TO: Gart Bowling LOCATION: 401-021

FROM: Chuck Dixon LOCATION: 401-021

DATE: December 2, 1969

SUBJECT: 310Z-1 FM Exciter Failures

REFERENCE:

This memo summarizes the results of my investigation of four production RF mixer cards from the 310Z-1 FM Exciter.

Card Identification and History:

Card No. 1 - Harry Mims picked this card up from the transmitter test area. It was reputed to be an example of a module having very low output. When received, it contained a crystal for 98.1 MHz output frequency and an untuned low band filter.

Card No. 2 - This card was received from Everett Gilbert and had been in service at radio station KMSC in Clear Lake, Texas. When received, it contained no crystal, but it was tuned for 102.1 MHz. A crystal for this frequency was obtained subsequently from stock.

Card No. 3 - This card was delivered by Gart Bowling after temperature tests had shown severe frequency instability at approximately 45°C. The module was tuned to 98.3 MHz and had been taken from a CRG exciter (WRMF).

Card No. 4 - This card was delivered by Harry Mims after temperature tests had shown possible frequency instability at 55°C. The module was tuned to 102.1 MHz and had been taken from a CRG exciter (KMSC).

Results of Investigation:

Card No. 1 - The filter was tuned, and it was noted that the linear gain of this module was 9.3db lower than the engineering model. It was noted also that the oscillator tuning was touchy and that the frequency favored the low side.

The gain loss was distributed throughout the module and not attributable to a single stage.

The following discrepancies were discovered:

1) Transformers T2 and T3 wound on Q2 cores rather than Q1.

2) Lead lengths too long on transformers T2 through T6.

3) Bad transistor in stage Q1. This transistor was in poor physical condition, showing much soldering and no markings on the case. The exact nature of the failure is unknown at this time, but the symptoms indicate a lower-than-normal gain bandwidth product. It is possible that the transistor type is incorrect.

4) The crystal measured 3.6kHz low on the CI meter and had an abnormally high motional resistance. It is probable that the glass-metal seal has been broken.

After the above discrepancies were corrected, the module showed normal gain and frequency stability. It showed a 40Hz frequency change between +27° C and +60° C with the engineering crystal.

It was noted that the module went into limiting at an output level which was approximately 2db lower than the engineering model. This symptom appeared also in the other production units and is believed to be a result of an abnormally high zener regulator voltage in the engineering model.

Card No. 2 - The only discrepancy discovered in this card was that the oscillator was coupled too tightly to the mixer. An indication of this condition is excessive frequency pulling as the mixer tuning adjustment is made.

The cores from this module were used to repair card no. 1.

Card No. 3 - This module contained an amplifier which became oscillatory at approximately +45° C. The following discrepancies were discovered:

1) The neutralization capacitor, C34, wired incorrectly. It was returned to the collector rather than the base.

2) Toroidal transformers T2 through T6 contained one extra turn on each winding.

3) Transformer T3 wired into circuit incorrectly.

4) High insertion loss in the band pass filter. The reason for this is unknown since the filter was not taken apart.

5) Excessive lead lengths on T2 through T6.

The above discrepancies, except 4), were corrected and temperature tests were run. The frequency shifted 20Hz as the temperature was changed from +30°C to +60°C.

Card No. 4 - The following discrepancies were noted in this module:

1) Both input and output RF connectors extremely loose.

2) Transformer T3 wired into circuit incorrectly.

3) Excessive lead lengths on transformers T2 through T6.

4) High insertion loss in the filter. Two adjustments were inoperative. The screws turned, but the capacitors didn't.

The first three of the above discrepancies were corrected and the module showed 90Hz frequency change between +28°C and +65°C.

Suggestions for Corrective Action

Engineering

1) Develop better test procedure for coupling mixer to oscillator. Revise PTS.

2) Develop better oscillator tuning instructions. Initiate addendum to instruction book.

3) Investigate feasibility of changing ceramic tuning capacitor to glass. Revise drawings as required to control lead lengths on T2 through T6.

Manufacturing

1) Develop procedures for better control of toroid core materials.

2) Develop procedures for obtaining better compliance with the drawings.

3) Do not initiate circuit modifications.

4) Measure frequency and motional resistance of all incoming crystals.

CED:bjb

CC: J. L. Smith

COLLINS 310Z-1 FM EXCITER

FM MODULATOR CARD – A5

(PWR OUT CONTROL CCW)

Q1 –	EMITTER	0.5 VDC 0.0 VRF	BASE	1.1 V DC 0.0 VRF	COLLECTOR	14.2 VDC 0.0 V.RF
Q2 –	"	15.6 V.D.C 0.0 V.R.F	"	14.2 V. DC 0.0 VRF	"	6.6 VDC .55 VRF
Q3 –	"	5.6 V. DC 0.75 VRF	"	5.6 VDC 1.3 VRF	"	0 ⏚ 0 ⏚
Q5 –	"	10.6 VDC 0.0 VRF	"	10.0 VDC 0.06 VRF	"	1.2 V. DC 1.3 V RF
Q4 –	"	6.8 VDC 0.0 VRF	"	5.6 VDC 1.2 V RF	"	1.2 VDC 1.7 V RF
Q6 –	"	5.8 VDC 0.0 V RF	"	9.5 V DC 0.1 V RF	"	16.0 V DC 4.0 V RF
Q7 –	"	6.7 V DC 0.08 V RF	"	7.3 V DC 0.0 V RF	"	15.0 V DC 6.0 V RF
Q8 –	"	8.2 VDC 0.0 V RF	"	7.5 V DC 0.0 V RF	"	0.0 V DC 4.8 V RF

RF MIXER CARD – A6

(PWR OUT CONTROL CCW)

Q1 –	EMITTER	6.0 VDC 0.8 VRF	BASE	6.0 VDC 0.35 VRF	COLLECTOR	0.0 V DC 3.0 V RF
Q4	"	8.7 V DC 0.0 V RF	"	9.5 V DC 0.0 V RF	"	11.3 VDC 0.025 VRF
Q5	"	9.0 VDC 0.0 VRF	"	9.5 VDC 0.01 VRF	"	11.2 VDC 0.5 V RF
Q6	"	⏚	"	1.15 V DC 0.4 V RF	"	8.3 V DC 0.75 V RF
Q7	"	⏚	"	1.15 V DC 0.4 V RF	"	8.3 V DC 0.79 V RF

CRYSTAL (BOTH LEGS) – 1.0 V RF

POWER AMP CARD – A7

(PWR OUT CONTROL ADJUSTED TO MAKE COLLECTOR ON Q3 READ 15.0 VDC)

Q1 –	EMITTER	1.3 VDC	BASE	1.5 VDC 3.4 V RF	COLLECTOR	20.0 V DC 7.4 V RF
Q2 –	"	⏚	"	-1.14 VDC 3.3 V RF	"	15.0 V DC 15.5 V RF
Q3 –	"	⏚	"	-0.375 V DC 2.9 V RF	"	15.0 V DC 12.6 V RF

POWER INPUT AT J1 – 2.8 V RF

POWER OUTPUT AT J2 – 25 V RF

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310Z-1 FM EXCITER

SPARE SEMICONDUCTOR LIST

9-1-69

Quantity Complete Set	Quantity Recommended Set	CPN	Description
2	1	352-0583-010	2N3055
1	1	352-0695-010	2N3740
4	2	352-0322-000	2N708
7	3	352-0743-010	2N4121
2	1	352-0713-030	2N3643
1	1	352-0116-000	2N491
4	2	352-0349-000	2N1613
1	1	352-0773-030	2N4250
1	1	352-0638-010	2N3565
1	1	352-0373-000	S4639
1	1	352-0848-020	2N4258
2	1	352-0756-010	2N4416
4	2	352-0630-010	2N3563
1	1	352-0671-010	2N3866
1	1	352-0611-010	2N3375
1	1	352-0747-010	2N5102
3	2	352-0629-030	2N3569
5	2	352-0695-040	2N4235
4	2	353-1721-000	1N1200
4	2	353-3593-010	FA2311U
10	4	353-2018-000	1N270
3	2	353-2857-000	1N626
3	2	353-3271-000	FA4000
1	1	353-2734-000	1N718
1	1	353-2710-000	1N751A

Quantity Complete Set	Quantity Recommended Set	CPN	Description
1	1	353-3304-000	SV3173
1	1	353-3123-000	1N3018B
1	1	353-3057-000	1N3027B
5	2	353-2607-000	1N645
3	2	353-2724-000	1N758A
2	1	353-2712-000	1N752A
2	1	353-3125-000	1N3020B
1	1	353-2718-000	1N755A

Complete Set of Semiconductor Spares	$177.00
Recommended Set of Semiconductor Spares	$121.00

Spare Semiconductor List
For the 786W-1 SCA Generator

9-1-69

QUANTITY COMPLETE SET	QUANTITY RECOMMENDED SET	P/N	DESCRIPTION
1	1	352-0318-000	2N718A
1	1	352-0629-010	2N3567
1	1	352-0629-030	2N3569
3	2	352-0630-010	2N3563
2	1	352-0636-020	2N3638A
2	1	352-0638-010	2N3565
1	1	352-0680-010	2N3646
3	2	352-0713-020	2N3643
5	2	353-2042-000	1N995
1	1	353-2712-000	1N752
1	1	353-2715-000	1N754
2	1	353-2719-000	1N756
1	1	353-2723-000	1N758
6	3	353-2906-000	1N914

Complete Set Semiconductor Spares $9.45

Recommended Set Semiconductor Spares $6.65

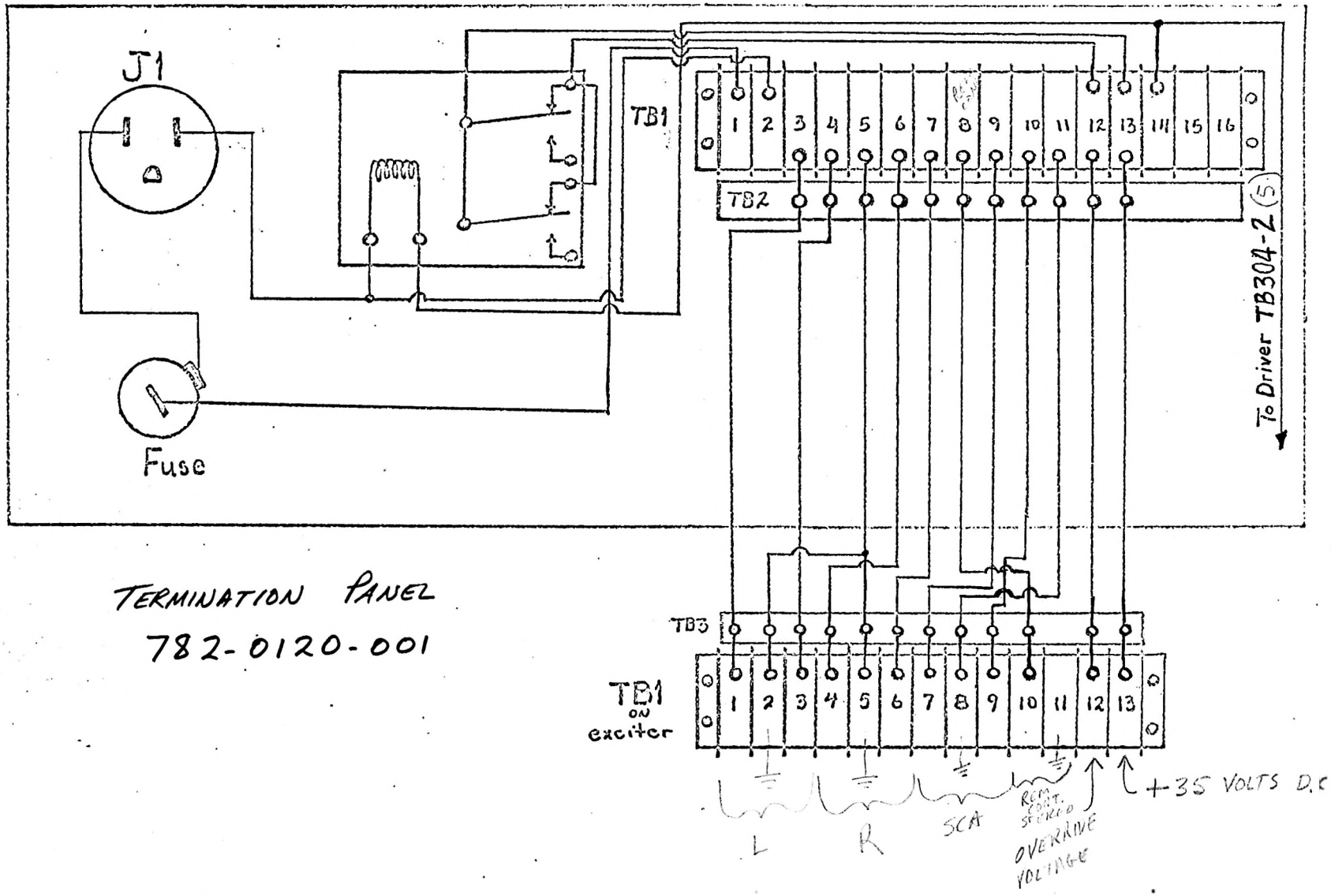
Spare Semiconductor List
For the 786V-1 Stereo Generator

9-1-69

Quantity Complete Set	Quantity Recommended Set	P/N	Description
2	1	351-7121-010	UL923
2	1	351-7121-030	UL900
6	3	352-0713-020	2N3643
2	1	352-0776-010	2N3153
1	1	353-2702-000	1N747A
2	1	353-2906-000	1N914

Complete Set Semiconductor Spares $30.40

Recommended Set Semiconductor Spares $15.35



TERMINATION PANEL

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glossary

Crosstalk - An undesired signal occurring in the main channel (or stereo subchannel) caused by an electrical signal in the stereo subchannel (or main channel).

FM stereophonic broadcast - The transmission of a stereophonic program by a single FM broadcast station utilizing the main channel and a stereophonic subchannel.

Left (or right) signal - The electrical output of a microphone or combination of microphones placed so as to convey the intensity, time, and location of sounds originating from areas predominately to the listener's left (or right) of the center of the performing area.

Left (or right) stereophonic channel - The left (or right) signal as electrically reproduced in the reception of FM stereophonic broadcasts.

Main channel - The band of frequencies from 50 to 15,000 Hz which frequency modulate the main carrier.

Pilot carrier - A subcarrier serving as a control signal for use in the reception of FM stereophonic broadcasts.

Stereophonic separation - The radio of the electrical signal caused in the right (or left) stereophonic channel to the electrical signal caused in the left (or right) stereophonic channel by the transmission of only a right (or left) signal.

Stereophonic subchannel - The band of frequencies from 23 to 53 kHz containing the suppressed stereophonic subcarrier and its associated AM sidebands.

100-percent modulation - 75-kHz deviation of the main carrier.

SCA - Subsidiary Communication Authorization. The authorization to transmit background music that is multiplexed on FM broadcast.

Multiplex - The simultaneous transmission of two or more programs or signals over a single rf channel.

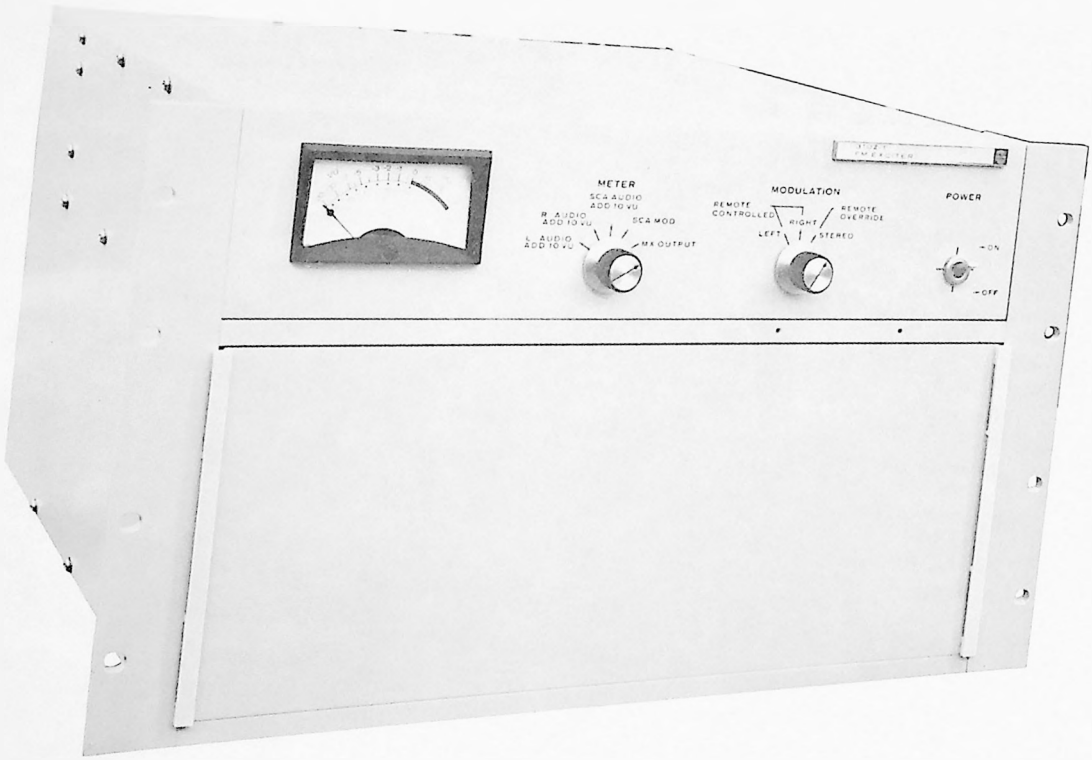


Figure 1-1. 310Z-1 FM Broadcast Exciter.

section 1
general description

1.1 INTRODUCTION

The 310Z-1 is an FM broadcast exciter (figure 1-1) that provides a frequency-modulated signal in the 88- to 108-MHz range (exact frequency as specified by the customer) for further amplification or direct transmission. It is a solid-state exciter which can be manually adjusted to provide a minimum output of 10 watts and a maximum output of 20 watts. The 310Z-1 exciter is prewired to accept two optional plug-in modules which perform stereo generation and SCA generation so that the 310Z-1 can perform any or all of the functions required of an FM broadcast exciter. The optional 786W-1 SCA Generator enables background music to be transmitted at 67 kHz multiplexed on an FM broadcast. The optional 786V-1 Stereo Generator allows broadcasting compatible time division multiplex stereo.

1.2 PHYSICAL DESCRIPTION

The 310Z-1 exciter is 19 inches wide, 10.5 inches high, and 15 inches deep, weighs approximately 40 pounds, and is designed for mounting in a standard 19-inch equipment rack. Six plug-in circuit cards contain most of the circuitry. Controls, audio filters, and power supply components are mounted on the chassis. A card cage secured to the chassis provides receptacles for the plug-in cards. A removable front panel provides access to the cards. The connector for the rf signal output and the connector 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-1 FM Broadcast Exciter are: an FM modulator, an afc discriminator, an afc synchronous detector, an rf mixer, and a power amplifier. In addition, a stereo generator and an SCA generator are optional units which may be included as part of the 310Z-1. Each of these major functional units is constructed as a plug-in module, and the 310Z-1 is prewired so that the stereo generator and the SCA generator plug-in modules can be added at any time.

When the 310Z-1 is used only for monaural broadcasts (without the optional SCA generator or stereo generator), the audio input is applied to the baseband amplifier of the FM modulator through the required audio processing circuits. A 14-MHz oscillator is modulated to full deviation by the input. A discriminator detects this FM signal and applies the detected audio as negative feedback to the baseband amplifier to minimize noise and distortion. This FM signal is also applied to the afc discriminator which, in conjunction with the afc synchronous detector, maintains the oscillator output frequency at 14 MHz. The modulation is removed from the error correction voltage by synchronously adding an out-of-phase baseband signal to the discriminator output so that the deviation effects are canceled.

The output frequency selected from the frequency range of 88 to 108 MHz is generated by mixing the 14-MHz output with the output from the 74- to 94-MHz crystal oscillator in the balanced mixer. The balanced mixer output frequency is the sum of the crystal oscillator frequency and the 14-MHz FM signal. This station output frequency signal is filtered and amplified to provide 10 to 20 watts of output power.

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 and shaping networks. These audio signals are multiplexed to provide the baseband signal which is filtered and applied to the FM modulator. When the SCA generator is used, the SCA audio input is amplified and used to frequency modulate a 67-kHz subcarrier oscillator. The FM SCA output is filtered and applied to the FM modulator.

1.4 OPTIONAL EQUIPMENT

Both the 786V-1 Stereo Generator and the 786W-1 SCA Generator are customer options. The exciter

may be purchased without either of these, for monophonic broadcasting.

1.5 TECHNICAL CHARACTERISTICS

The technical characteristics for the 310Z-1 are listed below, and have been divided into four lists: (1) general characteristics which apply to all 310Z-1 exciters, (2) those characteristics which apply to the 310Z-1 when it is used for monaural FM, (3) those characteristics which apply to the 310Z-1 when it is used for stereo FM with the 786V-1 Stereo Generator, and (4) those characteristics which apply to the 310Z-1 when it is used for SCA transmission with the 786W-1 SCA Generator.

1.5.1 General

Ambient Temperature Range:
+15° to +55°C

Ambient Humidity Range:
Up to 95%

Maximum Altitude:
7500 ft

Input Power Requirement:
117 volts ac, ±10%, single-phase, 50/60 Hz

RF Power Output:
10 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 ±1 kHz with ac line voltage of ±15% and temperature range of 0° to +55°C

Harmonic and Spurious Radiation:
Any emission appearing on a frequency removed from the carrier by between 120 and 240 kHz, inclusive is attenuated at least 30 db below the level of the unmodulated carrier

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

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

Type of Modulation:
Direct frequency modulation

Modulating Frequencies:
50 Hz to 75 kHz

FM Noise Level:
65 db below 100% modulation

AM Noise Level:
55 db below carrier level

1.5.2 Monaural FM

Audio Input Impedances:
Monaural (left channel)
600 ohms balanced

SCA
600 ohms balanced

Audio Input Levels:
Monaural
10 ±2 dbm for 100% modulation

SCA
6 to 15 dbm, adjustable from 0% to 10% modulation

Frequency Response:
Standard 75-microsecond preemphasis

Distortion:
Not more than 0.5%

1.5.3 Stereo FM With 786V-1

Audio Input Impedances:
Left Channel
600 ohms balanced

Right Channel
600 ohms balanced

Audio Input Levels:
Left Channel
+10 ±2 dbm for 100% modulation

Right Channel
+10 ±2 dbm for 100% modulation

Frequency Response:
Standard 75-microsecond preemphasis for both right and left channels

Distortion:
1.0% for 50-Hz to 15-kHz audio modulation

Stereophonic Subcarrier and Pilot Carrier Phasing:
When used with 786V-1 Stereo Generator or equivalent, phase difference between the stereophonic subcarrier 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 40 db below either single-channel level

38-kHz Stereo Subcarrier Suppression:
40 db below 90% modulation of the main carrier

Pilot Carrier Frequency:
19 kHz ±2 Hz

Pilot Carrier Level:
Adjustable from 0% to 15% modulation of main carrier

1.5.4 SCA FM With 786W-1

Audio Input Impedance:
600 ohms, balanced

Audio Input Level:
+6 to +15 dbm, adjustable from 0% to 10% modulation

SCA Subcarrier Center Frequency:
67 kHz

SCA Frequency Modulation of Main Carrier:
Adjustable from 10% to 30%

SCA Generator Center Frequency Stability:
Within ±0.5%

Frequency Response:
Standard 75-microsecond preemphasis

FM Noise Level:
Less than -55 db

Distortion:
1.0% for 50 to 15 Hz with 3.5-kHz deviation

1.0% for 50 to 5 Hz with 7.5-kHz deviation

2.0% for 50 Hz to 15 kHz with 7.5-kHz deviation

Crosstalk:
Crosstalk from main channel and stereo subchannel into the SCA channel shall be 40 db below 10% modulation of the main channel

section 2
installation

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, right channel filters FL-3 and FL-4 are not required.

2.3 WIRING

2.3.1 Audio Input Connections

Use only balanced 600-ohm audio inputs to the 310Z-1. 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 2-2.)
b. Stereophonic Inputs - Connect the left channel audio input line to TB1-1 and TB1-3. (See figure 2-2.) 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-1.
c. SCA Inputs - Connect the SCA audio input to TB1-7 and TB1-9. Connect the cable shield to TB1-8. Be sure that the 786W-1 SCA Generator is plugged into the 310Z-1. Set the 786W-1 METER switch to 3.6 kHz or 7.5 kHz, depending on the deviation to be used. Set the 786W-1 MUTE ENABLE switch to ON.

2.3.2 Stereo Remote Control

If stereo remote control is desired, connect the leads from the station remote control switch to TB1-10 and TB1-11 (ground).

2.3.3 RF Output

Connect a coaxial cable from the transmitter rf input to the exciter rf output 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-1 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 voltage should be connected to TB1-12 of the 310Z-1 to protect the exciter output transistors when the exciter is operated without a load. A dc voltage source (+12 to +35 volts) is connected to TB1-12 so that when no plate voltage is present in the transmitter, the dc voltage is applied to the power regulator card; and as a result the exciter output power is reduced to a sale level.

If the override voltage is not available directly from the transmitter with which the exciter is being used, the +35 volts provided at TB1-13 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.

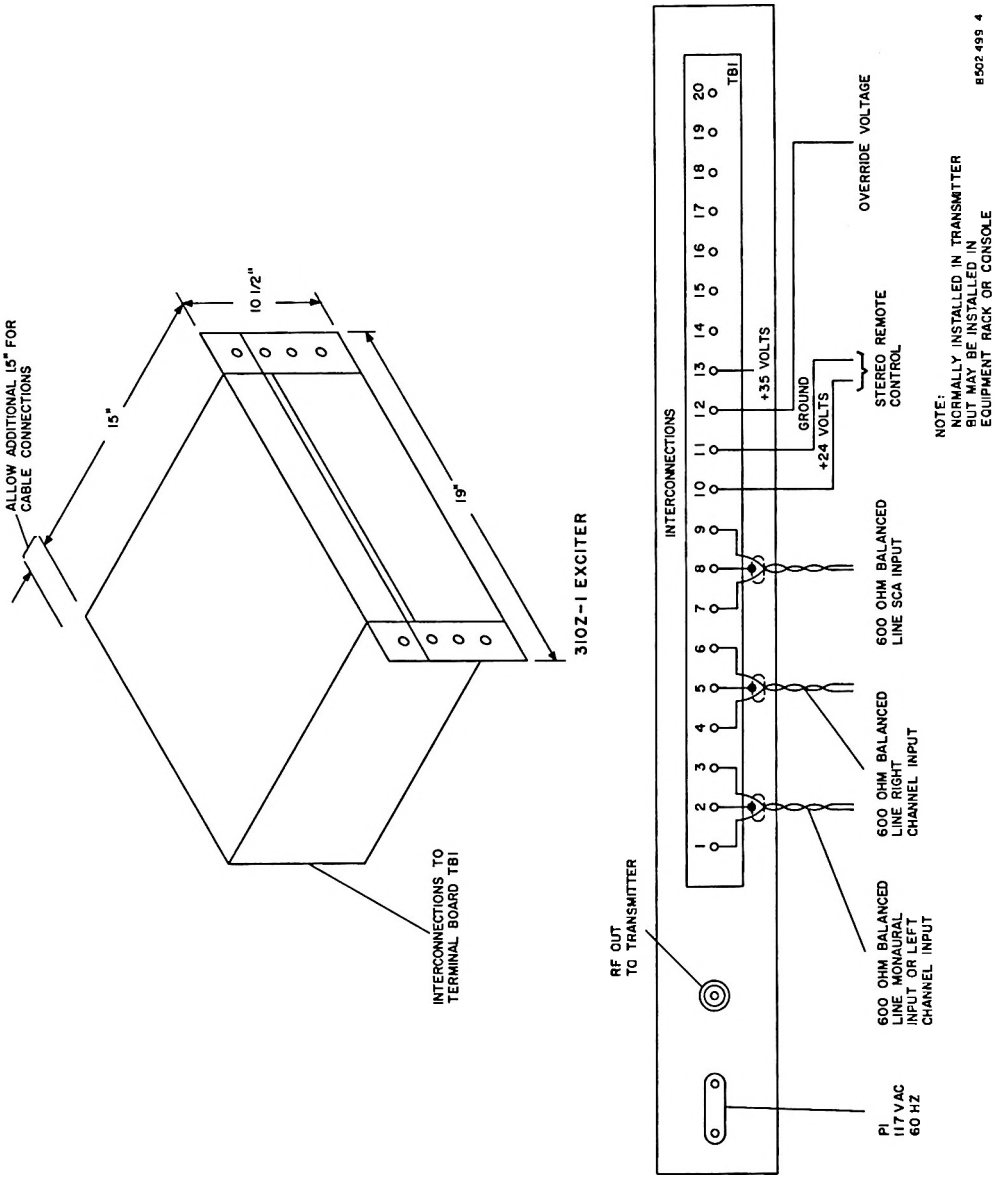


Figure 2-1. 310Z-1 FM Broadcast Exciter, Outline Dimensions and Installation Details.

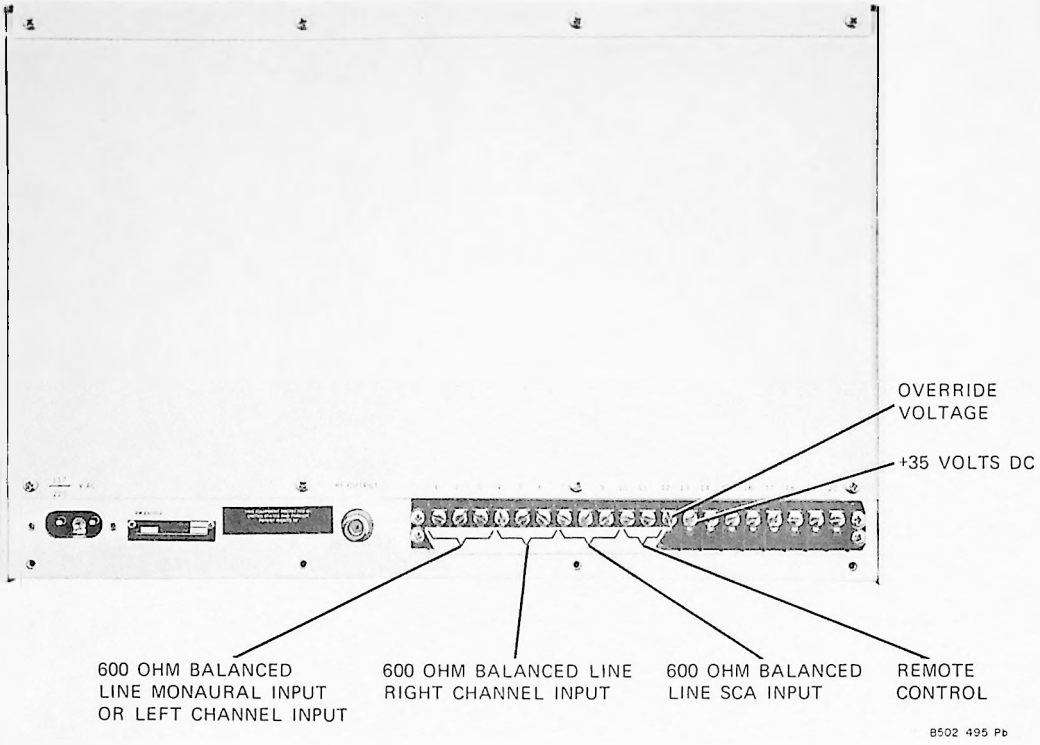


Figure 2-2. 310Z-1 FM Broadcast Exciter, External Connections.

2.4 INITIAL CHECKS

The 310Z-1 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 in the transmitter or other broadcast system, the transmitter should be checked to ensure that it is operating.

2.5 OUTPUT FREQUENCY CHANGE

The output frequency of the 310Z-1 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.

section 3
operation

3.1 GENERAL

Only the three front panel switches and the vu meter on the front panel of the exciter (figure 3-1) are used during normal operation. Refer to table 3-1. After the exciter has been placed in operation, it is necessary only to check meter indications 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 MODULATION switch to LEFT, RIGHT, or STEREO, depending on the type of modulation desired.
c. Make sure that exciter is functioning correctly by placing METER switch in each position and ensuring that the vu meter indicates 0 ±1 vu in each switch position.

Note

If monaural operation is used, the left audio input channel is normally used for the audio input with the MODULATION switch in the LEFT position. To use the left channel for monaural operation, filters FL1 and FL2 must be installed. To use the right audio input, filters FL3 and FL4 must be installed. For stereo operation all four filters must be installed.

3.3 ALTERNATE TURN-ON PROCEDURE

When the 310Z-1 is used in a Collins transmitter having 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/MONAURAL 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 10 and 11 of terminal board TB1. This switch will then control relay K1 so that remote switching can be used as long as the MODULATION switch is in either the LEFT or RIGHT position. The STEREO position overrides the remote stereo OFF position.

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

REFERENCE DESIGNATION (Figure 3-1)	CONTROL OR INDICATOR	FUNCTION
S1	MODULATION	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).
M1/S2	METER	The vu meter, in conjunction with the METER function switch S2, permits monitoring of the various audio inputs and the output from the 310Z-1 exciter. Refer to table 3-2.
S3	POWER	Controls the application of 117 vac to the exciter.

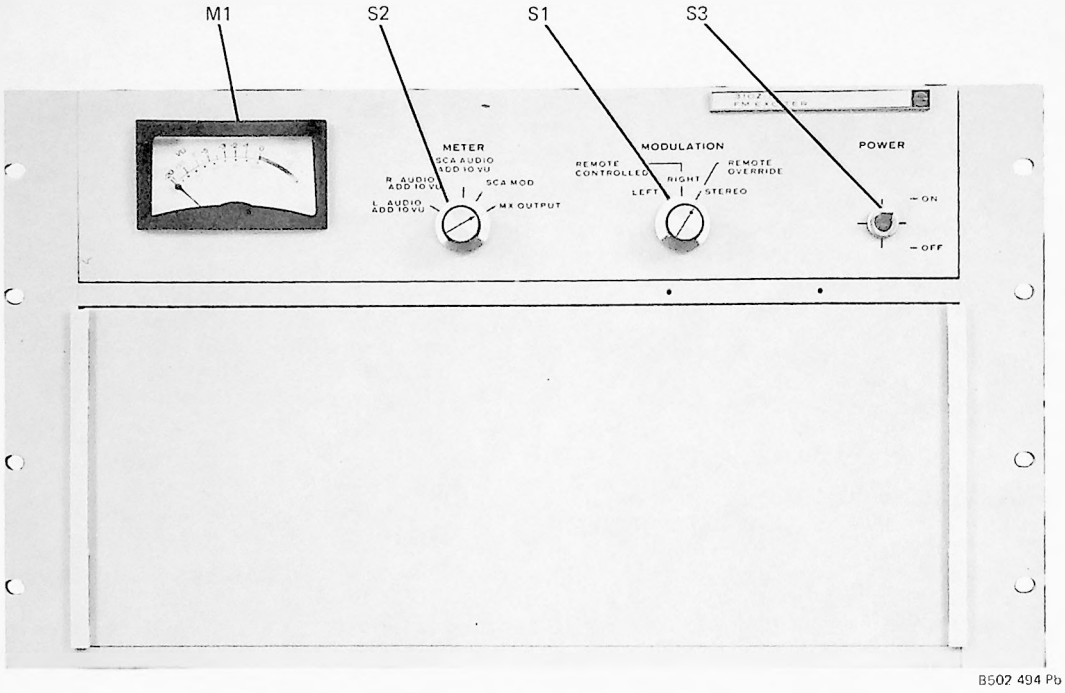


Figure 3-1. 310Z-1 FM Broadcast Exciter, Front Panel Controls and Indicators.

Table 3-2. 310Z-1 FM Broadcast Exciter, Typical Meter Indications.

POSITION OF METER SWITCH S2	FUNCTION	METER INDICATION
L AUDIO ADD 10 VU	Left channel audio input level	-1 to +1 vu
R AUDIO ADD 10 VU	Right channel audio input level	-1 to +1 vu
SCA AUDIO ADD 10 VU	SCA audio input level	-1 to +1 vu
SCA MOD	Amount of deviation of SCA subcarrier	0 ±1 vu. With switch S2 on the 786W-1 SCA Generator card in the 7.5-kHz position, 0-vu indication means that the SCA audio input is causing ±7.5-kHz deviation of the subcarrier. With S2 on the 786W-1 card in the ±3.5-kHz position, 0 vu indicates a 3.5-kHz deviation of the subcarrier.
MX OUTPUT	Level of baseband signal to the FM modulator	-1 to +1 vu

section 4
principles of operation

4.1 GENERAL

The 310Z-1 exciter produces a frequency-modulated output for driving a power amplifier in an FM broadcast transmitter. The 310Z-1 employs the direct method of frequency modulation. The optional 786V-1 Stereo Generator produces signals which 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) and figure 7-1 (detail block diagram) during the following discussion. The major circuits of the 310Z-1 are contained on plug-in modules; and as shown on figure 4-1, these modules are the major blocks of the 310Z-1 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 are used to modulate two 38-kHz subcarrier signals which 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 baseband amplifiers in the modulator and the baseband cancel amplifier in the afc synchronous detector.

The SCA audio input is applied to an audio transformer in the SCA generator, routed through a preemphasis network, amplified, and used to frequency modulate the 67-kHz center frequency 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.

The input to the modulator module is the baseband signal which modulates the 14-MHz carrier. This baseband signal may consist simply of the monaural audio signal or it may be a composite signal consisting of the L + R, L - R, 19-kHz pilot carrier, and the 67-kHz SCA signals, depending on the type of broadcast being employed. A portion of the FM output signal, which is routed to a modulator discriminator circuit from the modulator, applies a negative feedback to the baseband amplifier to reduce noise and distortion. The FM output from the modulator is then applied to the rf mixer.

The center frequency of the modulator oscillator is maintained at 14 MHz by the afc circuits of the afc discriminator and the synchronous detector. The afc discriminator compares the output frequency from the modulator with the output from a 14-MHz reference oscillator and derives an error signal. The afc synchronous detector uses this error signal from the discriminator to develop a voltage that will correct the frequency drift of the 14-MHz oscillator output.

The rf mixer develops the desired output frequency by the heterodyne action, mixing the frequency-modulated 14-MHz signal with the signal from a crystal-controlled oscillator. The sum of 14 MHz and the customer-selected crystal frequency is the FM output frequency (88 to 108 MHz). The output from the rf mixer is applied to the 3-stage rf amplifier which raises the signal to the desired output power level of 10 to 20 watts.

4.3 STEREO GENERATOR

The 786V-1 Stereo Generator performs the conversion of stereophonic input signals to an output which conforms to the standards approved by the FCC for transmission of stereophonic signals. In order 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.

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 comprised 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 ±3°.

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 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 which 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,

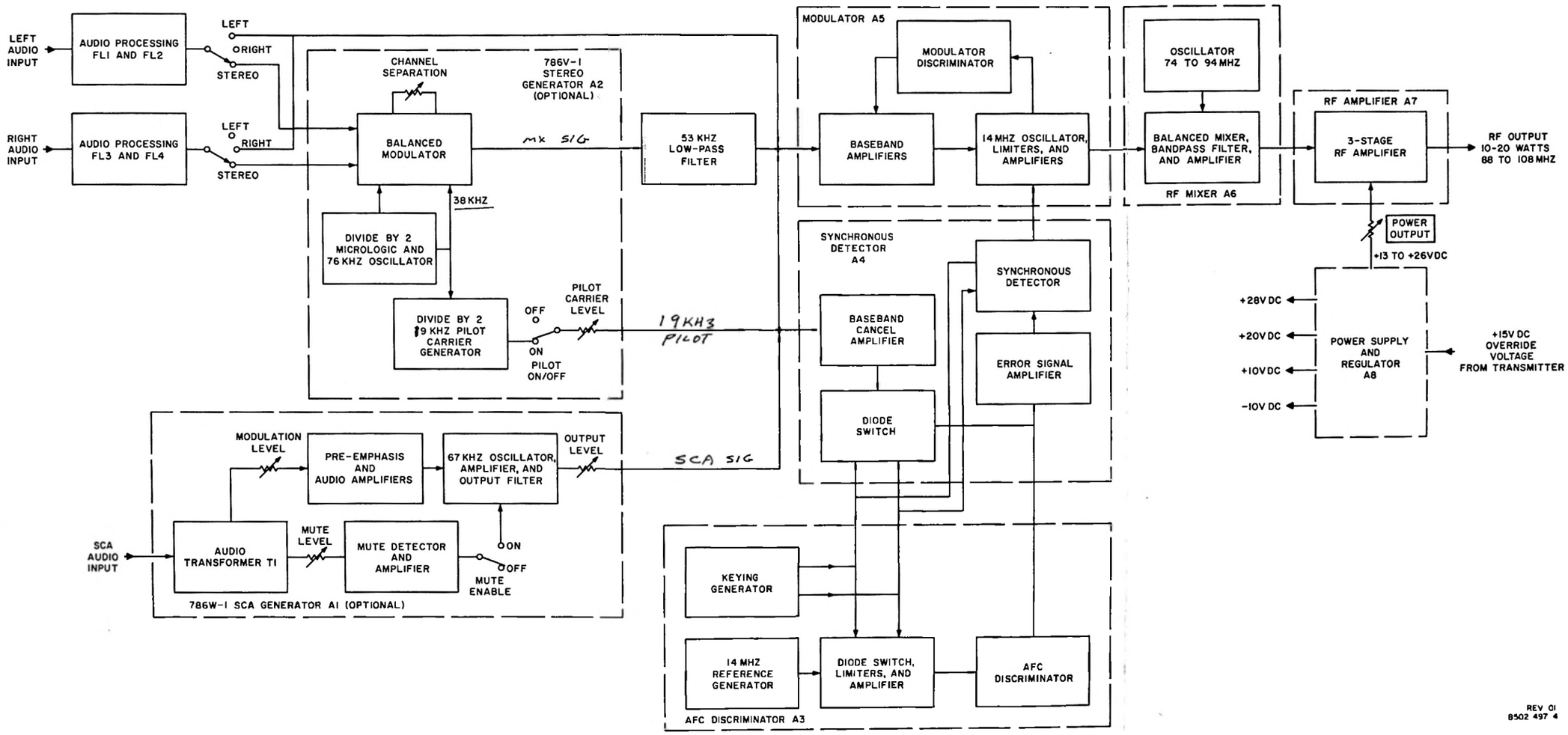


Figure 4-1. 310Z-1 FM Broadcast Exciter, Simplified Block Diagram.

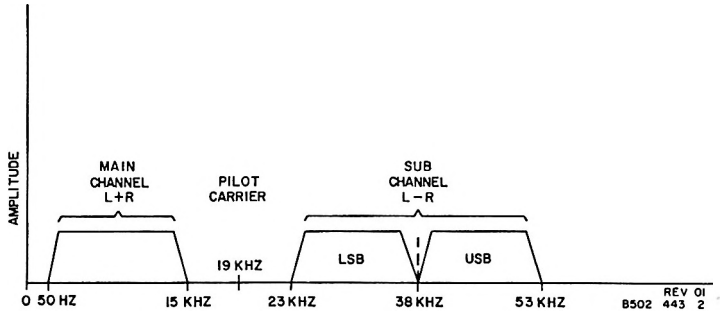


Figure 4-2. Spectrum of Signals in Stereo Baseband Audio.

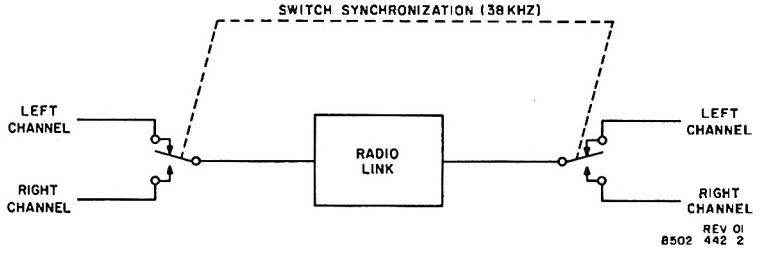


Figure 4-3. Elementary Time-Division Multiplex System.

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 balance 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 $\frac{4}{\pi}$ times the peak amplitude of the square wave itself, the L - R component mentioned above is $\frac{4}{\pi}$ 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 sine-wave input to both audio channels (L - R = 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 $\frac{L+R}{2}$). 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 $\frac{4}{\pi}$ 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.

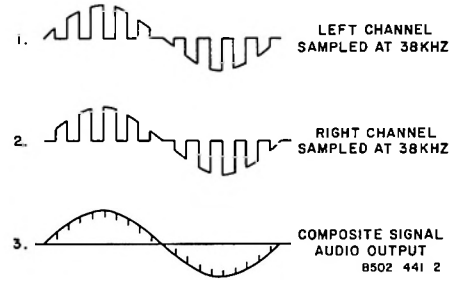


Figure 4-4. Balanced Modulator Output When L + R = 2; L - R = 0.

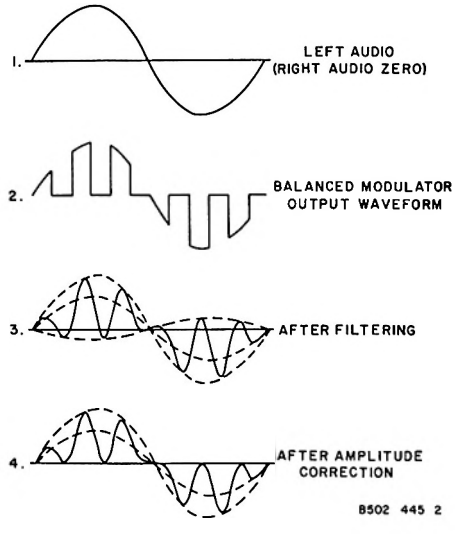


Figure 4-5. Balanced Modulator Output When L + R = 1; L - R = 1.

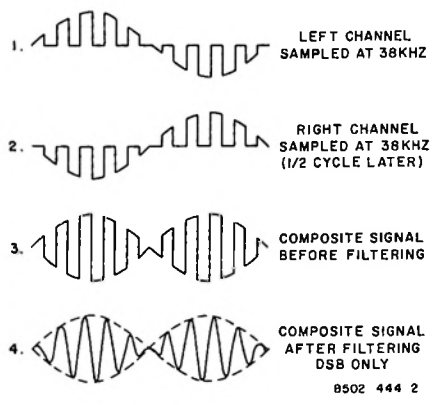


Figure 4-6. Balanced Modulator Output When L + R = 0; L - R = 2.

