INSTRUCTION MANUAL

MODEL TRL-1

TELEMETRY RETURN LINK

Moseley

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1. INTRODUCTION

The Moseley Associates, Inc., Model TRL-1 Telemetry Return Link was designed primarily to provide the broadcaster with a means of returning telemetry information from a transmitter site to a control point. The TRL-1 can also be used as a control link between two points (for controlling an ENG antenna, as an example), the duplex of the above, or for any narrowband broadcast-related communications. The TRL-1 transmitter accepts up to two telemetry (or control) signals in addition to a single high-impedance microphone input, all in the range of 20 to 3000 Hz. An optional Morse Code identifier enables automatic station identification. The transmitter output is one watt nominal in the 450 MHz region. The receiver has sufficient sensitivity to work with this low power level, and, in addition, has selectivity and overload resistance to accommodate adjacent channel interference. The system has been designed to operate on the Group P channels as allocated by the Federal Communications Commission, but is available on other frequencies in the 450-470 MHz region (and others on request) for areas outside the FCC jurisdiction. The units are compatible with other Moseley Associates, Inc., remote control and STL products including the accessory Models TPT-2 and TPR-2 Automatic Transfer Panels.

2. SPECIFICATIONS

2.1 SYSTEM

Frequency Response	±3 dB, 20 Hz to 3000 Hz
Harmonic Distortion	3% nominal
Signal to Noise Ratio	Better than 45 dB @ 60 μV
Carrier Frequencies	FCC Group P, 450-470 MHz; others available on special order

2.2 TRANSMITTER

FCC Type Acceptance	Part 74, Subpart D, as "TRL-1"
Type	Direct FM, direct crystal control
Frequency Stability	±0.00025% after 2 minute transmission
Frequency Deviation	±1.5 kHz
Telemetry Inputs (2)	1.5 V P-P nominal, Type BNC connector;
Microphone Input (1)	0.15 V P-P nominal, shorting-type ¼" phone jack; high-impedance (150K ohms)
RF Output	1 Watt nominal, Type N connector;
RF Output Impedance	50 ohms
Spurious Outputs	Better than 50 dB below carrier at transmitter output
Power Requirements	120/240 VAC, 50/60 Hz, 20 watts nominal 13.8 VDC, negative ground, 1.3 amperes nominal
Size	1.75" H x 19" W x 9" D (4.5 cm x 48.4 cm x 22.9 cm)
Net Weight (less battery)	10 pounds (4.5 kg)

2.3 RECEIVER

Type	Single-conversion Superheterodyne
RF Input Connector	Female Type N
RF Input Impedance	50 ohms
Sensitivity	1.5 microvolts nominal for 20 dB quieting; 100 microvolts suggested system design 45 dB SNR, 60 µV
Selectivity	6 dB bandwidth: 13 kHz or greater; 60 dB bandwidth: 26 kHz or less; Down approximately 30 dB at adjacent Group P carrier (±10 kHz)
Telemetry Outputs (2)	1.5 V P-P nominal, unbalanced, 600 ohm load
Output Connectors	Barrier strip and Type BNC connectors
Muting	Carrier-operated, adjustable; Form C relay contacts (one ampere, 48 Volts maximum, non-inductive) for operating external devices
Power Requirements	120/240 VAC, 50/60 Hz, 2 watts nominal
Size	1.75" H x 19" W x 9" D (4.5 cm x 48.4 cm x 22.9 cm)
Net weight	10 Pounds (4.5 kg)

3. UNPACKING

The TRL-1 units should be carefully unpacked and inspected for evident shipping damage. Keep all packing material in case a claim is to be made against the carrier for damages. Should this inspection reveal any damage, immediately file a claim with the carrier.

Remove the top covers from both units. In the case of the TRL-1 receiver, additionally remove the internal shielding cover. Confirm that the various plug-in components are securely seated in their sockets. Restore the covers.

> NOTE:
> DO NOT MAKE ANY ADJUSTMENTS OF ANY KIND TO THE EQUIPMENT AT THIS TIME. DO NOT ATTEMPT DISASSEMBLY OR INSPECTION OF THE RECEIVER BANDPASS FILTER ASSEMBLIES. DO NOT APPLY POWER TO EITHER UNIT UNTIL SPECIFICALLY INSTRUCTED TO DO SO LATER IN THIS MANUAL. DO NOT INSTALL THE "BATT" JUMPER UNTIL TOLD TO DO SO.

4. INSTALLATION

The following installation suggestions are based on the assumption that the TRL-1 link will be used in its most common application, that of providing a telemetry return link to the studio from a transmitter site. Should the installation involve control rather than telemetry, merely 'swap sites' and continue.

4.1 TRANSMITTER

4.1.1 Location

The TRL-1 transmitter may be located in any standard grounded equipment rack, at a height which will allow occasional readjustment. Connections required will be the primary power, the telemetry and microphone inputs and the antenna.

4.1.2 Power

As normally shipped, the TRL1 transmitter will be adjusted to the desired carrier frequency and will normally be set for 120 VAC operation. To change the primary power voltage rating, refer to section 7.1. To operate the transmitter from an external battery supply, see section 7.2.

4.1.3. Inputs

The telemetry signal(s) from the station's remote control equipment are connected to the Type BNC telemetry inputs (DATA 1 and/or DATA 2) on the rear of the TRL-1 transmitter. The level(s) of the signal(s) on these lines should be of the order of 1.5 volts peak-to-peak. This is not a critical value.

A microphone may be installed into the rear-panel MIC connector.

The frequency range of the signals to be transmitted should be in the range of 20 Hz to 3000 Hz.

4.1.4 Antenna

The transmitting antenna feedline is to be connected to the Type N ANTENNA connector on the rear of the TRL-1 transmitter. Section 4.3.5 elaborates on the use of 'pigtail' connectors to facilitate this part of the installation.

4.1.5 Remote Carrier Control / Automatic Transfer Panel

The TRL-1 transmitter can be remotely-controlled. To do this, the RMT terminal on the rear of the transmitter is connected to ground (for carrier on) or left floating (for carrier off). The terminal is operative as described only when the front-panel control switch is in the REMOTE position.

In addition, a signal is brought out to the rear of the transmitter for operating an automatic transfer panel. This voltage is at zero volts when the transmitter is off (or has failed) and goes to about 2 volts DC when the transmitter is operative. This signal, which appears at the 'SPARE 1' terminal, is intended to operate a Moseley Associates Model TPT-2 Transfer Panel Transmitter. See section 7.8 for information on this interconnection.

4.2 RECEIVER

4.2.1 Location

The TRL-1 receiver should be located in a standard grounded equipment rack at a height which will allow observation of the carrier-presence lamp on the front panel. In addition, the location chosen should allow occasional readjustment. Connections required will be the primary power, the telemetry (audio) outputs, optional connections to the muting relay, automatic transfer panel (if used) and the antenna.

4.2.2 Power

The TRL-1 receiver is normally shipped for operation on 120 VAC but may be operated on 240 VAC; see section 7.1 for the instructions on this change. Full-time operation on an external battery may also be accomplished by a simple wiring change; see section 7.2 for the required changes.

4.2.3 Outputs

The telemetry (audio) output from the TRL-1 receiver appears at two locations. One is the Type BNC connector, J102, labelled AUDIO OUT. The audio signal also appears at the adjacent barrier strip, at AUD and GND.

Also brought out to the rear of the receiver are single-pole double-throw (Form C) relay contacts. These are operated by the carrier-sensing circuitry in the receiver. These contacts are rated at one ampere at 115 volts or two amperes at 24 volts DC by the manufacturer. The internal wiring should not be exposed, however, to more than one ampere or 48 volts. In any event, the load should be non-inductive. The relay may be used to operate such items as a lamp or bell to signal carrier failure, or they may be used to operate the Moseley Associates Model TPR-2 Receiver Transfer Panel. See section 7.7 for information on this panel.

4.2.4 Antenna

The receiving antenna feedline is to be connected to the Type N ANTENNA connector on the rear of the TRL-1 receiver. Section 4.3.5 elaborates on the use of 'pigtail' connectors to facilitate this portion of the installation.

4.3 ANTENNAS

4.3.1 Types

The antennas used with the TRL-1 link should be of a directional type having gain. The higher the antenna gain and directivity, the better for multiple users on the same and adjacent channels. The FCC Group P frequencies are under the Auxiliary Broadcast Service (Part 74) rules, and exclusive frequency assignments do not exist; frequency coordination is essential. Line-of-sight paths are suggested to enable theoretical system calculations and, hence, proper antenna heights, locations, transmission line lengths, sizes and antenna gains. More in-depth assistance along these lines can be obtained by contacting the sales/applications engineers at Moseley Associates. Typical antennas are the Scala CA5-450 (with 10 dB gain) and the Scala PR-450U (with 15 dB gain).

4.3.2. Location

The frequency band used for the TRL-1 possesses 'line of sight' characteristics, to an approximation. For this reason, the antennas used at each end of the link should be visible one to the other, if at all possible.

4.3.3. Polarization

The antennas should be mounted using the same polarization at each end of the path, either horizontal or vertical. Interfering, co-channel or adjacent channel carriers may benefit from the approximately 20 dB of attenuation of cross-polarization.

4.3.4. Cable Type

Interconnection between the antenna and its associated unit (transmitter or receiver) should be accomplished using appropriate coaxial cable of 50 ohms nominal impedance. The cable should have appropriately low loss at the operating frequency in the 450 MHz region. Typical types are Andrew Corporation Type LDF4-50 (½" diameter, 1.5 dB loss per 100 feet at 450 MHz) and Andrew Corporation Type LDF5-50 (7/8"diameter, 0.85 dB loss per 100 feet at 450MHz). These new low-loss foam-dielectric cables have the same attenuation as air dielectric cables of the same size; thus, it is anticipated that air pressurized cables will not normally be used.

4.3.5 KTL-( ) Pigtails

The lower-loss cables are difficult to bend and so are hard to route inside of equipment racks. The same difficulty may be experienced at the antenna end of the line; the relatively rigid line could increase the difficulty of antenna positioning, or cause a stress on the antenna connector. For these reasons, Moseley Associates makes available short RG-8/U "Pigtail" assemblies. These are to be attached to the ends of the actual feedlines, and they enable the equipment (transmitter, receiver and antenna) to be moved somewhat for installation and maintenance purposes. Use KTL-6 kits for Andrew LDF4-50 half-inch line; use KTL-7 kits for LDF5-50 7/8" line. Each kit consists of two 3' pigtails with Type N male connectors attached, and two individual Type N female coaxial connectors. Each such kit is sufficient for installation of one antenna.

4.3.6 Isocouplers

Should it be desired to mount an antenna on a series-fed broadcast tower, the required isolation may be accomplished by using a Moseley Associates Model ICU-2 Isocoupler. This will allow passage of the (450 to 470 MHz) TRL-1 RF signal while introducing no particular change in the insulated tower base impedance. Isolation at standard broadcast frequencies is very high, and the Isocoupler introduces a minimal (about 1dB) loss to the TRL-1 RF signal.

4.4 INITIAL SETUP

The TRL-1 transmitter and receiver have been adjusted as a system at the factory. The only controls likely to be in need of adjustment at the time of installation are the front-panel input-level controls on the transmitter. In addition, there is a possibility that the output level control on the receiver may need readjustment for certain older remote control equipment compatibility.

Assuming that the entire system has been installed, and making sure that the transmitter antenna (or suitable 50 ohm load) is connected, attach and install the power cords.

The receiver's green POWER lamp should come on. When the transmitter is switched to ON, the transmitter's amber RF lamp should come on and the receiver's amber SIGNAL lamp should come on.

In the following paragraphs, the level-setting controls will be adjusted one at a time. After completion of these adjustments, the various inputs may be reconnected. It will be noted at that time that the red AGC lamp will be glowing slightly. This is normal.

> NOTE: THE OBJECT OF THE FOLLOWING PROCEDURE IS TO HAVE THE TELEMETRY TONE(S) (EACH) MODULATE THE TRANSMITTER EQUALLY, WHILE THE IDENTIFIER TONE AND THE VOICE SIGNAL WILL EACH MODULATE THE TRANSMITTER EQUALLY BUT AT A LEVEL ABOUT HALF THAT OF THE TELEMETRY TONE(S).

4.4.1 Data Level Adjustment

With only one telemetry signal (audio tone) applied to a rearpanel Type BNC connector, adjust the corresponding front-panel DATA control until the red AGC lamp starts to light.

In the case of two data signals, disconnect the first signal by unplugging the appropriate connector from the rear of the TRL-1 transmitter, and connect only the second signal. Adjust that level control as was done for the first. Now reconnect the first telemetry signal.

4.4.2 Voice Level Adjustment

Should voice transmission be used over the TRL-1 link, be aware that excess level into the microphone will cause the transmitter's internal limiter (AGC) to go into gain reduction, reducing the level of both the telemetry tone(s) and the Morse Code identifier tone.

