RCA

Broadcast Equipment

BTS-1A
Stereo Subcarrier Generator

ES-560202

IB-30297

Broadcast Equipment

Instructions

BTS-1A

Stereo Subcarrier Generator

ES-560202

Communications Systems Division/Front and Cooper Streets/Camden, New Jersey, U.S.A. 08102

DL753M

IB-30297

FIRST AID

WARNING

OPERATION OF ELECTRONIC EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT WITH VOLTAGE SUPPLY ON. UNDER CERTAIN CONDITIONS DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES, ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Personnel engaged in the installation, operation and maintenance of this equipment or similar equipment are urged to become familiar with the following rules both in theory and in the practical application thereof. It is the duty of every radioman to be prepared to give adequate First Aid and thereby prevent avoidable loss of life.

ARTIFICIAL RESPIRATION

(Courtesy of the American Red Cross)

If victim is not breathing, begin some form of artificial respiration at once. Wipe out quickly any foreign matter visible in the mouth, using your fingers or a cloth wrapped around your fingers.

MOUTH-TO-MOUTH (MOUTH-TO-NOSE) METHOD

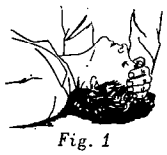

Fig. 1

Tilt victim's head back. (Fig. 1). Pull or push the jaw into a jutting-out position. (Fig. 2).

Fig. 2

If victim is a small child, place your mouth tightly over his mouth and nose and blow gently into his lungs about 20 times a minute. If victim is an adult (see Fig. 3), cover the mouth with your mouth, pinch his nostrils shut, and blow vigorously about 12 times a minute.

Fig. 3

If unable to get air into lungs of victim, and if head and jaw positions are correct, suspect foreign matter in throat, To remove it, place victim in position shown in Fig. 4, and slap sharply between shoulder blades.

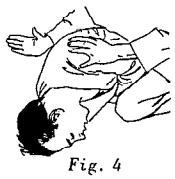

Fig. 4

Rescuers who cannot, or will not, use mouth-to-mouth or mouth-to-nose technique should use a manual method.

THE BACK PRESSURE-ARM LIFT (HOLGER-NIELSEN) METHOD

Place victim face-down, bend his elbows and place his hands one upon the other, turn his head slightly to one side and extend it as far as possible, making sure that the chin is jutting out. Kneel at the head of the victim. Place your hands on the flat of the victim's back so that the palms lie just below an imaginary line running between the armpits (Fig. 5).

Fig. 5

Rock forward until the arms are approximately vertical and allow the weight of the upper part of your body to exert steady, even pressure downward upon the hands (Fig. 6).

Fig. 6

Immediately draw his arms upward and toward you, applying enough lift to feel resistance and tension at his shoulders (Fig. 7). Then lower the arms to the ground. Repeat this cycle about 12 times per minute, checking the mouth frequently for obstruction.

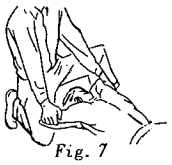

Fig. 7

If a second rescuer is available, have him hold the victim's head so that the jaw continues to jut out (Fig. 8). The helper should be alert to detect any stomach contents in the mouth and keep the mouth as clean as possible at all times.

Fig. 8

RELATED INFORMATION FOR BOTH METHODS

If vomiting occurs, quickly turn the victim on his side, wipe out his mouth, and then reposition him.

When a victim is revived, keep him as quiet as possible until he is breathing regularly. Keep him from becoming chilled and otherwise treat him for shock. Continue artificial respiration until the victim begins to breathe for himself or a physician pronounces him dead or he appears to be dead beyond any doubt.

Because respiratory and other disturbances may develop as an aftermath, a doctor's care is necessary during the recovery period.

BURNS

FIRST DEGREE BURN

SKIN REDDENED. Temporary treatment—Apply baking soda or Unguentine.

SECOND DEGREE BURN

SKIN BLISTERED. Temporary treatment — Apply baking sode, wet compress, white petroleum jelly, foille jelly, olive oil, or tea.

THIRD DEGREE BURN

FLESH CHARRED. Temporary treatment — Apply baking soda, wet compress, white petroleum jelly, or foille spray. Treat for severe shock.

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BTS-1A Stereo Subcarrier Generator

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

LIST OF CONTENTS OF SCHEDULE ES-560202

Stereo Subcarrier Generator (BTS-1A)

Item	Quantity	Description	Reference
1	1	STEREO SUBCARRIER GENERATOR	MI-560001
2	1	INPUT ADAPTER NOTE: MI-560004 Adapter is used only in conjunction with BTE-10B Exciter.	MI-560004
3	*	SET OF SPARE TUBES	MI-560005
4	*	FILTER NOTE: Items 3 and 4 are furnished only upon customer order. Item 4 will be required whenever simultaneous stereo and SCA transmissions are to be made by user. If used, it is installed by customer in the BTX-1A SCA Subcarrier Generator.	MI-560003

LIST OF CONTENTS OF MASTER ITEM MI-560001

Stereo Subcarrier Generator (BTS-1A)

Item	Quantity	Description	Reference	Part or Group
1	1	STEREO SUBCARRIER GENERATOR	8528102	501
2	1	NETWORK, PRE-EMPHASIS (Z1)	481755	3
3	1	CAPACITOR, ELECTROLYTIC	735712	53
4	1	SUITABLE CONTAINER CONTAINING:		
		(A) 3 CONNECTOR	481799	1
		(B) 1 PLUG	1510013	101
		(C) 1 CONNECTOR, FEMALE	727969	14
5	2	INSTRUCTION BOOK	IB-30297	
6	1	PACKING LIST	THIS MI	

LIST OF CONTENTS OF MASTER ITEM MI-560003

Filter For BTX-1A

Item	*Quantity*	*Description*	*Reference*	*Part of Group*
1	1	NETWORK, BANDPASS	8480354	501
2	1	CONNECTION DIAGRAM	8480349	

LIST OF CONTENTS OF MASTER ITEM MI-560004

Input Adapter For BTE-10B

Item	*Quantity*	*Description*	*Reference*	*Part or Group*
1	1	INPUT ADAPTER	8528909	501
2	1	PLUG (P 401)	1510013	101
3	1	SCHEMATIC DIAGRAM	8480344	

LIST OF CONTENTS OF MASTER ITEM MI-560005

Item	*Quantity*	*Description*	*Reference*
1	1	TUBE	7643
2	1	TUBE	6922

TECHNICAL DATA

Electrical Specifications

Power Requirements ..... 117/208/240 volts ±11 volts, 50/60 cps, 10 watts
Pilot Stability ..... 19 KC ±1 cps
Temperature Range ..... −20° to +45° C
Maximum Altitude ..... 7500 feet
Subcarrier Suppression 1%
Frequency Response (Composite Signal) ..... 30 to 15,000 cps, ±1.5 db
Pre-Emphasis ..... 75 microseconds
Peak Modulation Capability (any L, R combination) ..... ±100 KC
Separation (L vs. R and R vs. L) 50 to 15,000 cps ..... 30 db
Harmonic Distortion 30 to 15,000 cps 1%
Crosstalk (Main to Sub) ..... −50 db
Crosstalk (Sub to Main) ..... −50 db
Signal-to-Noise Ratio (RF Carrier modulated 90% by L−R (DSB) signal) ..... 60 db

Mechanical Specifications

Height ..... 10½ inches
Width ..... 19 inches
Depth ..... 9 inches (overall)
Weight ..... 25 pounds

TUBE COMPLEMENT

Quantity	*Symbol*	*Type*
1	V1	7643
2	V2, V401	6922

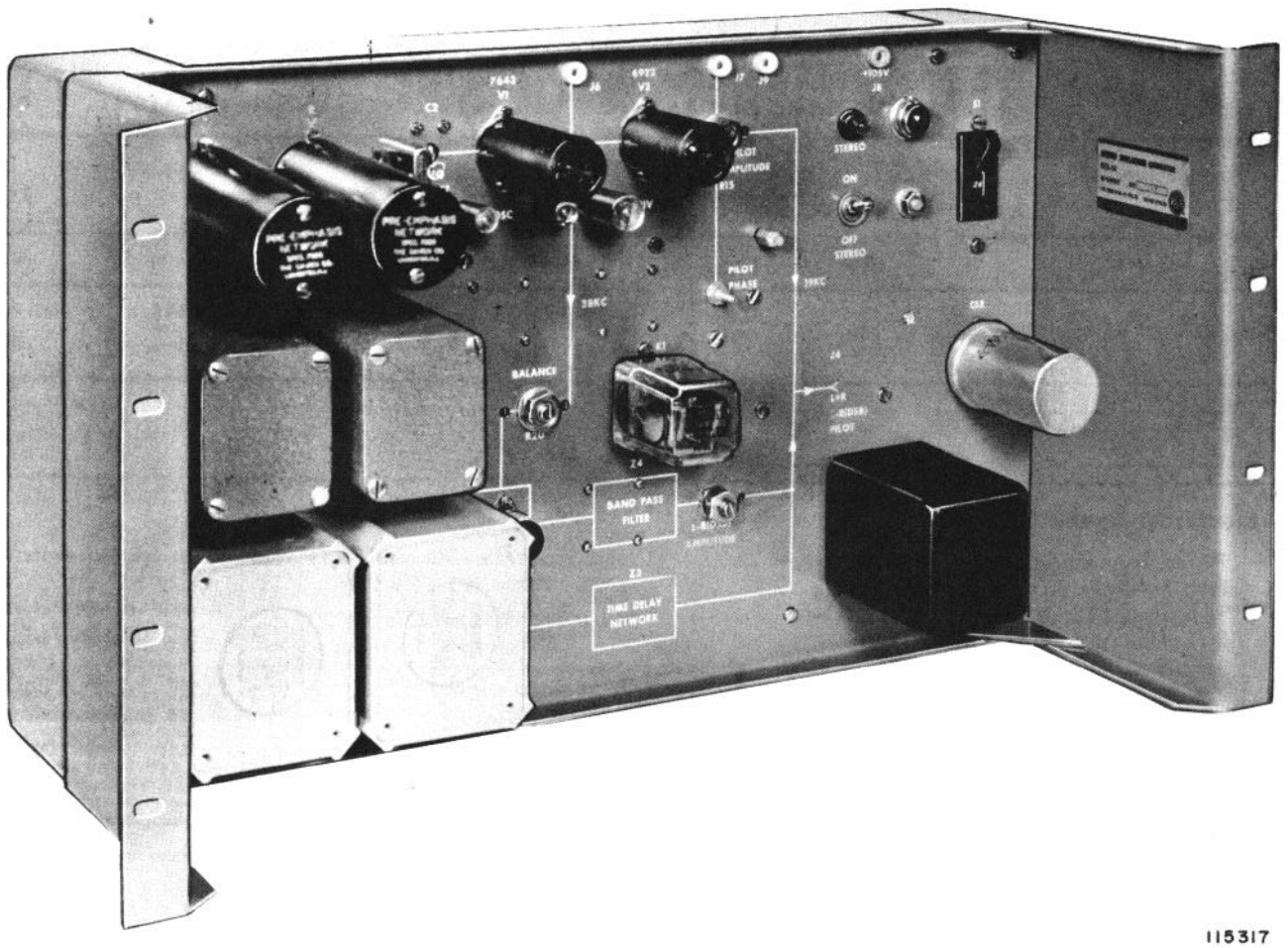


Figure 1 — BTS-1A Stereo Subcarrier Generator

DESCRIPTION

General

The RCA BTS-1A FM Stereo Subcarrier Generator, MI-560001 (see Figure 1) is a double sideband generator which produces a composite output containing the following: first, a L and R channel which consists of the sum signal (L+R); second, a double-sideband-suppressed carrier signal which is centered on the carrier frequency of 38KC, written as L—R (DSB); third, a carrier-pilot signal output at 19KC which is exactly half the carrier frequency. This composite signal is fed into the RCA BTE-10B FM Exciter as illustrated in Figure 2.

The overall function of the BTS-1A can be seen in Figure 3, which is a block diagram of the unit. The unit consists of two pre-emphasis networks, one for each channel. The output of each pre-emphasis network is applied to a matrix unit where the sum (L+R) and difference (L—R) of the left and right channels are obtained.

The L+R signal is fed through a time delay network and then combined with the L—R channel and a 19KC output for stereo transmission. The purpose of the time delay network is to provide the same time delay in the L+R signal that is found in the L—R channel due to a bandpass filter. A separate L+R bridging output is provided between the matrix and the delay network to feed an AM transmitter with a monophonic signal to permit duplicate programming.

The L—R signal is fed to a ring modulator where it amplitude modulates a suppressed 30KC subcarrier. The modulated subcarrier is then fed through a bandpass filter which results in the output of two wanted sidebands of the L—R modulation. This resultant is referred to as L—R (DSB) meaning left-minus-right double-sideband. It is in this L—R channel that the stereo information is carried. The L+R output from the time delay network then combines with the L—R (DSB) and 19KC signals as part of the composite output signal.

The 38KC subcarrier is obtained from a crystal oscillator which feeds the ring modulator and a regenerative divider. The regenerative divider divides the 38KC subcarrier signal by 2. The resultant 19KC signal is then used as a pilot signal which combines with the L—R (DSB) and the L+R signals forming the composite signal which is fed to the BTE-10B FM Exciter.

A stereo-mono relay is provided for switching between monaural and stereo operation. When operating on stereo, an indicator lamp on the front panel of the subcarrier generator will light.

Circuit Description

Pre-emphasis

The BTS-1A uses standard 75 microsecond pre-emphasis networks to apply pre-emphasis, independently, to the left and right channels. These pre-emphasis networks can be located elsewhere in the system, for instance, ahead of a limiting amplifier. In this case however, 18 db attenuators (see Figure 8 in the BTE-10B Exciter instruction book; IB-30262-1) will have to be inserted in place of the pre-emphasis networks ordinarily used in the BTS-1A. Refer to schematic diagram Figure 26 of this instruction book.

The pre-emphasis networks are designed to work from a 600 ohm source into a 600 ohm load impedance. Transformer T1 and T2 are provided for purposes of isolation and impedance matching. They will provide a match from a 600 ohm impedance to a 333 ohm impedance.

Matrixing

The functioning of the matrix can be visualized in Figure 4. Illustrated in Figure 4 is a common bridge

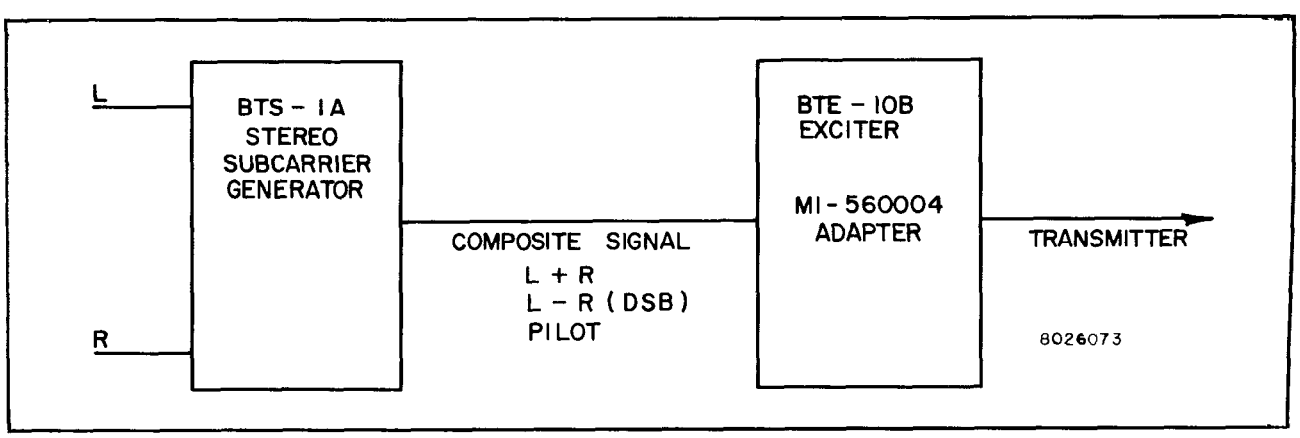


Figure 2 — Simplified Diagram Showing Relationship of BTS-1A to Exciter and Transmitter

