified by the FCC.

5.8 FREQUENCY CHANGE

If it is desired to change the output frequency of the 310Z-2, crystal A4Y1 located in the oven on the modulator card must be changed. Table 5-4 lists the channel frequency versus crystal frequency and the Collins part number for each crystal.

Table 5-4. Crystal Part Number.

| CHANNEL FREQ (MHz) | CRYSTAL FREQ (kHz) | COLLINS PART NUMBER | CHANNEL FREQ (MHz) | CRYSTAL FREQ (kHz) | COLLINS PART NUMBER |
|--------------------------|--------------------------|---------------------------|--------------------------|--------------------------|---------------------------|
| 88.1 | 1376.5625 | 289-7246-010 | 96.1 | 1501.5625 | 289-7246-410 |
| 88.3 | 1379.6875 | 289-7246-020 | 96.3 | 1504.6875 | 289-7246-420 |
| 88.5 | 1382.8125 | 289-7246-030 | 96.5 | 1507.8125 | 289-7246-430 |
| 88.7 | 1385.9375 | 289-7246-040 | 96.7 | 1510.9375 | 289-7246-440 |
| 88.9 | 1389.0625 | 289-7246-050 | 96.9 | 1514.0625 | 289-7246-450 |
| 89.1 | 1392.1875 | 289-7246-060 | 97.1 | 1517.1875 | 289-7246-460 |
| 89.3 | 1395.3125 | 289-7246-070 | 97.3 | 1520.3125 | 289-7246-470 |
| 89.5 | 1398.4375 | 289-7246-080 | 97.5 | 1523.4375 | 289-7246-480 |
| 89.7 | 1401.5625 | 289-7246-090 | 97.7 | 1526.5625 | 289-7246-490 |
| 89.9 | 1404.6875 | 289-7246-100 | 97.9 | 1529.6875 | 289-7246-500 |
| 90.1 | 1407.8125 | 289-7246-110 | 98.1 | 1532.8125 | 289-7246-510 |
| 90.3 | 1410.9375 | 289-7246-120 | 98.3 | 1535.9375 | 289-7246-520 |
| 90.5 | 1414.0625 | 289-7246-130 | 98.5 | 1539.0625 | 289-7246-530 |
| 90.7 | 1417.1875 | 289-7246-140 | 98.7 | 1542.1875 | 289-7246-540 |
| 90.9 | 1420.3125 | 289-7246-150 | 98.9 | 1545.3125 | 289-7246-550 |
| 91.1 | 1423.4375 | 289-7246-160 | 99.1 | 1548.4375 | 289-7246-560 |
| 91.3 | 1426.5625 | 289-7246-170 | 99.3 | 1551.5625 | 289-7246-570 |
| 91.5 | 1429.6825 | 289-7246-180 | 99.5 | 1554.6875 | 289-7246-580 |
| 91.7 | 1432.8125 | 289-7246-190 | 99.7 | 1557.8125 | 289-7246-590 |
| 91.9 | 1435.9375 | 289-7246-200 | 99.9 | 1560.9375 | 289-7246-600 |
| 92.1 | 1439.0625 | 289-7246-210 | 100.1 | 1564.0625 | 289-7246-610 |
| 92.3 | 1442.1825 | 289-7246-220 | 100.3 | 1567.1875 | 289-7246-620 |
| 92.5 | 1445.3125 | 289-7246-230 | 100.5 | 1570.3125 | 289-7246-630 |
| 92.7 | 1448.4375 | 289-7246-240 | 100.7 | 1573.4375 | 289-7246-640 |
| 92.9 | 1451.5625 | 289-7246-250 | 100.9 | 1576.5625 | 289-7246-650 |
| 93.1 | 1454.6875 | 289-7246-260 | 101.1 | 1579.6875 | 289-7246-660 |
| 93.3 | 1457.8125 | 289-7246-270 | 101.3 | 1582.8125 | 289-7246-670 |
| 93.5 | 1460.9375 | 289-7246-280 | 101.5 | 1585.9375 | 289-7246-680 |
| 93.7 | 1464.0625 | 289-7246-290 | 101.7 | 1589.0625 | 289-7246-690 |
| 93.9 | 1467.1875 | 289-7246-300 | 101.9 | 1592.1875 | 289-7246-700 |
| 94.1 | 1470.3125 | 289-7246-310 | 102.1 | 1595.3125 | 289-7246-710 |
| 94.3 | 1473.4375 | 289-7246-320 | 102.3 | 1598.4375 | 289-7246-720 |
| 94.5 | 1476.5625 | 289-7246-330 | 102.5 | 1601.5625 | 289-7246-730 |
| 94.7 | 1479.6875 | 289-7246-340 | 102.7 | 1604.6875 | 289-7246-740 |
| 94.9 | 1482.8125 | 289-7246-350 | 102.9 | 1607.8125 | 289-7246-750 |
| 95.1 | 1485.9375 | 289-7246-360 | 103.1 | 1610.9375 | 289-7246-760 |
| 95.3 | 1489.0625 | 289-7246-370 | 103.3 | 1614.0625 | 289-7246-770 |
| 95.5 | 1492.1875 | 289-7246-380 | 103.5 | 1617.1875 | 289-7246-780 |
| 95.7 | 1495.3125 | 289-7246-390 | 103.7 | 1620.3125 | 289-7246-790 |
| 95.9 | 1498.4375 | 289-7246-400 | 103.9 | 1623.4375 | 289-7246-800 |

Table 5-4. Crystal Part Number (Cont).

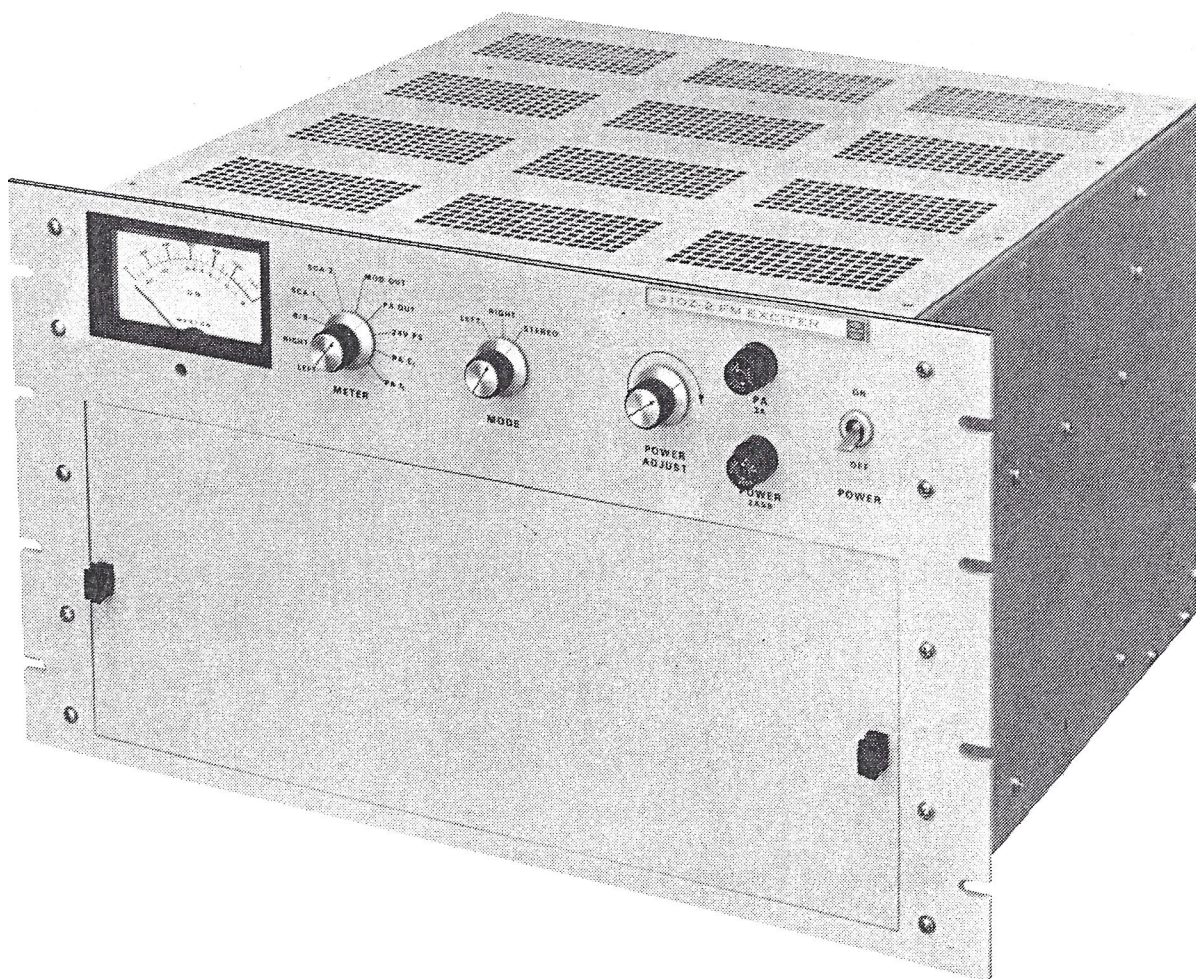
| CHANNEL FREQ (MHz) | CRYSTAL FREQ (kHz) | COLLINS PART NUMBER | CHANNEL FREQ (MHz) | CRYSTAL FREQ (kHz) | COLLINS PART NUMBER |
|--------------------------|--------------------------|---------------------------|--------------------------|--------------------------|---------------------------|
| 104.1 | 1626.5625 | 289-7246-810 | 106.1 | 1657.8125 | 289-7246-910 |
| 104.3 | 1629.6875 | 289-7246-820 | 106.3 | 1660.9375 | 289-7246-920 |
| 104.5 | 1632.8125 | 289-7246-830 | 106.5 | 1664.0625 | 289-7246-930 |
| 104.7 | 1635.9375 | 289-7246-840 | 106.7 | 1667.1875 | 289-7246-940 |
| 104.9 | 1639.0625 | 289-7246-850 | 106.9 | 1670.3125 | 289-7246-950 |
| 105.1 | 1642.1875 | 289-7246-860 | 107.1 | 1673.4375 | 289-7246-960 |
| 105.3 | 1645.3125 | 289-7246-870 | 107.3 | 1676.5625 | 289-7246-970 |
| 105.5 | 1648.4375 | 289-7246-880 | 107.5 | 1679.6875 | 289-7246-980 |
| 105.5 | 1651.5625 | 289-7246-890 | 107.7 | 1682.8125 | 289-7246-990 |
| 105.9 | 1654.6875 | 289-7246-900 | 107.9 | 1685.9375 | 289-7247-010 |

6.1 GENERAL

This section provides parts lists and parts locations for all electrical components of the 310Z-2 FM Exciter. Figures 6-1 through 6-3 provide general views of the 310Z-2 FM Exciter with various access panels removed. The remaining figures with their corresponding parts lists identify all electrical components. These figures and parts lists are in order according to assembly reference designation.

6.2 ORDERING REPLACEMENT PARTS

Refer to the information inside the front cover for instructions on how to order replacement parts.



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Figure 6-1. 310Z-2 FM Exciter (Sheet 1 of 3).

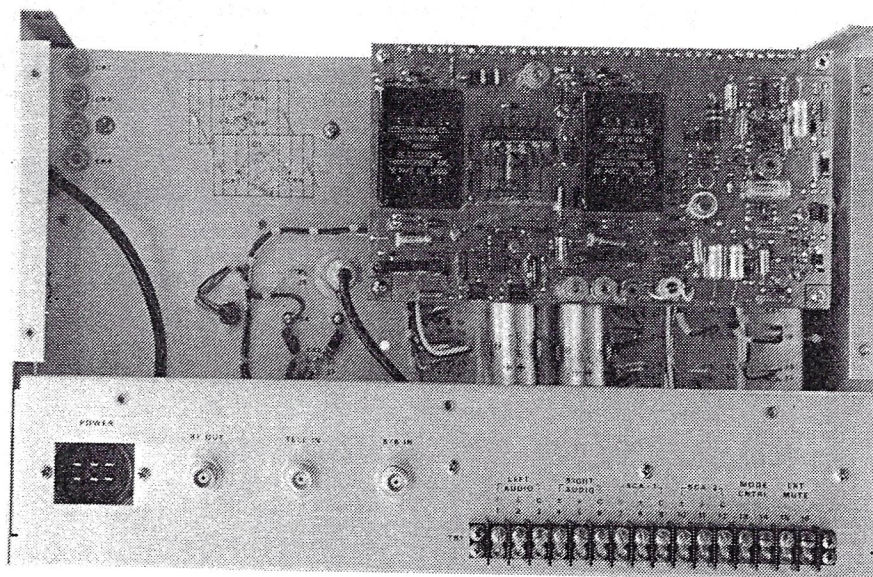
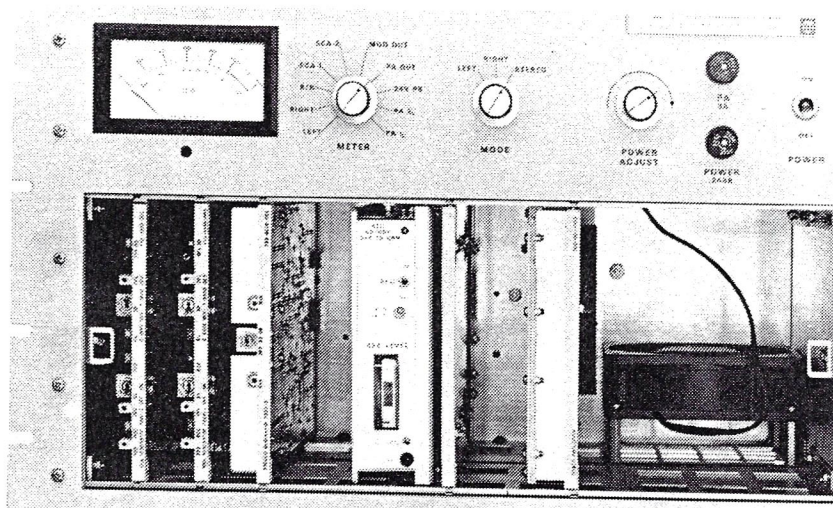
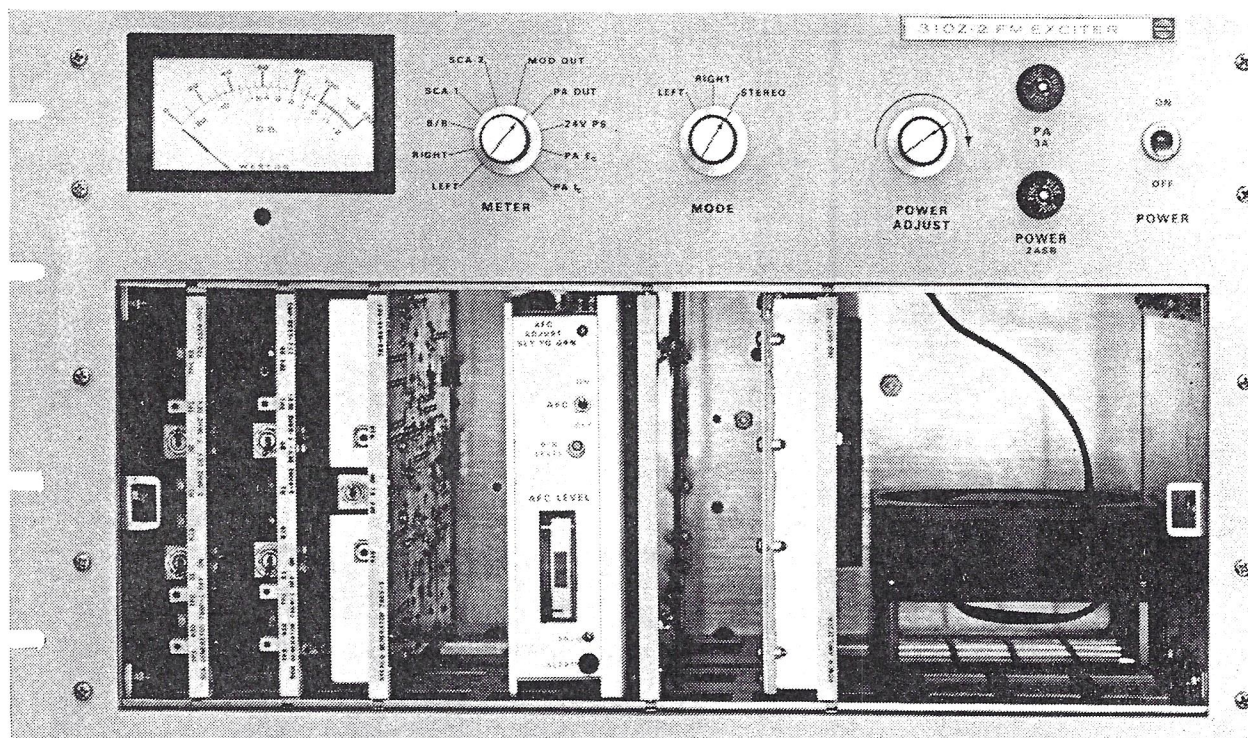


Figure 6-2. 310Z-2 FM Exciter (Sheet 2 of 3).