Using a standard microphone technique, with the microphone to be used in normal service, adjust the transmitter's front-panel MIC control until the red AGC lamp lights slightly on voice peaks.

A microphone with a push-to-talk button is recommended in order that when voice transmission is not used there will be no superfluous noise introduced into the system. When voice transmission is used, be aware that the voice-frequency energy may interfere with the telemetry tones, which are also in the audio region.

4.4.3 Identifier Level Adjustment

During an "ID" cycle, with the telemetry tone(s) removed and without voice input, adjust the transmitter's front panel KEYER level control until the red AGC lamp lights slightly and then back off the level until the lamp is no longer glowing.

4.4.4 Receiver Level Adjustment

Most remote control systems will tolerate wide variations in the input tone level. For this reason, the TRL-1 receiver output level will probably be satisfactory as shipped.

Some remote control equipment, particularly of older design, requires a specific tone level. Should a particular output level be needed to properly interface with a given piece of equipment, then the TRL-1 receiver output level may be readjusted at the time of installation.

The receiver output level is adjusted by R6, located inside the receiver. Because of the shielding employed, this will require removal of the top cover and the internal cover on the receiver. For this reason, the receiver's output level control should be left alone unless readjustment is mandatory.

4.4.5 Battery Strap Installation

After the system has been installed, adjusted and its general performance confirmed as being satisfactory, then (if the transmitter's battery is used) the BATT strap may be installed on the rear of the transmitter.

Assuming the internal battery is installed and the jumper is installed, removal of the primary power (AC mains) should allow continued operation of the transmitter. There may be a transient during the changeover transition, but this should be operationally insignificant.

5. CIRCUIT DESCRIPTION

5.1 TRANSMITTER

The TRL-1 transmitter consists of a main-frame containing a power supply, an optional internal battery, an audio section, an RF section, and a Morse Code identifier.

5.1.1 Audio Assembly

The following discussion of the TRL-1 Audio Assembly is with reference to schematic 91B7141 and component layout 20A2726.

Tones from the remote-control equipment are presented to the audio board at terminals 5 (Data 1) and 3 (Data 2). Mixed with these tones are the microphone signal (applied to terminal 1 and amplified by U1). The identifier tone, applied to the connector pin 4, is also summed with these signals. The summed inputs are observable at TP1, the brown test point.

These signals are all presented to amplifier U6. The output of U6 is applied to a second amplifier, U5, and a level comparator, U2. The comparator delivers an output whenever the signal, as sensed at pin 2, is greater than about one volt. This output signal is rectified by CR2 and used to charge capacitor C20 via resistor R27. The voltage across C20 is used to excite lamp CR3 and also to excite the lamp inside of CR1. (CR1 is an optically-coupled LED and phototransistor).

When the lamp inside of CR1 illuminates its phototransistor, that transistor conducts and reduces the level of the signal applied to U6. In this manner, AGC action is accomplished.

Resistor R27 determines the attack time of this system, while R26 determines the recovery time. These times have both been set rather slow to reduce distortion of low-frequency telemetry signals and also to reduce intermodulation distortion when a multiplicity of signals is applied to the system.

A byproduct of such a slow AGC system is that transients can escape it and cause overmodulation. For this reason, the output of amplifier U5 is applied to a stage deliberately arranged to be on the verge of overload. Transients are clipped by this stage, clipping is arranged to be symmetrical by R11, and the degree of clipping is set by R30.

Following the clipper (which clips transients only) is a lowpass filter which does not overshoot. This filter passes signals up to about 3000 Hz and then rolls off. The final output level is set by R36, which determines the modulating-signal drive into the voltage-controlled crystal oscillator on the RF board.

The modulator (in the RF section) has a rising high-frequency modulation response which is corrected to flat by capacitor C10 (on the audio assembly) operating in conjunction with resistors R34, R35 and R36.

The output of the audio board appears at the connector pin 3.

5.1.2 RF Section

This discussion of the TRL-1 RF Assembly is with reference to schematic 91C7149 and component layout 20A2725.

The crystal-stabilized Hartley oscillator (Q1 and associated components) is modulated by varying the capacity of voltage-controlled capacitor CR2. This element is biased by a fixed voltage developed across resistor R8. Added to that fixed voltage is the modulation, applied via the connector pin 3, blocking capacitor C4 and RF decoupling resistor R1.

The second RF stage, using transistor Q2 and associated components, is a frequency quadrupler, with output in the vicinity of 225 MHz. The third stage, using Q3, doubles the frequency again, to 450 MHz.

The last two stages are straight-through RF power amplifiers with output at 450 MHz. The final amplifier is followed by a lowpass filter to minimize harmonic content of the output waveform.

A sample of the RF voltage present on the collector of the final RF amplifier is applied to transistor Q6 via coupling capacitor C29. When RF is present, Q6 switches on and allows the front-panel RF lamp to glow.

The RF sample is also rectified by diode CR3 and is brought out to the rear-panel connector for automatic transfer panel control. This point is positive when RF is present.

5.1.3 Identifier

This discussion of the Morse Code Identifier is keyed to schematic drawing 91B7203 and component layout 20A2727.

This assembly generates a Morse Code signal by stepping through a programmable read-only memory (PROM) one bit at a time. This is accomplished by using a square-wave generator (clock), a series of binary dividers, the PROM, and a single-pole eight-throw electronic switch (multiplexer).

The multiplexer output is a series of high or low signal levels which correspond to the pre-programmed Morse Code message. This output is used to key a series gate using an FET. The gate is used to key on and off an audio oscillator. This keyed audio signal is applied to a buffer whose output is routed to the audio assembly. In that assembly the keyed tone is mixed with the telemetry and voice signals for subsequent transmission.

The clock consists of U3 (pins 12, 13, and 14) and associated components. This oscillator is a relaxation type and uses negative feedback (from pin 14 back to pin 13) via resistors R23, R25 and R26, and capacitor C9. Positive feedback is also used, with R24 and R22. The clock rate is adjustable from 300 to 1100 Hz. The output of this pulse generator is applied to divider U5 pin 10. The clock signal, divided by a factor of 128, appears at U5 pin 6. It also appears at U5 pins 13, 12, 14, 15, 1, 2 and 3. These pins carry the clock pulses divided by ratios of 256, 512, 1024, 2048, 4096, 8192 and 16,384 respectively.

U5 pins 6, 13 and 12 are applied to multiplexer U1 pins 11, 10 and 9 respectively. The multiplexer internally converts these three binary input signals into one of eight and selects one of eight signals from the PROM U2.

Meanwhile, additionally-divided clock signals (appearing at U5 pins 14, 15, 1, 2 and 3) are applied to the PROM U2 (pins 10, 11, 12, 13 and 14). The PROM internally converts these five binary input signals into one of 32.

The PROM outputs (pins 1, 2, 3, 4, 5, 6, 7 and 9) are connected to the multiplexer (U1) inputs (pins 4, 3, 2, 1, 15, 14, 13 and 12).

This series of interconnections may be thought of as a "rows and columns" method of reading the PROM.

U5 pin 3 also drives a second divider chain, U6. This second divider generates a time delay for the interval between PROM readouts. The actual interval is selected by the interval-select strapping option. The system will replay at a maximum rate (minimum interval) if the selecting strap is connected to U6 pin 7. The lowest rate (longest interval) will be obtained by strapping to pin 12. See section 7.4 for further data on this strapping.

After the clock has stepped the entire divider system through a full count as determined by the interval-select strap, a positive pulse is routed to U3 pin 10. This is a pulse stretcher. The output pulse from the pulse stretcher is used to reset all of the dividers.

The single clock controls not only the Morse Code words-per-minute but also the interval between readouts.

A sample of DC from the power supply is applied to the identifier assembly pin 1. This signal is applied to U7 pin 5. When this DC signal is present, the divided clock signal (U7 pin 3) is transferred to U7 pin 1. When the DC signal is high, the system operates as previously described, identifying at an interval selected by U6. When the DC signal is absent (primary AC power has failed), the system continuously transmits the PROM signal. Upon restoration of power, the system reverts to normal operation. At the end of each full-count cycle, a reset signal (from U3, pins 8, 9 and 10) is applied to U7 pin 4. If the primary power has been restored, then the system operates normally with an identifying interval as strap-selected. If, after that reset, the primary power is still missing, then the system immediately starts another identification cycle.

When, and only when U7 pin 1 is high, the multiplexer U1 is enabled. This input (U1 pin 7) will allow the multiplexer output (U1 pin 5) to go 'high' with Morse Code information. When the identifying action has been completed, U1 pin 5 remains low.

The output from the multiplexer is applied via shaping lowpass filter R9 and C1 to the series FET gate (Q2). The audio tone, generated by U3 (pins 1, 2 and 3) and associated components, is applied to the series FET drain via resistor R16. Q2 keys the tone with Morse Code information from multiplexer U1. The keyed tone is applied to buffer amplifier U3 (pins 5, 6 and 7), the output-level control R21, and is routed to the audio board via connector pin 4.

The audio tone generated by U3 is normally adjusted at the factory to a frequency in the vicinity of 1 kHz. Should this interfere with the telemetry signals, then it may be shifted to 300 Hz. Refer to section 7.5 for details on changing this tone frequency.

Should the PROM contain only a brief message, as for example, a very short set of call letters, then it is possible to read out only half of the PROM and disregard the remaining (non-existent) data. This is accomplished by resetting the divider chain (U5 and U6) and power-failure bistable U7, prematurely, by a full-PROM/half-PROM strap. This is the strap connected to U7 pin 3. Refer to section 7.3 for details of this change.

5.1.4 Power Supply

The power supply for the TRL-1 transmitter is relatively conventional. However, an interval battery may be used to sustain transmitter operation in the event of primary AC power failure. This battery is kept charged by an internal charger. Upon failure of the AC mains, the battery is automatically switched into service for a time interval of about 20 minutes. It is then disconnected until primary power is restored. In this manner the transmitter oven is operated only at a reasonable voltage (to prevent off-frequency operation), and the battery is kept from discharging completely. The transmitter's oscillator has its own voltage regulator.

The following discussion of the TRL-1 transmitter power supply is keyed to drawings 91B7157 (overall schematic), 91B7202 (power supply assembly) and 20A2738 (power supply assembly component layout).

Primary power is introduced to the unit via the RF filter, fuse and voltage-selecting assembly. The power transformer T1, bridge rectifier CR1 and filter capacitor C1 form a primary power supply delivering 17 volts DC at 1.3 amperes. This voltage is applied to the power supply assembly pins 5 (+) and 6 (-).

Integrated circuit regulator U1 delivers approximately 14.4 volts to disconnect diode CR2. The cathode end of this diode then conveys the regulated voltage to terminal 10. The voltage may be adjusted by R1 to its target value of 13.8 volts DC.

The 17-volt line is also applied to a second regulator, using U2, which is designed to charge the battery. Currrent-sensing is performed by resistor R4; a value of 15 ohms will limit the output current to 40 mA. The output voltage from this regulator is set to its target value of 13.8 volts (at the cathode end of disconnect diode CR3) by resistors R5, R6 and trimmer R14. The output of this regulator is applied to the battery via diode CR3.

The 17-volt line is monitored for a 'power down' condition by applying a sample of that voltage to U3A via resistor R9. When a primary power failure occurs, U3A pin 3 goes positive. This rise is coupled via capacitor C6 to U3B.

A primary power failure, then, causes a brief pulse to appear at U3B pins 5 and 6. U3B pin 4 then goes briefly 'low.' This signal is applied to U3C pin 9. U3C pin 8 is tied to the positive rail. The output of U3C is a brief positive-going pulse, which is inverted in U3D and is then applied to monostable multivibrator U4, pin 2. U4 then generates a nominal 20-minute long signal, appearing at pin 3, which is applied to amplifier Q1. When Q1 is driven into conduction, it, in turn, switches on series pass transistor Q2, connecting the battery to the 13 volt line.

When primary power is restored, the output of U3A pin 3 (which was high during that power failure) drops low. This signal is applied to the monostable pin 4. When pin 4 is low, the signal from U4 is immediately terminated, disconnecting the battery from the 13 volt line.

Note that the battery voltage is not regulated when it is used to operate the transmitter. The assumption is made that the battery voltage is relatively stable and low noise. By not regulating the battery voltage, system efficiency is increased and heat is kept to a minimum.

5.2 RECEIVER

The TRL-1 receiver consists of a main-frame containing an inner-enclosure (with the receiver itself) and a power transformer. The overall schematic is 91B7181; the receiver proper has schematic number 91D7352.

5.2.1 RF

The incoming RF signal is applied to the rear apron ANTENNA connector, J101, from which point it is routed to the inner enclosure input connector J103.

