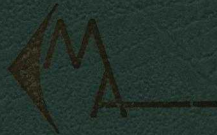


# INSTRUCTION MANUAL

INSTRUCTION MANUAL  
MODEL PCL-303/C  
STUDIO-TRANSMITTER LINK



MOSELEY ASSOCIATES, INC.

SANTA BARBARA RESEARCH PARK  
GOLETA, CALIFORNIA 93017



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MOSELEY ASSOCIATES, INC.

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## INSTRUCTION MANUAL

### MODEL PCL-303/C

### STUDIO-TRANSMITTER LINK

#### I. INTRODUCTION

The Model PCL-303/C Composite Aural Studio-Transmitter Link (STL) is a wide-band system designed for the transmission of a composite FM stereophonic signal between a broadcast studio and a remotely located FM transmitter. Ruggedly built, compact, and rated for continuous duty, the Model PCL-303/C is an all solid-state unit employing only silicon semiconductors.

There are several advantages to the transmission of a composite FM stereo signal. Some of these are:

1. Only one basic RF link is utilized to transmit the composite stereo waveform, including the 19 kHz pilot sub-carrier. This is in contrast to the utilization of two aural STL systems to convey the unmatrixed LEFT and RIGHT audio signal. This results in an equipment cost savings. It should also be noted that a 67 kHz SCA subcarrier can also be applied to the STL for direct rebroadcast by the FM transmitter.
2. The stereo generator is located at the studio site where adjustments, if required, can be made away from the strong RF fields found near large FM broadcast transmitters. These high RF fields can have deleterious effects on the instrumentation employed to properly align the stereophonic generation equipment.

The Model PCL-303/C Composite Aural STL is basically the same as the Model PCL-303 except that the 75  $\mu$ second pre-emphasis/de-emphasis networks and 15 kHz 600  $\Omega$  low-pass filters have been removed from the transmitter and receiver, respectively. The basic modulation response capability of the direct FM oscillator employed in the Model PCL-303/C is sufficient to accept

and faithfully transmit the frequency spectrum required for FM stereophonic broadcasting. Further, the bandwidth of the 10.7 MHz I.F. amplifier of the composite-system receiver has been increased and adjusted to follow a curve which yields a linear phase characteristic. The detected composite waveform in the Model PCL-303/C receiver is passed through a low-pass filter which does not significantly alter the phase relationship of the composite signal (does not degrade separation). This low-pass filter will attenuate any remote control or secondary program subcarriers multiplexed above the composite signal (far in excess of the requirements of FCC Rule 73.317(a)).

The Model PCL-303/C STL consists of a transmitter and a receiver each mounted on a standard  $5\frac{1}{4}$ " x 19" rack panel with slide-out provisions. The STL receiver is a crystal-controlled, double-conversion, superheterodyne type. A relay is included in the receiver to mute the composite output should the incoming carrier fall below a given preset value. In addition, Form C contacts of this relay are terminated on the rear apron for use by external alarm or control circuits.

The transmitter incorporates a direct FM basic oscillator to achieve flat response and uniformly low distortion over a wide modulation frequency range. Provisions are included on the transmitter to multiplex two subcarriers for remote control and auxiliary service. A special extended-life, quiet fan provides cooling for the final power amplifier chain. The basic direct FM oscillator is phase locked to a temperature-controlled, low-frequency, reference crystal oscillator. Also included in the transmitter are two frequency-doubler stages, one 3-stage Class C RF power amplifier, and a parametric multiplying power diode.

A 3-section bandpass filter is incorporated in the STL transmitter RF output circuitry. A sampling diode is included in this assembly to indicate relative RF power output of the transmitter.

All transistors and IC's in the Model PCL-303/C, other than the transistors on the AFC board in the transmitter, are socket mounted. Both transmitter and receiver units are fully shielded.

It should be noted that the Model PCL-303/C Composite Aural STL can only be used with those types of FM exciters employing a direct FM oscillator. Further, the unit is designed basically to operate with the Moseley Model SCG-3T Stereo Generator. However, it is possible to apply a signal from other stereophonic generators meeting the requirements of FCC Rule 73.322. The input level requirements of the PCL-303/C transmitter must be observed to obtain satisfactory results.

## II. SPECIFICATIONS Model PCL-303/C Composite Aural Studio-Transmitter Link

### A. Overall System Specifications

|                        |   |
|------------------------|---|
| L+R Frequency Response | ±0.5 db, 50 Hz to 15 kHz  |
| L+R Distortion         | Less than 0.75%, 50 Hz to 15 kHz  |
| L+R SNR                | 65 db for 35 μv input signal  |
| Stereo Separation      | Greater than 35 db, 50 Hz to 15 kHz (assuming that input stereo signal has separation in excess of 38 db) |

### B. Receiver Performance Specifications

|   |  |
|---|--|
| Frequency                                 | 890 MHz to 960 MHz, crystal controlled   |
| Sensitivity                               | Less than 8.0 μvolts for 20 db quieting  |
| RF Input                                  | 50 Ω, Type N female connector  |
| Modulation Acceptance                     | ±200 kHz   |
| Intermediate Frequencies                  | 1st I.F. 72 MHz; 2nd I.F. 10.7 MHz   |
| Spurious Response                         | Spurious and image responses attenuated more than 60 db                              |
| Stability                                 | Maintained to within ±0.001% of assigned frequency over ambient range of 0°C to 55°C |
| Maximum Available Composite Output Signal | 6 volts peak-to-peak, 1000 Ω minimum load impedance, unbalance                       |
| Metering                                  | Single multimeter for monitoring essential operating parameters                      |
| Operating Temperature Range               | 0°C to 55°C  |
| Dimensions                                | 5¼" x 19" x 14"  |
| Weight                                    | 17 lbs.  |
| Power Requirement                         | 120/240 VAC, ±10%, 50-60 Hz  |
| Mounting                                  | Standard 19" rack  |

### C. Transmitter Performance Specifications

|                             |   |
|-----------------------------|---|
| Type                        | Direct FM   |
| RF Output                   | 7 watts nominal; 8 watts maximum into nominal 50 $\Omega$ load, Type N female connector                                       |
| Frequency Stability         | Better than 0.001% (0°C to 60°C; crystals mounted in temperature-controlled oven)   |
| Multiplication              | 12 times basic oscillator frequency   |
| AM Noise                    | Better than 75 db below carrier reference   |
| Deviation                   | $\pm$ 70 kHz for 100% modulation  |
| Spurious Emissions          | More than 60 db below carrier   |
| Emission Symbols            |   |
| Stereo only                 | 246F9, 255 kHz B.W.   |
| Stereo and 67 kHz SCA       | 290F9, 300 kHz B.W.   |
| Composite Input             | 10,000 $\Omega$ unbalanced, approximately 3.5 volts peak-to-peak for 100% modulation  |
| Multiplex Inputs            | Two BNC connectors are provided for subcarrier channels in 110-200 kHz spectrum; approximately 1.0 volt rms for 20% deviation |
| Operating Temperature Range | 0°C to 55°C   |
| Power Supply                | Fully regulated, self-contained   |
| Power Requirement           | 120/240 VAC, $\pm$ 10%, 50-60 Hz  |
| Cooling                     | Convection and forced; fan has long-life bearings   |
| Dimensions                  | 5 $\frac{1}{4}$ " x 19" x 16"   |
| Mounting                    | Standard 19" rack   |



### III. UNPACKING AND INITIAL CHECKOUT

The Model PCL-303/C transmitter and receiver should be carefully unpacked and inspected for concealed shipping damages upon receipt of the equipment. Retain all boxes and spacers in case a claim is to be made against the carrier for damages.

Should the equipment be damaged, IMMEDIATELY file a claim with the carrier. The top-shield cover of the STL transmitter should be removed so that the shipping spacers which have been used to secure the various shock-mounted subassemblies can be removed. It is also recommended that the receiver top-shield cover be removed to confirm that the muting relay and all transistors are properly seated in their sockets. This visual inspection will also acquaint the user with the location of the key components in the equipment.

CAUTION: Do not attempt any tuning adjustments on the receiver or transmitter at this time. All tuned circuits have been pre-aligned at the factory and should not be adjusted unless proper test equipment is available and then only after reading the Tuning and Alignment Procedure outlined elsewhere in this manual.

If a 10 watt 50  $\Omega$  RF termination capable of operation at 950 MHz is available, with or without a calibrated wattmeter, the STL transmitter can be bench checked. With the RF load connected to the output of the STL transmitter and the line cord plugged into a source of 117 VAC, 50-60 Hz power, the front-panel RADIATE switch can be turned on. The RF wattmeter, if used, will immediately indicate between 6 watts and 8 watts of output power. The RF output meter on the front panel of the PCL-303/C will indicate between 50 and 55 divisions.

The receiver should be placed on an adjacent bench and, after the power plug has been connected to the power source, the power switch can be turned on. It may be necessary to carefully insert a small wire into the Type N RF input fitting on the rear of the receiver chassis to minimize multipathing effects. Do not attempt to adjust the input or output cavities of the STL receiver and transmitter under these test conditions. These are

preliminary tests and should be conducted to become familiar with the basic operation of the system. An audio test signal of 3.5 volts peak-to-peak may be applied to the Type BNC modulation input connector on the rear of the STL transmitter for the initial transmitter check. This signal can be derived from a standard audio oscillator or Model SCG-3T FM Stereo Generator. An oscilloscope or VTVM should be connected to the Type BNC output connector located on the rear of the STL receiver to confirm the presence of the test signal. Bear in mind that multipathing conditions can exist under these initial checks and will affect the measurements made. Since the STL transmitter does not employ pre-emphasis, it is not necessary to reduce the amplitude of the input signal source when making frequency response measurements. (This, of course, will not be true if the test signal source is derived from a stereo generator.)