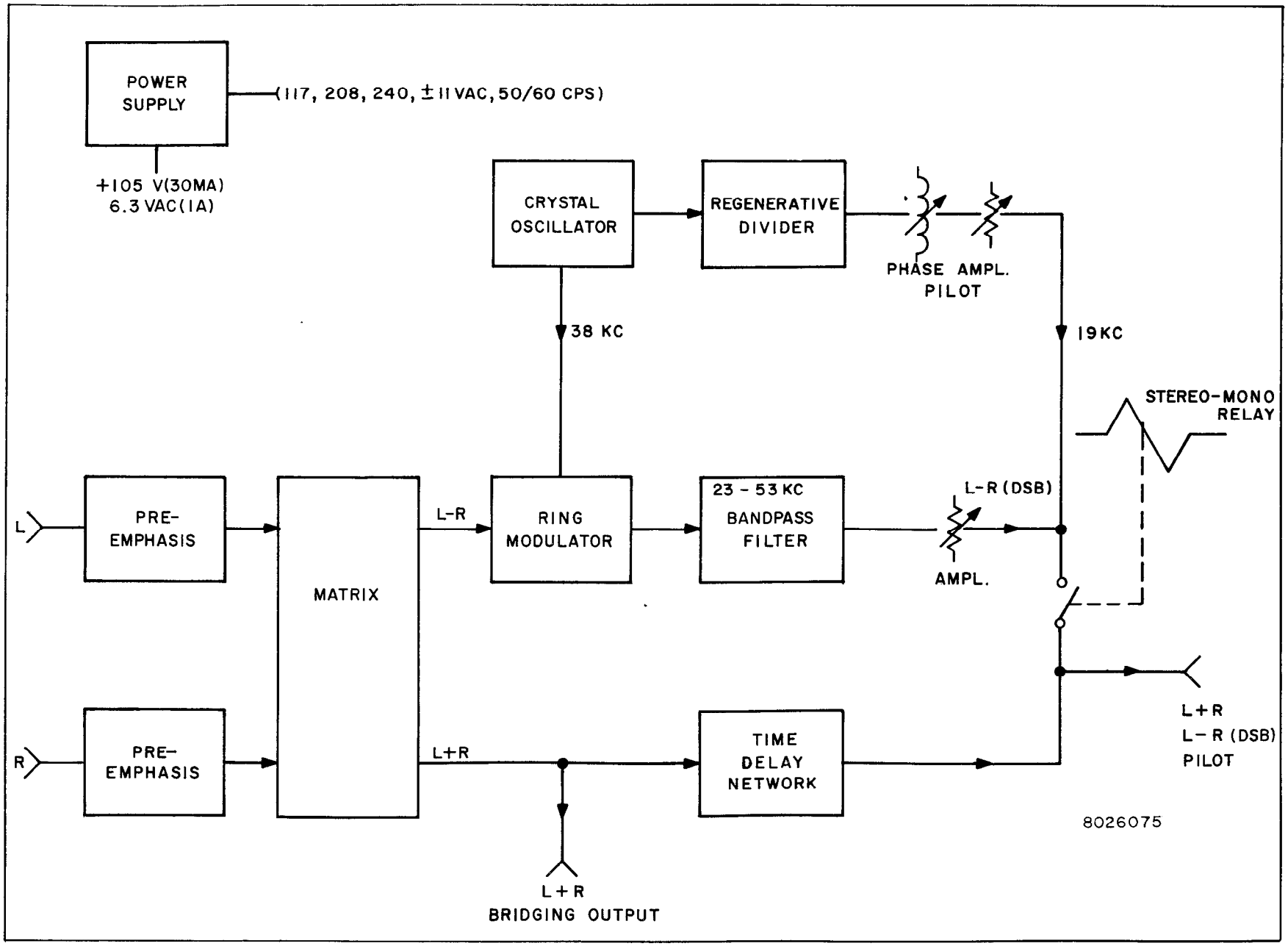


Figure 3 — Block Diagram, BTS-1A Stereo Subcarrier Generator

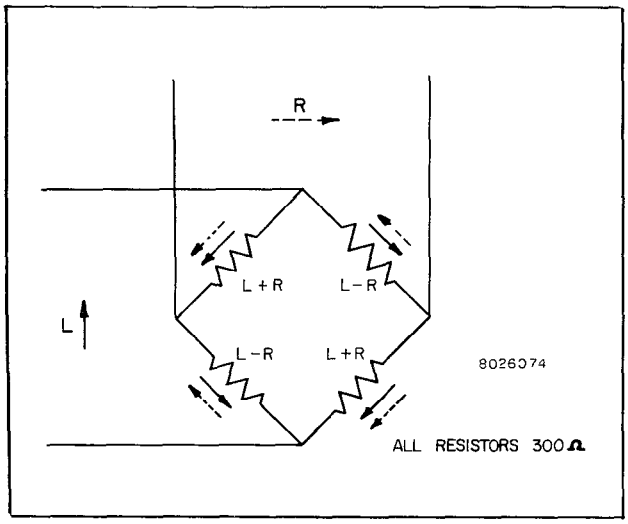


Figure 4 — Bridge Circuit Analogy of Matrix Functioning

circuit with a 300 ohm resistor in each leg. If the left and right channels are applied across the two diagonals of the bridge as shown, the L+R signals will appear in two legs of the bridge and the L—R signals will appear in the other two legs of the bridge. In the actual circuit, the 300 ohm resistors are replaced by half windings of transformers T3 and T4 respectively. The half windings are connected in series to provide a 600 ohm source impedance of the L+R and L—R signals. Resistors R21, R22, and R23 are provided so that each diagonal can obtain an impedance of 333 ohms, and they also permit balancing of the bridge.

The L+R information is subsequently fed to a time delay network. This time delay network has a characteristic impedance of 600 ohms. It is a low-pass network which is terminated by R18, a 600 ohm resistor, one side of which is grounded. Across this resistor a L+R signal will appear, delayed approximately 50 microseconds by the time delay network. An output is provided for the L+R signal at terminal J3. The load impedance across J3 should be in excess of 15,000 ohms in order not to disturb the matching of the bridge. It should also be noted that pin 2 of J3 is at ground potential.

The L—R signal is connected to a diode "quad", CR5, which consists of four germanium diodes. This diode "quad", if connected as a ring modulator, is basically a double-pole-double-throw switch. Depending on the polarity of the biasing voltage, the double-pole-double-throw switch is thrown from one position to the other as indicated in Figure 5 A and B. This means that the L—R signal voltage is reversed in polarity at the rate of the switching frequency. The switching frequency in the system is 38KC which is derived from the crystal oscillator. The resultant of the L—R signal being switched at a 38KC rate is illustrated in Figure 6. This waveform contains the wanted L—R (DSB) signal, but also contains amplitude modulated components with carrier frequencies 76KC, 104KC, and 142KC.

A balance control, R20, is provided in the modulator circuit. This control permits the carrier-rejection to be adjusted by compensating for slight differences in the diodes of the diode "quad". Due to the close proximity of the diodes in the diode "quad" and the close matching, the ring modulator is highly independent of variations in ambient temperature. The variation of carrier rejection is in the order of several db over the temperature range as indicated in the Technical Data.

The L—R (DSB) signal is fed into transformer T6 which provides an impedance match between the output of the ring modulator and the bandpass filter.

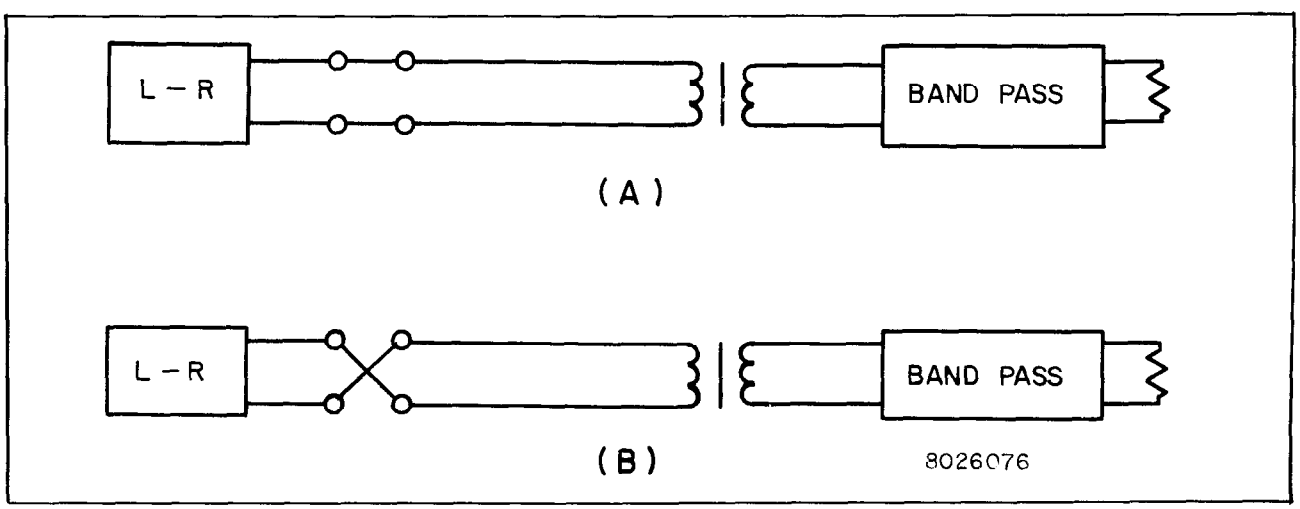


Figure 5 — Illustration of Ring Modulator Switching

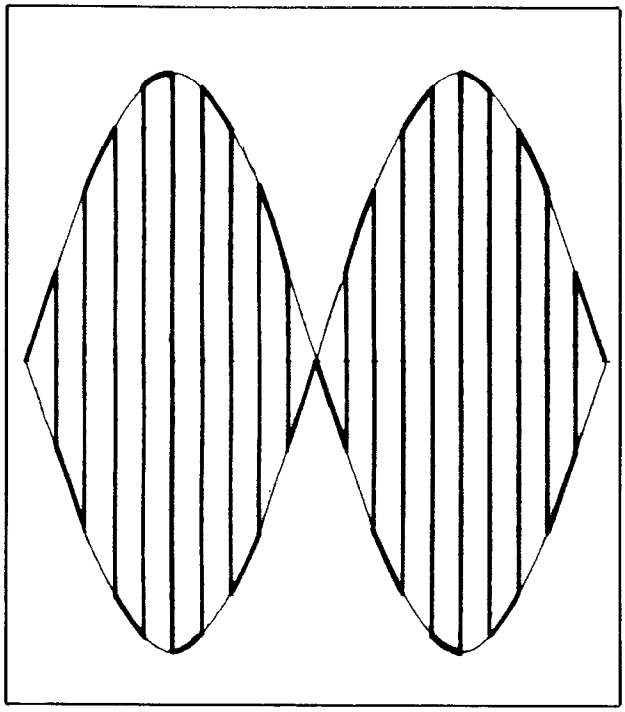


Figure 6 — The Combining of L − R Signal and 38 KC Carrier

Matrix Inputs and Outputs

The main reason for matrixing is compatibility. Thus a person who is not equipped to receive stereo will be able to receive the same information monophonically.

Refer to Figure 7, during this brief explanation on how the matrix functions: The different sketches illustrate the outputs of the matrix for different types of inputs.

In Figure 7A, if both left and right channels are fed with a sine wave in phase, there will only be an output from the L+R channel with twice the magnitude of the input signal. There will be no output at the L−R channel.

In Figure 7B, a sine wave is fed into the left (L) channel. The outputs are sine waves which equal one-half of the input but still in phase with the input sine wave.

In Figure 7C, a sine wave is fed into the right (R) channel. The output here is also one-half the input magnitude, however the L+R signal is in phase with the input but the L−R signal is of opposite polarity.

In Figure 7D, shows input signals to the left and right inputs with the same frequency, same amplitude but opposite polarity. This provides an output signal from the L−R channel which is in phase with the input to the left (L) channel. There will be no output from the L+R channel.

Figure 7E and 7F illustrate two other examples of what the outputs of the matrix would be for given inputs.

Filter Network

The bandpass filter has a 3 db bandwidth of 36KC with a center frequency of 38KC. This filter will eliminate all components outside a range from 23 to 53KC. It is particularly effective in removing components in the band of frequencies utilized by SCA subcarriers.

Any spurious components in a frequency range from 57KC and above, will be attenuated better than −70 db relative to 100% modulation on the main carrier. This means −50 db relative to an SCA subcarrier with a modulation percentage of only 10%. (See Figure 8.) The bandpass filter is terminated with resistors R17 and R16 which total 3600 ohms. At this location, an L−R (DSB) signal is present. This signal is connected in series, that is, added to the L+R signal which appears across R18; and in order to match the amplitude of both signals properly, the L−R (DSB) signal is adjustable with R16.

Composite Signal

The composite signal also has a 19KC pilot signal along with the L+R and L−R (DSB) signals. This 19KC pilot appears across resistor R15 which is also connected in series with R18 and R16. Thus, at this point the three signals (L+R, L−R (DSB) and 19KC) are added together forming the composite signal which appears at output terminal J4. The composite signal can also be measured from the front panel at test point J9.

The availability of the composite signal at the output has several advantages. It is easy to adjust modulation percentage and pilot phasing. Waveforms for this purpose can be observed on the oscilloscope without the need of FM detection. Figure 9 shows a waveform obtained with proper phasing of the 19KC pilot. To obtain this waveform, equal signals out of phase are fed into the left and right inputs of the matrix. The top waveform in Figure 9A represents a modulating frequency which is not an integral sub-multiple of the carrier frequency, while the bottom waveform of Figure 9B shows a modulating frequency being an exact sub-multiple of the carrier frequency. Figure 10A shows incorrect phasing with a pilot carrier being approximately 45° out of phase, and Figure 10B shows correct phasing with a left or right signal only.