FL2 and FL3 provide preselection for the RF amplifier, Q3. This amplifier is neutralized by (C8), and an output is taken from its tank (T1 and C7) and applied to a three-pole two-zero filter consisting of FL4, FL5 and FL6 and associated components. The filter output is applied to the balanced mixer, SBL-1.

5.2.2. Local Oscillator

The local oscillator is formed by Q7 and associated components. The frequency of this oscillator is determined primarily by crystal Y2. L13 and C54 form the output tank with a link for both feedback and excitation to the following stage.

The oscillator output is coupled to frequency multipliers (Q8 and Q9).

5.2.3. I.F.

The desired output from the balanced mixer is at 10.7 MHz and is applied via C33 to Q6. Q6 is the first IF amplifier, neutralized by C38. The output of Q6 is applied to the selectivity-determining bandpass filter FL1 and associated matching networks consisting of L5-C37 and L4-C36. The second IF amplifier uses Q5 and associated parts. This stage is neutralized by C43.

5.2.4. Demodulator

The output of Q5 is applied, via tuned circuit T2, to the limiter/ demodulator using U3 and associated components.

This integrated circuit provides limiting, demodulation, audio amplification, muting, level metering and AFC.

The 10.7 MHz signal is applied to the limiter input, U3 pin 1. Signal level sensing is brought out to pin 13; this is connected to test point TP1 (Blu). This signal is returned to pin 16 for AGC purposes, and is also applied to amplifier U1B pin 13.

U1B acts as a comparator; when the signal level is above a threshold determined by the mute control R7, then U1B pin 14 delivers a voltage to U3 pin 5 to allow audio output to appear at U3 pin 6.

The output of U1B is also applied to transistor Q1 which drives the carrier-operated relay K1. This relay will handle one ampere at 48 VDC, non-inductive. A portion of the collector current in this stage is used to operate the signal lamp on the front panel.

U3 also delivers an AFC output from pin 7. This is applied to amplifier U1C.

5.2.5 Audio

The audio output signal from U3 pin 6 is applied to a 3500 Hz lowpass filter using U1A and associated components. The output of this filter is applied to an amplifier using U1D and Q2. The gain of this stage is adjustable by operating R6.

5.2.6 Power Supply

External AC mains power is applied to the receiver via the Corcom filter assembly. After fusing and primary voltage selection, the mains signal is applied to the primary of power transformer T101. The transformer secondary is routed via RF filter capacitors C108, C109 and C110 to the inner shielded assembly.

Rectifiers CR3 and CR4 charge filter capacitor C76. Regulation is performed by U3 and associated components. The configuration of this circuit has been chosen to maximize the regulator's efficiency. The output voltage is adjusted by R1.

6. INTERNAL ADJUSTMENTS

The various assemblies in the TRL-1 transmitter and receiver have adjustable internal controls to allow realistic manufacturing tolerances and operational flexibility. These internal controls should not be readjusted unless a specific problem exists which will probably be corrected by readjustment.

The following procedures are not intended as a factory-type test procedure, which of necessity requires uncommon test equipment. Where such relatively exotic test equipment (such as a spectrum analyzer) would by helpful, then that will be pointed out.

6.1 TRANSMITTER

6.1.1 Power Supply

The AC power supply in the TRL-1 transmitter generates unregulated 17 volts DC and regulates it to 13 volts DC. While monitoring pin 10 of the power supply card (the right-most pin), adjust R1 (nearest the power transformer) for a reading of 13.5 volts DC to chassis ground.

The battery-charging circuit in the transmitter also accepts the 17-volt line and charges the battery. While monitoring pin 9 of the power supply card (next to pin ten, the frontmost), adjust R14 for a reading of 13.8 volts <u>when the battery is disconnected.</u> Then reconnect the battery.

6.1.2 Audio

The primary purpose of the audio assembly in the transmitter is to control the modulation level. This is accomplished by a combination of AGC for gain regulation and clipping for positive control. The clipping control and the clipping symmetry control are best adjusted while monitoring the red test point, TP2. With an input signal applied (an actual telemetry tone will suffice) at a level sufficient to cause AGC activity (AGC lamp lights), adjust the clipping control R30 (rear, nearest battery) for a slight amount of clipping. Then adjust R11 (front, left) for clipping symmetry. Then back off on the setting of R30 until the clipping is no longer visible.

The modulation control, R36 (center right, nearest RF section) is best adjusted using a modulation meter. Adjust this control for 1.5 kHz peak deviation while transmitting a signal which is sufficient amplitude to cause the front-panel AGC lamp to light dimly. Be sure that the clipping and clipping-symmetry controls (see previous paragraph) have been properly adjusted.

6.1.3 Identifier

The Morse Code identifier enables automatic station identification. The code speed is adjustable by operating clock frequency control R26 (center of board).

Interlocked with this clock is the delay time between identifying cycles. This is accomplished by changing the Interval Select strap on the identifier board. This is covered in section 7.4. A related strapping option is the Half/Full PROM select. This is covered in section 7.3.

A coarse output level adjustment is available on the output of the identifier. This is R21, and is normally set for an indication of 0.5 volts peak-to-peak on an oscilloscope connected to the wiper of R21 or pin 4 of P1. This is not critical; it enables a smooth level adjustment on the front-panel identifier level adjustment.

To "key on" the identifier, remove the AC mains power cord and wait about 20 seconds <u>or</u> switch OFF the carrier and then switch it back ON.

6.1.4. RF Section

The RF section of the TRL1 transmitter accepts the modulation input from the audio board, uses that input to modulate an oscillator operating in the 55 MHz region, and multiplies that signal to 450 MHz.

The carrier-frequency control R7 is used to set the transmitter on-frequency. An appropriate frequency counter connected to the transmitter output may be used.

The oscillator (Q1) is tuned for maximum output into the first multiplier by adjusting C7. Meter the brown test point TP1 and adjust C7 for maximum indication. Expect about 1.0 volt DC.

The quadrupler (Q2) is tuned for maximum output by adjusting C14 and C16. Meter the red test point TP2 and tune C14 and C16 for maximum indication. Expect about 0.5 volt DC.

The doubler (Q3) output is tuned for maximum drive into the driver (Q4) by adjusting C19, C23 and C24 for the least positive indication on a meter at the base of Q4. With no RF drive, the base of this transistor will measure about +0.5 volt. With normal RF drive this voltage will drop, to about +0.35 volt.

The driver (Q4) output circuit is tuned by adjusting C42 for maximum RF power output into the load (antenna or dummy).

The final RF amplifier (Q5) is tuned for maximum output by readjusting C33 and C45. Then readjust C42 (adjusted in previous paragraph), and again readjust C33 and C45.

If a wattmeter is not available, an alternative method of adjusting for maximum output is to monitor the output of CR3. This DC signal appears at the output ("SPARE #1") on the rear of the transmitter. Expect 2 to 4 volts DC.

The use of an appropriate spectrum analyzer is to be encouraged in all of the above RF adjustments, to ensure maximum desired signal output level consistent with satisfactory suppression of multiplier-related spurious outputs.

6.2 RECEIVER

6.2.1 Power Supply

The AC power supply in the TRL-1 receiver accepts the secondary of the power transformer, rectifies it to produce about 17 volts DC, and regulates this to 13.5 volts DC to operate the receiver. While monitoring the red test point TP5 (front of the 723 regulator), adjust R37 (immediately behind TP5) for a reading of 13.5 volts DC.

6.2.2 Local Oscillator

The local oscillator operates at (approximately) 55 MHz. The associated multipliers (Q8 and Q9) provide output at 440 MHz.

While monitoring the yellow test point TP4, readjust L7, C111, C112 and C72 for maximum. Expect at least 1.25 volts DC.

6.2.3 RF Amplifier

The following adjustments on the receiver input circuitry are not meant to be accomplished routinely. The only control which may need readjustment in the field is the first tuning control, C81, and this only if the antenna or feedline VSWR is high. It is assumed that the transmitter signal will be used as a test signal, and that the signal level can be reduced by using an appropriate input attenuator to avoid saturating the receiver. If this is not feasible, then a precision signal generator will be required.

With an input signal at a low level adjust C81, C84, C7 and C91 for a maximum reading on a meter at TP7 (AGC test point) (grn). Keep the signal level such that the AGC test point TP7 is between 0.5 and 1.25 volts DC.

The image traps are tuned for a minimum reading at TP7 by adjusting C86 and C97. This step, which should be skipped if at all possible, requires a precision signal generator set to 21.4000 MHz below the carrier frequency. The traps C86 and C97 are adjusted by tuning for a minimum reading at TP7 when sufficient signal on the image frequency is being applied to the receiver to give a reading.

After the image traps have been tuned, then C88 and C95 may be tuned for maximum AGC voltage while receiving an on-frequency signal from a precision signal generator or the transmitted signal. Keep the receiver below saturation.

After C88 and C95 are adjusted, return to the image traps, C86 and C97 and readjust them. Finally, recheck the settings of C88 and C95.

6.2.4 IF Amplifier

The following adjustments on the IF amplifier are not meant to be accomplished routinely. As with the RF amplifier, it is assumed that the transmitted signal will be used as the receiver input, or that a precision signal generator will be used.

While monitoring the AGC test point (TP7) (grn), tune L4 and T2 for a maximum meter reading. The adjustment of L4 and T2 will require the use of a non-metallic adjustor.

L4 and L5 may be adjusted for minimum distortion using a precision signal generator modulated with a low-distortion 1000 Hz sinusoid.

6.2.5 Demodulator

The demodulator performs not only the actual demodulation function but also has circuitry which accomplishes carrier-operated muting, AFC, AGC, and audio amplification.

The demodulator is tuned by means of the tanks formed by L2 and C47 as well as L3 and C16. L2 and L3 are adjusted for maximum recovered audio output consistent with minimum distortion at a modulating rate of 400 Hz.

There are no adjustments on the AFC system in this receiver.

The muting control R7 (left rear) is adjusted for muting of the audio output when the carrier level is below a selected level. Normally the receiver is muted when the incoming carrier is of a value which gives an unusable signal to noise ratio. It can also be adjusted to operate at a specific carrier level, if a precision signal generator is available.

6.2.6 Audio

The only adjustment on the output amplifier is the level control, R6 (left, next to filter capacitor). This is adjusted for a convenient output level, such as 0 dBm or 1.5 V P-P into the remote control equipment.

7. OPERATIONAL CONSIDERATIONS

7.1 OPERATION FROM 240 VAC

The TRL-1 transmitter and receiver are both normally shipped from the factory set for 120 VAC (50/60 Hz) operation. To convert either of these units to 240 VAC operation, remove the power cord from the connector on the rear of the equipment. This will expose the fuse and the voltage-changing card. Remove the one ampere fuse and replace it with a 0.5 ampere (500 mA) fuse. Remove the voltage changing card and rotate it horizontally so the "240" printing is visible. Re-store the slide cover and re-insert the power cord.

7.2 OPERATION FROM EXTERNAL BATTERY

When operating from an external battery, some precautions need to be mentioned. Such an external battery must be stable voltage-wise and it must be low ripple: a 'battery charger' type of supply is not suitable. The AC power cord must be removed.

In the case of the transmitter, the internal wiring must be altered with a connection brought out to the rear of the transmitter from pin 10 of the power supply. Then the external battery is connected to this point. It must be stable and low ripple. The AC power cord must be removed.

7.3 FULL-PROM/HALF-PROM STRAPPING

The Morse Code identifier in the TRL-1 transmitter reads out the message (stored as individual 'dits') in the PROM. If this message is short, and if it is desired to transmit this message as continuously as possible, then it is possible to read out only the first half. This will save transmission time by virtue of not 'reading' a series of blank spaces. This is of concern if the identifier is to give a relatively continuous readout during a transmitter power failure.

The identifier is normally strapped at the factory to read out the entire PROM message. To change the strap so that only the first half is read out, refer to the "PROM-SELECT AND INTERVAL-SELECT STRAPPING" drawing (Figure II). The PROM-select strap may be changed from the FULL pad to the HALF pad. Use care in this process, to avoid harming the printed-circuit board.

It is suggested that the clock frequency be set to 860 Hz, which will result in a Morse Code speed of 16 words per minute. Under these conditions, the interval will be strappable from 2.5 to 80 minutes between readouts, set by the interval-select strap. If strapped as shown on the drawing, the interval will be 10 minutes for an 860 Hz clock frequency.

7.4 IDENTIFIER INTERVAL STRAPPING

The Morse Code identifier will read out the message stored in the PROM at an interval which is user-selectable. This interval is determined by the INTERVAL-SELECT STRAP located on the identifier assembly. Referring to the PROM-SELECT AND INTERVAL-SELECT STRAPPING drawing, observe the INTERVAL-SELECT strap. The intervals are adjustable from 2.5 to 160 minutes by a strap. For a given Morse Code speed, the strapping will change the interval over a 32:1 range. Bear in mind that the interval between readouts is determined not only by the setting of this strap, but also by the code speed, which is determined by the clock. The clock rate is set by adjusting R26. The speed in words-per-minute can be set with precision by measuring the clock rate. Merely connect a counter or other frequency-measuring device to U3 pin 14. The words-per-minute will be the clock frequency in Hertz divided by 53.