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Figure 6-3. 310Z-2 FM Exciter (Sheet 3 of 3).

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|-------------------|-------------------------|---------------------------|
| 310Z-2 FM EXCITER | | 622-2184-001 |
| A1 | EXTENDER BOARD | 781-5365-001 |
| A2 | SCA GENERATOR 786W-1 | 772-5338-001 |
| A3 | SCA GENERATOR 786W-1 | 772 5338-001 |
| A3 | STL INTERFACE 785E-1 | 622-2374-001 |
| A3 | STEREO GENERATOR 786V-1 | 783-6648-001 |
| A4 | MODULATOR/EXCITER | 627-6695-001 |
| A5 | POWER AMPLIFIER | 769-0830-001 |
| A6 | AUDIO/MTR REGULATOR | 627-9773-001 |
| B1 | BLOWER | 009-1829-030 |
| C1 | CAPACITOR | 3900UF 50 V 183-1278-370 |
| C2 | CAPACITOR | 3900UF 50 V 183 1278-370 |
| C3 | CAPACITOR | 1000PF 500 V 913-1292-000 |
| C4 | CAPACITOR | 1000UF 50 V 183-1282-140 |
| C5 | CAPACITOR | 1000UF 50 V 183 1282-140 |
| C6 | CAPACITOR | 1000UF 50 V 183-1282-140 |
| C7 | CAPACITOR | 1000PF 500 V 913-1292-000 |
| C8 | CAPACITOR | 1000PF 500 V 913 1292-000 |
| C9 | CAPACITOR | 1000PF 500 V 913-1292-000 |
| C10 | CAPACITOR | 1000PF 500 V 913 1292-000 |
| C11 | CAPACITOR | 1000PF 500 V 913-1292-000 |
| C12 | CAPACITOR | 1000PF 500 V 913 1292-000 |
| C13 | CAPACITOR | 1000PF 500 V 913-1292-000 |
| C14 | CAPACITOR | 1000PF 500 V 913 1292-000 |
| C15 | CAPACITOR | 1000PF 500 V 913-1292-000 |
| C16 | CAPACITOR | 1000PF 500 V 913 1292-000 |
| C17 | CAPACITOR | 1000PF 500 V 913-1292-000 |
| C18 | CAPACITOR | 0.1UF 200 V 913-3681-000 |
| C19 | CAPACITOR | 0.1UF 200 V 913 3681-000 |
| C20 | CAPACITOR | 0.1UF 200 V 913-3681-000 |
| C21 | CAPACITOR | 100PF 500 V 912-2816-000 |
| CR1 | DIODE | 1N1202 353-1889-000 |
| CR2 | DIODE | 1N1202 353 1889-000 |
| CR3 | DIODE | 1N1202 353-1889-000 |
| CR4 | DIODE | 1N1202 353 1889-000 |
| CR5 | DIODE | 1N4003 353-6442-030 |
| CR6 | DIODE | 1N4003 353 6442-030 |
| CR7 | DIODE | 1N4003 353-6442-030 |
| CR8 | DIODE | 1N4003 353 6442-030 |
| E1 | TERMINAL | 547-5305-002 |
| E2 | TERMINAL | 304-2800-000 |
| E3 | TERMINAL | 304 2800-000 |
| E4 | TERMINAL | 304-2800-000 |
| E5 | TERMINAL | 304 2800-000 |
| E6 | TERMINAL | 304-2800-000 |
| E7 | TERMINAL | 304 2800-000 |
| E8 | TERMINAL | 304-0116-000 |
| E9 | TERMINAL | 304 0116-000 |
| E10 | TERMINAL | 304-1089-000 |
| E11 | TERMINAL | 304-0116-000 |
| E12 | TERMINAL | 304 0116-000 |
| F1 | FUSE | 2ASB 264-0297-000 |
| F2 | FUSE | 3A 264-0928-050 |
| FL1 | FILTER, LP | 673-1162-020 |
| HT1 | HEATSINK | 015-3612-010 |
| HT2 | HEATSINK | 015-3612-020 |
| J1 | CONNECTOR | 365-0034-000 |
| J2 | BNC CONNECTOR | 357-9248-010 |
| J3 | BNC CONNECTOR | 357 9248-010 |
| J4 | BNC CONNECTOR | 357-9248-010 |
| J5 | CONNECTOR | 357-7109-000 |
| J6 | CONNECTOR | 357 7109-000 |
| J7 | CONNECTOR | 357-7109-000 |
| P2 | TNC CONNECTOR | 357-9666-000 |
| P3 | TNC CONNECTOR | 357 9666-000 |
| P4 | TNC CONNECTOR | 357-9666-000 |
| Q1 | TRANSISTOR | 2N3054 352-0581-010 |

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parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|--------|--------------------|------------------------|
| Q2 | TRANSISTOR | 2N3055 |
| R1 | RESISTOR, VARIABLE | 5 K |
| R2 | RESISTOR, VARIABLE | 10 K |
| R3 | RESISTOR | 0.1 |
| R4 | RESISTOR | 68.1 K |
| R5 | RESISTOR | 1.5 |
| R6 | RESISTOR | 10 |
| R7 | RESISTOR | 10 |
| R8 | RESISTOR | 22 |
| R9 | RESISTOR | 3.83 K |
| R10 | RESISTOR | 464 |
| R11 | RESISTOR | 2700 |
| R12 | RESISTOR | 2.2 K |
| R13 | RESISTOR | 47 K |
| S1 | SWITCH | |
| S2 | SWITCH MODE | |
| S3 | SWITCH METER | |
| T1 | TRANSFORMER POWER | |
| TR1 | TERMINAL BOARD | |
| U1 | REGULATOR | 7824KC |
| U2 | REGULATOR | 7824KC |
| XF1 | FUSEHOLDER | |
| XF2 | FUSEHOLDER | |
| XFL1 | SOCKET | |
| XQ1 | SOCKET | T0-66 |
| XQ2 | SOCKET | T0-3 |
| XU1 | SOCKET | T0-3 |
| XU2 | SOCKET | T0-3 |

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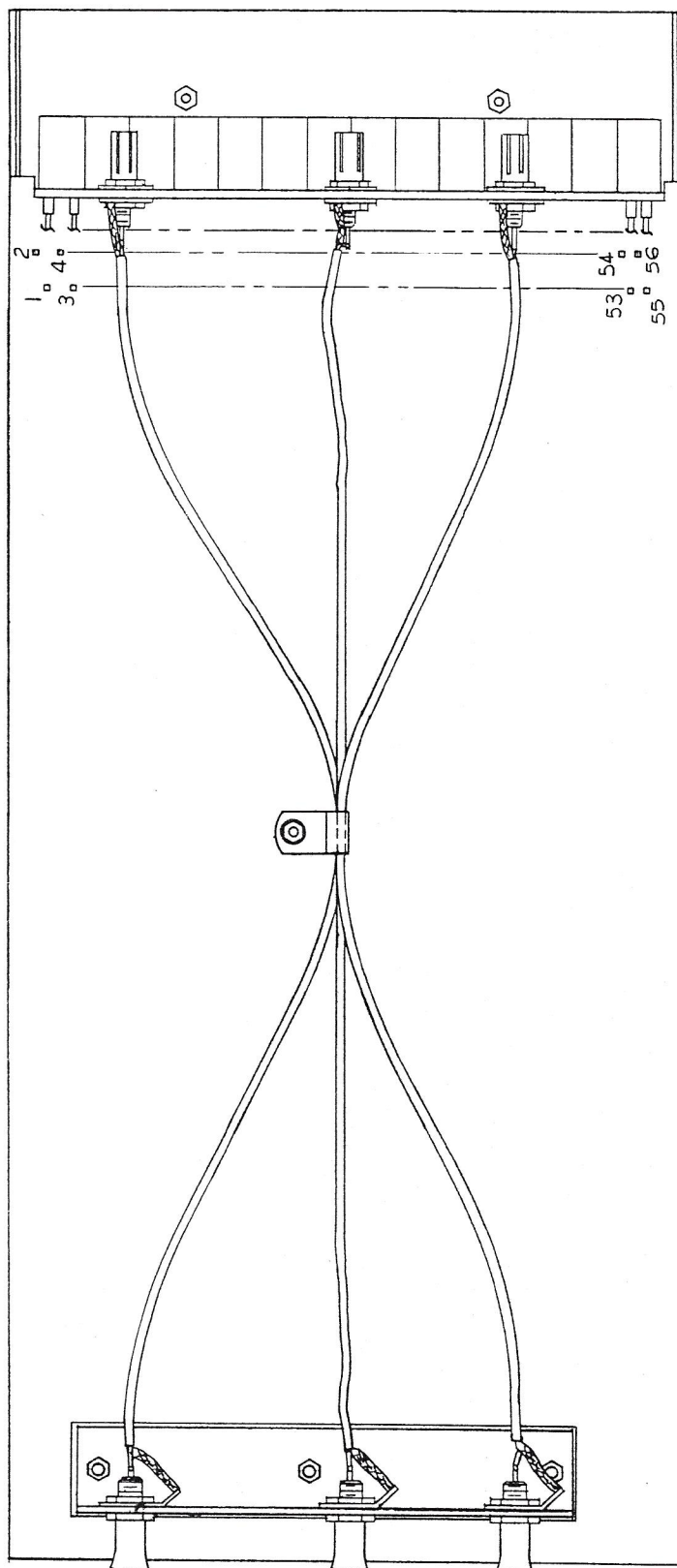


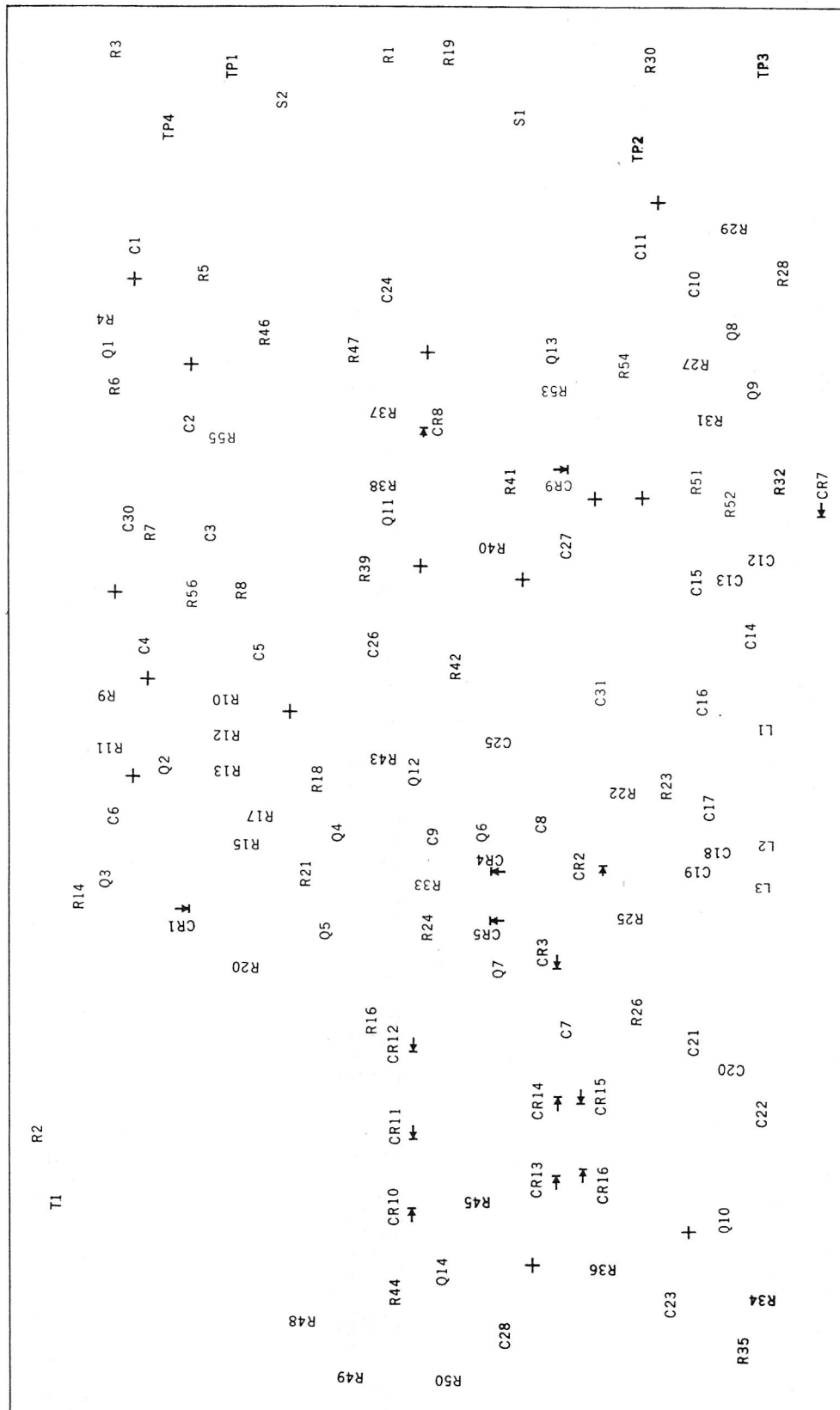
Figure 6-4. Extender Board.

8700 3267 Rp

parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|----------------|-------------|------------------------|
| EXTENDER BOARD | | 781-5365-001 |
| J1 | CONNECTOR | 357-9210-000 |
| J2 | CONNECTOR | 357 9210-000 |
| J3 | CONNECTOR | 357-9210-000 |
| J4 | CONNECTOR | 357-9211-000 |
| J5 | CONNECTOR | 357 9211-000 |
| J6 | CONNECTOR | 357-9211-000 |
| J7 | CONNECTOR | 372-2426-010 |
| J8 | CONNECTOR | 372 2426-010 |
| J9 | CONNECTOR | 372-2426-010 |
| J10 | CONNECTOR | 372 2426-010 |
| J11 | CONNECTOR | 372-2426-010 |
| J12 | CONNECTOR | 372 2426-010 |
| J13 | CONNECTOR | 372-2426-010 |
| J14 | CONNECTOR | 372 2426-010 |
| J15 | CONNECTOR | 372-2426-010 |
| J16 | CONNECTOR | 372 2426-010 |
| J17 | CONNECTOR | 372-2426-010 |
| J18 | CONNECTOR | 372 2426-010 |
| J19 | CONNECTOR | 372-2426-010 |
| J20 | CONNECTOR | 372 2426-010 |

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B700 3265 Rp

Figure 6-5. SCA Generator 786W-1 A1, A2.

parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|----------------------------|-------------------------|------------------------|
| SCA GENERATOR 786W-1 A1,A2 | | 772-5338-001 |
| C1 | CAPACITOR 6.8UF 35 V | 184-6216-000 |
| C2 | CAPACITOR 6.8UF 35 V | 184 6216-000 |
| C3 | CAPACITOR 0.022UF 50 V | 933-0858-000 |
| C4 | CAPACITOR 6.8UF 35 V | 184-6216-000 |
| C5 | CAPACITOR 250UF 40 V | 183-2355-150 |
| C6 | CAPACITOR 6.8UF 35 V | 184-6216-000 |
| C7 | CAPACITOR 3900PF 500 V | 912-3046-000 |
| C8 | CAPACITOR 3900PF 500 V | 912 3046-000 |
| C9 | CAPACITOR 6.8UF 35 V | 184-6216-000 |
| C10 | CAPACITOR 2PF 500 V | 916-0076-000 |
| C11 | CAPACITOR 6.8UF 35 V | 184-6216-000 |
| C12 | CAPACITOR 500UUF 500 V | 912-2977-000 |
| C13 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C14 | CAPACITOR 47PF 500 V | 912-2792-000 |
| C15 | CAPACITOR 5PF 500 V | 916-0118-000 |
| C16 | CAPACITOR 820PF 500 V | 912-2995-000 |
| C17 | CAPACITOR 22PF 500 V | 912-2768-000 |
| C18 | CAPACITOR 120PF 500 V | 912-2822-000 |
| C19 | CAPACITOR 18PF 500 V | 912-2763-000 |
| C20 | CAPACITOR 470PF 500 V | 912-2974-000 |
| C21 | CAPACITOR 47PF 500 V | 912-2792-000 |
| C22 | CAPACITOR 0.0075UF 75 V | 184-9062-040 |
| C23 | CAPACITOR 0.033UF 100 V | 184-6326-580 |
| C24 | CAPACITOR 22UF 50 V | 184-6257-000 |
| C25 | CAPACITOR 250UF 40 V | 183-2355-150 |
| C26 | CAPACITOR 47UF 35 V | 184-6231-000 |
| C27 | CAPACITOR 5UF 50 V | 183-1162-000 |
| C28 | CAPACITOR 6.8UF 35 V | 184-6216-000 |
| C29 | NOT USED | |
| C30 | CAPACITOR 15UF 35 V | 184-6222-000 |
| C31 | CAPACITOR 220UF 25 V | 183-2338-000 |
| CR1 | DIODE 1N914 | 353-2906-000 |
| CR2 | DIODE 1N995 | 353-2042-000 |
| CR3 | DIODE 1N995 | 353 2042-000 |
| CR4 | DIODE 1N995 | 353-2042-000 |
| CR5 | DIODE 1N995 | 353 2042-000 |
| CR6 | NOT USED | |
| CR7 | DIODE 1N995 | 353-2042-000 |
| CR8 | DIODE 1N914 | 353-2906-000 |
| CR9 | DIODE 1N758 | 353-2723-000 |
| CR10 | DIODE 1N914 | 353-2906-000 |
| CR11 | DIODE 1N756A | 353-2983-000 |
| CR12 | DIODE 1N756A | 353 2983-000 |
| CR13 | DIODE 1N914 | 353-2906-000 |
| CR14 | DIODE 1N914 | 353 2906-000 |
| CR15 | DIODE 1N914 | 353-2906-000 |
| CR16 | DIODE 1N754A | 353-2981-000 |
| E1 | TERMINAL | 306-2222-100 |
| E2 | TERMINAL | 306 2222-100 |
| E3 | TERMINAL | 306-2222-100 |
| L1 | INDUCTOR 5000UH | 240-0843-000 |
| L2 | INDUCTOR 1000UH | 240-0839-000 |
| L3 | INDUCTOR 5000UH | 240-0843-000 |
| Q1 | TRANSISTOR 2N3569 | 352-0629-030 |
| Q2 | TRANSISTOR 2N3565 | 352-0638-010 |
| Q3 | TRANSISTOR 2N718A | 352-0318-000 |
| Q4 | TRANSISTOR 2N3638A | 352-0636-020 |
| Q5 | TRANSISTOR 2N3638A | 352 0636-020 |
| Q6 | TRANSISTOR 2N3563 | 352-0630-010 |
| Q7 | TRANSISTOR 2N3563 | 352 0630-010 |
| Q8 | TRANSISTOR 2N3563 | 352-0630-010 |
| Q9 | TRANSISTOR 2N3646 | 352-0680-010 |
| Q10 | TRANSISTOR 2N3565 | 352-0638-010 |
| Q11 | TRANSISTOR 2N3643 | 352-0713-030 |
| Q12 | TRANSISTOR 2N3643 | 352 0713-030 |
| Q13 | TRANSISTOR 2N3643 | 352-0713-030 |

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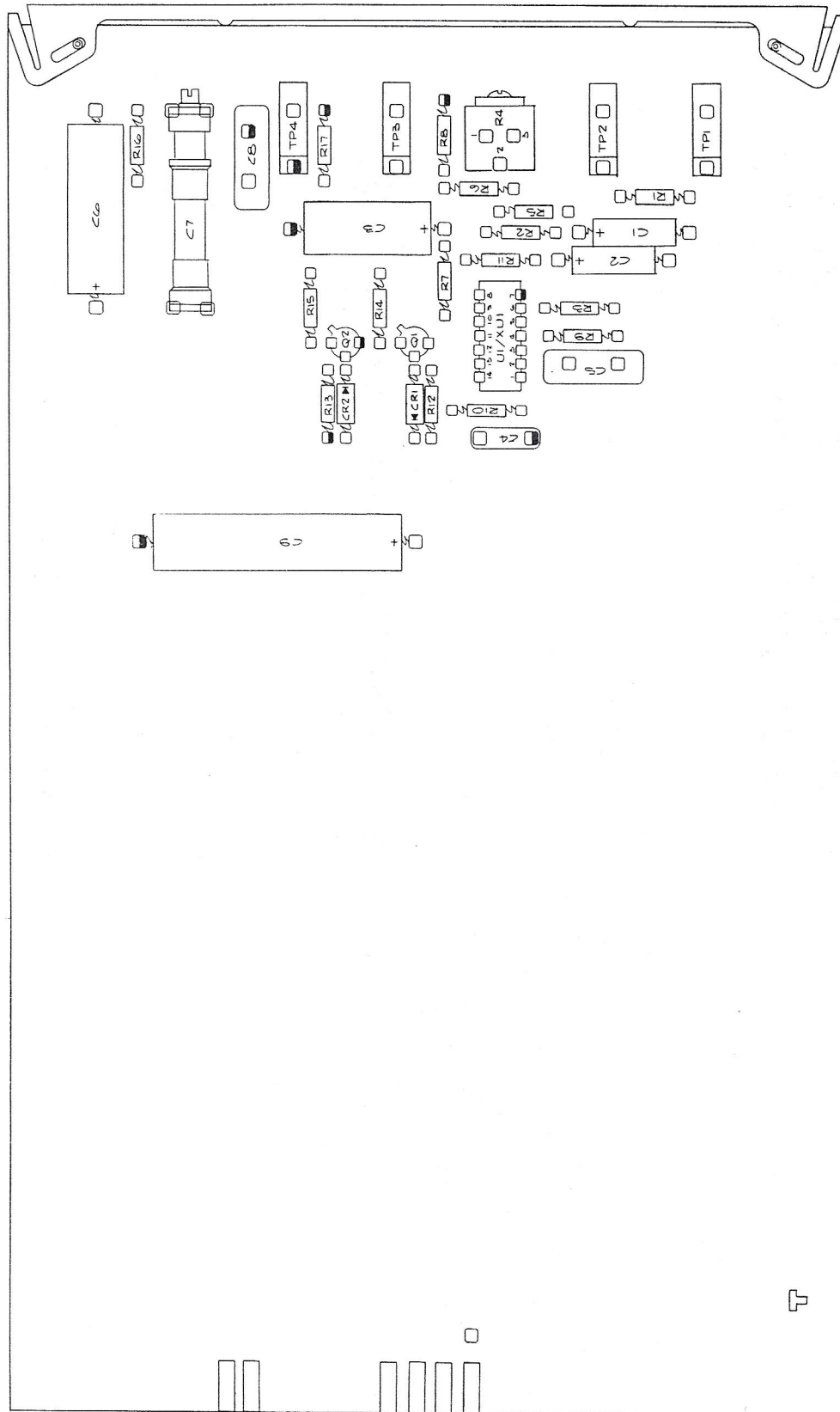
| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|--------|---------------------------------------|------------------------|
| Q14 | TRANSISTOR | 2N3643 |
| R1 | RESISTOR | 50 K 3/4 W |
| R2 | RESISTOR | 4700 1/4 W |
| R3 | RESISTOR | 5 K 3/4 W |
| R4 | RESISTOR | 39 K 1/4 W |
| R5 | RESISTOR | 56 K 1/4 W |
| R6 | RESISTOR | 1 K 1/4 W |
| R7 | RESISTOR | 6800 1/4 W |
| R8 | RESISTOR | 820 1/4 W |
| R9 | RESISTOR | 39 K 1/4 W |
| R10 | RESISTOR | 4700 1/4 W |
| R11 | RESISTOR | 3900 1/4 W |
| R12 | RESISTOR | 390 1/4 W |
| R13 | RESISTOR | 270 1/4 W |
| R14 | RESISTOR | 7500 1/2 W |
| R15 | RESISTOR | 6190 1/2 W |
| R16 | RESISTOR | 1780 1/2 W |
| R17 | RESISTOR | 2.15 K 1/2 W |
| R18 | RESISTOR | 33 K 1/4 W |
| R19 | RESISTOR | 5 K 3/4 W |
| R20 | RESISTOR | 2.15 K 1/2 W |
| R21 | RESISTOR | 33 K 1/4 W |
| R22 | RESISTOR | 10 K 1/4 W |
| R23 | RESISTOR | 1 K 1/4 W |
| R24 | RESISTOR | 1.96 K 1/4 W |
| R25 | RESISTOR | 1 K 1/4 W |
| R26 | RESISTOR | 10 K 1/4 W |
| R27 | RESISTOR | 27 K 1/4 W |
| R28 | RESISTOR | 10 K 1/4 W |
| R29 | RESISTOR | 470 1/4 W |
| R30 | RESISTOR | 50 K 3/4 W |
| R31 | RESISTOR | 3300 1/4 W |
| R32 | RESISTOR | 1800 1/4 W |
| R33 | RESISTOR | 1.62 K 1/4 W |
| R34 | RESISTOR | 3900 1/4 W |
| R35 | RESISTOR | 8200 1/4 W |
| R36 | RESISTOR | 820 1/4 W |
| R37 | RESISTOR | 10 K 1/4 W |
| R38 | RESISTOR | 220 K 1/4 W |
| R39 | RESISTOR | 2700 1/4 W |
| R40 | RESISTOR | 68 1/4 W |
| R41 | RESISTOR | 33 1/4 W |
| R42 | RESISTOR | 10 K 1/4 W |
| R43 | RESISTOR | 61.9 K 1/4 W |
| R44 | RESISTOR | 180 1/4 W |
| R45 | RESISTOR | 180 1/2 W |
| R46 | RESISTOR | 82.5 K 1/4 W |
| R47 | RESISTOR | 26.1 1/4 W |
| R48 | RESISTOR | 5110 1/2 W |
| R49 | RESISTOR | 5110 1/2 W |
| R50 | RESISTOR | 1330 1/2 W |
| R51 | RESISTOR | 1800 1/4 W |
| R52 | RESISTOR | 3900 1/4 W |
| R53 | SELECT R53 FROM THE FOLLOWING LIST | |
| | RESISTOR | 100 K 1/4 W |
| | RESISTOR | 121 K 1/4 W |
| | RESISTOR | 147 K 1/4 W |
| | RESISTOR | 178 K 1/4 W |
| | RESISTOR | 215 K 1/4 W |
| | RESISTOR | 274 K 1/4 W |
| | RESISTOR | 348 K 1/4 W |
| | RESISTOR | 422 K 1/4 W |
| | RESISTOR | 511 K 1/4 W |
| | RESISTOR | 619 K 1/4 W |
| | RESISTOR | 750 K 1/4 W |
| R54 | RESISTOR | 6800 1/4 W |
| R55 | RESISTOR | 3300 1/4 W |
| R56 | RESISTOR | 10 K 1/4 W |

D 2041-19-651

parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|--------|-----------------|------------------------|
| S1 | SWITCH, TOGGLE | 266-5321-980 |
| S2 | SWITCH, TOGGLE | 266 5321-980 |
| T1 | TRANSFORMER, AF | 667-0187-020 |
| TP1 | JACK, TIP | 360-0434-100 |
| TP2 | JACK, TIP | 360 0434-100 |
| TP3 | JACK, TIP | 360-0434-100 |
| TP4 | JACK, TIP | 360-0434-010 |

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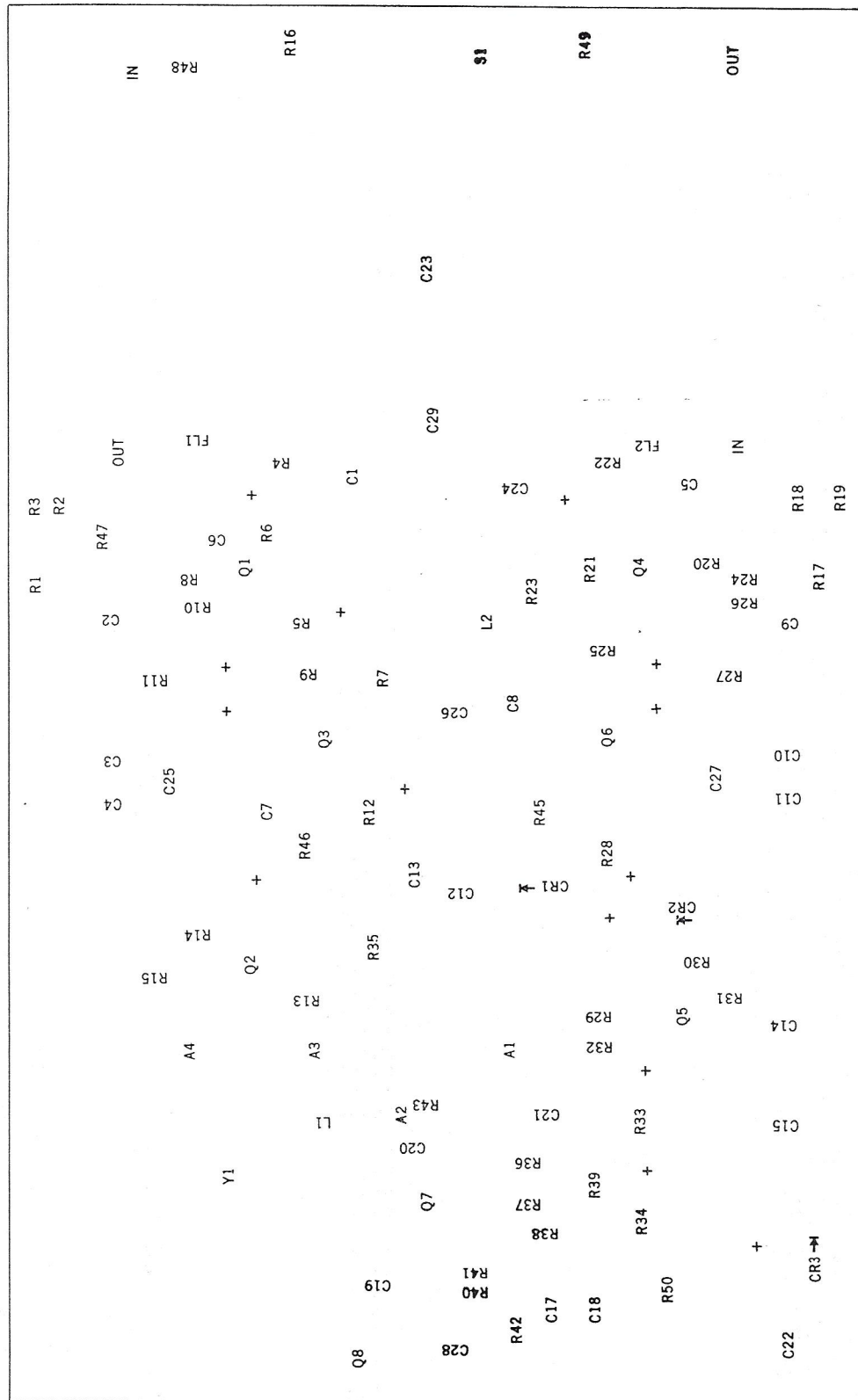
B700 3264 Rp

Figure 6-6. STL Interface 785E-1 A3.

parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|-------------------------|----------------------------------|------------------------|
| STL INTERFACE 785E-1 A3 | | 622-2374-001 |
| C1 | CAPACITOR 22UF 15 V | 184-9086-320 |
| C2 | CAPACITOR 22UF 15 V | 184 9086-320 |
| C3 | CAPACITOR 100UF 20 V | 184-9086-620 |
| C4 | CAPACITOR 1UF 50 V | 913-3279-590 |
| C5 | CAPACITOR 1000PF 500 V | 912-3001-000 |
| C6 | CAPACITOR 180UF 25 V | 184-8664-000 |
| C7 | CAPACITOR, VARIABLE 1-60PF 1000V | 922-0609-000 |
| C8 | CAPACITOR 510PF 500 V | 912-2980-000 |
| C9 | CAPACITOR 100UF 50 V | 183-1281-080 |
| CR1 | DIODE 1N914 | 353-2906-000 |
| CR2 | DIODE 1N914 | 353 2906-000 |
| Q1 | TRANSISTOR 2N2222A | 352-0661-023 |
| Q2 | TRANSISTOR 2N2907A | 352-0551-013 |
| R1 | RESISTOR 4.7 K 1/4 W | 745-0773-000 |
| R2 | RESISTOR 47 K 1/4 W | 745-0809-000 |
| R3 | RESISTOR 47 K 1/4 W | 745 0809-000 |
| R4 | RESISTOR, VARIABLE 10 K | 376-0254-070 |
| R5 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R6 | RESISTOR 100 K 1/4 W | 745-0821-000 |
| R7 | RESISTOR 8.2 K 1/4 W | 745-0782-000 |
| R8 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R9 | RESISTOR 100 1/4 W | 745-0713-000 |
| R10 | RESISTOR 100 1/4 W | 745 0713-000 |
| R11 | RESISTOR 100 K 1/4 W | 745-0821-000 |
| R12 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R13 | RESISTOR 10 K 1/4 W | 745 0785-000 |
| R14 | RESISTOR 10 1/4 W | 745-0677-000 |
| R15 | RESISTOR 10 1/4 W | 745 0677-000 |
| R16 | RESISTOR 4.7 K 1/4 W | 745-0773-000 |
| R17 | RESISTOR 270 1/4 W | 745-0728-000 |
| TP1 | JACK, TIP | 360-0434-040 |
| TP2 | JACK, TIP | 360-0434-020 |
| TP3 | JACK, TIP | 360-0434-030 |
| TP4 | JACK, TIP | 360-0434-010 |
| U1 | INTEGRATED CIRCUIT UA739 | 351-1175-010 |
| XU1 | SOCKET | 220-0001-010 |

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B700 3266 Rp

Figure 6-7. Stereo Generator 786V-1 A3.