#### IV. INSTALLATION

The Model PCL-303/C transmitter and receiver can be mounted in a standard 19" wide rack using the slides provided. For maximum mounting stability, the rear of these slides should be secured to the rear rails (or to the cabinet walls) with the brackets provided. The external connections which must be made for both units include the 3-wire power cord, RF input and output cables, unbalanced shielded composite program line and, if used, coaxial cables for multiplex subcarriers. The transmitter should be installed in such a manner as to allow air to freely circulate around the equipment. Transmission line considerations will determine to some extent the placement of the equipment. As lengthy transmission line will introduce undesirable amounts of attenuation of the transmitter output, it is always good practice to place the STL transmitter as close as possible to the antenna. If a long length of transmission line is required, use the lowest loss line possible consistent with mechanical and economical considerations. The same precautions should be followed in locating the receiver. Because of the use of slide-mounting rails, it is preferable to use a short length of RG-8A/U coaxial cable to connect the RF fittings on the rear of the STL transmitter and receiver to the actual transmission line. This prevents damage to the equipment and eases use of the slide-rail mounting technique. In all cases, constant impedance RF fittings should be used, such as a Type N connector, on the transmission line.

Assuming that the initial checks as outlined in the previous section have been made, the STL transmitter and receiver may now be turned on.

CAUTION: Be sure the transmission line and antenna have been properly connected to the PCL-303/C transmitter before activating the RADIATE switch.

When the RADIATE switch is turned on, the RF output meter of the transmitter should indicate between 50 and 55 divisions. A reading different from this value usually indicates the presence of a high VSWR. The tune-up procedure is described in Section VI of this manual.

When the PCL-303/C transmitter power cord is connected to the primary power line source, operating voltages are applied to the basic oscillator, crystal oven, AFC network, and low-level frequency multiplier stages. The front-panel lamp glows when the transmitter is connected to the power line. Turning the front panel switch to the RADIATE position applies voltage to the high frequency power amplifier chain as well as the cooling fan. The RF output meter on the front panel provides an indication of carrier radiation. This turn-on procedure prevents the STL transmitter from radiating an off-frequency signal prior to the capture of the basic oscillator by the AFC circuitry.

## V. ANTENNA

The Type PR-450 Scala Antenna is normally recommended for use with the Model PCL-303/C STL. The reflecting screen is a parabolic section in one plane and provides a gain of 17.5 db over a reference dipole antenna (approximately 19.6 dbi gain). Its physical aperture is 67" x 36". The anodized driver element is located at the focus of the paraboloid and is pretuned at the factory for the operating frequency. No attempt should be made to field tune the antenna. The actual radiating element is a folded dipole with a balun transformer permanently sealed within the driver-element support for impedance matching to a 50 $\Omega$  transmission line. This configuration results in less beam skewing under heavy ice and snow loading conditions. It should be noted that this antenna has a low DC resistance between the

inner conductor and the shield of the Type N RF fittings supplied. On special order, the reflecting screen of the antenna can be anodized and dichromate dipped to assure long life in a corrosive environment. The PR-450 Antenna is supplied with U-bolt mounting hardware so that it can be clamped to a 2 3/8" O.D. pipe. The open grid reflector design minimizes wind loading.

In assembling the PR-450, care should be taken to insure that the driver element support is fully seated. If this support is not fully seated, optimum gain of the PR-450 will not be achieved. Additionally, the polarization of the transmitting and receiving antennas should be in the same plane.

When mounting the PR-450 or equivalent antenna to an ungrounded standard broadcast tower, the Moseley Model ICU-1 Isocoupler may be used to eliminate the need to construct a resonant transmission line tank circuit or the requirement for a quarter-wave insulated transmission line section up the tower. The ICU-1 Isocoupler has less than 0.5 db of insertion loss at 950 MHz and presents less than 10 pf of capacity to the base of the tower. The ICU-1 is rated for a peak instantaneous voltage breakdown of 5,000 volts. The modulation voltage peaks should be taken into consideration when using the ICU-1.

## VI. DETAILED DESCRIPTION OF TRANSMITTER

### A. Transmitter Operation

To place the Model PCL-303/C in operation, connect the RF transmission line to the Type N output fitting. Connect the power cord to a source of 120/240 VAC, 50-60 Hz power. The green pilot light will indicate the presence of primary power. This lamp is on whenever the transmitter is connected to the power line. The composite stereo waveform is applied to the transmitter through the Type BNC connector on the rear panel. Power is applied to the RF power amplifier by activating the switch marked RADIATE on the front panel. RF power output is continuously displayed on the front-panel meter labeled RF OUTPUT. A copy of the final test data can be found on page 20 and should be referred to for specific meter readings and system performance measurements. These measurements will serve as a guide in operation of the equipment.

An approximate curve for the POWER OUTPUT meter position is shown in Drawing 15A1055. Potentiometer R-310, located at the rear of the power amplifier chain, adjusts the level of the RF output monitor meter. Should this control be changed, it will be necessary to recalibrate the potentiometer against an RF wattmeter of known accuracy. A transmission line or antenna impedance mismatch will introduce an error into this reading.

For 100% modulation of the STL the carrier is shifted approximately  $\pm 70$  kHz from its mean center frequency. A 1,000 Hz test tone at a level of 3.5 volts p-p will produce 100% modulation. Two BNC connectors are mounted adjacent to the composite input connector. These connectors provide equal but isolated multiplex inputs. For 10% subcarrier injection the voltage at the BNC input should be 0.5 volts rms. These subcarriers should be confined to the 110 kHz to 200 kHz spectrum to prevent interference to the stereo signal and out-of-band radiation. It is usually not advisable or necessary to reduce the main channel program level when a subcarrier is added to the STL.

#### B. Transmitter Circuit Description

The complete schematic of the PCL-303/C transmitter is shown in Drawing 91C-6242. The composite stereo input signal is first applied to the deviation control, R-145. It is then passed through a time constant correction network to the variable capacitance diodes (varicaps) CR-101 and CR-102. These diodes vary the resonant frequency of the tank circuit of the oscillator, Q-101. Q-101 oscillates at a frequency of  $1/12$  the final output or carrier frequency and is frequency modulated  $\pm 6$  kHz by the main channel program material for 100% modulation. For discussion purposes, an operating frequency of 945.0 MHz will be assumed. Hence, the frequency of the basic oscillator Q-101 will be  $945.0 \div 12$  or 78.75 MHz. This signal is amplified by Q-102 and fed to Q-201. This 78.75 MHz signal is multiplied four times and amplified by Q-202 and Q-203 to produce a 100 milliwatt signal at 315 MHz at J-202. This power is fed to J-301 on the RF power amplifier chassis. Q-301, Q-302 and Q-303 transistors amplify the 315 MHz signal to 12 watts which is applied to the parametric multiplier CR-301. Eight watts of

power are removed from the diode at 3 times 315 MHz or 945 MHz. L-313 and C-317 form the idler circuit of the parametric multiplier. The 945 MHz output of the varactor is then fed through C-323 and the 3-section, end-tuned filter cavities to J-302. The antenna coaxial cable is attached to J-302.

Automatic frequency control (AFC) of the transmitter output frequency is accomplished by phase locking the 78.75 MHz basic oscillator to a 76 kHz low-frequency, crystal-controlled, reference oscillator. The 78.75 MHz output of Q-102 is applied to the input of a high speed binary counter and divided eight times by integrated circuits IC-1, IC-2, and IC-3. This divided output, 9.844 MHz in the example, is applied to a level-changing amplifier Q-1 on the AFC printed circuit board. The output of Q-1 feeds another binary chain, IC-5 through IC-9, which divides the input frequency by 512. The total division of the basic oscillator frequency is 4.096. The low-frequency reference signal is derived from IC-4, an integrated circuit emitter-coupled crystal-controlled multivibrator. The output of this oscillator is applied to level changer Q-2 and applied to IC-10 and divided 4 times. Thus, the outputs of IC-9 and IC-10 operate at the same frequency. The phase of these two output signals is compared in IC-11 to achieve an integrated DC AFC error voltage which is amplified by Q-3. It should be noted that the entire AFC system is not frequency sensitive since all integrated circuits in the binary dividers operate in the saturated current or voltage mode. Thus, they exhibit excellent noise immunity. The AFC error voltage is then coupled through a low-pass filter network to varicap diodes CR-103 and CR-104. Thus, the frequency of the basic oscillator is phase locked to the low-frequency, temperature-controlled, crystal reference oscillator.

It should be noted that the two capacitors used to couple the four varicap diodes to the basic oscillator tank circuit are temperature compensated to achieve optimum frequency stability of the basic oscillator.

The power supply for the transmitter has three output voltages; +28 volts DC, +15 volts DC, and +3.6 volts DC. The +28 volt DC supply powers the RF power amplifier. The +15 volt DC supply powers all other circuitry except the binary which uses

the +3.6 volt output. The +28 volt, the +15 volt, and the +3.6 volt DC supplies are fully regulated by Q-401, Q-402, Q-403, Q-404, and the Zener diode references CR-407 and CR-410. R-408 adjusts the output voltage of the 28 volt supply and should never be set higher than +28 volts DC.

### C. Transmitter Remote Control

The Model PCL-303/C transmitter may be operated from a remote location. A 5-pin receptacle, J-403, is mounted on the rear of the chassis. This connector enables the remote radiate switch and meters to be connected to the PCL-303/C circuitry. A 5-conductor cable should be used between the remote control point and the PCL-303/C transmitter. A plug with pins A and B shorted together is provided with each Model PCL-303/C transmitter. If remote control operation is not intended, this plug should remain inserted in J-403.