7.5 IDENTIFIER TONE FREQUENCY

The frequency of the Morse Code identifier audio tone is normally factory-set to 1000 Hz. Should this frequency interfere with the telemetry signals normally present on the link, then it may be shifted downward to 300 Hz. This is accomplished by changing capacitor C4 from its standard value of 0.047 (for 1 kHz) to 0.47 microfarad (for 300 Hz). In addition, resistor R14 must be changed from its standard value of 1K (for 1 kHz) to 8200 ohms (for 300 Hz). This should be accomplished carefully to avoid harming the printed-circuit board.

7.6 OPERATING TRL-1 RECEIVER INTO "CUE" CHANNEL

It it suggested that the TRL-1 receiver output be applied to a line input on a commonly-manned audio console. In this manner, should the broadcast transmitter air signal 'go down', the operator can simply switch the TRL-1 signal onto the cue bus. If the identifier is running continuously, the problem is then immediately diagnosed as a power failure at the broadcast transmitter site.

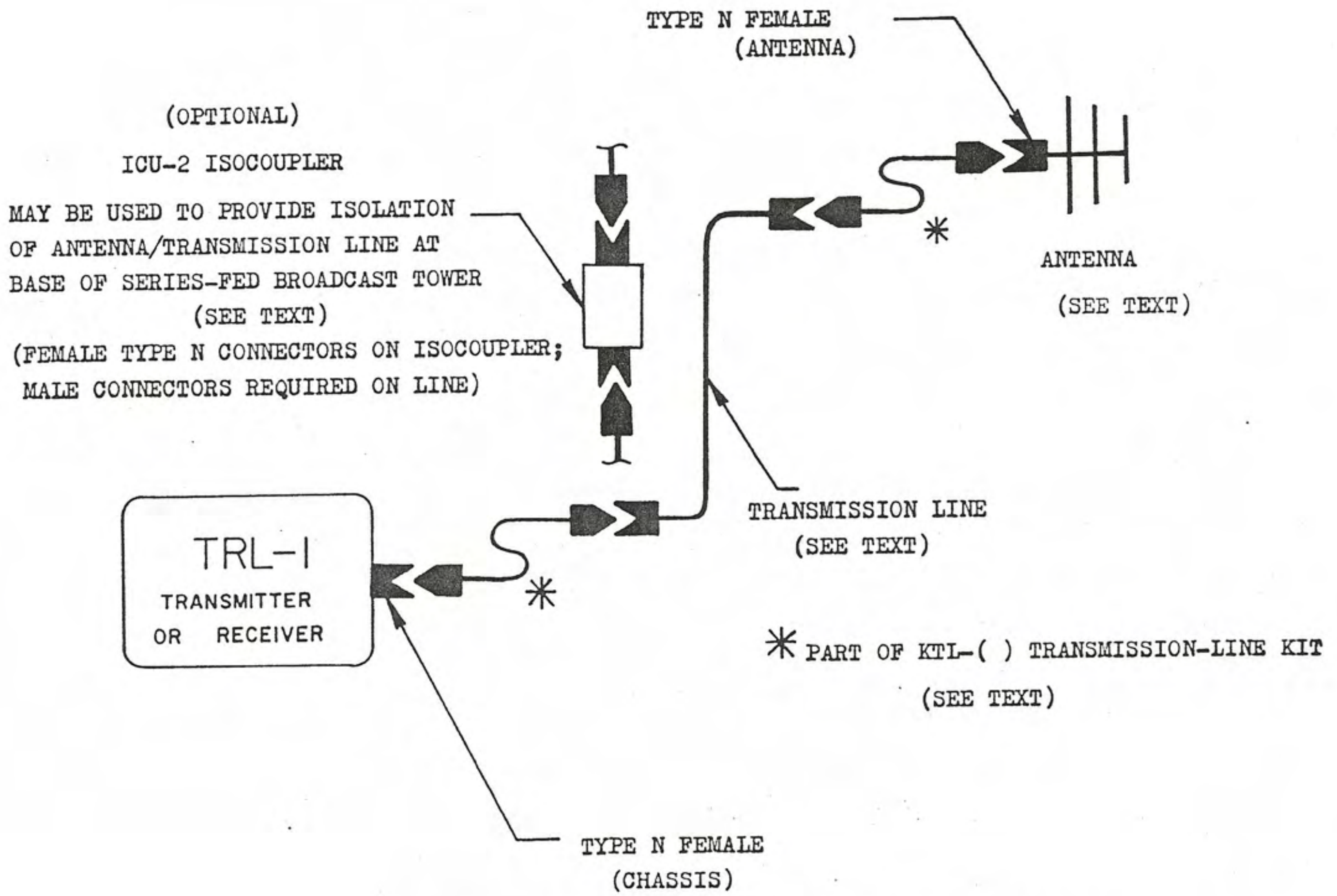
7.7 AUTOMATIC TRANSFER PANELS

The TRL-1 was designed to be compatible with the Moseley Associates Models TPT-2 and TPR-2 Automatic Transfer Panels. These give the user a method of automatically switching to a standby transmitter (or receiver).

When using the TPT-2 Transmitter Transfer Panel, each transmitter's RF output is routed to the panel, along with a sample of DC which is present when the transmitter is operative. The panel, by means of a switch, selects a primary transmitter for transmission. The other transmitter is idle. Both transmitters can have their modulation inputs in parallel or the modulation can be switched by the transfer panel.

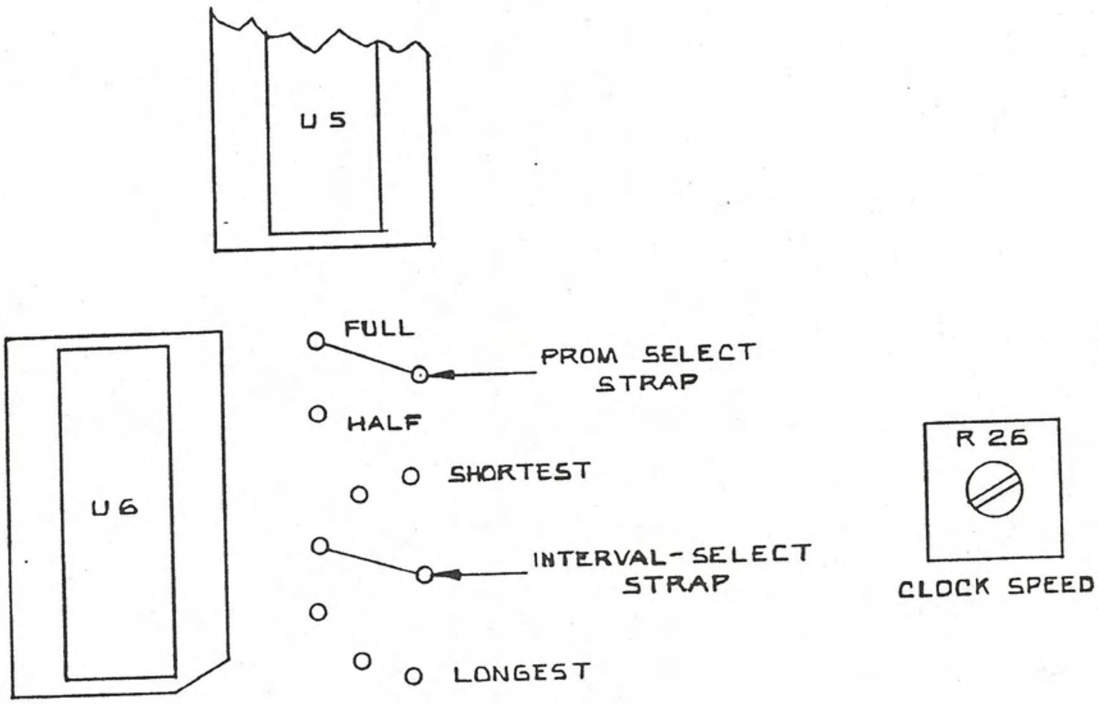
When using the TPR-2 Transfer Panel Receiver, each receiver's audio output is routed to the panel, along with a connection from the muting (squelch) relay. By means of a switch on the front panel of the TPR-2, one receiver is selected as a primary receiver; the other receiver is a standby unit and is selected upon failure of the primary receiver, as determined by its muting relay. The audio from the chosen receiver is delivered to the output barrier strip. This output is used in lieu of the normal receiver audio output.

Also be sure to operate the transfer panels from a battery (user-supplied). It is pointless to operate the transfer panels from AC when the very time they are required to operate may be during a power failure. Specific installation instructions are contained in the TPT-2 and TPR-2 manuals.