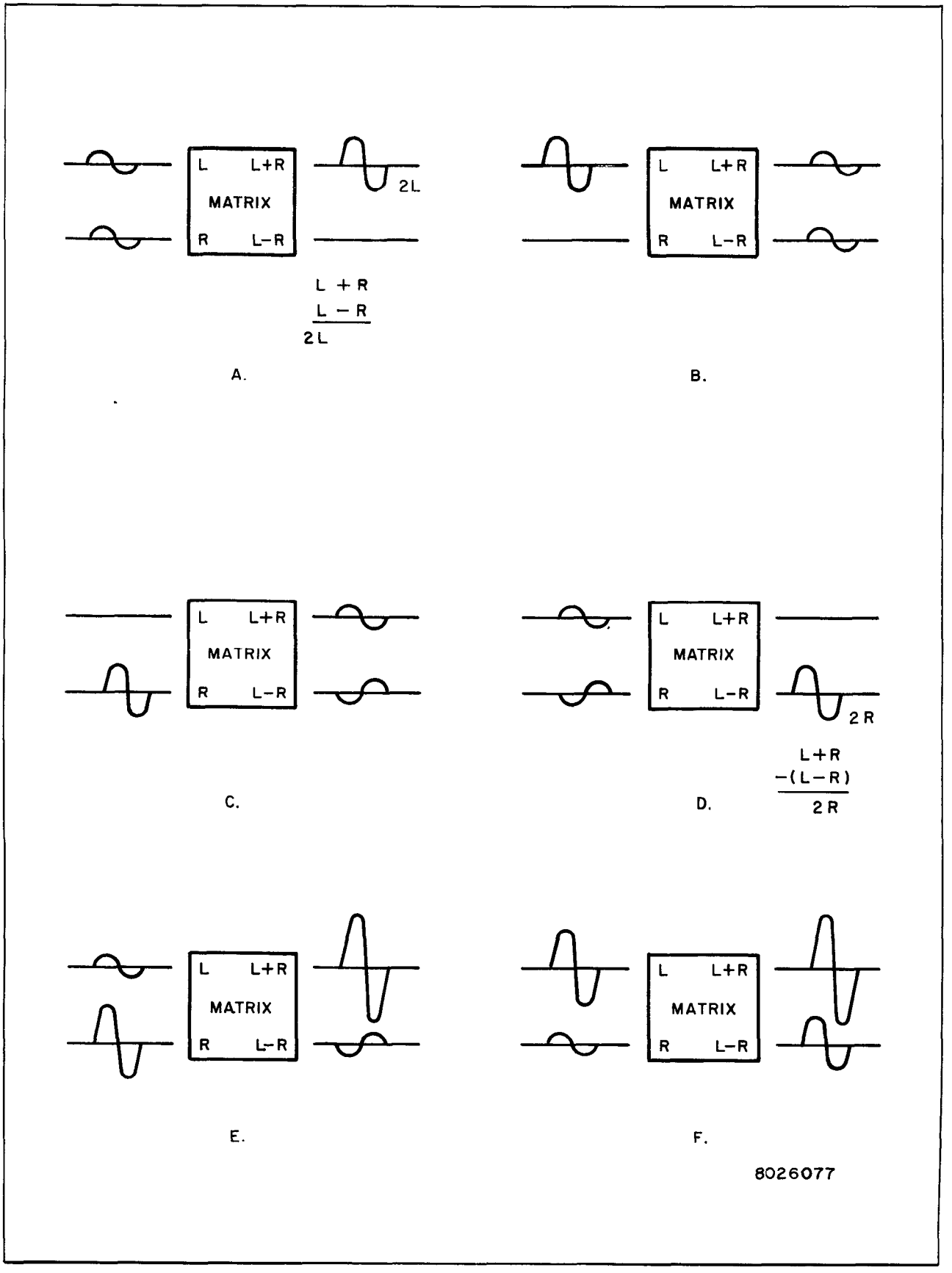


Figure 7 — Examples of Matrix Outputs for Different Type Inputs

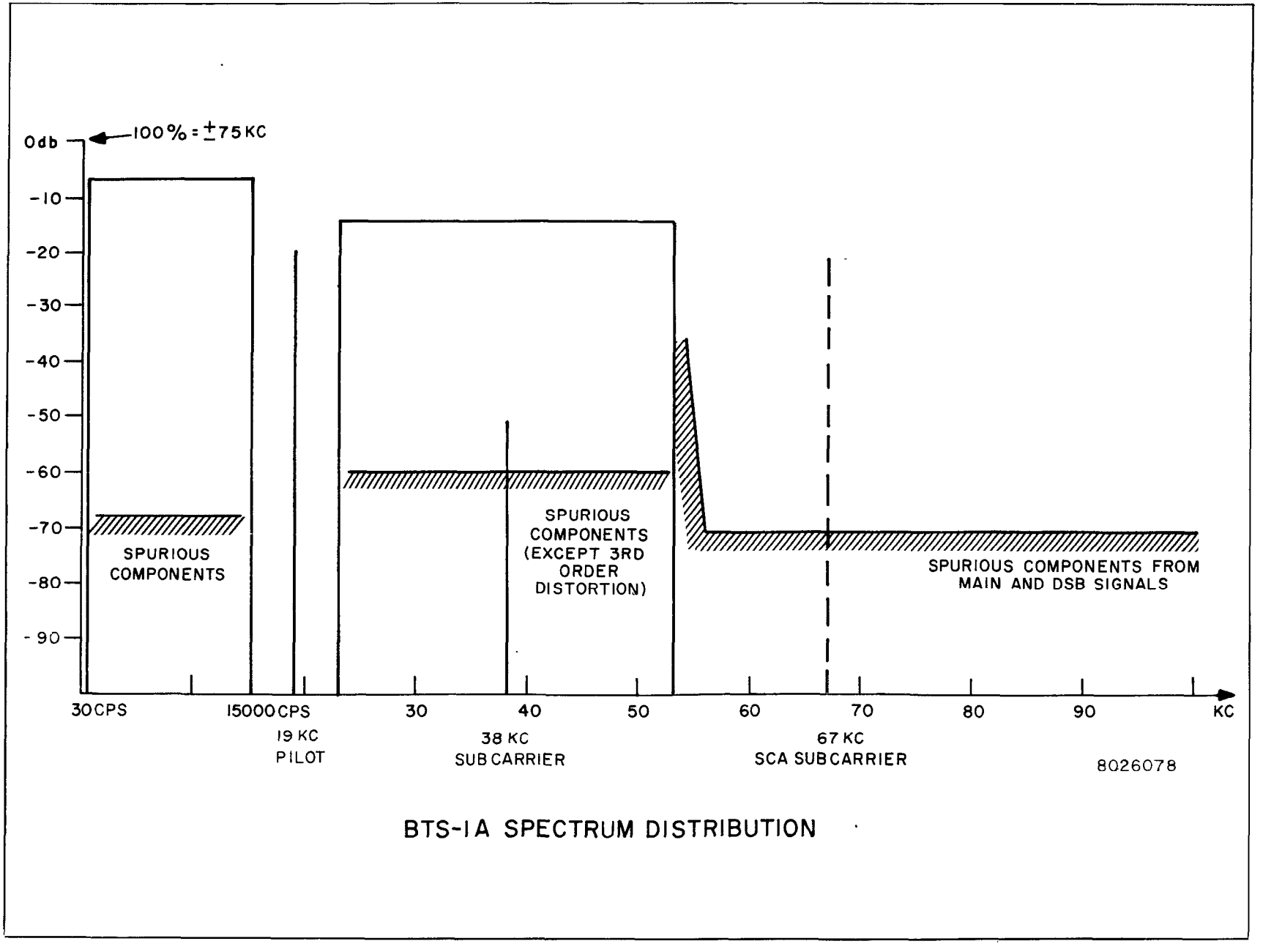


Figure 8 — BTS-1A Spectrum Distribution

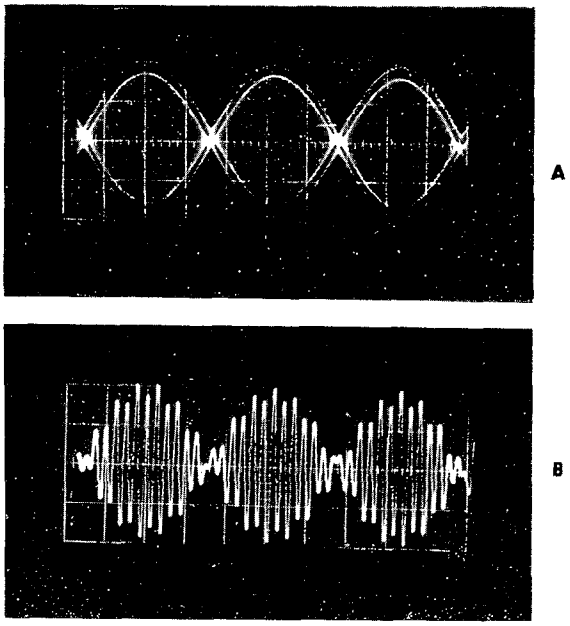


Figure 9 — Proper Phasing of 19 KC Pilot Signal

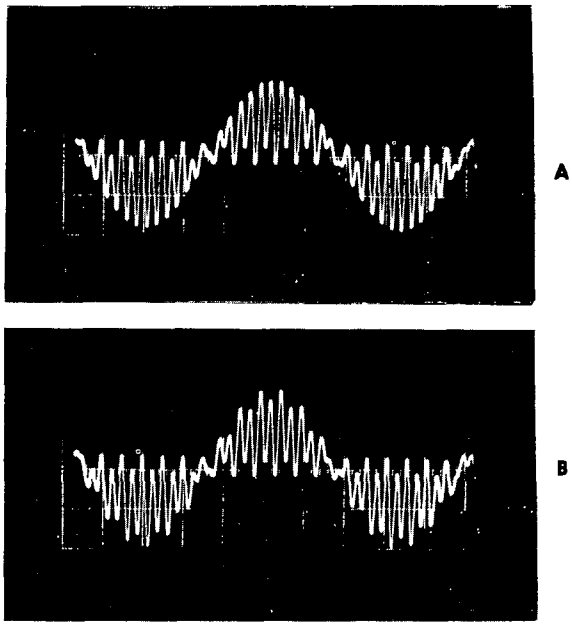


Figure 10 — Effects on Composite Signal Due to Pilot Phasing

Stereo Mono Relay

Part of the series connection of R18, R16, and R15 can be short circuited using relay K1. This relay can be actuated locally or remotely; locally by closing switch S2, and remotely by closing contacts 15 and 16 of J5.

For stereo operation, relay K1 will be energized and the contacts which short R15 and R16, will open. The other contact will close and apply power to pilot light DS2 indicating that the subcarrier generator is in the stereo mode.

Crystal Oscillator

The crystal oscillator which operates at 38KC can be varied 2 cps by capacitor C2, however the oscillator does not normally require any adjustment. This 38KC signal can be checked at J6.

The 38KC signal is amplified in the triode section of V1 and then fed to the ring modulator. The switching frequency of 38KC does not contain any components at 19KC or 57KC. Both components are very difficult to remove from the composite signal since they are very close to the edges of the bandpass filter.

The 38KC signal from the oscillator is also fed to a regenerative divider (V2) where the 19KC pilot signal is obtained. The divider is very stable, maintaining lock-in for synchronizing voltage variations of 40 db and plate voltage variations in excess of 50%. The output of the divider can be checked at J7. The amplitude of the 19KC pilot frequency can be varied using R15 while the phase of the pilot can be adjusted by means of L2. With the amplitude adjustment R15 full CCW, the amplitude of the pilot appearing in the composite signal is attenuated at least 60 db. This will facilitate the precise adjustment of the rejected 38KC carrier signal.

It is imperative that correct phase is maintained since all demodulating systems display a certain amount of sensitivity to phase errors. Most sensitive to phase errors are the time switching and AM synchronous detection systems, while the AM envelope detection method has a lesser dependency on pilot phase. Should the pilot phase error be ± 90 degrees, a left to right channel reversal will take place. The amplitude of the pilot can be adjusted to give modulation percentages between 0 and 15% on the main channel.

Power Supply

The power supply of the BTS-1A utilizes silicon rectifiers to provide 105 volts dc for tubes V1 and V2.

A break-down diode (CR6) is provided to maintain the plate voltage at 105 volts. This voltage can be checked at test point J8. The power transformer T8, also provides 6.3 volts ac to operate relay K1 and the filaments of V1 and V2. The sub-carrier generator can be operated from any line voltage between 106 to 128 volts ac, and 197 to 251 volts ac at 50 or 60 cycles.

Input Adapter

An Input Adapter MI-560004, is used to replace the input transformer, T101, in the BTE-10B Exciter. Refer to the schematic diagram Figure 25. The replacement of T101 is necessary to extend the frequency

response to a range from 5 cycles to approximately 80KC. This wide frequency response is required to accommodate the composite stereo signal without deterioration of left versus right channel separation. The input adapter contains one tube V401.

The adapter is powered from the BTE-10B Exciter. Voltages of 6.3 dc and 150 dc are provided for the filament and plate respectively. One section of the dual triode (type 6922) is used as a wideband phase splitter, providing equal and opposite phase voltages to be fed to the grids of the reactance tubes in the exciter.

The other section of V401 is used to overcome loading of the automatic frequency control loop by a 270K resistor (R410) and .33 mf capacitor (C405). The input adapter is mounted where T101 would normally be located.

Band Pass Filter

A Bandpass Filter (MI-560003) is provided to be installed in the BTX-1A subcarrier generator in case the BTX-1A is used simultaneously with the BTS-1A for simultaneous stereo and SCA transmissions. The purpose of this filter is to remove any components (at the BTX-1A output) below 53KC to a level of −60 db or better relative to 100% main carrier modulation. This is to prevent interference from the SCA channel into the stereo subchannel.

Two connections are necessary to connect the filter into the BTX-1A. The filter is a bandpass with a total bandwidth of 17KC and a center frequency of 67KC. The use of the bandpass filter, which has become necessary due to the introduction of the stereo subchannel, will cause a slight increase in harmonic distortion of the SCA channel. This increase will be more pronounced at higher modulating frequencies than at lower modulating frequencies. At 400 cycles, harmonic distortion at the SCA subcarrier generator will be in the order of 2%.

INSTALLATION

Carefully unpack and inspect the equipment to make certain that no damage has been incurred during shipment. Any damages or shortages should be immediately reported to RCA and to the transportation company in order that lost or damaged material may be recovered.

The BTS-1A is shipped complete in one container; but, MI-560003 and MI-560004 are packed in separate boxes. All internal wiring is done at the factory; only external cables and wiring need be prepared and connected to the equipment during installation.

BTE-10B Conversion

Disconnect all leads from terminals of T101 (input transformer) and remove transformer from chassis; save the mounting hardware. Discard transformer and the following components; R108, R109, R110, R111, Terminal E20 (next to terminal 9 of T101) and wires between terminals 6 and 15 of T101, 4 and 6 of XZ101, and the wires between terminals E20 and E19.

Install small Input Adapter chassis (MI-560004) in place of T101; insert input adapter from rear of chassis and mount using T101 mounting hardware. Orient such that electrolytic capacitor is right over the tube. Connect leads as shown in Figure 25. Utilize shielded cable to connect adapter to shock-mounted subchassis. Make sure that the lead from Pin 1 and 6 of V401 goes to the grid of V102 of the exciter, and the lead from pin 3 of V401 goes to the grid of V101 of the exciter. Check the operation of the automatic frequency control system. A small amount of retuning will be required at the rear adjustment of T103. Set C105 for maximum deflection of M101 with switch in the V101 + V102 I_K position, or set for maximum deviation as indicated on a modulation monitor. Figure 23 shows a completed conversion.

BTS-1A Stereo Subcarrier Generator

Remove the pre-emphasis network Z101 from the exciter and insert in the BTS-1A Stereo Subcarrier Generator. Also insert second pre-emphasis network as well as C13, filter capacitor, packed with the BTS-1A (Items 2 and 3 of MI-560001).

Connect taps of transformer T8 in accordance with the proper line voltage. Refer to Table 1.

The equipment is shipped with the taps set for 240 V operation.

The unit can be operated at power line frequencies of 50 to 60 cps. No change is required.

The circuit breaker S1 can at the same time be used as POWER ON-OFF switch if desired.

Using the enclosed power line plug (Item 4 (C) of MI-560001) connect the BTS-1A to suitable point in

TABLE 1 — TRANSFORMER PRIMARY TAPS

Power Line Voltage	106	117	128	197	208	219	229	240	251
Taps to be Used	3-4	2-4	1-4	3-5	2-5	1-5	3-6	2-6	1-6

the associated equipment. (e.g. Terminals 1E2 and 1E3 in the driver rack of the BTF-5/10 FM transmitters. By connecting to these terminals, the BTS-1A Stereo Subcarrier Generator is automatically provided with line voltage whenever the transmitter is switched on.)

Connect audio lines to Left (L) and Right (R) channel inputs (J1 and J2) using plugs P1 and P2 which are provided as Item 4 (A) of MI-560001. Be sure to maintain proper polarity in the L and R channels.

For monophonic operation equal signals should be fed to L and R inputs. If only one line is used, the input to either left or right inputs must be increased by 6 db.

Provide interconnecting cable from J4 of the BTS-1A to J401 of the MI-560004 input adapter, using plugs provided as Item 4 (B) of MI-560001 and Item 2 of MI-560004. Use RG58A/U cable or equivalent. Make this cable as short as practical, preferably not longer than 15 feet.

A bridging output is provided at J3. Note that the load impedance should not be less than 15,000 ohms. Terminal 2 of J3 (the small slot) is connected to ground. At this output a L+R signal is present. Check that the tubes, relay, pre-emphasis network, capacitor, crystal and the ring modulator, CR5, are properly seated in their respective sockets. Power can now be applied by closing S1. The green pilot light DS1 will light when power is applied to the unit and S1 is in the ON position. Place S2 in the STEREO ON position.

Initial Adjustments

The following adjustments are made in the factory before the unit is shipped; however, they may be repeated to confirm proper operation of the complete system.

1. Adjust R20 (Balance) for minimum voltage at J9 test point with R16 fully CW and R15 fully CCW.

2. Voltage at J9 should be $7mv_{RMS}$ or less (use HP330 distortion analyzer, meter position set for $30mv_{RMS}$ full scale).

NOTE: For the following steps, set oscilloscope for approximately 500 μs/cm sweep rate when using the J9 test point. Use 400 cps signal to synchronize the oscilloscope.

3. With L only input to J1 at 400 cps and +10 dbm, adjust R16 for proper balance L+R vs. L−R (DSB). Use scope on J9 test point. Display to resemble Figure 11 or 18E.

4. With 400 cps at +10 dbm 180° out of phase to J1 and J2, adjust L2 "Pilot Phase" to resemble Figure 9.

5. Adjust R15 for 8 to 10% pilot modulation as indicated on station monitor (25 to $35mv_{RMS}$ at test point J9).

Remote Switching

Switching from stereo to mono modes and vice versa is accomplished by switch S2 and relay K1. Whenever the unit is in the stereo mode an indicator light marked "Stereo" will be lit.

Switch S2 will override any remote commands. Open S2 for remote control. To control the mode from a remote point, connect two lines to terminals 15 and 16 of J5. Provide SPST switch at the remote end of this line. Closing this switch will put the BTS-1A in the stereo mode.

Should remote control over telephone lines be desired a latching relay panel MI-27509A must be installed at the BTS-1A location. Connect terminals 15 and 16 of J5 of the BTS-1A to terminals 3 and 7 of the MI-27509A Latching Relay Panel. Connect leads 4 and 8 to one side of a 117 V AC supply. The other side of the 117 V AC supply should go to proper terminals (depending on position used) in the A and C banks of terminals on the BTR-11A or 20A transmitter control units (MI-27526 or 27538). Terminal 5 of the latching relay panel should be connected to a terminal in the B bank and terminal 9 should go to the D bank. Further information is contained in the instruction book for the BTR-11A and BTR-20A Remote Control Systems.

Simultaneous Use of Stereo and SCA Subchannels

If simultaneous use of stereo and SCA subchannels is desired, an MI-560003 filter must be installed in the BTX-1A Subcarrier Generator to attenuate components of the 67 kc subcarrier. Information for proper installation is given in Figure 24.

This will complete the installation.