To turn the carrier on from the remote location, wires must be connected between pins C and D of J-403. A simple SPST toggle switch can be used for this purpose. Actuating this switch will operate relay K-401, applying  $+26 \pm 2$  volts DC to the RF power amplifier. To indicate the relative power output at the remote position, place a 50  $\mu$ a meter in series with pins A and B of J-403. Connecting another 50  $\mu$ a meter between pins J and A will provide the remote control point with an indication of the AFC error voltage.

The Model ECP-1 Extension Control Panel is available to operate the PCL-303/C from a remote location. It should be noted that a 5-conductor cable is required between the transmitter and the ECP-1 Control Panel. Thus, the use of the ECP-1 is limited to relatively short distances, usually within the same building.

### D. Transmitter Adjustments and Alignments

A complete alignment of the transmitter is not recommended in the field. However, in the case of transistor replacement, a touch-up alignment can be performed. First, remove the 2 amp fuse on the power supply chassis, and adjust R-408 for  $+26 \pm 2$  volts DC at the output of the power supply. Do not set the output above +28 volts. Check the +28 volt and +15 volt DC supplies with the front panel meter. Switch the meter to the BASIC OSC. position. If the reading is over 30, switch to the REF. OSC. position. If the

reading is again over 30, switch to the BINARY OUTPUT. This reading should be at 50 divisions  $\pm 10$ . If it reads either 10 divisions or 90 divisions, the binary is not working and service is required. If it reads 50 divisions, switch to the AFC position. This reading should be 40 to 60 divisions also. If it is not, switch to the AFC UNLOCK position. Adjust the AFC control C-104 until the meter reads zero. This can be done by adjusting C-104 until the meter reading rises and then falls to zero after some noticeable oscillation. After the meter falls to zero, switch back to the AFC position. The meter will read between 30 and 70 divisions. Continue to adjust C-104 until the meter reads 50 in the AFC position.

NOTE: When the frequency of the basic oscillator is not "locked" to the frequency of the reference crystal oscillator, it should be noted that the reading of the meter with the selector switch in the AFC position will be approximately 50. This is the SAME reading that appears when the basic oscillator is in phase with the reference oscillator and no AFC error voltage is present. AFC control of the basic oscillator can be quickly confirmed by switching to the AFC position. If the meter follows a slight change of adjustment in C104, the AFC is locked.

In normal operation the I.P.A. DRIVE position is used as an indication of the presence of normal drive to the RF amplifier. The amplitude of the I.P.A. DRIVE position meter reading is affected by the presence of +28 volts on the RF amplifier. The meter reading will be higher when the RADIATE switch is on. No attempt should be made to adjust the tuning of the frequency multiplier stages when it is connected to the RF amplifier input.

The following procedure is used when tuning up the multiplier section. Remove the cable connected to J-202, and connect a 50 $\Omega$  RF dummy load to J-202. Using an external multimeter, place it from the emitter of Q-203 to ground, and adjust L-201 and L-202 for a maximum reading on the external multimeter. Remove the external multimeter, and adjust L-203 for a maximum reading on the I.P.A. DRIVE position. Remove the RF dummy load, and reconnect the cable from J-301 to J-202. Place a dummy load or antenna on the RF output J-302. Turn the



RADIATE switch off, and replace the 2 amp fuse in the power supply chassis. Switch the meter to the FINAL CURRENT position, and turn the RADIATE switch on. The RF output meter should read approximately 50 divisions. If an RF wattmeter is used, it will read 6 to 8 watts. The FINAL CURRENT should read between 75 and 95. If the final current is correct but the power output is low, adjust C-319, C-320, C-321 for a maximum on the RF output meter. If a satisfactory maximum is achieved and the final current is correct, switch to the I.P.A. CURRENT position. It should be between 30 and 60. Switch to the MULTIPLIER BIAS. It should be between 40 and 90. C-314 through C-317 are not readily available adjustments and should not be attempted without consulting the manufacturer. Replacement of all transistors except Q-401, Q-402, Q-302, and Q-303 is straightforward. When replacing Q-401 or Q-402, be certain that the insulating washer is reinstalled between the transistor and the heat sink. If Q-203 or Q-301 are replaced, remove the finned heat sink on the old unit and install it on the replacement.

## VII. DETAILED DESCRIPTION OF RECEIVER

### A. Receiver Operation

After mounting the receiver, connect the power supply cord to a convenient source of 120/240 VAC, 50-60 Hz. Turn on the power switch on the front panel. Attach the antenna connection.

The potentiometer (R404, see Drawing 20A2090 for location) controlling the receiver squelch is available on the audio multiplex P.C. board. The receiver top must be removed to adjust this control. This level is preset to operate with an input signal of 50  $\mu$ volts and should not require readjustment.

The program output level control (R409) is also available on the audio multiplex board. This adjustment is factory set to deliver 6 volts peak-to-peak to the output attenuator pad, R-431 and R-432. These resistors are selected to match the deviation sensitivity of the FM exciter so that 100% modulation is achieved with the maximum signal-to-noise ratio capability of the Model PCL-303/C system.

A calibration table for SIGNAL 1 and SIGNAL 2 is included in the final test data on page 20 of this manual and shows the relationship between the meter reading and the actual input signal expressed in  $\mu$ volts. For 60 db quieting in the demodulated LEFT or RIGHT channels, the received signal should be 100  $\mu$ volts or greater.

The final test data sheet also includes the multimeter readings taken on the receiver during final test. These readings will serve as a guide during the operation and servicing of the equipment.

### B. Receiver Circuit Description

The receiver is a double-conversion superheterodyne type employing 19 transistors, 19 diodes, and one integrated circuit. A complete schematic of the receiver is shown in Drawing 91C-6243. The Model PCL-303/C receiver is housed in a rack-mounted, enclosed cabinet 19" wide and  $5\frac{1}{4}$ " high. External connections include the power cord, the RF Type N input connector located on the rear panel, type BNC connectors for the composite output signal, and two multiplex outputs. In addition, relay contacts (Form C) are also present on the rear chassis to indicate presence of a received carrier.

Quite often the STL receiver is located in a building containing high RF field energy. Under these conditions, cross-modulation products can be created in a conventional transistor amplifier stage if the input signals applied to the base circuit exceed the linear dynamic range of the device. To prevent this condition in the Model PCL-303/C receiver, the 3-stage 72 MHz I.F. amplifier employs field effect transistors (FET) with an Automatic Gain Control (AGC) circuit.

The AGC control voltage is derived from diode CR-302 in the 10.7 MHz 2nd I.F. amplifier. This voltage increases in the positive direction with an increase in the desired signal. Transistor Q-207 in the 72 MHz I.F. amplifier inverts this voltage and applies it to Gate 2 of the first and second 72 MHz FET stages (Q-204 and Q-205). A fixed bias is applied to Gate 2 of the last FET (Q-206) to assure a more constant input to the 10.7 MHz 2nd I.F. amplifier.

A table showing the readings for Signal 1 and Signal 2 meter positions is included in the final test data sheet of this instruction manual. The Signal 2 readings are shown with and without the AGC applied to the 72 MHz I.F. amplifier. Under normal conditions the meter will indicate the signal strength with AGC. To obtain a reading without AGC, it is necessary to remove Q-207 from its socket.

The input of the STL receiver is designed for an impedance of  $50\Omega$ . The antenna input connector is coupled to the first of five end-loaded resonate line cavities. The last cavity is coupled to the first crystal mixer CR-101, where it is mixed with the local oscillator injection signal. The local oscillator signal is derived from the first crystal oscillator Q-201 and multipliers Q-202, Q-203, and CR-102. The output of the crystal mixer is 72 MHz and is coupled into the signal gate of Q-204 which is the first 72 MHz I.F. stage. It is amplified by Q-205 and Q-206 and is applied to the base of the second mixer Q-302. The injection voltage for the second mixer is generated by Q-301, a crystal-controlled oscillator at 61.3 MHz. The output of this mixer is then amplified by the 10.7 MHz second I.F. amplifier, Q-303, Q-304, Q-305, and Q-306. This amplifier has a response designed to obtain maximum phase linearity over the entire stereophonic spectrum. Preservation of phase integrity is paramount to proper stereo performance. Q-306 acts as a limiter and drives a conventional ratio detector. The output of this detector is applied to a program amplifier which determines the composite output level of the receiver.

The entire baseband signal is amplified by IC-401. The composite signal is passed through a low-pass filter and amplified by Q-404, Q-405, and Q-406. The output of this amplifier is capable of delivering a 6 volt peak-to-peak composite stereo signal to a  $1,000\Omega$  load. Resistors R-431 and R-432 are selected to reduce the amplitude of the composite signal in accordance with the input requirements of the direct FM exciter being used. It is important that the AUDIO gain control R-409, be set to develop the correct voltage at the output of Q-405 and Q-406 so that the system will yield the greatest signal-to-noise ratio. Thus, resistors R-431 and R-432 should be selected to apply the proper input signal to the FM exciter. The output of

IC-401 is also applied through a 100 kHz high-pass filter and amplified by transistor Q-403 to drive the two low-impedance multiplex outputs appearing on the rear of the receiver chassis. The audio and multiplex outputs are squelched if there is no incoming carrier or if the receiver primary power is removed. Additional contacts (Form C) from K-401 are available on the rear of the panel of the receiver.

CAUTION: To avoid hum components from appearing on the output of the receiver, it is recommended that the external squelch contacts be used in a DC control circuit.

### C. Receiver Adjustments and Alignments

Under normal operating conditions all necessary tuning adjustments can be made with the aid of the selectable meter provided on the front panel and with the unit in operation. It will be necessary, however, to remove the top and bottom covers to gain access to the various circuit elements.