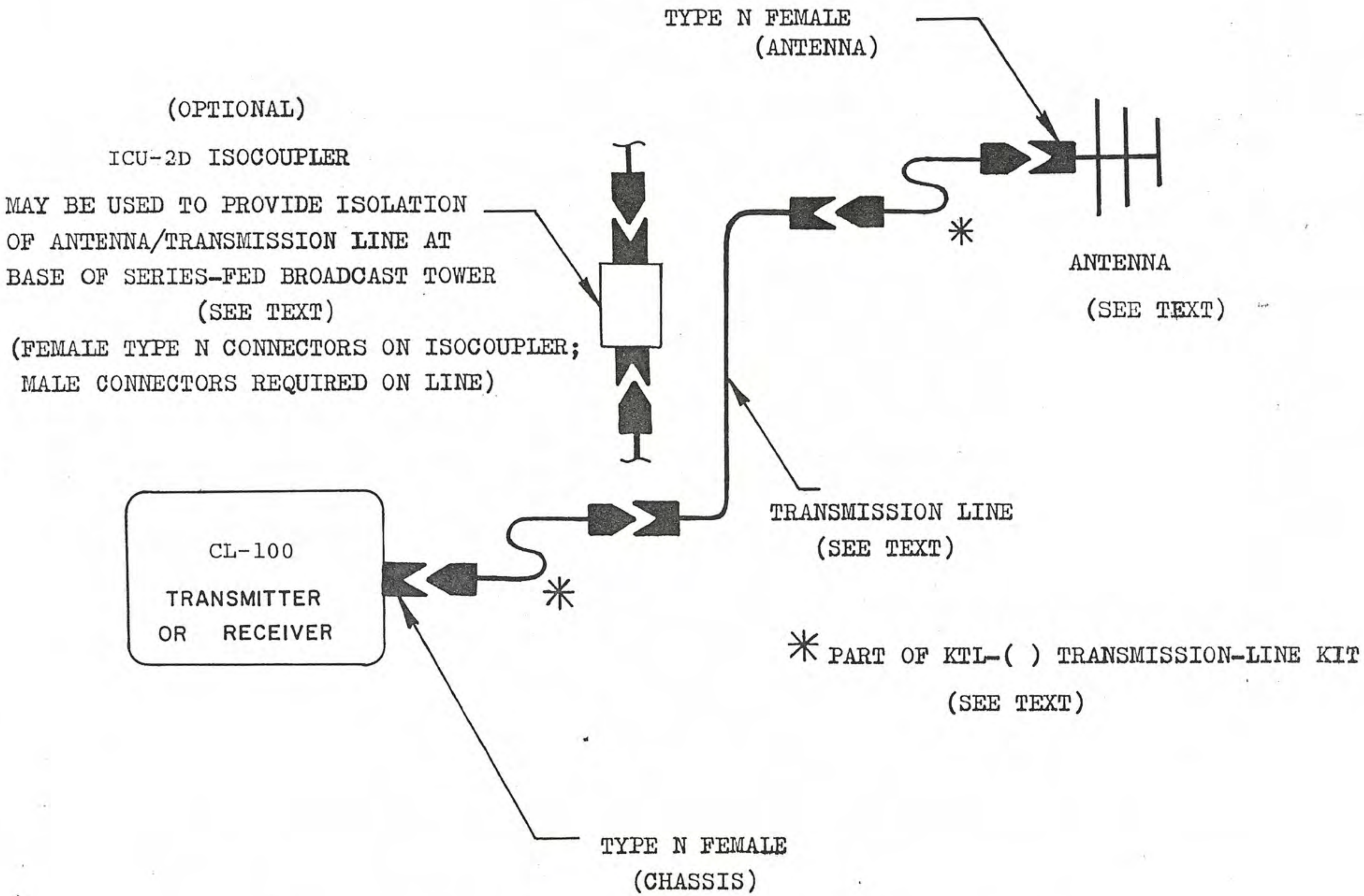
TYPICAL MODEL TRL-1 TRANSMITTER AND RECEIVER RF CONNECTIONS

Figure 1



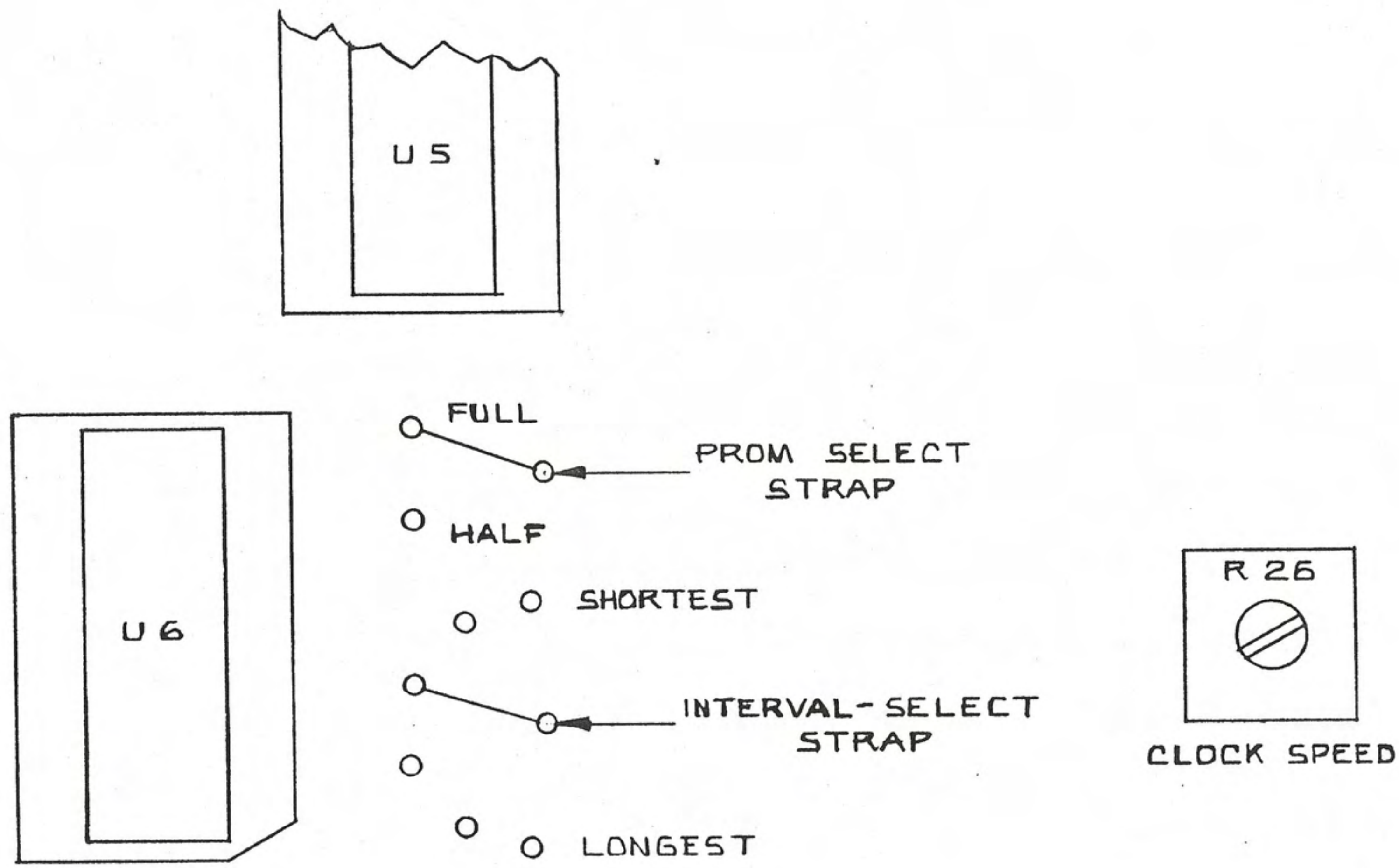
PROM-SELECT AND INTERVAL-SELECT STRAPPING

Figure 2



TYPICAL MODEL TRL-1 TRANSMITTER AND RECEIVER RF CONNECTIONS

Figure 1



PROM- SELECT AND INTERVAL- SELECT STRAPPING

Figure 2

MOSELEY ASSOCIATES, INC.
111 CASTILIAN DRIVE
SANTA BARBARA, CA 93117
(805) 968-9621

DATE 12/04/86

KIT NUMBER: ST-178 08/16/85

COMPONENT ITEM NO.	MANUFACTURER NUMBER/ ITEM DESCRIPTION	QTY PER
3390085	HLMP-3415 LED YEL 9.0@10 POINT SOURCE	1
3390135	MV-5022 LED RED 1.6@20 POINT SOURCE	1
3390143	MV-5354 LED YEL 10.@20 NARROW DIFFUSED	1
3390614	HLMP-3507 LED GRN 7-12@20 DIFFUSED 75DEG	1
3600053	1N914 DIO 1N914 75V 75MA SI A398	1
3600145	1N4154 DIO 1N4154 25V 4NS SI D035	1
3610003	1002 DIO 1002 200V 1A SI D039	2
3610045	5082-2835 DIO 5082-2835 FAST	1
3610136	MV-840 DIO VMV-840 030V 90-100PF D07	1
3610284	MDA2501 DIO BRIDGE 100V/25A	1
3630019	2N2222A XT NS2N2222A .4W250M060V.8A8P	1
3630027	2N2924-LF5 XT NS2N2924LFS.2W160M025V.1A7P	1
3630076	2N3563 XT NS2N3563 .2W600M030V50M2P	1
3630159	2N3819 XT NF2N3819 .4W 025V20M	1
3630191	2N4037 XT PP2N4037 01W060M060V01A.	1
3630308	2N5179 XT NS2N5179 .2W900M020V50M1P	1
3630415	3N204 XT NF3N204 .36W025V	1
3640018	A-400 XT NSA400 .2W005S015V25M	1
3640075	CHE-0 XT NPCHE-0 05W512M050V.25M	1
3640091	C3-12 XT NPC3-12 010W470M017V01A	1
3640216	TIP-30 XT PPTIP-30 02W003M040V01A	1
3640224	TIP-32A XT PPTIP-32A 02W003M060V03A	1
3650025	LM-309H RGLTR LM309H 05V 0.5A TO78	1
3650116	MC1723CL RGLTR MC1723CL VARV 0.15A 632	1

DATE 12/04/86

MOSELEY ASSOCIATES, INC.
111 CASTILIAN DRIVE
SANTA BARBARA, CA 93117
(805) 968-9621

KIT NUMBER: ST-17B 08/16/85

COMPONENT ITEM NO.	MANUFACTURER NUMBER/ ITEM DESCRIPTION	QTY PER
3650181	UA78L09AWC RGLTR UA78L09 09V 0.1A TO92	1
3650231	78GU1C RGLTR UA78GU1C VARV 1.0A 8ZU1	1
3660008	UA741CP IC UA741P OPAMP GEN COMP	1
3680006	74C151N IC 74C151N 8CH DIG MUX.	1
3680022	CD-4011BE IC CD4011BE QU 2IN NAND	1
3680030	CD4013AE IC CD4013AE DU D	1
3680071	CD4050AE IC CD4050AE HX BUF/CONV	1
3680261	CD4020BE IC BIN COUNT/DIVIDER	1
3730090	CA-3189E IC CA3189E AMP FM DETECTOR	1
3730199	LM-324N IC LM324N OPAMP SNGL SUPL	1
3730611	H11F3 IC H11F3 OPTOCOUP ISO	1
3730645	ICM-7555-1PA IC ICM 75551PA TIMER CMOS	1

ITEM NUMBER: 9051079 **** OP S/P TRL-1 TELE RETURN

- DATE 12/04/86

MOSELEY ASSOCIATES, INC.
111 CASTILIAN DRIVE
SANTA BARBARA, CA 93117
(805) 968-9621

KIT NUMBER: SO-17A 08/16/85

COMPONENT ITEM NO.	MANUFACTURER NUMBER/ ITEM DESCRIPTION		QTY PER
3270113	AZ-530-09-2 RELAY MIN PC 200OHM 12V NOM		1
3350147	PCL-1-16-12-65 OVEN XTAL		1
3370251	MDL 1 FUSE 1 AMP SLOW-BLO		2
4090411	3-1105 XFMR 8-P-97	A1	1
4090429	3-1106 XFMR 8-P-96	A1	1

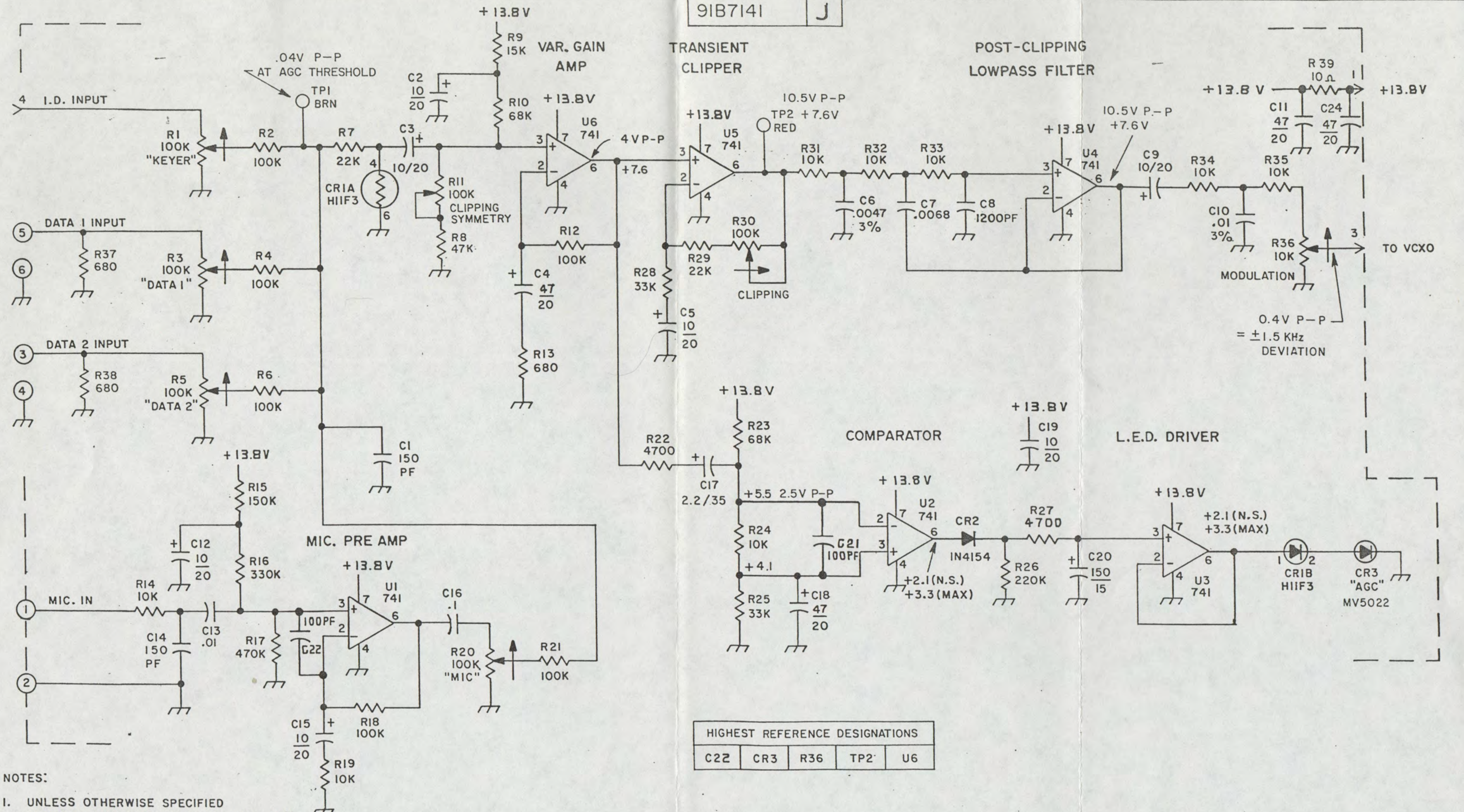
DATE 12/04/86

MOSELEY ASSOCIATES, INC.
111 CASTILIAN DRIVE
SANTA BARBARA, CA 93117
(805) 968-9621

KIT NUMBER: SX-17A 08/16/85

COMPONENT ITEM NO.	MANUFACTURER NUMBER/ ITEM DESCRIPTION	QTY PER
3340692	30A0067 F XTAL TX 450-456 MHZ TRL-1	1
3340700	30A0068 D1 XTAL RX 450-456 MHZ TRL-1	1

91B7141 J



HIGHEST REFERENCE DESIGNATIONS				
C22	CR3	R36	TP2	U6

NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS 1/4W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. COMPONENT LAYOUT 20A2726-G2
3. P.C. BOARD 51A5860