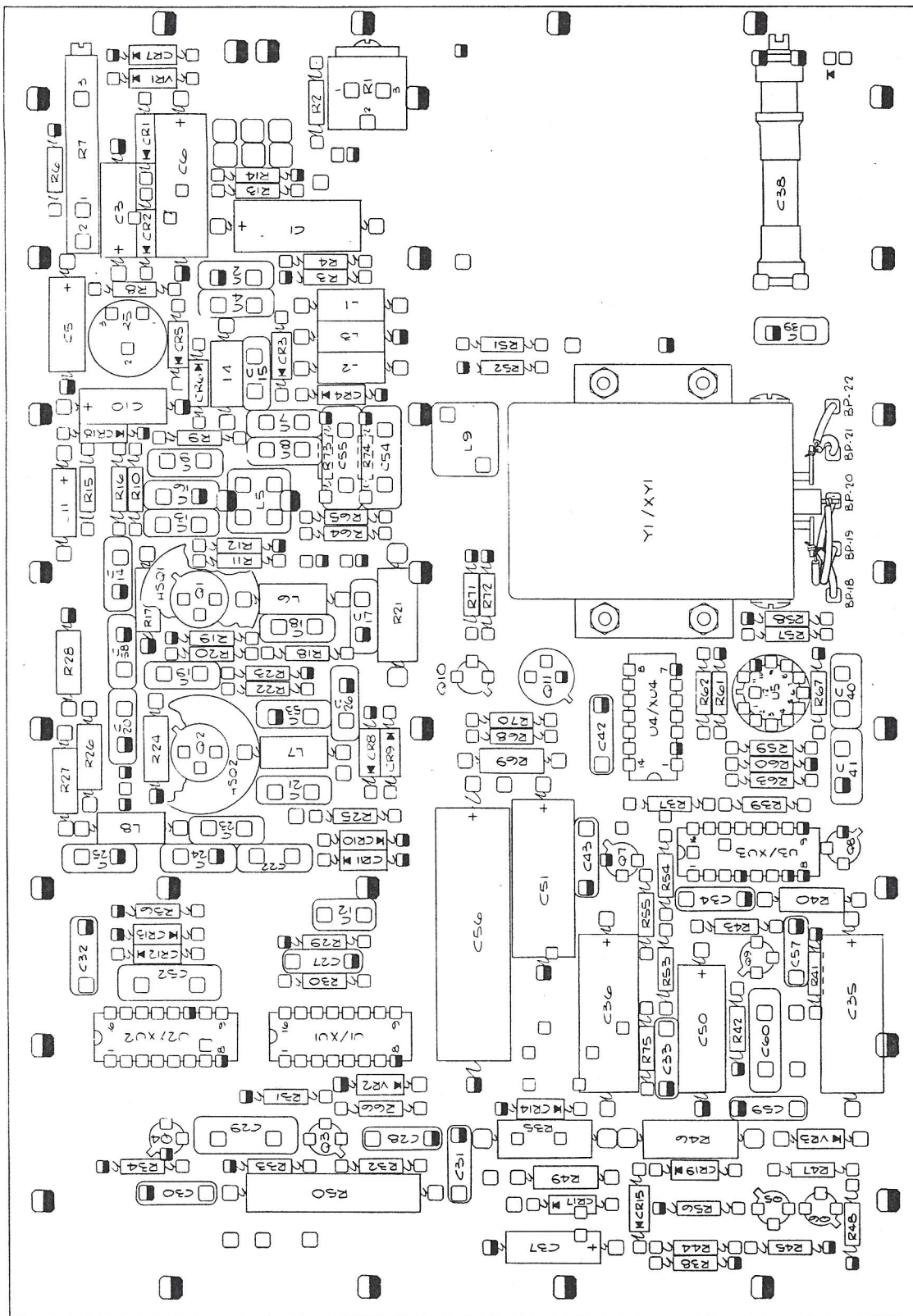
parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|----------------------------|---------------------------|------------------------|
| STEREO GENERATOR 786V-1 A3 | | 783-6648-001 |
| A1 | INTEGRATED CIRCUIT ML923 | 351-7121-010 |
| A2 | INTEGRATED CIRCUIT ML900 | 351-7121-030 |
| A3 | INTEGRATED CIRCUIT ML900 | 351 7121-030 |
| A4 | INTEGRATED CIRCUIT ML923 | 351-7121-010 |
| C1 | CAPACITOR 47 UF 35 V | 184-6231-000 |
| C2 | CAPACITOR 47 UF 35 V | 184 6231-000 |
| C3 | CAPACITOR 47 UF 35 V | 184-6231-000 |
| C4 | CAPACITOR 1000 UF 16 V | 183-2355-090 |
| C5 | CAPACITOR 47 UF 35 V | 184-6231-000 |
| C6 | CAPACITOR 47 UF 35 V | 184 6231-000 |
| C7 | CAPACITOR 1000 PF 500 V | 912-3001-000 |
| C8 | CAPACITOR 1000 PF 500 V | 912 3001-000 |
| C9 | CAPACITOR 47 UF 35 V | 184-6231-000 |
| C10 | CAPACITOR 47 UF 35 V | 184 6231-000 |
| C11 | CAPACITOR 1000 UF 16 V | 183-2355-090 |
| C12 | CAPACITOR 250 UF 40 V | 183-2355-150 |
| C13 | CAPACITOR 22 UF 35 V | 184-6225-000 |
| C14 | CAPACITOR 250 UF 40 V | 183-2355-150 |
| C15 | CAPACITOR 250 UF 40 V | 183 2355-150 |
| C16 | NOT USED | |
| C17 | CAPACITOR 2.2 UF 25 V | 913-3812-000 |
| C18 | CAPACITOR 2.2 UF 25 V | 913 3812-000 |
| C19 | CAPACITOR 33 PF 500 V | 912-2780-000 |
| C20 | CAPACITOR 820 PF 500 V | 912-2995-000 |
| C21 | CAPACITOR 3300 PF 500 V | 912-3040-000 |
| C22 | CAPACITOR 47 UF 35 V | 184-6231-000 |
| C23 | CAPACITOR 30,000 PF 500 V | 912-3131-000 |
| C24 | CAPACITOR 3900 PF 500 V | 912-3044-000 |
| C25 | CAPACITOR 2.2 UF 25 V | 913-3812-000 |
| C26 | CAPACITOR 33 PF 500 V | 912-2780-000 |
| C27 | CAPACITOR 2.2 UF 25 V | 913-3812-000 |
| C28 | CAPACITOR 47 PF 500 V | 912-2792-000 |
| C29 | CAPACITOR 1800 PF 500 V | 912-3018-000 |
| CR1 | DIODE 1N914 | 353-2906-000 |
| CR2 | DIODE 1N914 | 353 2906-000 |
| CR3 | DIODE 1N747A | 353-2702-000 |
| FL1 | FILTER, LOW PASS 15 KHZ | 673-1167-010 |
| FL2 | FILTER, LOW PASS 15 KHZ | 673 1167-010 |
| L1 | CHOKE, RF 6800 UH | 240-2560-000 |
| L2 | COIL, RF 2 MH | 240-0882-010 |
| Q1 | TRANSISTOR 2N3643 | 352-0713-030 |
| Q2 | TRANSISTOR 2N3643 | 352 0713-030 |
| Q3 | TRANSISTOR 2N3153 | 352-0776-010 |
| Q4 | TRANSISTOR 2N3643 | 352-0713-030 |
| Q5 | TRANSISTOR 2N3643 | 352 0713-030 |
| Q6 | TRANSISTOR 2N3153 | 352-0776-010 |
| Q7 | TRANSISTOR 2N3643 | 352-0713-030 |
| Q8 | TRANSISTOR 2N3643 | 352 0713-030 |
| R1 | RESISTOR 226 1/8 W | 705-0965-000 |
| R2 | RESISTOR 226 1/8 W | 705 0965-000 |
| R3 | RESISTOR 681 1/8 W | 705-0988-000 |
| R4 | RESISTOR 649 1/8 W | 705-0987-000 |
| R5 | RESISTOR 22 K 1/4 W | 745-0797-000 |
| R6 | RESISTOR 100 1/8 W | 705-0948-000 |
| R7 | RESISTOR 22 K 1/4 W | 745-0797-000 |
| R8 | RESISTOR 3300 1/4 W | 745-0767-000 |
| R9 | RESISTOR 10 K 1/8 W | 705-1044-000 |
| R10 | RESISTOR 464 1/8 W | 705-0980-000 |
| R11 | RESISTOR 61.9 1/8 W | 705-0938-000 |
| R12 | RESISTOR 1 K 1/2 W | 382-0008-070 |
| R13 | RESISTOR 120 K 1/4 W | 745-0824-000 |
| R14 | RESISTOR 21.5 K 1/8 W | 705-1060-000 |
| R15 | RESISTOR 348 1/8 W | 705-0974-000 |
| R16 | RESISTOR 20 K 1/2 W | 382-0008-450 |
| R17 | RESISTOR 226 1/8 W | 705-0965-000 |
| R18 | RESISTOR 226 1/8 W | 705 0965-000 |

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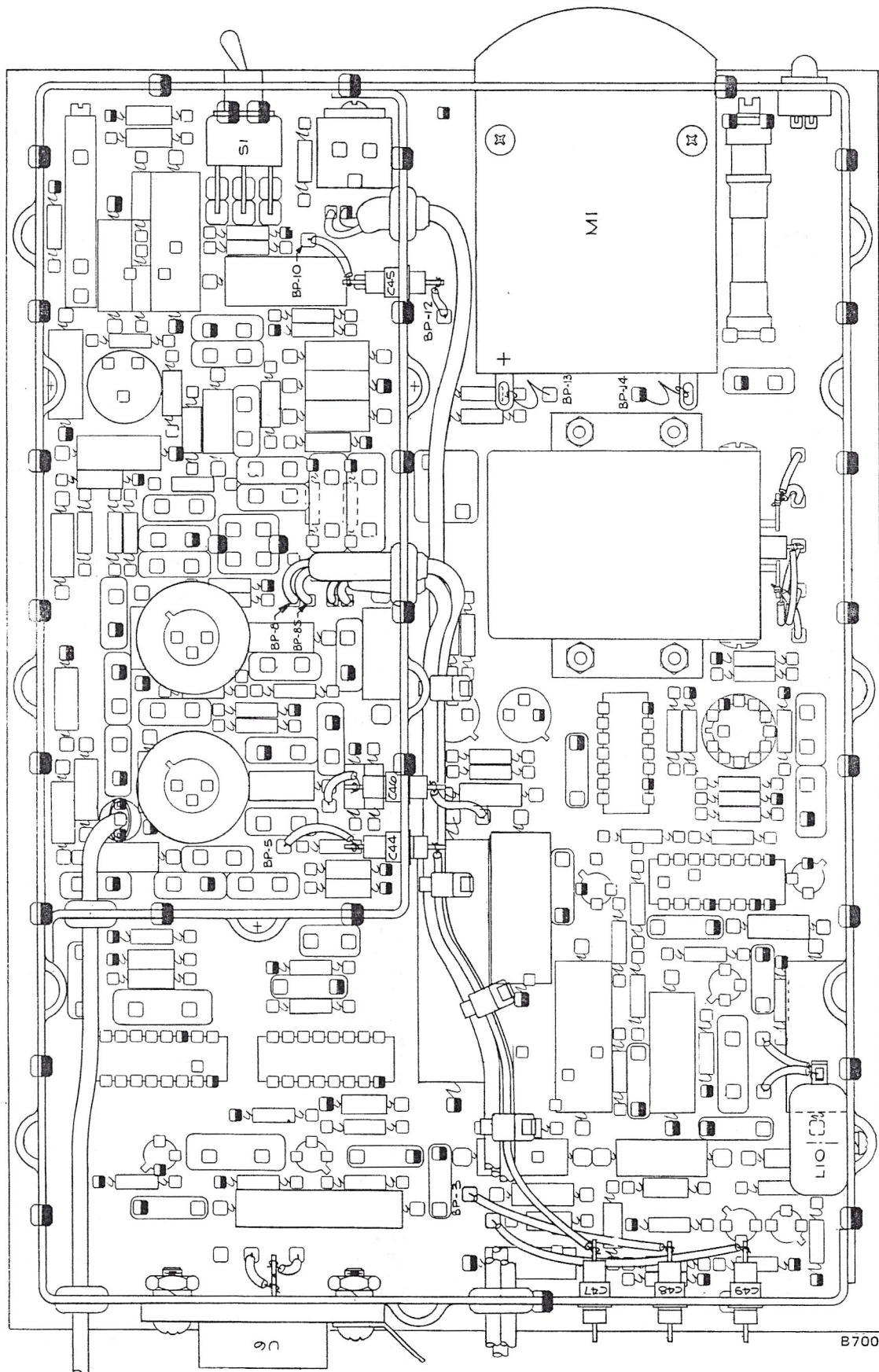
| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|--------|-----------------------|------------------------|
| R19 | RESISTOR 681 1/8 W | 705-0988-000 |
| R20 | RESISTOR 649 1/8 W | 705-0987-000 |
| R21 | RESISTOR 22 K 1/4 W | 745-0797-000 |
| R22 | RESISTOR 100 1/8 W | 705-0948-000 |
| R23 | RESISTOR 22 K 1/4 W | 745-0797-000 |
| R24 | RESISTOR 3300 1/4 W | 745-0767-000 |
| R25 | RESISTOR 10 K 1/8 W | 705-1044-000 |
| R26 | RESISTOR 464 1/8 W | 705-0980-000 |
| R27 | RESISTOR 61.9 1/8 W | 705-0938-000 |
| R28 | RESISTOR 1 K 1/2 W | 382-0008-070 |
| R29 | RESISTOR 120 K 1/4 W | 745-0824-000 |
| R30 | RESISTOR 21.5 K 1/8 W | 705-1060-000 |
| R31 | RESISTOR 348 1/8 W | 705-0974-000 |
| R32 | RESISTOR 619 1/4 W | 705-6586-000 |
| R33 | RESISTOR 560 1/4 W | 745-0740-000 |
| R34 | RESISTOR 56 1/4 W | 745-0704-000 |
| R35 | RESISTOR 470 1/4 W | 745-0737-000 |
| R36 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R37 | RESISTOR 68 K 1/4 W | 745-0815-000 |
| R38 | RESISTOR 100 1/4 W | 745-0713-000 |
| R39 | RESISTOR 820 1/4 W | 745-0746-000 |
| R40 | RESISTOR 100 K 1/4 W | 745-0821-000 |
| R41 | RESISTOR 3900 1/4 W | 745-0770-000 |
| R42 | RESISTOR 470 1/4 W | 745-0737-000 |
| R43 | RESISTOR 680 1/4 W | 745-0743-000 |
| R44 | NOT USED | |
| R45 | RESISTOR 147 1/8 W | 705-0956-000 |
| R46 | RESISTOR 147 1/8 W | 705-0956-000 |
| R47 | RESISTOR 470 1/4 W | 745-0737-000 |
| R48 | RESISTOR 330 1/4 W | 745-0731-000 |
| R49 | RESISTOR 50 1/2 W | 382-0008-370 |
| R50 | RESISTOR 270 3W | 747-5349-000 |
| S1 | SWITCH, TOGGLE | 266-5059-000 |
| XY1 | SOCKET, CRYSTAL | 292-0215-000 |
| Y1 | CRYSTAL UNIT, QUARTZ | 289-7095-020 |

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B700 3263 Rp

Figure 6-8. Modulator/Exciter A4 (Sheet 1 of 2).