Two definite points of resonance or peaks of equal amplitude may be observed when aligning the coils of this receiver. However, single tuned coils adjusted from the top of the chassis should be aligned on the peak observed when the slug is nearest to the top of the coil (with the screw protruding the most).

To align the first oscillator and subsequent multiplier stages the following procedure is used. Oscillations are indicated by a reading of the meter on the 1st OSC. position. (Refer to the typical readings given elsewhere in this manual.) With the meter selector switch set to the MIXER DRIVE position, adjust L-202, L-203, and L-204 for a maximum reading. The remaining adjustments should be made with a weak signal in order to avoid saturation of the limiters. This can be accomplished by rotating the azimuth of the receiving antenna in cases where the STL transmitter signal is being used or by reducing the output level of the RF signal generator providing the test signal. Under conditions of weak signal, the SIGNAL 1 position will provide adequate indications of proper tuning. The injection cavity control C-107 should then be adjusted for maximum reading. This will complete the alignment of the 1st oscillator multiplier chain.

The input cavities can be adjusted for maximum SIGNAL 2 (with AGC defeated) reading by tuning C-101, C-102, C-103, C-104 and C-105 on the top of the cavity for maximum reading. C-101, C-102, C-103, C-104, and C-105 should be about one turn from the CCW end. Go back over this step several times to assure optimum adjustment. Next, adjust L-208, L-205, L-206, L-207, L-303, and L-302 for resonance as indicated by a maximum reading on the panel meter in the SIGNAL 2 position. When making these adjustments remove transistor Q-207 on the 72 MHz I.F. amplifier chassis. This will defeat the AGC action so that more accurate tuning can be obtained.

Since the performance of the Model PCL-303/C Receiver depends primarily on the tuning of the 10.7 MHz I.F. and ratio detector transformer, it is not recommended as a field adjustment unless an I.F. sweep generator and an exact source of 10.7 MHz are available. Considerable effort has been expended in the design of the 10.7 MHz I.F. to achieve a phase linear transfer characteristic and to eliminate the need for tuning. Replacement of Q-302, Q-303, Q-304, Q-305, and Q-306 does not require the retuning of the 10.7 I.F. Retuning should only be attempted with the use of a sweep generator. The 3 db bandwidth of the second I.F. amplifier is 400 kHz. The SQUELCH adjustment should be set to a position where 50  $\mu$ v of RF at the input will cause the relay to unsquelch the output. It will be noted that three other contacts are provided on the back of the receiver. These are also controlled by the squelch relay and may be used for fail-safe or alarm operation if the STL carrier is lost.

### VIII. SHIPPING INSTRUCTIONS

If it should be necessary to ship the PCL-303/C to another destination, the following procedures should be followed:

- 1). Remove both transmitter and receiver top covers.
- 2). Secure the base plate supporting the blower with a 6-32 x 3/8" machine screw.
- 3). Secure the BASIC OSC AFC shock-mounted chassis. This can best be done by wedging cardboard between the chassis and the top cover.
- 4). Check to see that the relays in the receiver and transmitter are firmly in their sockets and that the retaining clamp is in place.
- 5). Replace both top covers.
- 6). Place equipment in shipping cartons. Use adequate spacers at all edges to prevent puncture damage if carton is dropped in transit. If possible, use an inner carton with additional packing material and a substantial outer carton.

IT IS RECOMMENDED THAT THE ORIGINAL SHIPPING CARTONS AND SPACERS BE STORED IN CASE THE UNIT MUST BE RE-PACKED FOR SHIPMENT.

MOSELEY ASSOCIATES, INC.

IX. FINAL TEST DATA

Date March 5, 1973  
 F.O.# 10-2181  
 Technician WWS

MODEL PCL-303/C

Customer KABL  
 Serial # RX-8237/TX-8233  
 Frequency 948.500 MHZ

METER READINGS

| TRANSMITTER           |           | RECEIVER          |         |
|-----------------------|-----------|-------------------|---------|
| Function              | Reading   | Function          | Reading |
| +28 Volts             | 55        | +10 Volts         | 46      |
| +15 Volts             | 69        | -10 Volts         | 47      |
| Basic Oscillator      | 22        | 1st Oscillator    | 54      |
| Reference Oscillator  | 60        | Mixer Drive       | 48      |
| Binary Output         | 54        | 2nd Oscillator    | 34      |
| AFC                   | 50        | Limiter           | 4       |
| AFC Unlocked          | 0         | Signal 1          | 4       |
| I.P.A. Drive          | 57        | Signal 2          | 4       |
| I.P.A. Current        | 42        | Discriminator (+) | 12      |
| Final Current         | 77        | Discriminator (-) | Neg.    |
| Multiplier Bias       | 62        |                   |         |
| Power Out             | 9.0 watts |                   |         |
| (See Drawing 15A1055) |           |                   |         |

PCL-303/C SYSTEM PERFORMANCE

| Freq. (Hz) | Response | Distortion (%) |
|------------|----------|----------------|
| 35         | +0.1 dB  | 0.25           |
| 50         | +0.1 dB  | 0.20           |
| 400        | +0.1 dB  | 0.20           |
| 1,000      | 0 ref.   | 0.15           |
| 5,000      | -0.1 dB  | 0.15           |
| 10,000     | -0.1 dB  | 0.15           |
| 15,000     | -0.1 dB  | 0.15           |

Mux Tx sens. 0.28V rms (20% injection 110 kHz)  
 Mux Rx Out 0.50V rms 110 kHz  
 Tx Deviation set for 3.5V P-P=100% mod. X  
 Rx Audio Gain set for 3.5V P-P=100% mod. X  
 SNR = 62 dB wide band  
 Squelch Control set 50  $\mu$ volts. X  
 NOTE: Distortion checks made at 100% modulation.  
 Wide-band quieting 50  $\mu$ volts for 45 dB SNR

| $\mu$ V input | Sig. 1 | Sig. 2 | Sig. 2 (No AGC) |
|---------------|--------|--------|-----------------|
| 50            | 14     | 6      | 6               |
| 100           | 20     | 13     | 14              |
| 300           | 22     | 37     | 49              |
| 500           | 22     | 40     | 67              |
| 700           | 22     | 40     | 72              |
| 1,000         | 22     | 40     | 78              |
| 1,500         | 22     | 40     | 82              |

\*Measured with 50 $\Omega$  R.F. signal generator

COMPOSITE OUTPUT RESPONSE

|             |           |
|-------------|-----------|
| 0 dB (ref.) | = 50 kHz  |
| -2 dB       | = 81 kHz  |
| -53 dB      | = 110 kHz |
| -49 dB      | = 185 kHz |

Receiver input signal required for 60 dB de-emphasized SNR.

L + R mono (50-15kHz): 35  $\mu$ volts  
 R (or L) stereo : 95  $\mu$ volts

Ultimate SNR with saturating signal.

L + R mono (50-15kHz): 69 dB SNR  
 R (or L) stereo : 65 dB SNR

Stereo Performance with SCG-3T

Pilot level 9.0 %

| Freq.  | Separation | Cross Talk |
|--------|------------|------------|
| 50     | 41         | 50         |
| 400    | 48         | 51         |
| 1,000  | 49         | 51         |
| 5,000  | 41         | 51         |
| 10,000 | 42         | 48         |
| 15,000 | 37         | 46         |

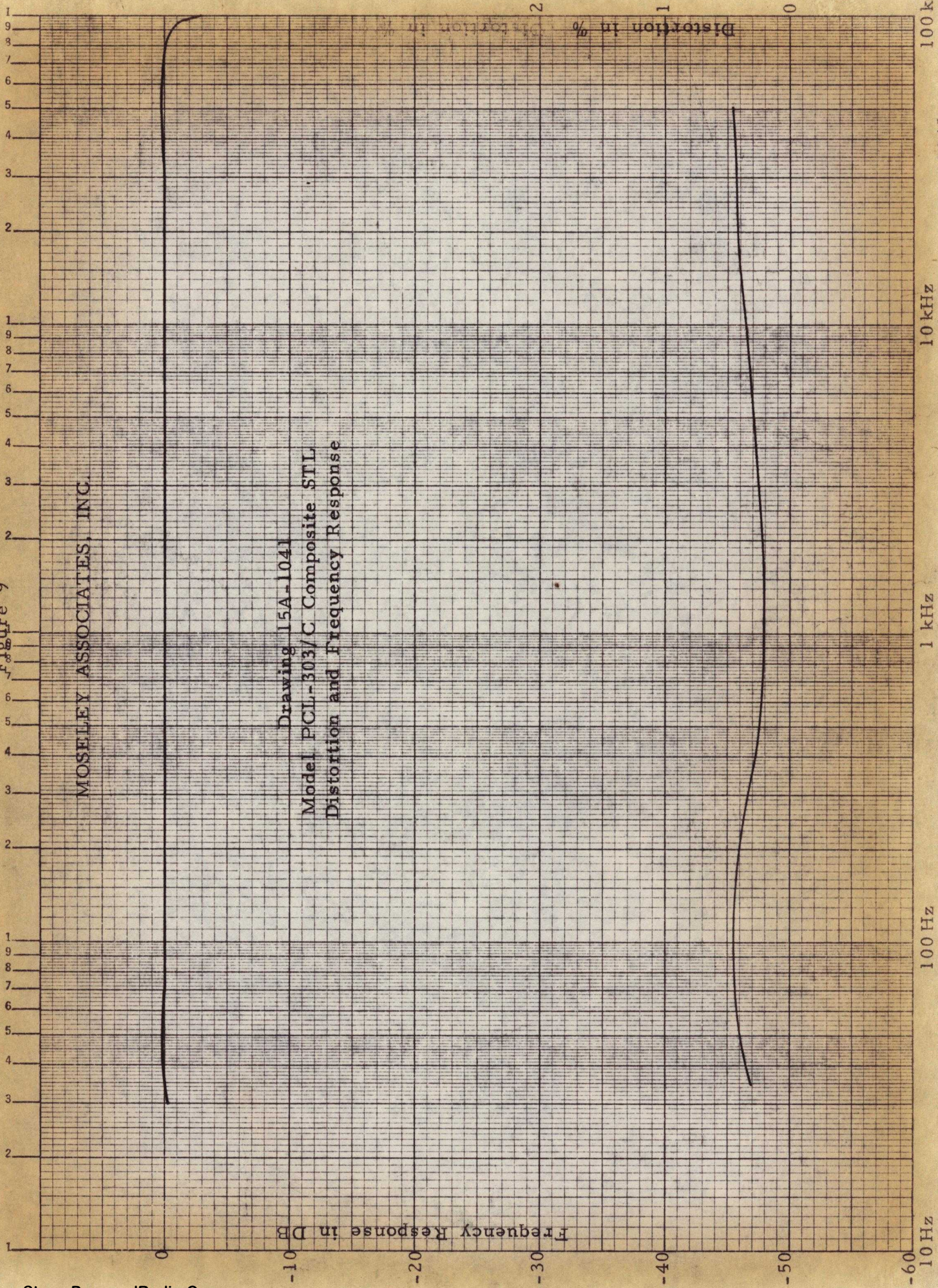
NOTE: The above readings were observed during final checkout of the equipment and are intended for reference purposes only. Readings may vary with transistor replacement, transistor aging, tuning, RF terminations, and equipment installation.