TUNE-UP PROCEDURE

The BTS-1A Stereo Subcarrier Generator is properly tuned before shipment. No further adjustments are normally required to put it into operation. However, if there is any indication of improper operation, the following steps may be taken:

1. With the unit operating, connect a frequency counter to test point J6. A frequency of 38KC ±2 cps should be read. With the frequency counter connected to test point J7 a frequency of 19KC ±1 cps should be read. At room temperature both readings will be within a fraction of one cycle of the proper frequencies. A small adjustment of the oscillator frequency is possible through adjustment of C2.

2. To check proper operation of the divider, test points J6 and J7 should be used to obtain a Lissajou pattern. Further details are given under *Maintenance.*

3. Apply a +10 dbm signal at 400 cps to J1; close S2; connect an oscilloscope to test point J9; set vertical gain for full deflection with approximately 700 mv peak-to-peak; connect 400 cps modulating signal to EXT. SYNC. of oscilloscope and adjust sweep rate to display about 2 cycles of the 400 cps waveform. Turn R15 full CCW. An oscilloscope display similar to Figure 11B should be obtained. Adjust R16 for straight base line. Figure 11A, taken with modulating signal being an exact sub-multiple of the 38KC carrier, and 11B shows a random L or R signal relative to the 38KC carrier.

If the display is similar to Figure 12A, turn R16 CW; if it is similar to Figure 12B turn R16 CCW. Figure 12A indicates amplitude of L−R (DSB) is too low, and Figure 12B indicates the same is too high. Figures 13A and B represent a condition of excessive time delay error which will result for modulating frequencies of approximately 16 to 17KC. To obtain the display shown in Figure 14A and B, equal out-of-phase signals must be applied to J1 and J2.

NOTE: Displays in Figures 11A and 14A are obtained with modulating frequencies which are exact sub-multiples of the 38 kc carrier, while the display in Figures 11B and 14B represent a random condition between both frequencies.

The waveforms shown in Figure 15A and B represent conditions of severe over-modulation. They are obtained with signals at J1 or J2 or both, in the order of +20 dbm.

4. To check proper balance of suppressed carrier, turn R15 full CCW; leave setting of R16 as determined in step 3; remove all signals from J1 and J2. Measure voltage at J9 with VTVM having a response at least up to 50KC. Adjust R20 to bring this voltage to a minimum, but at least to $7mv_{RMS}$. (An oscilloscope may be used instead of the VTVM; use internal synchronization; check for less than 20 mV p-p.)

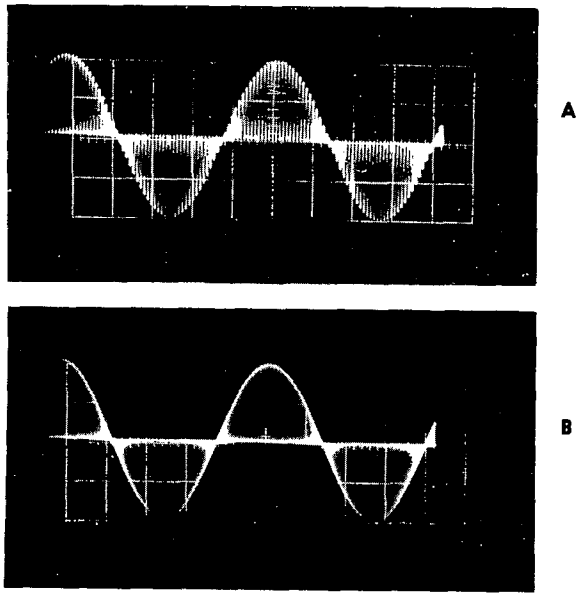


Figure 11 — Waveform Showing Proper Ratio of L + R and L − R (DSB) Signals

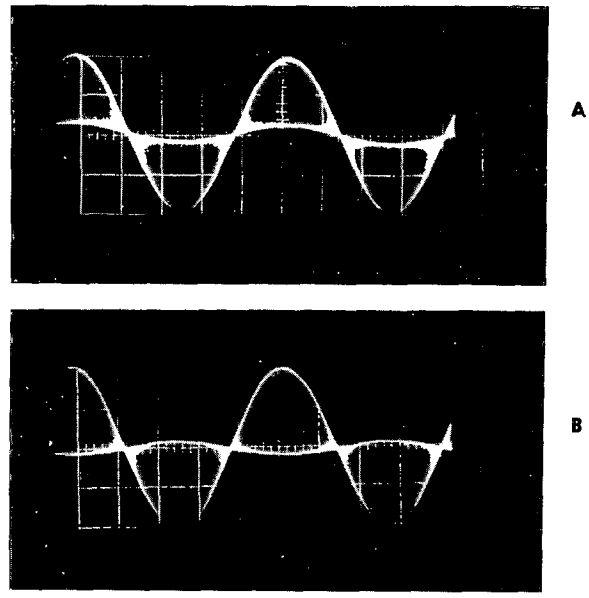


Figure 12 — Waveforms Showing Amplitude of L − R (DSB) Too Low and Too High

TUNE-UP PROCEDURE

The BTS-1A Stereo Subcarrier Generator is properly tuned before shipment. No further adjustments are normally required to put it into operation. However, if there is any indication of improper operation, the following steps may be taken:

1. With the unit operating, connect a frequency counter to test point J6. A frequency of 38KC ±2 cps should be read. With the frequency counter connected to test point J7 a frequency of 19KC ±1 cps should be read. At room temperature both readings will be within a fraction of one cycle of the proper frequencies. A small adjustment of the oscillator frequency is possible through adjustment of C2.

2. To check proper operation of the divider, test points J6 and J7 should be used to obtain a Lissajou pattern. Further details are given under *Maintenance.*

3. Apply a +10 dbm signal at 400 cps to J1; close S2; connect an oscilloscope to test point J9; set vertical gain for full deflection with approximately 700 mv peak-to-peak; connect 400 cps modulating signal to EXT. SYNC. of oscilloscope and adjust sweep rate to display about 2 cycles of the 400 cps waveform. Turn R15 full CCW. An oscilloscope display similar to Figure 11B should be obtained. Adjust R16 for straight base line. Figure 11A, taken with modulating signal being an exact sub-multiple of the 38KC carrier, and 11B shows a random L or R signal relative to the 38KC carrier.

If the display is similar to Figure 12A, turn R16 CW; if it is similar to Figure 12B turn R16 CCW. Figure 12A indicates amplitude of L−R (DSB) is too low, and Figure 12B indicates the same is too high. Figures 13A and B represent a condition of excessive time delay error which will result for modulating frequencies of approximately 16 to 17KC. To obtain the display shown in Figure 14A and B, equal out-of-phase signals must be applied to J1 and J2.

NOTE: Displays in Figures 11A and 14A are obtained with modulating frequencies which are exact sub-multiples of the 38 kc carrier, while the display in Figures 11B and 14B represent a random condition between both frequencies.

The waveforms shown in Figure 15A and B represent conditions of severe over-modulation. They are obtained with signals at J1 or J2 or both, in the order of +20 dbm.

4. To check proper balance of suppressed carrier, turn R15 full CCW; leave setting of R16 as determined in step 3; remove all signals from J1 and J2. Measure voltage at J9 with VTVM having a response at least up to 50KC. Adjust R20 to bring this voltage to a minimum, but at least to $7mv_{RMS}$. (An oscilloscope may be used instead of the VTVM; use internal synchronization; check for less than 20 mV p-p.)

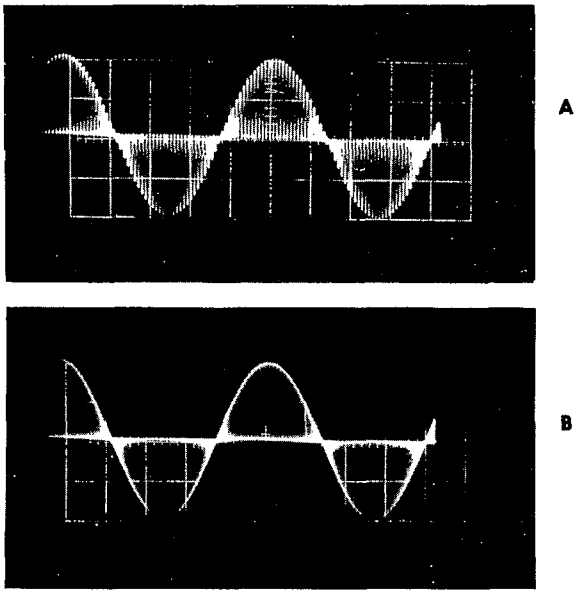


Figure 11 — Waveform Showing Proper Ratio of L + R and L − R (DSB) Signals

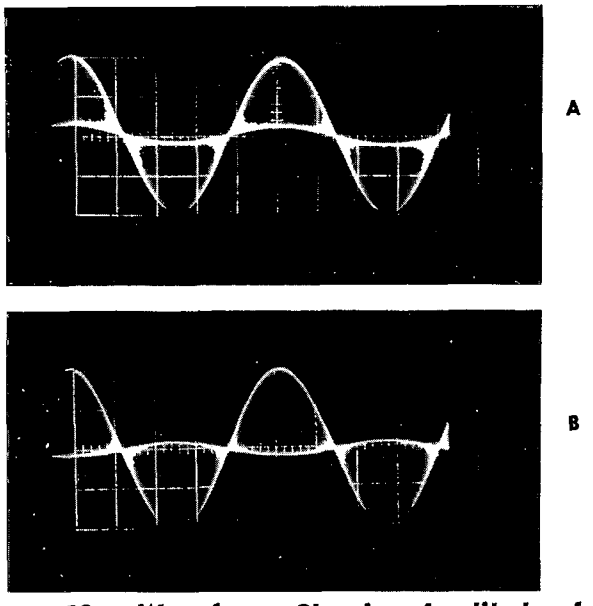


Figure 12 — Waveforms Showing Amplitude of L − R (DSB) Too Low and Too High

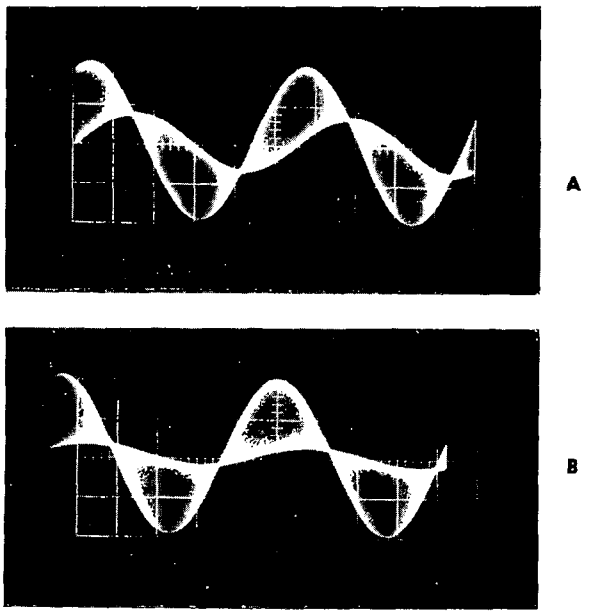


Figure 13 — Effects of Excessive Time Delay

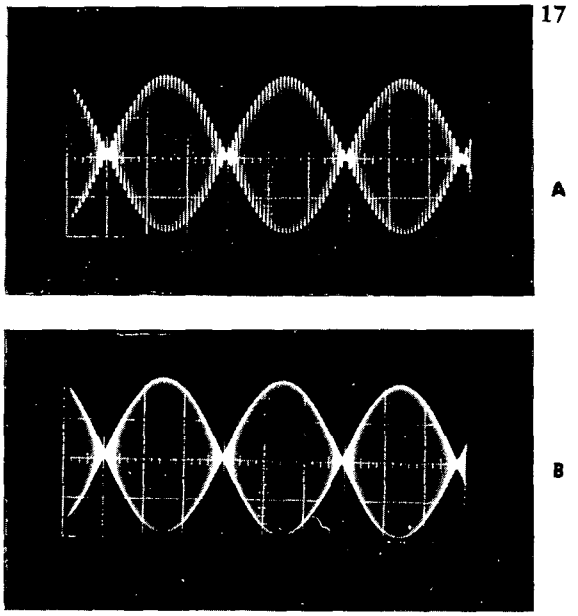


Figure 14 — Results When Equal and Out of Phase Signals are Applied to J1 and J2

5. To adjust the pilot amplitude turn R15 CW until an indication between 8 and 10% is obtained on a modulation monitor.

To adjust the pilot phase, apply equal out-of-phase signals (at 400 cps) to J1 and J2. Adjust L2 to resemble waveform of Figure 9A.

Figure 10B shows proper phase with an L or R only signal. (So does Figure 18B.)

Figure 10A shows a signal with approximately 45° phase error. If an L only signal is fed to the unit, the pilot lags 45°; with an R only signal, the pilot leads 45°.

To check phasing in conjunction with a stereo adapter, connect the output of the BTS-1A Stereo Subcarrier Generator to the input of the adapter.

Apply 400 cps equal amplitude, opposite phase signals to J1 and J2. Proper pilot phasing (by adjusting L2) should coincide with maximum signal from the L and the R channel output connectors of the Stereo adapter.

When a signal is applied to J1 only, the adapter should provide a signal in the left (frequently designated A channel) output.

With an oscilloscope display as shown in Figure 18B, adjust the separation control in the Stereo adapter for maximum unwanted channel rejection. (At 400 cps a ratio of 40 db of the wanted to the unwanted channel can be obtained with a good adapter.)

The adapter should then be connected to a regular FM receiver (designed for stereo operation). Any

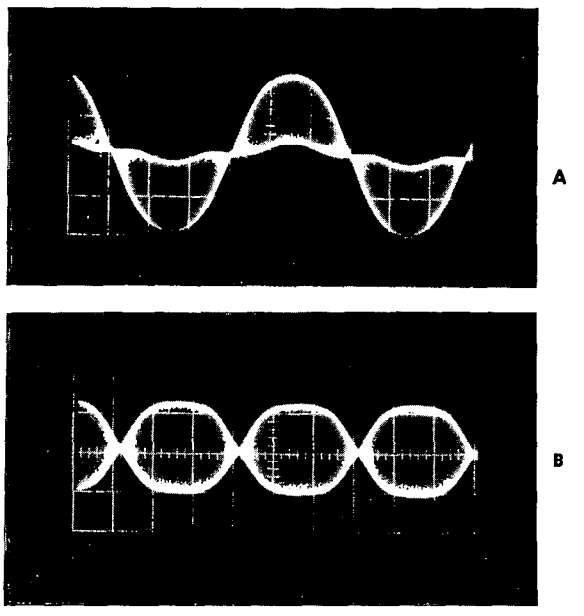


Figure 15 — Effects of Severe Overmodulation

deterioration of separation (due to slight variations in the frequency response of the exciter and receiver) can be compensated by advancing R16 in a CW direction.

NOTE: Many older FM tuners, especially ones using discriminator type detectors are sensitive to resistive and capacitive loading thus unduly reducing the L—R (DSB) signal amplitude. This will affect L vs. R channel separation. Any such discrepancy should *not* be corrected by advancing R16 in the BTS-1A since it will reduce separation in properly operating equipment.

MAINTENANCE

All components in the BTS-1A Stereo Subcarrier Generator are selected to give long, maintenance-free service. The tubes carry a 10,000 hour guarantee; however, they should be checked after the unit has been in operation from 1 to 2 years.

The relay contacts should be cleaned with a proper spatula if noises during mono-stereo switchover indicate dirty contacts.

If capacitor C13 fails, a replacement unit can be plugged in immediately. If such a replacement unit is not available, any single capacitor of .5 mf or more and a voltage rating of at least 100 V DC connected to pins 5 and 1 (5 being positive relative to 1) will provide sufficient plate voltage to keep the BTS-1A in operation.

Failure of the relay K1 can temporarily be corrected by removing the relay from its socket. The unit will then be in the stereo mode. In the monophonic mode the pilot will not be removed.

If tube V1 fails, any of the following tubes can be used if the 7643 should not be available: 6U8, 6U8A, 7731, 6BL8, E80CF, or ECF80.

If tube V2 fails, any of the following tubes can be used if the 6922 should not be available: 6DJ8, 7308, 6FW8, E88CC, or ECC88.

The green pilot light uses a standard #47 bulb. It is operated below its rated voltage and should have a life in excess of 10,000 hours.

Matrix Balancing

Should it be desired to check the initial balance of the matrix the following steps should be taken:

Remove CR5 from its socket. Connect a 600 ohm resistor from pin 2 to 6. Remove Z1 and Z2 and apply jumpers between pins 3 and 4 and between pins 5 and 6 of XZ1 and XZ2.

Connect an audio generator to J1 and J2 in such a way that the two signals are in phase. (Pin 1 of J1 to pin 1 of J2, and pin 2 of J1 to pin 2 of J2.) Adjust audio input level to approximately +10 dbm at 12KC.