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 which would be heard if only one microphone is used for input, and it is also the sound which would be heard from a monophonic 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 which 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 $\frac{1}{2}(L + R) + \frac{1}{2}(L - R) = L$ in the left channel, and $\frac{1}{2}(L + R) - \frac{1}{2}(L - R) = R$, 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 which 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 which 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

4.4.1 General

Signals from the SCA generator become part of the audio baseband signal which 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 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 the 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 the 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 which generates the 67-kHz center frequency subcarrier. Deviation of the subcarrier frequency, as adjusted by modulation level control 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 which 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

The FM modulator card of the 310Z-1 exciter uses the direct method of frequency modulation. The modulating signal combines with the audio baseband signal through pin 19 (figure 7-7) and

the SCA signal through pin 23 (if SCA is used). If only stereo is being broadcast, the audio baseband signal may contain frequencies ranging from 50 Hz to approximately 53 kHz. If an SCA signal is included, the baseband frequency range extends upward to approximately 70.5 kHz. Consequently, broadband amplifiers are used throughout the FM modulator circuits.

The audio baseband signal is fed through potentiometer R3, which provides a control for the level of the signal to the modulated oscillator. From R3 the baseband signal is fed through C5 to the input of the oscillator. Voltage-sensitive capacitor C52 has a capacitance which changes with variations of the input signal, thus controlling the frequency of the oscillator and providing frequency deviation of ±75 kHz for 100-percent modulation. The Q3 and associated components comprise the modulated oscillator which develops a center frequency of 14 MHz.

Zener diode CR2 maintains a constant dc potential at the cathode of voltage-sensitive capacitor C52. An afc correction signal is fed through L1, R18, and pin 27 to the anode of C52. If the oscillator center frequency drifts below 14 MHz, the afc circuit develops a positive dc voltage (see paragraph 4.6.2) which is applied to C52, and the oscillator frequency is driven back toward 14 MHz. If the center frequency drifts upward, a negative voltage is applied to C52.

The 14-MHz FM signal from Q3 is fed to the first limiter, Q4. The first and second limiters, Q4 and Q5, clip the signal fed through them, and remove any amplitude modulation. Q6 is a discriminator driver which feeds a signal to the output amplifier, Q7, and to the modulator discriminator circuit.

The purpose of the discriminator on the FM modulator card is to complete an audio feedback loop which suppresses distortion, incidental noise, and transient carrier offset in the FM modulator circuits. The discriminator circuit provides negative feedback with fidelity over the range of frequencies handled. The discriminator demodulates the 14-MHz FM signal and develops an inverted baseband signal which is detected in diodes CR8 and CR9 and fed back to opposite sides of R6, in the input circuit of the first baseband amplifier.

The amplifier output signal from Q7 is filtered and then coupled through J1 to the rf mixer card. The output from Q7 is also coupled to Q8. The output from Q8 is filtered and fed through J2 to the afc discriminator card.

4.6 AUTOMATIC FREQUENCY CONTROL

The automatic frequency control (afc) of the 310Z-1 maintains the center frequency of the modulator oscillator at 14 MHz. The afc discriminator compares the output frequency from the modulator with the output from a 14-MHz crystal-controlled reference oscillator, and derives an error signal that is proportional in magnitude and polarity to the magnitude and direction of the difference in frequency of these two signals. The afc synchronous detector develops from the error signal a correction voltage that is used to correct the modulator oscillator. The afc discriminator uses a 5-Hz square-wave switching signal, generated by a keying generator-multivibrator circuit, to compare the two signals. This switching signal causes the discriminator to sample first one frequency and then the other. The afc circuits correct for frequency drift of the modulator oscillator and maintain stability of the center frequency of the exciter output within ±1 kHz.

4.6.1 AFC Discriminator Card

A 14-MHz crystal, Y1 (figure 7-5), controls the output frequency of the reference oscillator comprised of transistor Q4 and associated circuits. Capacitor C24 couples the output of Q4 to potentiometer R21 (REF LEVEL), which controls the 14-MHz reference signal level. From R21 the reference signal is coupled through C21 and is sampled on alternate half-cycles of the 5-Hz signal from the keying generator-multivibrator circuit. Diode CR7 is a gate for the 14-MHz reference signal. Contact J1 is the input for the 14-MHz FM signal from the FM modulator card. This signal is coupled through C27 and is sampled on alternate half-cycles (180° phase difference from the sampled 14-MHz reference signal) of the 5 Hz from the multivibrator circuit. Diode CR8 is the gate for this output. Transistors Q7, Q6, Q5, and associated circuits comprise the keying generator-multivibrator circuit which generates two 5-Hz square-wave signals equal in amplitude but opposite in phase. The signal from one multivibrator output is coupled through R27 and R26, combined with the signal from the FM modulator card, and applied to CR8. The signal in the other multivibrator output is coupled through a similar circuit, combined with the signal from the reference oscillator, and fed to CR7.

Diodes CR7 and CR8 are a gating switch which is controlled by the 5-Hz square-wave signals. During one half-cycle of the square wave, the signal from the oscillator is coupled through CR7 and C18 and to the first limiter, Q3. During the next half-cycle of the square wave, the signal from the FM modulator card is coupled through CR8 and C18 and to Q3. The first and second limiters, Q3 and Q2, clip the signal and remove any amplitude variations. The output of Q2 is a signal which for 1/10 second (one half-cycle of the 5-Hz square wave) represents the frequency of the reference oscillator, and for the next 1/10 second represents the frequency of the FM oscillator output. The output of Q2 is coupled through C11 to the discriminator driver, transistor Q1. The output of Q1, through transformer T2, drives a conventional discriminator, comprised of T1, CR1, CR2, and associated circuits. Capacitors C6 and C4 are variable to allow tuning of the discriminator transformer primary and secondary windings. Provided the signal from the FM modulator carries no frequency modulation, the output of the discriminator at connector pin 8 is a 5-Hz square wave proportional in amplitude to the frequency drift, or error, of the FM modulator. The polarity of the square wave depends on the direction of drift, or error.

When the FM modulator is modulated by a baseband audio signal, the baseband audio signal is fed around the discriminator to a baseband cancellation circuit on the afc synchronous detector card, and added in opposite phase to the detector output. This action assures that the output of the discriminator at pin 9 is a true difference signal related to the modulator center frequency, when the FM modulator is modulated by a baseband audio signal. This circuit will be identified and discussed with the afc synchronous detector (paragraph 4.6.2).

A signal from one multivibrator output is coupled through pin 21, and a signal from the other output through pin 23. These signals key the circuits of the afc synchronous detector, and synchronize the detector with the afc discriminator.

4.6.2 AFC Synchronous Detector

The signal through connector pin 26 (figure 7-6) is the output of the afc discriminator discussed above, and is coupled to the error signal amplifiers, which consist of three stages, Q1, Q2, and Q3. The output of the discriminator is a 5-Hz square-wave error signal with amplitude proportional to the magnitude of the frequency error, and with a polarity dependent upon the direction of error.

From Q3 the amplified error signal is coupled to phase splitter Q4. Capacitor C9 couples one square-wave error signal from the collector of Q4 to CR2. Capacitor C8 couples an equal signal of opposite phase from the emitter of Q4 to CR3. Both CR2 and CR3 are synchronous bridge detectors with nearly similar functions, but the internal diode elements of CR2 are connected in opposite polarity to those of CR3. Two other signals are connected through pins 29 and 30, each to an opposite side of both CR2 and CR3. These two signals are outputs of the discriminator multivibrator, and are 5-Hz square waves of equal amplitude and opposite polarity. One of these signals is always the same polarity as one output of Q4; the other signal is the polarity of the opposite output of Q4. The polarity of the error signal determines which multivibrator signal is in step with a given output of Q4. Because the signals from the multivibrator are equal and opposite, they cancel in the detector circuit (do not appear in the output) but function as keying signals for CR2 and CR3.

Diode CR2 conducts on one half-cycle of its input signal and produces a pulsating dc output. CR3 does the same thing, but because of the opposite phase of their input signals and the action of the keying signals from the multivibrator, the two detectors conduct during alternating time intervals and produce dc voltages of the same polarity. If no FM modulation effect is present in the error signal, and if the error signal remains constant, then the dc voltage pulses from CR2 and CR3, applied in sequence to the junction of R13 and R10, are equal. These pulses are filtered by R10, R11, C24, C7, and R9 to provide a relatively constant dc output.

As mentioned in the discussion of the discriminator, frequency modulation of the FM modulator output may affect the output of the discriminator, so that this output is not a true reflection of modulator frequency drift. Any such modulation effect is amplified proportionate to the error signal in Q1, Q2, and Q3, and results in an input to Q4 which is largely false.

The baseband cancellation circuit cancels the effect of frequency modulation on the error signal. A baseband audio signal is fed through pin 31 and capacitor C10 to the base of amplifier Q5. It will also be noted that the keying signals from the multivibrator are fed to opposite sides of

CR1, through R40 and R48. Capacitor C16 couples the audio output from Q5 to CR1. CR1 acts as a switch and shunts the audio to ground on alternate half-cycles of the 5-Hz square wave from the multivibrator. During the other half-cycle, capacitor C22 and resistor R47 couple the signal to the base of Q1 where it is subtracted (added as a negative quantity) from the error signal input from the afc discriminator card. This action cancels the effect of the frequency modulation of the error signal. Because frequency modulation affects only that portion of the error signal (one half-cycle) which relates to the output of the FM modulator, the output of CR1 must be subtracted only during this particular half-cycle. These effects are accomplished through interaction of the keying signals from the multivibrator and the keying signal coupled through C22.

When the modulation balance control (R35) is properly adjusted, the combined and filtered output of CR2, CR3, and CR1 provides an accurate dc correction voltage. This signal is coupled through pin 32 to the input of the FM modulator. When the frequency of the modulator drifts, the correction voltage always tends to drive it back toward the frequency of the reference oscillator.

4.7 RF MIXER

The primary function of the rf mixer is to convert the 14-MHz FM signal from the FM modulator to an FM signal having the desired station output frequency (88- to 108-MHz). This is accomplished by heterodyne action, mixing the 14-MHz signal with the output of a crystal-controlled oscillator. The crystal used is selected at the Collins factory for a resonant frequency which equals the desired station output frequency minus 14 MHz. This frequency is between 74 and 94 MHz, and the desired output frequency is produced by heterodyning.

Transistor Q1 (figure 7-8) and associated components comprise the oscillator which is controlled by crystal Y1 to provide the 74- to 94-MHz signal. This signal is fed through transformer T1 to the balanced mixer (Q2 and Q3). The 14-MHz signal from the FM modulator is coupled to the mixer through T2. The mixer output signal (88- to 108-MHz) is routed through transformer T3 to a bandpass filter which shapes the signal and removes unwanted mixer products. From the filter, the signal is amplified in Q4 and Q5 and applied through transformer T5 to a push-pull output amplifier, Q6 and Q7. The output is coupled through transformer T6 to the output jack, J1. At this point, the signal is the frequency-modulated 88- to 108-MHz signal to be routed to the power amplifier card.

4.8 POWER AMPLIFIER

The power amplifier card of the 310Z-1 contains a broadband, solid-state, 3-stage power amplifier. The FM signal from the rf mixer is amplified to provide an rf output power level of 10 to 20 watts.

The first amplifier stage (Q1, figure 7-9) 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 13- 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 CONTROL adjustment mounted under the card cage front panel. The power amplifier output is coupled through J2 to J1 on the exciter main chassis.

4.9 POWER SUPPLY AND REGULATOR

The solid-state power supply and regulator card of the 310Z-1 provides closely regulated dc power at the levels required for operation of the other cards and modules of the exciter. These levels include -10 volts, +10 volts, +20 volts, +28 volts, and a variable +13- to +26-volt supply. The level of the variable supply at pin 9 (figure 7-10) is controlled by power control potentiometer R15, which is located under the card cage front panel, and which in turn controls the rf output power level of the power amplifier card.

Exciter components may be damaged if the exciter is operated with no load or if it is operated into a vswr greater than 2:1. To avoid the danger of such operation, an output control override is provided. This positive voltage (+15 to +35 volts dc) is connected, through a relay circuit controlled by the transmitter. This override voltage is applied to pin 7, breaks down zener diode CR18, lowers the voltage at the base of Q5, and stops all current flow except leakage current through Q3, Q2, and Q1. A +15 volts applied to pin 7 effectively lowers the output voltage at pin 9 to less than 1 volt.

section 5
maintenance

5.1 GENERAL

The 310Z-1 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-1 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-1 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-1 this routine maintenance should consist only of cleaning and inspecting, and should occasionally include a check of the minimum performance standards for the 310Z-1 in accordance with paragraph 5.7.

Caution

The 310Z-1 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-1 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

Perchlorethylene, 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.

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 vtvm	Hewlett-Packard 400L
Vtvm	Hewlett-Packard 410B
Radio Receiver	Collins 51S-1
Wattmeter	Sierra 164B with 181A/250 plug-in element
Stereo test circuit	Fabricated per figure 5-3
Low-distortion af signal generator	Hewlett-Packard 206A
Oscilloscope	Tektronix 581A
Vertical amplifier	Tektronix type 81
Rf voltmeter	Boonton 91-C
Crosstalk test circuit	Fabricated per figure 5-7
FM frequency monitor	Collins 54N-1
SCA monitor	Collins 900F-1
Wave analyzer	Hewlett-Packard 302A

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.
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-1 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-1 that are referenced in the following procedures are shown on figure 5-1 and their function is described in table 5-2.

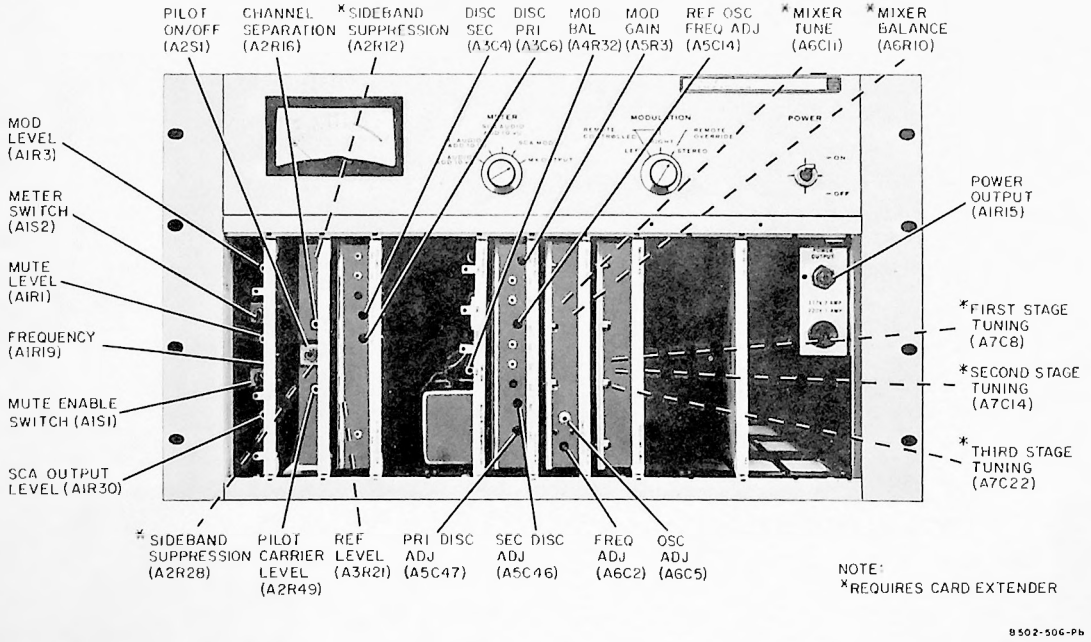


Figure 5-1. 310Z-1 FM Broadcast Exciter, Maintenance Controls and Adjustments.

Table 5-2. Maintenance Controls.

CONTROL	FUNCTION
Power output R15	Controls the amount of collector voltage applied the rf output transistors.
786W-1 SCA Generator card A1	
S1 - MUTE ENABLE switch	ON position enables mute circuit to remove the 67-kHz SCA oscillator output when there is no SCA audio input. OFF position disables mute circuit for maintenance.
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.
Afc discriminator card A3	
R21 - reference level	Sets the level of the 14-MHz crystal oscillator input to the first limiter.
C6 - DISC PRI	Tunes the primary of the discriminator transformer.
C4 - DISC SEC	Tunes the secondary of the discriminator transformer.
Afc synchronous detector card A4	
R35 - MOD BAL	Sets the output level of the baseband canceling amplifier.
FM modulator card A5	
R3 - MOD GAIN	Sets the baseband input level into the FM modulator.
R12	Sets the base bias on transistor Q1.
C14	Sets the center frequency of the 14-MHz frequency modulator oscillator.
C47	Tunes the primary of the modulator discriminator transformer.
C46	Tunes the secondary of the modulator discriminator transformer.
Rf mixer A6	
C2 - trimmer capacitor	Adjusts oscillator frequency.
C5 - collector tuning	Tunes collector load to oscillator frequency.
C11 - mixer tune	Tunes input to mixer circuit.
R10 - mixer balance	Sets Q2 gate current equal to Q3 gate current.
Power amplifier card A7	
C8	Tunes the collector of Q1.
C14	Tunes the collector of Q2.
C22	Tunes the collector of Q3.
Power supply regulator A8	
R27	Sets output level of +20-vdc regulator.
S2 - 7.5-kHz/3.5-kHz SCA deviation switch	7.5-kHz position causes vu meter to indicate 0 vu in SCA MOD position when SCA subcarrier deviation is 7.5 kHz. 3.5-kHz position causes vu meter to indicate 0 vu in SCA MOD position when SCA subcarrier deviation is 3.5 kHz.

Table 5-2. Maintenance Controls (Cont).

CONTROL	FUNCTION
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.
786V-1 Stereo Generator card A2	
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 multiply output to give proper levels for good stereo channel generation.

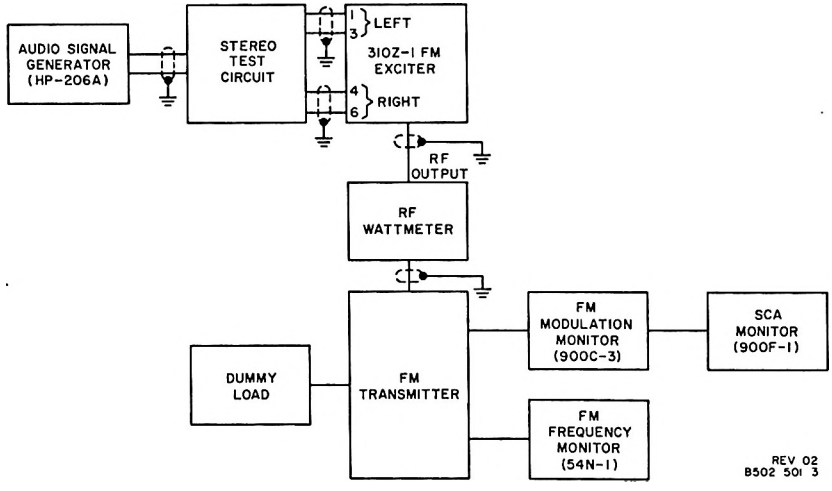


Figure 5-2. Test Equipment Connections to 310Z-1 for Adjustment and Test Procedures.

Caution

Do not attempt to make any adjustment to the 310Z-1 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 top cover, and connect equipment as shown in figures 5-2 and 5-3.

b. Locate capacitor C4 (see figure 6-1, sheet 3) and connect a vtvm across it (20-volt dc mid-scale range).

c. Place POWER switch to ON, and adjust A8R27 until vtvm indicates +20 ±1 volts.

d. Place POWER switch to OFF, and remove power amplifier card.

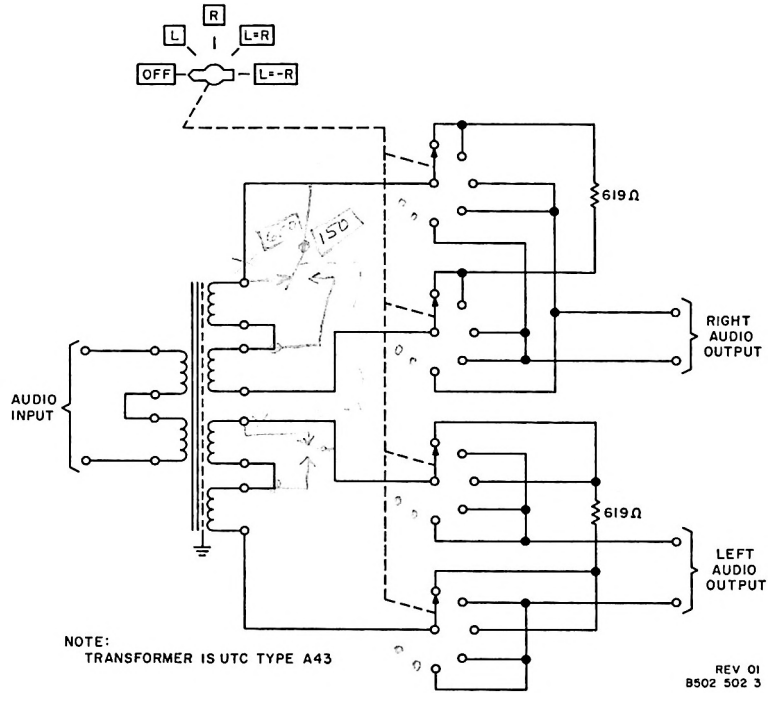


Figure 5-3. Stereo Test Circuit, Schematic Diagram.

e. Connect vtvm across capacitor C3 and place POWER switch to ON.
f. Vtvm indication should be between +13 and +26 volts dc.
g. Mark position of POWER OUTPUT adjustment (R15), and then turn it fully clockwise. Vtvm should indicate +24 to +27 volts dc.
h. Turn POWER OUTPUT adjustment fully counterclockwise and ensure that vtvm indicates +10 to +13 volts dc.
i. Connect vtvm between A8-14 and ground, and ensure that vtvm indicates +10 volts dc.
j. Connect vtvm between A8-18 and ground, and ensure that vtvm indicates -10 volts dc.
k. Return POWER OUTPUT adjustment to its original position, place POWER switch to OFF, and remove vtvm.
l. Replace top cover and power amplifier card.

5.6.2 Oscillator Alignment (FM Modulator)

a. Connect the equipment as shown in figure 5-2 and 5-3.
b. Place MUTE ENABLE switch (located on SCA generator card) to ON.
c. Place 19-kHz PILOT CARRIER switch (located on stereo generator card) to OFF. Turn stereo test switch to off.
d. Connect a jumper between A4TP3 and A4TP4 on synchronous detector card.
e. Connect a receiver (Collins 51S or equivalent) to a short antenna placed near A5Q3 at the back of FM modulator card.
f. Tune receiver to exactly 14.0 MHz.
g. Place POWER switch to ON, and adjust A5C14 for 14.0 MHz.

5.6.3 Discriminator Alignment (FM Modulator)

a. With equipment still connected as shown in figure 5-2, connect vtvm to test point A5TP2.
b. Adjust A5C47 for a maximum indication on vtvm.
c. Connect vtvm (0.1-volt dc range) to test point A5TP3, and ensure that level at A5TP3 can be varied from a positive level to a negative level by adjusting A5C46.
d. Adjust A5C46 until vtvm indicates 0 ±0.1 volt dc.

e. Connect vtvm (15-volt dc range) to test point A5TP1 and adjust A5R12 for +7.5 volts dc.
f. Remove the jumper from A4TP3 and A4TP4 on synchronous detector card.
g. Place MUTE ENABLE switch to ON.

5.6.4 Discriminator Alignment (AFC Discriminator)

a. Connect equipment as shown in figure 5-2.
b. Remove afc discriminator card from card cage, install extender card, and install afc discriminator card on card extender.
c. Remove cover from afc discriminator card and disconnect one end of resistor A3R32.
d. Connect oscilloscope to A3TP4.
e. Place POWER switch to ON and adjust A3R21 for a maximum level.
f. Connect vtvm to A3TP1 and adjust A3C6 for a maximum indication on vtvm.
g. Connect vtvm to A3TP2 and ensure that level at A3TP2 can be varied from a positive level to a negative level by adjusting A3C4.
h. Adjust A3C4 for a 0 ±0.1-volt dc indication on vtvm.
i. Reconnect resistor A3R32.

5.6.5 Reference Oscillator Level Adjustment (AFC Discriminator)

a. Connect oscilloscope to A3TP4 with external trigger lead connected to the collector of A3Q5.
b. Place POWER switch to ON, and adjust A3R21 until equal amplitudes of alternate signals are obtained as shown in figure 5-4.

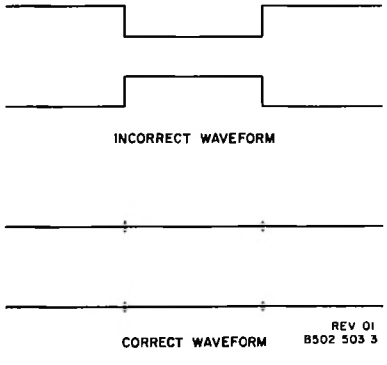


Figure 5-4. Reference Oscillator Waveform.

c. Place POWER switch to OFF, remove extender card, and replace afc discriminator card in card cage.

5.6.6 Oscillator Tuning (RF Mixer)

a. Connect equipment as shown in figure 5-2.
b. Place rf mixer card on extender card and remove cover from rf mixer.
c. Place POWER switch to ON, and touch probe of rf voltmeter to primary of transformer A6T1 (approximately 1/2 inch above ground).
d. Adjust A6C5 for a maximum indication on rf voltmeter.
e. Adjust A6C2 until correct station frequency is indicated on frequency monitor (Collins 54N-1 or equivalent).

Note

If oscillator cannot be adjusted on frequency by A6C2, also adjust A6C5.

5.6.7 Mixer Tuning (RF Mixer)

a. Ensure that power amplifier card is installed.
b. Replace cover on rf mixer card, and connect rf voltmeter to rf mixer output A6J1.
c. Adjust A6C11 for maximum output.

5.6.8 RF Mixer Balance

a. Connect audio oscilloscope (HP130C or equivalent) to FM modulator monitor (Collins 900C-3) WIDEBAND output.
b. Increase sensitivity of oscilloscope until 100-kHz signal can be observed.
c. Adjust MIXER BALANCE control A7R11 for a minimum 100-kHz signal on oscilloscope.

5.6.9 RF Modulator Sensitivity

a. Connect vtvm to A5TP5 on FM modulator card.
b. Place MODULATION switch on 310Z-1 to LEFT and stereo test circuit switch to L. (See figure 5-3.)
c. Adjust audio oscillator (HP206A or equivalent) for an output of 400 Hz and 100 ±2 mv rms on vtvm.
d. Turn MODULATION METER switch on FM modulator monitor to MAIN CHAN MOD.
e. Adjust A5R3 to obtain an indication of 100-percent main channel modulation on FM modulator monitor.

5.6.10 Baseband Cancel Amplifier Adjustment (AFC Synchronous Detector)

a. Place afc synchronous detector card on extender card.
b. Set MODULATION switch on 310Z-1 to LEFT and stereo test circuit switch to I.
c. Adjust audio oscillator to a frequency of 50 Hz and 100-percent modulation as indicated on FM modulation monitor.
d. Turn A4R32 on afc synchronous detector card fully counterclockwise.
e. Connect jumper from A4TP3 to A4TP4.
f. Connect oscilloscope (Tektronix 581A or equivalent) to A4TP4, and observe the 50-Hz audio on one half-cycle of 5-Hz signal.
g. Adjust A4R32 slowly clockwise to minimize 50-Hz audio signal.
h. Remove card extender and replace afc synchronous detector card in card cage.

5.6.11 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.

5.6.12 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.

5.6.13 Stereo Generator Adjustment

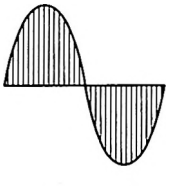
a. Connect equipment as shown in figure 5-2.
b. Set MODULATION switch on 310Z-1 front panel to STERO.
c. Set MODULATION METER switch on FM modulator monitor to TOTAL MOD.
d. Place 19-kHz PILOT CARRIER switch on stereo generator card to OFF.
e. Turn stereo test circuit (figure 5-3) switch to L position (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. Connect oscilloscope (HP130C or equivalent) to A5TP5 on FM modulator card.
h. Adjust channel separation control A2R16 on stereo generator for perfect stereo signal as observed on oscilloscope. (See figure 5-5.)

Note

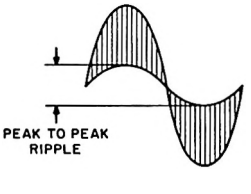
A perfect stereo signal is indicated by a straight baseline with the oscilloscope dc coupled, vertical sensitivity set to 2 mv/cm, and external triggering applied from audio oscillator.

5.7 MINIMUM PERFORMANCE STANDARDS

The 310Z-1 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-1 is operating properly. Table 5-3 lists those tests which are applicable to monaural, stereo, and SCA functions of the 310Z-1. If it is desired to test the 310Z-1 for monaural only, perform only those tests listed in table 5-3 for monaural, etc.



PERFECT SIGNAL



IMPERFECT SIGNAL
REV 01
8502 500 3

Figure 5-5. Stereo Waveforms.

Table 5-3. Tests Applicable to Broadcast Mode.

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	Frequency stability
5.7.3	5.7.3	5.7.3	Output power
5.7.4	5.7.4	5.7.4	Afc loop test
	5.7.5		Remote control
5.7.6	5.7.6	5.7.6	AM noise
5.7.7	5.7.7	5.7.7	FM noise
5.7.8			Frequency response (monaural)
5.7 9			Harmonic distortion (monaural)
	5.7.10		Frequency response (stereo)
	5.7.11		Harmonic distortion (stereo)
	5.7.12		Subcarrier suppression
	5.7.13		Channel separation
	5.7.14		Main-to-subchannel crosstalk
	5.7.15		Subchannel-to-main crosstalk
		5.7.16	SCA input test
		5.7.17	SCA noise test
		5.7.18	SCA mute test
		5.7.19	SCA harmonic distortion
		5.7.20	SCA frequency response

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.
c. If the output frequency is incorrect (should be the customer-selected frequency of 88 to 108 MHz), readjust the rf mixer circuits as outlined in paragraph 5.6.6.

5.7.2 Frequency Stability

a. With the equipment connected as shown in figure 5-6, turn stereo test circuit switch to L.
b. Adjust the audio oscillator output for 50 Hz.
c. Set output level for 100-percent main channel modulation on FM modulation monitor (Collins 900C-3 or equivalent).
d. Output frequency should be ±500 Hz of desired station frequency.

5.7.3 Output Power

a. Connect equipment as shown in figure 5-2.
b. Adjust OUTPUT POWER control until rf wattmeter indicates output of 10 watts.
c. Adjust OUTPUT POWER control until rf wattmeter indicates an output of 20 watts.

5.7.4 AFC Loop Test

a. Connect a receiver (Collins 51S or equivalent) to a short antenna and place it near A5Q3 in the back of the FM modulator card.
b. Tune receiver to exactly 14.0 MHz and note that a pulsed tone is heard.
c. Place stereo test circuit switch to OFF and connect a jumper between test points A4TP3 and A4TP4 on the synchronous detector card.
d. Pulse tone should increase in pitch until it cannot be heard.
e. Remove jumper and note that pitch of pulsed tone decreases to a zero beat.

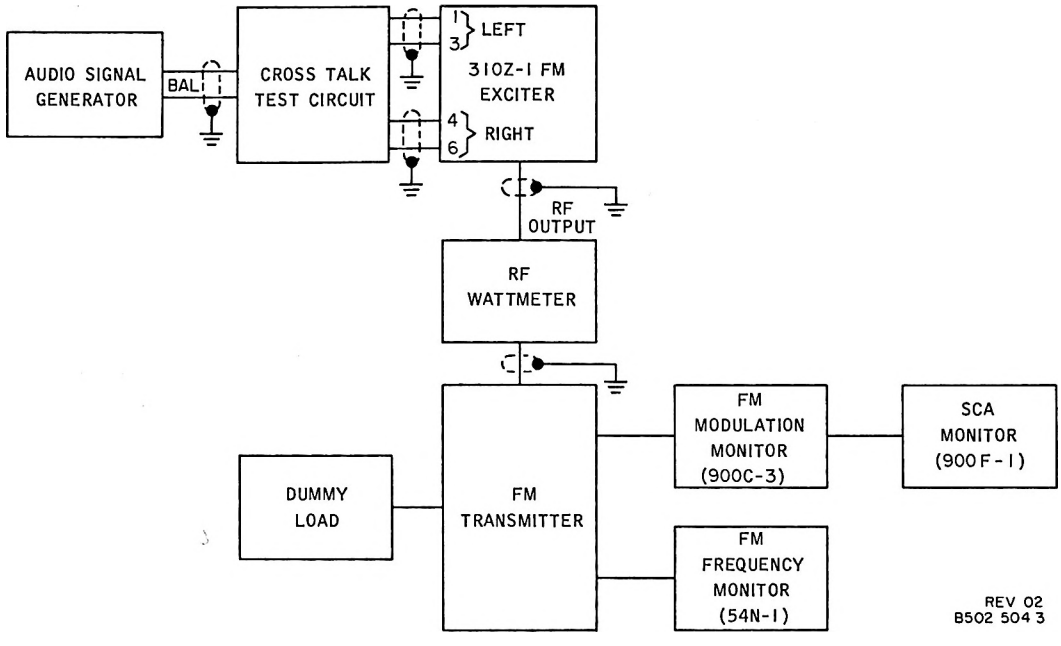


Figure 5-6. Test Equipment Connections to 310Z-1 Exciter for Crosstalk Test.

5.7.5 Remote Control Circuit Test

a. With the equipment connected as shown in figure 5-2, set the stereo test switch to OFF.
b. Turn the MODULATION switch on the 310Z-1 to LEFT.
c. Turn the METER switch on the FM modulation monitor (Collins 900C-3) to PILOT MOD.
d. Place 19-kHz PILOT switch A2S1 on the stereo generator card to ON.
e. Ensure that there is no indication on the FM modulation monitor.
f. Turn MODULATION switch on 310Z-1 to RIGHT and observe that there is no meter reading on the FM modulation monitor.
g. Connect a jumper between terminals TB1-10 and TB1-11 on the rear panel of the 310Z-1.
h. Observe that meter indicates approximately 8.5 percent on the FM modulation monitor.
i. Place 19-kHz PILOT switch A2S1 on the stereo generator to OFF.

5.7.6 AM Noise

a. Connect the equipment as shown in figure 5-2.
b. Turn the METER switch on the FM modulation monitor to RF LEVEL and adjust the RF LEVEL control for 100 percent on the front panel meter.
c. Connect audio voltmeter (HP400L) to the AM NOISE jack on the FM modulation monitor.
d. Ensure that the indicated noise level on the voltmeter is no more than 1.78 mv rms.

5.7.7 FM Noise

a. Connect the equipment as shown in figure 5-2.
b. Turn MODULATION switch on 310Z-1 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.

5.7.8 Frequency Response (Monaural)

a. With the equipment connected as shown in figure 5-2, set the MODULATION switch on the 310Z-1 to LEFT and the stereo test circuit switch to L.
b. Set the audio generator (HP206A or equivalent) for a frequency of 50 Hz.
c. Place DE-EMPHASIS switch on FM modulation monitor to OUT.
d. Adjust the output of the audio generator for 100-percent main channel modulation as indicated on the FM modulation monitor.
e. Vary the audio generator and maintain 100-percent modulation for frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz.
f. Ensure that attenuator settings for each frequency are within the limits of the 75 microsecond preemphasis curve as defined by the FCC.

5.7.9 Harmonic Distortion (Monaural)

a. Connect the equipment as shown in figure 5-2.
b. Turn MODULATION switch on the 310Z-1 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 OUT.
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 0.5 percent.
i. Repeat steps e. through h. for modulating frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz.

5.7.10 Frequency Response (Stereo)

a. With equipment connected as shown in figure 5-2, set the MODULATION switch on the 310Z-1 to LEFT and the stereo test circuit switch to STEREO.
b. Turn on 19-kHz pilot.
c. Repeat steps b. through f. of paragraph 5.7.8.
d. Place MODULATION switch on 310Z-1 to RIGHT.
e. Repeat steps b. through f. of paragraph 5.7.8.

5.7.11 Harmonic Distortion (Stereo)

a. With equipment connected as shown in figure 5-2, place PILOT CARRIER switch to ON.
b. Turn MODULATION switch on 310Z-1 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, 7500, 10,000 and 15,000 Hz. Maintain modulation on 900C-3 at 100 percent for all frequencies, and distortion should be not more than 1.0 percent.
h. Connect distortion meter to RIGHT AUDIO jack on 900C-3 and repeat step g.

5.7.12 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-1 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 SUB CAR, 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 -40 db.

5.7.13 Channel Separation

It is recommended that the channel separation test be performed using the Collins 900C-3 FM Modulation Monitor; however, channel separation can also be checked using an oscilloscope and following the procedure outlined in paragraph 5.7.13.2.

5.7.13.1 Channel Separation Test Using 900C-3

a. Connect equipment as shown in figure 5-2.
b. Turn MODULATION switch on front panel of 310Z-1 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 A2R16 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 A2R16.
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 A2R16.

5.7.13.2 Channel Separation Test Using Oscilloscope

a. Connect the shipment as shown in figure 5-2.
b. Turn the MODULATION switch on the front of the 310Z-1 to the STEREO position.
c. Turn MODULATION METER switch on the FM modulation monitor (900C-3) to TOTAL MOD.
d. Place the 19-kHz PILOT CARRIER switch A2A1 to OFF.
e. Turn stereo test circuit switch to L.
f. Set audio oscillator (HP206A) to 5000 Hz and adjust the output amplitude for 100-percent total modulation on the FM modulator monitor.
g. Connect an oscilloscope (HP130C) to A5TP5 on the FM modulator card.
h. Adjust the channel separation control A2R16 for a perfect stereo signal as observed on the oscilloscope. See figure 5-4.

Note

A perfect signal is indicated by a straight baseline with the oscilloscope dc coupled, vertical sensitivity set to 2 mv/cm, and external triggering applied from the audio oscillator.

i. Connect the oscilloscope (HP130C) to the WIDEBAND output jack on the FM modulation monitor.
j. Adjust the audio generator output for 400-mv p-p signal on the oscilloscope.
k. Increase the vertical sensitivity on the oscilloscope to 5 mv/cm, and ensure that the ripple on the baseline is not more than 7.0 mv p-p.
l. Repeat steps f. through k. for frequencies of 50, 100, 1000, 7500, 10,000 and 15,000 Hz, except the channel separation control should not be readjusted.
m. Turn stereo test switch to R, and repeat steps f. through l. Do not readjust the channel separation control.

5.7.14 Main Channel to Subchannel Crosstalk

a. Connect the equipment as shown in figure 5-6. The crosstalk test circuit shown on figure 5-7 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-1 to STEREO.

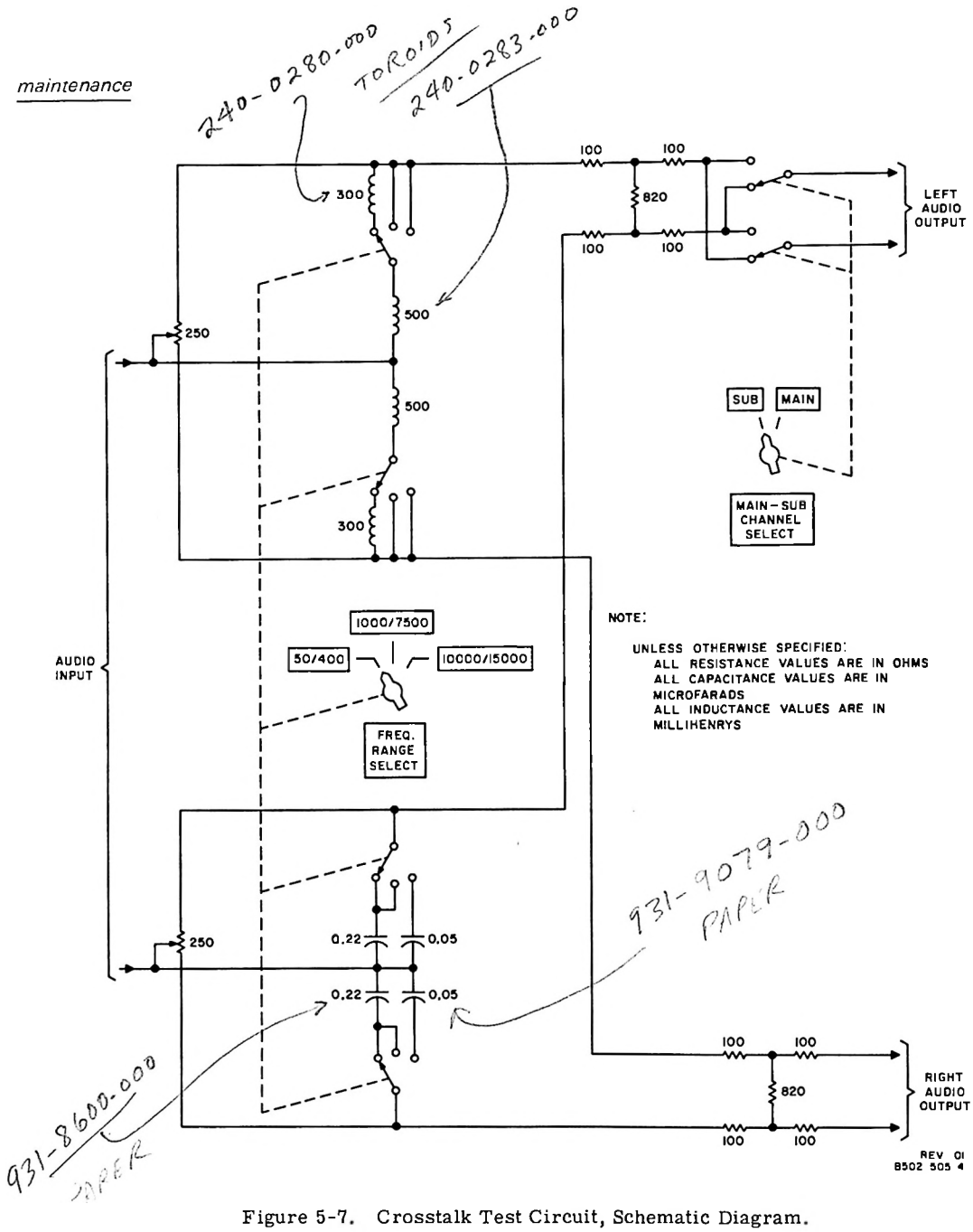


Figure 5-7. Crosstalk Test Circuit, Schematic Diagram.

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 attenation to achieve the proper null.

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 -40 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.

5.7.15 Subchannel to Main Channel Crosstalk

a. With the test equipment connected as shown in figure 5-6, 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.

5.7.16 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.
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.

5.7.17 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 (TB1-7 and TB1-9) of exciter.
c. Set the audio generator for a frequency of 400 Hz and an output level of +10 dbm.
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-1 exciter, and increase the sensitivity of the cated.
g. The difference between the levels recorded in steps e. and f. should be not less than 55 db.

5.7.18 SCA Mute Circuit Test

a. Connect equipment as shown in figure 5-2.
b. Connect audio signal generator (HP206A) to terminals TB1-7 and TB1-9.
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 TB1-7 and TB1-9 for 400 Hz at 6 dbm.
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-dbm 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.

5.7.19 SCA Harmonic Distortion

a. With equipment connected as shown in figure 5-2, connect a wave analyzer (HP302A or equivalent) to the audio output of the SCA monitor.

b. Connect audio signal generator to SCA input terminals on exciter, and adjust audio generator frequency to 50 Hz.
c. Adjust audio signal generator output to obtain a 425 mv rms at TP1 of the SCA card.
d. On the wave analyzer, set the ABSOLUTE/RELATIVE switch to RELATIVE, set MAX INPUT VOLTAGE to .3, and set RANGE switch to -10 db.
e. Tune wave analyzer to 50 Hz and adjust REF ADJUST for 0 db.
f. Measure the level of the second harmonic (100 Hz) and third harmonic (150 Hz) below the 0-db reference level. Harmonic levels should be not more than -43 db.
g. Tune signal generator and wave analyzer to 1000 Hz and adjust REF ADJUST for 0 db.
h. Measure level of second and third harmonics. Harmonic levels should be not more than -43 db.
i. Repeat steps g. and h. for 5000 Hz.
k. Repeat steps g. and h. for 10,000 Hz. Harmonic levels should be not more than -37 db.
l. Repeat steps g. and h. for 15,000 Hz. Harmonic levels should be not more than -37 db.

5.7.20 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) 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 7.5-kHz deviation on the SCA modulaton monitor.
f. While maintaining the 7.5-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. See figure 5-8.

5.8 FREQUENCY CHANGE

If it is desired to change the output frequency of the 310Z-1, crystal A6Y1 located in the oscillator compartment on the rf mixer must be changed. Table 5-4 lists the channel frequency versus crystal frequency and the Collins part number for each crystal.

5.9 WIRE LIST

A complete list of the point-to-point wiring within the 310Z-1 FM Broadcast Exciter is included in table 5-5.