359-001  
KREUFFEL & ESSER CO. MADE IN U.S.A.  
4 CYCLES X 70 DIVISIONS

Figure 9

MOSELEY ASSOCIATES, INC.

Drawing 15A-1041  
Model PCL-303/C Composite STL  
Distortion and Frequency Response



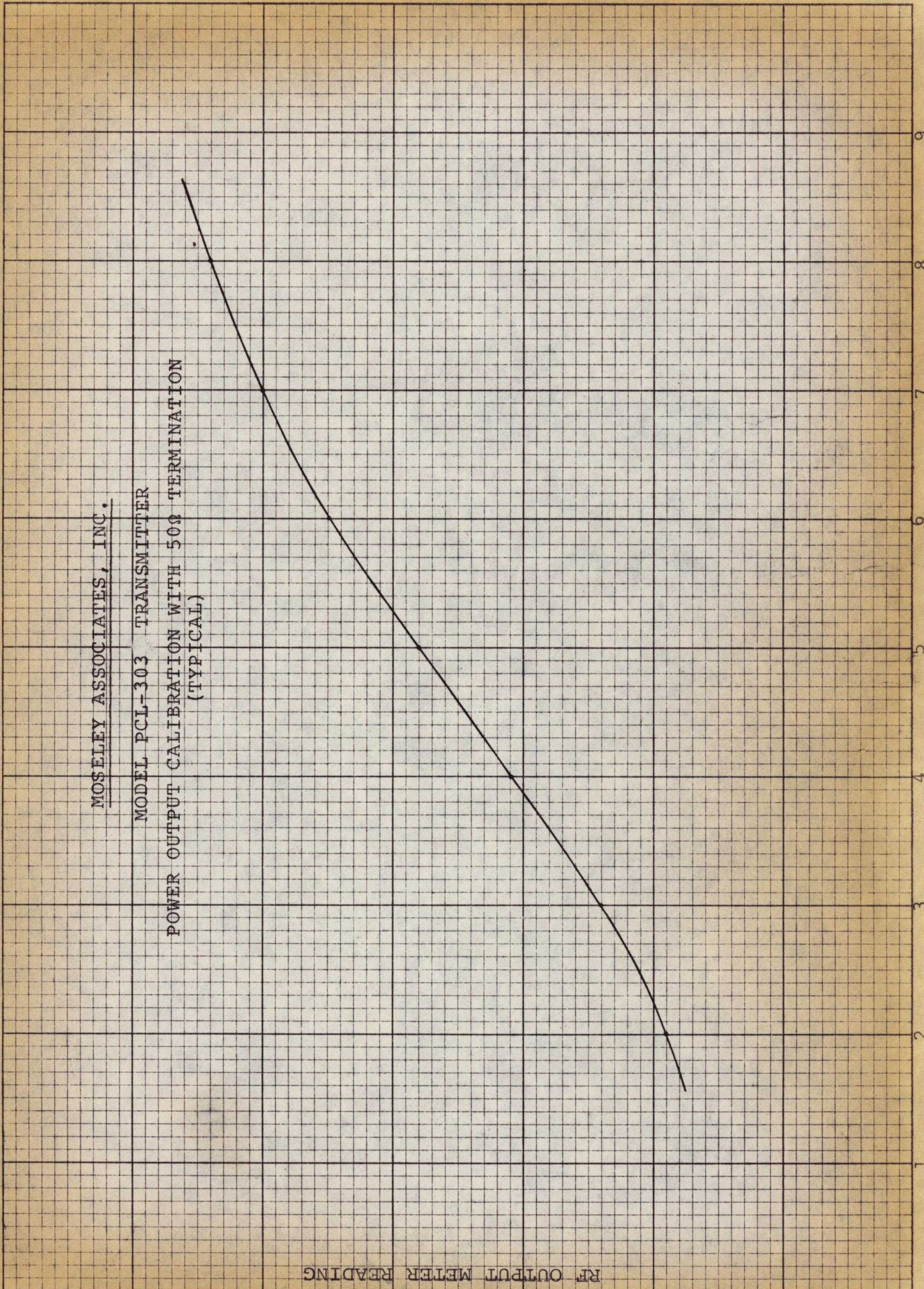


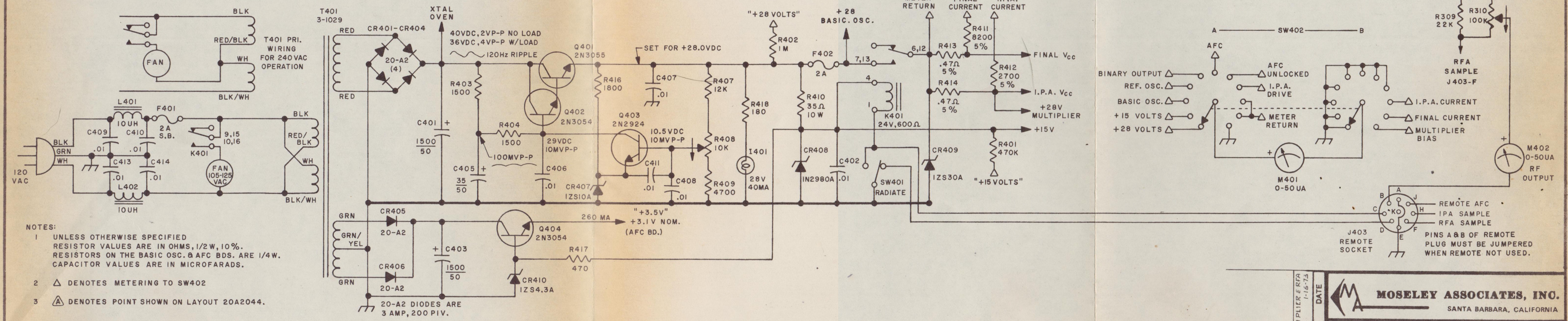
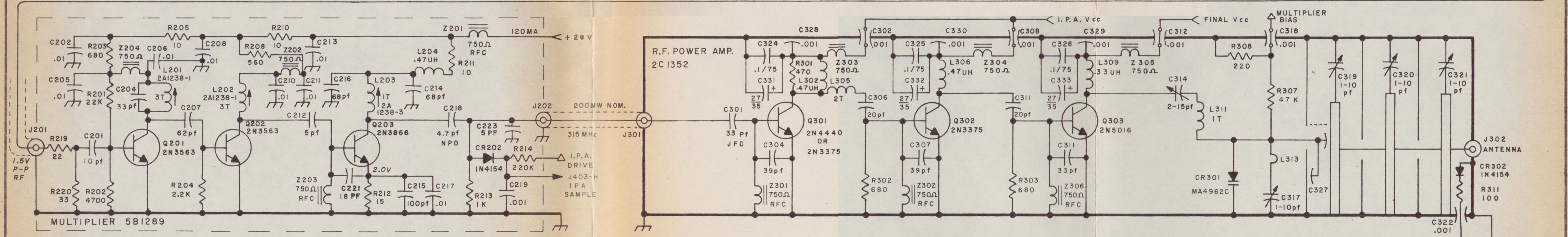
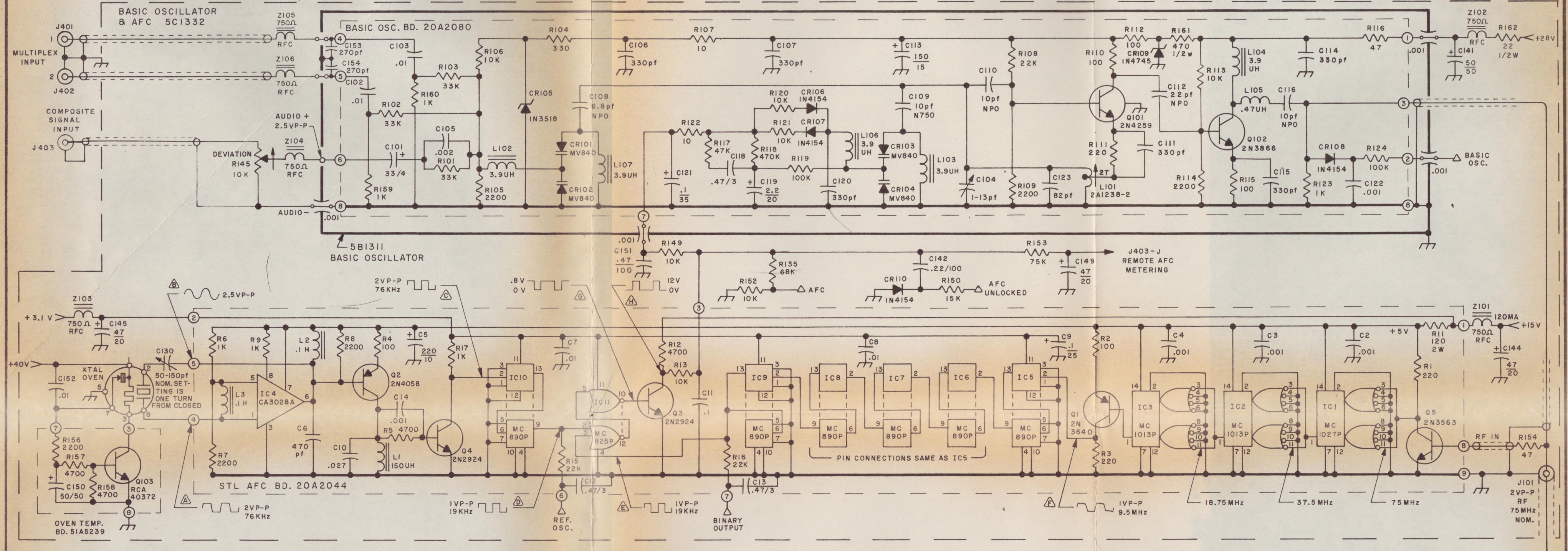
10 X 10 TO THE INCH 3595  
KEUFFEL & ESSER CO. MADE IN U.S.A.