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Then It Was Stolen From...
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parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|----------------------|------------------------|------------------------|
| MODULATOR/EXCITER A4 | | 627-6695-001 |
| C1 | CAPACITOR 100UF 25 V | 184-9103-570 |
| C2 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C3 | CAPACITOR 10UF 25 V | 184-9103-530 |
| C4 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C5 | CAPACITOR 10UF 25 V | 184-9103-530 |
| C6 | CAPACITOR 100UF 25 V | 184-9103-570 |
| C7 | CAPACITOR 51PF 500 V | 916-0476-000 |
| C8 | CAPACITOR 22PF 500 V | 916-0432-000 |
| C9 | CAPACITOR 47PF 500 V | 912-2792-000 |
| C10 | CAPACITOR 2.2UF 50 V | 184-9087-500 |
| C11 | CAPACITOR 1UF 50 V | 184-9087-440 |
| C12 | CAPACITOR 220PF 500 V | 912-2840-000 |
| C13 | CAPACITOR 47PF 500 V | 912-2792-000 |
| C14 | CAPACITOR 47PF 500 V | 912 2792-000 |
| C15 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C16 | CAPACITOR 100PF 500 V | 912 2816-000 |
| C17 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C18 | CAPACITOR 18PF 500 V | 912-2762-000 |
| C19 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C20 | CAPACITOR 100PF 500 V | 912 2816-000 |
| C21 | CAPACITOR 5PF 500 V | 912-2751-000 |
| C22 | CAPACITOR 5PF 500 V | 912 2751-000 |
| C23 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C24 | CAPACITOR 22PF 500 V | 912-2768-000 |
| C25 | CAPACITOR 39PF 500 V | 912-2786-000 |
| C26 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C27 | CAPACITOR 1UF 25 V | 913-3810-000 |
| C28 | CAPACITOR 1UF 25 V | 913 3810-000 |
| C29 | CAPACITOR 1000PF 500 V | 912-3001-000 |
| C30 | CAPACITOR 0.1UF 25 V | 912-3806-000 |
| C31 | CAPACITOR 0.1UF 200 V | 913-3681-000 |
| C32 | CAPACITOR 1UF 25 V | 913-3810-000 |
| C33 | CAPACITOR 0.1UF 25 V | 912-3806-000 |
| C34 | CAPACITOR 0.1UF 25 V | 912 3806-000 |
| C35 | CAPACITOR 180UF 25 V | 184-8664-000 |
| C36 | CAPACITOR 180UF 25 V | 184 8664-000 |
| C37 | CAPACITOR 10UF 25 V | 184-9103-530 |
| C38 | CAPACITOR 1-60PF 1000V | 922-0609-000 |
| C39 | CAPACITOR 18PF 500 V | 912-2762-000 |
| C40 | CAPACITOR 180PF 500 V | 912-2834-000 |
| C41 | CAPACITOR 180PF 500 V | 912 2834-000 |
| C42 | CAPACITOR 1UF 25 V | 913-3810-000 |
| C43 | CAPACITOR 1UF 25 V | 913 3810-000 |
| C44 | CAPACITOR 1000PF 500 V | 913-3208-000 |
| C45 | CAPACITOR 1000PF 500 V | 913 3208-000 |
| C46 | CAPACITOR 1000PF 500 V | 913-3208-000 |
| C47 | CAPACITOR 1000PF 500 V | 913 3208-000 |
| C48 | CAPACITOR 1000PF 500 V | 913-3208-000 |
| C49 | CAPACITOR 1000PF 500 V | 913 3208-000 |
| C50 | CAPACITOR 100UF 10 V | 184-9086-610 |
| C51 | CAPACITOR 180UF 25 V | 184-8664-000 |
| C52 | CAPACITOR 1000PF 500 V | 912-3001-000 |
| C53 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C54 | CAPACITOR 510PF 500 V | 912-2980-000 |
| C55 | CAPACITOR 510PF 500 V | 912 2980-000 |
| C56 | CAPACITOR 100UF 50 V | 183-1281-080 |
| C57 | CAPACITOR 0.1UF 25 V | 912-3806-000 |
| C58 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C59 | CAPACITOR 0.1UF 25 V | 912-3806-000 |
| C60 | CAPACITOR 560PF 500 V | 912-2983-000 |
| CR1 | DIODE 1N914 | 353-2906-000 |
| CR2 | DIODE 1N914 | 353 2906-000 |
| CR3 | DIODE MV1404 | 922-6100-020 |
| CR4 | DIODE MV1404 | 922 6100-020 |
| CR5 | DIODE MV1650 | 922-6109-020 |
| CR6 | DIODE MV1650 | 922 6109-020 |

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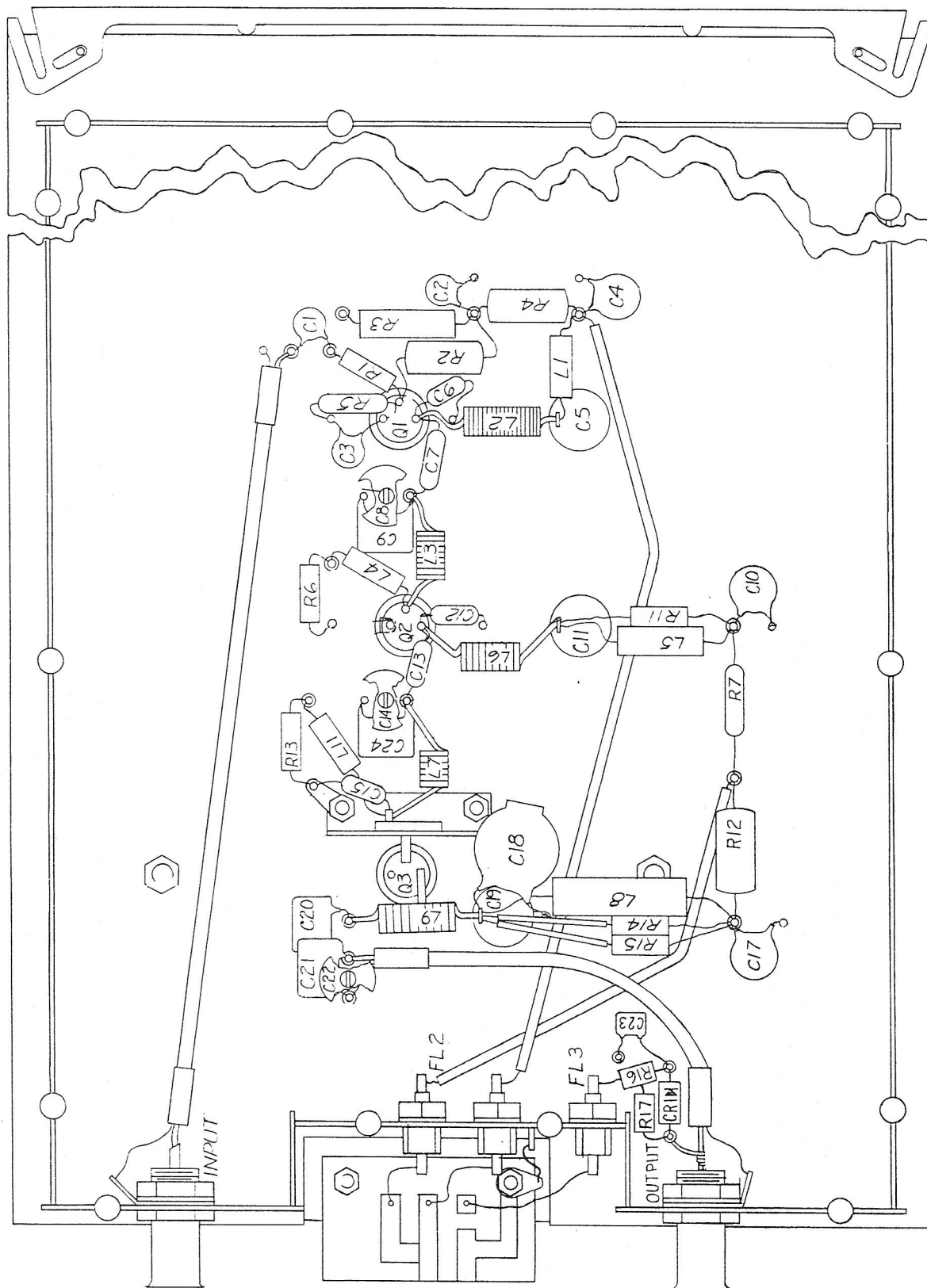
| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|--------|--------------------|--------------------------|
| CR7 | DIODE | 1N914 353-2906-000 |
| CR8 | DIODE | 1N914 353 2906-000 |
| CR9 | DIODE | 1N914 353-2906-000 |
| CR10 | DIODE | 1N914 353 2906-000 |
| CR11 | DIODE | 1N914 353-2906-000 |
| CR12 | DIODE | 1N914 353 2906-000 |
| CR13 | DIODE | 1N914 353-2906-000 |
| CR14 | DIODE | 1N914 353 2906-000 |
| CR15 | DIODE | 1N914 353-2906-000 |
| CR16 | DIODE | 353-3725-060 |
| CR17 | DIODE | 1N914 353-2906-000 |
| CR18 | DIODE | 1N5159 353-6549-020 |
| CR19 | DIODE | 1N914 353-2906-000 |
| HSQ1 | HEATSINK | 352-2619-030 |
| HSQ2 | HEATSINK | 352 2619-030 |
| L1 | INDUCTOR | 1.5 UHY 240-2715-150 |
| L2 | INDUCTOR | 1.5 UHY 240 2715-150 |
| L3 | INDUCTOR | 1.5 UHY 240-2715-150 |
| L4 | INDUCTOR | 1.5 UHY 240 2715-150 |
| L5 | INDUCTOR, VARIABLE | 278-1969-620 |
| L6 | INDUCTOR | 0.47 UHY 240-2715-090 |
| L7 | INDUCTOR | 1.5 UHY 240-2715-150 |
| L8 | INDUCTOR | 0.1 UHY 240-2715-010 |
| L9 | INDUCTOR | 10 HY 678-0205-010 |
| L10 | INDUCTOR | 150 MHY 240-0276-000 |
| M1 | METER | 0-50 UA 458-0908-020 |
| P1 | CONNECTOR BOARD | 627-9766-001 |
| P2 | CONNECTOR | 357-9210-000 |
| Q1 | TRANSISTOR | 2N5109 352-0766-010 |
| Q2 | TRANSISTOR | 2N5109 352 0766-010 |
| Q3 | TRANSISTOR | 2N2907A 352-0551-013 |
| Q4 | TRANSISTOR | 2N2222A 352-0661-023 |
| Q5 | TRANSISTOR | 2N2222A 352 0661-023 |
| Q6 | TRANSISTOR | 2N2222A 352-0661-023 |
| Q7 | TRANSISTOR | 2N2222A 352 0661-023 |
| Q8 | TRANSISTOR | 2N2222A 352-0661-023 |
| Q9 | TRANSISTOR | 2N2222A 352 0661-023 |
| Q10 | TRANSISTOR | 2N2222A 352-0661-023 |
| Q11 | TRANSISTOR | 2N3053 352-0613-010 |
| R1 | RESISTOR, VARIABLE | 500 376-0254-030 |
| R2 | RESISTOR | 100 745-0713-000 |
| R3 | RESISTOR | 22 K 1/4 W 745-0797-000 |
| R4 | RESISTOR | 47 K 1/4 W 745-0809-000 |
| R5 | RESISTOR, VARIABLE | 25 K 380-3761-080 |
| R6 | RESISTOR | 22 K 1/4 W 745-0797-000 |
| R7 | RESISTOR, VARIABLE | 10 K 3/4 W 381-1802-000 |
| R8 | RESISTOR | 22 K 1/4 W 745-0797-000 |
| R9 | RESISTOR | 22 K 1/4 W 745 0797-000 |
| R10 | RESISTOR | 10 K 1/4 W 745-0785-000 |
| R11 | RESISTOR | 4.7 K 1/4 W 745-0773-000 |
| R12 | RESISTOR | 1 K 1/4 W 745-0749-000 |
| R13 | RESISTOR | 10 K 1/4 W 745-0785-000 |
| R14 | RESISTOR | 8.2 K 1/4 W 745-0782-000 |
| R15 | RESISTOR | 47 K 1/4 W 745-0809-000 |
| R16 | RESISTOR | 470 K 1/4 W 745-0845-000 |
| R17 | RESISTOR | 100 1/2 W 745-1310-000 |
| R18 | RESISTOR | 15 1/4 W 745-0683-000 |
| R19 | RESISTOR | 68 1/4 W 745-0707-000 |
| R20 | RESISTOR | 15 1/4 W 745-0683-000 |
| R21 | RESISTOR | 150 1 W 745-3317-000 |
| R22 | RESISTOR | 3.3 K 1/4 W 745-0767-000 |
| R23 | RESISTOR | 470 1/4 W 745-0737-000 |
| R24 | RESISTOR | 47 1/2 W 745-1296-000 |
| R25 | RESISTOR | 4.7 K 1/4 W 745-0773-000 |
| R26 | RESISTOR | 22 1/2 W 745-1282-000 |
| R27 | RESISTOR | 22 1/2 W 745 1282-000 |
| R28 | RESISTOR | 47 1/2 W 745-1296-000 |
| R29 | RESISTOR | 3.9 K 1/4 W 745-0770-000 |
| R30 | RESISTOR | 1.2 K 1/4 W 745-0752-000 |

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parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|--------|----------------------------|------------------------|
| R31 | RESISTOR 470 1/4 W | 745-0737-000 |
| R32 | RESISTOR 100 1/4 W | 745-0713-000 |
| R33 | RESISTOR 270 1/4 W | 745-0728-000 |
| R34 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R35 | RESISTOR 220 1 W | 745-3324-000 |
| R36 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R37 | RESISTOR 10 K 1/4 W | 745 0785-000 |
| R38 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R39 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R40 | RESISTOR 2.2 K 1/2 W | 745-1366-000 |
| R41 | RESISTOR 2.2 K 1/4 W | 745-0761-000 |
| R42 | RESISTOR 470 1/4 W | 745-0737-000 |
| R43 | RESISTOR 4.7 K 1/4 W | 745-0773-000 |
| R44 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R45 | RESISTOR 2.7 K 1/4 W | 745-0764-000 |
| R46 | RESISTOR 1 K 1 W | 745-3352-000 |
| R47 | RESISTOR 4.7K 1/4 W | 745-0773-000 |
| R48 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R49 | RESISTOR 2.7 K 1/2 W | 745-1370-000 |
| R50 | RESISTOR 39 2 W | 745-5593-000 |
| R51 | RESISTOR 100 K 1/4 W | 745-0821-000 |
| R52 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R53 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R54 | RESISTOR 10 K 1/4 W | 745 0785-000 |
| R55 | RESISTOR 4.7 K 1/4 W | 745-0773-000 |
| R56 | RESISTOR 15 1/4 W | 745-0683-000 |
| R57 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R58 | RESISTOR 10 K 1/4 W | 745 0785-000 |
| R59 | RESISTOR 270 1/4 W | 745-0728-000 |
| R60 | RESISTOR 470 1/4 W | 745-0737-000 |
| R61 | RESISTOR 470 1/4 W | 745 0737-000 |
| R62 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R63 | RESISTOR 1 K 1/4 W | 745 0749-000 |
| R64 | RESISTOR 27 K 1/4 W | 745-0800-000 |
| R65 | RESISTOR 27 K 1/4 W | 745 0800-000 |
| R66 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R67 | RESISTOR 100 1/4 W | 745-0713-000 |
| R68 | RESISTOR 15 K 1/4 W | 745-0791-000 |
| R69 | RESISTOR 1.2 K 1/2 W | 745-1356-000 |
| R70 | RESISTOR 15 K 1/4 W | 745-0791-000 |
| R71 | RESISTOR 2.2 K 1/4 W | 745-0761-000 |
| R72 | RESISTOR 4.7 K 1/4 W | 745-0773-000 |
| R73 | RESISTOR 2.2 K 1/4 W | 745-0761-000 |
| R74 | RESISTOR 2.2 K 1/4 W | 745 0761-000 |
| R75 | RESISTOR 15 K 1/4 W | 745-0791-000 |
| S1 | SWITCH | 266-5321-990 |
| U1 | INTEGRATED CIRCUIT MC10178 | 351-1520-020 |
| U2 | INTEGRATED CIRCUIT CD4020 | 351-8159-090 |
| U3 | INTEGRATED CIRCUIT CD4027 | 351-8159-180 |
| U4 | INTEGRATED CIRCUIT CD4024 | 351-8159-100 |
| U5 | INTEGRATED CIRCUIT CA3018 | 351-1016-010 |
| U6 | INTEGRATED CIRCUIT 7805KC | 351-1120-080 |
| VR1 | ZENER DIODE 1N4744A | 353-6481-330 |
| VR2 | ZENER DIODE 1N4744A | 353 6481-330 |
| VR3 | ZENER DIODE 1N4740A | 353-6481-250 |
| XCR16 | RING, RETAINING | 353-3725-060 |
| XU1 | SOCKET | 220-0001-020 |
| XU2 | SOCKET | 220 0001-020 |
| XU3 | SOCKET | 220-0001-020 |
| XU4 | SOCKET | 220-0001-010 |
| XU5 | INSULATOR DISC | 352-9552-040 |
| XY1 | OVEN CRYSTAL | 292-0328-010 |

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B700 3268 Rp

Figure 6-10. Power Amplifier A5.