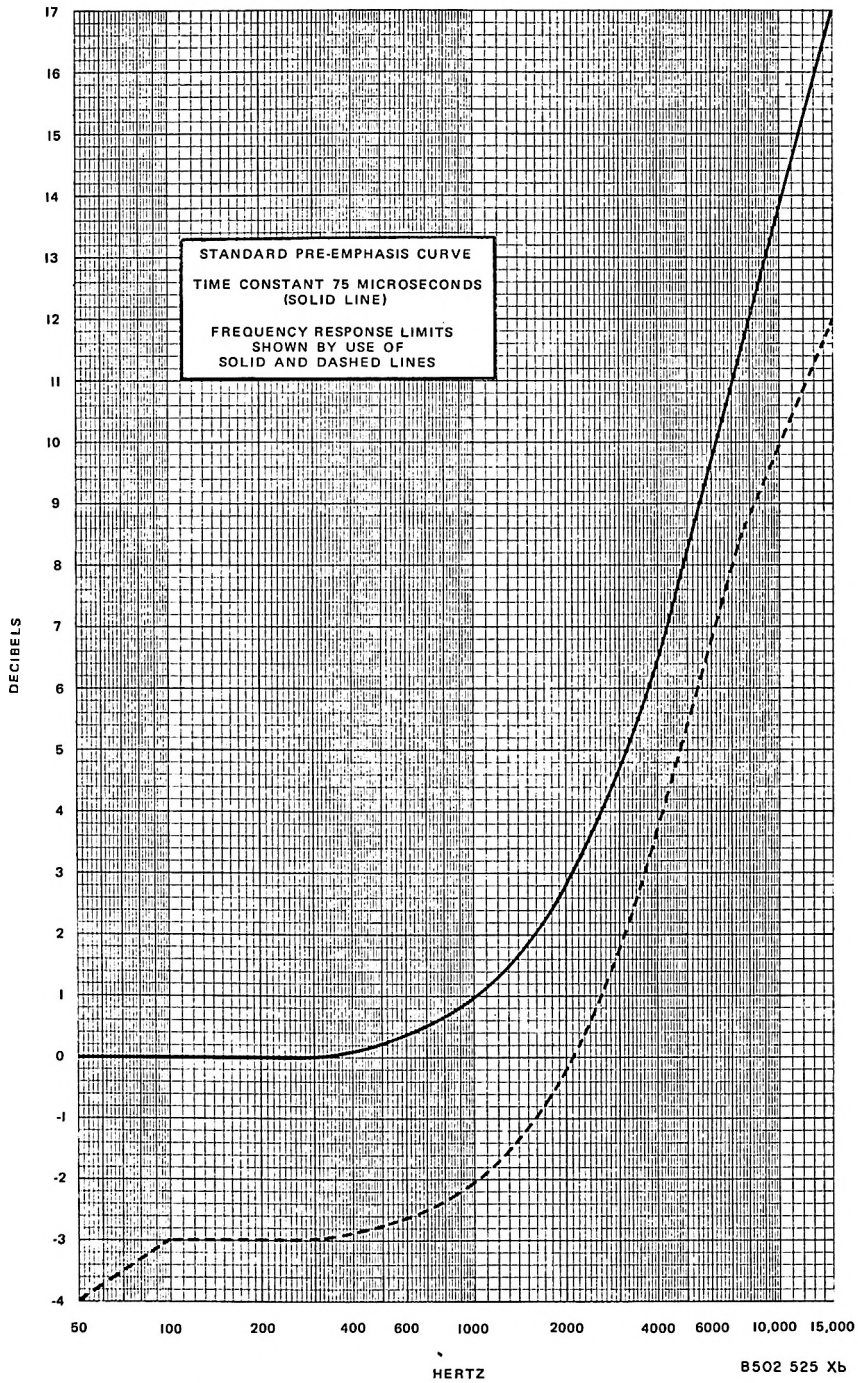


Figure 5-8. Standard Preemphasis Curve.

Table 5-4. Crystal Part Numbers.

CHANNEL FREQ (MHz)	CRYSTAL FREQ (MHz)	COLLINS PART NUMBER	CHANNEL FREQ (MHz)	CRYSTAL FREQ (MHz)	COLLINS PART NUMBER
88.1	74.10000	289-2744-00	96.1	82.10000	289-2784-00
88.3	74.30000	289-2745-00	96.3	82.30000	289-2785-00
88.5	74.50000	289-2746-00	96.5	82.50000	289-2786-00
88.7	74.70000	289-2747-00	96.7	82.70000	289-2787-00
88.9	74.90000	289-2748-00	96.9	82.90000	289-2788-00
89.1	75.10000	289-2749-00	97.1	83.10000	289-2789-00
89.3	75.30000	289-2750-00	97.3	83.30000	289-2790-00
89.5	75.50000	289-2751-00	97.5	83.50000	289-2791-00
89.7	75.70000	289-2752-00	97.7	83.70000	289-2792-00
89.9	75.90000	289-2753-00	97.9	83.90000	289-2793-00
90.1	76.10000	289-2754-00	98.1	84.10000	289-2794-00
90.3	76.30000	289-2755-00	98.3	84.30000	289-2795-00
90.5	76.50000	289-2756-00	98.5	84.50000	289-2796-00
90.7	76.70000	289-2757-00	98.7	84.70000	289-2797-00
90.9	76.90000	289-2758-00	98.9	84.90000	289-2798-00
91.1	77.10000	289-2759-00	99.1	85.10000	289-2799-00
91.3	77.30000	289-2760-00	99.3	85.30000	289-2800-00
91.5	77.50000	289-2761-00	99.5	85.50000	289-2801-00
91.7	77.70000	289-2762-00	99.7	85.70000	289-2802-00
91.9	77.90000	289-2763-00	99.9	85.90000	289-2803-00
92.1	78.10000	289-2764-00	100.1	86.10000	289-2804-00
92.3	78.30000	289-2765-00	100.3	86.30000	289-2805-00
92.5	78.50000	289-2766-00	100.5	86.50000	289-2806-00
92.7	78.70000	289-2767-00	100.7	86.70000	289-2807-00
92.9	78.90000	289-2768-00	100.9	86.90000	289-2808-00
93.1	79.10000	289-2769-00	101.1	87.10000	289-2809-00
93.3	79.30000	289-2770-00	101.3	87.30000	289-2810-00
93.5	79.50000	289-2771-00	101.5	87.50000	289-2811-00
93.7	79.70000	289-2772-00	101.7	87.70000	289-2812-00
93.9	79.90000	289-2773-00	101.9	87.90000	289-2813-00
94.1	80.10000	289-2774-00	102.1	88.10000	289-2814-00
94.3	80.30000	289-2775-00	102.3	88.30000	289-2815-00
94.5	80.50000	289-2776-00	102.5	88.50000	289-2816-00
94.7	80.70000	289-2777-00	102.7	88.70000	289-2817-00
94.9	80.90000	289-2778-00	102.9	88.90000	289-2818-00
95.1	81.10000	289-2779-00	103.1	89.10000	289-2819-00
95.3	81.30000	289-2780-00	103.3	89.30000	289-2820-00
95.5	81.50000	289-2781-00	103.5	89.50000	289-2821-00
95.7	81.70000	289-2782-00	103.7	89.70000	289-2822-00
95.9	81.90000	289-2783-00	103.9	89.90000	289-2823-00

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

CHANNEL FREQ (MHz)	CRYSTAL FREQ (MHz)	COLLINS PART NUMBER	CHANNEL FREQ (MHz)	CRYSTAL FREQ (MHz)	COLLINS PART NUMBER
104.1	90.10000	289-2824-00	106.1	92.10000	289-2834-00
104.3	90.30000	289-2825-00	106.3	92.30000	289-2835-00
104.5	90.50000	289-2826-00	106.5	92.50000	289-2836-00
104.7	90.70000	289-2827-00	106.7	92.70000	289-2837-00
104.9	90.90000	289-2828-00	106.9	92.90000	289-2838-00
105.1	91.10000	289-2829-00	107.1	93.10000	289-2839-00
105.3	91.30000	289-2830-00	107.3	93.30000	289-2840-00
105.5	91.50000	289-2831-00	107.5	93.50000	289-2841-00
105.7	91.70000	289-2832-00	107.7	93.70000	289-2842-00
105.9	91.90000	289-2833-00	107.9	93.90000	289-2843-00

Table 5-5. Wire List.

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
204	RG58	A..1-.J1	A..7-.J2	RF OUT
.13A	D26TVSJ9	A..1-.17	TB.1-..7	SCA IN
.13B	D26TVSJ6	A..1-.19	TB.1-..9	SCA IN
.44	A22TA01S7XXX	A..1-.19	S..2B-..9	INPUT
.40	A20PB00X8XXX	A..1-.25	A..2-.25	+20V
207	A20PB00X0XXX	A..1-.28	A..2-.28	GRD
.46	A20PB00X1XXX	A..1-.28	TB..1-.11	GRD
..2S	SHIELD	A..1-.28	E.26	GRD
..1S	SHIELD	A..1-.28	E.25	GRD
.17	A22TA01S6XXX	A..1-.41	S..2A-.12	SCA MPD.
.16	A22TA01S5XXX	A..1-.42	S..2B-..1	AUDIO LV
.20	A22TA01S9XXX	A..1-.43	A..5-.23	SCA OUT
.20S	SHIELD	A..1-END-NC	E.17	SHIELD
.44S	SHIELD	A..1-END-NC	S..2-E28	SHIELD
.17S	SHIELD	A..1-END-NC	S..2-E27	SHIELD
.16S	SHIELD	A..1-END-NC	S..2-E28	SHIELD
.13S	SHIELD	A..1-END-NC	TB.1-..8	SHIELD
..1	A22TA01S3XXX	A..2-.13	S..1-..7	RIGHT IN
..3	A22TA01S2XXX	A..2-.16	XFL5-3	MX. OUT
.39	A20PB00X8XXX	A..2-.25	A..3-.25	+20V
.40	A20PB00X8XXX	A..2-.25	A..1-.25	+20V
208	A20PB00X0XXX	A..2-.28	A..3-.28	GRD
..3S	SHIELD	A..2-.28	SHIELD	GRD

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
207	A20PB00X0XXX	A..2-.28	A..1-.26	GRD
..2	A22TA01S1XXX	A..2-.29	S..1-.11	LEFT IN
.24	RG196/U	A..3-..J1	A..5-.J1	AFC OUT
.21	A22TA01S5XXX	A..3-..9	A..4-.26	DISC OUT
.41	A20PB00X7XXX	A..3-.17	A..8-.14	+10V
.42	A20PB00X3XXX	A..3-.19	A..8-.18	-10V
.23	A22PB00X2XXX	A..3-.21	A..4-.30	MVB OUT
.22	A22PB00X1XXX	A..3-.23	A..4-.29	MVB OUT
.38	A20PB00X8XXX	A..3-.25	A..4-.25	+20V
.39	A20PB00X8XXX	A..3-.25	A..2-.25	+20V
209	A20PB00X0XXX	A..3-.28	A..4-.28	GRD
208	A20PB00X0XXX	A..3-.28	A..2-.28	GRD
.21S	SHIELD	A..3-END-NC	E.17	SHIELD
.53	A22TA01S3XXX	A..4-..3	S..2A-.11	MX IN
.19	A22TA01S4XXX	A..4-..4	S..2B-.11	MX. OUT
.38	A20PB00X8XXX	A..4-.25	A..3-.25	+20V
.37	A20PB00X8XXX	A..4-.25	A..5-.25	+20V
.21	A22TA01S5XXX	A..4-.26	A..3-..9	DISC OUT
210	A20PB00X0XXX	A..4-.28	A..5-.28	GRD
209	A20PB00X0XXX	A..4-.28	A..3-.28	GRD
.22	A22PB00X1XXX	A..4-.29	A..3-.23	MVB OUT
.23	A22PB00X2XXX	A..4-.30	A..3-.21	MVB OUT
.27	A22TA01S6XXX	A..4-.31	A..5-.21	AUD.CNCL

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
213	A22PB00X9XXX	A..4-.32	A..5-.27	AFC
..7A	D26TVSJ9	A..4-.41	TB.1-..3	RIGHT IN
..9B	D26TVSJ6	A..4-.41	S..2B-..7	LEFT IN
..9A	D26TVSJ9	A..4-.42	S..2B-..1	LEFT OUT
..5A	D26TVSJ9	A..4-.45	TB.1-..6	LEFT IN
.10B	D26TVSJ6	A..4-.45	S..2B-..8	RIGHT IN
..5B	D26TVSJ6	A..4-.47	TB.1-..4	LEFT IN
.10A	D26TVSJ9	A..4-.48	S..2B-..2	R OUT
..5S	SHIELD	A..4-END-NC	TB.1-..5	GRD
..7S	SHIELD	A..4-END-NC	TB..1-..2	GRD
.10S	SHIELD	A..4-END-NC	S..2-E27	SHIELD
.27S	SHIELD	A..4-END-NC	E.17	SHIELD
.19S	SHIELD	A..4-END-NC	S..2-E28	SHIELD
.24	RG196/U	A..5-.J1	A..3-..J1	AFC OUT
205	RG196/U	A..5-.J2	A..6-.J2	OUT -MXR
..4	A22TA01S3XXX	A..5-.19	K..1-..9	BASEBDIN
.27	A22TA01S6XXX	A..5-.21	A..4-.31	AUD.CNCL
.20	A22TA01S9XXX	A..5-.23	A..1-.43	SCA OUT
.37	A20PB00X8XXX	A..5-.25	A..4-.25	+20V
.36	A20PB00X8XXX	A..5-.25	A..6-.25	+20V
213	A22PB00X9XXX	A..5-.27	A..4-.32	AFC
210	A20PB00X0XXX	A..5-.28	A..4-.28	GRD
211	A20PB00X0XXX	A..5-.28	A..6-.27	GRD

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
..4S	SHIELD	A..5-END-NC	E..20	GRD
206	RG196/U	A..6-..J1	A..6-..J1	OUT - IN
206	RG196/U	A..6-..J1	A..6-..J1	OUT - IN
205	RG196/U	A..6-..J2	A..5-..J2	OUT -MXR
240	B20BA00XXXXX	A..6-..25	A..6-..26	JUMPER
.35	A20PB00X8XXX	A..6-..25	A..7-..25	+20V
.36	A20PB00X8XXX	A..6-..25	A..5-..25	+20V
240	B20BA00XXXXX	A..6-..26	A..6-..25	JUMPER
212	A20PB00X0XXX	A..6-..27	A..7-..27	GRD
211	A20PB00X0XXX	A..6-..27	A..5-..28	GRD
204	RG58	A..7-..J2	A..1-..J1	RF OUT
.35	A20PB00X8XXX	A..7-..25	A..6-..25	+20V
.34	A20PB00X8XXX	A..7-..25	A..8-..12	+20V
.29	A20PB00X3XXX	A..7-..26	Q1-E	13-26V
212	A20PB00X0XXX	A..7-..27	A..6-..27	GRD
.86	A20PB00X0XXX	A..7-..27	A..8-..13	GRD
.33	A22PB00X9XXX	A..8-..1	XK1-..4	+28V
.71	A20PB00X9XXX	A..8-..3	E..6	+40 VDC
.72	A20PB00X9XXX	A..8-..3	Q6-C	+40 VDC
.87	A20PB00X9CXX	A..8-..4	E..2	+40 COMM
.59	A22PB00X6XXX	A..8-..5	Q2-B	DC CON V
.70	A22PB00X2XXX	A..8-..6	R..15-..2	
.94	A22TA01S5XXX	A..8-..7	TB..1-..12	PWR CONT

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
.84	A22PB00X91XX	A..8-..8	Q6-B	
.56	A22PB00X1XXX	A..8-..9	E..9	13-26VDC
.63	A22PB00X4XXX	A..8-.10	R.15-..1	
.69	A22PB00X5XXX	A..8-.11	R.15-..3	
.51	A20PP00X8XXX	A..8-.12	E..5	+20V
.34	A20PB00X8XXX	A..8-.12	A..7-.25	+20V
.86	A20PB00X0XXX	A..8-.13	A..7-.27	GRD
.85	A20PB00X0XXX	A..8-.13	E.11	GRD
.41	A20PB00X7XXX	A..8-.14	A..3-.17	+10V
.83	A22PB00X93XX	A..8-.15	E..3	
.81	A20PB00X902X	A..8-.16	TB.1-..7	6 VAC IN
.82	A20PB00X96XX	A..8-.17	TB.1-..9	6 VAC IN
.42	A20PB00X3XXX	A..8-.18	A..3-.19	-10V
.94S	SHIELD	A..8-END-NC	TB..1-.11	SHIELD
.95	A22PB00X1XXX	A..9-.49	T..1-..1	117 VAC
.96	A22PB00X2XXX	A..9-.51	T..1-..4	117 VAC
219	A22PB00X9XXX	CR..1-..A	CR..2-..C	JUMPER
.79	A20PB00X8XXX	CR..1-..A	T..1-..6	AC
217	A22PB00X9XXX	CR..1-..C	CR..3-..C	JUMPER
.74	A20PB00X4XXX	CR..1-..C	E..7	+40 VDC
.75	A20PB00X4XXX	CR..2-..A	E..1	+40 COMM
218	A22PB00X9XXX	CR..2-..A	CR..4-..A	JUMPER
219	A22PB00X9XXX	CR..2-..C	CR..1-..A	JUMPER

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
.77	A20PB00X1XXX	CR..3-..A	T..1-..5	AC
216	A22PB00X9XXX	CR..3-..A	CR..4-..C	JUMPER
217	A22PB00X9XXX	CR..3-..C	CR..1-..C	JUMPER
218	A22PB00X9XXX	CR..4-..A	CR..2-..A	JUMPER
216	A22PB00X9XXX	CR..4-..C	CR..3-..A	JUMPER
.75	A20PB00X4XXX	E..1	CR..2-..A	+40 COMM
226	B20TM00XXXXX	E..1	E..2	JUMPER
C.1	CAPACITOR	E..1(-)	E..7(+)	
226	B20TM00XXXXX	E..2	E..1	JUMPER
.87	A20PB00X90XX	E..2	A..8-. 4	+40 COMM
.83	A22PB00X93XX	E..3	A..8-.15	
C.5	CAPACITOR	E..3(-)	E..4(+)	
228	B20BA00XXXXX	E..4	E.10	GRD
C.5	CAPACITOR	E..4(+)	E..3(-)	
C.4	CAPACITOR	E..4(-)	E..5(+)	
.51	A20PB00X8XXX	E..5	A..8-.12	+20V
.52	A20PB00X8XXX	E..5	Q6-E	+20V
C.4	CAPACITOR	E..5(+)	E..4(-)	
.71	A20PB00X9XXX	E..6	A..8-..3	+40 VDC
227	B20TM00XXXXX	E..6	E..7	JUMPER
227	B20TM00XXXXX	E..7	E..6	JUMPER
.74	A20PB00X4XXX	E..7	CR..1-..C	+40 VDC
C.1	CAPACITOR	E..7(+)	E..1(-)	

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
229	B20BA00XXXXX	E..8	E.11	GRD
C.3	CAPACITOR	E..8(-)	E..9(+)	
.55	A22PB00X1XXX	E..9	Q1-E	13-26VDC
.56	A22PB00X1XXX	E..9	A..8-..9	13-26VDC
C.3	CAPACITOR	E..9(+)	E..8(-)	
228	B20BA00XXXXX	E.10	E..4	GRD
229	B20BA00XXXXX	E.11	E..8	GRD
.67	A20PB00X0XXX	E.11	T..1-..8	CT GRD
.85	A20PB00X0XXX	E.11	A..8-.13	GRD
204S	SHIELD	E.12	GRD	SHIELD
205S	SHIELD	E.13	E.14	GRD
205S	SHIELD	E.14	E.13	GRD
206S	SHIELD	E.15	E.16	GRD
206S	SHIELD	E.16	E.15	GRD
.24S	SHIELD	E.17	E.18..	GRD
.21S	SHIELD	E.17	A..3-END-NC	SHIELD
.20S	SHIELD	E.17	A..1-END-NC	SHIELD
.27S	SHIELD	E.17	A..4-END-NC	SHIELD
.53S	SHIELD	E.17	S..2-END-NC	SHIELD
.24S	SHIELD	E.18	E.17	GRD
221	B20TM00XXXXX	E.19	FL..4-..6	GRD
..4S	SHIELD	E.20	A..5-END-NC	GRD
223	B20TM00XXXXX	E.21	FL..2-..6	GRD

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
230	B20TM0CXXXXX	E.22	FL..3-..1	GRD
231	B20TM0OXXXXX	E.23	FL..1-..1	GRD
233	B2CTM0OXXXXX	E.24	FL..5-..1	GRD
..1S	SHIELD	E.25	A..1-.28	GRD
..2S	SHIELD	E.26	A..1-.28	GRD
R.3	RESISTOR	E.26	S..1-..5	
237	A20PB00X0XXX	E.28	S..2B-..5	GRD
231	B20TM00XXXXX	FL..1-..1	E.23	GRD
.89A	D26TVSJ9	FL..1-..4	FL..2-..3	CONN
.78A	D26TVSJ9	FL..1-..5	T8..1-..3	L AUDIO
.89B	D26TVSJ6	FL..1-..6	FL..2-..5	
.89S	SHIELD	FL..1-E23	FL..2-E21	SHIELD
222	B20TM00XXXXX	FL..2-..1	FL..2-..6	GRD
.89A	D26TVSJ9	FL..2-..3	FL..1-..4	CONN
.89B	D26TVSJ6	FL..2-..5	FL..1-..6	
222	B20TM0OXXXXX	FL..2-..6	FL..2-..1	GRD
223	B20TM0OXXXXX	FL..2-..6	E.21	GRD
.89S	SHIELD	FL..2-E21	FL..1-E23	SHIELD
230	B20TM0OXXXXX	FL..3-..1	E.22	GRD
.93B	D26TVSJ6	FL..3-..3	TB..1-..4	R AUDIO
.93A	D26TVSJ9	FL..3-..5	TB..1-..6	R AUDIO
..93S	SHIELD	FL..3-E22	TB..1-..5	GRD
220	B20TM0CXXXXX	FL..4-..1	FL..4-..6	GRD

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
221	B20TM00XXXXX	FL..4-..6	E.19	GRD
220	B20TM00XXXXX	FL..4-..6	FL..4-..1	GRD
233	B20TM00XXXXX	FL..5-..1	E.24	GRD
232	B20BA00XXXXX	FL..5-..1	FL..5-..8	GRD
R.5	RESISTOR	FL..5-..6	FL..5-..8	
R.5	RESISTOR	FL..5-..8	FL..5-..6	
232	B20BA00XXXXX	FL..5-..8	FL..5-..1	GRD
.57S	SHIELD	FL..5-ENDNC	S..1-E25	SHIELD
.25S	SHIELD	FL..5-ENDNC	XFL4-E20	SHIELD
..9S	SHIELD	GRD	S..2-E27	GRD
204S	SHIELD	GRD	E.12	SHIELD
..4	A22TA01S3XXX	K..1-..9	A..5-.19	BASEBDIN
.92	A22TA01S4XXX	M..1-..N	S..2B- 12	METER -
.91	A22TA01S4XXX	M..1-..P	S..2B-..6	METER +
.92S	SHIELD	M..1-END-NC	S..2B-E28	SHIELD
.91S	SHIELD	M..1-END-NC	S..2-E28	SHIELD
.61	A20PB00X3XXX	P..1-..1	S..3-..4	AC HOT
.60	A20PB00X6XXX	P..1-..2	S..3-..2	AC NEUT
215	A22PB00X9XXX	Q1-B	Q2-C	JUMPER
.76	A20PB00X9XXX	Q1-C	Q6-C	+40 VDC
214	A22PB00X9XXX	Q1-C	Q2-E	JUMPER
.29	A20PB00X3XXX	Q1-E	A..7-.26	13-26V
.55	A22PB00X1XXX	Q1-E	E..9	13-26VDC

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
.59	A22PB00X6XXX	Q2-B	A..8-..5	DC CON V
215	A22PB00X9XXX	Q2-C	Q1-B	JUMPER
214	A22PB00X9XXX	Q2-E	Q1-C	JUMPER
.84	A22PB00X91XX	Q6-B	A..8-..8	
.76	A20PB00X9XXX	Q6-C	Q1-C	+40 VDC
.72	A20PB00X9XXX	Q6-C	A..8-..3	+40 VDC
.52	A20PB00X8XXX	Q6-E	E..5	+20V
.68	A22PB00X4XXX	R.15-..1	A..8-.10	
R16	RESISTOR	R.15-..1	R.15-..3	
.70	A22PB00X2XXX	R.15-..2	A..8-..6	
R16	RESISTOR	R.15-..3	R.15-..1	
.69	A22PB00X5XXX	R.15-..3	A..8-.11	
R.1	RESISTOR	S..1-..1	S..1-.10	
234	B22BA00XXXXX	S..1-..1	S..1-..2	JUMPER
234	B22BA00XXXXX	S..1-..2	S..1-..1	JUMPER
.48	A22TA01S5XXX	S..1-..3	XFL5-6	CONN
.57	A22TA01S5XXX	S..1-..3	XFL5-6	CONN
.50	A20TA01S8XXX	S..1-..4	XK1-.8	CONN
R.2	RESISTOR	S..1-..5	S..1-..6	
235	B22TM00XXXXX	S..1-..5	S..1-.10	JUMPER
R.3	RESISTOR	S..1-..5	E.26	
R.2	RESISTOR	S..1-..6	S..1-..5	
..1	A22TA01S3XXX	S..1-..7	A..2-.13	RIGHT IN

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
.49	A22TA01S6XXX	S..1-..7	XK1-.7	CONN
R.4	RESISTOR	S..1-..9	S..1-.10	
235	B22TM00XXXXX	S..1-.10	S..1-..5	JUMPER
R.1	RESISTOR	S..1-.10	S..1-..1	
R.4	RESISTOR	S..1-.10	S..1-..9	
..2	A22TA01S1XXX	S..1-.11	A..2-.29	LEFT IN
.15	A22TA01S4XXX	S..1-.11	XK1-.3	CONN.
.47	A22TA01S2XXX	S..1-.12	XK1-11	CONN
.47S	SHIELD	S..1-E25	XK1-END-NC	SHIELD
.15S	SHIELD	S..1-E25	XK1-END-NC	SHIELD
.57S	SHIELD	S..1-E25	FL..5-ENDNC	SHIELD
.48S	SHIELD	S..1-E26	XK1-END-NC	SHIELD
.50S	SHIELD	S..1-E26	XK1-END-NC	SHIELD
.49S	SHIELD	S..1-E26	XK1-END-NC	SHIELD
.53S	SHIELD	S..2-END-NC	E.17	SHIELD
.18S	SHIELD	S..2-E27	XFL4-E20	GRD
..9S	SHIELD	S..2-E27	GRD	GRD
.17S	SHIELD	S..2-E27	A..1-END-NC	SHIELD
.10S	SHIELD	S..2-E27	A..4-END-NC	SHIELD
.19S	SHIELD	S..2-E28	A..4-END-NC	SHIELD
.44S	SHIELD	S..2-E28	A..1-END-NC	SHIELD
.91S	SHIELD	S..2-E28	M..1-END-NC	SHIELD
.16S	SHIELD	S..2-E28	A..1-END-NC	SHIELD

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
239	A22PB00X9XXX	S..2A-..1	S..2A-..6	JUMPER
R.6	RESISTOR	S..2A-..4	S..2B-..4	
.18	A22TA01S7XXX	S..2A-..5	XK1-.9	CONN.
239	A22PB00X9XXX	S..2A-..6	S..2A-..1	JUMPER
.53	A22TA01S3XXX	S..2A-.11	A..4-..3	MX IN
.17	A22TA01S6XXX	S..2A-.12	A..1-.41	SCA MPD.
.16	A22TA01S5XXX	S..2B-..1	A..1-.42	AUDIO LV
..9A	D26TVSJ9	S..2B-..1	A..4-.42	LEFT OUT
.10A	D26TVSJ9	S..2B-..2	A..4-.48	R OUT
236	B22BA00XXXXX	S..2B-..4	S..2B-..4	JUMPER
R.6	RESISTOR	S..2B-..4	S..2A-..4	
236	B22BA00XXXXX	S..2B-..4	S..2B-..4	JUMPER
237	A20PB00X0XXX	S..2E-..5	E.28	GRD
.91	A22TA01S4XXX	S..2B-..6	M..1-..P	METER +
..9B	D26TVSJ6	S..2B-..7	A..4-.41	LEFT IN
.10B	D26TVSJ6	S..2B-..8	A..4-.45	RIGHT IN
.44	A22TA01S7XXX	S..2B-..9	A..1-.19	INPUT
238	B22BA00XXXXX	S..2B-.10	S..2B-.11	JUMPER
238	B22BA00XXXXX	S..2B-.11	S..2B-.10	JUMPER
.19	A22TA01S4XXX	S..2B-.11	A..4-..4	MX. OUT
.92	A22TA01S4XXX	S..2B- 12	M..1-..N	METER -
.92S	SHIELD	S..2B-E28	M..1-END-NC	SHIELD
.62	A20PB00X2XXX	S..3-..1	T..1-..4	AC NEUT

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
.60	A20PB00X6XXX	S..3-..2	P..1-..2	AC NEUT
.63	A20PB00X9XXX	S..3-..3	XF..1-..2	AC HOT
.61	A20PB00X3XXX	S..3-..4	P..1-..1	AC HOT
..3S	SHIELD	SHIELD	A..2-.28	GRD
224	B20TM00XXXXX	T..1-..1	T..1-..1	JUMPER
224	B20TM00XXXXX	T..1-..1	T..1-..1	JUMPER
.64	A20PB00X9XXX	T..1-..1	XF..1-..1	AC FUSED
.95	A22PB00X1XXX	T..1-..1	A..9-.49	117 VAC
225	B20TM00XXXXX	T..1-..2	T..1-..4	JUMPER
.62	A20PB00X2XXX	T..1-..4	S..3-..1	AC NEUT
225	B20TM00XXXXX	T..1-..4	T..1-..2	JUMPER
.96	A22PB00X2XXX	T..1-..4	A..9-.51	117 VAC
.77	A20PB00X1XXX	T..1-..5	CR..3-..A	AC
.79	A20PB00X8XXX	T..1-..6	CR..1-..A	AC
.67	A20PB00X0XXX	T..1-..8	E.11	CT GRD
.78B	D26TVSJ9	TB..1-..1	XFL1-3	L AUDIO
C.6	CAPACITOR	TB..1-..1	TB..1-..2	
C.7	CAPACITOR	TB..1-..2	TB..1-..3	
C.6	CAPACITOR	TB..1-..2	TB..1-..1	
.78S	SHIELD	TB..1-..2	XFL1-E23	GRD
201	A20PB00X0XXX	TB..1-..2	TB..1-..5	GRD
..7S	SHIELD	TB..1-..2	A..4-END-NC	GRD
.78A	D26TVSJ9	TB..1-..3	FL..1-..5	L AUDIO

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
C.7	CAPACITOR	TB..1-..3	TB..1-..2	
.93B	D26TVSJ6	TB..1-..4	FL..3-..3	R AUDIO
C.8	CAPACITOR	TB..1-..4	TB..1-..5	
C.8	CAPACITOR	TB..1-..5	TB..1-..4	
C.9	CAPACITOR	TB..1-..5	TB..1-..6	
.93S	SHIELD	TB..1-..5	FL..3-E22	GRD
202	A20PB00X0XXX	TB..1-..5	TB..1-..8	GRD
201	A20PB00X0XXX	TB..1-..5	TB..1-..2	GRD
.93A	D26TVSJ9	TB..1-..6	FL..3-..5	R AUDIO
C.9	CAPACITOR	TB..1-..6	TB..1-..5	
C10	CAPACITOR	TB..1-..7	TB..1-..8	
C11	CAPACITOR	TB..1-..8	TB..1-..9	
C10	CAPACITOR	TB..1-..8	TB..1-..7	
203	A20PB00X0XXX	TB..1-..8	TB..1-.11	GRD
202	A20PB00X0XXX	TB..1-..8	TB..1-..5	GRD
C11	CAPACITOR	TB..1-..9	TB..1-..8	
.54	A22PB00X6XXX	TB..1-.10	XK1-.1	STRO RMT
203	A20PB00X0XXX	TB..1-.11	TB..1-..8	GRD
.46	A20PB00X1XXX	TB..1-.11	A..1-.28	GRD
.94S	SHIELD	TB..1-.11	A..8-END-NC	SHIELD
.94	A22TA01S5XXX	TB..1-.12	A..8-..7	PWR CONT
..7A	D26TVSJ9	TB.1-..3	A..4-.41	RIGHT IN
..5B	D26TVSJ6	TB.1-..4	A..4-.47	LEFT IN

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
..5S	SHIELD	TB.1-..5	A..4-END-NC	GRD
..5A	D26TVSJ9	TB.1-..6	A..4-.45	LEFT IN
.81	A20PB00X902X	TB.1-..7	A..8-.16	6 VAC IN
.13A	D26TVSJ9	TB.1-..7	A..1-.17	SCA IN
.13S	SHIELD	TB.1-..8	A..1-END-NC	SHIELD
.82	A20PB00X96XX	TB.1-..9	A..8-.17	6 VAC IN
.13B	D26TVSJ6	TB.1-..9	A..1-.19	SCA IN
.64	A20PB00X9XXX	XF..1-..1	T..1-..1	AC FUSED
.63	A20PB00X9XXX	XF..1-..2	S..3-..3	AC HOT
.78S	SHIELD	XFL1-E23	TB..1-..2	GRD
.78B	D26TVSJ9	XFL1-3	TB..1-..1	L AUDIO
.73S	SHIELD	XFL2-E21	XK1-END-NC	SHIELD
.73	A22TA01S4XXX	XFL2-4	XK1-12	L AUDIO
.65S	SHIELD	XFL3-E22	XFL4-E19	SHIELD
.65A	D26TVSJ9	XFL3-4	XFL4-3	CONN
.65B	D26TVSJ6	XFL3-6	XFL4-5	CONN
.58S	SHIELD	XFL4-E19	XK1-END-NC	SHIELD
.65S	SHIELD	XFL4-E19	XFL3-E22	SHIELD
.18S	SHIELD	XFL4-E20	S..2-E27	GRD
.25S	SHIELD	XFL4-E20	FL..5-ENDNC	SHIELD
.65A	D26TVSJ9	XFL4-3	XFL3-4	CONN
.58	A22TA01S1XXX	XFL4-4	XK1-.6	R AUDIO
.65B	D26TVSJ6	XFL4-5	XFL3-6	CONN

Table 5-5. Wire List (Cont).

WIRE NO.	WIRE CODE	CONNECTION	CONNECTION	FUNCTION
..3	A22TA01S2XXX	XFL5-3	A..2-.16	MX. OUT
.48	A22TA01S5XXX	XFL5-6	S..1-..3	CONN
.57	A22TA01S5XXX	XFL5-6	S..1-..3	CONN
.25	A22TA01S5XXX	XFL5-6	XK1-10	CONN
.54	A22PB00X6XXX	XK1-.1	TB..1-.10	STRO RMT
.15	A22TA01S4XXX	XK1-.3	S..1-.11	CONN.
.33	A22PB00X9XXX	XK1-.4	A..8-..1	+28V
.58	A22TA01S1XXX	XK1-.6	XFL4-4	R AUDIO
.49	A22TA01S6XXX	XK1-.7	S..1-..7	CONN
.50	A20TA01S8XXX	XK1-.8	S..1-..4	CONN
.18	A22TA01S7XXX	XK1-.9	S..2A-..5	CONN.
.49S	SHIELD	XK1-END-NC	S..1-E26	SHIELD
.58S	SHIELD	XK1-END-NC	XFL4-E19	SHIELD
.50S	SHIELD	XK1-END-NC	S..1-E26	SHIELD
.73S	SHIELD	XK1-END-NC	XFL2-E21	SHIELD
.47S	SHIELD	XK1-END-NC	S..1-E25	SHIELD
.15S	SHIELD	XK1-END-NC	S..1-E25	SHIELD
.48S	SHIELD	XK1-END-NC	S..1-E26	SHIELD
.25	A22TA01S5XXX	XK1-10	XFL5-6	CONN
.47	A22TA01S2XXX	XK1-11	S..1-.12	CONN
.73	A22TA01S4XXX	XK1-12	XFL2-4	L AUDIO

section 6
parts list

6.1 GENERAL

This section contains a list of all replaceable electrical, electronic, and critical mechanical parts for the 310Z-1 FM EXCITER.

The manufacturers' codes appearing in the Mfr Code column of the parts list are listed in numerical order at the end of the parts list. The code list provides the manufacturer's name and address as shown in the Federal Supply Code for Manufacturers' Handbook H4-1. Manufacturers not listed in Handbook H4-1 are assigned a 5-letter code and appear first in the code list.

6.2 LIST OF EQUIPMENT

	Page
310Z-1 FM Exciter	6-2
SCA Generator 786W-1	6-7
Stereo Generator 786V-1	6-13
AFC Discriminator	6-18
AFC Synchronous Detector	6-23
FM Modulator	6-28
RF Mixer	6-36
Power Amplifier	6-40
Power Supply Regulator	6-43
Fan	6-46
Extender Board	6-48

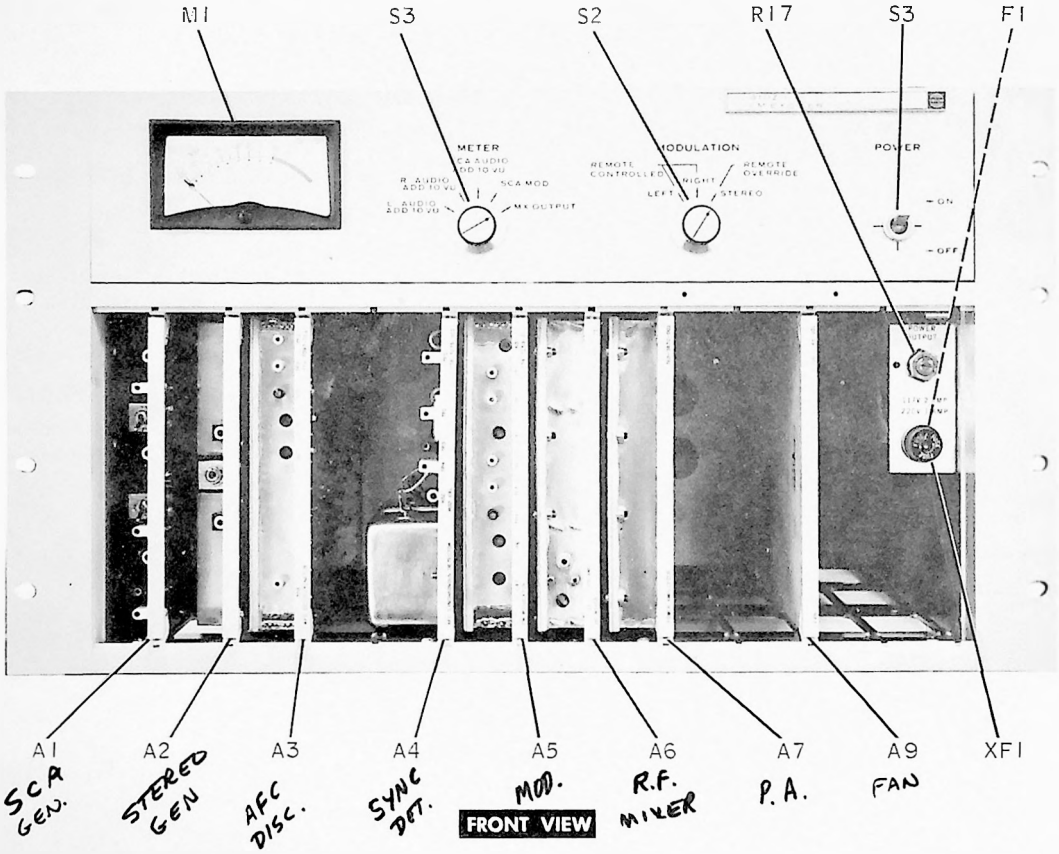


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Figure 6-1. 310Z-1 FM Exciter (Sheet 1 of 3).

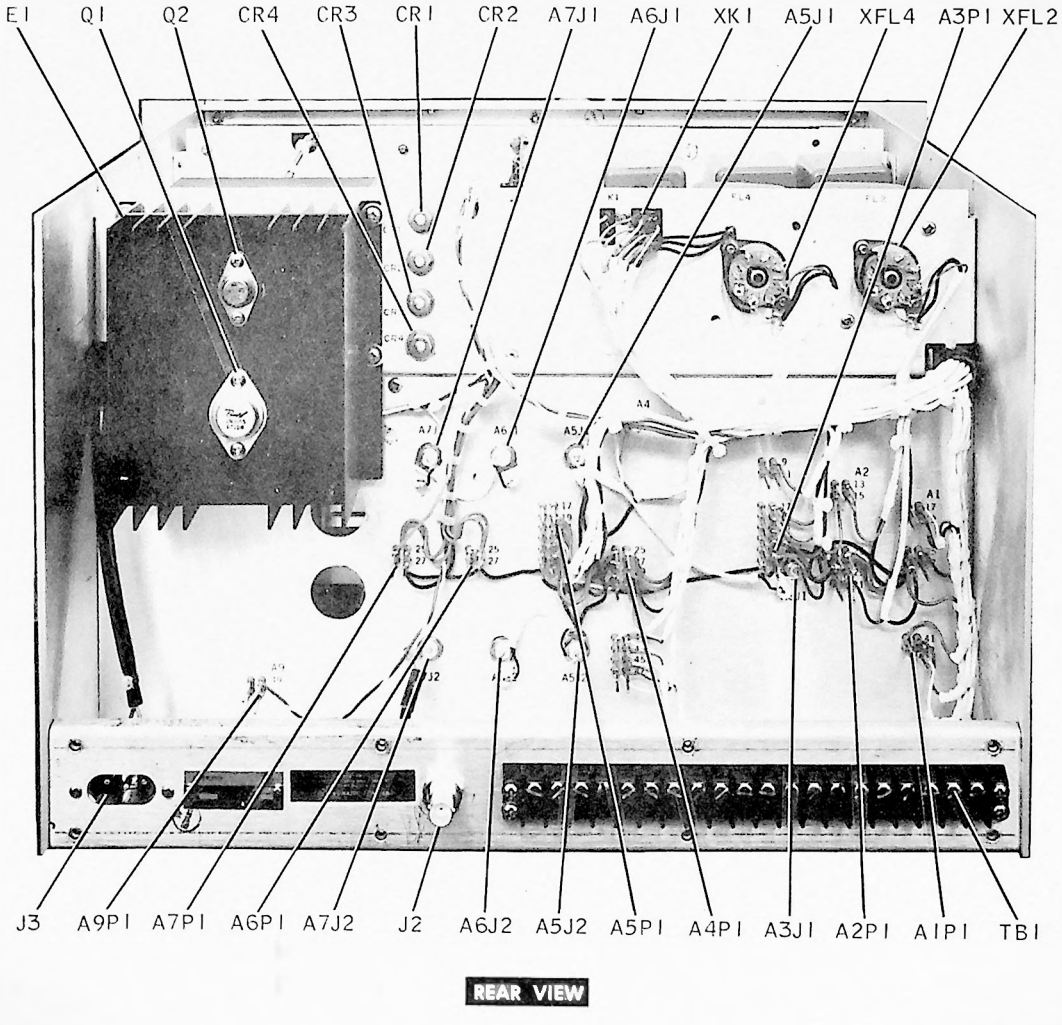

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Figure 6-1. 310Z-1 FM Exciter (Sheet 2 of 3).

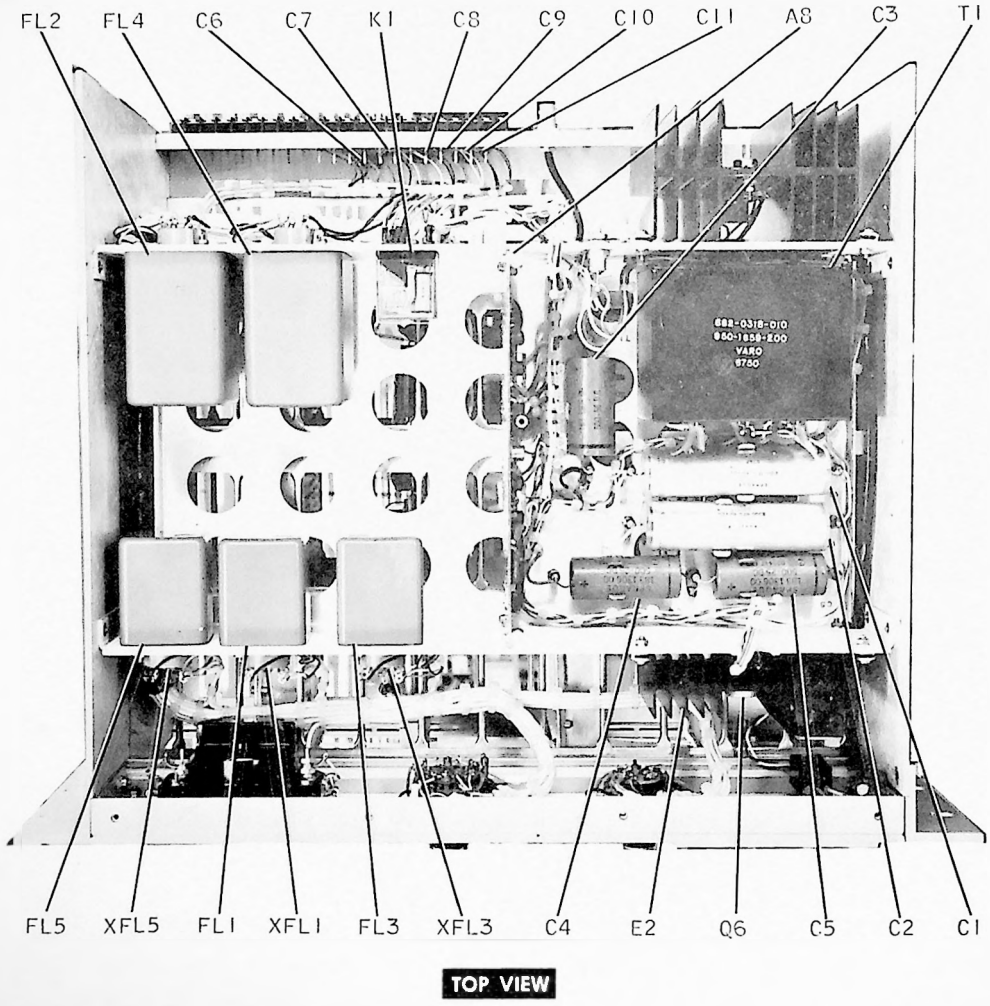

Figure 6-1. 310Z-1 FM Exciter (Sheet 3 of 3).