REV	REVISIONS
J	DELETED FILM REV. CALLOUT. ECO 3815. S.J. 3-23-83
H	CHG. C17 22/35 WAS 10/20 ECO 3499 5-14-82 AJB.
G	MODIFY VOLT MEASUREMENT ECO 3061 7-10-81 AJB.
F	REVISIONS UPDATED ECO 1819 LDH 29AUG80
E	?
EØ	RELEASED FOR PROD. ECO 1641 3-7-80
DØ	CHANGES AS PER ECO 1522 2 JAN 1980 D.T.W.
CØ	UP-DATE FOR REVISION. 25 OCT. 79 ECO 1434 R.J.B.
B	R8 WAS 470K. ECO 1204 19JUN79 JAM
A	RELEASED FOR PRODUCTION. 21FEB79 JAM

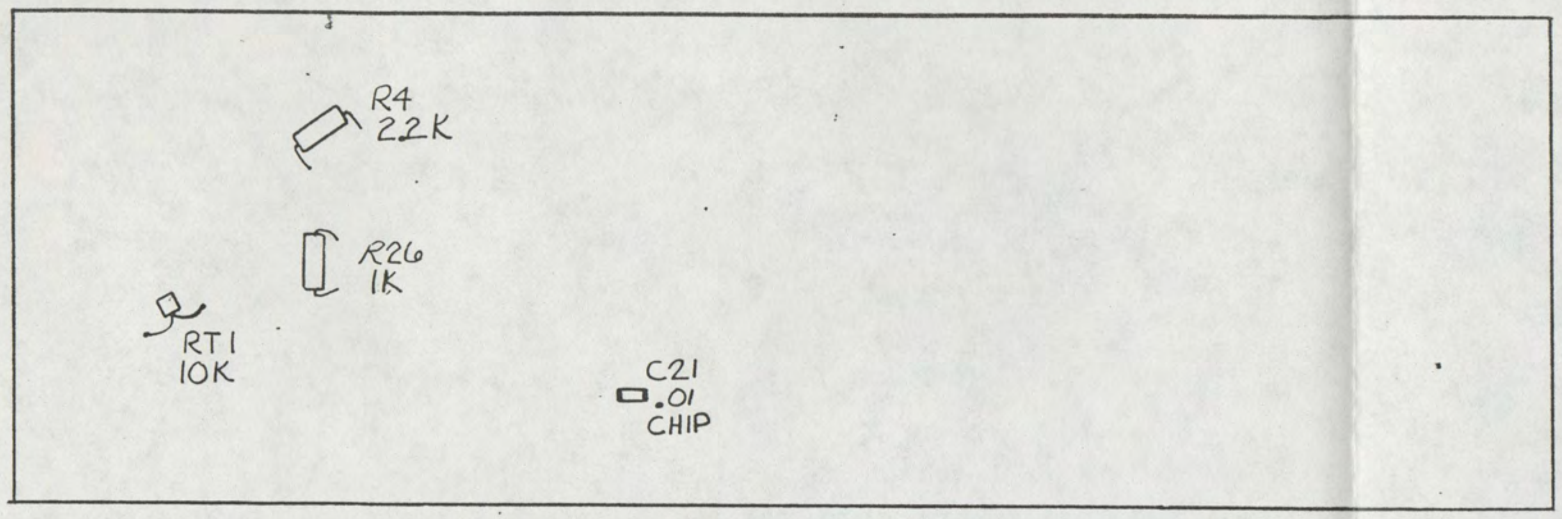
REVISIONS | MGMT. APPR. | DATE

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

SCHEMATIC
AUDIO
TRL-1 XMTR

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

DWN	JAM	14DEC78	SCALE:
CHK	FXY	21FEB79	
ENG	DAC	13FEB79	91B7141 J



CIRCUIT SIDE OF BOARD SHOWN

NOTE:

INSTALL R4, R26 AND RT1 THIS SIDE OF P.C. BOARD AT POSITIONS SHOWN. LEADS MUST BE KEPT AS SHORT AS POSSIBLE.

ITEM NO 9200536

SHEET 2 OF 2

T	SEE SHEET 1 NO CHANGE SHEET 2 ECO 4346 14 JAN 85 CH
S	SEE SHEET 1 SHOW C21 THIS SHEET ECO 4206 20 AUG 84 CH
R	SEE SHEET 1 NO CHG SHT 2 ECO 4117 15 JUNE 84 CH
P	REDRAWN FROM 20A2725 ECO # 4003 8-23-83

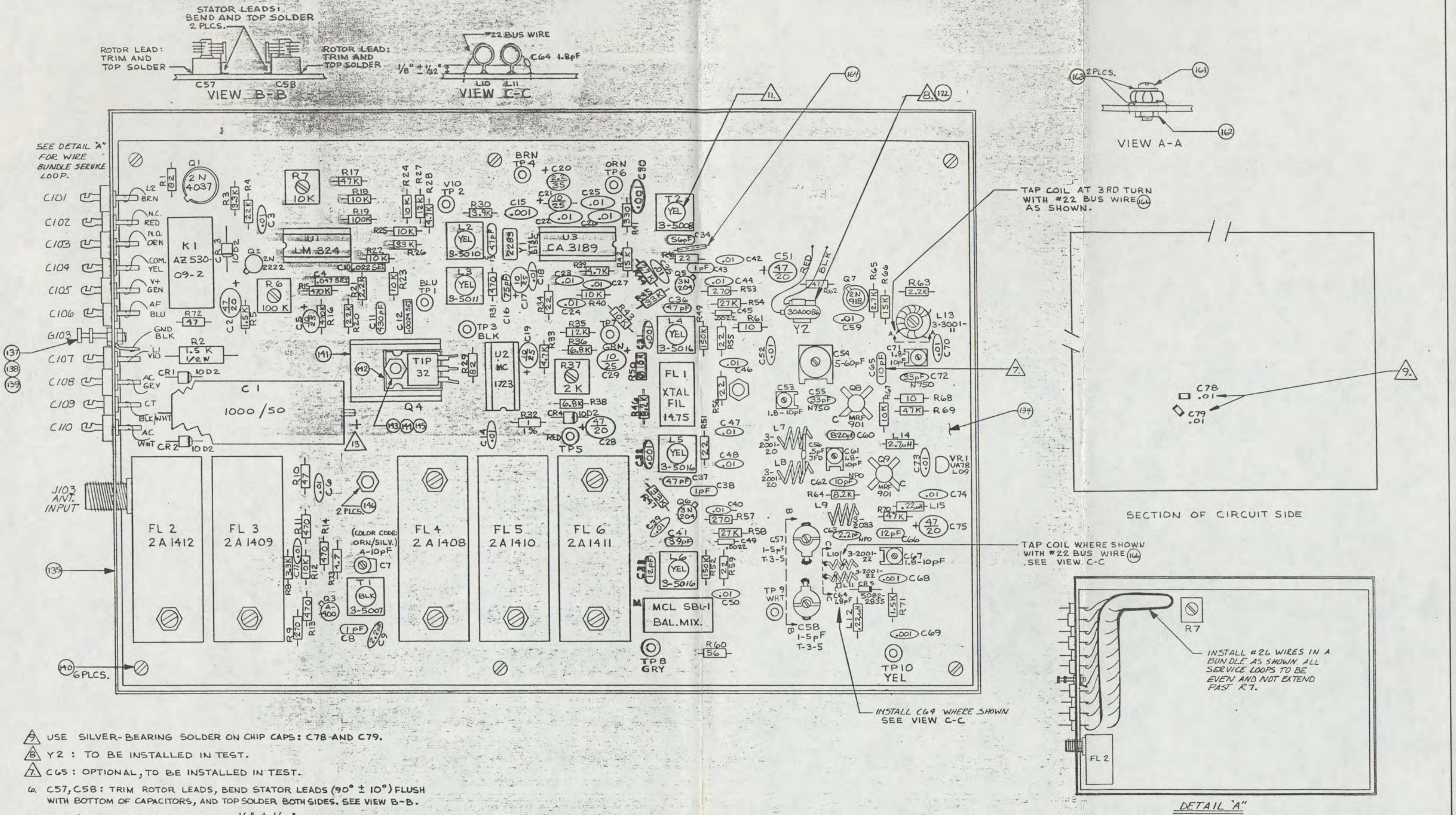
REVISIONS | DATE | MGMT. APPR.

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93117

COMPONENT LAYOUT
TRL-1 POWER AMP & VCXO XMTR

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

DWN	IAF	8/23/83	SCALE: FULL
CHK	JCR	9-21-83	20B2725 T
ENG			



9. USE SILVER-BEARING SOLDER ON CHIP CAPS: C78 AND C79.

8. Y2 : TO BE INSTALLED IN TEST.

7. C65 : OPTIONAL, TO BE INSTALLED IN TEST.

6. C57, C58 : TRIM ROTOR LEADS, BEND STATOR LEADS (90° ± 10°) FLUSH WITH BOTTOM OF CAPACITORS, AND TOP SOLDER BOTH SIDES. SEE VIEW B-B.

5. MOUNT L7 THRU L11 ABOVE P.C. BD. 1/8" ± 1/32" AS SHOWN IN VIEW C-C.

4. INSTALL AND SOLDER SOCKET PINS AT Q2, Q3, Q5, Q6, FL1 AND Y1.

3. SCHEMATIC : 91 D 7352

2. P.C. BOARD : 51C 6017

1. UNLESS OTHERWISE SPECIFIED:
RESISTOR VALUES ARE IN OHMS, 1/4 W, 10%
CAPACITOR VALUES ARE IN MICROFARADS.

NOTES:

14. TOP SOLDER ALL LEADS ON Q8 AND Q9.

13. INSTALL SHRINK TUBING ON "+" END OF C1, & SECURE C1 WITH RTV.

12. INSTALL SOCKETS AT U1, U2, U3, Q1, Q7.

11. REMOVE 8-32 UNC X 3/4" BINDER HEAD M.S. AFTER SOLDERING IN PLACE. INSTALL THE REQD. THREADED CORE, 6 PLCS. YEL ; 1 PLC. BLK.

10. INSTALL BALANCED-MIXER AS SHOWN.

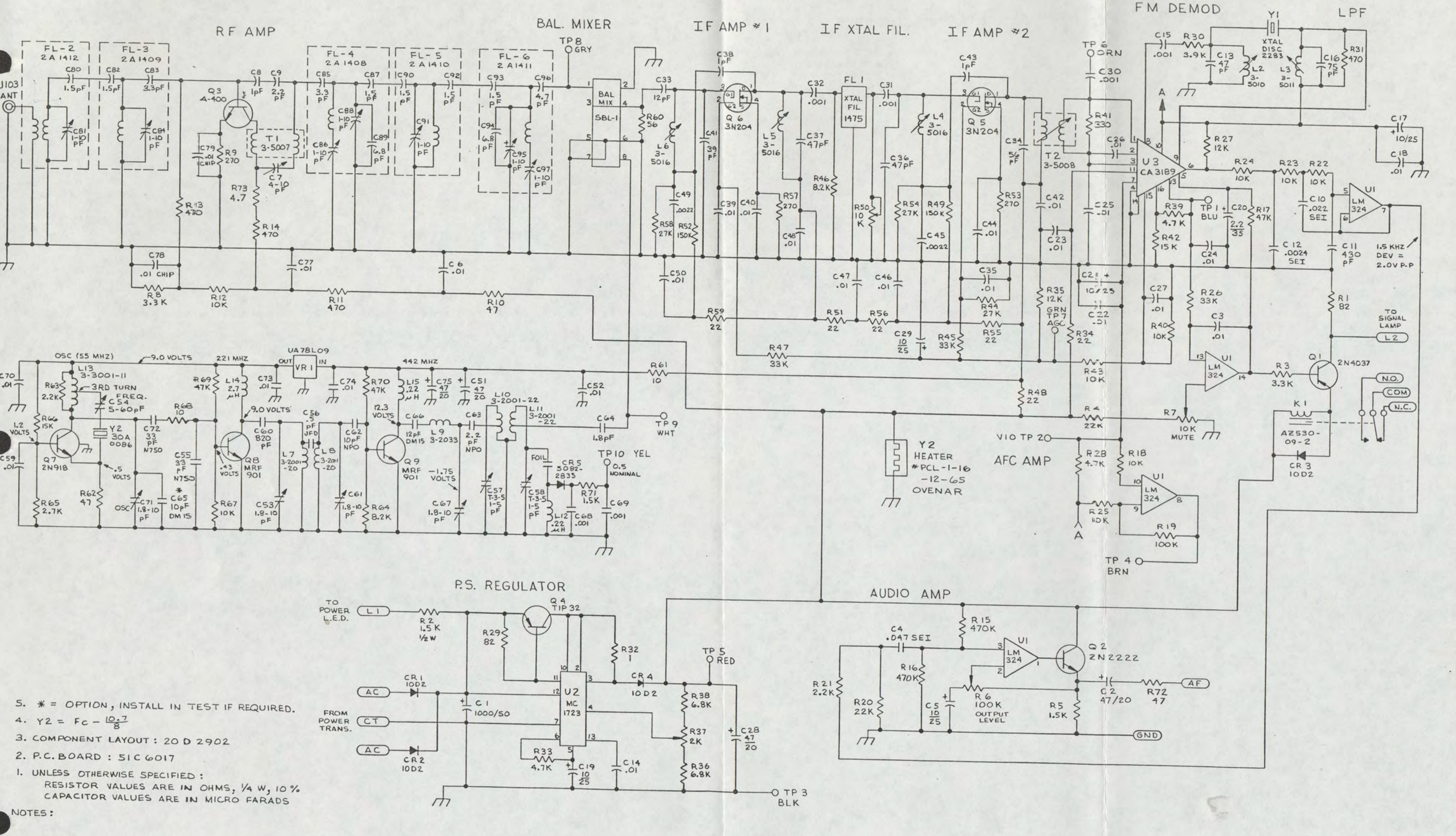
ITEM NO. 9204926

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK GOLETA CALIFORNIA

COMPONENT LAYOUT
TRL-1 RECEIVER MODULE

SCALE 2X

20D2902 B



NOTES:

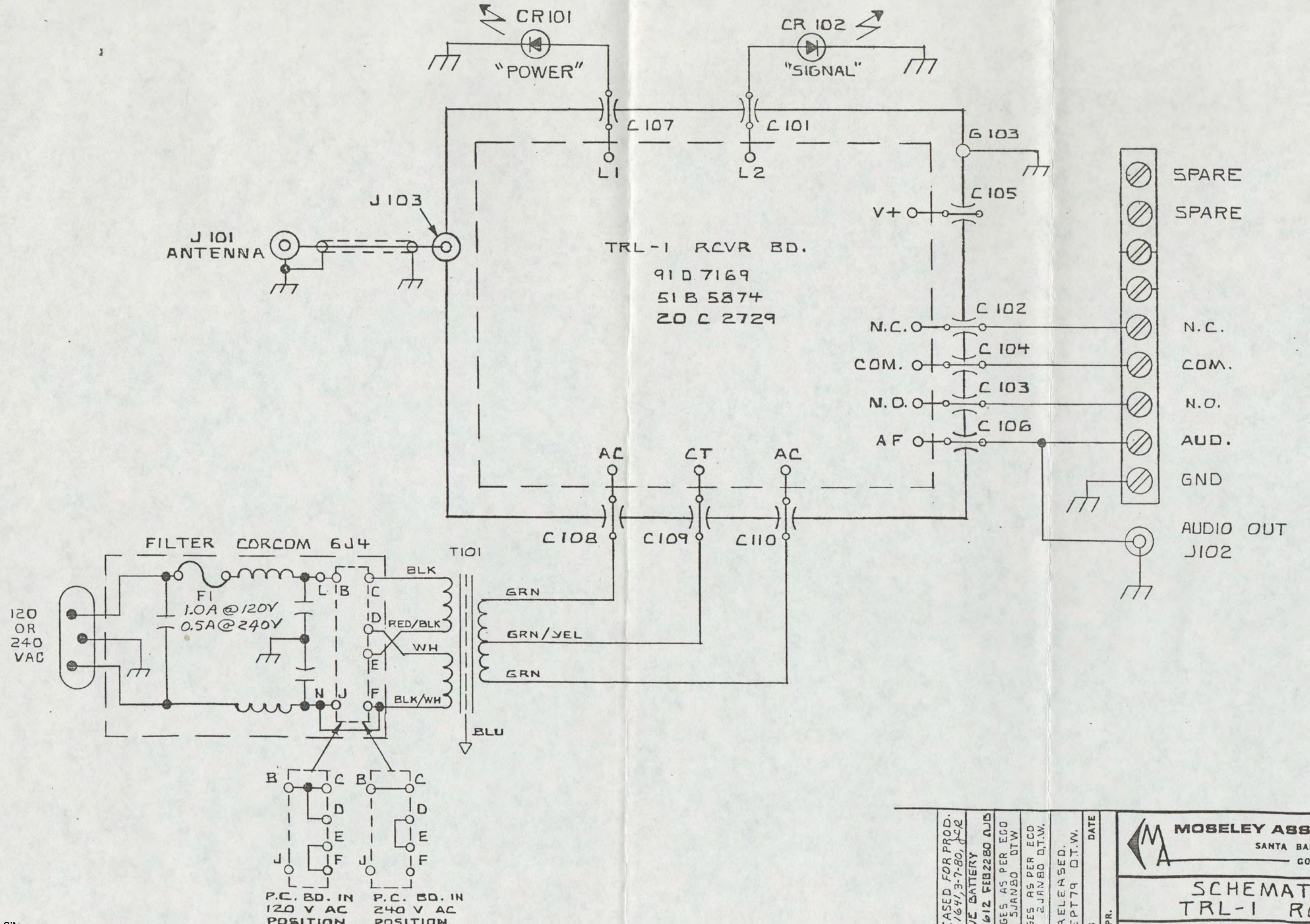
1. UNLESS OTHERWISE SPECIFIED:
   RESISTOR VALUES ARE IN OHMS, 1/4 W, 10%
   CAPACITOR VALUES ARE IN MICRO FARADS
2. P.C. BOARD : 51C 6017
3. COMPONENT LAYOUT : 20 D 2902
4. Y2 = Fc − 10.7/8
5. * = OPTION, INSTALL IN TEST IF REQUIRED.

MOSELEY ASSOCIATES, INC.

SCHEMATIC
TRL-1 RECEIVER

91D7352 B

91B 7181 EØ



REVISIONS	DATE
EØ RELEASED FOR PROD. ECO 1641, 3-7-80	
DØ REMOVE BATTERY ECO1612 FEB22 80 AJS	
CØ CHANGES AS PER ECO 1434 5JAN80 D.T.W.	
BØ CHANGES AS PER ECO 1522 2JAN80 D.T.W.	
AØ RELEASED 18 SEPT 79 D.T.W.	

MGMT. APPR.

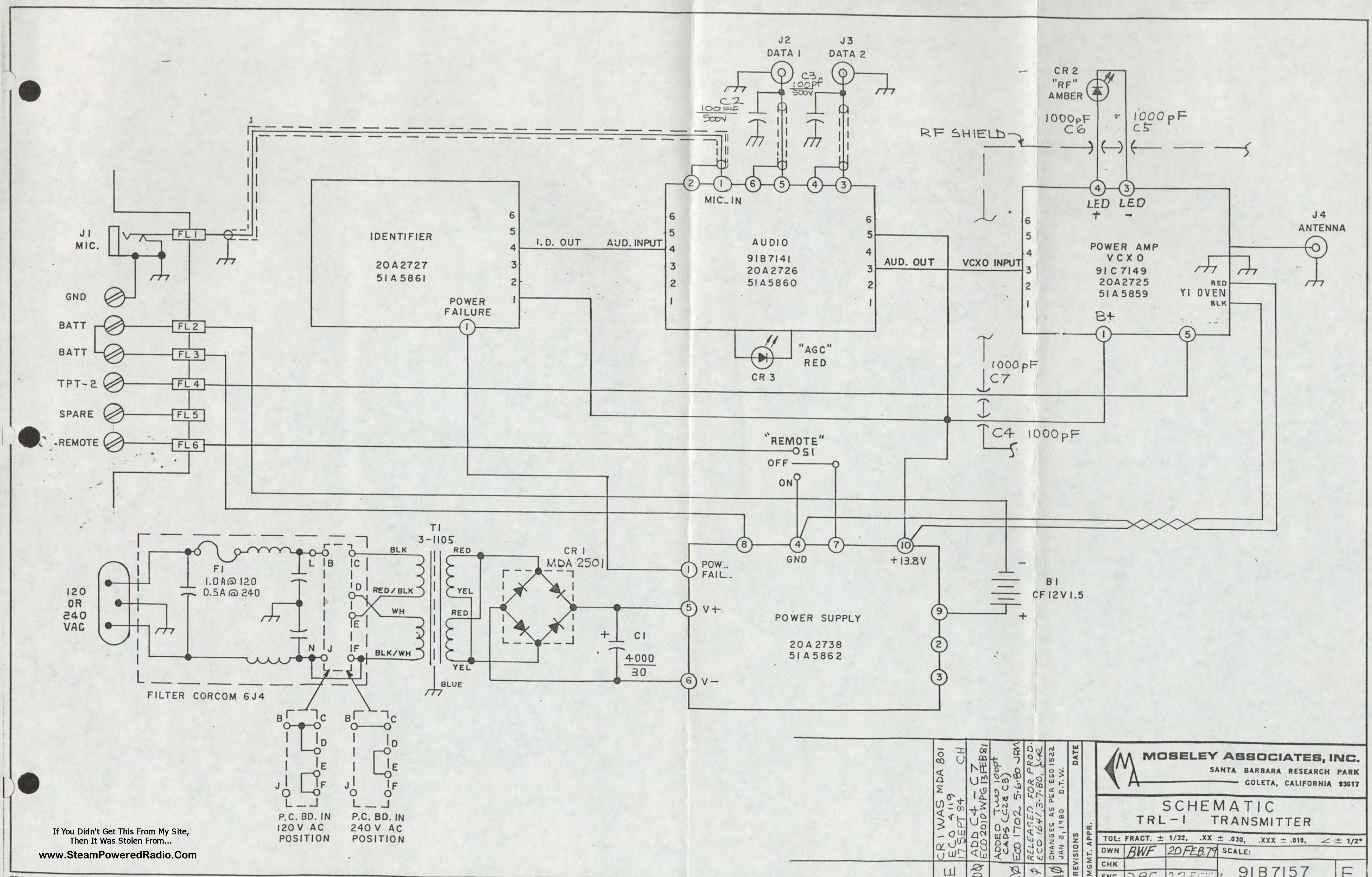
MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