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|--------------------|--------------------------|------------------------|
| POWER AMPLIFIER A5 | | 769-0830-001 |
| C1 | CAPACITOR 680PF 1000V | 913-1194-000 |
| C2 | CAPACITOR 470PF 500 V | 913-1189-000 |
| C3 | CAPACITOR 470PF 500 V | 913 1189-000 |
| C4 | CAPACITOR 0.01UF 100 V | 913-3680-000 |
| C5 | CAPACITOR 1000PF 500 V | 912-4115-330 |
| C6 | CAPACITOR 15PF 500 V | 912-2759-000 |
| C7 | CAPACITOR 15PF 500 V | 912 2759-000 |
| C8 | CAPACITOR 5.5-18PF 350 V | 917-1222-000 |
| C9 | CAPACITOR 33PF 500 V | 912-2781-000 |
| C10 | CAPACITOR 0.01UF 100 V | 913-3680-000 |
| C11 | CAPACITOR 1000PF 500 V | 912-4115-330 |
| C12 | CAPACITOR 10PF 500 V | 912-2753-000 |
| C13 | CAPACITOR 18PF 500 V | 912-2762-000 |
| C14 | CAPACITOR 5.5-18PF 350 V | 917-1222-000 |
| C15 | CAPACITOR 82PF 500 V | 912-2810-000 |
| C16 | CAPACITOR 500PF 500 V | 912-0667-000 |
| C17 | CAPACITOR 0.01UF 100 V | 913-3680-000 |
| C18 | CAPACITOR 0.1UF 100 V | 913-4240-050 |
| C19 | CAPACITOR 1000PF 500 V | 912-4115-330 |
| C20 | CAPACITOR 110PF 500 V | 912-2819-000 |
| C21 | CAPACITOR 27PF 500 V | 912-2774-000 |
| C22 | CAPACITOR 5.5-18PF 350 V | 917-1222-000 |
| C23 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C24 | CAPACITOR 22PF 500 V | 912-2769-000 |
| CR1 | DIODE 1N914 | 353-2906-000 |
| FL1 | FILTER, RI 1300PF 200 V | 241-0332-000 |
| FL2 | FILTER, RI 1300PF 200 V | 241 0332-000 |
| FL3 | FILTER, RI 1300PF 200 V | 241-0332-000 |
| J1 | CONNECTOR VG1051 | 357-9210-000 |
| J2 | CONNECTOR VG1051 | 357 9210-000 |
| L1 | COIL, RF 1 UH | 240-1590-000 |
| L2 | COIL 0.082 UH | 776-1882-001 |
| L3 | COIL 0.048 UH | 776-1910-001 |
| L4 | COIL, RF 0.15 UH | 240-1585-000 |
| L5 | COIL, RF 2.2 UH | 240-1654-000 |
| L6 | COIL 0.056 UH | 776-1911-001 |
| L7 | COIL 0.05 UH | 776-1912-001 |
| L8 | CHOKE, RF 1.2 UH | 240-1605-000 |
| L9 | COIL 0.092 UH | 776-1883-001 |
| L11 | COIL, RF 0.15 UH | 240-1585-000 |
| Q1 | TRANSISTOR 2N3866 | 352-0671-010 |
| Q2 | TRANSISTOR 2N3375 | 352-0611-010 |
| Q3 | TRANSISTOR 2N5102 | 352-0747-010 |
| R1 | RESISTOR 39 1/2 W | 745-1293-000 |
| R2 | RESISTOR 22 3 W | 747-5327-000 |
| R3 | RESISTOR 23.7 1/2 W | 705-7018-000 |
| R4 | RESISTOR 270 3 W | 747-5349-000 |
| R5 | RESISTOR 10 1/4 W | 705-6500-000 |
| R6 | RESISTOR 100 1/2 W | 745-1310-000 |
| R7 | RESISTOR 2 1 W | 747-4230-300 |
| R11 | RESISTOR 10 1/2 W | 745-1268-000 |
| R12 | RESISTOR 0.5 2.5 W | 746-9457-000 |
| R13 | RESISTOR 4.7 1/2 W | 745-6279-000 |
| R14 | RESISTOR 10 1/2 W | 745-1268-000 |
| R15 | RESISTOR 10 1/2 W | 745 1268-000 |
| R16 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R17 | RESISTOR 470 1/4 W | 745-0737-000 |

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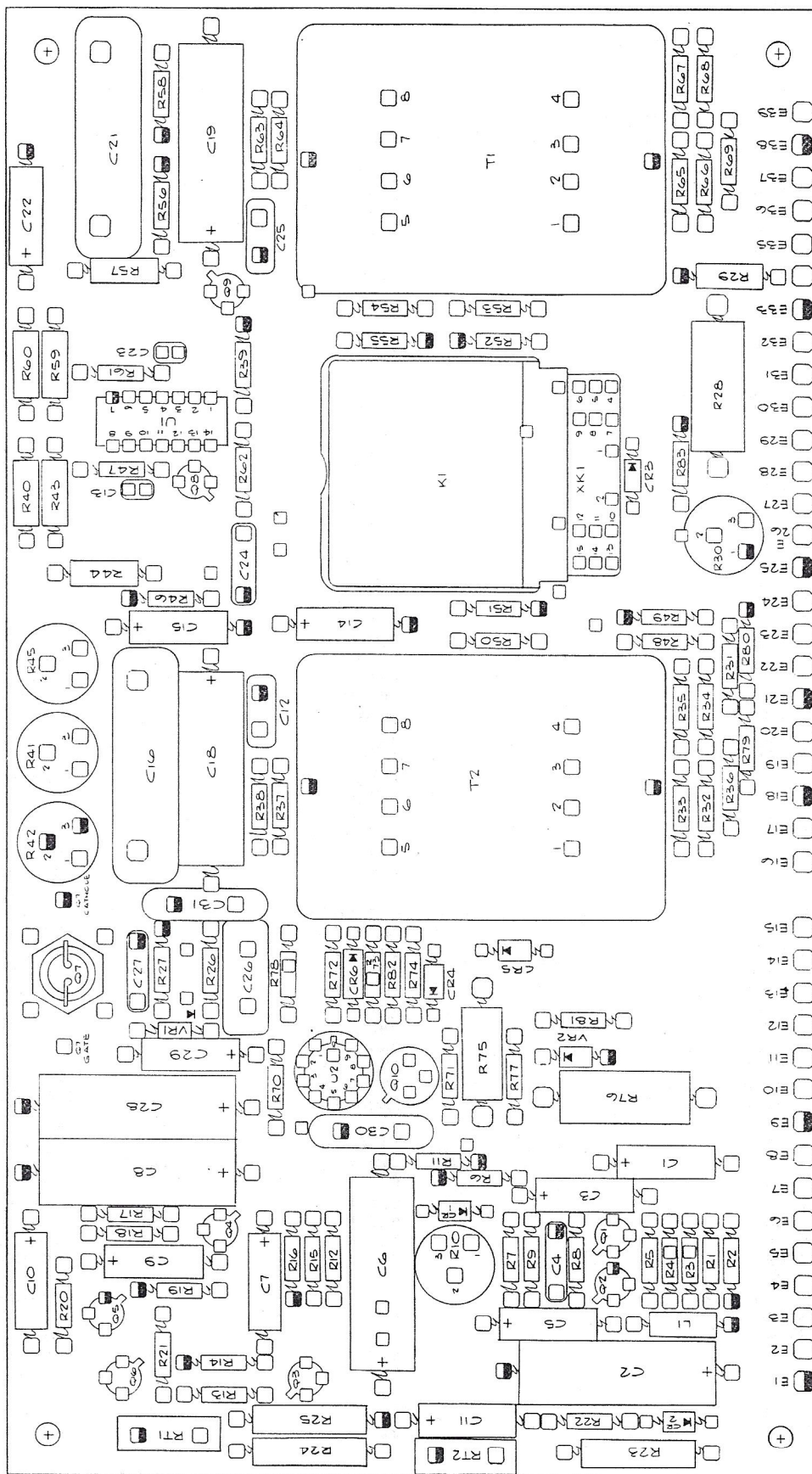


Figure 6-11. Audio/Mtr Regulator A6.

B700 3269 Rp

parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|------------------------|-------------------------|------------------------|
| AUDIO/MTR REGULATOR A6 | | 627-9773-001 |
| C1 | CAPACITOR 22UF 15 V | 184-9086-320 |
| C2 | CAPACITOR 180UF 25 V | 184-8664-000 |
| C3 | CAPACITOR 22UF 15 V | 184-9086-320 |
| C4 | CAPACITOR 0.1UF 25 V | 913-3806-000 |
| C5 | CAPACITOR 10UF 20 V | 184-9086-470 |
| C6 | CAPACITOR 150UF 30 V | 184-8673-000 |
| C7 | CAPACITOR 22UF 15 V | 184-9086-320 |
| C8 | CAPACITOR 180UF 25 V | 184-8664-000 |
| C9 | CAPACITOR 22UF 15 V | 184-9086-320 |
| C10 | CAPACITOR 22UF 15 V | 184 9086-320 |
| C11 | CAPACITOR 10UF 20 V | 184-9086-470 |
| C12 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C13 | CAPACITOR 0.01UF 50 V | 913-3279-110 |
| C14 | CAPACITOR 22UF 15 V | 184-9086-320 |
| C15 | CAPACITOR 22UF 15 V | 184 9086-320 |
| C16 | CAPACITOR 0.030UF 500 V | 912-3133-000 |
| C17 | NOT USED | |
| C18 | CAPACITOR 180UF 25 V | 184-8664-000 |
| C19 | CAPACITOR 180UF 25 V | 184 8664-000 |
| C20 | NOT USED | |
| C21 | CAPACITOR 0.030UF 500 V | 912-3133-000 |
| C22 | CAPACITOR 22UF 15 V | 184-9086-320 |
| C23 | CAPACITOR 0.01UF 50 V | 913-3279-110 |
| C24 | CAPACITOR 1UF 25 V | 913-3810-000 |
| C25 | CAPACITOR 100PF 500 V | 912-2816-000 |
| C26 | CAPACITOR 2200PF 500 V | 913-3025-000 |
| C27 | CAPACITOR 1UF 25 V | 913-3810-000 |
| C28 | CAPACITOR 180UF 25 V | 184-8664-000 |
| C29 | CAPACITOR 22UF 15 V | 184-9086-320 |
| C30 | CAPACITOR 0.1UF 200 V | 913-3681-000 |
| C31 | CAPACITOR 0.1UF 200 V | 913 3681-000 |
| CR1 | DIODE 1N914 | 353-2906-000 |
| CR2 | DIODE 1N914 | 353 2906-000 |
| CR3 | DIODE 1N4003 | 353-6442-030 |
| CR4 | DIODE 1N914 | 353-2906-000 |
| CR5 | DIODE 1N914 | 353 2906-000 |
| CR6 | DIODE 1N914 | 353-2906-000 |
| K1 | RELAY | 970-2420-040 |
| L1 | INDUCTOR 6.8 MHY | 240-1578-000 |
| Q1 | TRANSISTOR 2N2907A | 352-0551-013 |
| Q2 | TRANSISTOR 2N2907A | 352 0551-013 |
| Q3 | TRANSISTOR 2N2907A | 352-0551-013 |
| Q4 | TRANSISTOR 2N2907A | 352 0551-013 |
| Q5 | TRANSISTOR 2N2907A | 352-0551-013 |
| Q6 | TRANSISTOR 2N2907A | 352 0551-013 |
| Q7 | TRANSISTOR, SCR 2N4168 | 353-6485-020 |
| Q8 | TRANSISTOR 2N2222A | 352-0661-023 |
| Q9 | TRANSISTOR 2N2222A | 352 0661-023 |
| Q10 | TRANSISTOR 2N3053 | 352-0613-010 |
| R1 | RESISTOR 8.2 K 1/4 W | 745-0782-000 |
| R2 | RESISTOR 47 K 1/4 W | 745-0809-000 |
| R3 | RESISTOR 1.2 K 1/4 W | 745-0752-000 |
| R4 | RESISTOR 82 1/4 W | 745-0710-000 |
| R5 | RESISTOR 5.6 K 1/4 W | 745-0776-000 |
| R6 | RESISTOR 8.2 K 1/4 W | 745-0782-000 |
| R7 | RESISTOR 5.6 K 1/4 W | 745-0776-000 |
| R8 | RESISTOR 23.7 K 1/4 W | 705-6662-000 |
| R9 | RESISTOR 1.2 K 1/4 W | 745-0752-000 |
| R10 | RESISTOR, VARIABLE 100 | 380-3761-010 |
| R11 | RESISTOR 390 K 1/4 W | 745-0842-000 |
| R12 | RESISTOR 5.6 K 1/4 W | 745-0776-000 |
| R13 | RESISTOR 1.2 K 1/4 W | 745-0752-000 |
| R14 | RESISTOR 5.6 K 1/4 W | 745-0776-000 |
| R15 | RESISTOR 3.9 K 1/4 W | 745-0770-000 |
| R16 | RESISTOR 12 K 1/4 W | 745-0788-000 |
| R17 | RESISTOR 2.2 K 1/4 W | 745-0761-000 |

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| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|--------|----------------------------|------------------------|
| R18 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R19 | RESISTOR 5.6 K 1/4 W | 745-0776-000 |
| R20 | RESISTOR 22 K 1/4 W | 745-0797-000 |
| R21 | RESISTOR 390 1/4 W | 745-0734-000 |
| R22 | RESISTOR 1.5 K 1/4 W | 745-0755-000 |
| R23 | RESISTOR 12.1 K 1/4 W | 705-6648-000 |
| R24 | RESISTOR 1.78 K 1/4 W | 705-1418-250 |
| R25 | RESISTOR 511 1/4 W | 705-1417-690 |
| R26 | RESISTOR 100 1/4 W | 745-0713-000 |
| R27 | RESISTOR 220 1/4 W | 745-0725-000 |
| R28 | RESISTOR 390 2 W | 745-5635-000 |
| R29 | RESISTOR 100 K 1/4 W | 745-0821-000 |
| R30 | RESISTOR, VARIABLE 1 K | 380 3761-040 |
| R31 | RESISTOR 22 K 1/4 W | 745-0797-000 |
| R32 | RESISTOR 274 1/8 W | 705-0969-000 |
| R33 | RESISTOR 274 1/8 W | 705 0969-000 |
| R34 | RESISTOR 274 1/8 W | 705-0969-000 |
| R35 | RESISTOR 274 1/8 W | 705 0969-000 |
| R36 | RESISTOR 154 1/8 W | 705-0957-000 |
| R37 | RESISTOR 2.7 K 1/4 W | 745-0764-000 |
| R38 | RESISTOR 10 K 1/8 W | 705-1454-630 |
| R39 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R40 | RESISTOR 2.67 K 1/4 W | 705-1418-420 |
| R41 | RESISTOR, VARIABLE 2.5 K | 380-3761-050 |
| R42 | RESISTOR, VARIABLE 100 | 380-3761-010 |
| R43 | RESISTOR 4.64 K 1/4 W | 705-1418-650 |
| R44 | RESISTOR 2.87 K 1/4 W | 705-1418-450 |
| R45 | RESISTOR, VARIABLE 2.5 K | 380-3761-200 |
| R46 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R47 | RESISTOR 33 1/4 W | 745-0695-000 |
| R48 | RESISTOR 12.1 K 1/8 W | 705-1454-650 |
| R49 | RESISTOR 237 1/8 W | 705-1454-240 |
| R50 | RESISTOR 4.22 K 1/8 W | 705-1454-540 |
| R51 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R52 | RESISTOR 10 K 1/4 W | 745 0785-000 |
| R53 | RESISTOR 4.22 K 1/8 W | 705-1454-540 |
| R54 | RESISTOR 12.1 K 1/8 W | 705-1454-650 |
| R55 | RESISTOR 237 1/8 W | 705-1454-240 |
| R56 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R57 | RESISTOR 3.32 K 1/4 W | 705-1418-510 |
| R58 | RESISTOR 100 1/4 W | 745-0713-000 |
| R59 | RESISTOR 6.81 K 1/4 W | 705-1418-810 |
| R60 | RESISTOR 3.32 K 1/4 W | 705-1418-510 |
| R61 | RESISTOR 33 1/4 W | 745-0695-000 |
| R62 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R63 | RESISTOR 10 K 1/8 W | 705-1454-630 |
| R64 | RESISTOR 2.7 K 1/4 W | 745-0764-000 |
| R65 | RESISTOR 274 1/8 W | 705-0969-000 |
| R66 | RESISTOR 274 1/8 W | 705 0969-000 |
| R67 | RESISTOR 274 1/8 W | 705-0969-000 |
| R68 | RESISTOR 274 1/8 W | 705 0969-000 |
| R69 | RESISTOR 154 1/8 W | 705-0957-000 |
| R70 | RESISTOR 1.5 K 1/4 W | 745-0755-000 |
| R71 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R72 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R73 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R74 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R75 | RESISTOR 470 1 W | 745-3338-000 |
| R76 | RESISTOR 100 2 W | 745-5610-000 |
| R77 | RESISTOR 1.8 K 1/4 W | 745-0758-000 |
| R78 | RESISTOR 100 1/4 W | 745-0713-000 |
| R79 | RESISTOR 22 K 1/4 W | 745-0797-000 |
| R80 | RESISTOR 39 1/4 W | 745-0698-000 |
| R81 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| R82 | RESISTOR 1 K 1/4 W | 745-0749-000 |
| R83 | RESISTOR 10 K 1/4 W | 745-0785-000 |
| RT1 | RESISTOR, THERMAL 1 W | 714-1732-000 |
| RT2 | RESISTOR, THERMAL 10 K 1 W | 714-0182-000 |
| T1 | TRANSFORMER, AUDIO INPUT | 667-0187-030 |