LINE CORD 426-5426-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	310Z-1 FM EXCITER			522-4687-001
A1	SCA GENERATOR 786W-1 SEE BREAKDOWN ON PAGE 6-7			772-5338-001
A1P1	CONNECTOR, ELECTRICAL -QTY 3- 4 CONTACTS	375430-9010	91662	372-2425-010
A2	STEREO GENERATOR 786V-1 SEE BREAKDOWN ON PAGE 6-13			772-5336-001
A2P1	SAME AS A1P1			
A3	AFC DISCRIMINATOR SEE BREAKDOWN ON PAGE 6-18			774-7097-001
A3J1	CONNECTOR, ELECTRICAL 1 CONTACT			372-9211-000
A3P1	CONNECTOR, ELECTRICAL -QTY 4- 4 CONTACTS	375430-9010	91662	372-2425-010
A4	AFC SYNCHRONOUS DETECTOR 6-23 SEE BREAKDOWN ON PAGE			774-7075-001
A4P1	CONNECTOR, ELECTRICAL -QTY 6- 4 CONTACTS	375430-9010	91662	372-2425-010
A5	FM MODULATOR SEE BREAKDOWN ON PAGE 6-28			774-7160-001
A5J1	SAME AS A3J1			
A5J2	SAME AS A3J1			
A5P1	SAME AS A1P1			
A6	RF MIXER SEE BREAKDOWN ON PAGE 6-36			781-5380-001
A6J1	SAME AS A3J1			
A6J2	SAME AS A3J1			
A6P1	CONNECTOR, ELECTRICAL 4 CONTACTS	375430-9010	91662	372-2425-010
A7	POWER AMPLIFIER SEE BREAKDOWN ON PAGE 6-40			769-0830-001
A7J1	SAME AS A3J1			
A7J2	SAME AS A3J1			
A7P1	SAME AS A6P1			
A8	POWER SUPPLY REGULATOR SEE BREAKDOWN ON PAGE 6-43			774-7216-001
A9	FAN SEE BREAKDOWN ON PAGE 6-46			783-7049-001
A9P1	SAME AS A6P1			
A10	EXTENDER BOARD SEE BREAKDOWN ON PAGE 6-48			781-5365-001
C1	CAPACITOR, FXD, ELECTROLYTIC 2300 UF, PLUS 75% MINUS 10%, 40 VDCW	601D238G040JT4	56289	183-1282-050
C2	SAME AS C1			
C3	CAPACITOR, FXD, ELECTROLYTIC 500 UF, PLUS 100% MINUS 10%, 50 VDCW			183-1309-000
C4	CAPACITOR, FXD, ELECTROLYTIC 500 UF, PLUS 100% MINUS 10%, 25 VDCW	D25447	56289	183-1306-000
C5	SAME AS C4			
C6	CAPACITOR, FXD, MICA 4700 UUF, 5% TOL, 500 VDCW	CM06F472J03	81349	912-3052-000
C7 THROUGH C11	SAME AS C6			
CR1	SEMICONDUCTOR DEVICE, DIODE	1N1200	07688	353-1721-000
CR2	SAME AS CR1			
CR3	SAME AS CR1			
CR4	SAME AS CR1			
E1	HEATSINK			776-1855-001
E2	HEATSINK, TRANSISTOR	6403B2	13103	352-9597-010
F1	FUSE, CARTRIDGE 2-AMP, 130 VAC/DC	GBB2	71400	264-0928-040

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
FL1	NETWORK, PRE-EMPHASIS	526-0016-010	95105	673-1158-010
FL2	FILTER, HIGH PASS	D11193	70674	673-1159-010
FL3	SAME AS FL1			
FL4	SAME AS FL2			
FL5	FILTER, LOW PASS	5220	17857	673-1162-020
J1	CONNECTOR, ELECTRICAL 1 CONTACT	UG1050AU	80058	357-9211-000
J2	CONNECTOR, ELECTRICAL 1 CONTACT	10083000C75	94375	357-9248-000
J3	CONNECTOR, ELECTRICAL 3 CONTACTS	1065-1	87930	368-0207-010
K1	RELAY, ARMATURE 4C CONTACT ARRANGEMENT	T154CCCC24VDC	70309	970-2106-000
M1	METER, AUDIO LEVEL	36-0276-0000	80105	456-0056-000
Q1	TRANSISTOR	2N3505	07688	352-0583-010
Q2	TRANSISTOR	2N3740	07688	352-0695-010
Q3	NOT USED			
Q4	NOT USED			
Q5	NOT USED			
Q6	SAME AS Q1			
R1	RESISTOR, FXD, FILM 261 OHMS, 1% TOL, 1/4 WATT	RN60D2610F	81349	705-6568-000
R2	SAME AS R1			
R3	RESISTOR, FXD, FILM 562 OHMS, 1% TOL, 1/4 WATT	RN60D5620F	81349	705-6584-000
R4	SAME AS R1			
R5	RESISTOR, FXD, COMPOSITION 100K OHMS, 10% TOL, 1/4 WATT	RC07GF104K	81349	745-0821-000
R6 THROUGH R15	NOT USED			
R16	RESISTOR, FXD, FILM 5620 OHMS, 1% TOL, 1/2 WATT	RN65D5621F	81349	705-7132-000
R17	RESISTOR, VAR, COMPOSITION 5K OHMS, 20% TOL, 1/4 WATT	LL6059	71450	376-4729-000
S1	SWITCH, ROTARY, WAFER 3 POLE, 3 POSITION, 1 SECTION	233065A1	76854	259-1866-010
S2	SWITCH, ROTARY, WAFER 2 POLE, 5 POSITION 2 SECTIONS	264752N1	76854	259-2328-030
S3	SWITCH, TOGGLE DPST CONTACT ARRANGEMENT	81024SP	04009	266-5376-010
T1	TRANSFORMER, AF, STEP-DOWN 115/230 VOLTS TO 28 VOLTS	950-1669-200	83003	662-0318-010
TB1	BOARD, TERMINAL 20 TERMINALS	670A3000-20	75382	367-1852-200
XF1	FUSEHOLDER 30-AMP CURRENT RATING	HKPH	71400	265-1171-000
XFL1	SOCKET, ELECTRON TUBE 8 CONTACTS	88-8TM	02660	220-1005-000
XFL2 THROUGH XFL5	SAME AS XFL1			
XK1	SOCKET, RELAY 16 CONTACTS	30055-2	02288	220-1471-000
X-	FEMALE QUAD SOCKET FOR ALL CARDS.	375430.9010	ELCO	372-2425-010

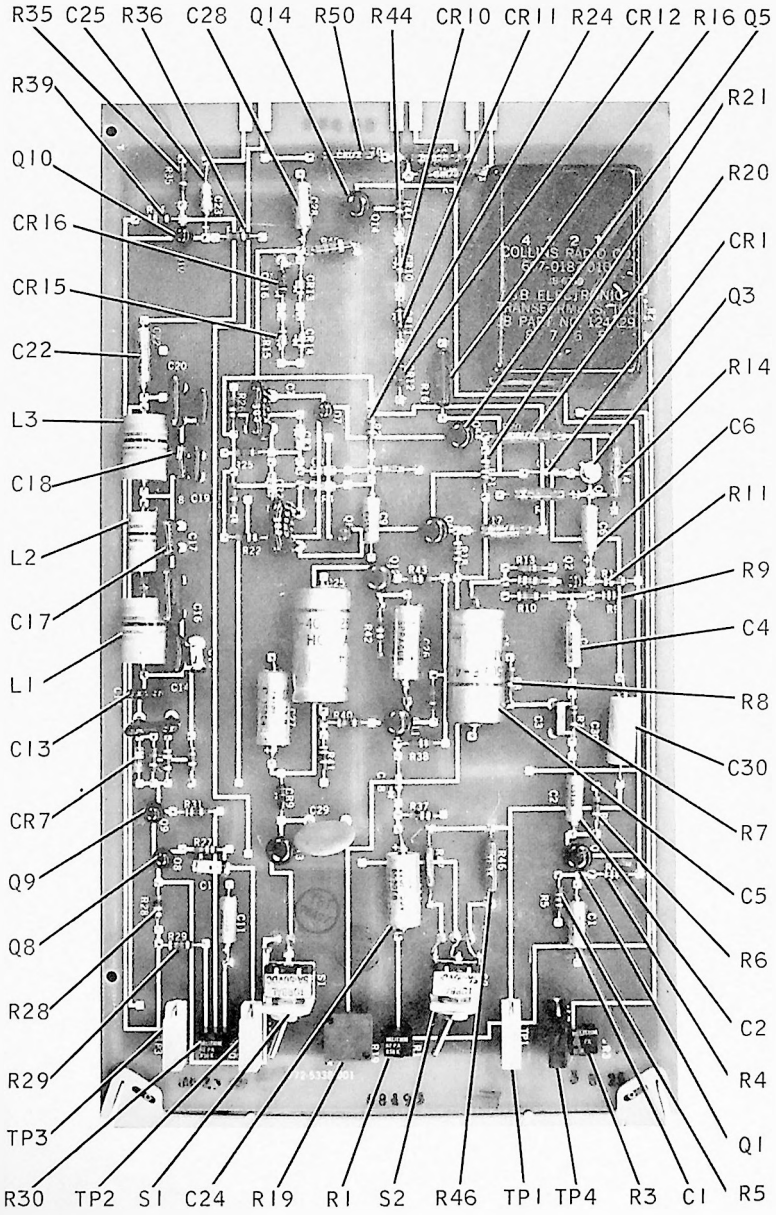

Figure 6-2. SCA Generator 786W-1 (Sheet 1 of 2).

A-1

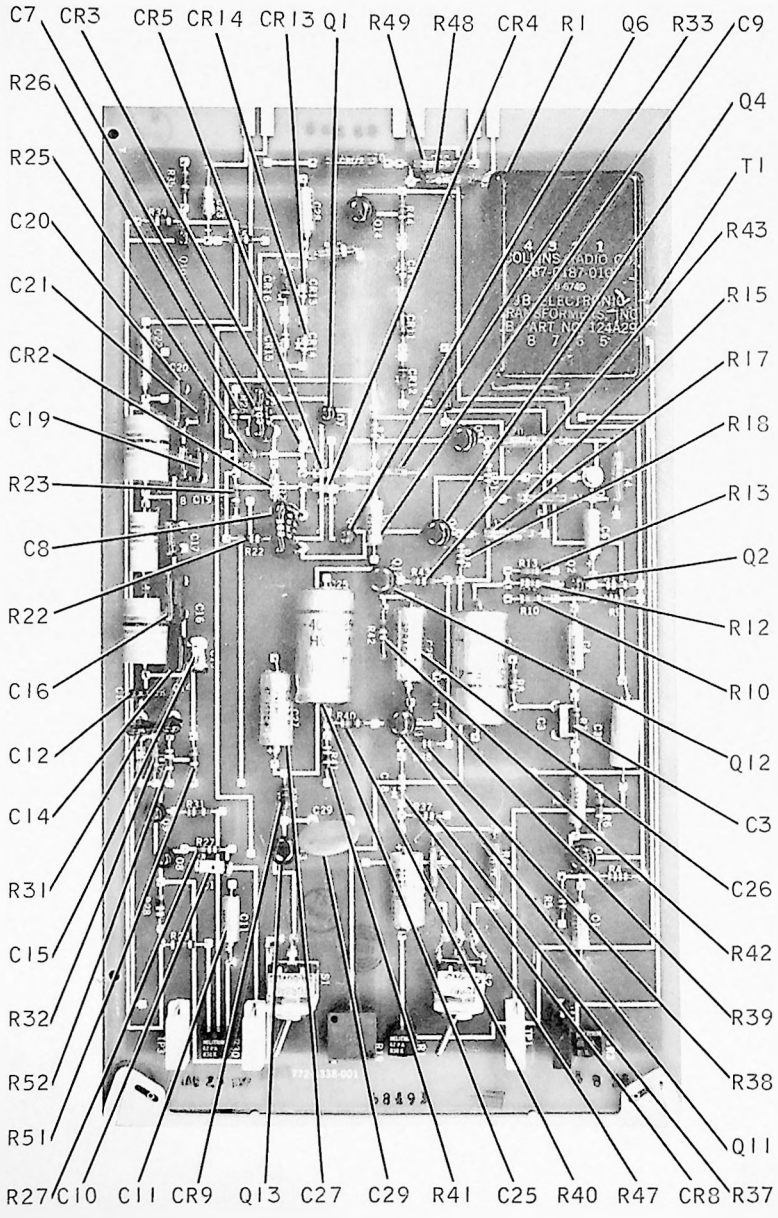

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Figure 6-2. SCA Generator 786W-1 (Sheet 2 of 2).

A-1

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	SCA GENERATOR 786W-1 A-1			772-5338-001
C1	CAPACITOR, FXD, ELECTROLYTIC 6.8 UF, 20% TOL, 35 VDCW	CS13BF685M	81349	184-6216-000
C2	SAME AS C1			
C3	CAPACITOR, FXD, FILM 0.01 UF, 10% TOL, 50 VDCW	65F10AA103	01002	933-0854-000
C4	SAME AS C1			
C5	CAPACITOR, FXD, ELECTROLYTIC 250 UF, PLUS 50%, MINUS 10%, 40 VDCW	C437ARG250	73445	183-2355-150
C6	SAME AS C1			
C7	CAPACITOR, FXD, MICA 3900 UUF, 5% TOL, 500 VDCW	CM06FD392J03	81349	912-3046-000
C8	SAME AS C7			
C9	SAME AS C1			
C10	CAPACITOR, FXD, CERAMIC 2 UUF, 1/2 UUF TOL, 500 VDCW	CC20CK020D	81349	916-0076-000
C11	SAME AS C1			
C12	CAPACITOR, FXD, MICA 500 UUF, 5% TOL, 500 VDCW	DM19E501J03	72136	912-2977-000
C13	CAPACITOR, FXD, MICA 100 UUF, 5% TOL, 500 VDCW	CM05F101J03	81349	912-2816-000
C14	CAPACITOR, FXD, MICA 47 UUF, 5% TOL, 500 VDCW	CM05F470J03	81349	912-2792-000
C15	CAPACITOR, FXD, CERAMIC 5 UUF, 1/2 UUF TOL, 500 VDCW	CC20CH050D	81349	916-0118-000
C16	CAPACITOR, FXD, MICA 820 UUF, 5% TOL, 500 VDCW	CM06F821J03	81349	912-2995-000
C17	CAPACITOR, FXD, MICA 22 UUF, 5% TOL, 500 VDCW	CM05E220J03	81349	912-2768-000
C18	CAPACITOR, FXD, MICA 120 UUF, 5% TOL, 500 VDCW	CM05F121J03	81349	912-2822-000
C19	CAPACITOR, FXD, MICA 18 UUF, 10% TOL, 500 VDCW	CM05C180K03	81349	912-2763-000
C20	CAPACITOR, FXD, MICA 470 UUF, 5% TOL, 500 VDCW	CM06F471J03	81349	912-2974-000
C21	SAME AS C14			
C22	CAPACITOR, FXD, ELECTROLYTIC 0.0075 UF, 20% TOL, 75 VDCW	151D752X0075W2	56289	184-9062-040
C23	CAPACITOR, FXD, ELECTROLYTIC 0.033 UF, 20% TOL, 100 VDCW	CS13BJ333M	81349	184-6326-580
C24	CAPACITOR, FXD, ELECTROLYTIC 22 UF, 20% TOL, 50 VDCW	CS13BG226M	81349	184-6257-000
C25	SAME AS C5			
C26	CAPACITOR, FXD, ELECTROLYTIC 47 UF, 20% TOL, 35 VDCW	CS13BF476M	81349	184-6231-000
C27	SAME AS C26			
C28	SAME AS C1			
C29	CAPACITOR, FXD, CERAMIC 0.01 UF, 20% TOL, 500 VDCW	36C175A	01939	913-3013-000
C30	CAPACITOR, FXD, ELECTROLYTIC 15 UF, 20% TOL, 35 VDCW	CS13BF156M	81349	184-6222-000
CR1	SEMICONDUCTOR DEVICE, DIODE	1N914	07688	353-2906-000
CR2	SEMICONDUCTOR DEVICE, DIODE	1N995	07688	353-2042-000
CR3	SAME AS CR2			
CR4	SAME AS CR2			
CR5	SAME AS CR2			
CR6	NOT USED			
CR7	SAME AS CR2			
CR8	SAME AS CR1			
CR9	SEMICONDUCTOR DEVICE, DIODE	1N758	07688	353-2723-000
CR10	SAME AS CR1			
CR11	SEMICONDUCTOR DEVICE, DIODE	1N756	07688	353-2719-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
CR12	SAME AS CR11			
CR13	SAME AS CR1			
CR14	SAME AS CR1			
CR15	SAME AS CR1			
CR16	SEMICONDUCTOR DEVICE, DIODE	1N754A	07688	353-2981-000
L1	CHOKE, RF 5000 UH, 10% TOL	3500-40	99800	240-0843-000
L2	COIL, RF 1000 UH, 10% TOL	3500-32	99800	240-0839-000
L3	SAME AS L1			
Q1	TRANSISTOR	2N3569	07688	352-0629-030
Q2	TRANSISTOR	2N3565	07688	352-0638-010
Q3	TRANSISTOR	2N718A	07688	352-0318-000
Q4	TRANSISTOR	2N3638A	07688	352-0636-020
Q5	SAME AS Q4			
Q6	TRANSISTOR	2N3563	07688	352-0630-010
Q7	SAME AS Q6			
Q8	SAME AS Q6			
Q9	TRANSISTOR	2N3646	07688	352-0680-010
Q10	SAME AS Q2			
Q11	TRANSISTOR	2N3643	07688	352-0713-030
Q12	SAME AS Q11			
Q13	SAME AS Q11			
Q14	SAME AS Q11			
R1	RESISTOR, VAR, CERAMIC 50K OHMS, 30% TOL, 1/2 WATT	62PAR50K	73138	382-0012-130
R2	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/4 WATT	RC07GF472K	81349	745-0773-000
R3	RESISTOR, VAR, CERAMIC 5K OHMS, 30% TOL, 1/2 WATT	62PAR5K	73138	382-0012-090
R4	RESISTOR, FXD, COMPOSITION 39K OHMS, 10% TOL, 1/4 WATT	RC07GF393K	81349	745-0806-000
R5	RESISTOR, FXD, COMPOSITION 56K OHMS, 10% TOL, 1/4 WATT	RC07GF563K	81349	745-0812-000
R6	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 1/4 WATT	RC07GF102K	81349	745-0749-000
R7	RESISTOR, FXD, COMPOSITION 6800 OHMS, 10% TOL, 1/4 WATT	RC07GF682K	81349	745-0779-000
R8	RESISTOR, FXD, COMPOSITION 820 OHMS, 10% TOL, 1/4 WATT	RC07GF821K	81349	745-0746-000
R9	SAME AS R4			
R10	SAME AS R2			
R11	RESISTOR, FXD, COMPOSITION 3900 OHMS, 10% TOL, 1/4 WATT	RC07GF392K	81349	745-0770-000
R12	RESISTOR, FXD, COMPOSITION 390 OHMS, 10% TOL, 1/4 WATT	RC07GF391K	81349	745-0734-000
R13	RESISTOR, FXD, COMPOSITION 270 OHMS, 10% TOL, 1/4 WATT	RC07GF271K	81349	745-0728-000
R14	RESISTOR, FXD, FILM 7500 OHMS, 1% TOL, 1/2 WATT	RN65D7501F	81349	705-7138-000
R15	RESISTOR, FXD, FILM 6190 OHMS, 1% TOL, 1/2 WATT	RN65D6191F	81349	705-7134-000
R16	RESISTOR, FXD, FILM 1780 OHMS, 1% TOL, 1/2 WATT	RN65D1781F	81349	705-7108-000
R17	RESISTOR, FXD, FILM 2.15K OHMS, 1% TOL, 1/2 WATT	RN65D2151F	81349	705-7112-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R18	RESISTOR, FXD, COMPOSITION 33K OHMS, 10% TOL, 1/4 WATT	RC07GF333K	81349	745-0803-000
R19	RESISTOR, VAR, WIRE WOUND 5K OHMS, 0.16% TOL, 3/4 WATT	RT22C2P502	81349	381-1721-060
R20	SAME AS R17			
R21	SAME AS R18			
R22	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/4 WATT	RC07GF103K	81349	745-0785-000
R23	SAME AS R6			
R24	RESISTOR, FXD, COMPOSITION 1.96K OHMS, 10% TOL, 1/4 WATT	RN60D1961F	81349	705-6610-000
R25	SAME AS R6			
R26	SAME AS R22			
R27	RESISTOR, FXD, COMPOSITION 27K OHMS, 10% TOL, 1/4 WATT	RC07GF273K	81349	745-0800-000
R28	SAME AS R22			
R29	RESISTOR, FXD, COMPOSITION 470 OHMS, 10% TOL, 1/4 WATT	RC07GF471K	81349	745-0737-000
R30	SAME AS R1			
R31	RESISTOR, FXD, COMPOSITION 3300 OHMS, 10 TOL, 1/4 WATT	RC07GF332K	81349	745-0767-000
R32	RESISTOR, FXD, COMPOSITION 1800 OHMS, 10% TOL, 1/4 WATT	RC07GF182K	81349	745-0758-000
R33	RESISTOR, FXD, COMPOSITION 1.62K OHMS, 10% TOL, 1/4 WATT	RN60D1621F	81349	705-6606-000
R34	SAME AS R11			
R35	RESISTOR, FXD, COMPOSITION 8200 OHMS, 10% TOL, 1/4 WATT	RC07GF822K	81349	745-0782-000
R36	SAME AS R8			
R37	SAME AS R22			
R38	RESISTOR, FXD, COMPOSITION 220K OHMS, 10% TOL, 1/4 WATT	RC07GF224K	81349	745-0833-000
R39	RESISTOR, FXD, COMPOSITION 2700 OHMS, 10% TOL, 1/4 WATT	RC07GF272K	81349	745-0764-000
R40	RESISTOR, FXD, COMPOSITION 68 OHMS, 10% TOL, 1/4 WATT	RC07GF680K	81349	745-0707-000
R41	RESISTOR, FXD, COMPOSITION 33 OHMS, 10% TOL, 1/4 WATT	RC07GF330K	81349	745-0695-000
R42	SAME AS R22			
R43	RESISTOR, FXD, COMPOSITION 100K OHMS, 10% TOL, 1/4 WATT	RC07GF104K	81349	745-0821-000
R44	RESISTOR, FXD, COMPOSITION 180 OHMS, 10% TOL, 1/4 WATT	RC07GF181K	81349	745-0722-000
R45	RESISTOR, FXD, COMPOSITION 220 OHMS, 10% TOL, 1/4 WATT	RC07GF221K	81349	745-0725-000
R46	RESISTOR, FXD, FILM 12K OHMS, 2% TOL, 2 WATTS	RL42S123G	81349	745-7188-000
R47	RESISTOR, FXD, FILM 28.7K OHMS, 2% TOL, 2 WATTS	RN65D2872F	81349	705-7166-000
R48	RESISTOR, FXD, FILM 5110 OHMS, 1% TOL, 1/2 WATT	RN65D5111F	81349	705-7130-000
R49	SAME AS R48			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R50	RESISTOR, FXD, FILM 1330 OHMS, 1% TOL, 1/2 WATT	RN65D1331F	81349	705-7102-000
R51	SAME AS R32			
R52	SAME AS R11			
S1	SWITCH, TOGGLE SPST CONTACT ARRANGEMENT	SP4	60418	266-5064-000
S2	SWITCH, TOGGLE DPDT CONTACT ARRANGEMENT	MS24659-21D	96906	266-5065-000
T1	TRANSFORMER, AF OPEN FRAME, LEAD BROWN TO ORANGE 1.9K OHMS IMPEDANCE, LEAD YELLOW TO BLUE 600 OHMS IMPEDANCE, LEADS RED AND GREEN CENTER TAP, LEAD WHITE STATIC SHIELD	A16940	70674	677-0187-010
TP1	JACK, TIP WHITE	4877-125-9	17117	360-0434-100
TP2	SAME AS TP1			
TP3	SAME AS TP1			
TP4	JACK, TIP BLACK	11J1043	82389	360-0434-010

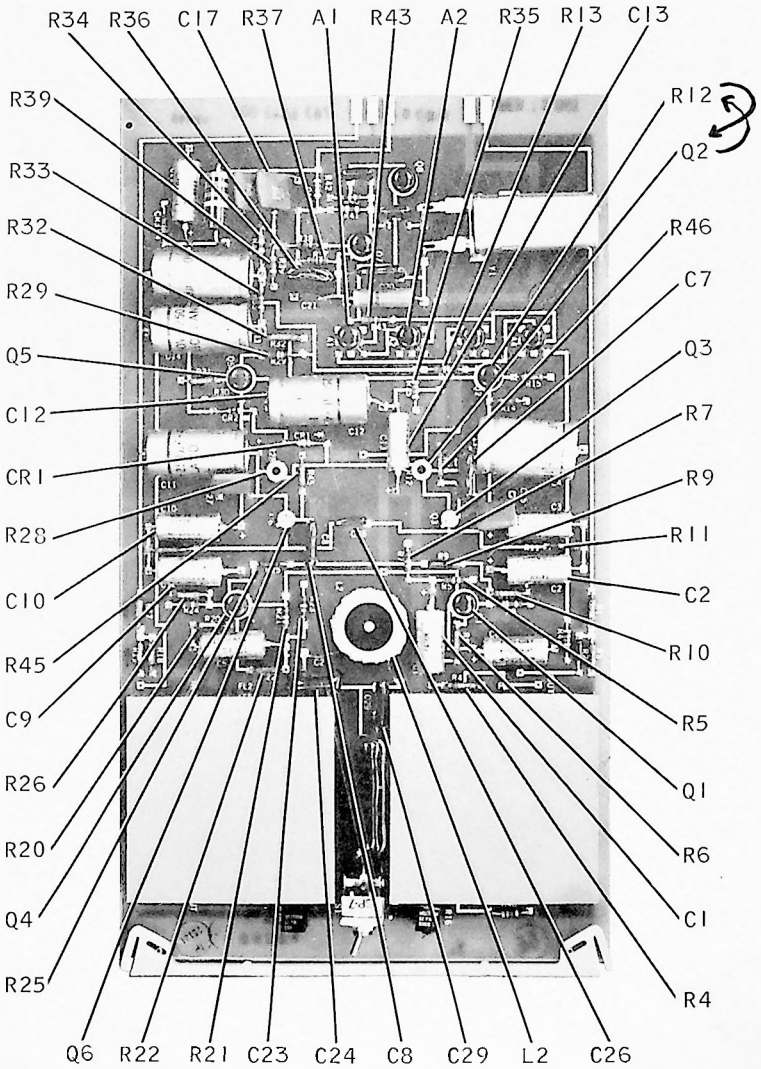

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Figure 6-3. Stereo Generator 786V-1 (Sheet 1 of 2).

A-2

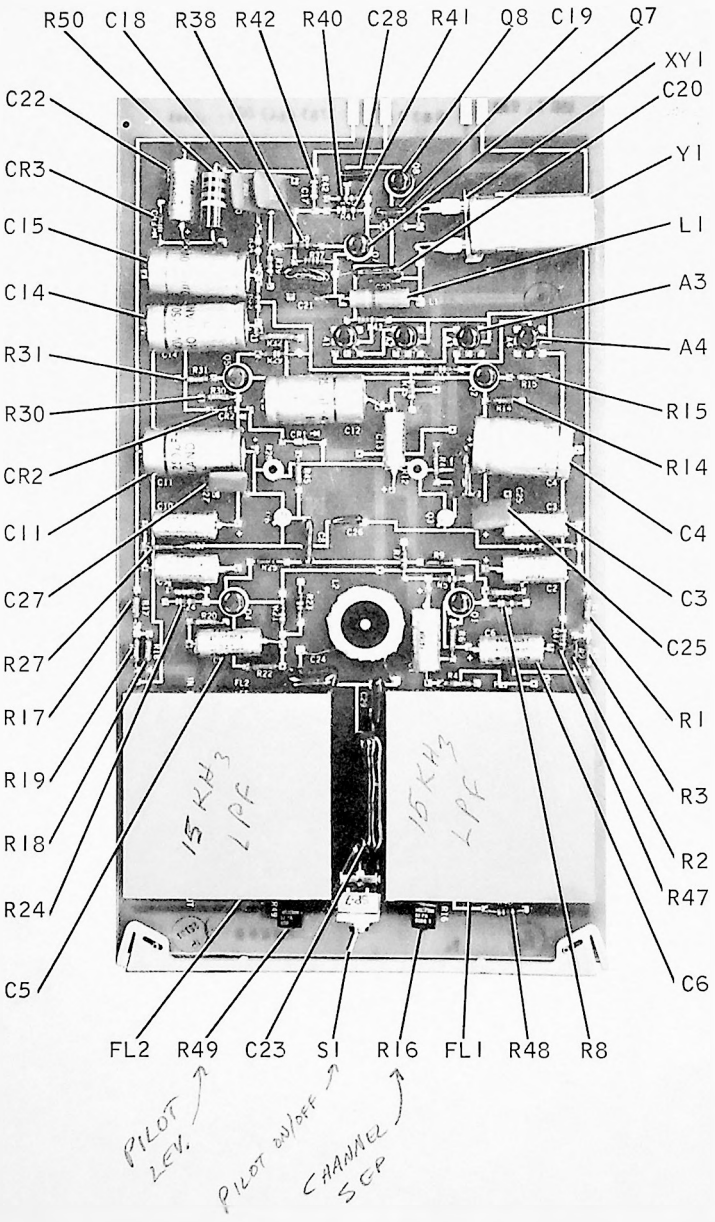

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Figure 6-3. Stereo Generator 786V-1 (Sheet 2 of 2).

A-2

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	STEREO GENERATOR 786V-1 A-2			772-5336-001
A1	INTERGRATED CIRCUIT	SL3977	07263	351-7121-010
A2	INTERGRATED CIRCUIT	SL3979	07263	351-7121-030
A3	SAME AS A2			
A4	SAME AS A1			
C1	CAPACITOR, FXD, ELECTROLYTIC 47 UF, 20% TOL, 35 VDCW	CS13BF476M	81349	184-6231-000
C2	SAME AS C1			
C3	SAME AS C1			
C4	CAPACITOR, FXD, ELECTROLYTIC 1000 UF, PLUS 50% MINUS 10%, 16 VDCW	C437ARE1000	73445	183-2355-090
C5	SAME AS C1			
C6	SAME AS C1			
C7	CAPACITOR, FXD, MICA 1000 UUF, 5% TOL, 500 VDCW	CM06F102J03	81349	912-3001-000
C8	SAME AS C7			
C9	SAME AS C1			
C10	SAME AS C1			
C11	SAME AS C4			
C12	CAPACITOR, FXD, ELECTROLYTIC 250 UF, PLUS 50% MINUS 10%, 40 VDCW	C437ARG250	73445	183-2355-150
C13	CAPACITOR, FXD, ELECTROLYTIC 22 UF, 20% TOL, 35 VDCW	CS13BF226M	81349	184-6225-000
C14	SAME AS C12			
C15	SAME AS C12			
C16	NOT USED			
C17	CAPACITOR, FXD, CERAMIC 2.2 UF, PLUS 80% MINUS 20%, 25 VDCW	5C15A	56289	913-3812-000
C18	SAME AS C17			
C19	CAPACITOR, FXD, MICA 33 UUF, 5% TOL, 500 VDCW	CM05E330J03	81349	912-2780-000
C20	CAPACITOR, FXD, MICA 820 UUF, 5% TOL, 500 VDCW	CM06F821J03	81349	912-2995-000
C21	CAPACITOR, FXD, MICA 3300 UUF, 5% TOL, 500 VDCW	CM06F332J03	81349	912-3040-000
C22	SAME AS C1			
C23	CAPACITOR, FXD, MICA 30,000 UUF, 1% TOL, 500 VDCW	CM08FD303F03	81349	912-3131-000
C24	CAPACITOR, FXD, MICA 3900 UUF, 1% TOL, 500 VDCW	CM06FD392F03	81349	912-3044-000
C25	SAME AS C17			
C26	SAME AS C19			
C27	SAME AS C17			
C28	CAPACITOR, FXD, MICA 47 UUF, 5% TOL, 500 VDCW	CM05F470J03	81349	912-2792-000
C29	CAPACITOR, FXD, MICA 1800 UUF, 2% TOL, 500 VDCW	CM06F182G03	81349	912-3018-000
CR1	SEMICONDUCTOR DEVICE, DIODE	1N914	07688	353-2906-000
CR2	SAME AS CR1			
CR3	SEMICONDUCTOR DEVICE, DIODE	1N747A	07688	353-2702-000
FL1	FILTER, LOW PASS 1500 HZ CENTER FREQUENCY			673-1167-010
FL2	SAME AS FL1			
L1	CHOKE, RF 6800 UH, 5% TOL	MS90541-07	96906	240-2560-000
L2	INDUCTOR, RF 2.055 MH			781-5329-001
Q1	TRANSISTOR	~~2N3642~~ 3693	07688	352-0713-030
Q2	SAME AS Q1			
Q3	TRANSISTOR	2N3153	12040	352-0776-010
Q4	SAME AS Q1			
Q5	SAME AS Q1			
Q6	SAME AS Q2			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
Q7	SAME AS Q1			
Q8	SAME AS Q1			
R1	RESISTOR, FXD, FILM 226 OHMS, 1% TOL, 1/8 WATT	RN55D2260F	81349	705-0965-00C
R2	SAME AS R1			
R3	RESISTOR, FXD, FILM 681 OHMS, 1% TOL, 1/8 WATT	RN55D6810F	81349	705-0988-00C
R4	RESISTOR, FXD, FILM 649 OHMS, 1% TOL, 1/8 WATT	RN55D6490F	81349	705-0987-CCC
R5	RESISTOR, FXD, COMPOSITION 22K OHMS, 10% TOL, 1/4 WATT	RC07GF223K	81349	745-0797-00C
R6	RESISTOR, FXD, FILM 100 OHMS, 1% TOL, 1/8 WATT	RN55D1000F	81349	705-0948-00C
R7	SAME AS R5			
R8	RESISTOR, FXD, COMPOSITION 3300 OHMS, 10 TOL, 1/4 WATT	RC07GF332K	81349	745-0767-CCC
R9	RESISTOR, FXD, FILM 10K OHMS, 1% TOL, 1/8 WATT	RN55D1002F	81349	705-1044-00C
R10	RESISTOR, FXD, FILM 464 OHMS, 1% TOL, 1/8 WATT	RN55D4640F	81349	705-C98C-00C
R11	RESISTOR, FXD, FILM 61.9 OHMS, 1% TOL, 1/8 WATT	RN55D61R9F	81349	705-C938-CCC
R12	RESISTOR, VAR, CERAMIC 1K OHMS, 30% TOL, 1/2 WATT	62PR1K	73138	382-C008-07C
R13	RESISTOR, FXD, COMPOSITION 120K OHMS, 10% TOL, 1/4 WATT	RC07GF124K	81349	745-0824-CCC
R14	RESISTOR, FXD, FILM 21.5K OHMS, 1% TOL, 1/8 WATT	RN55D2152F	81349	705-1C6C-CCC
R15	RESISTOR, FXD, FILM 348 OHMS, 1% TOL, 1/8 WATT	RN55D3480F	81349	705-0974-CCC
R16	RESISTOR, VAR, CERAMIC 10K OHMS, 30% TOL, 1/2 WATT	62PAR10K	73138	382-C008-44C
R17	RESISTOR, FXD, FILM 215 OHMS, 1% TOL, 1/8 WATT	RN55D2150F	81349	705-C964-CCC
R18	SAME AS R17			
R19	RESISTOR, FXD, FILM 715 OHMS, 1% TOL, 1/8 WATT	RN55D7150F	81349	705-0989-CCC
R20	SAME AS R4			
R21	SAME AS R5			
R22	SAME AS R6			
R23	SAME AS R5			
R24	SAME AS R8			
R25	SAME AS R9			
R26	SAME AS R10			
R27	SAME AS R11			
R28	SAME AS R12			
R29	SAME AS R13			
R30	SAME AS R14			
R31	SAME AS R15			
R32	RESISTOR, FXD, FILM 619 OHMS, 1% TOL, 1/4 WATT	RN60D6190F	81349	705-6586-CCC
R33	RESISTOR, FXD, COMPOSITION 560 OHMS, 10% TOL, 1/4 WATTS	RC07GF561K	81349	745-074C-CCC
R34	RESISTOR, FXD, COMPOSITION 56 OHMS, 10% TOL, 1/4 WATT	RC07GF560K	81349	745-0704-CCC
R35	RESISTOR, FXD, COMPOSITION 470 OHMS, 10% TOL, 1/4 WATT	RC07GF471K	81349	745-C737-CCC
R36	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/4 WATT	RC07GF103K	81349	745-0785-CCC

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R37	RESISTOR, FXD, COMPOSITION 68K OHMS, 10% TOL, 1/4 WATT	RC07GF683K	81349	745-0815-000
R38	RESISTOR, FXD, COMPOSITION 100 OHMS, 10% TOL, 1/4 WATT	RC07GF101K	81349	745-0713-000
R39	RESISTOR, FXD, COMPOSITION 820 OHMS, 10% TOL, 1/4 WATT	RC07GF821K	81349	745-0746-000
R40	RESISTOR, FXD, COMPOSITION 100K OHMS, 10% TOL, 1/4 WATT	RC07GF104K	81349	745-0821-000
R41	RESISTOR, FXD, COMPOSITION 3900 OHMS, 10% TOL, 1/4 WATT	RC07GF392K	81349	745-0770-000
R42	SAME AS R35			
R43	RESISTOR, FXD, COMPOSITION 680 OHMS, 10% TOL, 1/4 WATT	RC07GF681K	81349	745-0743-000
R44	NOT USED			
R45	RESISTOR, FXD, FILM 147 OHMS, 1% TOL, 1/8 WATT	RN5501470F	81349	705-0956-000
R46	SAME AS R45			
R47	SAME AS R35			
R48	RESISTOR, FXD, COMPOSITION 330 OHMS, 10% TOL, 1/4 WATT	RC07GF331K	81349	745-0731-000
R49	RESISTOR, VAR, CERAMIC 50 OHMS, 30% TOL, 1/2 WATT	62PAR50	73138	382-0008-370
R50	RESISTOR, FXD, COMPOSITION 180 OHMS, 10% TOL, 2 WATTS	RC42GF181K	81349	745-5621-000
S1	SWITCH, TOGGLE SPDT CONTACT ARRANGEMENT	SP7	60418	266-5059-000
XY1	SOCKET, CRYSTAL 2 CONTACTS	8000AG2	91506	292-0215-000
Y1	CRYSTAL UNIT, QUARTZ	289-7095-020	71034	289-7095-020

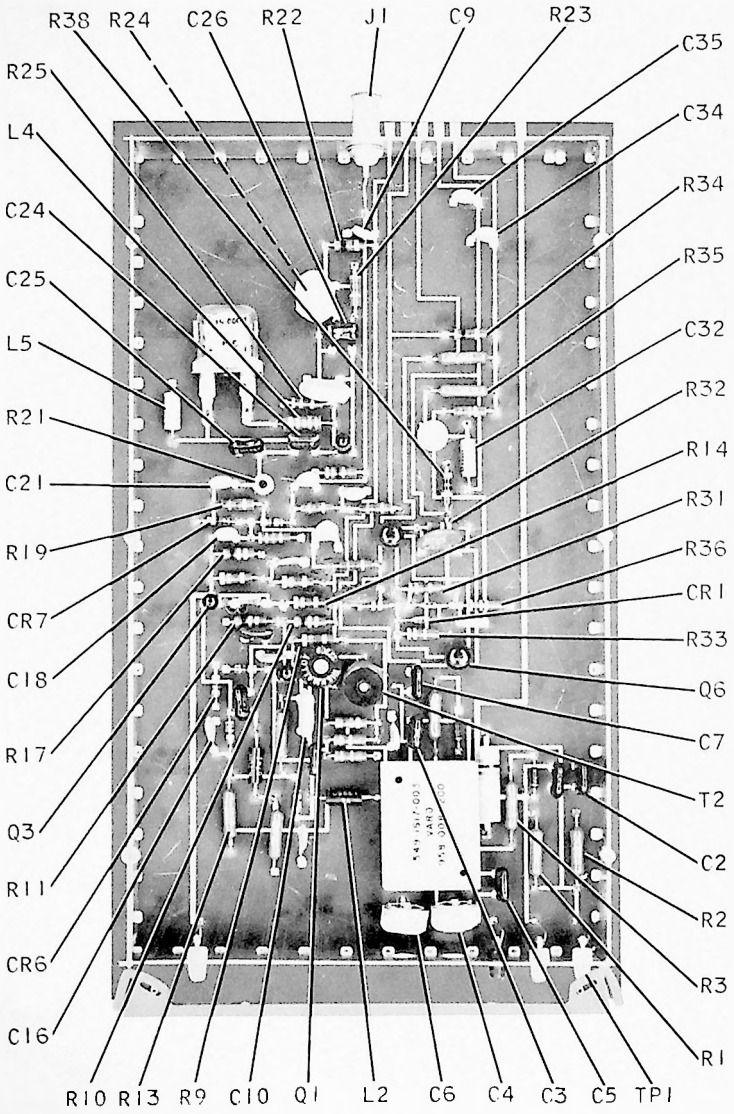

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Figure 6-4. AFC Discriminator (Sheet 1 of 2).

A-3

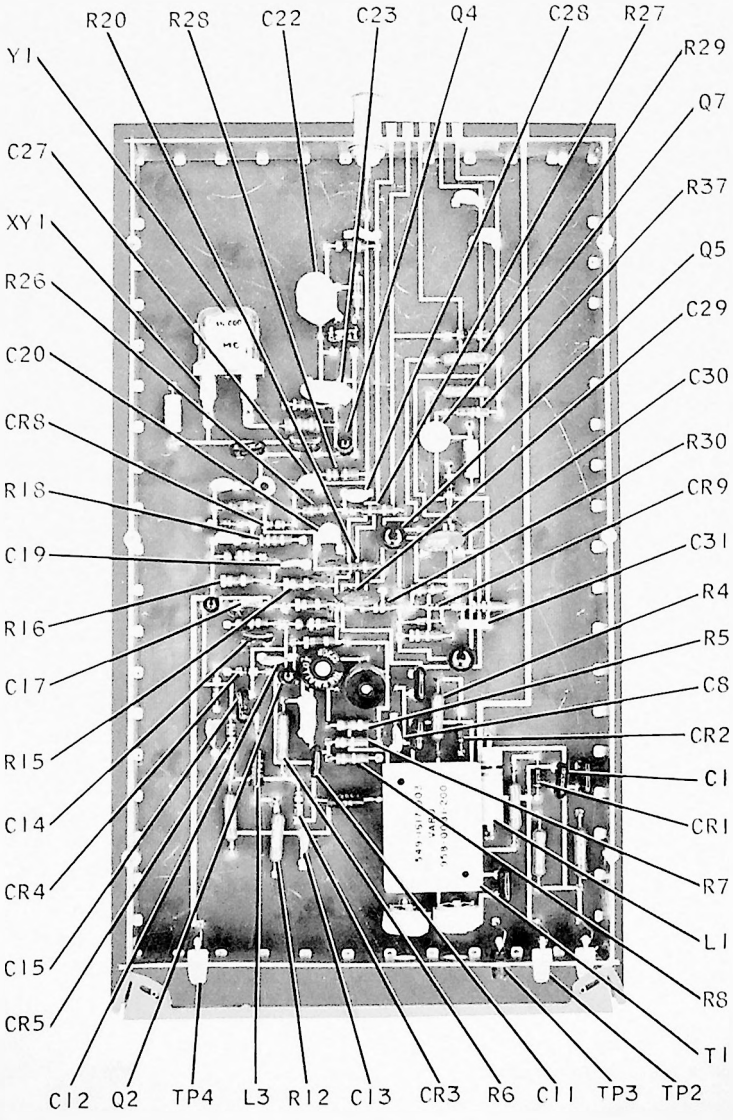

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Figure 6-4. AFC Discriminator (Sheet 2 of 2).