Connect an AC VTVM (e.g. Distortion Analyzer) to J3 (use pin 1 of J3 which is the wide terminal and ground) and note reading, or set to 0 db. Then connect AC VTVM to pins 2 and 6 of XCR5. With a 12 kc input signal being fed in, set R23 for minimum voltage. This voltage should be attenuated at least 50 db relative to the voltage in the L+R channel. For any frequency below 10 kc, L−R rejection should be better than −60 db. After balancing is completed, reinsert Z1, Z2, and CR5.

DC Voltage Readings

Table 2 shows DC voltage readings at the tube pins; the plate voltage, measured at test point J8 should be +105 V ±5%.

AC Voltage Readings

All voltages connected with the crystal oscillator will vary slightly depending on the setting of C2.

Table 3 shows AC voltage readings at the tube pins. Additional voltages can be measured at points given in Table 4.

The waveforms shown in Figure 17 will provide additional information.

The small spikes seen in Figure 17E are stationary when the divider is properly locked in. The range of variation of L2 is too small to affect lock-in of the divider. Transformer T7 contains an adjusting pin (left handed thread) which will permit it to vary the inductance of its windings. This pin is adjusted before shipment to give 0° phase of the 19 kc pilot with L2 set to its mid-position.

TABLE 2 — BTS-1A TUBE VOLTAGES (DC)

CONDITIONS: All measurements (taken with RCA Senior Voltohmyst) made under normal operating conditions. All readings DC and taken relative to ground. Allow ±10% tolerance.

Symbol	*Type*	*Pin Numbers*								
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
V1	7643	80	−1.8	65	—	—	95	—	2.3	0
V2	6922	85	0	7.8	—	—	55	−.2	7.8	—
V401*	6922	90	16	17.5	—	6.3	90	16	17.2	—

* Located in Input Adapter MI-560004.

TABLE 3 — BTS-1A TUBE VOLTAGES (AC)

CONDITIONS: All measurements (taken with RCA Senior Voltohmyst) made under normal operating conditions. All readings AC and taken relative to ground. Allow ±20% tolerance.

Symbol	*Type*	*Pin Numbers*								
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
V1	7643	** 15 Vpp	** 3 Vpp	0	—	* 6.3 Vrms	See Notes	—	** 1 Vpp	** 3.5 Vpp
V2	6922	† 35 Vpp	** 2.75 Vpp	† 15 Vpp	—	* 6.3 Vrms	0	See Notes	† 15 Vpp	—

* 50 or 60 cps, depending on power line frequency.

** 38 KC

† KC

NOTES: (1) Vpp = volts peak-to-peak.

(2) Read oscillator plate circuit voltage at junction of L1 and R2; voltage should be 30 Vpp at 38 KC.

(3) Read divider grid voltage at junction of T7 and R13, voltage should be 35 Vpp at 19 KC.

(4) Waveform appearing at pin 2, XV2 is not sinusoidal. Some vacuum tube voltmeters may cause erroneous readings. If in doubt, use oscilloscope. (See Figure 17F.)

Variation of L2 will also slightly change the amplitude at test point J7.

The captions of Figure 18A to F, and Figure 19A and B, will fully explain the conditions under which the waveforms were obtained.

Input Adapter

Components in this unit are selected to give long, maintenance-free service. The tube carries a 10,000 hour guarantee. It should be checked after 1 to 2 years of service.

Voltage values are listed in Table 1.

To check for proper AC operation, apply 400 cps at .5 v_{RMS} to J401. Check AC voltages appearing at pins 3 and 6 of XV401. Both voltages should be alike and somewhat less than $.5_{RMS}$.

It is the purpose of one triode section of V401 (pins 6, 7, 8) to provide feedback for proper phase-amplitude correction in the AFC loop. If this tube fails, the center frequency will pulsate at a slow (1 cps) rate around the center frequency. This tube represents a variable load between pins 1 and 3 of the other triode section (pins 1, 2, and 3).

Any slow-varying voltage appearing across C104 in the exciter will likewise appear at pin 3 of V401 and in opposite phase at pin 1 of V401. In this manner, excessive phase shift on the AFC voltage caused by R410 and C405 is compensated.

The tube type 6922 can be replaced by the same equivalent types as listed under V2 of the BTS-1A if the exact replacement should not be immediately available.

With the adapter installed, and the selector switch of the exciter in the + or — AFC position, the pointer of M101 (on exciter) will display a slightly higher degree of random variation. This is a normal condition and does not affect the proper operation.

Measurement of L vs. R Channel Separation

The waveform in Figure 16 illustrates separation between left and right channels. The actual waveform can be observed at testpoint J9 of the BTS-1A or at the multiplex output of an FM-tuner. It shows a composite signal without pilot, but with a L only or R only input to the BTS-1A stereo subcarrier generator. The ratio of the amplitudes A and B will determine separation. Use formula given to obtain the ratio in db (Separation = Log A/B). For a perfect signal, the B amplitude would be zero, (by proper setting of R16) separation therefore infinite and the baseline perfectly straight. The above method will become inaccurate for separation ratios in excess of approximately 36 db due to the inability to read the small amplitude correctly. Some slight improvement can be gained by displaying the upper or lower half-wave only.

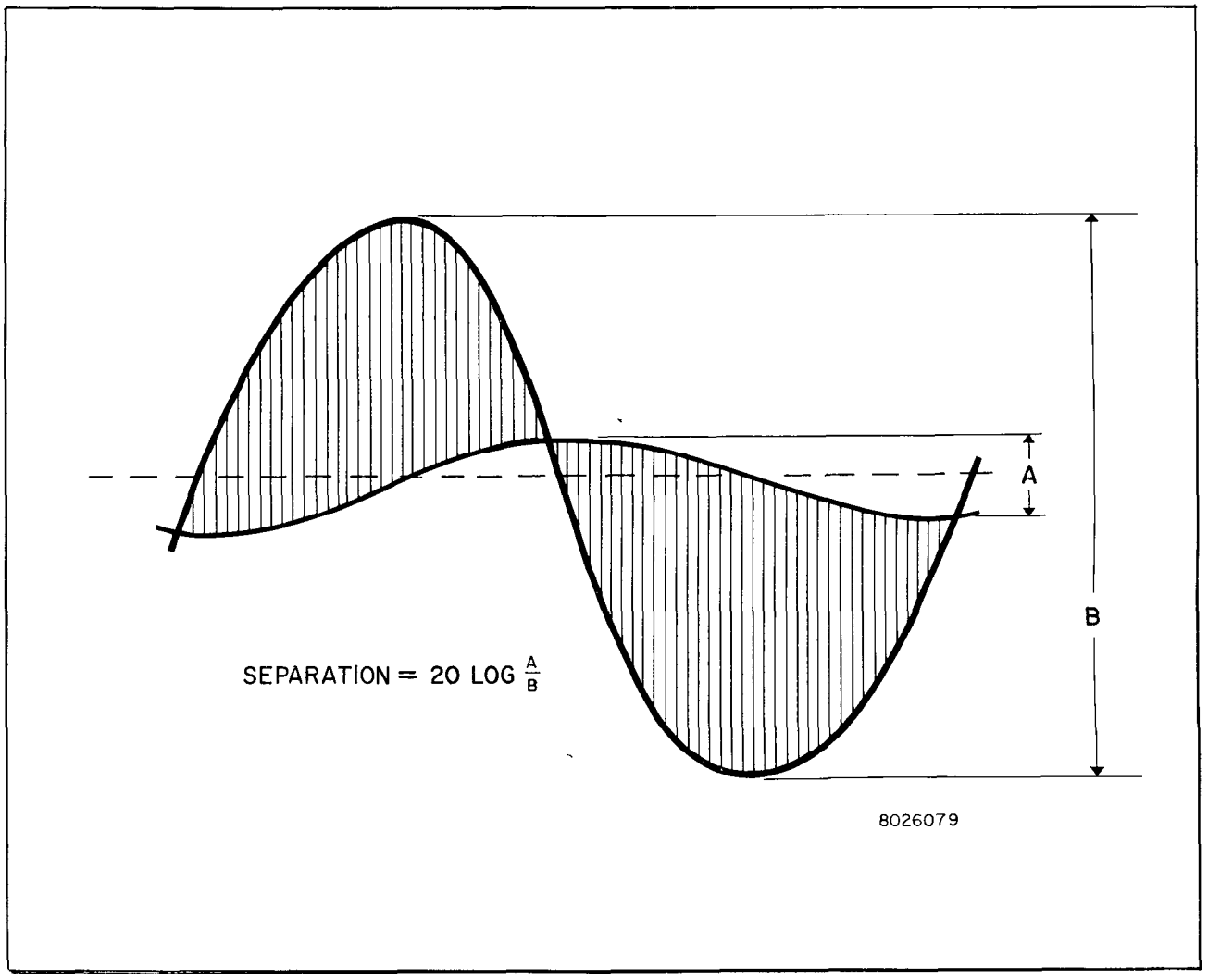


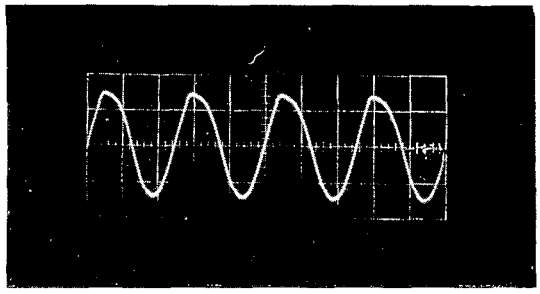
Figure 16 — Illustration of Basic Method to Measure Separation

TABLE 4 — VOLTAGES AT VARIOUS LOCATIONS FOR GIVEN FREQUENCIES

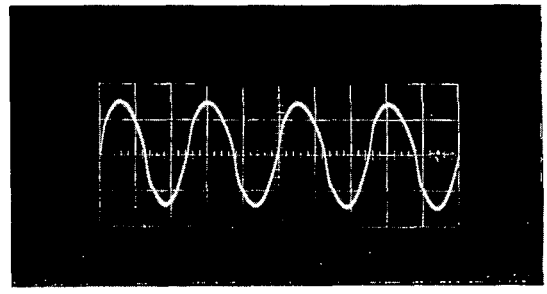
Junction	*Voltage*	*Frequency*
Y1 — C2 to GND	4 V p-p	at 38 kc
C2 — C4 to GND	10 V p-p	at 38 kc
Test Points	*Voltage*	*Frequency*
J6 to GND	30 V p-p	at 38 kc
J7 to GND	2 V p-p	at 19 kc
J9	See Oscilloscope Displays, Figures 17 to 19	
Across Terminals	*Voltage*	*Frequency*
4 — 5 of T5	2 V p-p	at 38 kc
7 — 8 of T8	100 V rms	at 50 or 60 cps
9 — 10 of T8	6.3 V rms	at 50 or 60 cps
3 — 4 of T7	approx. 40 mv rms	at 19 kc

NOTES:

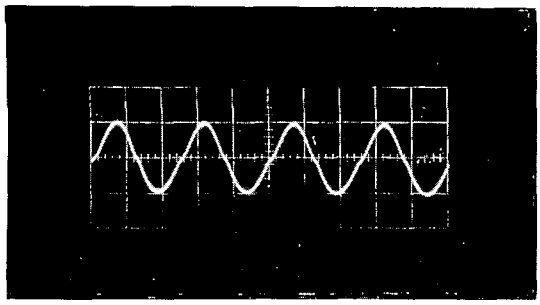
1. Waveforms taken with Tektronix Type 585 scope. Hewlett Packard Type 130-B or 150-A may be used.
2. Waveforms of Figure 17 A to F and waveforms A and C of Figure 18, were taken with internal sync, all others are of external sync by modulating waveform.
3. Squares on graticule equal 1 centimeter (horizontally and vertically); μsec/cm refers to sweep time base, and V/cm refers to vertical calibration.



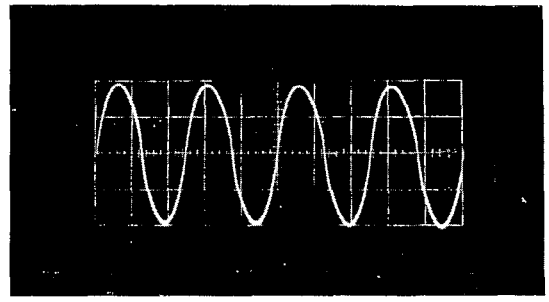
A. V1 Pin 2
10 usec/cm, 1v/cm



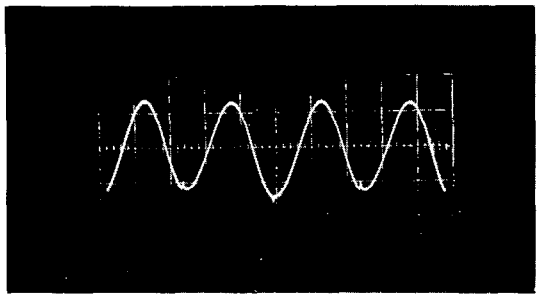
B. V1 Pin 1
10 usec/cm, 5v/cm



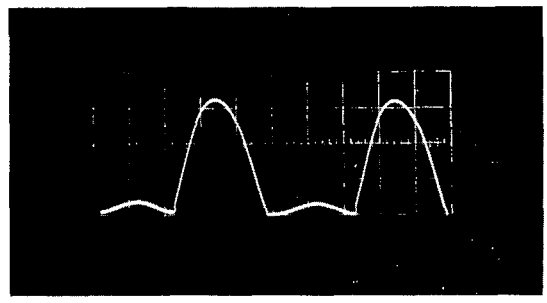
C. V1 Pin 8
10 usec/cm, .5v/cm



D. T5 Terminals 4 and 5
10 usec/cm, .5v/cm

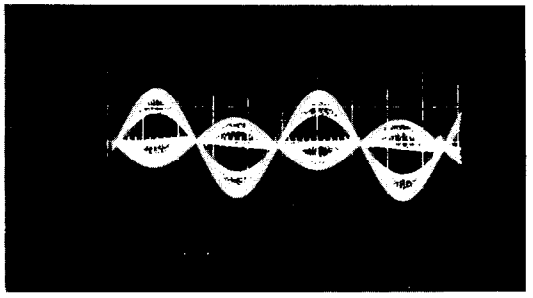


E. V2 Pin 2
10 usec/cm, 1v/cm

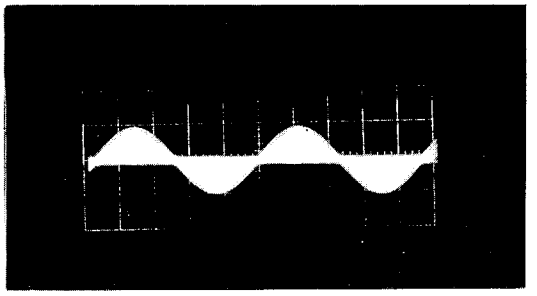


F. V2 Pins 3 and 8
10 usec/cm, 5v/cm

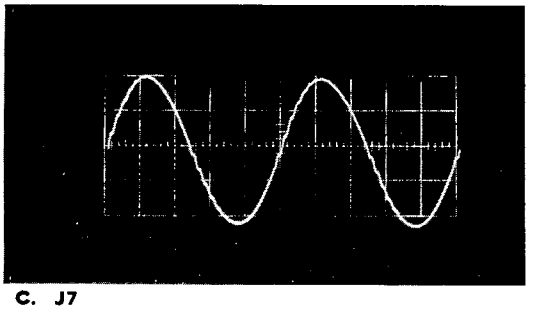
Figure 17 — BTS-1A Reference Waveforms



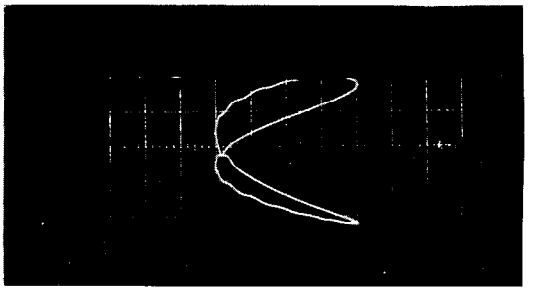
A. T6; Btwn. terminal 6 and gnd.
+13 db input to J1 at 400 cps
.5 millisec/cm, .5v/cm



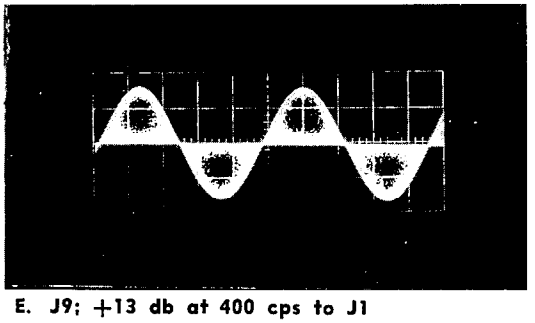
B. J9; +13 db input to J1
at 400 cps, pilot included
.5 millisec/cm, .5v/cm