MOSELEY ASSOCIATES, INC.

MODEL PCL-303 TRANSMITTER

POWER OUTPUT CALIBRATION WITH 50Ω TERMINATION  
(TYPICAL)





NOTES:  
 1 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. RESISTORS ON THE BASIC OSC. & AFC BDS. ARE 1/4W. CAPACITOR VALUES ARE IN MICROFARADS.  
 2 Δ DENOTES METERING TO SW402  
 3 ▲ DENOTES POINT SHOWN ON LAYOUT 20A2044.

**MOSELEY ASSOCIATES, INC.**  
 SANTA BARBARA, CALIFORNIA

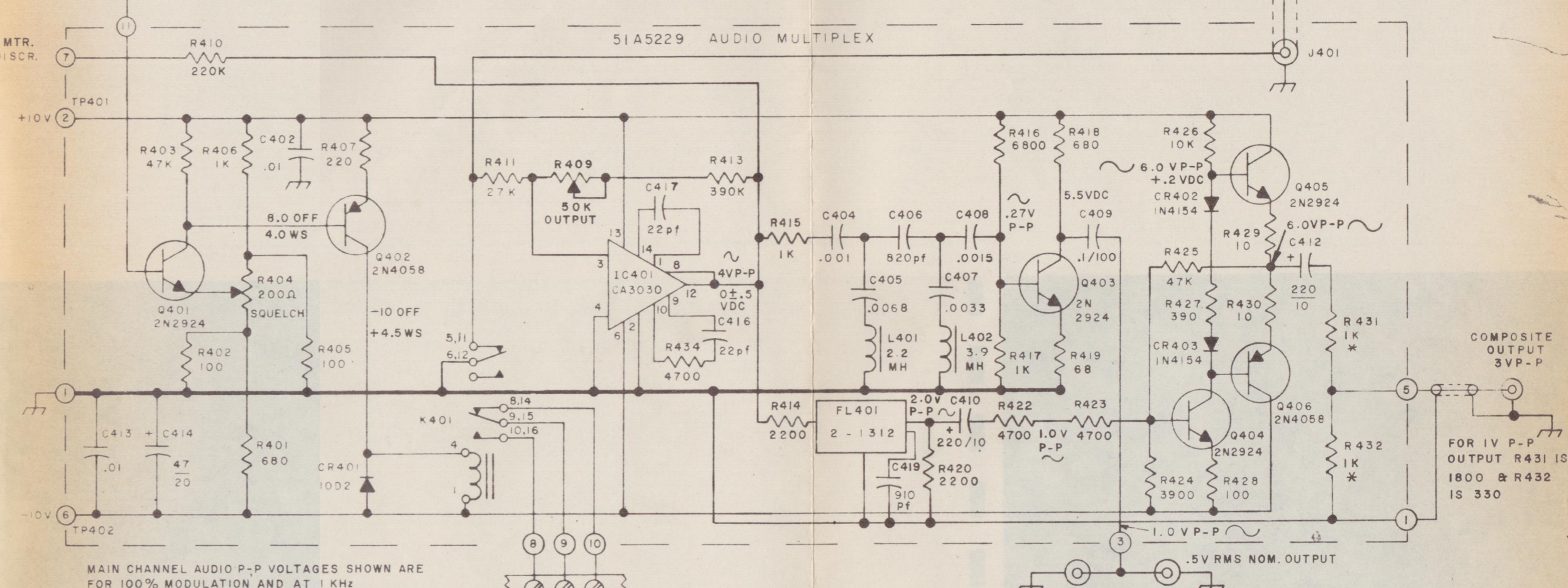
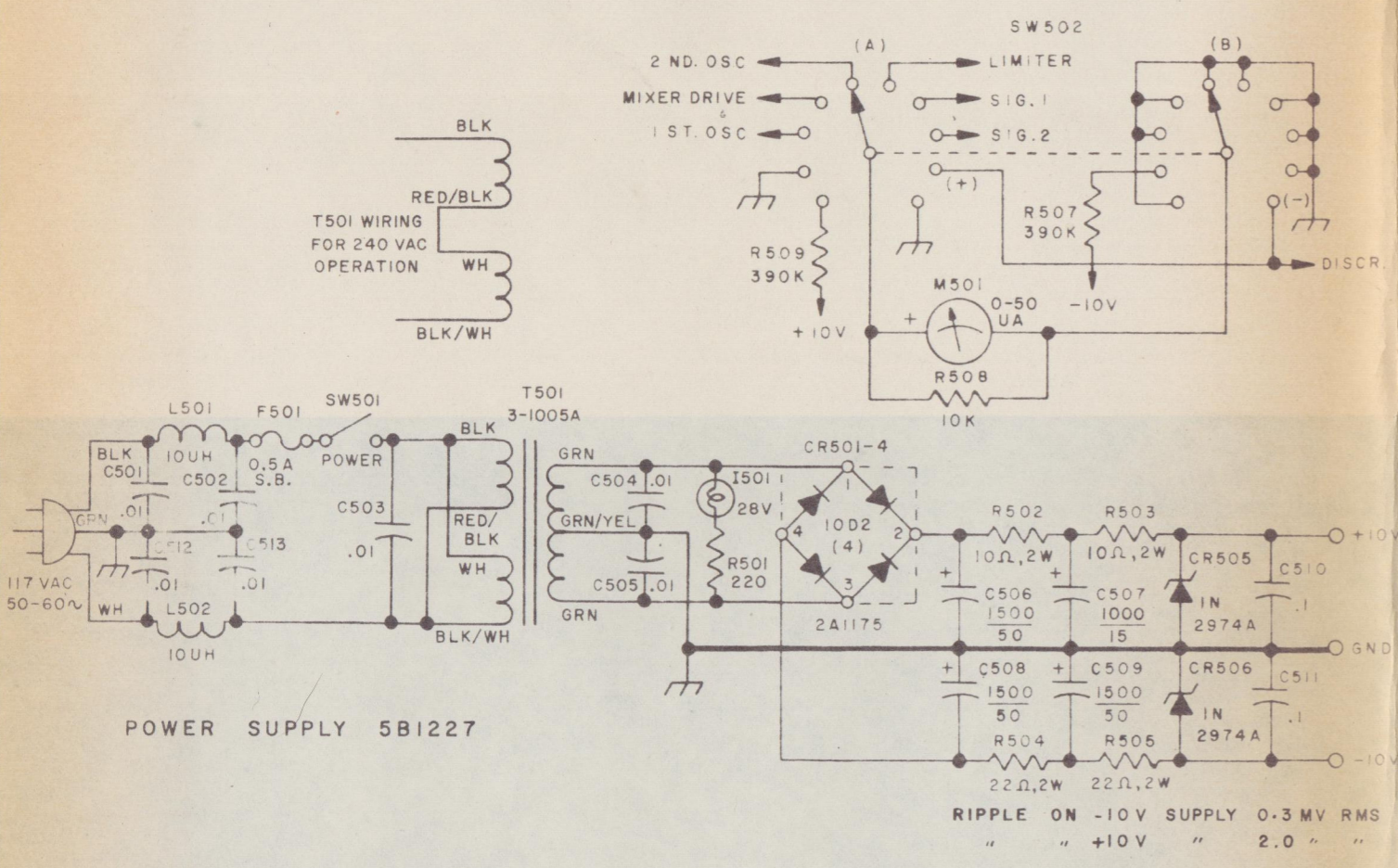
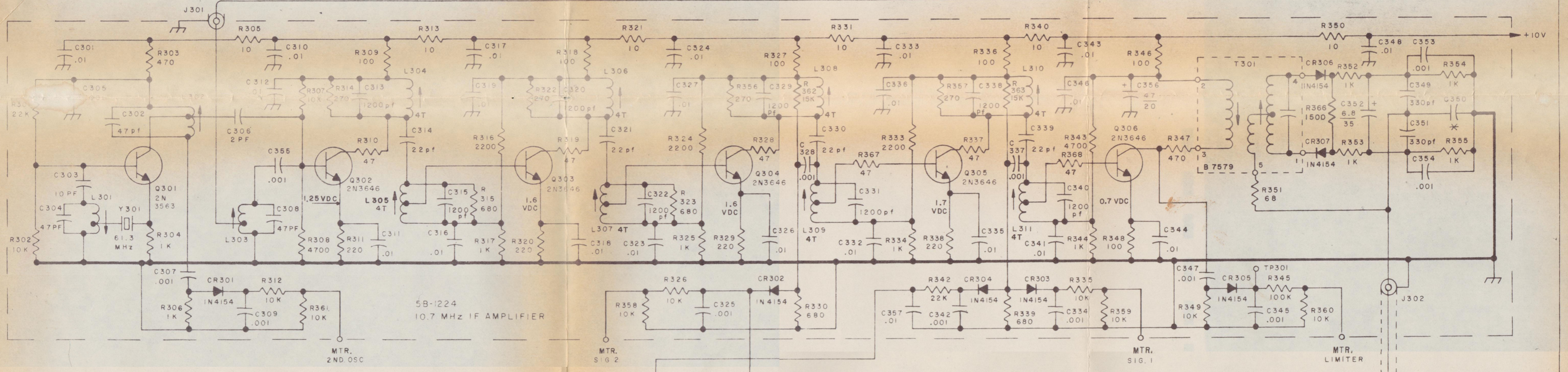
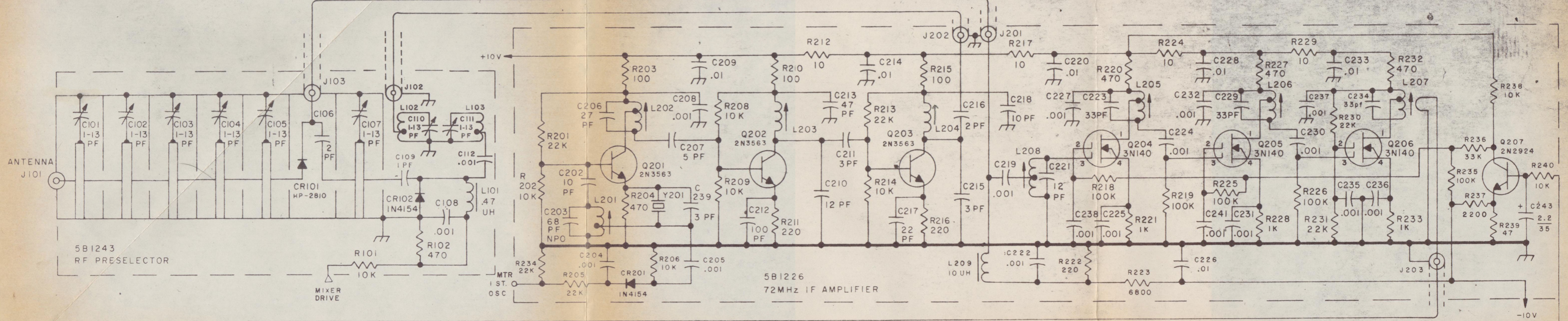
**SCHEMATIC**  
 PCL-303B/C COMPOSITE TRANSMITTER