A-3

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	AFC DISCRIMINATOR A-3			774-7097-001
C1	CAPACITOR, FXD, MICA 470 UUF, 5% TOL, 300 VDCW	DM15F471J03	72136	912-2864-000
C2	SAME AS C1			
C3	CAPACITOR, FXD, MICA 220 UUF, 5% TOL, 500 VDCW	CM05F221J03	81349	912-2840-000
C4	CAPACITOR, VAR, CERAMIC 4-12 UUF, 350 VDCW	3192-000-COPO-15R	72982	917-1253-020
C5	CAPACITOR, FXD, MICA 22 UUF, 5% TOL, 500 VDCW	CM05E220J03	81349	912-2768-000
C6	CAPACITOR, VAR, CERAMIC 6-25 UUF, 350 VDCW	3192-000-COPO-32R	72982	917-1253-030
C7	CAPACITOR, FXD, MICA 75 UUF, 5% TOL, 500 VDCW	CM05ED750J03	81349	912-2807-000
C8	CAPACITOR, FXD, CERAMIC 0.01 UF, PLUS 80% MINUS 20%, 100 VDCW	805-014X5V0103Z	72982	913-3680-000
C9	SAME AS C8			
C10	CAPACITOR, FXD, CERAMIC 0.01 UF, PLUS 80% MINUS 20%, 50 VDCW	33C41	56289	913-3886-000
C11	SAME AS C5			
C12	SAME AS C8			
C13	SAME AS C8			
C14	CAPACITOR, FXD, MICA 82 UUF, 5% TOL, 500 VDCW	CM05E820J03	81349	912-2810-000
C15	CAPACITOR, FXD, MICA 10 UUF, 5% TOL, 500 VDCW	DM15C100J01	72136	912-2753-000
C16	SAME AS C8			
C17	SAME AS C8			
C18	CAPACITOR, FXD, CERAMIC 1000 UUF, 20% TOL, 500 VDCW	40C73A1	01939	913-3009-000
C19	SAME AS C8			
C20	SAME AS C18			
C21	SAME AS C18			
C22	SAME AS C10			
C23	SAME AS C10			
C24	CAPACITOR, FXD, MICA 68 UUF, 5% TOL, 500 VDCW	CM05E680J03	81349	912-2804-000
C25	CAPACITOR, FXD, MICA 510 UUF, 5% TOL, 300 VDCW	DM15F511J03	72136	912-2867-000
C26	CAPACITOR, FXD, MICA 180 UUF, 5% TOL, 500 VDCW	CM05F181J03	81349	912-2834-000
C27	SAME AS C18			
C28	SAME AS C18			
C29	CAPACITOR, FXD, CERAMIC 3300 UUF, 20% TOL, 500 VDCW	CK62AW332M	81349	913-1193-000
C30	SAME AS C29			
C31	CAPACITOR, FXD, CERAMIC 10,000 UUF, 20% TOL, 200 VDCW	CK06CW103M	81349	913-4001-000
C32	CAPACITOR, FXD, ELECTROLYTIC 2.2 UF, 10% TOL, 35 VDCW	CS12BF225K	81349	184-6077-000
C33	NOT USED			
C34	SAME AS C18			
C35	SAME AS C18			
CR1	SEMICONDUCTOR DEVICE, DIODE	FA2311U	07263	353-3593-010
CR2	SAME AS CR1			
CR3	SEMICONDUCTOR DEVICE, DIODE	1N270	07688	353-2018-000
CR4 THROUGH CR8	SAME AS CR3			
CR9	SEMICONDUCTOR DEVICE, DIODE	1N626	07688	353-2857-000
CR10	SAME AS CR9			
J1	CONNECTOR, ELECTRICAL 1 CONTACT	UG1051U	80058	357-9210-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
L1	CHOKE, RF 1000 UH, 10% TOL	LT7K209	81349	240-0193-000
L2	COIL, RF 6.8 UH, 5% TOL	13950	03550	240-1996-110
L3	COIL, RF 6.2 UH, 5% TOL	13949	03550	240-1996-100
L4	COIL, RF 3.3 UH, 10% TOL	C7307	42190	240-0065-000
L5	COIL, RF 4.7 UH, 10% TOL	LT4K042	81349	240-0145-000
Q1	TRANSISTOR	2N741	07688	352-0322-000
Q2	TRANSISTOR	2N4121	07688	352-0743-010
Q3	SAME AS Q2			
Q4	SAME AS Q2			
Q5	TRANSISTOR	2N3643	07688	352-0713-030
Q6	SAME AS Q5			
Q7	TRANSISTOR	2N491	07688	352-0116-000
R1	RESISTOR, FXD, FILM 6810 OHMS, 1% TOL, 1/2 WATT	RN65D6811F	81349	705-7136-000
R2	SAME AS R1			
R3	RESISTOR, FXD, FILM 110 OHMS, 1% TOL, 1/2 WATT	RN65D1100F	81349	705-7050-000
R4	SAME AS R3			
R5	RESISTOR, FXD, COMPOSITION 150 OHMS, 10% TOL, 1/2 WATT	RC20GF151K	81349	745-1317-000
R6	RESISTOR, FXD, FILM 261 OHMS, 1% TOL, 1/2 WATT	RN65D2610F	81349	705-7068-000
R7	RESISTOR, FXD, COMPOSITION 1800 OHMS, 10% TOL, 1/2 WATT	RC20GF182K	81349	745-1363-000
R8	SAME AS R7			
R9	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/2 WATT	RC20GF472K	81349	745-1380-000
R10	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/2 WATT	RC20GF103K	81349	745-1394-000
R11	SAME AS R10			
R12	RESISTOR, FXD, FILM 42.2 OHMS, 1% TOL, 1/2 WATT	RN65D42R2F	81349	705-7030-000
R13	RESISTOR, FXD, FILM 51.1 OHMS, 1% TOL, 1/2 WATT	RN65D51R1F	81349	705-7034-000
R14	SAME AS R9			
R15	SAME AS R9			
R16	SAME AS R9			
R17	SAME AS R10			
R18	RESISTOR, FXD, COMPOSITION 680 OHMS, 10% TOL, 1/2 WATT	RC20GF681K	81349	745-1345-000
R19	RESISTOR, FXD, COMPOSITION 2700 OHMS, 10% TOL, 1/2 WATT	RC20GF272K	81349	745-1370-000
R20	SAME AS R19			
R21	RESISTOR, VAR, CERMET 500 OHMS, 30% TOL, 1/2 WATT	62PR500	73138	382-0008-060
R22	RESISTOR, FXD, COMPOSITION 100 OHMS, 10% TOL, 1/2 WATT	RC20GF101K	81349	745-1310-000
R23	RESISTOR, FXD, COMPOSITION 8200 OHMS, 10% TOL, 1/2 WATT	RC20GF822K	81349	745-1391-000
R24	RESISTOR, FXD, COMPOSITION 18K OHMS, 5% TOL, 1/2 WATT	RC20GF183J	81349	745-1404-000
R25	RESISTOR, FXD, COMPOSITION 6800 OHMS, 10% TOL, 1/2 WATT	RC20GF682K	81349	745-1387-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R26	SAME AS R19			
R27	SAME AS R19			
R28	RESISTOR, FXD, COMPOSITION 68 OHMS, 10% TOL, 1/2 WATT	RC20GF680K	81349	745-1303-000
R29	RESISTOR, FXD, FILM 1.33K OHMS, 1% TOL, 1/2 WATT	RN65D1331F	81349	705-7102-000
R30	RESISTOR, FXD, COMPOSITION 15K OHMS, 10% TOL, 1/2 WATT	RC20GF153K	81349	745-1401-000
R31	RESISTOR, FXD, COMPOSITION 3300 OHMS, 10% TOL, 1/2 WATT	RC20GF332K	81349	745-1373-000
R32	SAME AS R30			
R33	SAME AS R31			
R34	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 1/2 WATT	RC20GF102K	81349	745-1352-000
R35	RESISTOR, FXD, FILM 56.2K OHMS, 1% TOL, 1/2 WATT	RN65D5622F	81349	705-7180-000
R36	RESISTOR, FXD, COMPOSITION 47K OHMS, 10% TOL, 1/2 WATT	RC20GF473K	81349	745-1422-000
R37	RESISTOR, FXD, COMPOSITION 220 OHMS, 10% TOL, 1/2 WATT	RC20GF221K	81349	745-1324-000
R38	RESISTOR, FXD, COMPOSITION 10 OHMS, 10% TOL, 1/2 WATT	RC20GF100K	81349	745-1268-000
T1	TRANSFORMER			549-1617-003
T2	TRANSFORMER			549-1589-002
TP1	JACK, TIP WHITE	SL490-458WHT	12615	306-2241-100
TP2	SAME AS TP1			
TP3	JACK, TIP BLACK	SL490-458BLK	12615	306-2241-010
TP4	SAME AS TP1			
XY1	SOCKET, CRYSTAL	8000AG2	91506	292-0215-000
Y1	CRYSTAL UNIT, QUARTZ 14 MHZ FREQUENCY RANGE	S289-2743-00	94148	289-2743-000

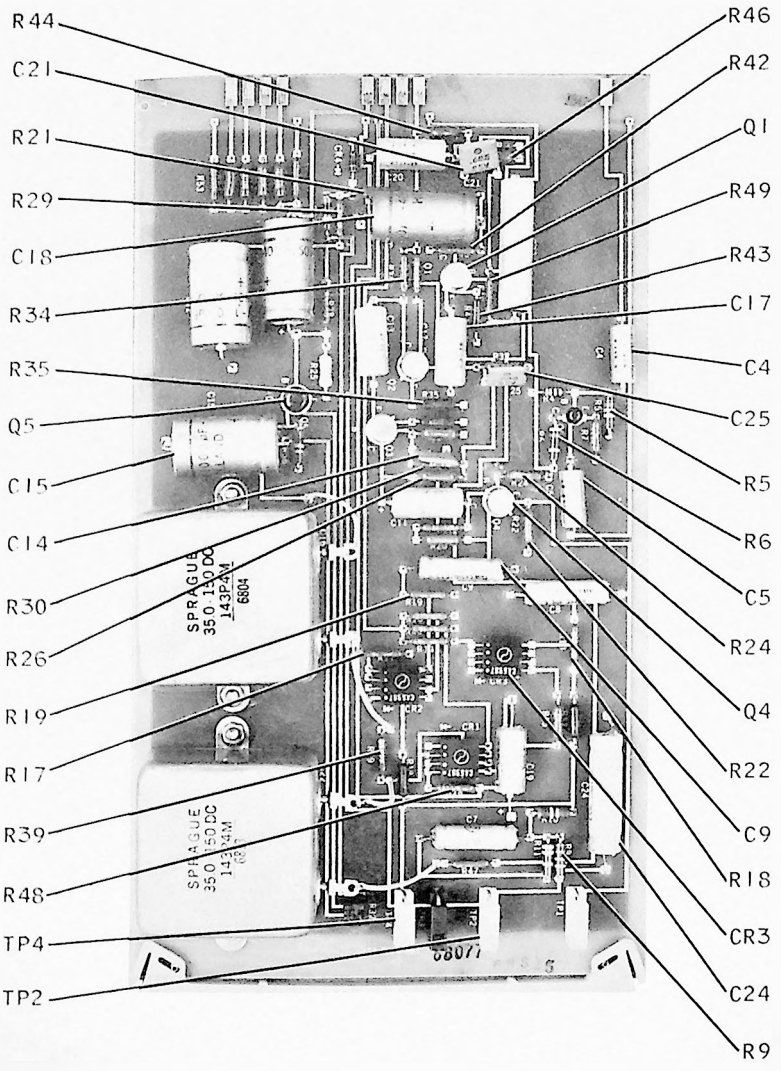

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Figure 6-5. AFC Synchronous Detector (Sheet 1 of 2).

A-4

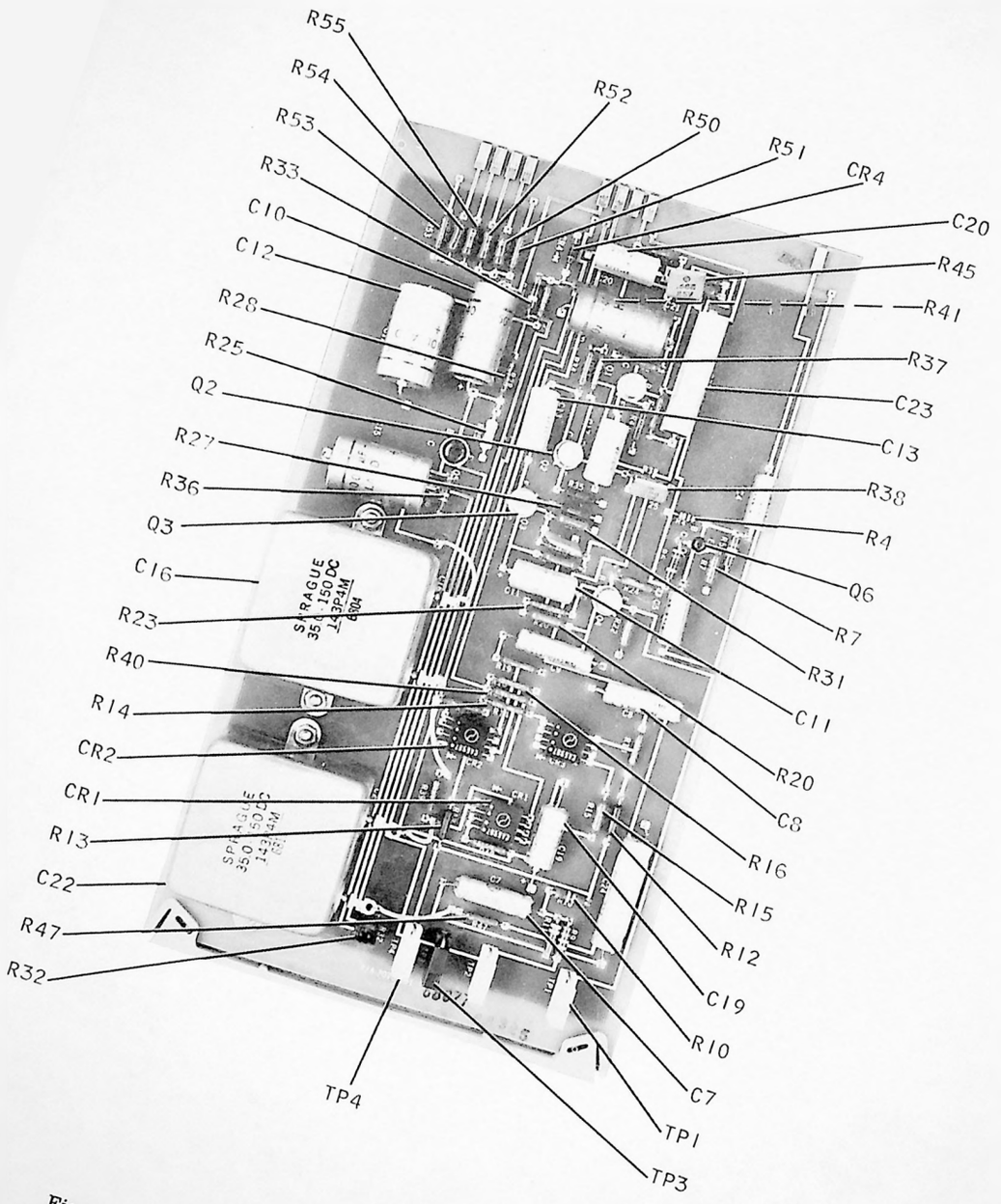

Figure 6-5. AFC Synchronous Detector (Sheet 2 of 2).

A-4

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	AFC SYNCHRONOUS DETECTOR A-4			774-7075-001
C1	NOT USED			
C2	NOT USED			
C3	NOT USED			
C4	CAPACITOR, FXD, ELECTROLYTIC 15 UF, 20% TOL, 35 VDCW	CS13BF156M	81349	184-6222-000
C5	SAME AS C4			
C6	NOT USED			
C7	CAPACITOR, FXD, ELECTROLYTIC 2 UF, 20% TOL, 75 VDCW	CL378L020MN3	81349	184-7929-000
C8	CAPACITOR, FXD, ELECTROLYTIC 5.5 UF, 20% TOL, 30 VDCW	CL378N5R5MN3	81349	184-7918-000
C9	SAME AS C8			
C10	CAPACITOR, FXD, ELECTROLYTIC 250 UF, PLUS 50% MINUS 10%, 40 VDCW	C437ARG250	73445	183-2355-150
C11	CAPACITOR, FXD, ELECTROLYTIC 100 UF, 20% TOL, 20 VDCW	CS13BE107M	81349	184-6190-000
C12	CAPACITOR, FXD, ELECTROLYTIC 1000 UF, PLUS 50% MINUS 10%, 16 VDCW	C437ARE1000	73445	183-2355-090
C13	SAME AS C11			
C14	CAPACITOR, FXD, CERAMIC 0.68 UF, PLUS 80% MINUS 20%, 25 VDCW	5C12A	56289	913-3809-000
C15	SAME AS C12			
C16	CAPACITOR, FXD, PAPER 35 UF, 20% TOL, 150 VDCW	143P4M	56289	951-2003-000
C17	SAME AS C11			
C18	SAME AS C10			
C19	CAPACITOR, FXD, ELECTROLYTIC 220 UF, 20% TOL, 10 VDCW	CS13BC227M	81349	184-6154-000
C20	SAME AS C11			
C21	SAME AS C14			
C22	SAME AS C16			
C23	CAPACITOR, FXD, ELECTROLYTIC 100 UF, PLUS 100% MINUS 10%, 10 VDCW	S13691	56289	183-2151-000
C24	CAPACITOR, FXD, ELECTROLYTIC 20 UF, 20% TOL, 25 VDCW	CL378G200MN3	81349	184-7258-000
C25	SAME AS C14			
CR1	SEMICONDUCTOR DEVICE, DIODE	FA40C0	07263	353-3271-000
CR2	SAME AS CR1			
CR3	SAME AS CR1			
CR4	SEMICONDUCTOR DEVICE, DIODE	1N718	07688	353-2734-000
Q1	TRANSISTOR	2N1613	07688	352-0349-000
Q2	SAME AS Q1			
Q3	SAME AS Q1			
Q4	SAME AS Q1			
Q5	TRANSISTOR	2N4250	07263	352-0773-030
Q6	TRANSISTOR	2N3565	07688	352-0638-010
R1	NOT USED			
R2	NOT USED			
R3	NOT USED			
R4	RESISTOR, FXD, COMPOSITION 330K OHMS, 10% TOL, 1/4 WATT	RC07GF334K	81349	745-0839-000
R5	RESISTOR, FXD, COMPOSITION 27K OHMS, 10% TOL, 1/2 WATT	RC20GF273K	81349	745-1412-000
R6	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/2 WATT	RC20GF472K	81349	745-1380-000
R7	RESISTOR, FXD, FILM 287 OHMS, 1% TOL, 1/8 WATT	RN60C2870F	81349	705-6260-000
R8	NOT USED			
R9	RESISTOR, FXD, COMPOSITION 180K OHMS, 10% TOL, 1/2 WATT	RC20GF184K	81349	745-1447-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R10	RESISTOR, FXD, COMPOSITION 120K OHMS, 10% TOL, 1/2 WATT	RC20GF124K	81349	745-1440-000
R11	RESISTOR, FXD, COMPOSITION 27K OHMS, 10% TOL, 1/2 WATT	RC20GF273K	81349	745-1412-000
R12	RESISTOR, FXD, FILM 100K OHMS, 1% TOL, 1/4 WATT	RN60D1003F	81349	705-6692-000
R13	SAME AS R12			
R14	RESISTOR, FXD, FILM 9090 OHMS, 1% TOL, 1/4 WATT	RN60D9091F	81349	705-6642-000
R15	RESISTOR, FXD, FILM 8250 OHMS, 1% TOL, 1/4 WATT	RN60D8251F	81349	705-6640-000
R16	RESISTOR, FXD, FILM 5620 OHMS, 1% TOL, 1/4 WATT	RN60D5621F	81349	705-6632-000
R17	SAME AS R14			
R18	RESISTOR, FXD, FILM 2870 OHMS, 1% TOL, 1/4 WATT	RN60D2871F	81349	705-6618-000
R19	SAME AS R18			
R20	RESISTOR, FXD, FILM 1470 OHMS, 1% TOL, 1/4 WATT	RN60D1471F	81349	705-6604-000
R21	RESISTOR, FXD, COMPOSITION 820 OHMS, 10% TOL, 1/2 WATT	RC20GF821K	81349	745-1349-000
R22	SAME AS R20			
R23	RESISTOR, FXD, FILM 38.3K OHMS, 1% TOL, 1/4 WATT	RN60D3832F	81349	705-6672-000
R24	RESISTOR, FXD, FILM 19.6K OHMS, 1% TOL, 1/4 WATT	RN60D1962F	81349	705-6658-000
R25	RESISTOR, FXD, FILM 31.6K OHMS, 1% TOL, 1/4 WATT	RN60D3162F	81349	705-6668-000
R26	RESISTOR, FXD, FILM 7500 OHMS, 1% TOL, 1/4 WATT	RN60D7501F	81349	705-6638-000
R27	RESISTOR, FXD, FILM 422 OHMS, 1% TOL, 1/4 WATT	RN60D4220F	81349	705-6578-000
R28	RESISTOR, FXD, FILM 2610 OHMS, 1% TOL, 1/4 WATT	RN60D2611F	81349	705-6616-000
R29	RESISTOR, FXD, FILM 3160 OHMS, 1% TOL, 1/4 WATT	RN60D3161F	81349	705-6620-000
R30	RESISTOR, FXD, FILM 196K OHMS, 1% TOL, 1/4 WATT	RN60D1963F	81349	705-6706-000
R31	RESISTOR, FXD, FILM 14.7K, 1% TOL, 1/4 WATT	RN60D1472F	81349	705-6652-000
R32	RESISTOR, VAR 1K OHMS, 30% TOL, 1/2 WATT	62PAR1K	73138	382-0008-410
R33	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 1/2 WATT	RC20GF102K	81349	745-1352-000
R34	SAME AS R26			
R35	SAME AS R27			
R36	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/2 WATT	RC20GF103	81349	745-1394-000
R37	SAME AS R30			
R38	SAME AS R31			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R39	RESISTOR, FXD, FILM 34.8K OHMS, 1% TOL, 1/4 WATT	RN60D3482F	81349	705-6670-000
R40	RESISTOR, FXD, FILM 3480 OHMS, 1% TOL, 1/4 WATT	RN60D3481F	81349	705-6622-000
R41	RESISTOR, FXD, FILM 2150 OHMS, 1% TOL, 1/4 WATT	RN60D2151F	81349	705-6612-000
R42	SAME AS R26			
R43	SAME AS R27			
R44	RESISTOR, FXD, FILM 10K OHMS, 1% TOL, 1/4 WATT	RN60D1002F	81349	705-6644-000
R45	RESISTOR, FXD, FILM 178K OHMS, 1% TOL, 1/4 WATT	RN60D1783F	81349	705-6704-000
R46	SAME AS R31			
R47	SAME AS R39			
R48	RESISTOR, FXD, FILM 4640 OHMS, 1% TOL, 1/4 WATT	RN60D4641F	81349	705-6628-000
R49	SAME AS R39			
R50	RESISTOR, FXD, FILM 5110 OHMS, 1% TOL, 1/4 WATT	RN60D5111F	81349	705-6630-000
R51	RESISTOR, FXD, FILM 1330 OHMS, 1% TOL, 1/4 WATT	RN60D1331F	81349	705-6602-000
R52	SAME AS R50			
R53	SAME AS R51			
R54	SAME AS R50			
R55	SAME AS R50			
TP1	JACK, TIP WHITE	4877-125-9	17117	360-0434-100
TP2	SAME AS TP1			
TP3	JACK, TIP BLACK	4877-125-0	17117	360-0434-010
TP4	SAME AS TP1			

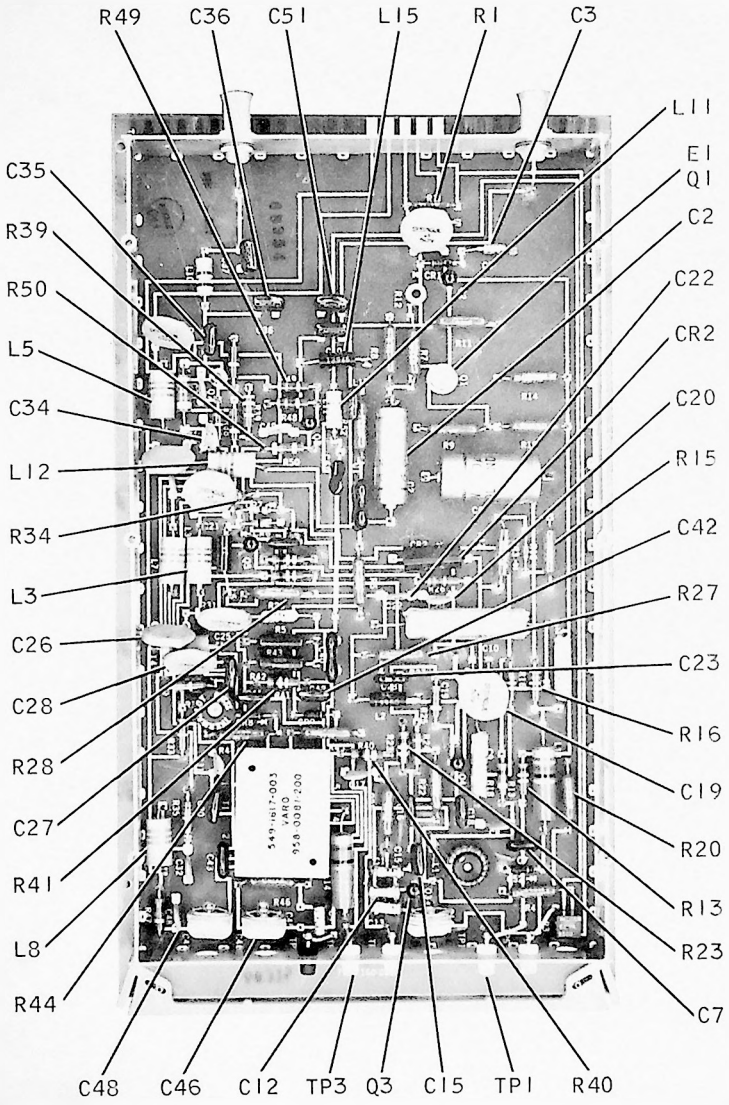

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Figure 6-6. FM Modulator (Sheet 1 of 3).

A-5

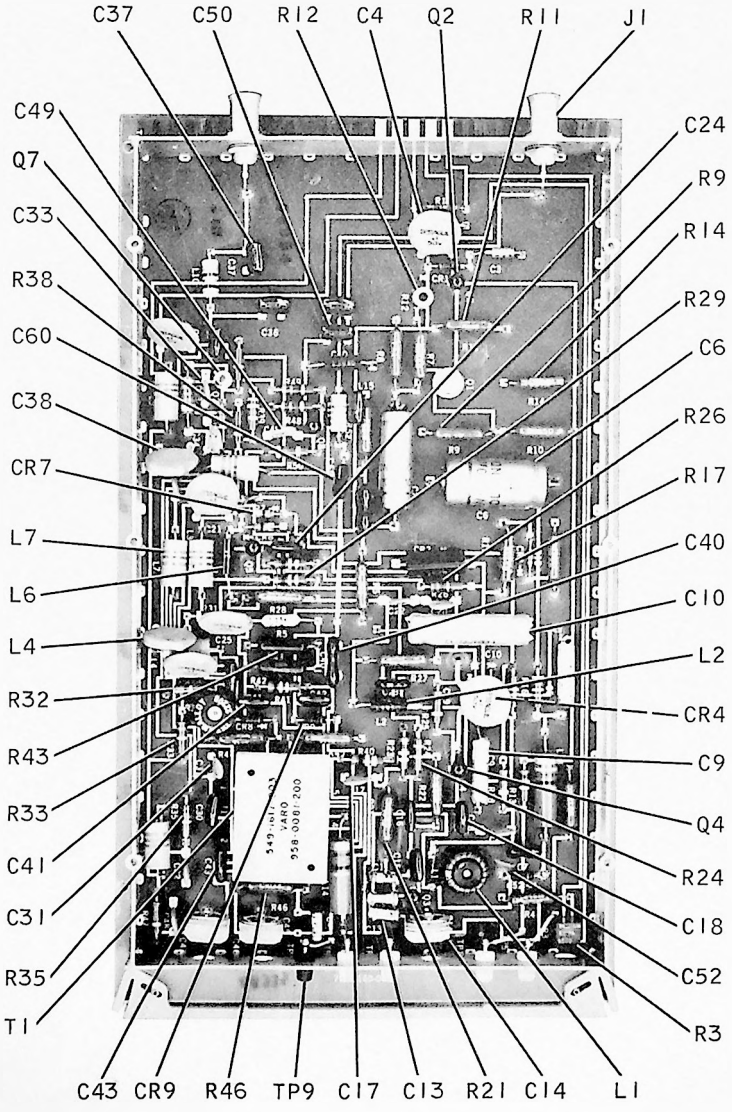

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Figure 6-6. FM Modulator (Sheet 2 of 3).

A-5

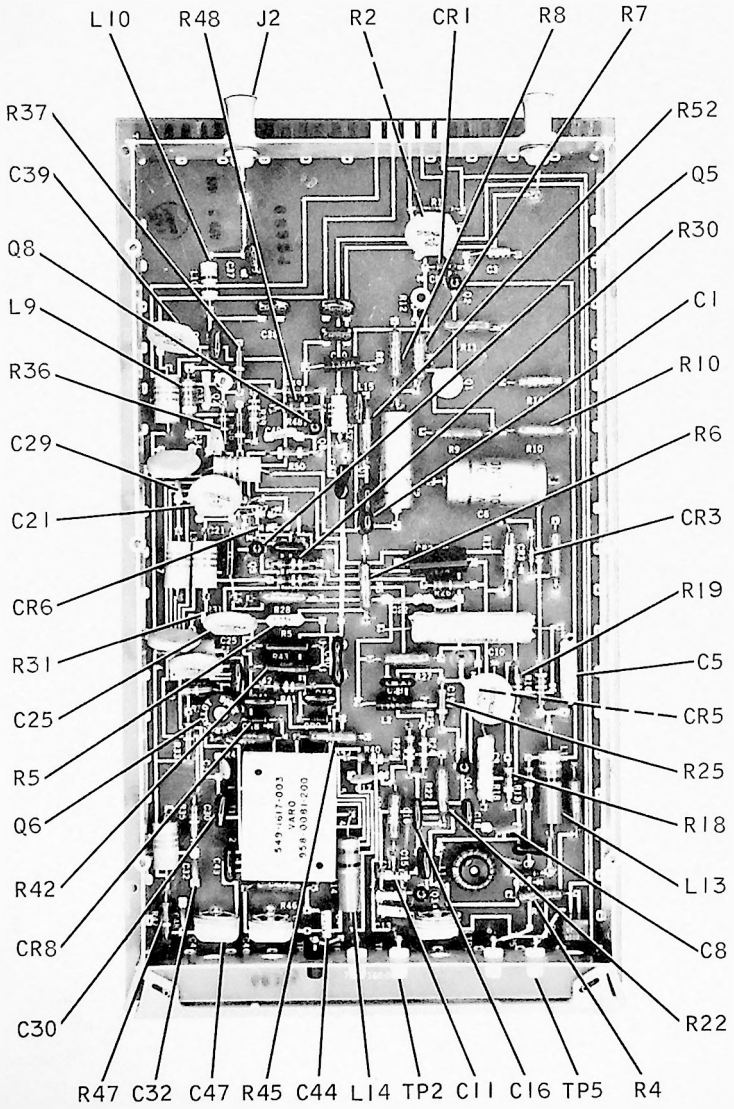

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Figure 6-6. FM Modulator (Sheet 3 of 3).

A.5

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	FM MODULATOR A-5			774-7160-001
C1	CAPACITOR, FXD, MICA 2200 UUF, 5% TOL, 500 VDCW	CM06F222J03	81349	912-3025-000
C2	CAPACITOR, FXD, ELECTROLYTIC 100 UF, PLUS 50% MINUS 10% 40 VDCW	C437ARG100	73445	183-2355-140
C3	CAPACITOR, FXD, ELECTROLYTIC 1 UF, 10% TOL, 35 VDCW	CS12BF105K	81349	184-6071-000
C4	CAPACITOR, FXD, CERAMIC 0.01 UF, PLUS 80% MINUS 20%, 50 VDCW	33C41	56289	913-3886-000
C5	CAPACITOR, FXD, ELECTROLYTIC 1 UF, PLUS 50% MINUS 15%, 150 VDCW	CL25BQ010SP3	81349	184-7227-000
C6	CAPACITOR, FXD, ELECTROLYTIC 250 UF, PLUS 50% MINUS 10%, 40 VDCW	C437ARG250	73445	183-2355-150
C7	CAPACITOR, FXD, MICA 100 UUF, 5% TOL, 500 VDCW	CM05F101J03	81349	912-2816-000
C8	CAPACITOR, FXD, CERAMIC 0.01 UF, PLUS 80% MINUS 20%, 100 VDCW	805-014X5V0103Z	72982	913-3680-000
C9	CAPACITOR, FXD, ELECTROLYTIC 0.5 UF, PLUS 50% MINUS 15% TOL, 75 VDCW	CL378L0R5MN3	81349	184-7220-000
C10	CAPACITOR, FXD, ELECTROLYTIC 20 UF, PLUS 75% MINUS 20%, 25 VDCW	CL378G200MN3	81349	184-7258-000
C11	CAPACITOR, FXD, CERAMIC 20 UUF, 2% TOL, 500 VDCW	CC20SH200G	81349	916-0362-000
C12	CAPACITOR, FXD, CERAMIC 20 UUF, 2% TOL, 500 VDCW	CC20SH200G	81349	916-0362-000
C13	CAPACITOR, FXD, CERAMIC 10 UUF, 1/4% TOL, 500 VDCW	CC20UJ100C	81349	916-0412-000
C14	CAPACITOR, VAR, CERAMIC 625 UUF, 350 VDCW	3192-000C0P0-32R	72989	917-1253-030
C15	CAPACITOR, FXD, MICA 68 UUF, 5% TOL, 500 VDCW	CM05E680J03	81349	912-2804-000
C16	SAME AS C15			
C17	SAME AS C8			
C18	CAPACITOR, FXD, MICA 220 UUF, 5% TOL, 500 VDCW	CM05F221J03	81349	912-2840-000
C19	SAME AS C4			
C20	SAME AS C8			
C21	SAME AS C4			
C22	SAME AS C8			
C23	CAPACITOR, FXD, MICA 10 UUF, 5% TOL, 500 VDCW	DM15C100J01	72136	912-2753-000
C24	CAPACITOR, FXD, MICA 82 UUF, 5% TOL, 500 VDCW	CM05E820J03	81349	912-2810-000
C25	SAME AS C4			
C26	SAME AS C4			
C27	CAPACITOR, FXD, MICA 22 UUF, 5% TOL, 500 VDCW	CM05E220J03	81349	912-2768-000
C28	SAME AS C4			
C29	SAME AS C8			
C30	SAME AS C15			
C31	CAPACITOR, FXD, CERAMIC 1000 UUF, 20% TOL, 1000 VDCW	CK604W102M	81349	913-1186-000
C32	SAME AS C8			
C33	SAME AS C8			
C34	SAME AS C8			
C35	CAPACITOR, FXD, MICA 39 UUF, 5% TOL, 500 VDCW	CM05E390J03	81349	912-2786-000
C36	CAPACITOR, FXD, MICA 150 UUF, 5% TOL, 500 VDCW	CM05F151J03	81349	912-2828-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
C37	SAME AS C36			
C38	SAME AS C4			
C39	SAME AS C4			
C40	CAPACITOR, FXD, MICA 560 UUF, 5% TOL, 500 VDCW	CM06F561J03	81349	912-2983-000
C41	CAPACITOR, FXD, MICA 33 UUF, 5% TOL, 500 VDCW	CM05E330J03	81349	912-2780-000
C42	SAME AS C41			
C43	SAME AS C18			
C44	SAME AS C11			
C45	NOT USED			
C46	CAPACITOR, VAR, CERAMIC 4-12 UUF, 300 VDCW	3192-000C0P0-20R	72982	917-1253-020
C47	SAME AS C14			
C48	SAME AS C8			
C49	SAME AS C8			
C50	SAME AS C27			
C51	CAPACITOR, FXD, MICA 270 UUF, 5% TOL, 500 VDCW	CM05F271J03	81349	912-2846-000
C52	SEMICONDUCTOR DEVICE, DIODE	1N5146A	07688	922-6095-160
C53 THROUGH C59	NOT USED			
C60	SAME AS C24			
CR1	SEMICONDUCTOR DEVICE, DIODE	1N751A	07688	353-2710-000
CR2	SEMICONDUCTOR DEVICE, DIODE	SV3173	03877	353-3304-000
CR3	SEMICONDUCTOR DEVICE, DIODE	1N626	07688	353-2857-000
CR4	SEMICONDUCTOR DEVICE, DIODE	1N270	07688	353-2018-000
CR5	SAME AS CR4			
CR6	SAME AS CR4			
CR7	SAME AS CR4			
CR8	SEMICONDUCTOR DEVICE, DIODE	FA2311U	07263	353-3593-010
CR9	SAME AS CR8			
E1	HEATSINK	22208	13103	352-9950-060
J1	CONNECTOR, ELECTRICAL 1 CONTACT	UG1051U	09408	357-9210-000
J2	SAME AS J1			
L1	INDUCTOR, RF 2.4 UH, 2% TOL	526-6799-00	95105	240-1529-000
L2	COIL, RF 6.8 UH, 5% TOL	13950	03550	240-1996-110
L3	COIL, RF 220 UH, 5% TOL	HS217	99800	240-0198-000
L4	SAME AS L3			
L5	SAME AS L3			
L6	COIL, RF 2.4 UH, 5% TOL	13949	03550	240-1996-100
L7	SAME AS L3			
L8	SAME AS L3			
L9	COIL, RF 4.3 UH, 5% TOL	13946	03550	240-1996-030
L10	COIL, RF 1 UH, 10% TOL	LT4K034	81349	240-0062-000
L11	SELECT L11 FROM THE FOLLOWING LIST			
L11	COIL, RF 1.5 UH, 10% TOL	LT4K036	81349	240-0063-000
	INDUCTOR, RF 2.4 UH, 2% TOL	526-6799-00	95105	240-1529-000
	COIL, RF 82 UH, 10% TOL	LT7K208		240-0192-000
L12	SAME AS L3			
L13	COIL, RF 82 UH, 10% TOL	LT7K208	81349	240-0192-000
L14	COIL, RF 56 UH, 10% TOL	LT7K207	81349	240-0191-000
L15	COIL, RF 6.2 UH, 10% TOL	13956	03550	240-1996-070
Q1	TRANSISTOR	S4639	07263	352-0373-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
Q2	TRANSISTOR	2N4121	07688	352-0743-010
Q3	SAME AS Q2			
Q4	SAME AS Q2			
Q5	SAME AS Q2			
Q6	TRANSISTOR	MM2181	04713	352-0322-000
Q7	SAME AS Q6			
Q8	SAME AS Q2			
R1	RESISTOR, FXD, FILM 12.1K OHMS, 1% TOL, 1/4 WATT	RN60D1212F	81349	705-6648-000
R2	RESISTOR, FXD, COMPOSITION 680 OHMS, 10% TOL, 1/2 WATT	RC20GF681K	81349	745-1345-000
R3	RESISTOR, VAR, CERAMIC 500 OHMS, 30% TOL, 1/2 WATT	62PAR500	73138	382-0008-400
R4	RESISTOR, FXD, FILM 348 OHMS, 1% TOL, 1/2 WATT	RN65D3480F	81349	705-7074-000
R5	SELECT R5 FROM THE FOLLOWING LIST			
	RESISTOR, FXD, FILM 3480 OHMS, 1% TOL, 1/2 WATT	RN65D3481F	81349	705-7122-000
	RESISTOR, FXD, FILM 4220 OHMS, 1% TOL, 1/2 WATT	RN65D4221F	81349	705-7126-000
	RESISTOR, FXD, FILM 5110 OHMS, 1% TOL, 1/2 WATT	RN65D5111F	81349	705-7130-000
	RESISTOR, FXD, FILM 10K OHMS, 1% TOL, 1/2 WATT	RN65D1002F	81349	705-7144-000
R6	RESISTOR, FXD, FILM 1210 OHMS, 1% TOL, 1/2 WATT	RN65D1211F	81349	705-7100-000
R7	RESISTOR, FXD, FILM 100K OHMS, 1% TOL, 1/2 WATT	RN65D1003F	81349	705-7192-000
R8	RESISTOR, FXD, FILM 7.5K OHMS, 1% TOL, 1/2 WATT	RN65D7501F	81349	705-7138-000
R9	RESISTOR, FXD, FILM 316 OHMS, 1% TOL, 1/2 WATT	RN65D3160F	81349	705-7072-000
R10	RESISTOR, FXD, FILM 13.3K OHMS, 1% TOL, 1/2 WATT	RN65D1332F	81349	705-7150-000
R11	RESISTOR, FXD, FILM 5110 OHMS, 1% TOL, 1/2 WATT	RN65D5111F	81349	705-7130-000
R12	RESISTOR, VAR, CERAMIC 50K, 30% TOL, 1/2 WATT	62PR50K	73138	382-0008-130
R13	RESISTOR, FXD, COMPOSITION 100K OHMS, 10% TOL, 1/2 WATT	RC20GF104K	81349	745-1436-000
R14	RESISTOR, FXD, FILM 2870 OHMS, 1% TOL, 1/2 WATT	RN65D2871F	81349	705-7118-000
R15	RESISTOR, FXD, FILM 19K OHMS, 1% TOL, 1/2 WATT	RN65D1902F	81349	705-7158-000
R16	RESISTOR, FXD, COMPOSITION 47K OHMS, 10% TOL, 1/2 WATT	RC20GF473K	81349	745-1422-000
R17	SELECT R17 FROM THE FOLLOWING LIST			
	RESISTOR, FXD, FILM 1K OHMS, 1% TOL, 1/2 WATT	RN65D1001F	81349	705-7096-000
	RESISTOR, FXD, FILM 1960 OHMS, 1% TOL, 1/2 WATT	RN65D1961F	81349	705-7110-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	RESISTOR, FXD, FILM 3160 OHMS, 1% TOL, 1/2 WATT	RN65D3161F	81349	705-7120-000
	RESISTOR, FXD, FILM 4220 OHMS, 1% TOL, 1/2 WATT	RN65D4221F	81349	705-7126-000
R18	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 1/2 WATT	RC20GF102K	81349	745-1352-000
R19	RESISTOR, FXD, COMPOSITION 27K OHMS, 10% TOL, 1/2 WATT	RC20GF273K	81349	745-1412-000
R20	RESISTOR, FXD, FILM 21.5K OHMS, 1% TOL, 1/2 WATT	RN65D2152F	81349	705-7160-000
R21	RESISTOR, FXD, FILM 12.1K OHMS, 1% TOL, 1/2 WATT	RN65D1212F	81349	705-7148-000
R22	RESISTOR, FXD, FILM 2610 OHMS, 1% TOL, 1/2 WATT	RN65D2611F	81349	705-7116-000
R23	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/2 WATT	RC20GF103K	81349	745-1394-000
R24	RESISTOR, FXD, COMPOSITION 5600 OHMS, 10% TOL, 1/2 WATT	RC20GF562K	81349	745-1384-000
R25	RESISTOR, FXD, COMPOSITION 1500 OHMS, 10% TOL, 1/2 WATT	RC20GF152K	81349	745-1359-000
R26	RESISTOR, FXD, COMPOSITION 1800 OHMS, 10% TOL, 1/2 WATT	RC20GF182K	81349	745-1363-000
R27	RESISTOR, FXD, FILM 51.1 OHMS, 1% TOL, 1/2 WATT	RN65D51R1F	81349	705-7034-000
R28	RESISTOR, FXD, FILM 42.2 OHMS, 1% TOL, 1/4 WATT	RN65D42R2F	81349	705-7030-000
R29	SAME AS R23			
R30	SAME AS R23			
R31	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/2 WATT	RC20GF472K	81349	745-1380-000
R32	SAME AS R26			
R33	SAME AS R26			
R34	RESISTOR, FXD, FILM 261 OHMS, 1% TOL, 1/2 WATT	RN65D2610F	81349	705-7068-000
R35	RESISTOR, FXD, FILM 220 OHMS, 10% TOL, 1/2 WATT	RC20GF221K	81349	745-1324-000
R36	SAME AS R26			
R37	RESISTOR, FXD, COMPOSITION 2200 OHMS, 10% TOL, 1/2 WATT	RC20GF222K	81349	745-1366-000
R38	RESISTOR, FXD, COMPOSITION 22 OHMS, 10% TOL, 1/2 WATT	RC20GF220K	81349	745-1282-000
R39	RESISTOR, FXD, COMPOSITION 390 OHMS, 10% TOL, 1/2 WATT	RC20GF391K	81349	745-1335-000
R40	SAME AS R13			
R41	SAME AS R13			
R42	RESISTOR, FXD, FILM 1100 OHMS, 1% TOL, 1/2 WATT	RN65D1101F	81349	705-7098-000
R43	SAME AS R42			
R44	RESISTOR, FXD, FILM 1960 OHMS, 1% TOL, 1/2 WATT	RN65D1961F	81349	705-7110-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R45	SAME AS R44			
R46	RESISTOR, FXD, FILM 8250 OHMS, 1% TOL, 1/2 WATT	RN65D8251F	81349	705-7140-000
R47	RESISTOR, FXD, COMPOSITION 150 OHMS, 10% TOL, 1/2 WATT	RC20GF151K	81349	745-1317-000
R48	RESISTOR, FXD, COMPOSITION 6800 OHMS, 10% TOL, 1/2 WATT	RC20GF682K	81349	745-1387-000
R49	SAME AS R48			
R50	SAME AS R31			
R51	NOT USED			
R52	RESISTOR, FXD, FILM 68.1 OHMS, 1% TOL, 1/2 WATT	RN65D68R1F	81349	705-7040-000
T1	TRANSFORMER			549-1617-003
TP1	JACK, TIP WHITE	SL490-458	12615	306-2241-100
TP2	SAME AS TP1			
TP3	SAME AS TP1			
TP4	JACK, TIP BLACK	SL490-468	12615	306-2241-010
TP5	SAME AS TP1			

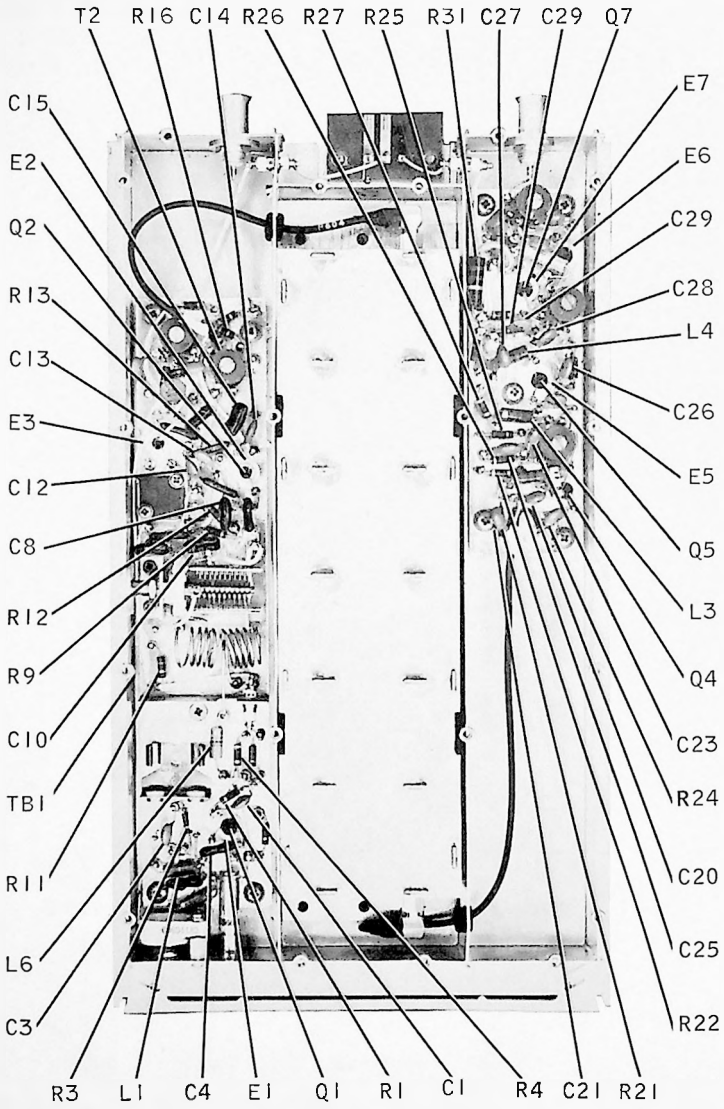

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Figure 6-7. RF Mixer (Sheet 1 of 2).