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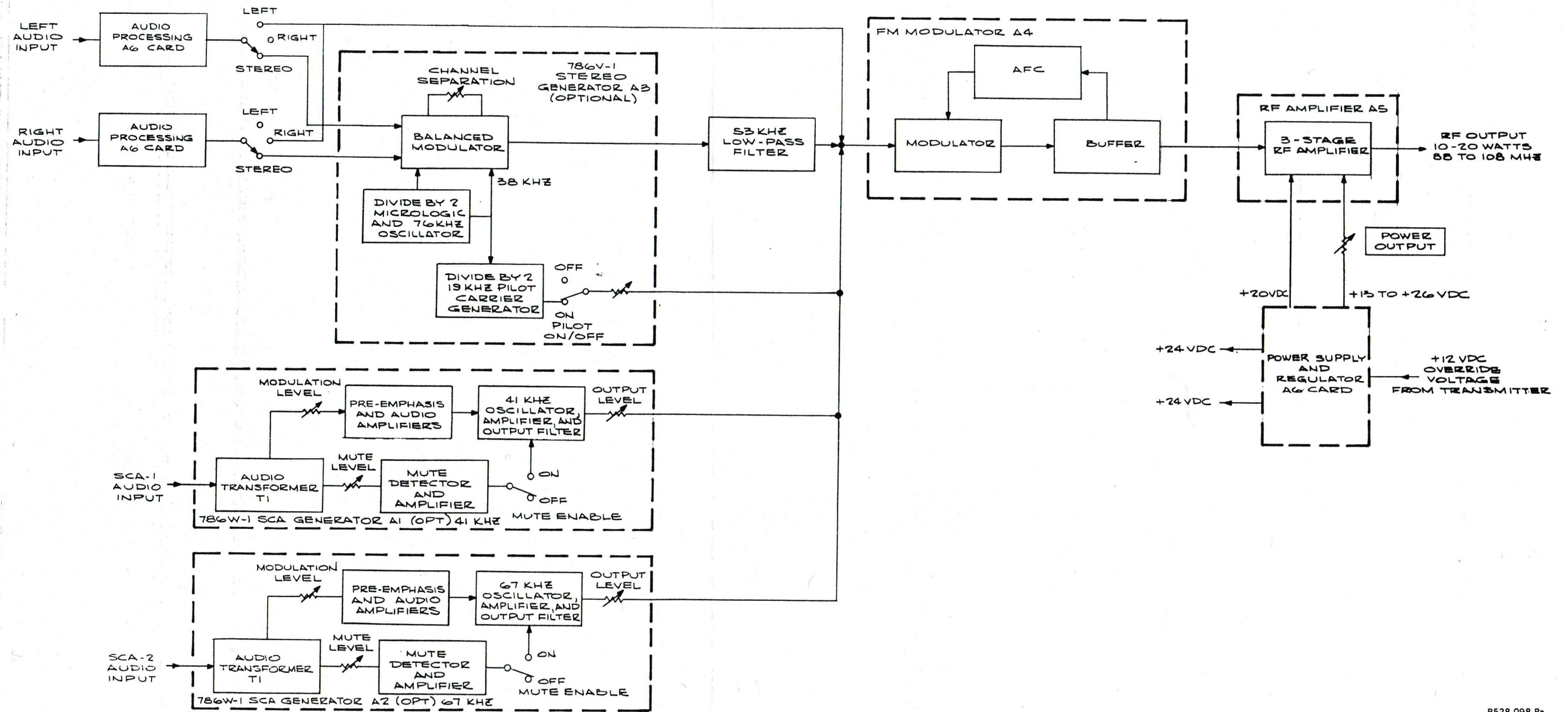
parts list

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|--------|----------------------------|------------------------|
| T2 | TRANSFORMER, AUDIO INPUT | 667 0187-030 |
| U1 | INTEGRATED CIRCUIT | 351-1175-010 |
| U2 | INTEGRATED CIRCUIT | 351-1035-040 |
| VR1 | ZENER DIODE | 353-6481-470 |
| VR2 | ZENER DIODE | 353-6481-510 |
| XK1 | SOCKET, RELAY | 220-0027-010 |
| XU1 | SOCKET, INTEGRATED CIRCUIT | 220-0001-010 |
| XU2 | INSULATOR, DISC | 352-9552-060 |

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Section 7

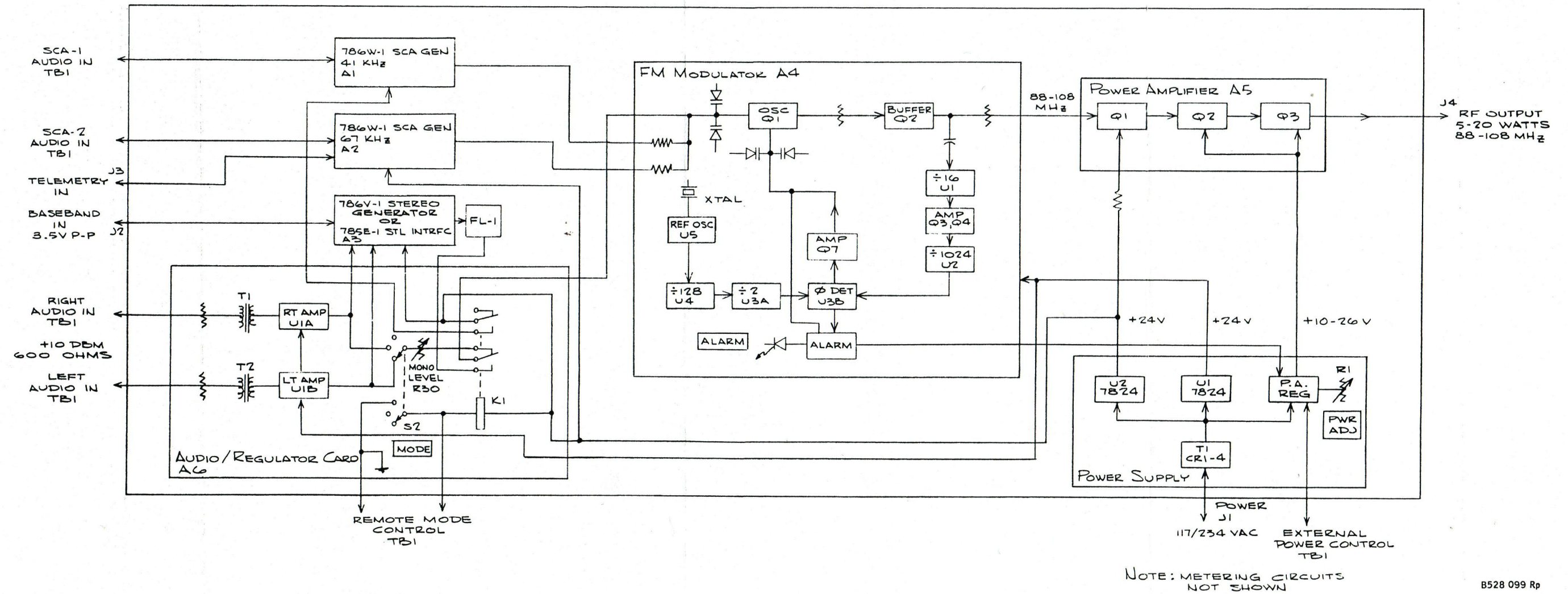
Diagrams



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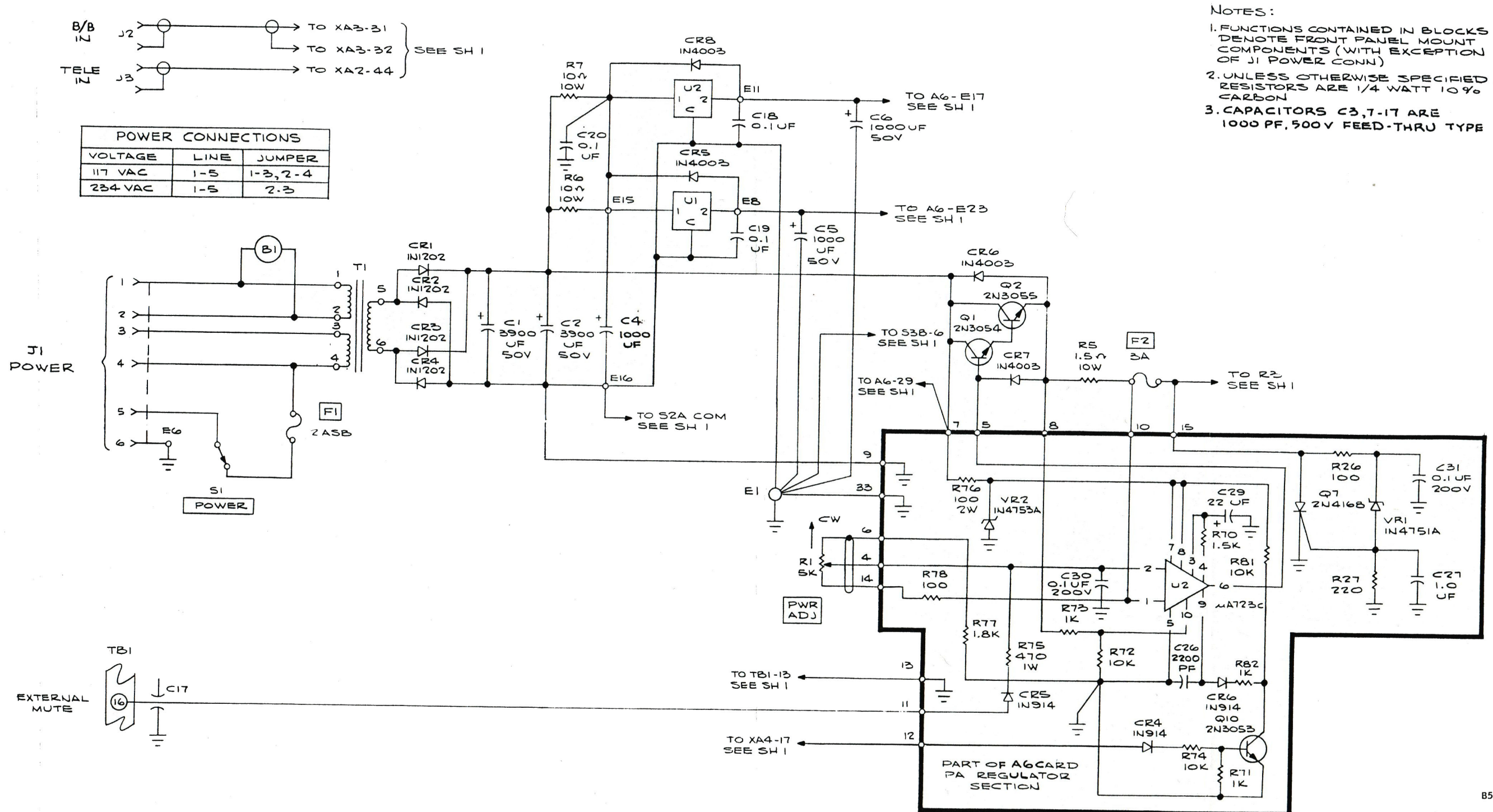
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Figure 4-1. 310Z-2 FM Exciter, Simplified Block Diagram.



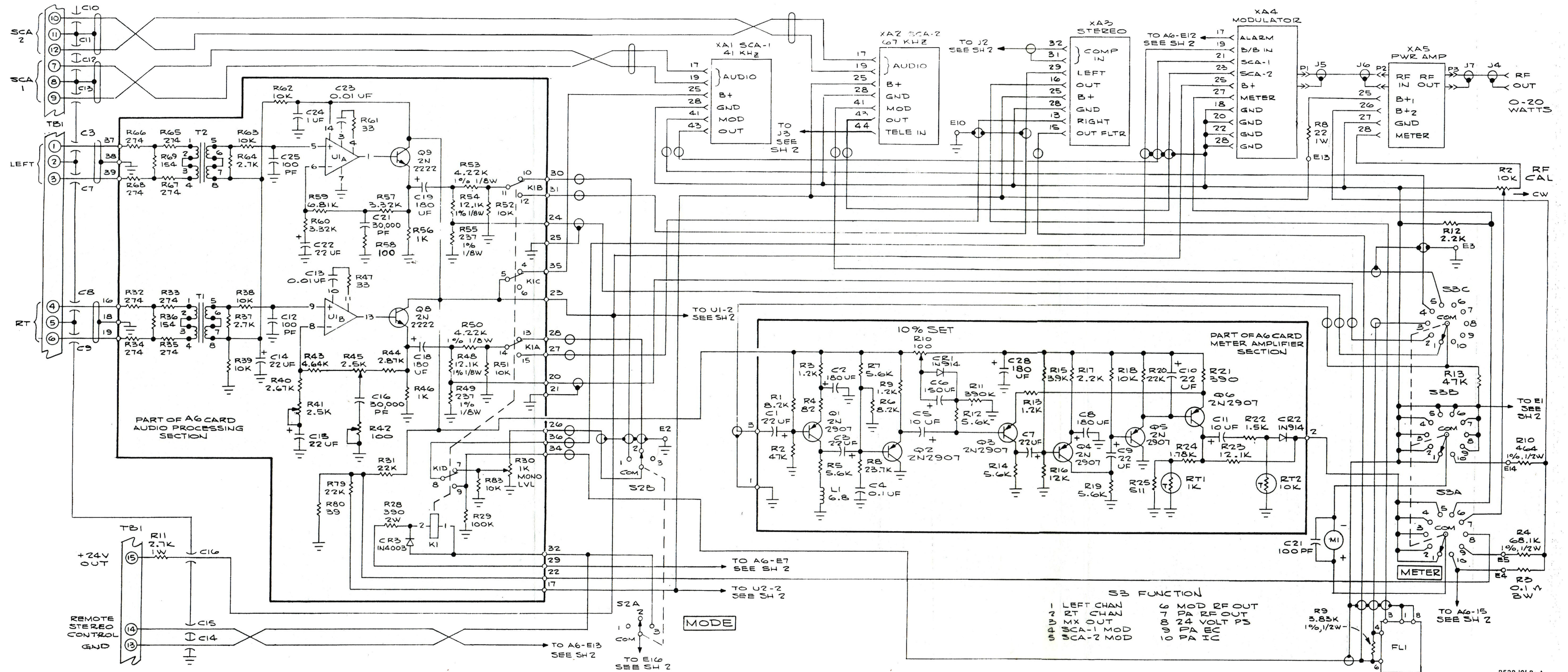
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Figure 7-1. 310Z-2 FM Exciter, Detail Block Diagram.



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Figure 7-2. 310Z-2 FM Exciter Main Frame,
Schematic Diagram (Sheet 2 of 2).



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Figure 7-2. 310Z-2 FM Exciter Main Frame, Schematic Diagram (Sheet 1 of 2).