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN FXY 9/70 SCALE:  
 CHK  
 ENG

REV. 1-16-71  
 DATE  
 REVISIONS

91C6242 AM



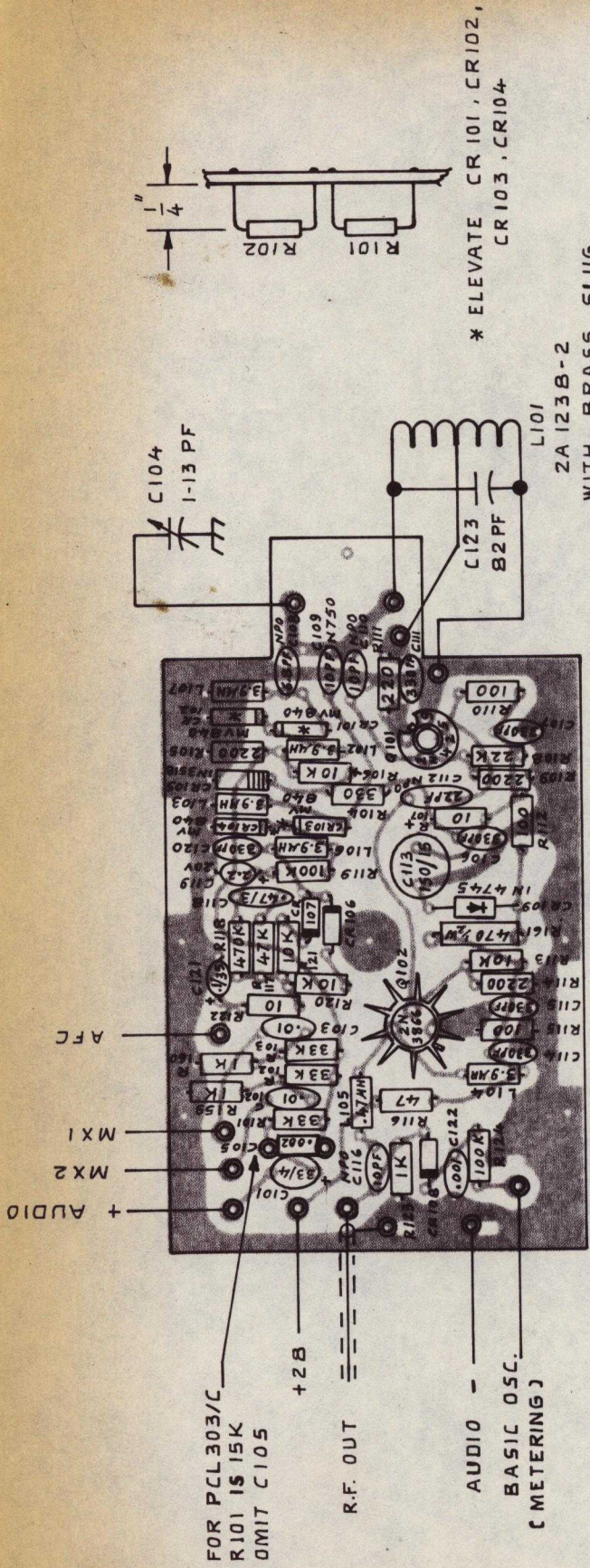
NOTES:  
 1 UNLESS OTHERWISE SPECIFIED  
 RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.  
 RESISTORS IN THE IF AMP SECTIONS ARE 1/4 W  
 CAPACITOR VALUES ARE IN MICROFARADS  
 2 \* DENOTES SELECTED VALUE

MAIN CHANNEL AUDIO P-P VOLTAGES SHOWN ARE  
 FOR 100% MODULATION AND AT 1 KHz  
 SUB FREQ. = 67 KHz ± 20% INJECTION

| REV. | DATE    | REVISIONS     |
|------|---------|---------------|
| AI   | REVISED | ECO 548 9/172 |
| AH   | ECO 548 | 7/12/72       |
| AG   | ECO 548 | 7/12/72       |
| AF   | ECO 548 | 7/12/72       |
| AE   | ECO 548 | 7/12/72       |
| AD   | ECO 548 | 7/12/72       |
| AC   | ECO 548 | 7/12/72       |
| AB   | ECO 548 | 7/12/72       |
| AA   | ECO 548 | 7/12/72       |

TOL FRACT: 1/32 XX 0/30 XXX + 0/10  
 DWN FXY 2/70 SCALE NONE  
 CHK  
 ENG

**MOSELEY ASSOCIATES, INC.**  
 SANTA BARBARA, CALIFORNIA  
**SCHEMATIC**  
**RECEIVER PCL 303 B/C**  
**91C6243 AI**



- NOTES:
- 1 P.C. BOARD 51A 5114.
  - 2 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/4 W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
  - 3 DENOTES IN 4154 DIODE.
  - 4 SCHEMATICS PCL 303 91C 6254 PCL 202 91C 6236 PCL 303/C 91C 6242
  - 5 NEXT ASSEMBLY 21C 2114.