A-6

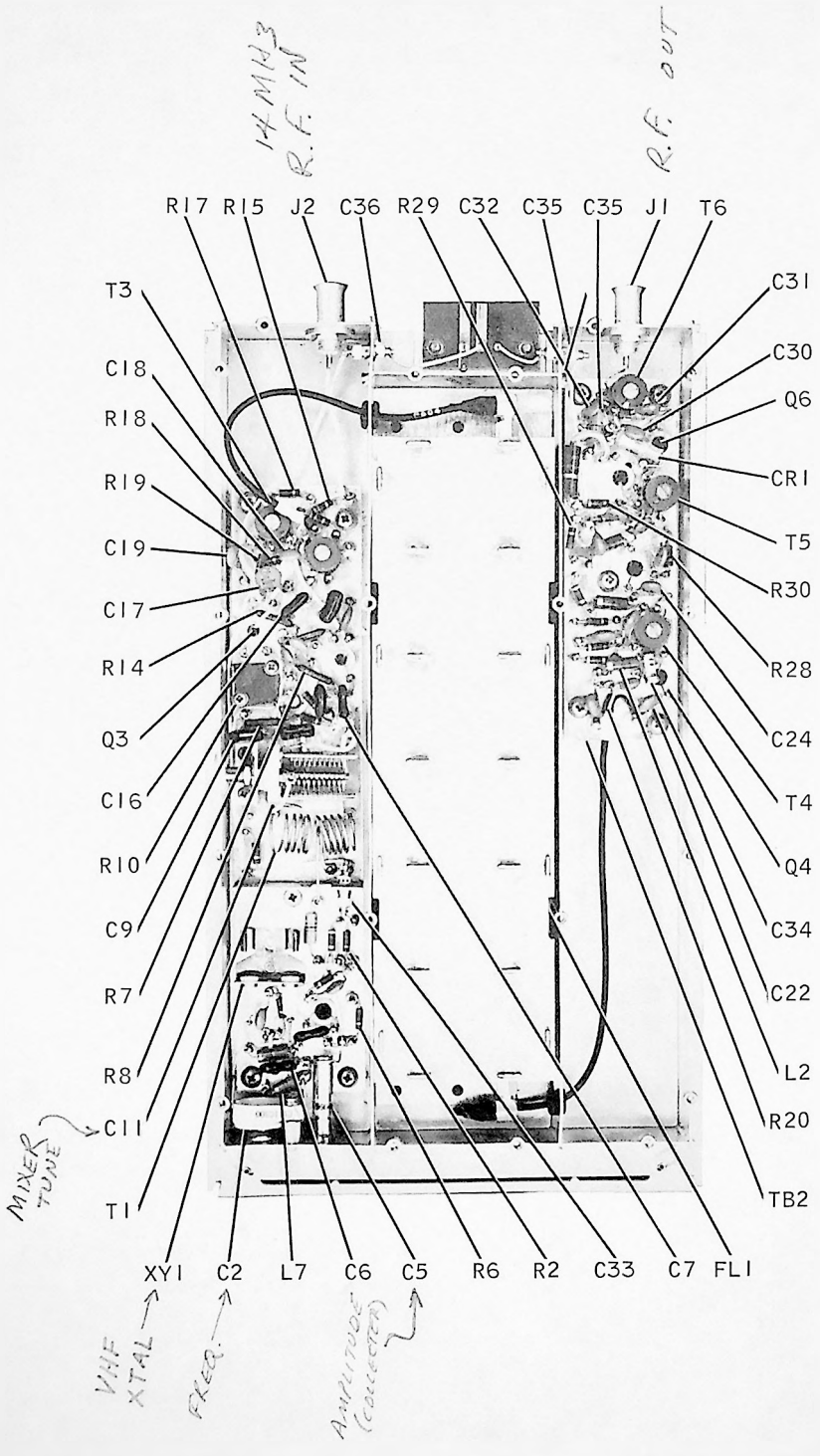

Figure 6-7. RF Mixer (Sheet 2 of 2).

A-6

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	RF MIXER A-6			781-5380-001
C1	CAPACITOR, FXD, CERAMIC 1000 UUF, 20% TOL, 500 VDCW	40C73A1	01939	913-3009-000
C2	CAPACITOR, VAR, CERAMIC 4-30 UUF, 50 VDCW	CV11C300	81349	917-9005-000
C3	SAME AS C1			
C4	CAPACITOR, FXD, MICA 10 UUF, 10% TOL, 500 VDCW	CM05C100K03	81349	912-2754-000
C5	CAPACITOR, VAR, GLASS 0.8-18 UUF, 1K VDCW	VC23G	73899	922-0437-000
C6	SAME AS C4			
C7	SAME AS C4			
C8	CAPACITOR, FXD, MICA 18 UUF, 10% TOL, 500 VDCW	CM05C180K03	81349	912-2763-000
C9	SAME AS C8			
C10	SAME AS C4			
C11	CAPACITOR, VAR, AIR 3-9.8 UUF, 1250 VDCW	160-211-35	74970	922-0046-000
C12	SAME AS C1			
C13	SAME AS C1			
C14	CAPACITOR, FXD, CERAMIC 0.01 UF, PLUS 80% MINUS 20%, 100 VDCW	805-14X5V0103Z	72982	913-3680-000
C15	CAPACITOR, FXD, MICA 33 UUF, 5% TOL, 500 VDCW	CM05E330J03	81349	912-2780-000
C16	SAME AS C15			
C17	SAME AS C14			
C18 THROUGH C32	SAME AS C1			
C33	CAPACITOR, FXD, CERAMIC 1000 UUF, GMV TOL, 500 VDCW	2465-008W5T0102P	72982	913-3208-000
C34	CAPACATOR, FXD, CERAMIC 1.5 UUF, 33% TOL, 500 VDCW	CC20CK1R5D	81349	916-0073-000
C35	SAME AS C33			
C36	SAME AS C33			
CR1	SEMICONDUCTOR DEVICE, DIODE	1N3018B	07688	353-3123-000
E1	HOLDER, TRANSISTOR	T1533	98291	352-9509-000
E2 THROUGH E7	SAME AS E1			
FL1	SELECT FL1 FROM THE FOLLOWING LIST			
	FILTER, HIGH BAND			781-5343-001
	FILTER, LOW BAND			781-5344-001
J1	CONNECTOR, ELECTRICAL	UG1051U	80058	357-9210-000
J2	SAME AS J1			
L1	COIL, RF 0.68 UH, 10% TOL	MS18130-6	96906	240-1566-000
L2	COIL, RF 0.22 UH, 20% TOL	MS18130-1	96906	240-1572-000
L3	SAME AS L2			
L4	SAME AS L2			
L5	COIL, RF 2.20 UH, 10% TOL	MS18130-12	96906	240-1572-000
L6	COIL, RF 0.22 UH, 20% TOL	MS18130-2	96906	240-1563-000
L7	SAME AS L6			
Q1	TRANSISTOR	2N4258	07263	352-0848-020
Q2	TRANSISTOR	2N4416	22229	352-0756-010
Q3	SAME AS Q2			
Q4	TRANSISTOR	2N3563	07688	352-0630-010
Q5	SAME AS Q4			
Q6	SAME AS Q4			
Q7	SAME AS Q4			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R1	RESISTOR, FXD, COMPOSITION 2200 OHMS, 10% TOL, 1/4 WATT	RC07GF222K	81349	745-0761-000
R2	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/4 WATT	RC07GF472K	81349	745-0773-000
R3	RESISTOR, FXD, COMPOSITION 1800 OHMS, 10% TOL, 1/4 WATT	RC07GF182K	81349	745-0758-000
R4	RESISTOR, FXD, COMPOSITION 180 OHMS, 10% TOL, 1/4 WATT	RC07GF181K	81349	745-0722-CCC
R5	NOT USED			
R6	RESISTOR, FXD, COMPOSITION 820 OHMS, 10% TOL, 1/4 WATT	RC07GF821K	81349	745-0746-000
R7	RESISTOR, FXD, FILM 2150 OHMS, 1% TOL, 1/4 WATT	RN60D2151F	81349	705-6612-000
R8	SAME AS R7			
R9	RESISTOR, FXD, COMPOSITION 6800 OHMS, 10% TOL, 1/4 WATT	RC07GF682K	81349	745-0779-000
R10	RESISTOR, VAR 5K OHMS, 5% TOL, 3/4 WATT	RT22C2L502	81349	381-1721-120
R11	RESISTOR, FXD, COMPOSITION 5600 OHMS, 10% TOL, 1/4 WATT	RC07GF562K	81349	745-0776-000
R12	SAME AS R9			
R13	SAME AS R7			
R14	SAME AS R7			
R15	RESISTOR, FXD, COMPOSITION 33 OHMS, 10% TOL, 1/4 WATT	RC07GF330K	81349	745-0695-000
R16	SAME AS R15			
R17	RESISTOR, FXD, COMPOSITION 22 OHMS, 10% TOL, 1/4 WATT	RC07GF220K	81349	745-0689-000
R18	RESISTOR, FXD, COMPOSITION 680 OHMS, 10% TOL, 1/4 WATT	RC07GF681K	81349	745-0743-000
R19	RESISTOR, FXD, COMPOSITION 270 OHMS, 10% TOL, 1/4 WATT	RC07GF271K	81349	745-0728-000
R20	RESISTOR, FXD, COMPOSITION 150 OHMS, 10% TOL, 1/4 WATT	RC07GF151K	81349	745-0719-000
R21	SAME AS R2			
R22	SAME AS R2			
R23	NOT USED			
R24	SAME AS R6			
R25	SAME AS R6			
R26	SAME AS R2			
R27	SAME AS R2			
R28	SAME AS R6			
R29	SAME AS R6			
R30	SAME AS R2			
R31	RESISTOR, FXD, COMPOSITION 270 OHMS, 10% TOL, 1 WATT	RC32GF271K	81349	745-3328-000
R32	RESISTOR, FXD, COMPOSITION 100 OHMS, 10% TOL, 1/4 WATT	RC07GF101K	81349	745-0713-000
T1	TRANSFORMER			781-5376-001
T2	TRANSFORMER			781-5389-001
T3	TRANSFORMER			781-5371-001
T4	TRANSFORMER			781-5372-001
T5	TRANSFORMER			781-5373-001
T6	TRANSFORMER			781-5374-001
TB1	BOARD, FABRICATED			781-5358-001
TB2	BOARD, FABRICATED			781-5352-001
XY1	SOCKET, CRYSTAL	8000AG20	91506	292-0305-010

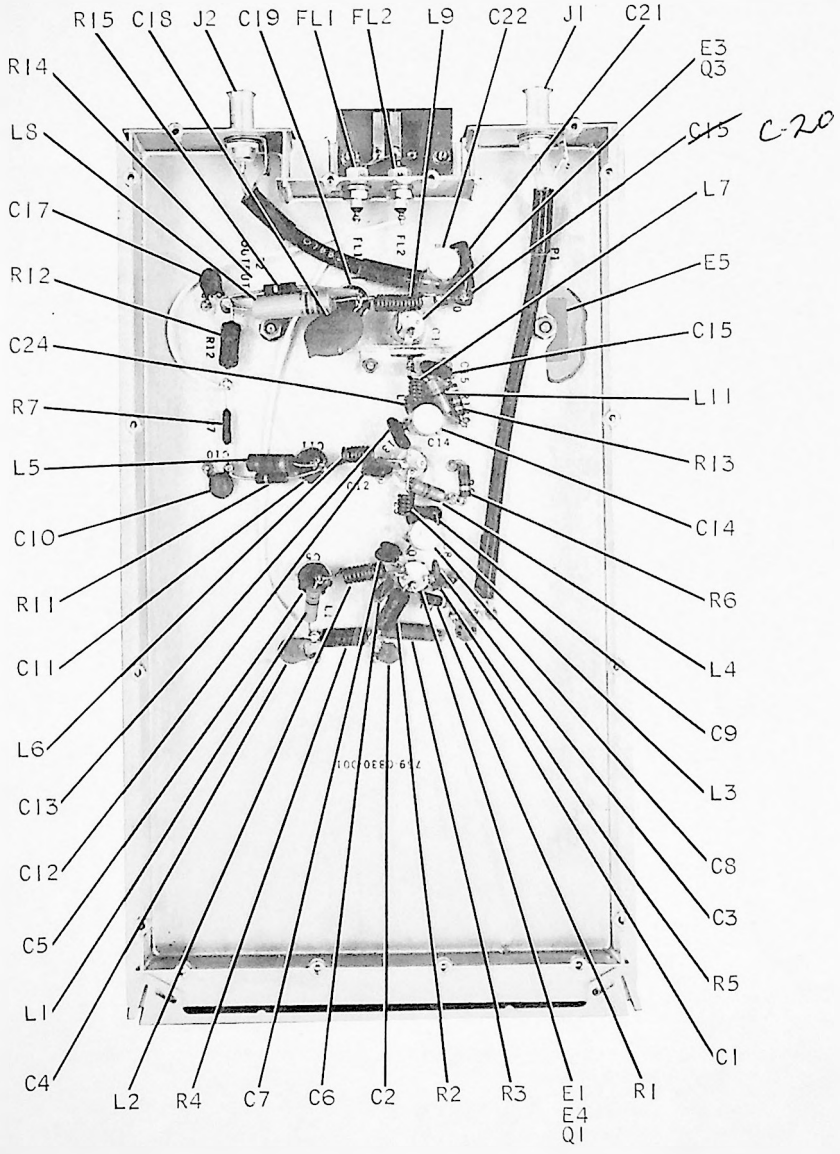

Figure 6-8. Power Amplifier.

A-7

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	POWER AMPLIFIER A-7			769-0830-001
C1	CAPACITOR, FXD, CERAMIC 680 UUF, 20% TOL, 1000 VDCW	CK60AW681M	81349	913-1194-000
C2	CAPACITOR, FXD, CERAMIC 470 UUF, 20% TOL, 500 VDCW	CK60AX471M	81349	913-1189-000
C3	SAME AS C2			
C4	CAPACITOR, FXD, CERAMIC 0.01 UF, PLUS 80 MINUS 20%, 100 VDCW	805-014X5V0103Z	72982	912-3680-000
C5	CAPACITOR, FXD, MICA 1000 UUF, 5% TOL, 500 VDCW	CB21PE102J	81349	912-4115-330
C6	CAPACITOR, FXD, MICA 15 UUF, 5% TOL, 500 VDCW	DM15C150J01	72136	912-2759-000
C7	SAME AS C6			
C8	CAPACITOR, VAR, CERAMIC 5.5-18 UUF, PLUS 2% MINUS 2.5%, 350 VDCW	538011C0P092R	72982	917-1222-000
C9	CAPACITOR, FXD, MICA 33 UUF, 10% TOL, 500 VDCW	DM30F562K03	72136	912-2781-000
C10	SAME AS C4			
C11	SAME AS C5			
C12	CAPACITOR, FXD, MICA 10 UUF, 5% TOL, 500 VDCW	DM15C100J01	72136	912-2753-000
C13	CAPACITOR, FXD, MICA 18 UUF, 5% TOL, 500 VDCW	DM15C180J01	72136	912-2762-000
C14	SAME AS C8			
C15	CAPACITOR, FXD, MICA 82 UUF, 5% TOL, 500 VDCW	CM05ED820J03	81349	912-2810-000
C16	CAPACITOR, FXD, MICA 1500 UUF, 20% TOL, 500 VDCW	M23-500M	53021	912-0667-000
C17	SAME AS C4			
C18	CAPACITOR, FXD, CERAMIC 0.1 UUF, PLUS 80% MINUS 20%, 200 VDCW	805-213X5V0104Z	72982	913-3681-000
C19	SAME AS C5			
C20	CAPACITOR, FXD, MICA 110 UUF, 5% TOL, 500 VDCW	CM05F111J03	81349	912-2819-000
C21	CAPACITOR, FXD, MICA 27 UUF, 5% TOL, 500 VDCW	CM05E270J03	81349	912-2774-000
C22	SAME AS C8			
C23	NOT USED			
C24	CAPACITOR, FXD, MICA 22 UUF, 10% TOL, 500 VDCW	D155E220K0	00853	912-2769-000
E1	INSULATOR, TRANSISTOR	X8021667-5	98291	352-9800-070
E2	INSULATOR, TRANSISTOR	T1529	98291	352-9800-010
E3	SAME AS E2			
E4	HEATSINK	TXP05088	98978	352-9555-030
E5	HEATSINK	6156-7	13103	352-9612-010
FL1	FILTER, RADIO INTERFERENCE 1300 UUF, GMV TOL, 200 VDCW	10201050	72982	241-0332-000
FL2	SAME AS FL1			
J1	CONNECTOR, ELECTRICAL 1 CONTACT	UG1051U	80058	357-9210-000
J2	SAME AS J1			
L1	COIL, RF 1 UH, 10% TOL	MS75008-28	96906	240-1590-000
L2	COIL, RF			776-1882-000
L3	COIL, RF			776-1910-000
L4	COIL, RF 0.15 UH, 20% TOL	MS75008-21	96906	240-1585-000
L5	COIL, RF 2.2 UH, 10% TOL	MS16222-5	96906	240-1654-000
L6	COIL, RF			776-1911-000
L7	COIL, RF			776-1912-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
L8	COIL, RF 1.2 UH, 10% TOL	MS16231-1	96906	240-1605-000
L9	COIL, RF			776-1883-001
L10	NOT USED			
L11	SAME AS L4			
Q1	TRANSISTOR	2N3866	07688	352-0671-010
Q2	TRANSISTOR	2N3375	07688	352-0611-010
Q3	TRANSISTOR	2N5102	02735	352-0747-010
R1	RESISTOR, FXD, COMPOSITION 39 OHMS, 10% TOL, 1/2 WATT	RC20GF390K	81349	745-1293-000
R2	RESISTOR, FXD, WIRE WOUND 22 OHMS, 5% TOL, 3 WATTS	RW69V220	81349	747-5327-000
R3	RESISTOR, FXD, FILM 23.7 OHMS, 1% TOL, 1/2 WATT	RN65D23R7F	81349	705-7018-000
R4	RESISTOR, FXD, WIRE WOUND 270 OHMS, 5% TOL, 3 WATTS	RW69V271	81349	747-5349-000
R5	RESISTOR, FXD, FILM 10 OHMS, 1% TOL, 1/4 WATT	RN60D10R0F	81349	705-6500-000
R6	RESISTOR, FXD, COMPOSITION 100 OHMS, 10% TOL, 1/2 WATT	RC20GF101K	81349	745-1310-000
R7	RESISTOR, FXD, WIRE WOUND 2 OHMS, 1% TOL, 1.25 WATT	RS1A73-2R00-1PCT	91637	747-4230-300
R8	NOT USED			
R9	NOT USED			
R10	NOT USED			
R11	RESISTOR, FXD, COMPOSITION 10 OHMS, 10% TOL, 1/2 WATT	RC20GF100K	81349	745-1268-000
R12	RESISTOR, FXD, WIRE WOUND 0.5 OHM, 1% TOL, 2.5 WATT	RSM2C0R500F	91637	746-9457-000
R13	RESISTOR, FXD, COMPOSITION 4.7 OHMS, 5% TOL, 1/2 WATT	GBT1-2 4-7-5	75042	745-6279-000
R14	SAME AS R11			
R15	SAME AS R11			

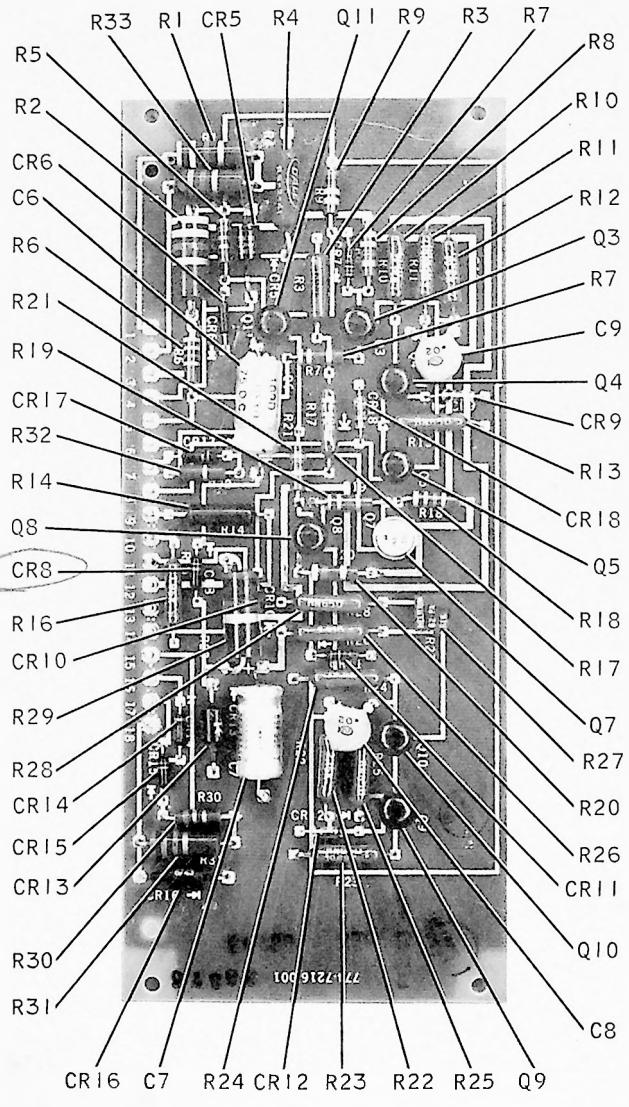

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Figure 6-9. Power Supply Regulator.

A-8

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	POWER SUPPLY REGULATOR A-8			774-7216-000
C1 THROUGH C5	NOT USED			
C6	CAPACITOR, FXD, ELECTROLYTIC 56 UF, 20% TOL, 75 VDCW	109D566X0075T2	56289	184-7793-000
C7	CAPACITOR, FXD, ELECTROLYTIC 150 UF, 20% TOL, 30 VDCW	109D157X0030T2	56289	184-7796-000
C8	CAPACITOR, FXD, CERAMIC 0.02 UF, PLUS 60% MINUS 40%, 250 VDCW	20C109	01939	913-2097-000
C9	SAME AS C8			
CR1 THROUGH CR4	NOT USED			
CR5	SEMICONDUCTOR DEVICE, DIODE	1N3027B	81349	353-3057-000
CR6	SEMICONDUCTOR DEVICE, DIODE	1N645	07688	353-2607-000
CR7	SEMICONDUCTOR DEVICE, DIODE	1N758A	07688	353-2724-000
CR8	SAME AS CR6			
CR9	SEMICONDUCTOR DEVICE, DIODE	1N752A	07688	353-2712-000
CR10	SEMICONDUCTOR DEVICE, DIODE	1N645	07688	353-2607-000
CR11	SAME AS CR7			
CR12	SAME AS CR9			
CR13	SEMICONDUCTOR DEVICE, DIODE	1N3020B	07688	353-3125-000
CR14	SAME AS CR6			
CR15	SAME AS CR6			
CR16	SAME AS CR13			
CR17	SAME AS CR6			
CR18	SEMICONDUCTOR DEVICE, DIODE	1N755A	07688	353-2718-000
Q1	NOT USED			
Q2	NOT USED			
Q3	TRANSISTOR	2N3569	07688	352-0629-030
Q4	SAME AS Q3			
Q5	SAME AS Q3			
Q6	NOT USED			
Q7	TRANSISTOR	2N4235	07688	352-0695-040
Q8 THROUGH Q11	SAME AS Q3			
R1	RESISTOR, FXD, COMPOSITION 390 OHMS, 10% TOL, 1 WATT	RC32GF391K	81349	745-3335-000
R2	RESISTOR, FXD, COMPOSITION 330 OHMS, 10% TOL, 2 WATTS	RC42GF331K	81349	745-5631-000
R3	RESISTOR, FXD, FILM 46.4 OHMS, 1% TOL, 1/2 WATT	RN65D46R4F	81349	705-7032-000
R4	RESISTOR, FXD, WIRE WOUND 0.2 OHM 3% TOL, 3 WATTS	RSM2R2000G	91637	747-9651-000
R5	RESISTOR, FXD, COMPOSITION 18K OHMS, 10% TOL, 1/2 WATT	RC20GF183K	81349	745-1405-000
R6	RESISTOR, FXD, COMPOSITION 330 OHMS, 10% TOL, 1/2 WATT	RC20GF331K	81349	745-1331-000
R7	RESISTOR, FXD, COMPOSITION 3300 OHMS, 10% TOL, 1/2 WATT	RC20GF332K	81349	745-1373-000
R8	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/2 WATT	RC20GF472K	81349	745-1380-000
R9	RESISTOR, FXD, COMPOSITION 15K OHMS, 10% TOL, 1/2 WATT	RC20GF153K	81349	745-1401-000
R10	RESISTOR, FXD, FILM 2150 OHMS, 1% TOL, 1/2 WATT	RN65D2151F	81349	705-7112-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R11	RESISTOR, FXD, FILM 19K OHMS, 1% TOL, 1/2 WATT	RN65D1902F	81349	705-7158-000
R12	SAME AS R11			
R13	RESISTOR, FXD, FILM 5110 OHMS, 1% TOL, 1/2 WATT	RN65D5111F	81349	705-7130-000
R14	RESISTOR, FXD, FILM 4.42K OHMS, 1% TOL, 1/2 WATT	RN65D4421F	81349	705-7127-000
R15	NOT USED			
R16	RESISTOR, FXD, FILM 1960 OHMS, 1% TOL, 1/2 WATT	RN65D1961F	81349	705-7110-000
R17	RESISTOR, FXD, FILM 464 OHMS, 1% TOL, 1/2 WATT	RN65D4640F	81349	705-7080-000
R18	SAME AS R6			
R19	SAME AS R7			
R20	SAME AS R8			
R21	RESISTOR, FXD, COMPOSITION 5600 OHMS, 10% TOL, 1/2 WATT	RC20GF562K	81349	745-1384-000
R22	SAME AS R10			
R23	SAME AS R11			
R24	SAME AS R11			
R25	SAME AS R13			
R26	RESISTOR, FXD, FILM 4640 OHMS, 1% TOL, 1/2 WATT	RN65D4641F	81349	705-7128-000
R27	RESISTOR, VAR 1K, 30% TOL, 1/2 WATT	62PAR1K	73138	382-0008-410
R28	RESISTOR, FXD, FILM 1470 OHMS, 1% TOL, 1/2 WATT	RN65D1411F	81349	705-7104-000
R29	RESISTOR, FXD, COMPOSITION 150 OHMS, 10% TOL, 2 WATTS	RC42GF151K	81349	745-5617-000
R30	RESISTOR, FXD, COMPOSITION 5.1 OHMS, 5% TOL, 1/2 WATT	RC20GF5R1J	81349	745-1544-000
R31	RESISTOR, FXD, COMPOSITION 160 OHMS, 5% TOL, 1 WATT	RC32GF161J	81349	745-3319-000
R32	RESISTOR, FXD, COMPOSITION 2200 OHMS, 10% TOL, 1/2 WATT	RC20GF222K	81349	745-1366-000
R33	RESISTOR, FXD, COMPOSITION 560 OHMS, 10% TOL, 1 WATT	RC32GF561K	81349	745-3342-000

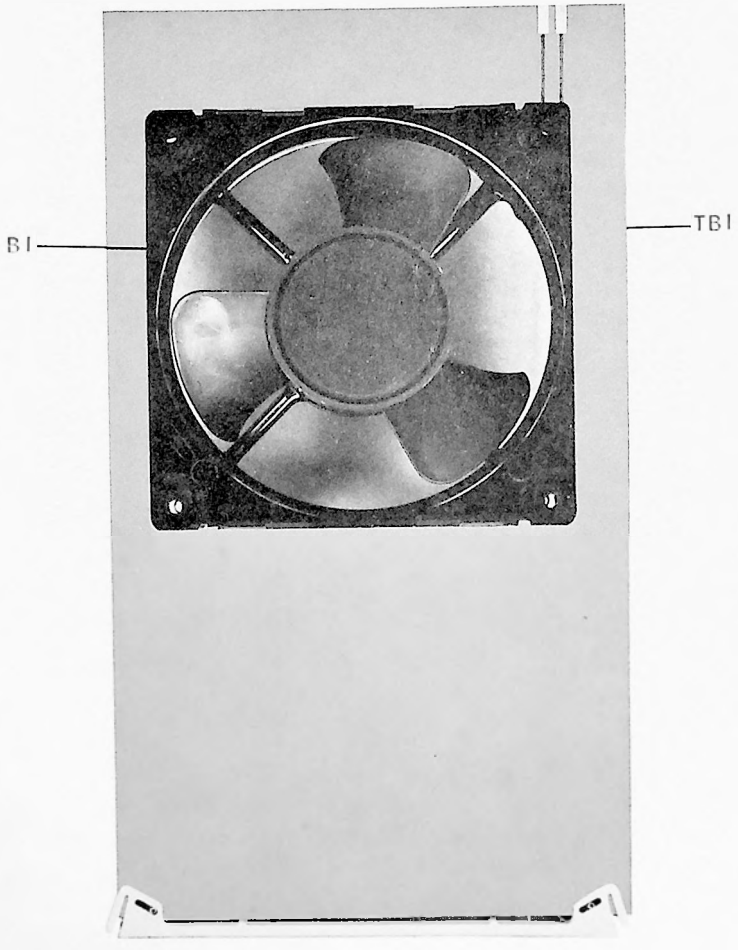

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Figure 6-10. Fan. A-9

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	FAN A-9			783-7049-001
B1	FAN, TUBEAXIAL 0.16-AMP, 115 VAC	20-244-2301	82887	009-1829-020
TB1	BOARD, FABRICATED			786-1248-001

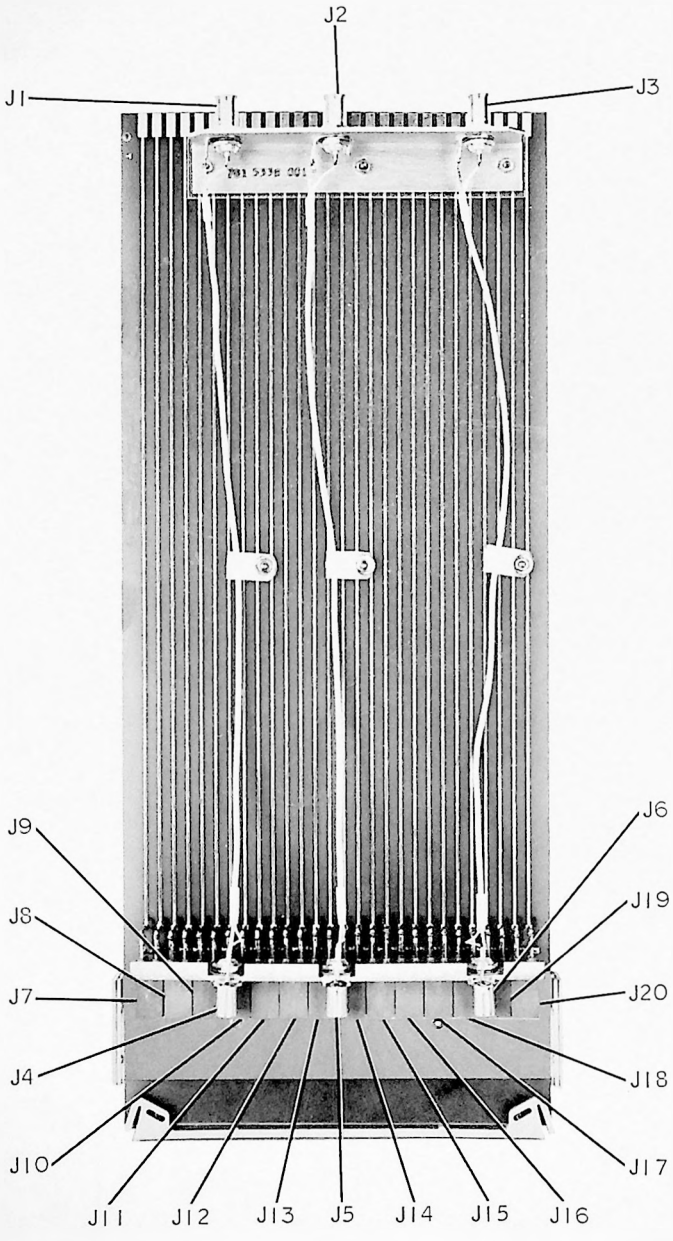

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Figure 6-11. Extender Board.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	EXTENDER BOARD			781-5365-001
J1	CONNECTOR, ELECTRICAL 1 CONTACT	UG1051U	80058	357-9210-000
J2	SAME AS J1			
J3	SAME AS J1			
J4	CONNECTOR, ELECTRICAL 1 CONTACT	UG1050AU	80058	357-9211-000
J5	SAME AS J4			
J6	SAME AS J4			
J7	CONNECTOR, ELECTRICAL 2 CONTACTS	375430-9010	91662	372-2425-010 OR-040
J8 THROUGH J20	SAME AS J7			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	MANUFACTURERS CODES			
CODE	MANUFACTURER			
00853	SANGAMO ELECTRIC CO S CAROLINA DIV PICKENS, S.C.			
01002	GENERAL ELECTRIC CO CAPACITOR DEPT HUDSON FALLS, N.Y.			
01939	SPRAGUE ELECTRIC CO OF WISCONSIN GRAFTON, WISC			
02288	ALLIED CONTROL CO INC PLANTSVILLE, CONN			
02660	AMPHENOL CORP BROADVIEW, ILL.			
02735	RADIO CORP OF AMERICA SOLID STATE AND RECEIVING TUBE DIVISION SOMERVILLE, N.J.			
03550	VANGUARD ELECTRONICS CO INGLEWOOD, CALIF			
03877	TRANSISTRON ELECTRONIC WAKEFIELD, MASS.			
04009	ARROW-HART AND HEGEMAN ELECTRIC CO HARTFORD, CONN			
04713	MOTOROLA SEMICONDUCTOR PRODUCTS INC PHOENIX, ARIZ			
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV MOUNTAIN VIEW, CALIF			
07688	MILITARY SPECIFICATIONS			
09408	STAR-TRONICS INC GEORGETOWN, MASS.			
12040	NATIONAL SEMICONDUCTOR CORP DANBURY, CONN			
12615	U.S. TERMINALS INC CINCINNATI, OHIO			
13103	THERMALLOY CO DALLAS, TEX			
16352	COMPUTER DIODE CORP LODI, N.J.			
17117	ELECTRONIC MOULDING CORP PANTUCKET, R.I.			
17857	KARKAR ELECTRONICS INC SAN FRANSISCO, CALIF			
22229	UNION CARBIDE CORP LINDE DIV MOUNTAIN VIEW, CALIF			
42190	THE MUTER CO CHICAGO, ILL.			
53021	SANGAMO ELECTRIC CO SPRINGFIELD, ILL.			
56289	SPRAGUE ELECTRIC CO NORTH ADAMS, MASS.			
60418	THE TORSION BALANCE CO CLIFTON, N.J.			
70309	ALLIED CONTROL CO INC NEW YORK, N.Y.			
70674	ADC PRODUCTS INC MINNEAPOLIS, MINN			
71034	BLILEY ELECTRIC CO INC ERIE, PA.			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
71400	BUSSMANN MFG DIV OF MCGRAW-EDISON CO ST LOUIS, MO			
71450	CTS CORP ELKHART, IND			
72136	THE ELECTRO MOTIVE MFG CO INC WILL IMANTIC, CONN			
72982	ERIE TECHNOLOGICAL PRODUCTS INC ERIE, PA			
73138	BECKMAN INSTRUMENTS INC HELIPOT DIVISION FULLERTON, CALIF			
73445	AMPEREX ELECTRONIC CORP HICKSVILLE LONG ISLAND, N.Y.			
73899	J F D ELECTRONICS CO A DIVISION OF STRATFORD RETREAT HOUSE BROOKLYN, N.Y.			
74970	E F JOHNSON CO WASECA, MINN			
75042	I R C INC PHILADELPHIA, PA.			
75382	KULKA ELECTRIC CORP MT VERNON, N.Y.			
76854	OAK MFG CO CRYSTAL LAKE, ILL.			
80058	MILITARY SPECIFICATIONS			
80105	BOLLER AND CHIVENS INC PASADENA, CALIF			
80145	A P I INSTRUMENTS CO CHESTERLAND, OHIO			
81349	MILITARY SPECIFICATIONS			
82389	SWITCH CRAFT INC CHICAGO, ILL.			
83003	VARO INC GARLAND, TEX			
87930	TOWER MFG CORP LATROBE, PA			
91506	AUGAT INC ATTLEBORO, MASS.			
91637	DALE ELECTRONICS INC COLUMBUS, NEBR			
91662	ELCO CORP WILLOW GROVE, PA.			
94148	SCIENTIFIC ELECTRONIC PRODUCTS INC LOVELAND, COLO			
94375	AUTOMATIC METAL PRODUCTS BROOKLYN, N.Y.			
95105	COLLINS RADIO CO INFORMATION SCIENCE CENTER NEWPORT BEACH, CALIF			
96906	MILITARY SPECIFICATIONS			
98291	SEALECTRIC CORP MAMARONECK, N.Y.			
98978	INTERNATIONAL ELECTRONIC RESEARCH CORP BURBANK, CALIF			
99800	DELEVAN ELECTRONICS CORP AURORA, N.Y.			

section 7
schematic diagrams

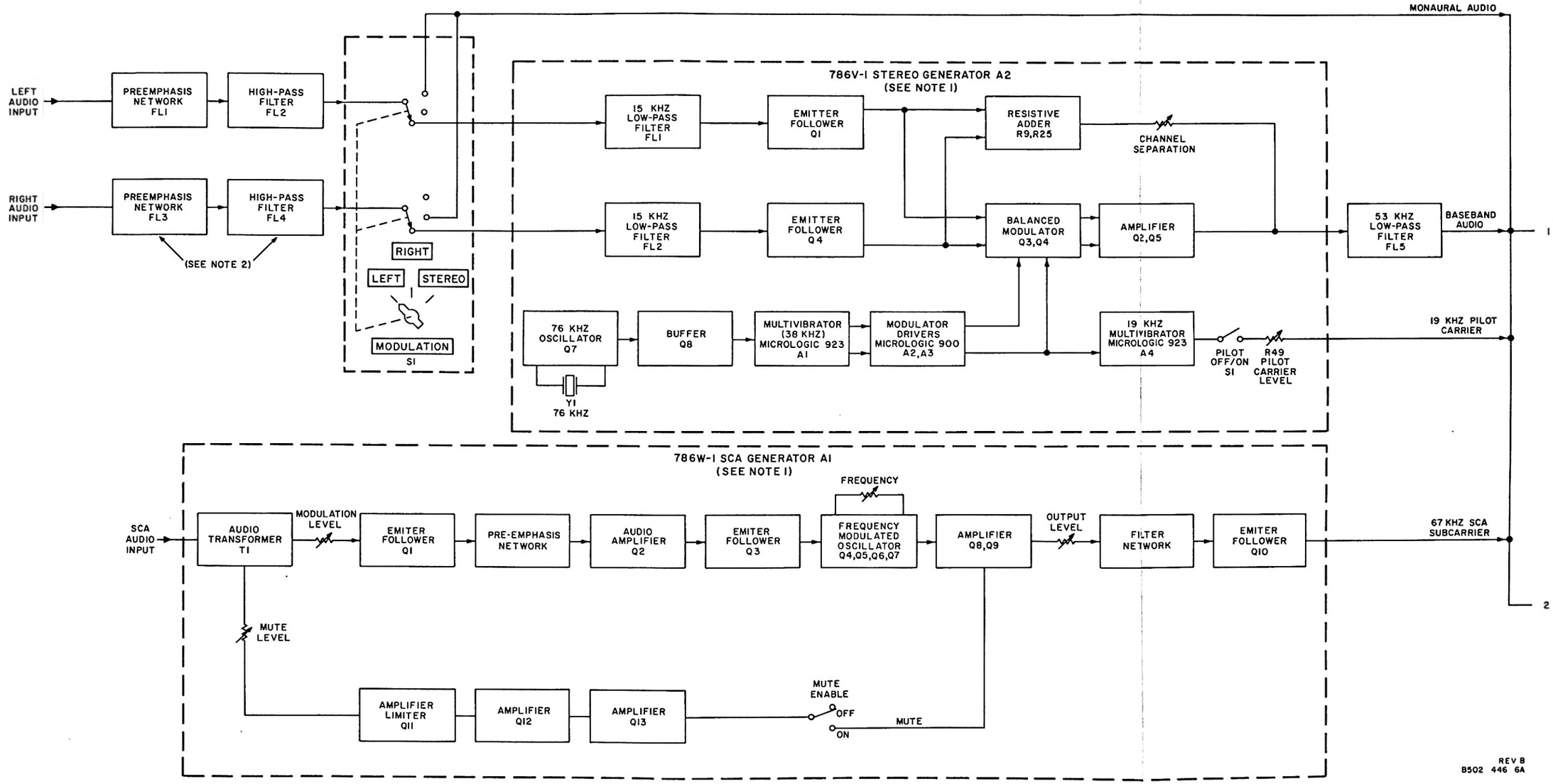


Figure 7-1. 310Z-1 FM Broadcast Exciter, Detail Block Diagram (Sheet 1 of 2).

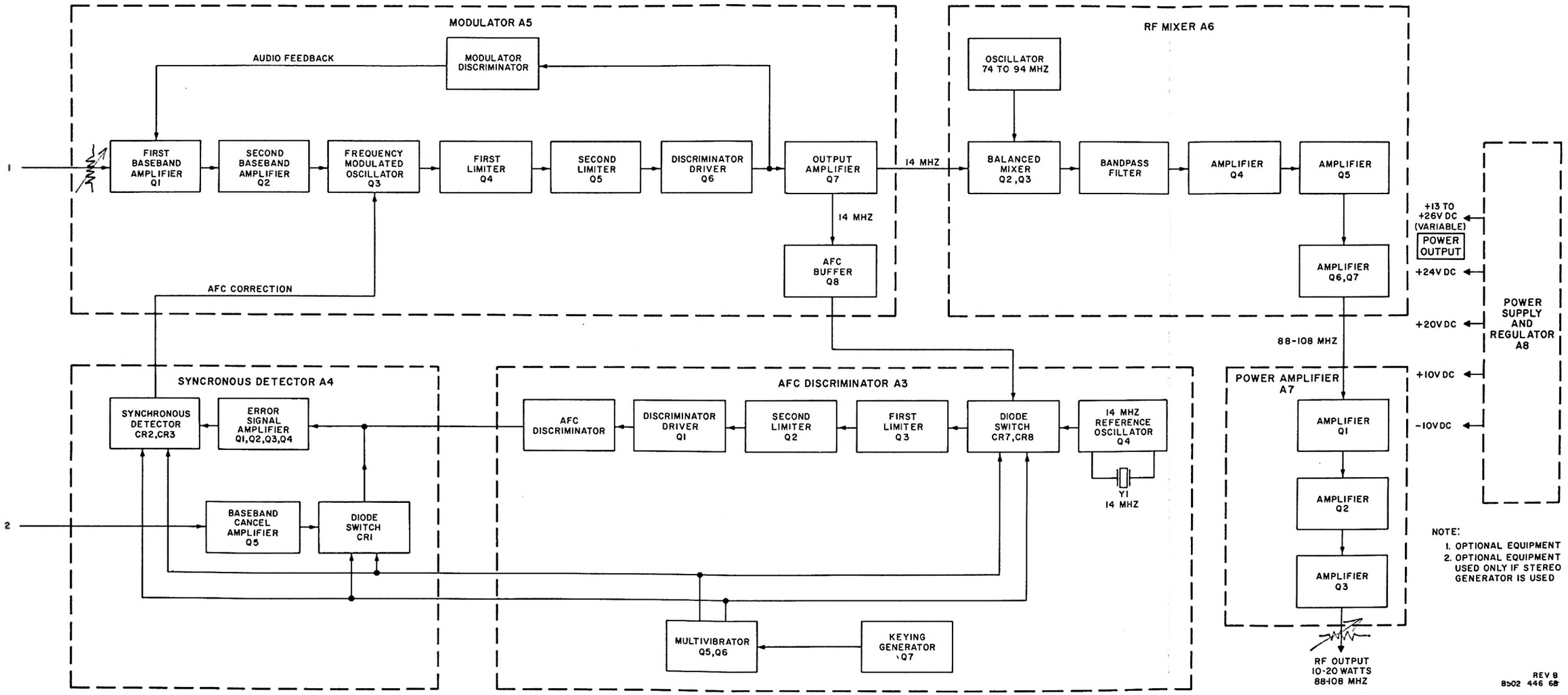


Figure 7-1. 310Z-1 FM Broadcast Exciter, Detail Block Diagram (Sheet 2 of 2).