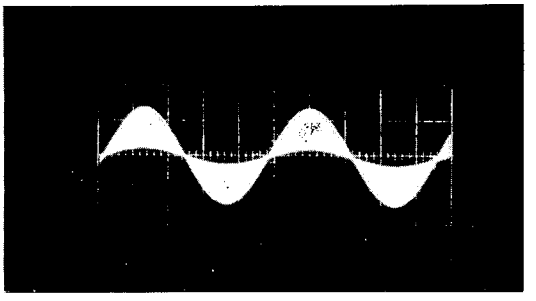
C. J7
10 usec/cm, .5v/cm



D. J7 to Vert. and J6 to Horiz. Ampls.
equal deflections

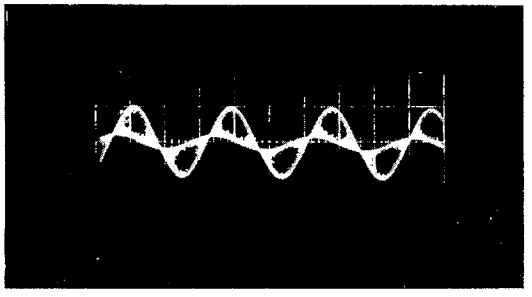


E. J9; +13 db at 400 cps to J1
R15 full ccw, correct balance
.5 millisec/cm, .5v/cm

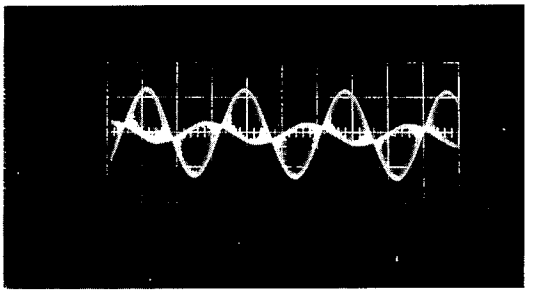


F. J9; insufficient L—R (DSB) Ampl.
R15 full ccw
.5 millisec/cm, .5v/cm

Figure 18 — BTS-1A Reference Waveforms



A. J9; Time delay error only
(—5 db at 16 KC to J1)
R15 full ccw
20 usec/cm, .5v/cm



B. J9; Time delay and amplitude error
R15 full ccw
20 usec/cm, .5v/cm

Figure 19 — BTS-1A Reference Waveforms

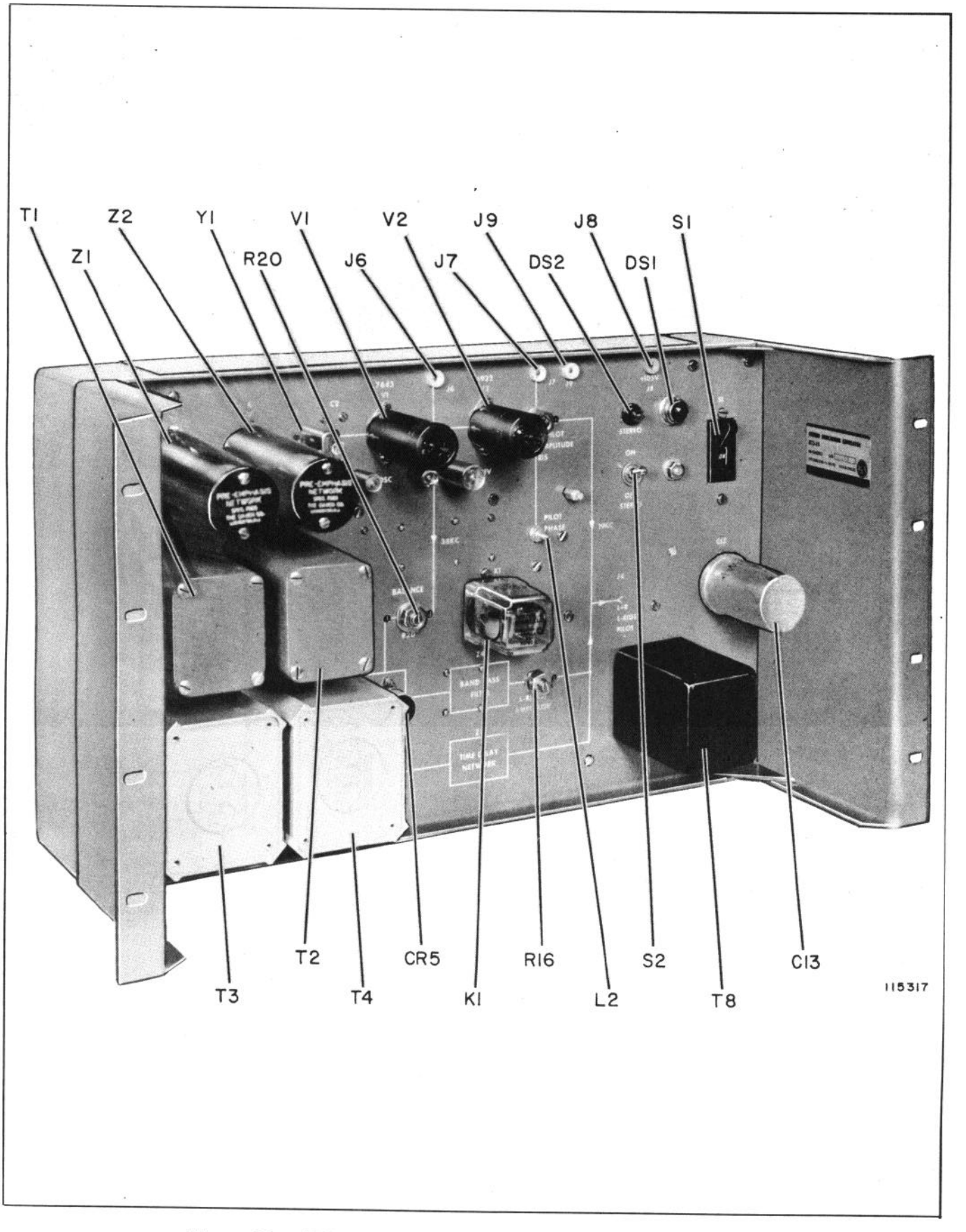


Figure 20 — BTS-1A Stereo Subcarrier Generator, Front View

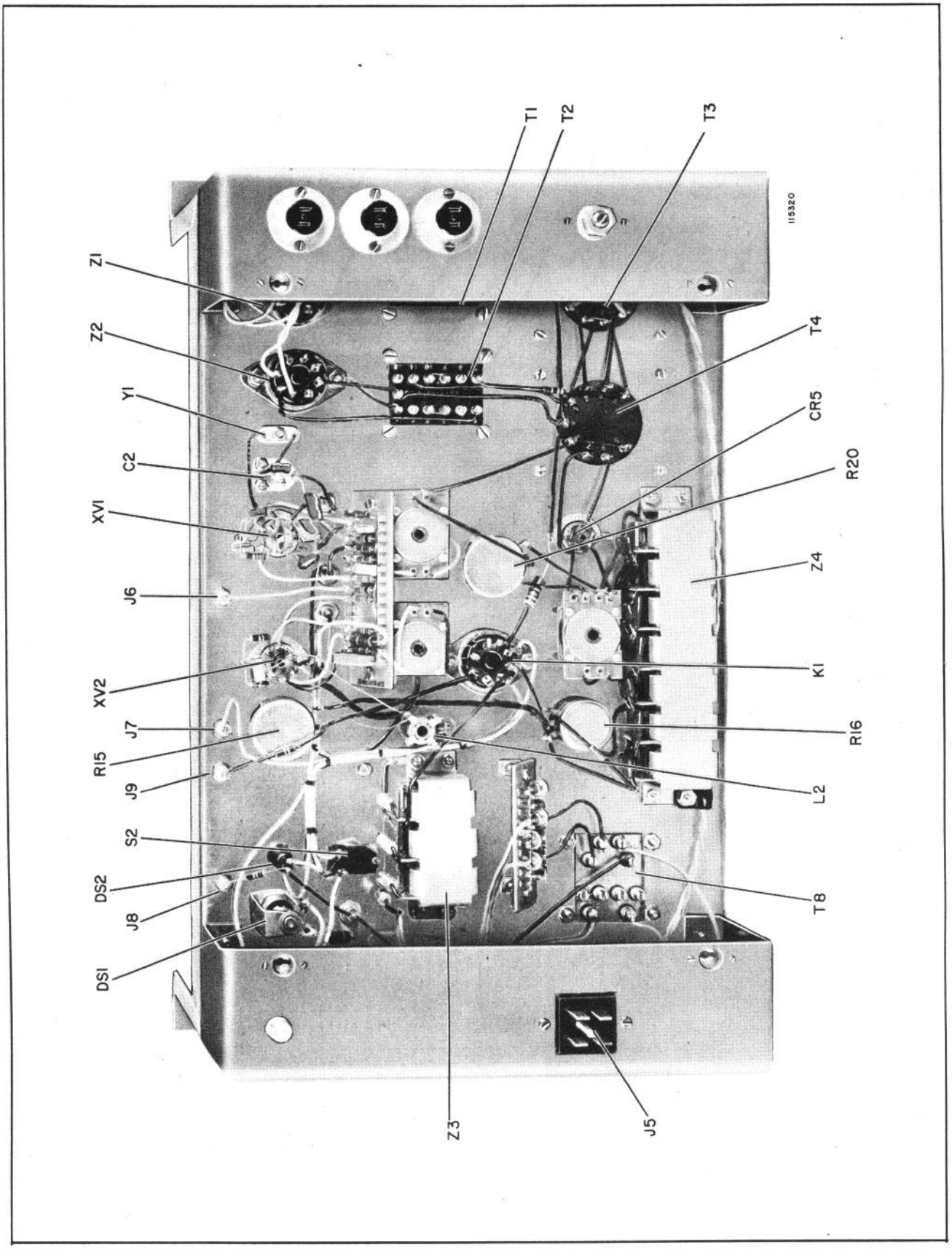


Figure 21 — BTS-1A Stereo Subcarrier Generator, Rear View

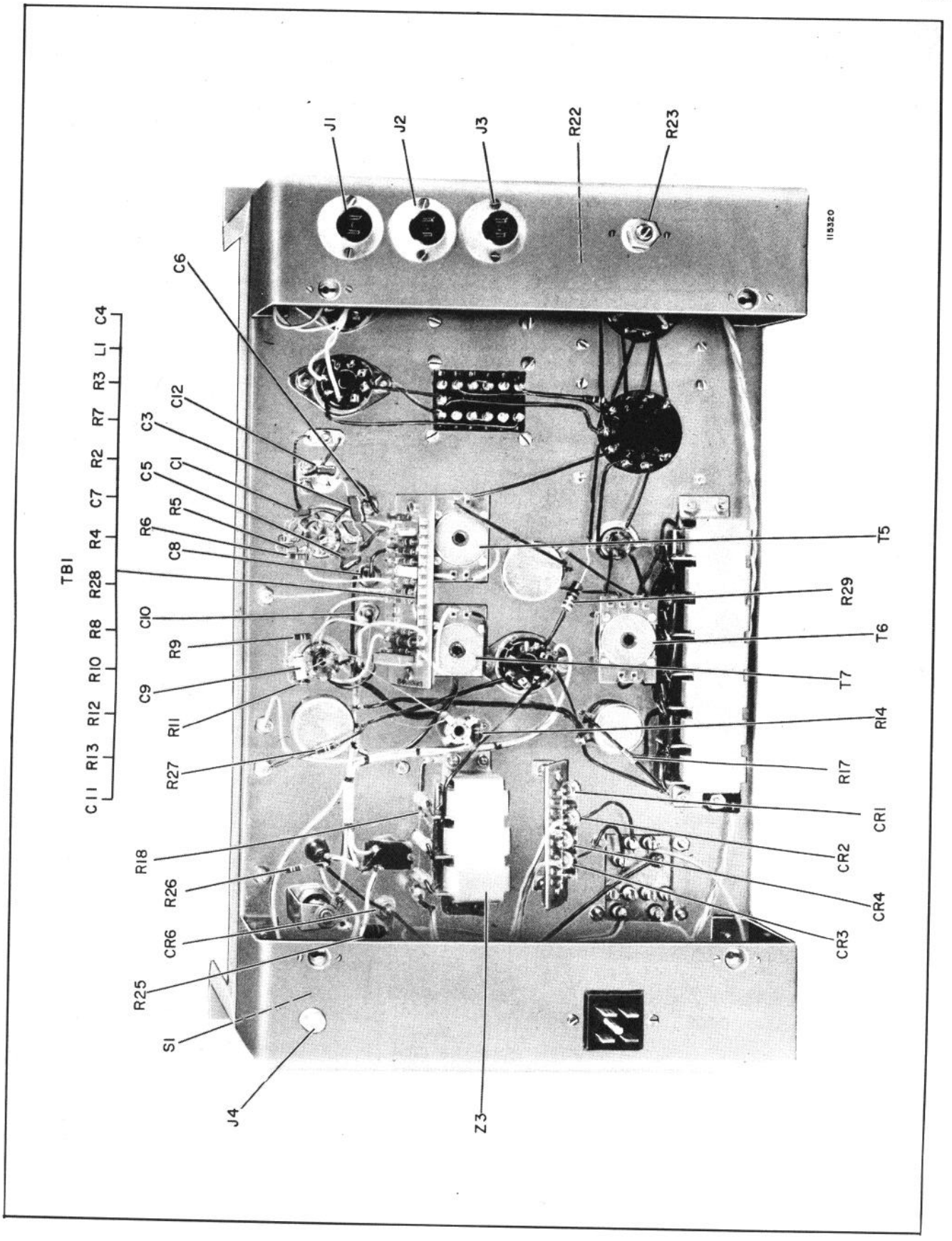


Figure 22 — BTS-1A Stereo Subcarrier Generator, Rear View

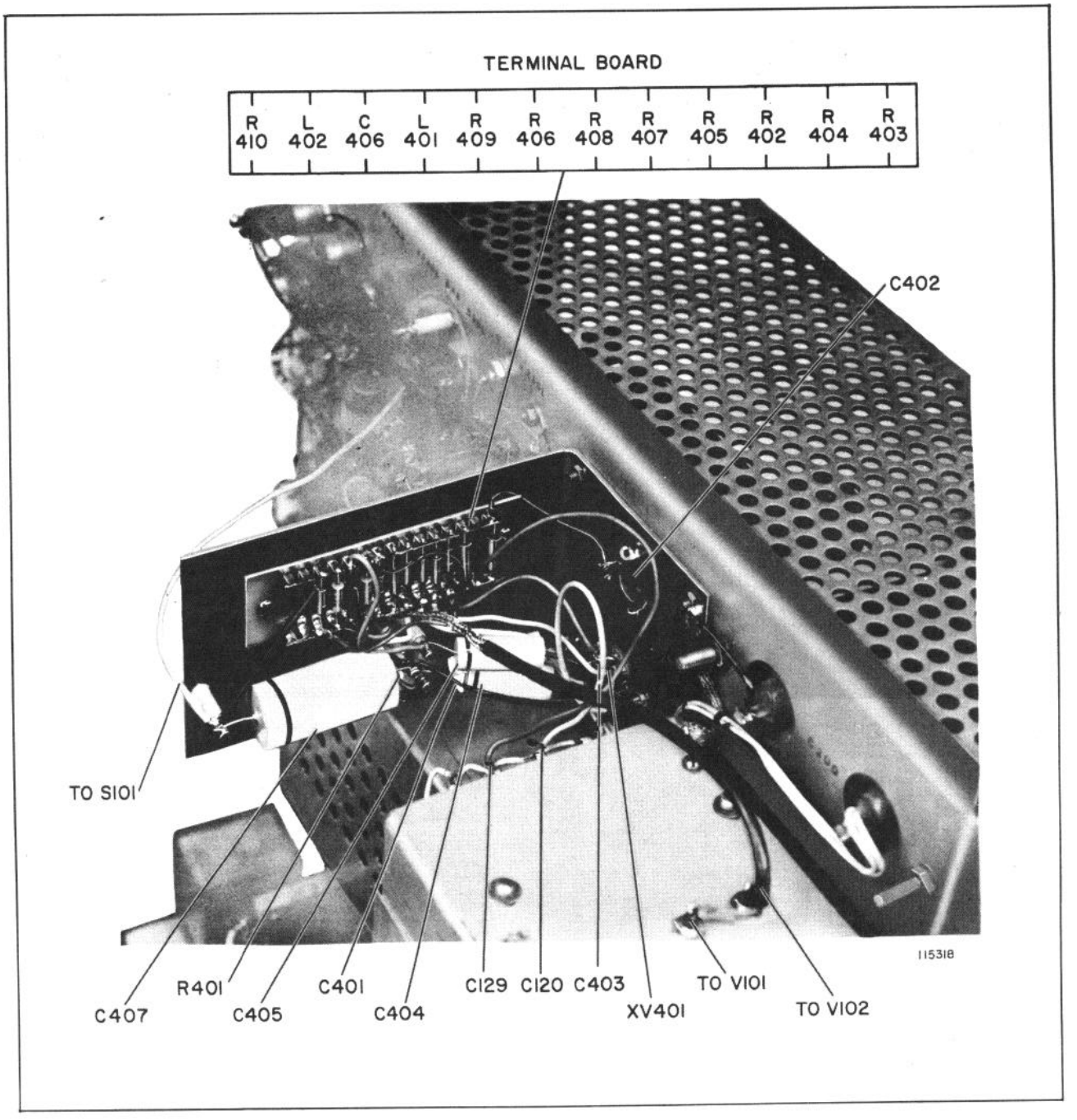


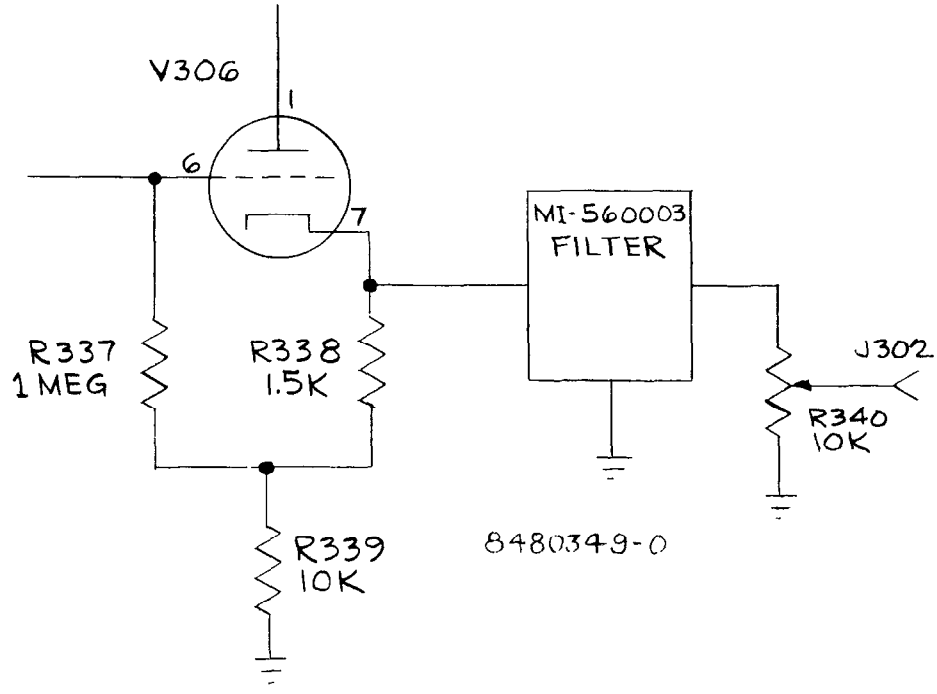
Figure 23 — Input Adapter MI-560004, Component Identification; Shown Installed in BTE-10B Exciter

REPLACEMENT PARTS LIST

Symbol	*Stock No.*	*Drawing No.*	*Description*
			STEREO SUBCARRIER GENERATOR, MI-560001
			CAPACITORS
C1		993026-229	MICA, 47 PF ±10% 500 V
C2	057602	8886256-7	VARIABLE, 4.5-25 PF
C3		993026-465	MICA, 1500 PF ±5% 500 V
C4		993026-457	MICA, 680 PF ±5% 500 V
C5		993026-453	MICA, 470 PF ±5% 500 V
C6	215276	737863-175	PAPER, 0.1 MF ±20% 200 V
C7		990786-213	FILM, 10 NF ±20% 200 V
C8		737863-175	SAME AS C6
C9		990786-213	SAME AS C7
C10	098402	737863-183	PAPER, 0.47 MF ±20% 200 V
C11		993026-673	MICA, 3.3 NF ±2% 500 V
C12		993026-219	MICA, 18 PF ±10% 500 V
C13A/B	225279	735712-53	ELECTROLYTIC, 60/60 MF 150 V
CR1	225200		DIODE - SILICON
CR2			SAME AS CR1
CR3			SAME AS CR1
CR4			SAME AS CR1
CR5	225202		DIODE - QUAD
CR6	225201		DIODE - ZENER
DS1		990158-12	LAMP - INDICATOR, TYPE 47
DS2	225203	8524111-1	SOCKET - PILOT LIGHT, WITH LAMP AND AMBER JEWEL
J1	211510	481799-2	CONNECTOR - FEMALE, 2 CONTACT
J2		481799-2	SAME AS J1
J3		481799-2	SAME AS J1
J4	223973	1510013-181	CONNECTOR - FEMALE, COAXIAL
J5	052107	727969-13	CONNECTOR - MALE, 4 CONTACT
J6	208983	8825493-7	CONNECTOR - TIP JACK, YELLOW
J7		8825493-7	SAME AS J6
J8	203532	8825493-2	CONNECTOR - TIP JACK, RED
J9		8825493-7	SAME AS J6
K1	094864	8971187-3	RELAY - 6 V AC, D.P.D.T. CONTACTS
L1	225274	8528117-1	CHOKE - 47 MILLIHENRY
L2	225204	8946250-11	COIL - ADJUSTABLE, 1000-2000 MICROHENRY
P1	211509	481799-1	CONNECTOR - MALE, 2 CONTACT
P2		481799-1	SAME AS P1
P3		481799-1	SAME AS P1
P4	921359	1510013-101	CONNECTOR - MALE, COAXIAL
P5	052108	727969-14	CONNECTOR - FEMALE, 4 CONTACT
			RESISTORS FIXED COMPOSITION - UNLESS OTHERWISE SPECIFIED
R1		82283-98	1 MEG ±10% 1/2 W
R2		82283-72	6800 OHM ±10% 1/2 W
R3		82283-86	100,000 OHM ±10% 1/2 W
R4		82283-83	56,000 OHM ±10% 1/2 W
R5		82283-72	SAME AS R2
R6		82283-54	220 OHM ±10% 1/2 W
R7		82283-66	2200 OHM ±10% 1/2 W
R8		82283-87	120,000 OHM ±10% 1/2 W
R9		82283-74	10,000 OHM ±10% 1/2 W
R10		82283-78	22,000 OHM ±10% 1/2 W
R11		82283-62	1000 OHM ±10% 1/2 W
R12		90496-72	6800 OHM ±10% 1 W
R13		82283-64	1500 OHM ±10% 1/2 W
R14		82283-74	SAME AS R9
R15	225205	8480313-1	VARIABLE, WIRE WOUND, 20 OHM ±10% 4 W
R16	052011	433196-17	VARIABLE, 2000 OHM ±10% 2 W
R17		82283-164	1600 OHM ±5% 1/2 W