**MOSELEY ASSOCIATES, INC.**  
 SANTA BARBARA RESEARCH PARK  
 GOLETA, CALIFORNIA 93017

**COMPONENT LAYOUT**

BASIC OSC. BD. PCL 303, 202 XMTR

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, 1/2°

|     |              |             |
|-----|--------------|-------------|
| DWN | 9/27/72      | SCALE: FULL |
| CHK | FXV 10/4/72  |             |
| ENG | SLW 4 Oct 74 |             |

20 A 2080 L

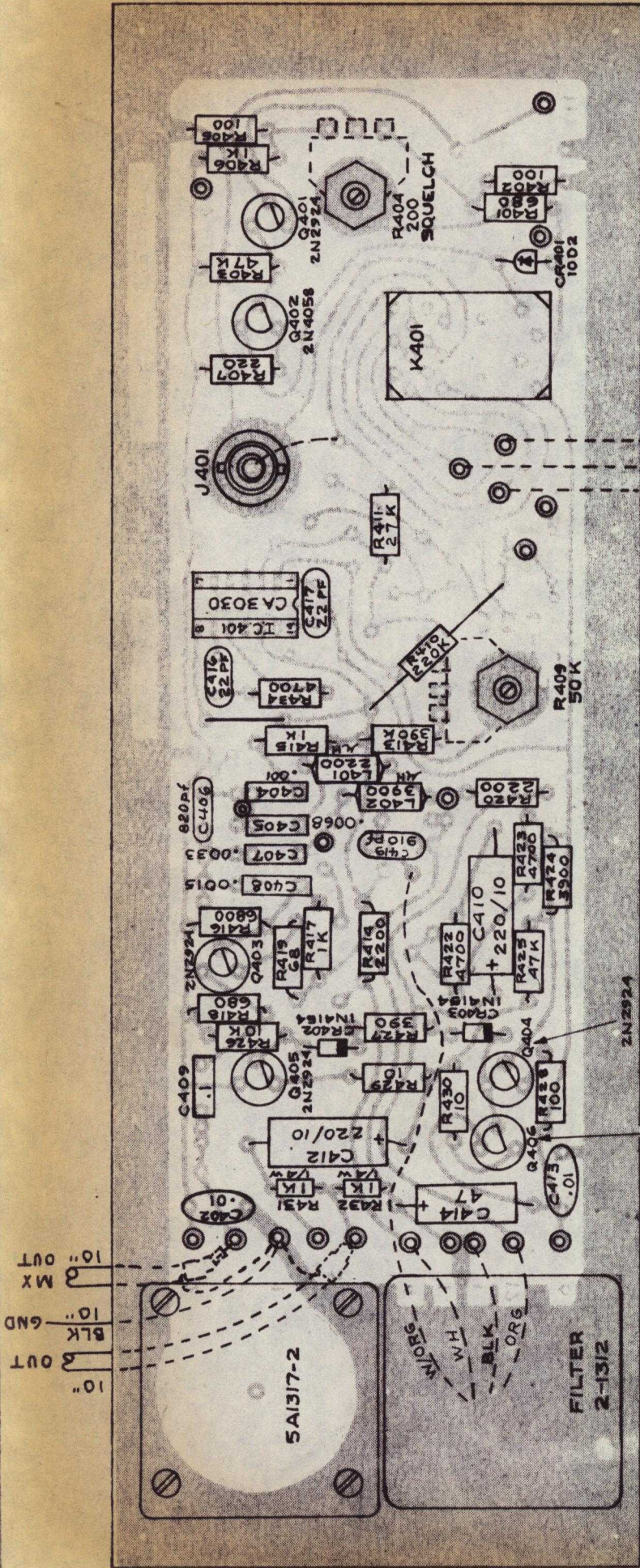
MGMT. APPR. \_\_\_\_\_

REVISIONS

|        |      |
|--------|------|
| REV. E | 9/72 |
|--------|------|

REDRAWN, ART WORK

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W/YEL N/O  
 W/GRN C  
 W/GRY N/C

CARRIER  
 RELAY

18"

- NOTES :
- 1 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10% CAPACITOR " " MICROFARADS
  - 2 TRIM & DRILL 51A5229
  - 3 SCHEMATIC 91C6243
  - 4 \* DENOTES SELECTED VALUE

**MOSELEY ASSOCIATES, INC.**  
 SANTA BARBARA, CALIFORNIA

**COMPONENT LAYOUT**

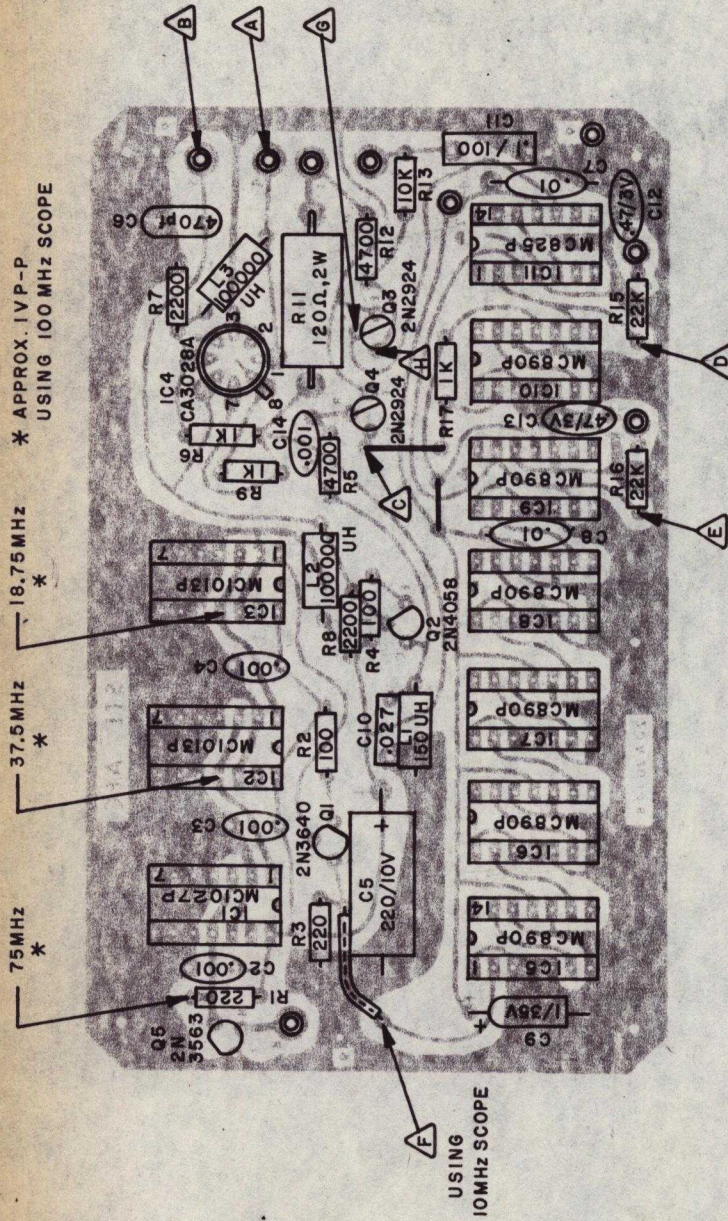
**AUDIO BOARD PCL-303/C RCVR**

TOL. FRACT ± 1/32, XX ± .030, XXX ± .010

|     |     |      |             |
|-----|-----|------|-------------|
| DWN | JAG | 9-69 | SCALE: FULL |
| CHK | FXY | 9/69 |             |
| ENG | AA  | 9-69 |             |

20A2090 N

| REVISIONS | DATE      |
|-----------|-----------|
| F         | REVISIONS |
| M         | REVISIONS |
| T         | REVISIONS |
| G         | REVISIONS |
| H         | REVISIONS |
| I         | REVISIONS |
| C         | REVISIONS |
| K         | REVISIONS |
| L         | REVISIONS |
| M         | REVISIONS |
| N         | REVISIONS |



NOTES

- 1 UNLESS OTHERWISE SPECIFIED  
RESISTOR VALUES ARE IN OHMS, 1/4 W, 10 %.  
CAPACITOR VALUES ARE IN MICROFARADS.
- 2 INDICATES WAVEFORMS SHOWN ON  
TRANSMITTER SCHEMATIC.
- 3 P.C. BOARD DWG. 51A5103.

| REVISIONS                        | DATE  |
|----------------------------------|-------|
| ○ REDRAWN FOR REVISED<br>ARTWDRK | 2/70  |
| □ IC1 WAS MC1013P.<br>ECO 408.   | 12-70 |

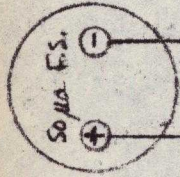
**MOSELEY ASSOCIATES, INC.**  
SANTA BARBARA, CALIFORNIA

**COMPONENT LAYOUT**  
STL AFC BD. PCL-303&202 XMTR

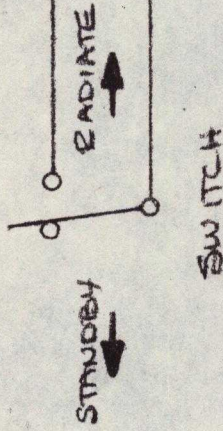
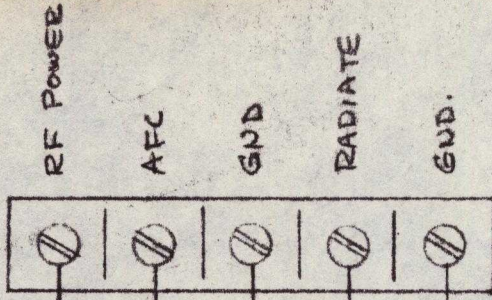
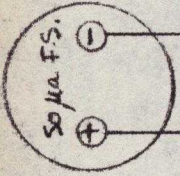
|            |                                 |
|------------|---------------------------------|
| TOL. FRACT | ± 1/32, .XX ± .030, .XXX ± .070 |
| DWN        | F X Y 2/70 SCALE: FULL          |
| CHK        | ENG 2/70                        |
| ENG        | 2/70                            |

20A2044

RF OUTPUT METER



AFC METER



NOTE  
 EXTENSION CONTROL PANEL  
 USED ON JTL UNITS -  
 PCL - 303  
 PCL - 303/C  
 PCL - 202

DATE

REVISIONS

|      |      |   |      |     |   |      |      |   |      |
|------|------|---|------|-----|---|------|------|---|------|
| TOL. | FRAC | ± | 1/32 | .XX | ± | .030 | .XXX | ± | .010 |
| DWN  | BY   |   | SVA  |     |   |      |      |   |      |
| CHK  |      |   |      |     |   |      |      |   |      |
| ENG  |      |   |      |     |   |      |      |   |      |

SCALE: NONE

91A 6364

MODEL ECP-1

WIRING DIAGRAM

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