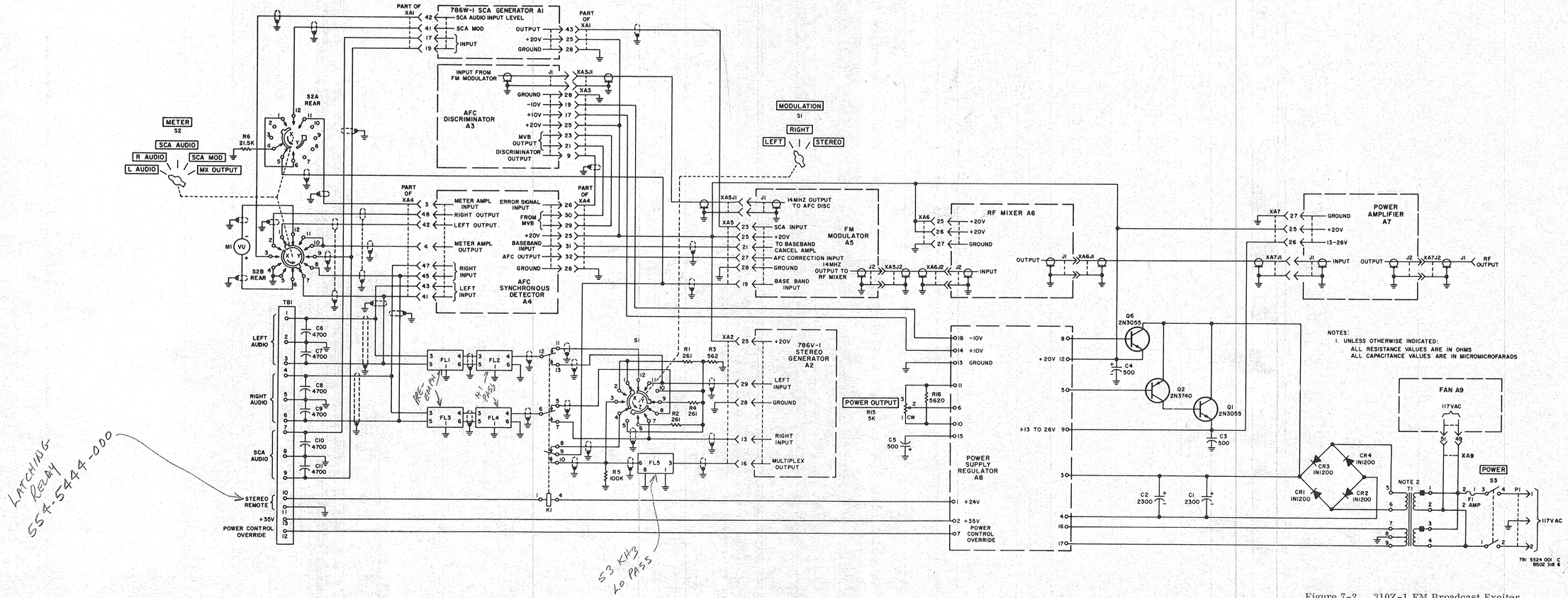
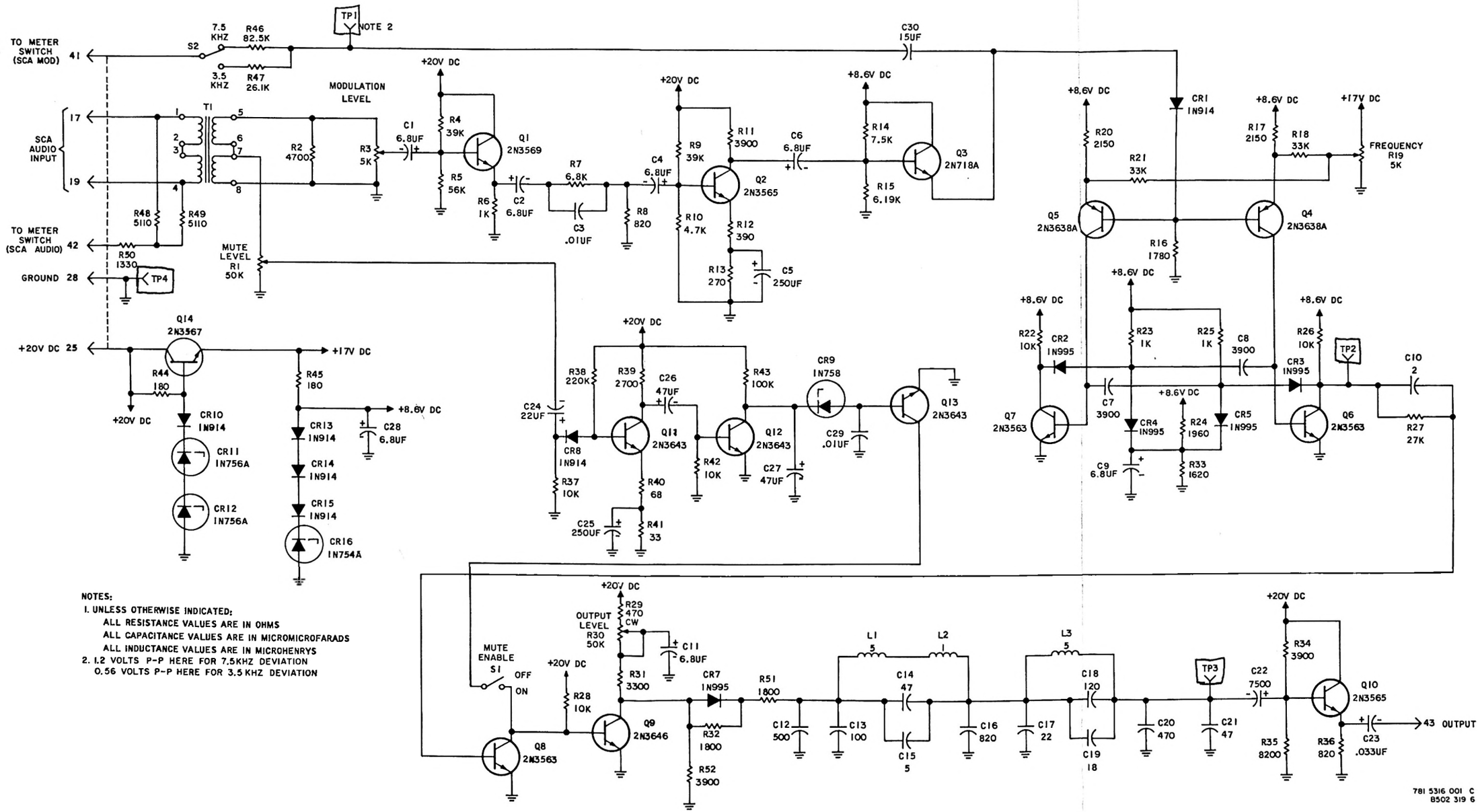


Figure 7-2. 310Z-1 FM Broadcast Exciter, Overall Schematic Diagram.



NOTES:

1. UNLESS OTHERWISE INDICATED:
   - ALL RESISTANCE VALUES ARE IN OHMS
   - ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
   - ALL INDUCTANCE VALUES ARE IN MICROHENRYS
2. 1.2 VOLTS P-P HERE FOR 7.5KHZ DEVIATION
   0.56 VOLTS P-P HERE FOR 3.5 KHZ DEVIATION

Figure 7-3. 786W-1 SCA Generator (A1), Schematic Diagram.

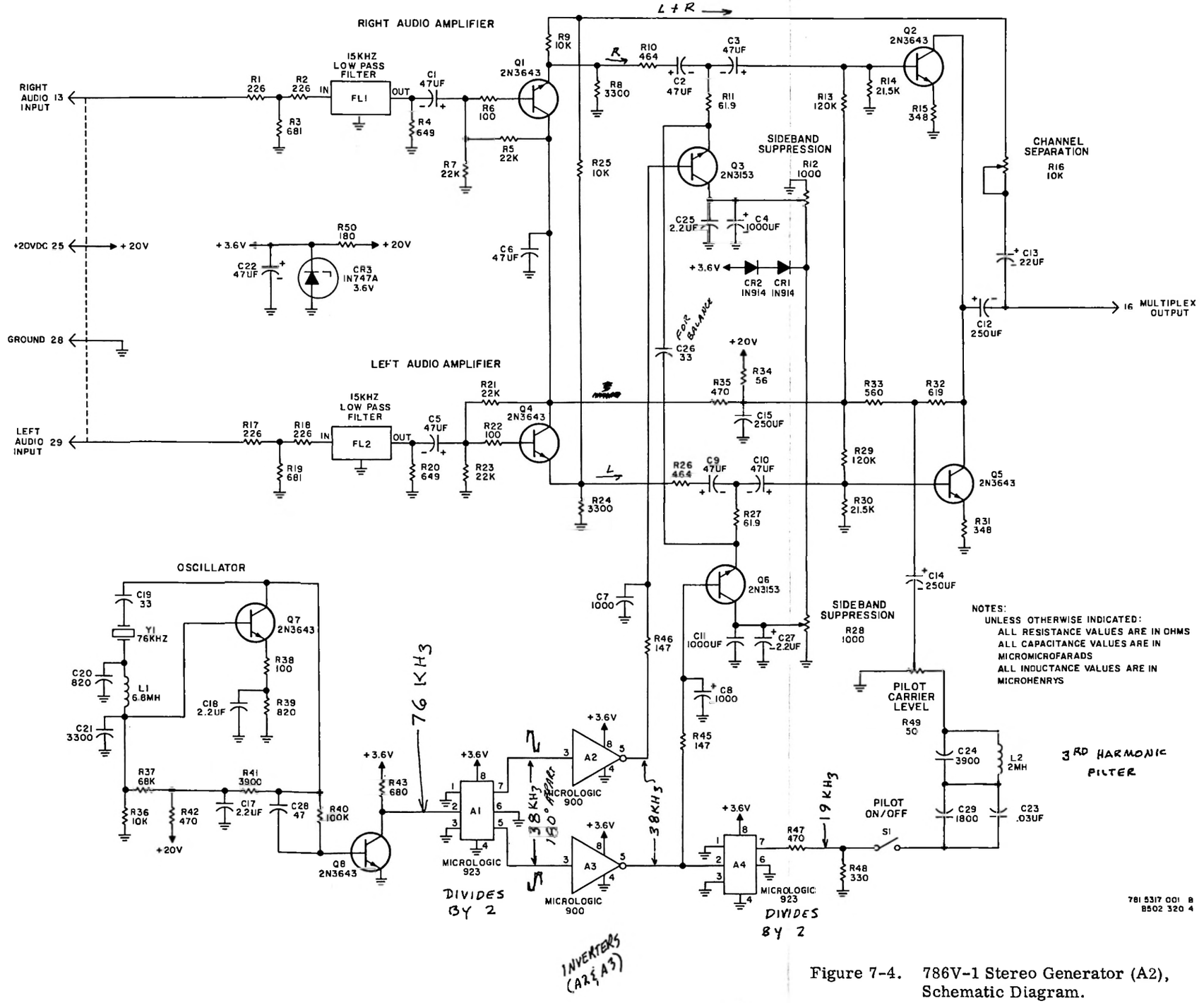
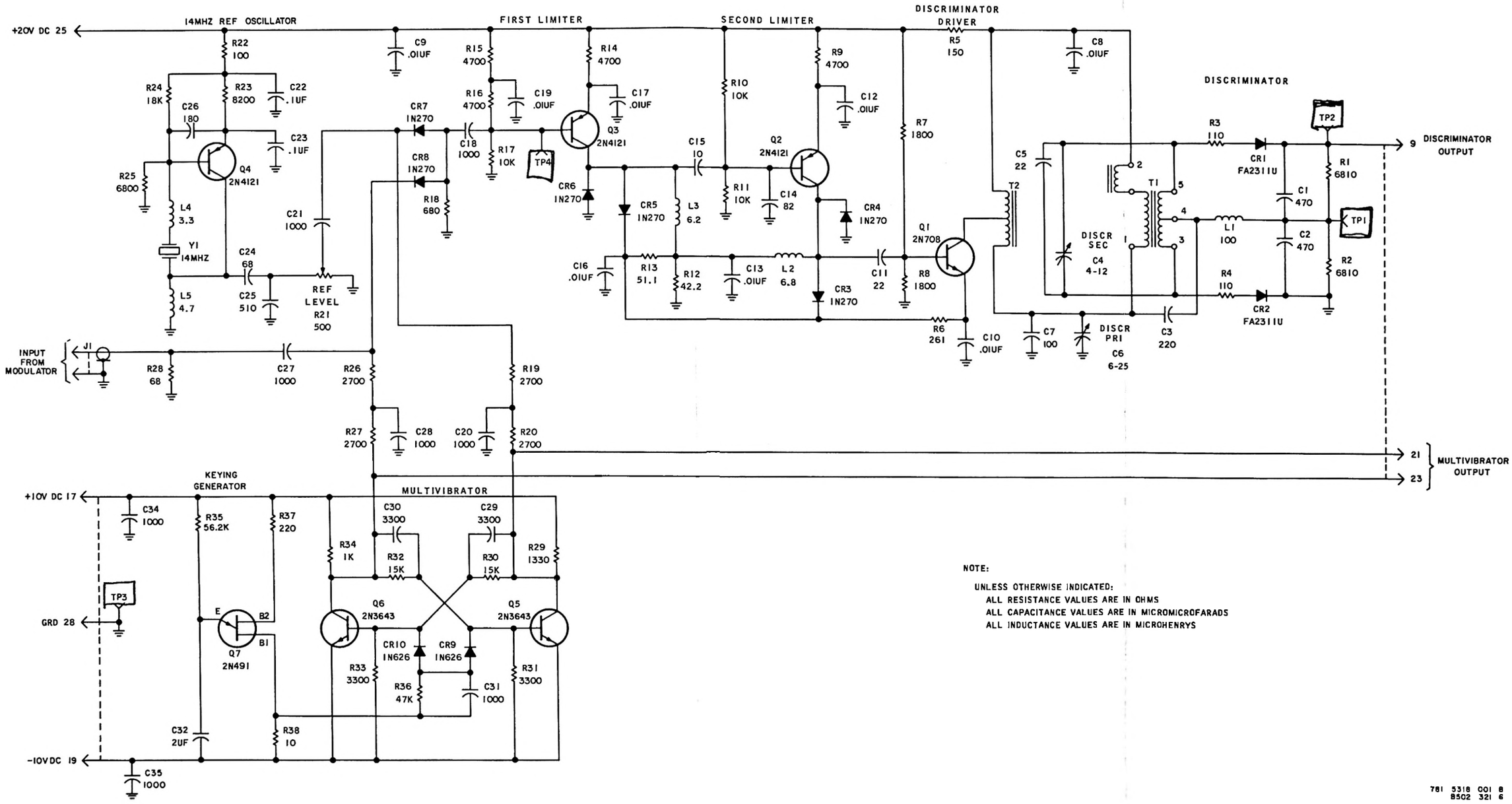


Figure 7-4. 786V-1 Stereo Generator (A2), Schematic Diagram.

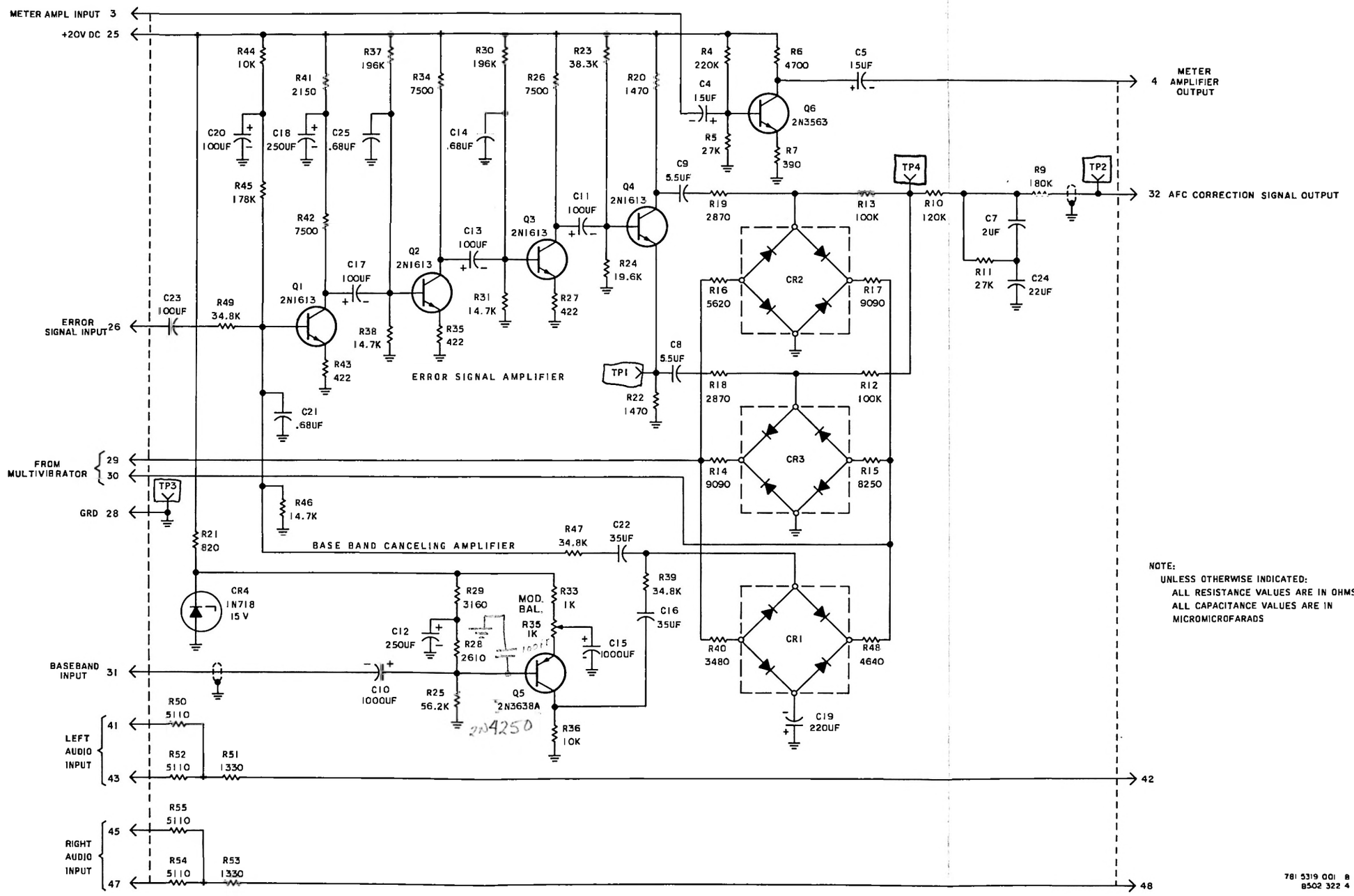


NOTE:

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

781 5318 001 8
8502 321 6

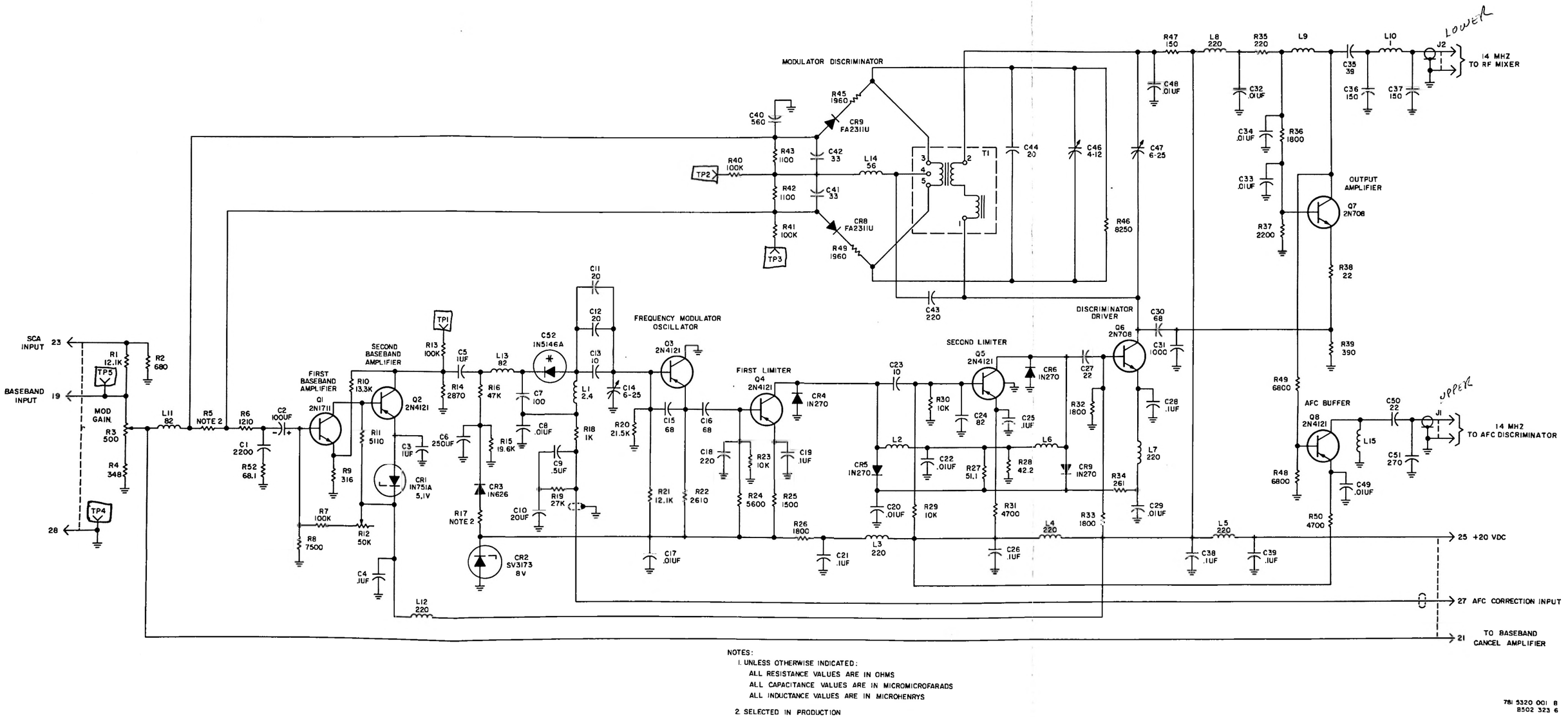
Figure 7-5. AFC Discriminator (A3), Schematic Diagram.



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

781 5319 001 B
8502 322 4

Figure 7-6. AFC Synchronous Detector (A4), Schematic Diagram.



NOTES:

1. UNLESS OTHERWISE INDICATED:
   - ALL RESISTANCE VALUES ARE IN OHMS
   - ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
   - ALL INDUCTANCE VALUES ARE IN MICROHENRYS
2. SELECTED IN PRODUCTION

781 5320 001 B
8502 323 6

Figure 7-7. FM Modulator (A5), Schematic Diagram.

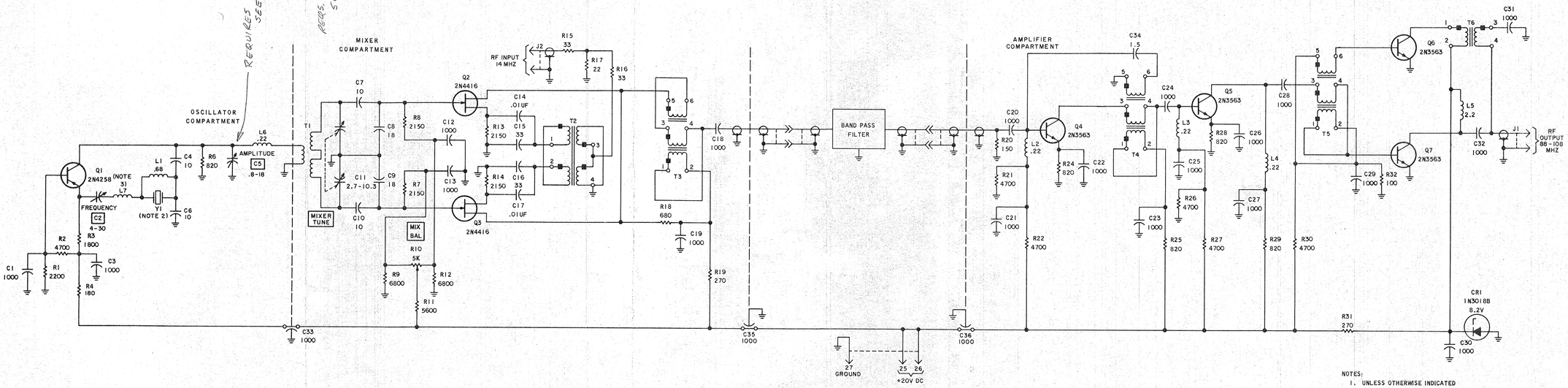


Figure 7-8. RF Mixer (A6), Schematic Diagram.

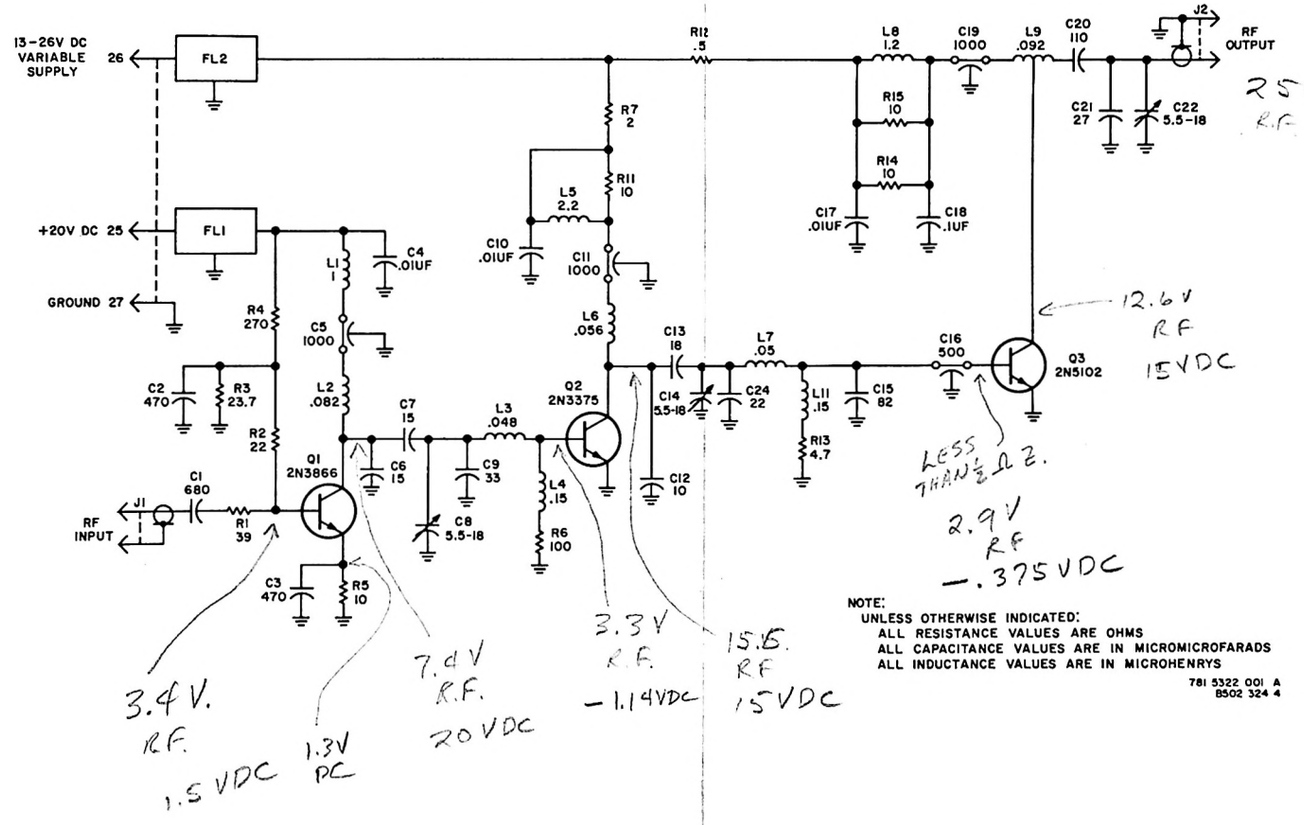


Figure 7-9. Power Amplifier (A7), Schematic Diagram.

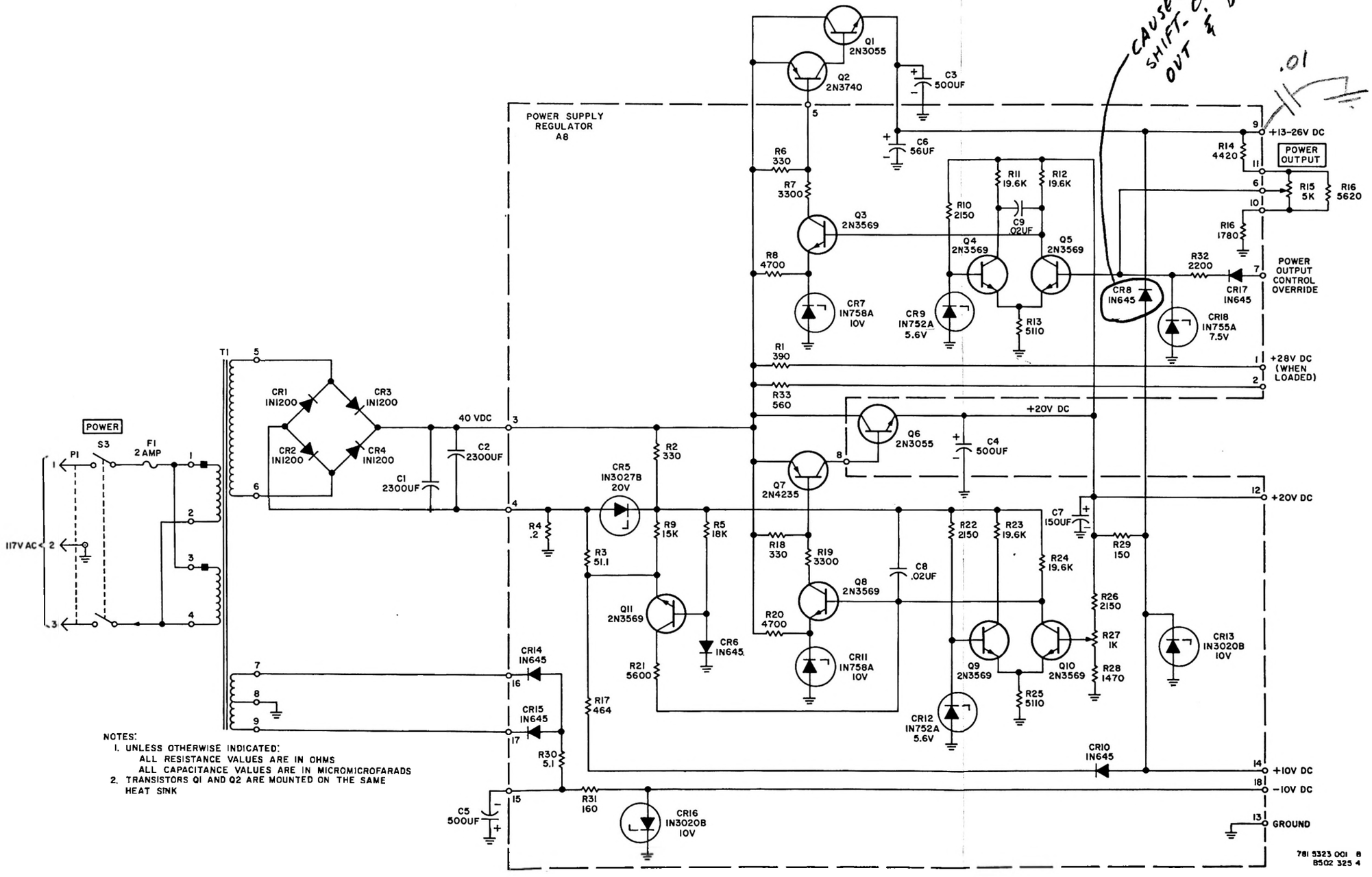


Figure 7-10. Power Supply (A8), Schematic Diagram.

NO. 569-5639-001

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA - DALLAS DIVISION

PRODUCTION TEST SPECIFICATIONS

FOR

310Z-1 FM BROADCAST EXCITER
522-4687-001

APPROVED BY

PROJECT ENGINEER Glenn Lance DATE 12-5-67

ENGINEERING GROUP HEAD Kurt Bowling DATE 12-5-67

QUALITY ASSURANCE C.M. Tillery DATE 12-6-67

QUALITY CONTROL L.R. Upschaw DATE 12/6/67

DCN CONTROL

C2	P. DATE	C3	P. DATE	C4	P. DATE	C5	P. DATE	CAGE NO. 0774-5639-000
0		0		2/68/85	0			

SYM	REV.NO	DATE	SH.REV	APPD	SYM	REV.NO	DATE	SH.REV	APPD
A	T72261	2-14 68		HM					

REVISION DATA

CODE IDENT NO. 13499

569-5639-001

SHEET 1 OF 28

D-207 (REV. 6-63)

1.0 SCOPE

These Production Test Requirements apply to the Collins Type 310Z-1, FM Exciter, Part No. 522-4687-001.

2.0 REFERENCE INFORMATION

2.1 Specifications:

Equipment Specification, Part No. 568-5005-001
Type Test Specification , Part No. 570-8319-001
FCC Rules and Regulations, Para. 73.317, 73.319 and 73.322

2.2 Publications:

Instruction Book, Part No.

2.3 Drawings:

Schematic Diagram, Part No. 781-5324-001
Practical Wiring Diagram 781-5302-001

2.4 Definitions:

2.4.1 100% Modulation

100% modulation is defined as ±75 kHz deviation of the r-f carrier.

2.4.2 Stereophonic Separation

The ratio of the audio signal in the right or left stereophonic channel to the stereophonic crosstalk that signal produces in the left or right stereophonic channel.

2.4.3 Channel Crosstalk Ratio

The ratio of the signal in the main or stereo sub channel to the crosstalk that signal produces in the stereo sub or main channel.

2.4.4 Stereophonic Subchannel

A band of modulating frequencies between 23 kHz and 53 kHz composed of a DSBSC amplitude modulated signal centered about 38 kHz which frequency modulates the radiated carrier and thereby conveys the stereophonic L-R information.

2.4.5 Main Channel

A band of modulating frequencies between 50 Hz and 15 kHz which frequency modulates the radiated carrier and thereby conveys the stereophonic L + R information.

2.4.6 Stereophonic Subcarrier

The stereophonic subchannel center frequency (38 kHz) about which the DSBSC amplitude modulated subchannel sidebands are centered.

2.4.7 Pilot Carrier

A subcarrier at 19 kHz which frequency modulates the radiated carrier and which is phase related to the stereophonic subcarrier in a precise manner which permits a stereophonic receiver to demodulate the DSBSC stereophonic subchannel information.

2.4.8 SCA Subchannel

A band of modulating frequencies between 59 kHz and 75 kHz composed of a frequency modulated subcarrier at 67 kHz which frequency modulates the radiated carrier and thereby conveys a third channel of information which is usually used to transmit closed-circuit background music.

3.0 TEST EQUIPMENT REQUIRED

The following equipments or their equivalents are required to perform the specified tests:

1. SCA Generator, Collins Type 786W-1, part number 774-5338-001
2. Stereo Generator, Collins Type 786V-1, Part Number 774-5336-001.
3. Wideband FM Modulation Monitor, Collins Type 900C-3. Part No. 758-5812-001.
4. Hewlett Packard 130C Oscilloscope
5. Frequency Counter, Hewlett Packard 5246L
6. Frequency Converter, Hewlett Packard 5253B
7. Distortion and Noise Meter, Hewlett Packard 334A

3.0 Continued

8. Audio VTVM, Hewlett Packard 400L
9. VTVM, Hewlett Packard 410B
10. Radio Receiver, Collins Type 51S-1
11. R-F Attenuator, 6 db, EMCO A-8706 NR, 50 watts (qty. 2)
12. Wattmeter, Sierra Model 164B with 181A/250 Plug-In Element.
13. Stereo Test Circuit, Figure 4.
14. 900C-3 Crystal for 98.1 MHz, Collins Part Number 289-7078-050.
15. 310Z-1 Crystal for 98.1 MHz, Collins Part Number 289-2794-00.
16. Low Distortion AF Signal Generator, Hewlett Packard 206A
17. Oscilloscope, Tektronix 581A.
18. Vertical Amplifier, Plug-in Head, Tektronix Type 81
19. Filter, High Band, CPN 781-5343-001 tuned to 98.1 MHz per PTS
20. RF Voltmeter, Boonton 91-C.
21. Power Supply, 0-15 VDC 10 mA.
22. Crosstalk Test Circuit, Figure 5.

4.0 TEST CONDITIONS

Unless otherwise specified, all tests shall be performed under the following conditions:

4.1 Power Supply Voltage, Frequency and Phase:

117 ± 5% Vrms, 50-60 Hz, single phase

4.2 Ambient Temperature:

Normal factory ambient.

4.3 Ambient Humidity:

Normal factory ambient.

4.4 Ambient Atmospheric Pressure:

Normal factory ambient.

4.5 Shielding and Isolation Requirements:

None.

4.6 Operational Duty Cycle:

Continuous.

4.7 Warm-Up Period:

5 minutes.

5. PRELIMINARY TESTS

5.1 Fusing:

Check to see that F1 (2.0 amp) is in place.

5.2 Power Supply Wiring:

Check wiring of power supply transformer, T1, for 117 VAC operation. Terminals 1 and 3 should be connected together. Terminals 2 and 4 should be connected together.

5.3 Oscillator Crystal:

Install the 84.1 MHz crystal, P/N 289-7078-050, in the RF Mixer card.

5.4 Power Supply Voltages:

Remove all circuit cards from the 310Z-1 and apply power (117 VAC). Using VTVM HP-410B, measure and record the following DC voltages:

5.4.1 Voltage across C4 on the 310Z-1 chassis.

5.4.2 Voltage from P.S. Regulator card (A8-14) to ground.

5.4.3 Voltage from P.S. Regulator card (A8-18) to ground.

5.4.4 Voltage across C3 on the 310Z-1 chassis. Vary the POWER OUTPUT control on the front of the 310Z-1 and record the minimum and maximum voltages across C3. Set the voltage across C3 to the maximum level.

5.4.5 Short test. Using a heavy duty clip lead, short the voltage across C3 to ground and observe that the voltage across C4 is less than 1 VDC. Remove the clip lead and place it across C4. Observe that the voltage across C3 is less than 1 VDC. Remove the clip lead.

5.5. External Supply Control Test:

Using the HP410B VTVM, measure the voltage across C3. Connect an external power supply (set to 0 VDC) between TB1-12 and ground (TB1-11). Slowly increase the external supply voltage to +15 VDC and observe that the voltage across C3 decreases to less than 1 VDC. Remove the external power supply and adjust the POWER OUTPUT Control for a minimum voltage across C3. Install all circuit cards except the power amplifier card.

6. INITIAL ADJUSTMENTS

On the SCA Generator card, turn the MUTE DISABLE switch to ON. On the Stereo Generator card, turn the 19 kHz switch to OFF.

6.1 FM Modulator Card:

Connect the equipment as shown in Figure 1. Connect a jumper from TP3 to TP4 on the Sync Detector card.

6.1.1 FM Oscillator Alignment:

Connect the Collins 51S receiver to a short antenna placed near Q3 at the back of the FM Modulator card. Set the receiver to receive a frequency of 14.0 MHz. Select a value of 3.48K ohms for R17. Vary C14 and tune the oscillator frequency to 14.0 MHz as indicated on the 51S. If the oscillator tuning range is too low in frequency, decrease the value of R17. If the oscillator tuning range is too high in frequency increase the value of R17. Adjust the value of R17 until the tuning range is approximately centered about 14.0 MHz. The value of R17 should be between 2K and 5K ohms. After the value of R17 has been selected, solder the selected resistor in place and adjust the oscillator frequency to 14.0 MHz as indicated on the 51S receiver.

6.

6.1.2 Discriminator Alignment:

6.1.2.1 Primary

Connect a DC VTVM HP 410B to the test point TP2. Adjust C47 for a maximum level on the DC VTVM.

6.1.2.2 Secondary

Connect the DC VTVM to test point TP3. Adjust C46 and verify that the level at TP3 will vary from a positive level to a negative level then set to 0 $\pm$ 0.1 VDC on the DC VTVM.

6.1.2.3 Q2 Bias Adjustment:

Connect the DC VTVM HP410B to test point TP1 and adjust R12 to 7.5 VDC on the DC VTVM.

6.2 AFC Discriminator Card Alignment:

Remove the jumper from TP3 to TP4 on the FM Modulator card.

6.2.1 Keying Generator Frequency:

Connect the counter HP5246L to the collector of Q6. Measure and record the frequency of the +8V to -10V square wave.

6.2.2 Discriminator Alignment

6.2.2.1 Primary

Remove the cover from the card and lift one end of R32. Using the oscilloscope HP581A adjust R21 for a maximum level at TP4. Connect a DC VTVM HP410B to TP1 and adjust C6 for a maximum level on the DC VTVM.

6.2.2.2 Secondary

Connect the DC VTVM to TP2. Adjust C4 and verify that the level at TP2 will vary from a positive to a negative level then set to 0 $\pm$ 0.1 VDC.

6.2.3 Reference Oscillator Level Adjustment

Replace R32 and place the card on the card extender. Connect the oscilloscope HP581A to TP4. Trigger externally from the collector of Q5. Adjust R21 for equal amplitudes of alternate signals as shown in Figure 2. Replace the cover and insert the card in the card cage.

6.3 RF Mixer Card:

6.3.1 Filter Installation:

Install the filter, P/N 781-5343-001, in the RF Mixer card.

6.3.2 Oscillator Tuning:

Place the RF Mixer card on the extender and remove the cover. Touch the probe of the Boonton 91-C to the primary of T1 (approx. ½ inch above ground). Adjust C5 for a maximum reading on the RF voltmeter. Lightly couple the counter to T1 primary using a loop (2 turns) and adjust C2 to give a frequency of 84.1 MHz ± 100 Hz. If the oscillator cannot be adjusted on frequency with C2, adjust C5.

6.3.3 Mixer Tuning:

Install the power amplifier card. Replace the cover on the RF Mixer. Connect the Boonton 91-C to the RF Mixer output (J1) and adjust C11 for a maximum output. Record this level.

6.4 Output Power:

Adjust the POWER OUTPUT control, R15, for 10 watts output. Measure and record the DC voltage across C3 on the 310Z-1 chassis. Adjust the POWER OUTPUT control for 20 watts output. Measure and record the DC voltage across C3.

6.5 RF Mixer Balance:

Connect the HP130C audio oscilloscope to the 900C-3 WIDEBAND output. Increase the sensitivity of the scope and observe the 100 kHz signal. Adjust the MIXER BALANCE control R11 for a minimum 100 kHz signal on the scope. Record the level of the 100 kHz signal.

6.6 FM Modulator Sensitivity:

Connect the HP400L VTVM to TP5 on the FM Modulator card. Set the MODULATION switch on the 310Z-1 to LEFT and the Stereo Test Circuit switch to L (see Figure 4). Turn R3 on the FM Modulator card maximum clockwise. Adjust the HP206A audio oscillator for an output of 400 Hz and 85 ± 2 mv rms on the VTVM. Turn the 900C-3 MODULATION METER switch to MAIN CHAN MOD. Select a value of resistance for R5 to give 100% modulation on the 900C-3.

Set the audio level to 100 ± 2 mv rms. Adjust R3 to give 100% main channel modulation on the 900C-3.

6.7 Base Band Cancel Amplifier Alignment:

Place the AFC Synchronous Detector on the extender card. Set the MODULATION switch on the 310Z-1 to LEFT and the Stereo Test Circuit switch to L. Adjust the audio oscillator to a frequency of 50 Hz and 100% modulation on the 900C-3. Turn R32 on the AFC synchronous Detector card maximum counter clockwise and connect a jumper from TP3 to TP4 on the AFC Detector card. Connect the Tektronix 581A oscilloscope to TP4. Observe the 50 Hz audio on one-half cycle of the 5 Hz signal. Adjust R32 slowly to minimize the 50 Hz audio signal.

7.0 TEST REQUIREMENTS

7.1 Preliminary Tests:

Preliminary tests as outlined in Section 5.

7.2 Initial Adjustments:

Initial adjustments as outlined in Section 6.

7.3 Output Frequency Test:

7.3.1 Output Frequency

Connect the equipment as shown in Figure 1 and turn the Stereo Test Circuit switch to OFF. Loosely couple the counter to the exciter RF output and measure the output frequency. If the frequency is not within the limits on the data sheet, adjust C2 on the RF Mixer card. If the frequency is not within the limits on the data sheet, adjust C5 on the RF Mixer card.

7.3.2 Frequency Stability Test:

Turn the Stereo Test Circuit switch to L. Adjust the audio oscillator frequency to 50 Hz. Set the output level for 100% main channel modulation on the 900C-3. Measure and record the exciter RF output frequency.

7.3.3 AFC Loop Test:

Connect the Collins 51S receiver to a short antenna placed near Q3 at the back of the FM Modulator card. Tune the receiver to 14.0 MHz and note that a pulsed tone is heard. With modulation as in 7.8.2, connect a jumper between TP3 and TP4 on the AFC Synchronous Detector card. Note that the pulsed tone increases in pitch until it cannot be heard. Remove the jumper and note that the pitch of the pulsed tone decreases to a zero beat.

7.4 SCA Input Test:

Set the MODULATION METER switch on the 900C-3 to SCA MOD. On the SCA Generator card, turn the MUTE DISABLE switch to ON. Adjust OUTPUT LEVEL control, R30, on the SCA Generator card for 10% modulation on the 0 to 30% scale on the 900C-3.

7.4.2 10% Level:

Adjust R30 for minimum modulation on the 900C-3.

7.5 Meter Test:

7.5.1 Left Audio:

Connect the equipment as shown in Figure 1. Set the stereo test circuit (Figure 4) to L. Turn the MODULATION switch on the 310Z-1 to LEFT. Set the audio oscillator frequency to 400 Hz and adjust the output level for 90% on the 900C-3. Turn the METER switch on the 310Z-1 to L AUDIO and record the reading on the meter.

7.5.2 Right Audio:

Repeat 7.5.1 except set the stereo test circuit to R, turn the MODULATION switch to RIGHT and turn the METER switch to R AUDIO.

7.5.3 SCA Audio:

Remove the audio oscillator from the input to the stereo test circuit and connect it between terminals TB1-7 and TB1-9 (balanced) on the 310Z-1. Connect the HP400L VTVM to TP1 on the SCA Generator card. Set the audio oscillator frequency to 400 Hz and adjust the output for 425 ± 10 mv rms on the VTVM. Turn the METER switch on the 310Z-1 to SCA AUDIO and record the meter reading.

7.5.4 SCA Modulation:

7.5.4.1 7.5 kHz Peak Deviation:

On the SCA Generator card, turn the DEV kHz switch to 7.5. Turn the METER switch on the 310Z-1 to SCA MOD. Record the meter reading.

7.5.4.2 3.5 kHz Peak Deviation:

Reduce the level at TP1 to 200 ± 5 mv rms. Turn the DEV kHz switch to 3.5 and record the meter reading.

7.5.5 Multiplex Output:

Set the stereo test circuit to L = R and turn the MODULATION switch on the 310Z-1 to STEREO. Set the audio oscillator frequency to 400 Hz and adjust the output to 90% total modulation on the 900C-3. Turn the METER switch to MX OUTPUT and record the meter reading.

7.6 Remote Relay Test:

Connect the equipment as shown in Figure 1. Set the stereo test circuit to OFF. Turn the MODULATION switch on the 310Z-1 to LEFT. Turn the METER switch on the 900C-3 to PILOT MOD. On the Stereo Generator card, turn the 19 kHz PILOT to ON. Observe that there is no meter reading on the 900C-3.

Turn the MODULATION switch on the 310Z-1 to RIGHT and observe that there is no meter reading on the 900C-3.

Connect a jumper between TB1-10 and TB1-11 (this connects a ground to the remote relay) on the rear of the 310Z-1. Observe that there is now a meter reading of approximately 8.5%. Turn the 19 kHz pilot carrier OFF.

7.7 Frequency Response:

Connect the 310Z-1 to the test equipment as shown in Figure 1. Turn the MODULATION switch on the front of the 310Z-1 to the LEFT position and the Stereo Test Circuit switch to L (see Figure 4).

7.7.1 Pre-Emphasis In:

7.7.1.1 Left Channel:

Set the HP206A audio generator frequency to 50 Hz and set all generator attenuators for 2.0 db. Adjust the output to give 100% main channel modulation on the 900C-3. Using the HP400L, measure the level of the 900C-3 wideband output. Vary the HP206A attenuators and maintain this level for frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz. Record the HP206A oscillator attenuator settings for each test frequency.