R18	215167	990186-276	FILM, 604 OHM ±1% 1/2 W
R19		82283-42	22 OHM ±10% 1/2 W
R20	223835	8480313-2	VARIABLE, WIRE WOUND, 100 OHM ±10% 4 W
R21		82283-44	33 OHM ±10% 1/2 W
R22		82283-42	SAME AS R19
R23		8480313-1	SAME AS R15

Symbol	*Stock No.*	*Drawing No.*	*Description*
R24	300604	993007-79	WIRE WOUND, 800 OHM ±5% 5 W
R25		99126-41	18 OHM ±10% 2 W
R27		82283-74	SAME AS R9
R28		82283-74	SAME AS R9
R29		90496-527	3.3 OHM ±10% 1 W
S1	225206	449761-15	BREAKER - CIRCUIT, 250 V, 60 CPS, 0.08 AMP
S2	269100	990780-1	SWITCH - TOGGLE, S.P.D.T.
T1		8871989-1	TRANSFORMER - AUDIO, MI-11713
T2		8871989-1	SAME AS T1
T3	225275	8468383-1	TRANSFORMER - AUDIO
T4		8468383-1	SAME AS T3
T5	225207	8480330-1	TRANSFORMER
T6	225208	8480331-1	TRANSFORMER
T7	225209	8480333-1	TRANSFORMER
T8	225276	8468378-1	TRANSFORMER - POWER
V1	225210		TUBE - VACUUM
V2	219675		TUBE - VACUUM
XC13	217561	99390-3	SOCKET - CAPACITOR, OCTAL, RED
XCR5	099594	737867-106	SOCKET - TUBE, 7 PIN
XDS1	057751	990789-6	SOCKET - LAMPHOLDER, WITH BUSHING
XK1	068590	99100-4	SOCKET - RELAY, OCTAL
XV1	094880	737870-18	SOCKET - TUBE, 9 PIN
XV2		737870-18	SAME AS XV1
XY1	211175	8885952-3	SOCKET - CRYSTAL
XZ1		99100-4	SAME AS XK1
XZ2		99100-4	SAME AS XK1
Y1	225211		CRYSTAL- 38 KC
Z1	219730	481755-3	NETWORK - PREEMPHASIS
Z2		481755-3	SAME AS Z1
Z3	225212	8480322-1	NETWORK - TIME DELAY
Z4	225213	8480321-1	NETWORK - BANDPASS
			MISCELLANEOUS
	225214	8468393-501	CIRCUIT - STRIP PACK, COMPLETE WITH COMPONENTS
	225215	480369-1	FASTENER - TURNLOCK, 0.5 LONG
	216637	990788-402	JEWEL - INDICATOR LIGHT, GREEN
	098480	8886047-3	RING - RETAINER, FOR FASTENER
	215853	483884-12	SHIELD - TUBE, 2.5 LONG
	225216	483884-11	SHIELD - TUBE, 2.0 LONG
			INPUT ADAPTER, MI-560004
			CAPACITORS
C401		990786-133	FILM, 0.47 MF ±10% 100 V
C402	300062	95695-73	ELECTROLYTIC, 50 MF 350 V
C403		993026-249	MICA, 330 PF ±10% 500 V
C404		990786-281	FILM, 0.33 MF ±10% 200 V
C405		990786-181	FILM, 0.33 MF ±20% 100 V
C406		993026-249	SAME AS C403
C407		990786-191	FILM, 2.2 MF ±10% 100 V
J401	223973	1510013-181	CONNECTOR - FEMALE, COAXIAL
L401	225277	8701587-249	CHOKE - R.F. 10 MICROHENRY
L402		8701587-249	SAME AS L401
P401	921359	1510013-101	CONNECTOR - MALE, COAXIAL
			RESISTORS FIXED COMPOSITION - UNLESS OTHERWISE SPECIFIED
R401		82283-88	150,000 OHM ±10% 1/2 W
R402		82283-97	820,000 OHM ±10% 1/2 W
R403		90496-63	1200 OHM ±10% 1 W
R404		90496-66	2200 OHM ±10% 1 W
R405		82283-54	220 OHM ±10% 1/2 W
R406		82283-62	1000 OHM ±10% 1/2 W
R407		82283-51	120 OHM ±10% 1/2 W
R408		82283-98	1 MEG ±10% 1/2 W
R409		82283-91	270,000 OHM ±10% 1/2 W

Symbol	*Stock No.*	*Drawing No.*	*Description*
R410		82283-91	SAME AS R409
V401	219675		TUBE - VACUUM
XV401	094880	737870-18	SOCKET - TUBE, 9 PIN
			MISCELLANEOUS
	225278	8480345-501	CIRCUIT - STRIP PACK, COMPLETE WITH COMPONENTS
	225216	483884-11	SHIELD - TUBE, 2.0 LONG



1. REMOVE CAPACITOR C331.
2. MOUNT FILTER UNDER 2 MOUNTING SCREWS OF CHOKE L307. USE STUDS CLOSEST TO EDGE OF CHASSIS. MOUNT FILTER SUCH THAT FILTER COMPONENTS DO NOT PENETRATE BEYOND EDGE OF CHASSIS.
3. CONNECT RED WIRE OF FILTER TO PIN 7 OF XV306.
4. CONNECT BLUE WIRE OF FILTER TO R340. USE TERMINAL ORIGINALLY TAKEN BY C331. THIS COMPLETES THE FILTER INSTALLATION

Figure 24 — Connection Diagram of Filter Installation (8480349)

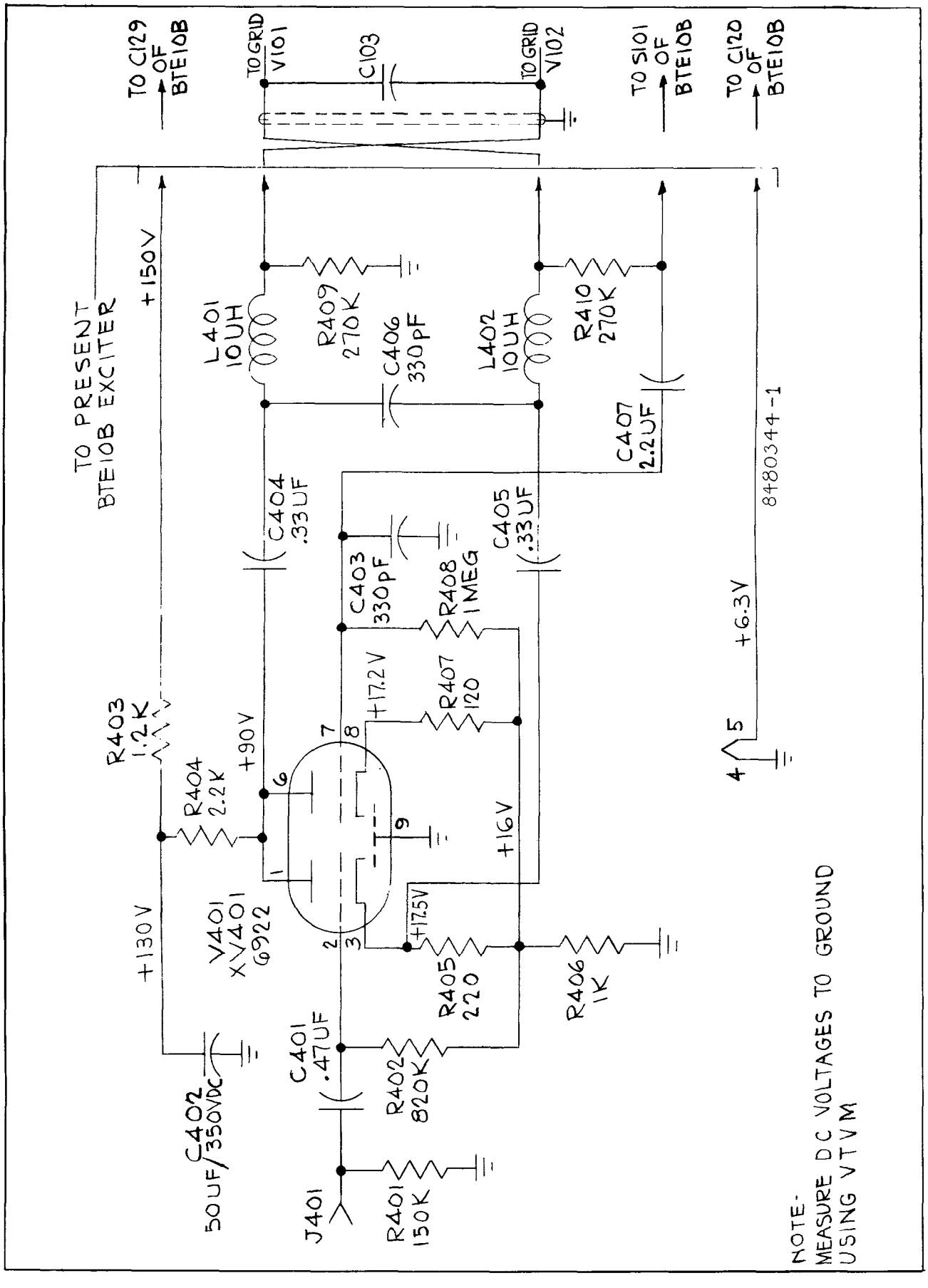
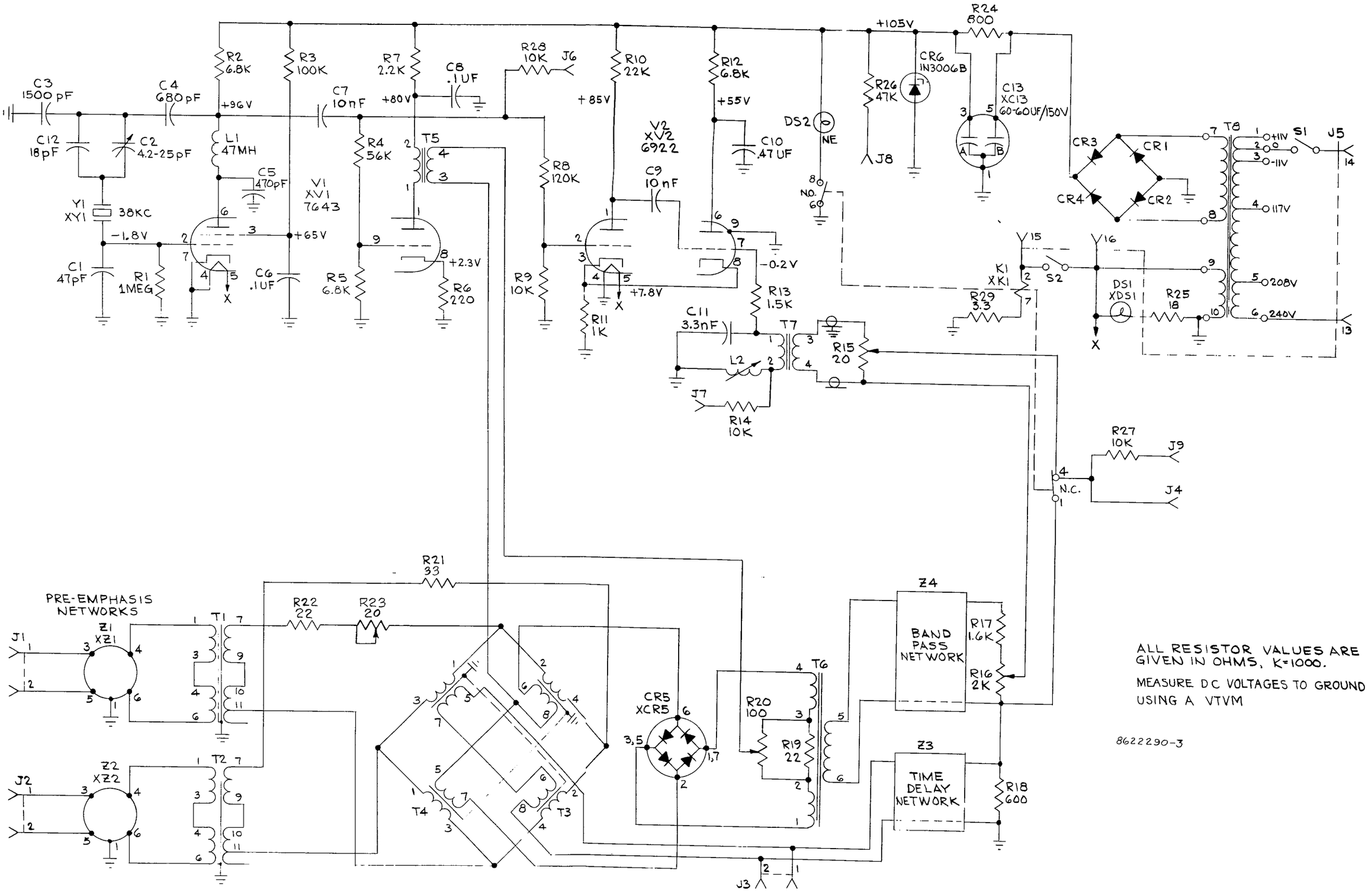