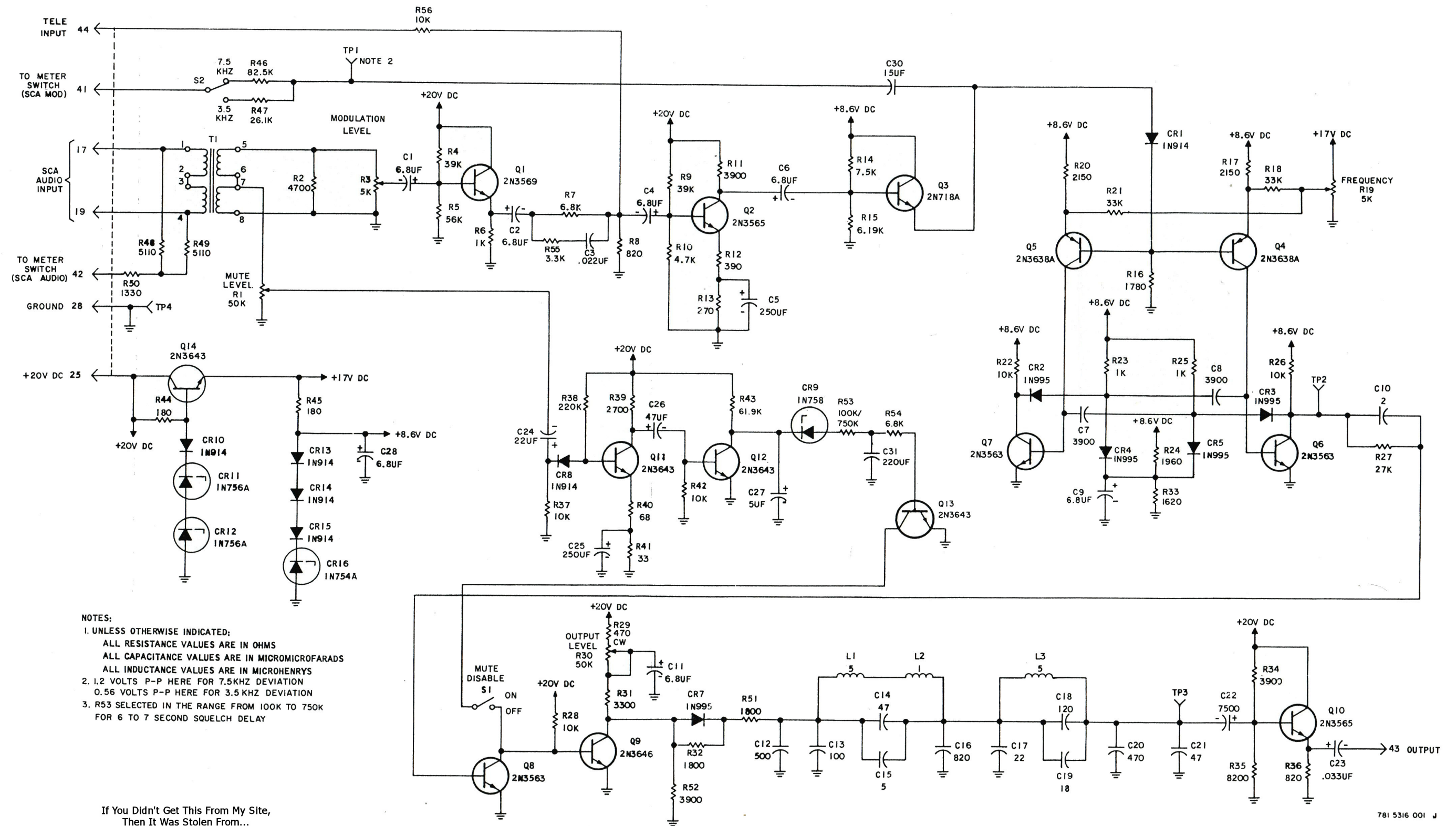
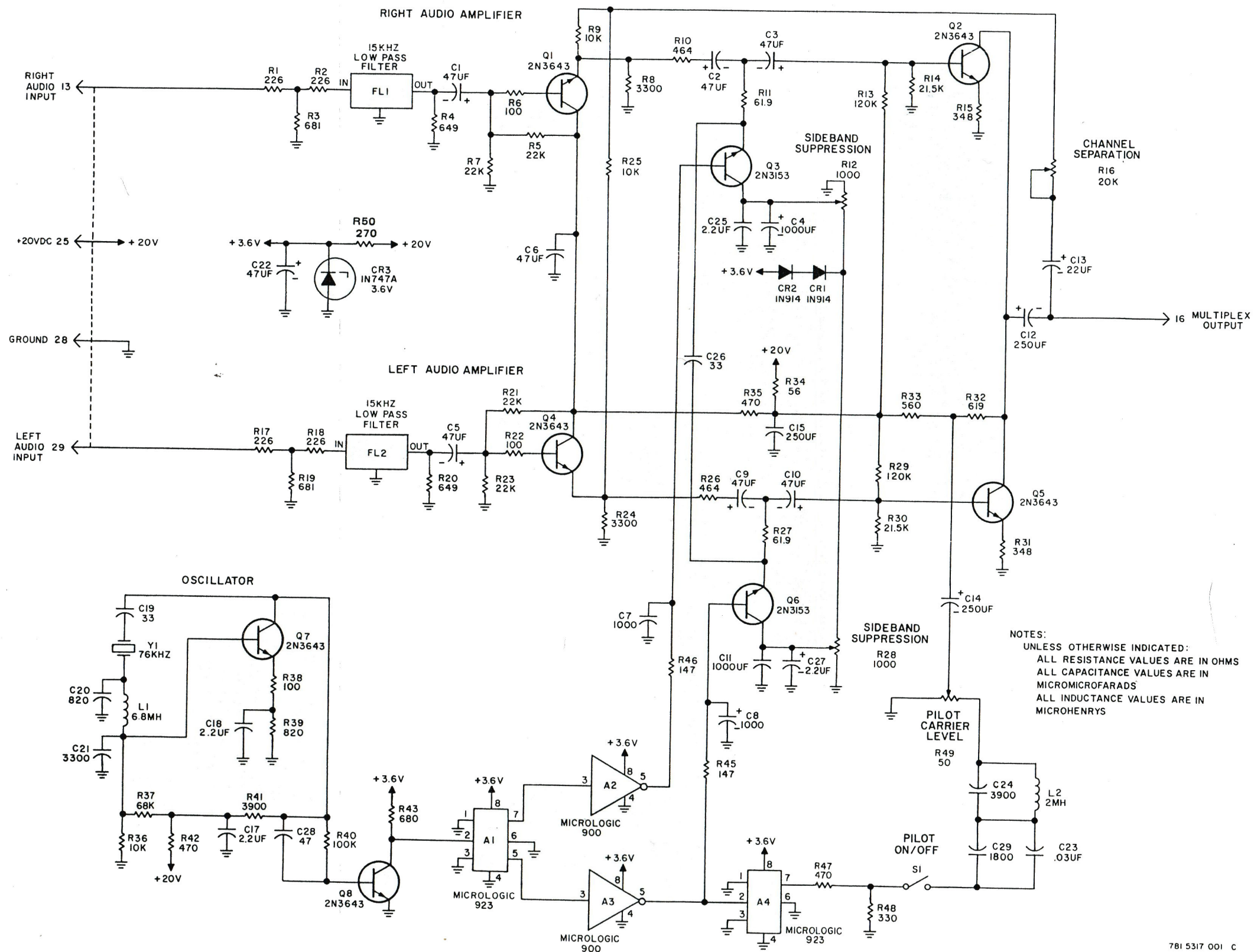
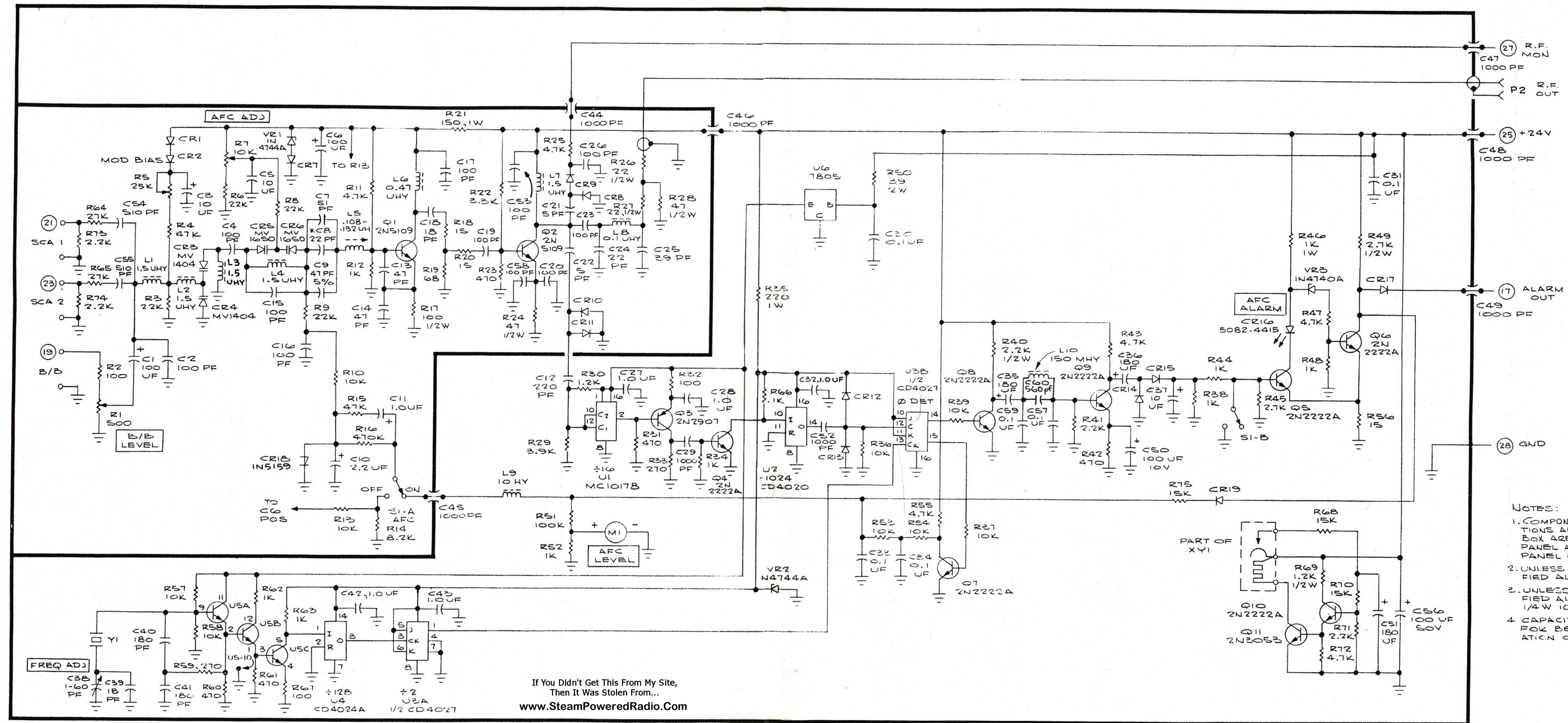


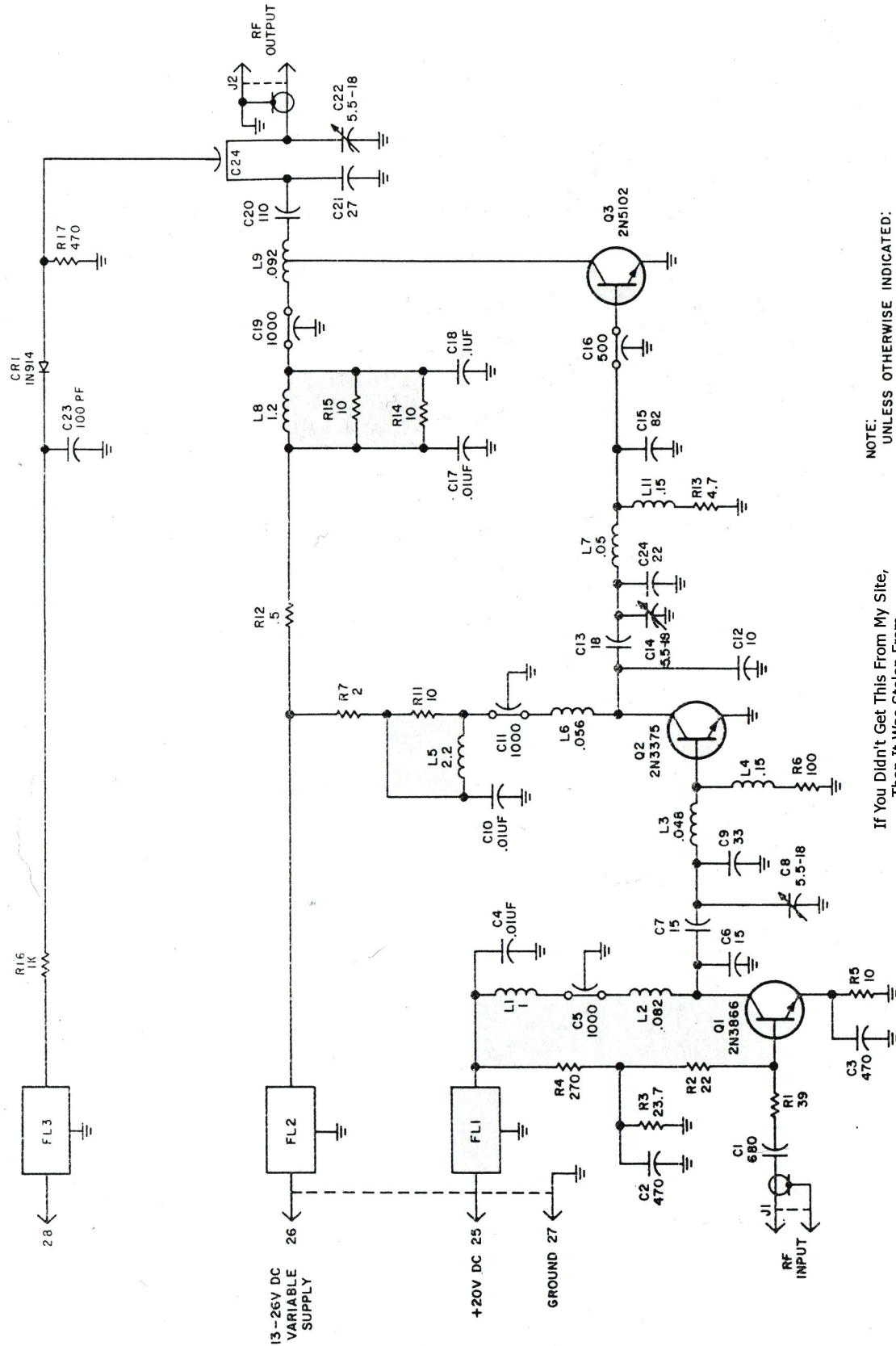
Figure 7-3. 786W-1 SCA Generators A1/A2, Schematic Diagram.



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Figure 7-4. 786V-1 Stereo Generator A3,
 Schematic Diagram.





NOTE:
UNLESS OTHERWISE INDICATED:
ALL RESISTANCE VALUES ARE OHMS
ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
ALL INDUCTANCE VALUES ARE IN MICROHENRYS

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781 5322 001 A

Figure 7-6. RF Amplifier A5, Schematic Diagram.

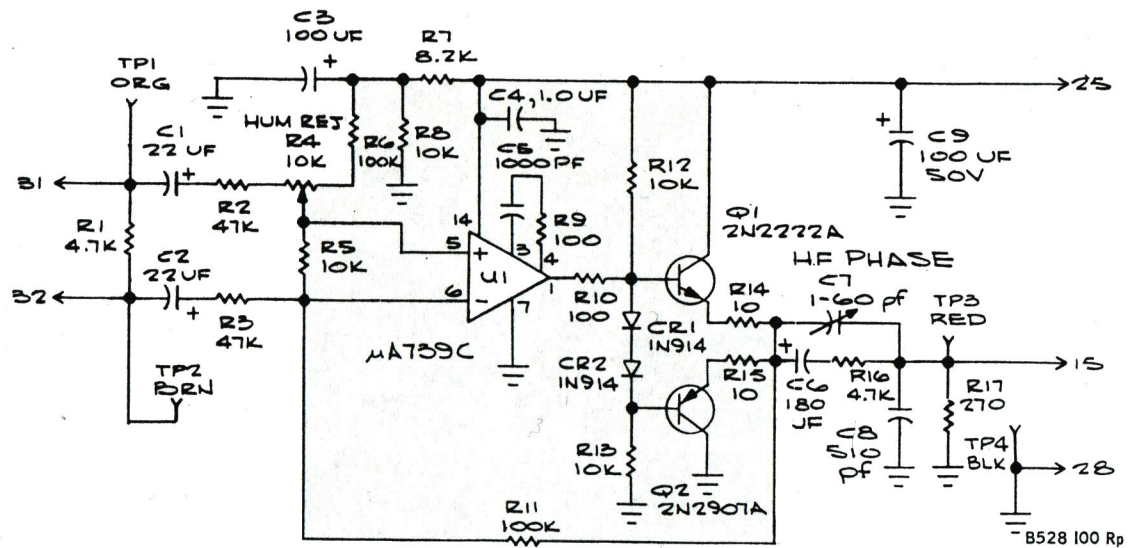


Figure 7-7. 785E-1 STL Interface Card A3, Schematic Diagram.