7.7.1.2 Right Channel:

Turn the 310Z-1 MODULATION switch to RIGHT and the Stereo Test Circuit switch to R. Repeat 7.7.1.1.

7.8 Channel Separation:

7.8.1 Transmit Left Channel:

Connect the equipment as shown in Figure 1. Turn the MODULATION Switch on the front of the 310Z-1 to the STEREO position. Turn the MODULATION METER switch on the 900C-3 to TOTAL MOD. Turn off the 19 kHz pilot carrier on the Stereo Generator card. Turn the Stereo Test Circuit (figure 4) switch to the L position for the left modulation only. Set the audio oscillator HP206A to 5000 Hz and adjust the output amplitude for 100% total modulation on the 900C-3. Connect the oscilloscope HP130C to TP5 on the FM Modulator card. Adjust the channel separation control, R16, on the Stereo Generator card for a "perfect" stereo signal as observed on the HP130C (see Figure 3). A "perfect" signal is indicated by a straight base line with the oscilloscope DC coupled, vertical sensitivity set to 2 mv/cm and external triggering applied from the audio oscillator. Connect the oscilloscope HP130C to the 900C-3 WIDEBAND output jack. Adjust the audio generator output to give a 400 mvp-p signal on the oscilloscope. Increase the vertical sensitivity on the oscilloscope to 5 mv/cm. Measure and record the amplitude of the ripple on the base line (see Figure 3).

Repeat the above procedure for frequencies of 50, 100, 1000, 5000, 7500, 10,000 and 15,000 Hz except do not adjust the channel separation control on the Stereo Generator card.

7.8.2 Transmit Right Channel:

Repeat the test of 7.8.1 except turn the switch on the test circuit (see Figure 4) to R for right modulation only and do not adjust the channel separation control.

7.9 Harmonic Distortion:
Connect the equipment as shown in Figure 1. Turn the MODULATION switch on the 310Z-1 to the L=R position. Turn the MODULATION METER switch on the 900C-3 to TOTAL MOD and the DE-EMPHASIS switch to OUT. On the test circuit (see Figure 4), set to L=R modulation only. Set the audio oscillator, HP206A, to 1 kHz and adjust the output amplitude for 100% total modulation on the 900C-3. Turn the MODULATION METER switch on the 900C-3 to the MAIN CHAN AUDIO position. Connect the distortion meter, HP334A, to the DISTORTION METER jack on the 900C-3. Adjust C46 on the FM modulation card for minimum distortion on the distortion meter.

Measure and record the total distortion for modulating frequencies of 50, 100, 400, 1K, 5K, 7.5K, 10K and 15 kHz. Maintain the modulation on the 900C-3 at 100% for all frequencies.

7.10 FM Noise:

7.10.1 Main Channel:

Connect the equipment as shown in Figure 1. Turn the MODULATION switch on the 310Z-1 to LEFT. Turn the MODULATION METER switch on the 900C-3 to TOTAL MOD. Turn the Stereo Test Circuit switch to L. Set the output of the audio oscillator to 400 Hz and 100% modulation on the 900C-3. On the 900C-3, turn the DECIBELS switch to 0 and the METER switch to MAIN CHAN AUDIO. Turn the METER ADJUST control until 0 db is indicated on the 900C-3 front panel meter. Remove the 400 Hz monaural input signal and turn the DECIBELS switch clockwise until a reading is observed on the meter. The main channel FM noise is the algebraic sum of the DECIBELS switch and the meter indication.

7.10.2 Sub Channel:

Turn the METER switch to SUB CHAN AUDIO. The sub channel FM noise is the algebraic sum of the DECIBELS switch and meter indication.

7.11 AM Noise:

Connect the equipment as shown in Figure 1. Turn the METER switch on the 900C-3 to RF LEVEL and adjust the RF LEVEL control for 100% on the 900C-3 meter. Connect an audio voltmeter, HP400L, to the AM NOISE jack on the 900C-3. Measure and record the AM noise on the audio voltmeter.

7.12 Crosstalk

7.12.1 Main into Subchannel:

Connect the equipment as indicated in figure 6. Turn the MODULATION Switch on the 310Z-1 to STEREO. Set the crosstalk test circuit to main channel select and 50/400 frequency range. Adjust the HP200CD to a frequency of 50 Hz and adjust the output level for 90% main channel modulation on the 900C-3. On the 900C-3, turn the DECIBELS switch to 0 and the METER switch to MAIN CHAN AUDIO. Turn the METER ADJUST control until 0 db is indicated on the meter. Turn the METER switch to SUB CHAN AUDIO and turn the DECIBELS switch clockwise until an indication is observed.

Turn the adjustments on the crosstalk test circuit for a null on the 900C-3 meter. These adjustments are critical and will require special attention to achieve the proper null. The crosstalk is the algebraic sum of the DECIBELS switch and the meter indication.

Repeat the above procedure for frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz observing the proper frequency range select position on the crosstalk test circuit.

7.12.1 Subchannel Into Main:

Set the crosstalk test circuit to subchannel select and 50/400 frequency range. Adjust the 200CD to a frequency of 50Hz and adjust the output level for 90% main channel modulation on the 900C-3. On the 900C-3, turn the DECIBELS switch to 0 and the METER switch to MAIN CHAN AUDIO. Turn the METER ADJUST control until 0 db is indicated on the meter. Turn the METER switch to MAIN CHAN AUDIO and turn the DECIBELS switch clockwise until an indication is observed. Turn the adjustments on the crosstalk test circuit for a null on the 900C-3 meter. These adjustments are critical and will require special attention to achieve proper null. The crosstalk is the algebraic sum of the DECIBELS switch and the meter indication.

Repeat the above procedure for frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz observing the proper frequency select position on the crosstalk test circuit.

			Test Limits
8.0	DATA SHEET REQUIREMENTS		
8.1	Preliminary Tests:		
8.1.1	Fusing:		
	F1 (2.0 Amp) fuse is in place	_____	Check
8.1.2	Power Supply Wiring:		
	Wiring is connected for 117 VAC operation	_____	Check
8.1.3	Oscillator Crystal:		
	84.1 MHz crystal installed	_____	Check
8.1.4	Power Supply Voltages:		
8.1.4.1	Voltage across C4	_____VDC	+19 to +21 VDC
8.1.4.2	Voltage from A8-14 to gnd.	_____VDC	+9.3 to +10.7 VDC
8.1.4.3	Voltage from A8-18 to gnd.	_____VDC	-9.3 to -10.7 VDC
8.1.4.4	Voltage across C3		
	Minimum	_____VDC	10.0 to 13.0 VDC
	Maximum	_____VDC	25.0 to 27.0 VDC
8.1.4.5	Short test satisfactory	_____	Check
8.1.5	External Supply Control Test:		
	Test satisfactory	_____	Check
8.2	Initial Adjustments:		
8.2.1	FM Modulator Card:		
8.2.1.1	FM Oscillator Alignment:		
	Oscillator frequency set to 14.0 MHz	_____	Check

8.2.1.2	Discriminator Alignment:		Test Limits
8.2.1.2.1	Primary:		
	Maximum level at TP2	_____	Check
8.2.1.2.2	Secondary:		
	Level at TP3 set to 0 ± 0.1 volts	_____	Check
8.2.1.2.3	Q2 Bias Adjustment:		
	Level at TP1 set	_____VDC	7.4 to 7.6 VDC
8.2.2	AFC Discriminator Card Alignment:		
8.2.2.1	Keying Generator Frequency:		
	Generator frequency	_____Hz	3.8 to 5.6 Hz
8.2.2.2	Discriminator Alignment:		
8.2.2.2.1	Primary:		
	Maximum level at TP4	_____	Check
8.2.2.2.2	Secondary:		
	Level at TP2 set to 0 ± 0.1 volts	_____	Check
8.2.2.3	Reference Oscillator Level Adjustment:		
	Level adjusted	_____	Check
8.2.3	RF Mixer Card:		
8.2.3.1	Filter Tuning:		
	Filter installed	_____	Check

			Test Limits
8.2.3.2	Oscillator Tuning:		
	Osc. frequency adjusted	_____	Check
8.2.3.3	Mixer Tuning:		
	RF Mixer output	_____Vrms	NLT 2.0 Vrms
8.2.4	Output Power:		
	Voltage across C3 for 10 watts output	_____VDC	NMT 13.0 VDC
	Voltage across C3 for 20 watts output	_____VDC	NMT 26.0 VDC
8.2.5	RF Mixer Balance:		
	Level of 100 kHz signal	_____MVp-p	NMT 0.4 MVp-p
8.2.6	FM Modulator Sensitivity:		
	Level at TP5 set	_____	Check
	Value of R5 selected and installed	_____	Check
	R3 set for 100% modulation	_____	Check
8.2.7	R32 adjusted	_____	Check
8.3	Output Frequency Test:		
8.3.1	Output Frequency:		
	Output Frequency	_____MHz	98.1 MHz ± 100 Hz
8.3.2	Frequency Stability Test:		
	Output Frequency	_____MHz	98.1 MHz ± 500 Hz
8.3.3	AFC Loop Test:		
	AFC loop operates as described in 7.3.3	_____	Check

8.4 SCA Input Test:

SCA output level _____ Check

8.5 Meter Test:

8.5.1 Left Audio:

Meter reading _____Vu -1 to +1 Vu

8.5.2 Right Audio:

Meter Reading _____Vu -1 to +1 Vu

8.5.3 SCA Audio:

Meter reading _____Vu -1 to +1 Vu

8.5.4 SCA Modulation:

8.5.4.1 7.5 kHz Peak Deviation:

Meter reading _____Vu -1 to +1 Vu

8.5.4.2 3.5 kHz Peak Deviation:

Meter reading _____Vu -1 to +1 Vu

8.5.5 Multiplex Output:

Meter Reading _____Vu -1 to +1 Vu

			Test Limits
8.6	Remote Relay Test:		
	Modulation switch in left position - no meter reading	_____	Check
	Modulation switch in right position - no meter reading	_____	Check
	With ground jumper connected there is a reading of approx. 8.5%	_____	Check
8.7	Frequency Response:		
8.7.1	Pre-Emphasis In:		
8.7.1.1	Left Channel:		
	50 Hz	2.0 db	Reference
	100	_____ db	0.5 to 3.5 db
	400	_____ db	0.6 to 3.6 db
	1000	_____ db	1.4 to 4.4 db
	5000	_____ db	8.7 to 11.7 db
	7500	_____ db	11.8 to 14.8 db
	10,000	_____ db	14.2 to 17.1 db
	15,000	_____ db	17.0 to 21.0 db
8.7.1.2	Right Channel:		
	50 Hz	2.0 db	Reference
	100	_____ db	0.5 to 3.5 db
	400	_____ db	0.6 to 3.6 db
	1000	_____ db	1.4 to 4.4 db
	5000	_____ db	8.7 to 11.7 db

8.7.1.2	Continued		Test Limits
	7500	_____db	11.8 to 14.8 db
	10,000	_____db	14.2 to 17.1 db
	15,000	_____db	17.0 to 21.0 db

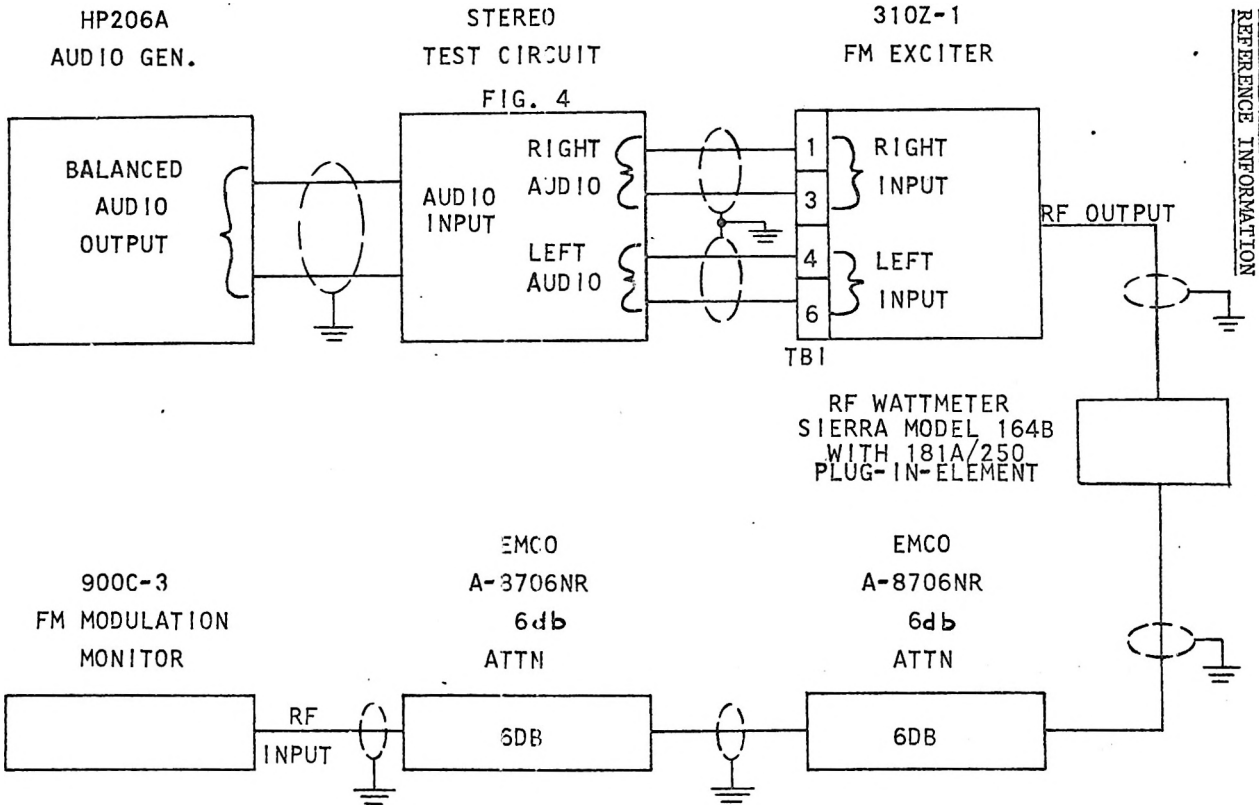
8.8 Channel Separation:

8.8.1 Transmit Left Channel:

50 Hz	_____MVp-p	NMT 7.0 MVp-p
100 Hz	_____MVp-p	NMT 7.0 MVp-p
1000 Hz	_____MVp-p	NMT 7.0 MVp-p
5000 Hz	_____MVp-p	NMT 7.0 MVp-p
7500 Hz	_____MVp-p	NMT 7.0 MVp-p
10,000 Hz	_____MVp-p	NMT 7.0 MVp-p
15,000 Hz	_____MVp-p	NMT 7.0 MVp-p

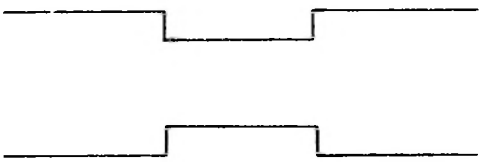
			Test Limits
8.8.2	Transmit Right Channel:		
	50 Hz	_____MVp-p	NMT 7.0 MVp-p
	100 Hz	_____MVp-p	NMT 7.0 MVp-p
	1000 Hz	_____MVp-p	NMT 7.0 MVp-p
	5000 Hz	_____MVp-p	NMT 7.0 MVp-p
	7500 Hz	_____MVp-p	NMT 7.0 MVp-p
	10,000 Hz	_____MVp-p	NMT 7.0 MVp-p
	15,000 Hz	_____MVp-p	NMT 7.0 MVp-p
8.9	Harmonic Distortion:		
	50 Hz	_____%	NMT 1.0%
	100 Hz	_____%	NMT 1.0%
	400 Hz	_____%	NMT 1.0%
	1000 Hz	_____%	NMT 1.0%
	5000 Hz	_____%	NMT 1.0%
	7500 Hz	_____%	NMT 1.0%
	10,000 Hz	_____%	NMT 1.0%
	15,000 Hz	_____%	NMT 1.0%
8.10	FM Noise:		
8.10.1	Main Channel:		
	Noise level	_____db	NMT -65 db
8.10.2	Sub Channel:		
	Noise level	_____db	NMT -65 db
8.11	AM Noise:		
	Noise level	_____Vrms	NMT 1.78 mv rms

			Test Limits
8.12	Crosstalk:		
8.12.1	Main into Subchannel:		
	50 Hz	_____db	NMT -40 db
	100	_____db	NMT -40 db
	400	_____db	NMT -40 db
	1000	_____db	NMT -40 db
	5000	_____db	NMT -40 db
	7500	_____db	NMT -40 db
	10,000	_____db	NMT -40 db
	15,000	_____db	NMT -35 db
8.12.1	Subchannel into Main:		
	50 Hz	_____db	NMT -40 db
	100	_____db	NMT -40 db
	400	_____db	NMT -40 db
	1000	_____db	NMT -40 db
	5000	_____db	NMT -40 db
	7500	_____db	NMT -40 db
	10,000	_____db	NMT -40 db
	15,000	_____db	NMT -35 db

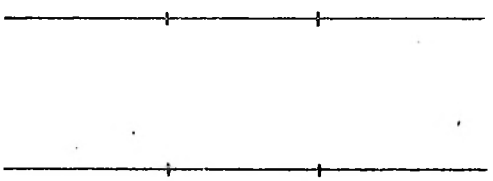


EQUIPMENT CONNECTIONS

FIGURE 1



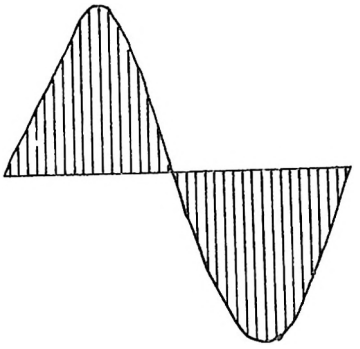
INCORRECT WAVEFORM



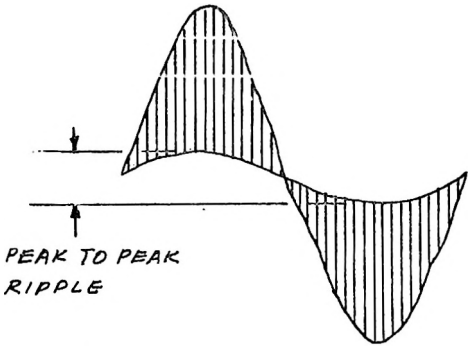
CORRECT WAVEFORM

REFERENCE OSCILLATOR WAVEFORM

FIGURE 2



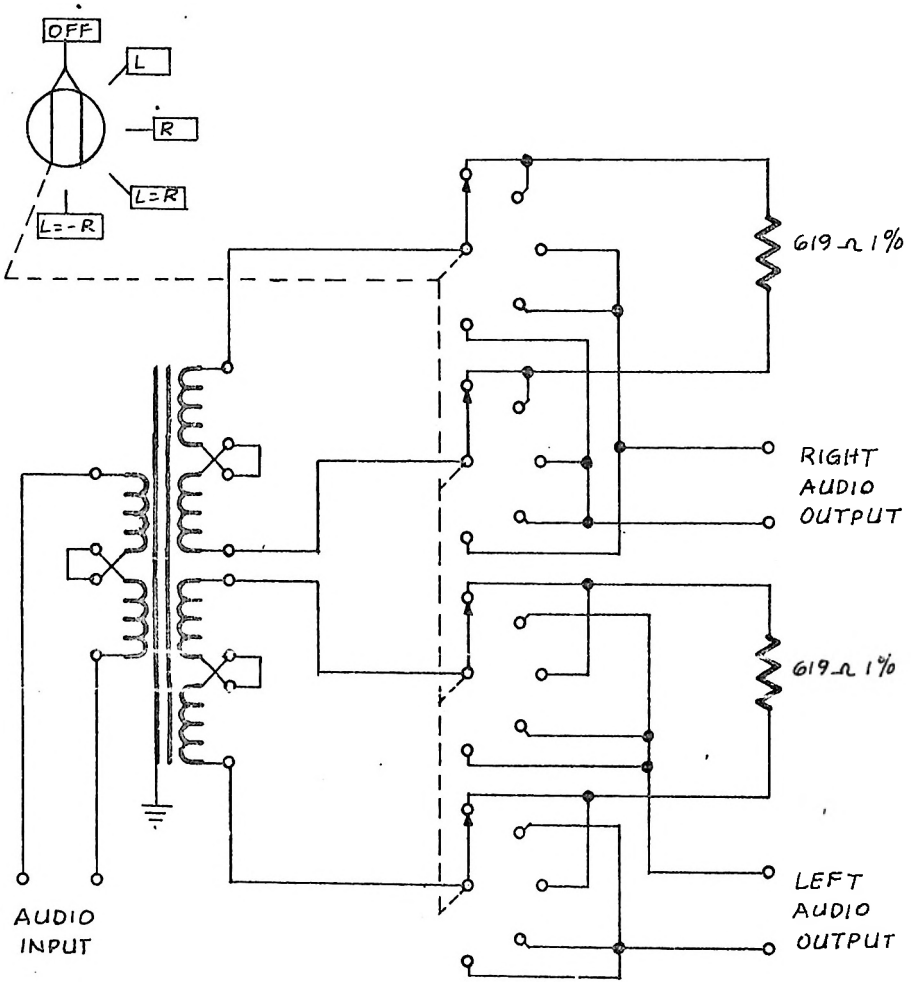
PERFECT SIGNAL



IMPERFECT SIGNAL

STEREO WAVEFORMS

FIGURE 3



NOTE: THE TRANSFORMER IS UTC TYPE A43

STEREO TEST CIRCUIT

FIGURE 4

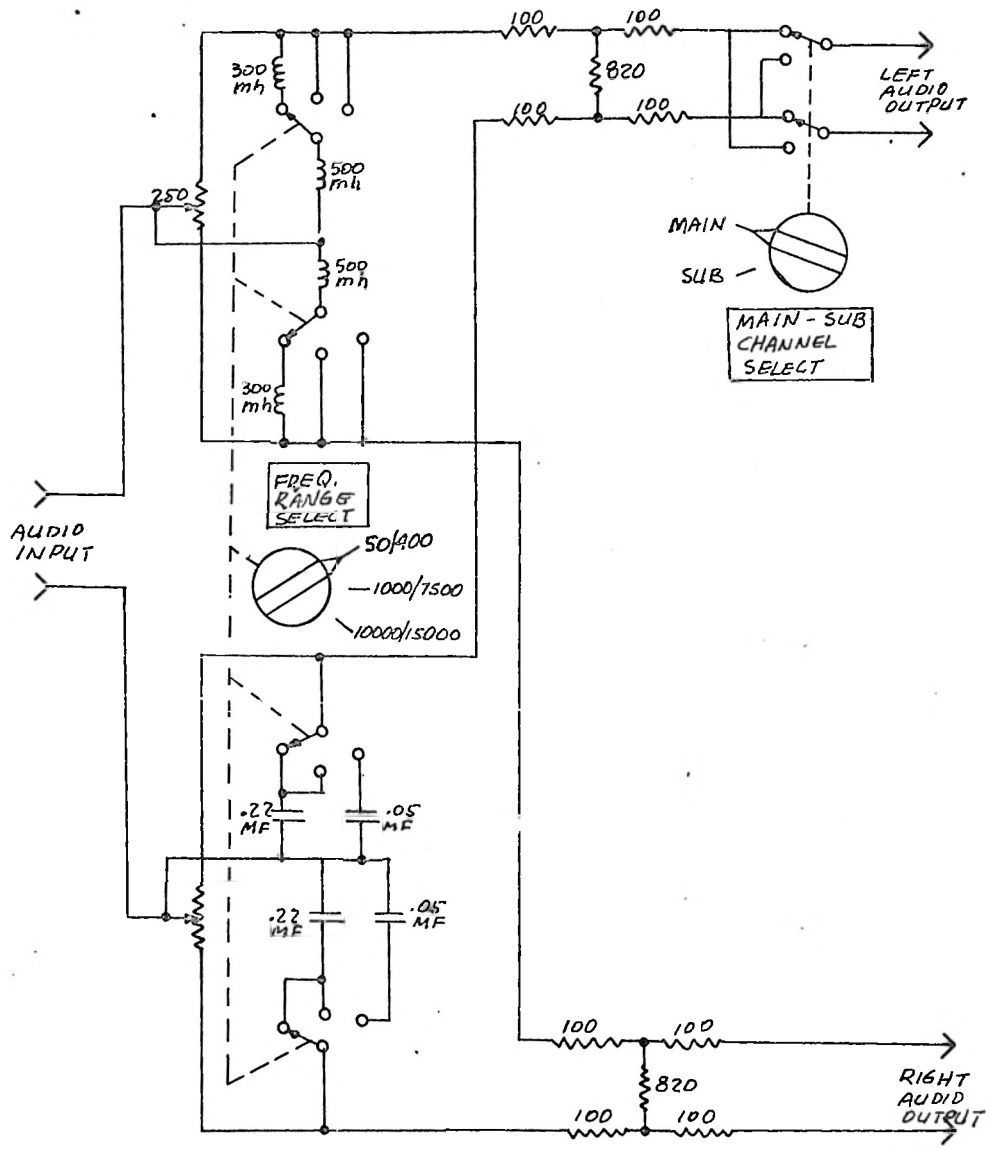


FIGURE 5

CROSSTALK TEST CIRCUIT

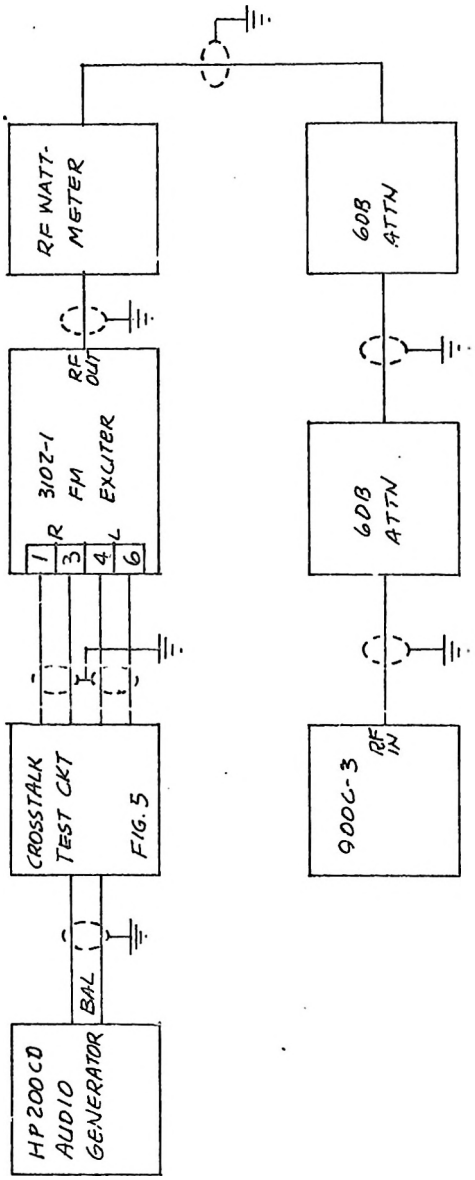


FIGURE 6

EQUIPMENT CONNECTIONS

STEREO CROSSTALK

COLLINS

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA - DALLAS DIVISION

PRODUCTION TEST SPECIFICATIONS

FOR

STEREO GENERATOR 786V-1
772-5336-001

APPROVED BY

PROJECT ENGINEER Dean Lane DATE 11-22-67

ENGINEERING GROUP HEAD [illegible] DATE 11-27-67

QUALITY ASSURANCE [illegible] DATE 11-30-67

QUALITY CONTROL [illegible] DATE 11/28/67

CR	F. DATE	NR	F. DATE	LET	F. DATE	IR	F. DATE	CUST. DWG. 074-5333-300
0		0		2681850				

SYM	REV.NO	DATE	SH.REV	APPD	SYM	REV.NO	DATE	SH.REV	APPD
B	T91846	11-5 68		HPM					
A	T90304	9-12 68		HPM					
C									

REVISION DATA

CODE IDENT NO. 134

569-5641-001

SHEET 1 OF 13

D-207 (REV. 6-63)

1.0 SCOPE

These Production Test Specifications are applicable to Collins Type 786V-1 Stereo Generator, Part No. 772-5336-001.

2.0 APPLICABLE DOCUMENTS

2.1 Specifications:

Equipment Specification, Part No. 568-5006-001

2.2 Publications:

Instruction Book, Part No.

2.3 Drawings:

Schematic Diagram, Part No. 781-5317-001.

2.4 Photographs:

3.0 TEST EQUIPMENT REQUIRED

The following equipments or their equivalent are required to perform the specified tests:

1. Frequency Counter, HP Model 5212A
2. Wave Analyzer, HP Model 302A.
3. Wave Analyzer, HP Model 310A
4. Oscilloscope, HP Model 130C.
5. Audio Oscillator, HP Model 206A.
6. Power Supply, HP Model 721.
7. Test Fixture, Figure 1.
8. Audio Oscillator, HP200CD.

4.0 TEST CONDITIONS

Unless otherwise specified, all tests shall be performed under the following conditions:

6.0 INITIAL ADJUSTMENTS

6.1 Pilot Carrier Level and Frequency:

Connect the 310A wave analyzer to the output of the test fixture. Connect the frequency counter to the output of the wave analyzer. Do not use any audio input to the test fixture at this time. Turn PILOT switch on the board to ON and adjust R49 for maximum output voltage. Tune the wave analyzer for a peak at 19 KHz, read and record the maximum output voltage. Also read and record the frequency on the frequency counter. Turn PILOT switch OFF.

6.2 Unwanted Sideband Suppression:

Connect the audio oscillator to the input of the test fixture and the 310A wave analyzer to the output of the test fixture. Place FUNCTION SELECT switch on test fixture to L ONLY. On wave analyzer, place ABSOLUTE/RELATIVE switch in ABSOLUTE position. Adjust oscillator output at 15,000 Hz for a 0 db (100 mv range) on the wave analyzer. Now tune the wave analyzer to 61 KHz, increasing sensitivity until an on scale reading is obtained. Adjust R12 on printed circuit card for minimum 61 KHz signal. Read and record the level in db of the 61 KHz signal.

Repeat the above for R ONLY and adjust R28 for minimum 61 KHz signal. Read and record the level in db of the 61 KHz signal.

6.3 Channel Separation:

Connect the audio oscillator to the input and the oscilloscope to the output of the test fixture. Set FUNCTION SELECT switch on test fixture to L ONLY: At a frequency of 5000 Hz adjust oscillator output level for a 285 millivolt p-p signal on the oscilloscope. Increase vertical sensitivity to 2 mv/cm, and adjust R16, CHANNEL SEPARATION, on the card for a flat base line as shown in Figure 2. Read and record the ripple in mv for L ONLY and R ONLY for the following frequencies: 50, 100, 400 Hz, 1, 5, 7.5, 10, 15 KHz.

7.0 TEST REQUIREMENTS

7.1 Preliminary Tests:

Preliminary tests as outlined in Section 5.

7.2 Initial Adjustments:

Initial adjustments as outlined in Section 6.

7.3 38 KHz Subcarrier Suppression:

Connect the 310A wave analyzer to the output of the test fixture. Place the MODE switch on the test fixture to L = R. On the wave analyzer set the RANGE switch to 0 db, the ABSOLUTE-RELATIVE switch to ABSOLUTE, the MAX INPUT VOLTAGE switch to .1, and the FREQUENCY to 15 KHZ. Connect the audio oscillator to the input of the test fixture, frequency to 15,000 Hz and output level sufficient to cause a reading of 90 millivolts RMS on the wave analyzer. Place the ABSOLUTE-RELATIVE switch on the wave analyzer to the RELATIVE position and adjust the REF ADJUST control for 0 db on the meter. Change the FREQUENCY dial on wave analyzer to 38 KHz and read the amount of 38 KHz present. Record this value in db. Change the FREQUENCY dial to 76 KHz and read the amount of 76 KHz present. Record this value in db.

7.4 Frequency Response:

Connect the audio oscillator to the input of the test fixture and the oscilloscope to the output. Set FUNCTION SELECT switch on test fixture to L ONLY. On the audio oscillator, place all attenuators to 0, frequency to 50 Hz, and adjust AMPLITUDE control for 285 mv. p-p on the oscilloscope. Read and record the db level on the oscillator meter. Maintaining the db level reading on the meter, change frequency to 100 Hz and, if necessary, adjust attenuators on oscillator for 285 mv. p-p on the oscilloscope. Read and record attenuator readings in db for 100 Hz and repeat for 400, 1,000 Hz, 5, 7.5, 10, and 15 KHz.

Repeat for R only modulation.

7.5 Harmonic Distortion:

Connect the HP302A Wave Analyzer to the output of the test fixture and the audio oscillator to the input of the test fixture. Set FUNCTION SELECT switch to L ONLY. At 50 Hz adjust oscillator output for a -20 db reading on the wave analyzer meter. Tune the wave analyzer to the second harmonic (100 Hz), read and record the level in db. Tune the wave analyzer to the third harmonic (150 Hz), read and record the level in db. Repeat for 1 KHz, 10 KHz and 15 KHz.

Repeat for R ONLY modulation and 50 Hz, 1 KHz, 10 KHz, and 15 KHz.

7.6 Pilot Phasing:

Connect the audio oscillator to the input and the oscilloscope to the output of the test fixture. Set FUNCTION SELECT switch on the test fixture to L = -R. At a frequency of 1000 Hz adjust the oscillator output level for 285 millivolts p-p on the oscilloscope. Now connect the external trigger input of the oscilloscope to the top end of R45 on the stereo generator card through a 22 K ohm 1/2 watt resistor. Adjust the HOR SWEEP on the oscilloscope to 0.5 microsec/CM, and the vertical sensitivity to 5 mv/CM. Carefully adjust the triggering controls on the oscilloscope for a stable pattern on the screen. Refer to Figure 5. Now turn the audio input OFF and the Pilot Carrier ON. Observe and record the horizontal displacement of the two crossovers of the signals. The maximum allowable displacement is $\frac{4}{5}$ CM or 0.4 usec. Now adjust R49 for 0.0085 volts rms of Pilot Carrier at the output of the card.

SER NO._____
TECH._____
DATE_____

8. DATA SHEET REQUIREMENTS

8.1 Preliminary Tests:

76.000 KHz crystal installed	_____	Check
Card and filters installed	_____	Check

8.2 Initial Adjustments:

8.2.1 Maximum voltage of pilot	_____Vrms	NLT 0.012Vrms
Pilot carrier frequency	_____Hz	19,000 ± 2 Hz
8.2.2 Left Channel 61 KHz signal	-_____db	NMT -60 db
Right Channel 61 KHz signal	-_____db	NMT -60 db

8.2.3 Channel Separation:

f_{Hz}	L ONLY	R ONLY	Test Limits
50	_____	_____	NMT 2 MV P-P
100	_____	_____	NMT 2 MV P-P
400	_____	_____	NMT 2 MV P-P
1K	_____	_____	NMT 2 MV P-P
5K	_____	_____	NMT 2 MV P-P
7.5K	_____	_____	NMT 2 MV P-P
10K	_____	_____	NMT 2 MV P-P
15K	_____	_____	NMT 2 MV P-P

8.3 38 KHz Subcarrier Suppression:

38 KHz signal	_____db	NMT -40 db
76 KHz signal	_____db	NMT -40 db

SER. NO._____
TECH._____
DATE_____

8.4 Frequency Response:

50 Hz reference level _____dbm

ATTENUATOR SETTINGS

Freq. Hz	L ONLY	R ONLY	Test Limits
50	_____	_____	0 Ref.
100	_____	_____	0 ± 1.5 db
400	_____	_____	-.14 ± 1.5 db
1,000	_____	_____	-0.88 ± 1.5 db
5,000	_____	_____	-8.16 ± 1.5 db
7,500	_____	_____	-11.30 ± 1.5 db
10,000	_____	_____	-13.66 ± 1.5 db
15,000	_____	_____	-17.08 ± 2.0 db

8.5 Harmonic Distortion:

L ONLY

f_{Hz}	1st	2nd	3rd	Test Limits
50	-20	_____	_____	NMT -69 db
1K	-20	_____	_____	NMT -69 db
10K	-20	_____	_____	NMT -69 db
15K	-20	_____	_____	NMT -69 db

R ONLY

f_{Hz}	1st	2nd	3rd	
50	-20	_____	_____	NMT -69 db
1K	-20	_____	_____	NMT -69 db
10K	-20	_____	_____	NMT -69 db
15K	-20	_____	_____	NMT -69 db

8.6 Pilot Phasing:

Displacement _____CM $\pm \frac{4}{5}$ CM

R49 adjusted for .0085V _____Check

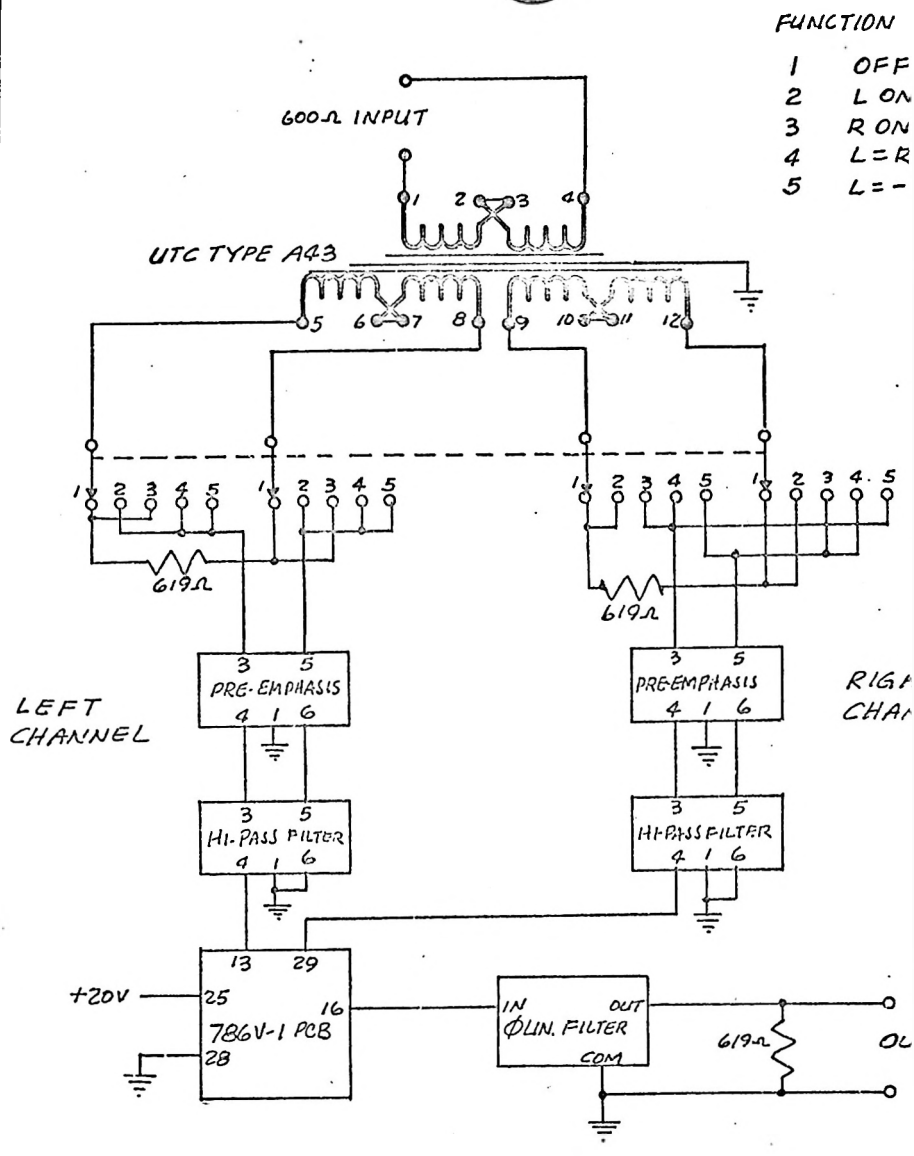


FIGURE 1
TEST FIXTURE SCHEMATIC

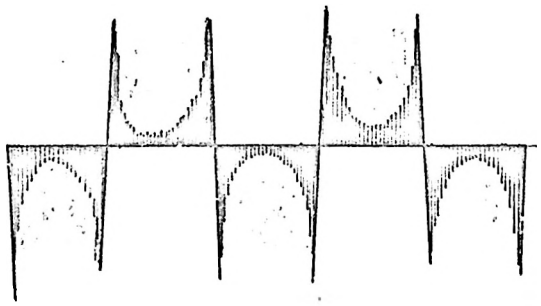


FIGURE 2

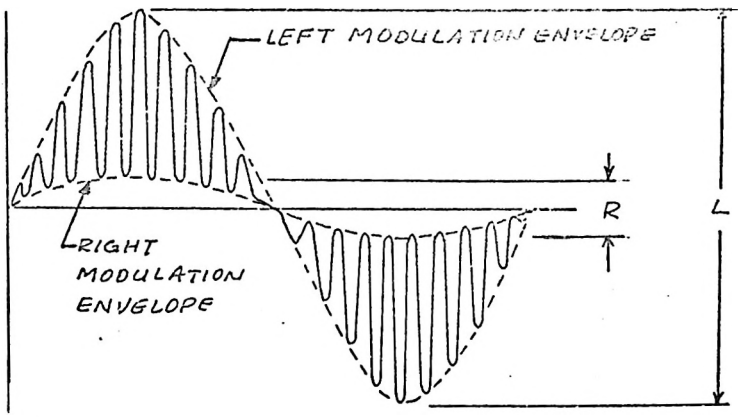


FIGURE 3

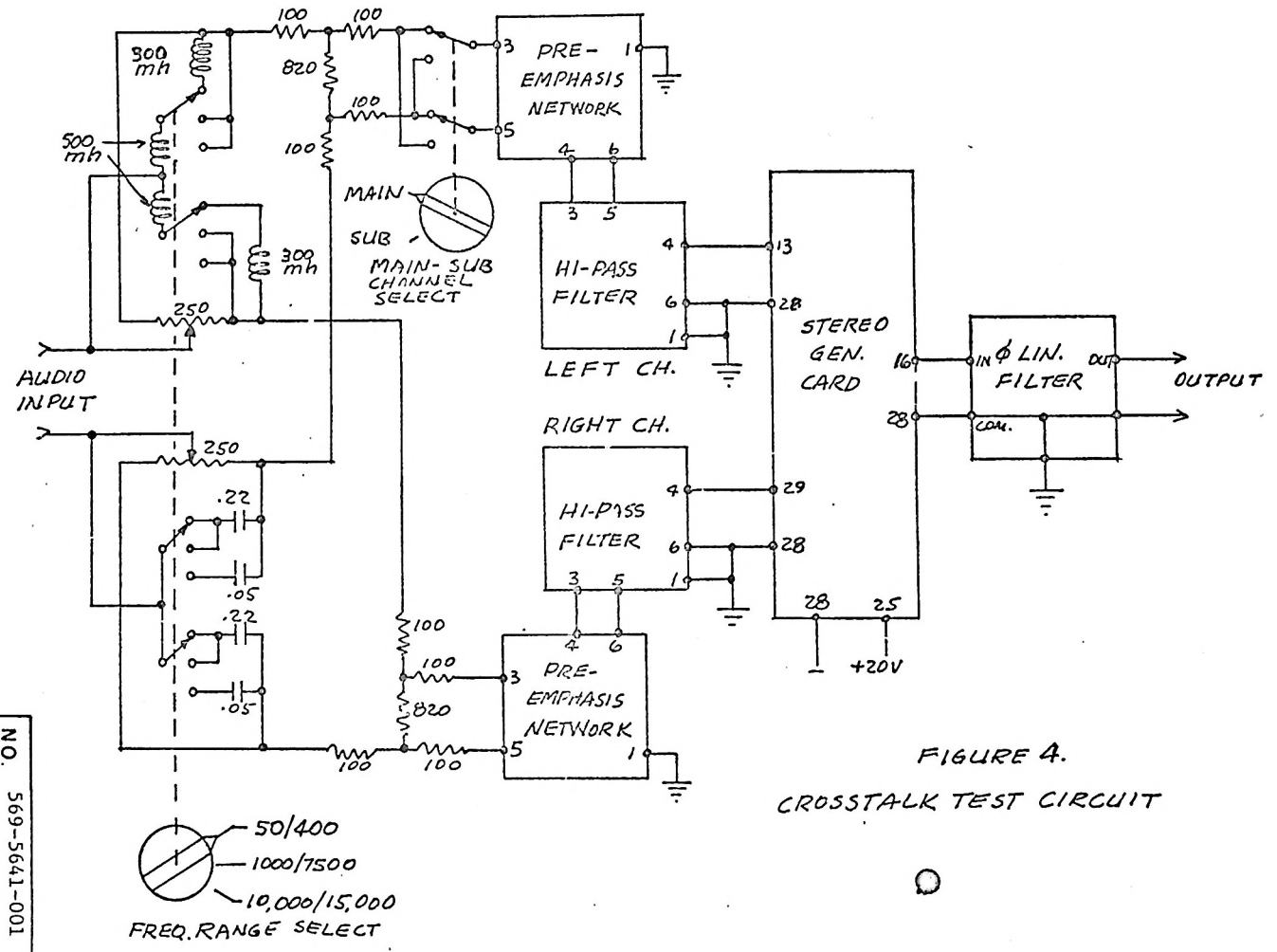


FIGURE 4.

CROSSTALK TEST CIRCUIT

NO. 569-5641-001

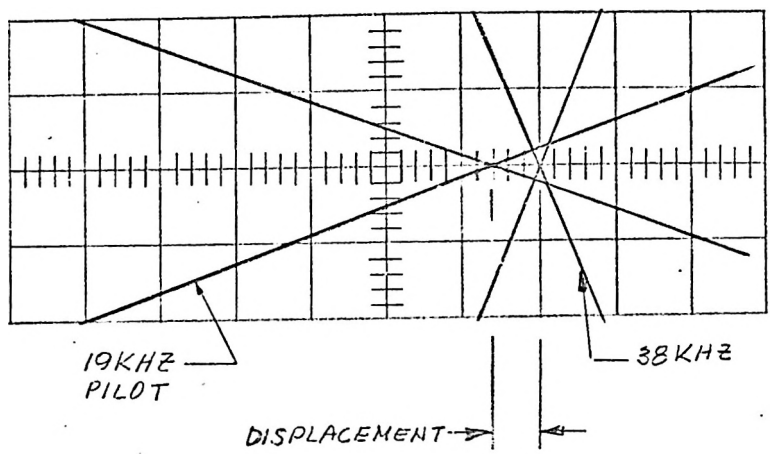


FIGURE 5.