Figure 25 — Schematic Diagram, Input Adapter (8480344)



ALL RESISTOR VALUES ARE GIVEN IN OHMS, K=1000.

MEASURE D C VOLTAGES TO GROUND USING A VTVM

8622290-3

Figure 26 — Schematic Diagram, BTS-1A Stereo Subcarrier Generator (8622290)

Filter Modification Kit MI-560017-2

For RCA BTS-1A Stereo Subcarrier Generator

DESCRIPTION

PURPOSE

This addendum describes a factory modification to the BTS-1A Stereo Subcarrier Generator to improve instrument performance particularly as to channel separation. Included are changes in the instruction book parts list, a revised schematic diagram, modification instructions and a new tuning procedure resulting from the modification. These changes should be made to the instruction book, IB-30297, and this addendum then made a part of the instruction book. The procedure used in making the factory modification is recorded in this addendum for future reference.

EQUIPMENT SUPPLIED

Filter Modification Kit, MI-560017-2 includes the following components:

Quantity	Description	Reference
1	Low Pass Filter (Z3)	
1	Bandpass Filter (Z4)	
2	Capacitor, 2700 pf (C15, C16)	
1	Capacitor, 150 pf (C14)	300185
1	Resistor, 3 k-ohm, 1/2-W (R30)	502230
1	Mounting Hardware	
2	Instruction Book Addendum	IB-30297-A

INSTRUCTION BOOK CHANGES

PARTS LIST

The replacement parts list in the BTS-1A instruction book should be corrected as follows:

1. Delete resistors R18 and R8 (Page 27).

2. Delete Z3 and Z4 stock numbers and add note: "Field replacement not recommended".

3. Add resistor and description (Page 28):

Symbol	Stock Number	Description
R30	502230	Resistor, 3 k-ohm 1/2-watt

4. Add capacitors (Page 28):

Symbol	Stock Number	Description
C14	300185	Capacitor, mica, 150 pf
C15, C16	Mallory SXM227	Capacitor, polystyrene 2700 pf ±2-1/2%, 160 V

SCHEMATIC DIAGRAM

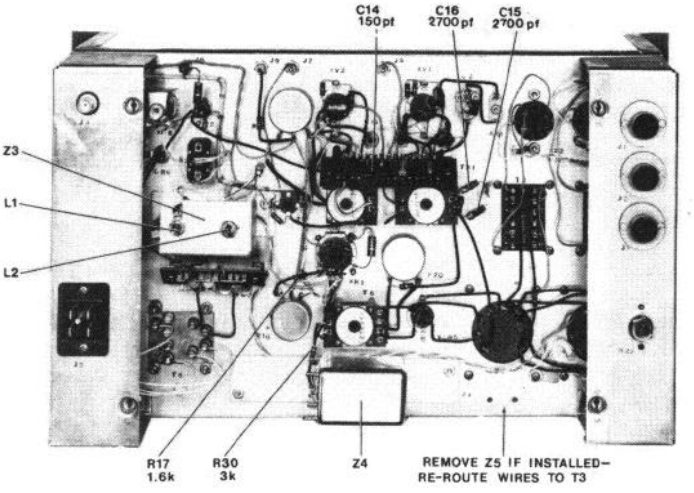
Replace schematic diagram, figure 26, in IB-30297, with revised figure 26 schematic diagram included in this addendum.

EQUIPMENT MODIFICATION

MODIFICATION PROCEDURE (USED BY FACTORY)

Following is the procedure employed by RCA in factory installation of the Filter Modification Kit, MI-560017-2:

1. Remove and save Z4 mounting hardware.
2. Remove R17, Save for re-use.
3. Remove ground connection from Z4 to R16.
4. Disconnect terminals 5 and 6 on T6.
5. Remove ground connection from pin 1 of XK1 to R16.
6. Mount new Z4 filter with terminal end toward power transformer, using 1/4" spacers and 5/8" #6 screws supplied, and nuts and lockwasher saved from Step 1.
7. Install 3-3/8" wire from output (white terminal alone) of new Z4 filter, to CW end of R16 (end that R17 was disconnected from in Step 2).
8. Connect 1.6 k-ohm R17 resistor from counterclockwise end of R16, to terminal #6 of T6. Remove resistor from old filter.
9. Connect 3" wire from terminal #6 of T6, to common connection (black terminal), of new Z4 filter.
10. Connect 3" piece of wire from terminal #6 of T6 to pin 1 of XK1 (leave orange wire on pin 1 of XK1).
11. Install new 3 k-ohm resistor (R30) from terminal #5 of T6, to input (next to black) terminals of new Z4 filter.
12. Connect new 2700 pf capacitor (C15) from terminal #3 of T5, to new solder lug placed under mounting screw of T2 (screw nearest T5).
13. Connect other new 2700 pf capacitor (C16) from terminal #4 of T5, to same solder lug as in Step 12.
14. Remove old Z3 filter, saving hardware lockwashers and nuts to mount new Z3 filter.
15. Disconnect twisted pair (orange and white wire) from old Z3 filter (leaving other end connected to T3). If BTS-1A unit has Z5 filter remove filter and continue orange and white leads to T3 (Re-route leads so that they will reach T3, but keep away from T8 and wires that go to T8).
16. Disconnect wire on Z3 that goes to pin 1 of XK1.
17. Disconnect ground wire from Z3.
18. Connect white wire (from terminal 5 of T3) to top connection of L1 of new Z3 filter.
19. Connect wire from pin 1 of XK1 to L2 (output) of Z3.
20. Connect orange wire (from terminal 8 of T3) to insulated terminal of new Z3; connect new wire from this terminal to chassis ground (or to ground side of chassis-mounted BNC J4, if J4 is insulated).
21. Replace R8 with 150 pf capacitor (C14).
22. Mount new Z3 with open side toward top of generator using hardware from old Z3.
23. Measure position of adjustment screws of Z3 and drill two holes in BTS-1A back cover for screwdriver access.



TUNING PROCEDURE

The factory modification described in this addendum alters the procedure given in the BTS-1A instruction book for measuring channel separation and crosstalk in the BTS-1A. When it is deemed necessary to make these measurements, use the procedure given in the following paragraphs:

1. Remove pre-emphasis networks, Z1 and Z2, and install bypass plugs. The plugs are made up by connecting jumpers between pins 3 and 4, and between pins 5 and 6, of an 8-prong tube socket type plug.
2. With no input, set phasing on BW-85A (stereo) modulation meter for null.
3. Connect output of BTS-1A to proper input of BW-75A monitor.
4. Set pilot level (R15) injection on the BTS-1A to approximately 10% (100% of scale on BW-75A modulation meter).
5. Using high quality audio oscillator, insert 400 Hz at 100% modulation into right channel of BTS-1A, with left channel of BTS-1A terminated in 600 ohms.
6. Measure separation (left into right) on BW-85A monitor.
7. Adjust L-R amplitude (R16) on BTS-1A for maximum separation at 400 Hz.
8. Insert 400 Hz at 100% modulation into right channel of BTS-1A, with left channel of BTS-1A terminated in 600 ohms.
9. Measure separation (right into left) on BW-85A. Adjust L-R amplitude (R16) of BTS-1A so that left into right separation, and right into left separation at 400 Hz are equal, or as close in measurement as possible.
10. Insert 15 kHz into left channel of BTS-1A, with right channel of BTS-1A terminated in 600 ohms.
11. Adjust right hand slug (L1) of Z3 on rear of BTS-1A for maximum separation at 15 kHz.
12. Insert 15 kHz into right channel of BTS-1A, with left channel terminated in 600 ohms.

(See back page)

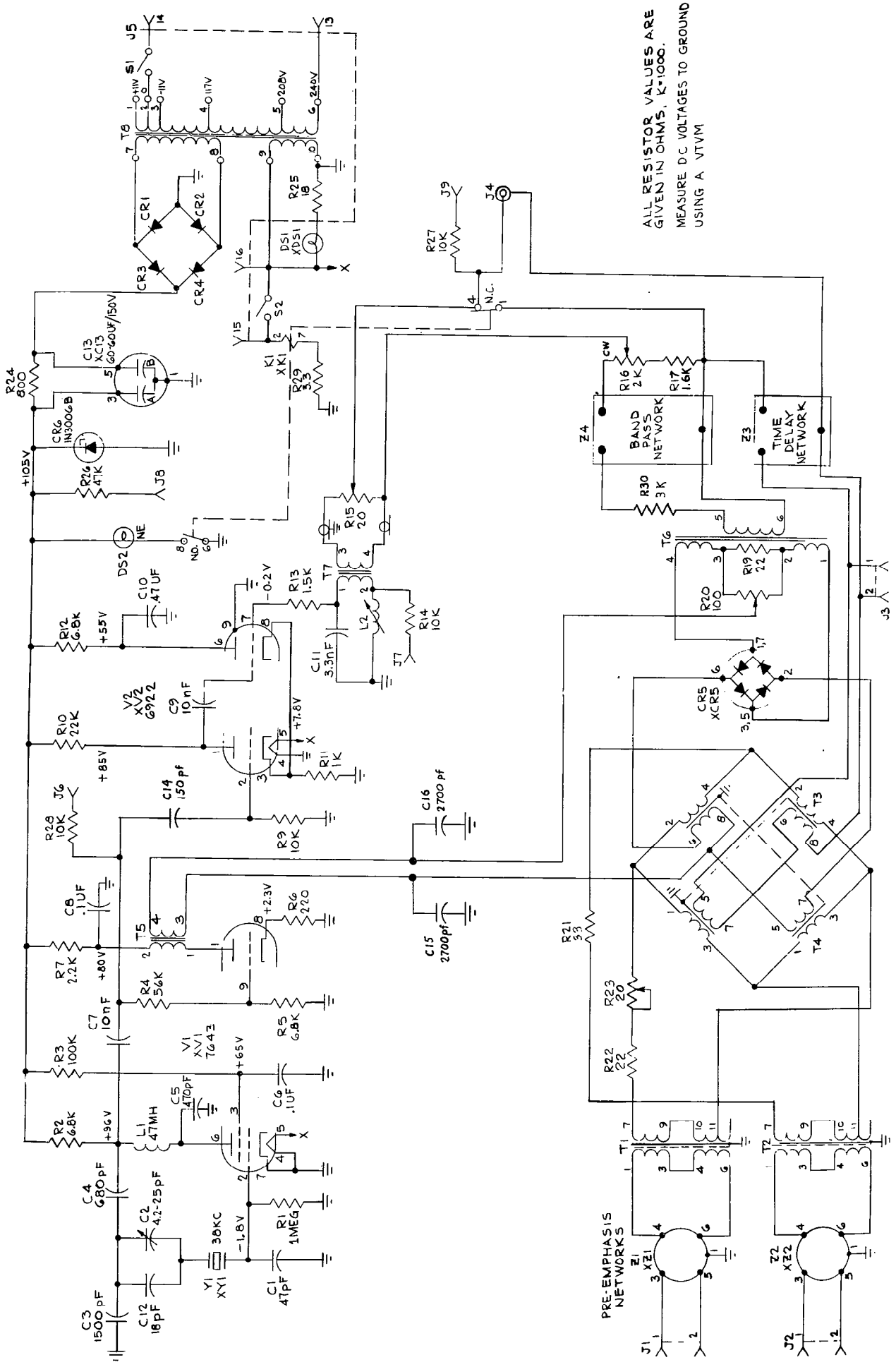


Figure 26. Schematic Diagram, BTS-1A Stereo Subcarrier Generator

13. Adjust L1 of Z3 for maximum separation, and so that left into right and right into left are about equal.

14. Adjust pilot phase slug (L2) on front of BTS-1A for maximum separation at 15 kHz (should be 30 dB or greater).

15. Sweep from 15 kHz to 5 kHz, and at points 10 kHz and 5 kHz, adjust L2 (at right on Z3) for maximum separation left into right, so that L into R and R into L are as close in measurement as possible.

NOTE: Normal separation at 50 Hz will be 30 to 32 dB and rise to around 35 to 40 dB up to 1 kHz. Separation will be 35 to 30 dB, 1 kHz to 15 kHz.

16. Parallel left and right (in phase) inputs, and insert 400 Hz.

17. Measure crosstalk L+R into L-R. Adjust Balance pot (R20) for minimum crosstalk of at least 40 dB.

18. Combine inputs out of phase L-R. Insert 400 Hz.

19. Measure crosstalk L-R into L+R. Crosstalk should be 40 dB or greater.

20. Adjust R23 on back of BTS-1A for best crosstalk figure.

21. Seal all adjustment screws so that they maintain adjustment.

EQUIPMENT LOST OR DAMAGED IN TRANSIT

Unpack and thoroughly inspect equipment upon receipt. If shortages or damaged parts are found, immediately notify RCA and the carrier, and secure an inspection report from the carrier. Notification of equipment loss or damage must be made in writing to RCA, Communications Systems Division, Camden, New Jersey 08102 WITHIN 15 DAYS after receipt of material.

WARRANTY ITEMS

Parts or equipments covered by warranty may be replaced by contacting the local RCA Sales Office. Avoid delays by supplying complete information such as Original Invoice Number , MI-Number, Type Number, Model Number, Serial Number, Stock Number and Description.

REPLACEMENT PARTS

Replacement parts bearing a **Stock Number** should be ordered by Item Description and Stock Number from RCA Parts and Accessories, Deptford, New Jersey 08096. Parts listed under a **Master Item (MI-) Number** should be ordered from RCA, Communications Systems Division, Camden, New Jersey 08102. Parts bearing no number are not stocked by RCA.

RCA Broadcast Equipment

Communications Systems Division/Front and Cooper Streets/Camden, New Jersey, U.S.A., 08102

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