SCHEMATIC
TRL-1 RCVR

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

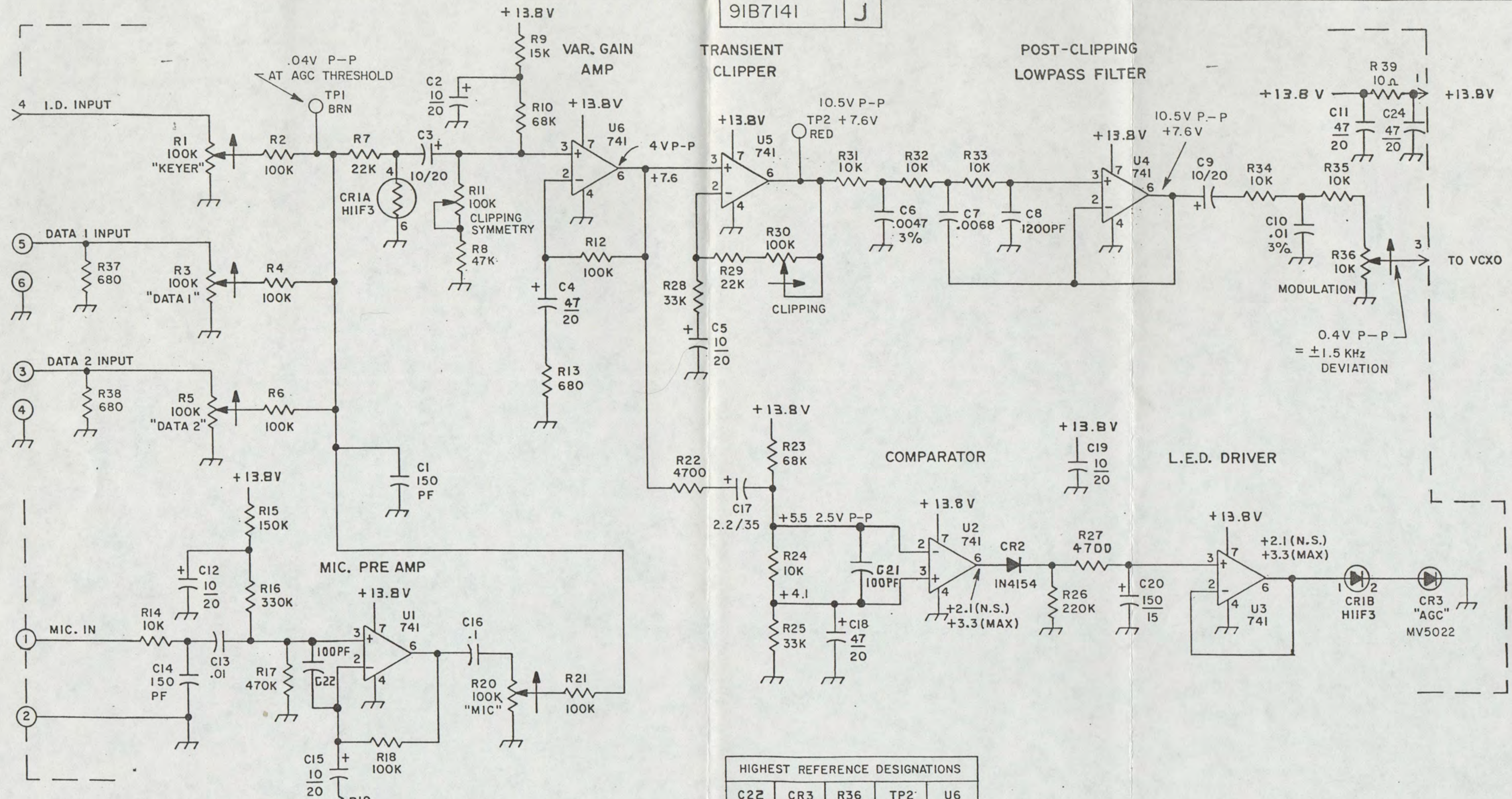
DWN BWF 3 JUL 79 SCALE:
CHK 30 JUL 79
ENG DBC 30 JUL 79

91B 7181 EØ



J2
DATA 1
J3
DATA 2
C2
100 PF
500V
C3
100 PF
500V
CR 2
"RF"
AMBER
1000 pF
C6
1000 pF
C5
RF SHIELD
MIC. IN
LED +
LED -
J4
ANTENNA
J1
MIC.
FL 1
FL 2
FL 3
FL 4
FL 5
FL 6
GND
BATT
BATT
TPT-2
SPARE
REMOTE
IDENTIFIER
20A2727
51A5861
POWER FAILURE
I.D. OUT
AUD. INPUT
AUDIO
91B7141
20A2726
51A5860
AUD. OUT
VCXO INPUT
POWER AMP
VCXO
91C7149
20A2725
51A5859
RED
BLK
Y1 OVEN
B+
"AGC"
RED
CR 3
1000 pF
C7
C4 1000 pF
"REMOTE"
S1
OFF
ON
GND
+13.8V
T1
3-1105
BLK
RED
RED/BLK
YEL
WH
RED
BLK/WH
YEL
BLUE
CR 1
MDA 2501
F1
1.0A @ 120
0.5A @ 240
120
OR
240
VAC
FILTER CORCOM 6J4
C1
4000
30
POW. FAIL.
V+
V-
POWER SUPPLY
20A2738
51A5862
B1
CF12V1.5
P.C. BD. IN
120V AC
POSITION
P.C. BD. IN
240 V AC
POSITION
E CR1 WAS MDA 801 ECO 4119 17 SEPT 84 CH
D ADD C4 - C7 ECO 2010 WPG 13 FEB 81
C ADDED TWO 100pf CAPS (C2 & C3) ECO 1702 5-6-80 JRK
B RELEASED FOR PROD. ECO 1641 3-7-80 RKL
A CHANGES AS PER ECO 1522 JAN 2, 1980 D.T.W.
REVISIONS
DATE
MGMT. APPR.
MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017
SCHEMATIC
TRL-1 TRANSMITTER
TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°
DWN BWF 20 FEB 79
CHK
ENG DAC 22 FEB 79
SCALE:
91B7157
E

91B7141 J



HIGHEST REFERENCE DESIGNATIONS				
C22	CR3	R36	TP2	U6

NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS 1/4W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. COMPONENT LAYOUT 20A2726-G2
3. P.C. BOARD 51A5860

REV	DESCRIPTION
J	DELETED FILM REV. CALLOUT, ECO 3815. S.J. 3-23-83
H	CHG. C17 22/35 WAS 10/20 ECO 3499 5-14-82 AJB.
G	MODIFY VOLT MEASUREMENT ECO 3061 7-10-81 AJB.
F	REVISIONS UPDATED ECO 1819 LDH 29AUG80
E	?
E	RELEASED FOR PROD. ECO 1641 3-7-80 ACR
D	CHANGES AS PER ECO 1522 2 JAN 1980 D.T.W.
C	UP-DATE FOR REVISION. 25 OCT. 79 ECO 1434 R.J.B.
B	R8 WAS 470K. ECO 1204 19JUN79 JAM
A	RELEASED FOR PRODUCTION. 21FEB79 JAM.
REVISIONS	DATE

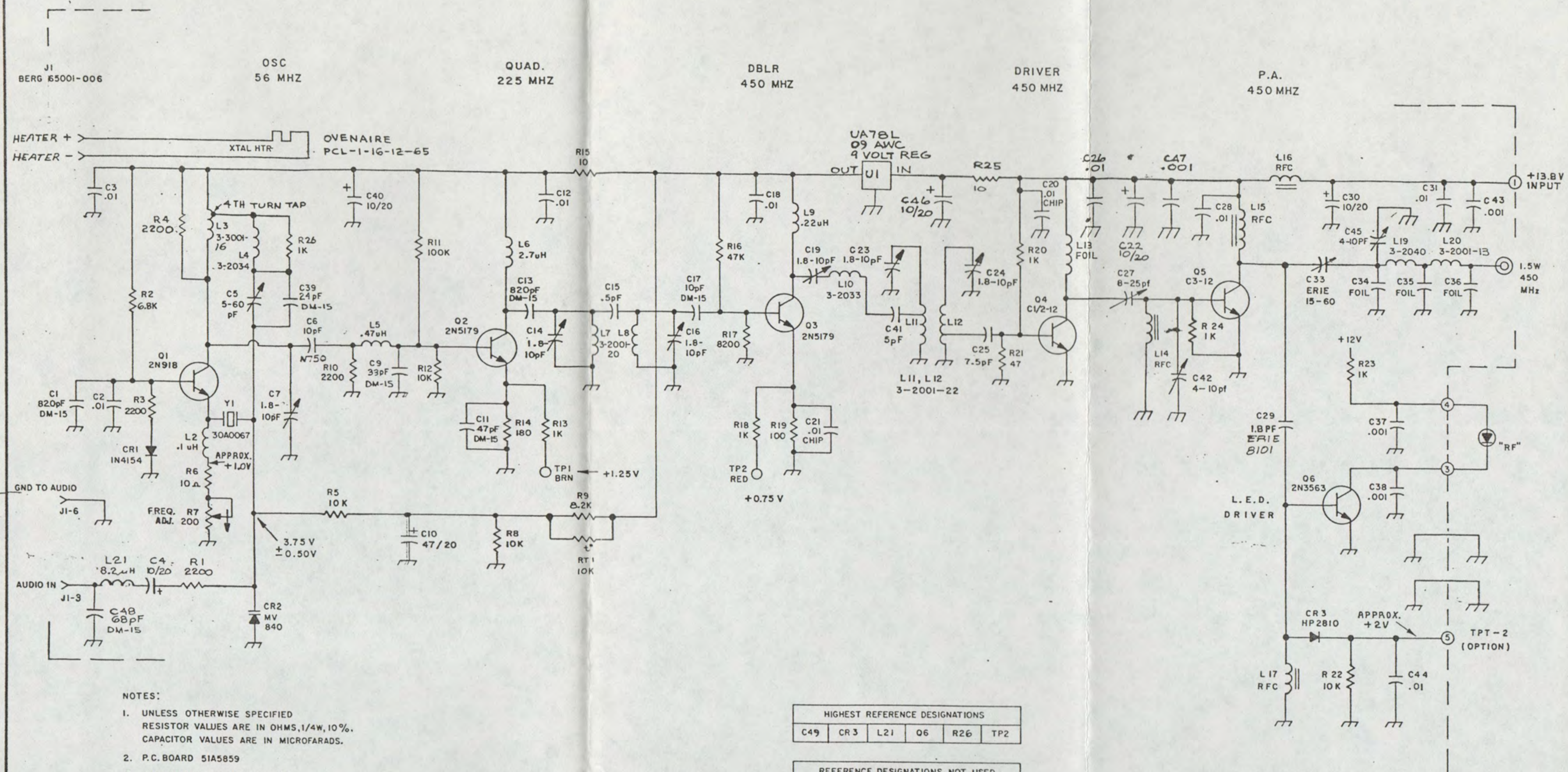
MGMT. APPR.

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

SCHEMATIC
AUDIO
TRL-1 XMTR

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

DWN	JAM	14DEC78	SCALE:
CHK	FXY	21FEB79	
ENG	DAC	13FEB79	91B7141 J



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/4W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51A5859
3. COMPONENT LAYOUT 2082725.
4. ALL RFC'S ARE VK200.

HIGHEST REFERENCE DESIGNATIONS					
C49	CR3	L21	Q6	R26	TP2

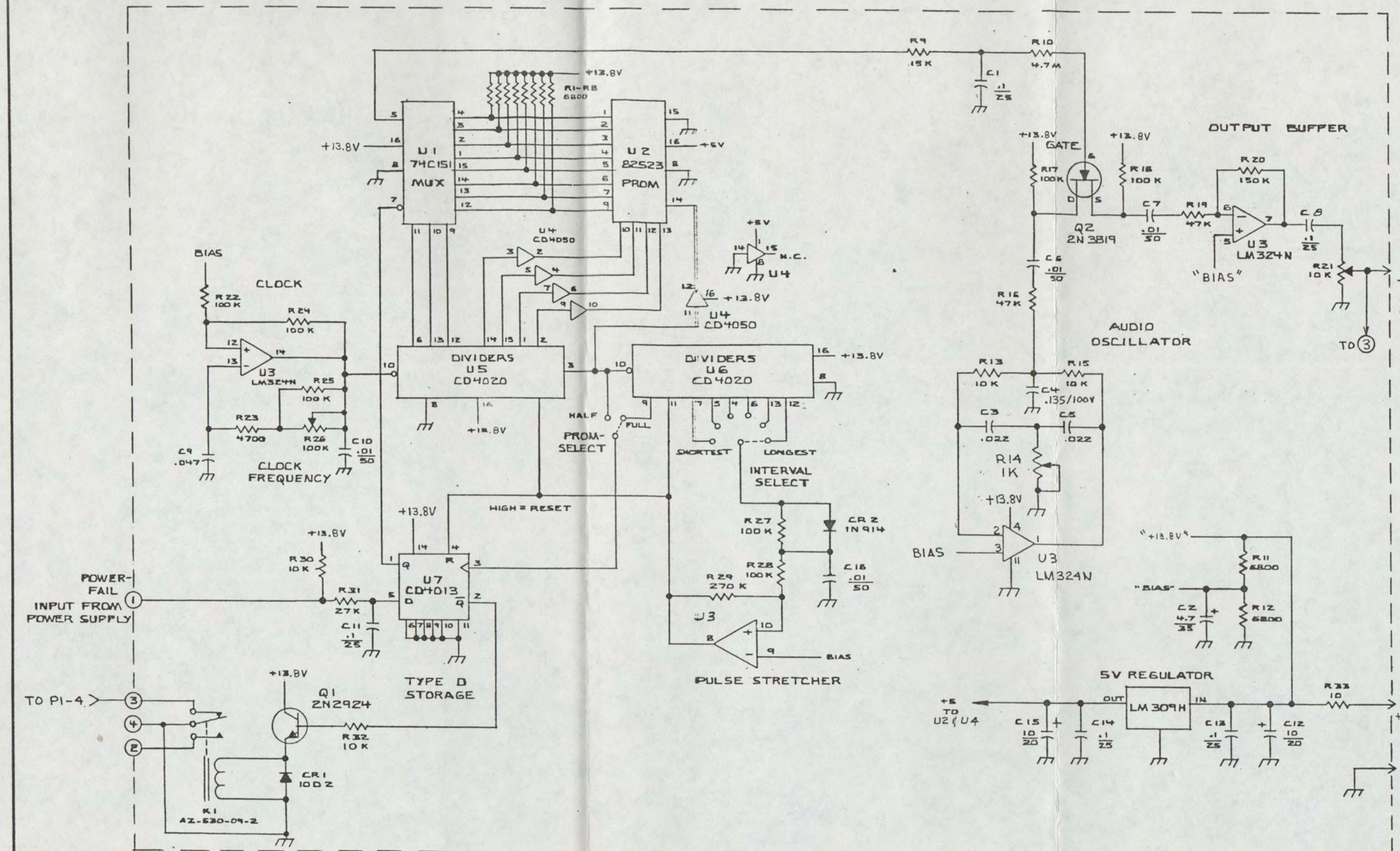
REFERENCE DESIGNATIONS NOT USED
L1, L18, C32

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

SCHEMATIC
POWER AMP & VCXO TRL-1

DWN JAM 17JAN79
ENG DAC 25JUN79

91C7149 N



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/4 W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD SIA5861.
3. COMPONENT LAYOUT 20A2727.

1/76 DIETERICH-POST CLEARPRINT 1020-8

REVISIONS		
D	R14 WAS 8.2K ECO 3596 21 JUL 82	CH
C	DELETE TWO TONE FREQ. OPTIONS EA 5328	CH
B	RELEASED FOR PROD.	
A	CHANGES AS PER E.C.O.	

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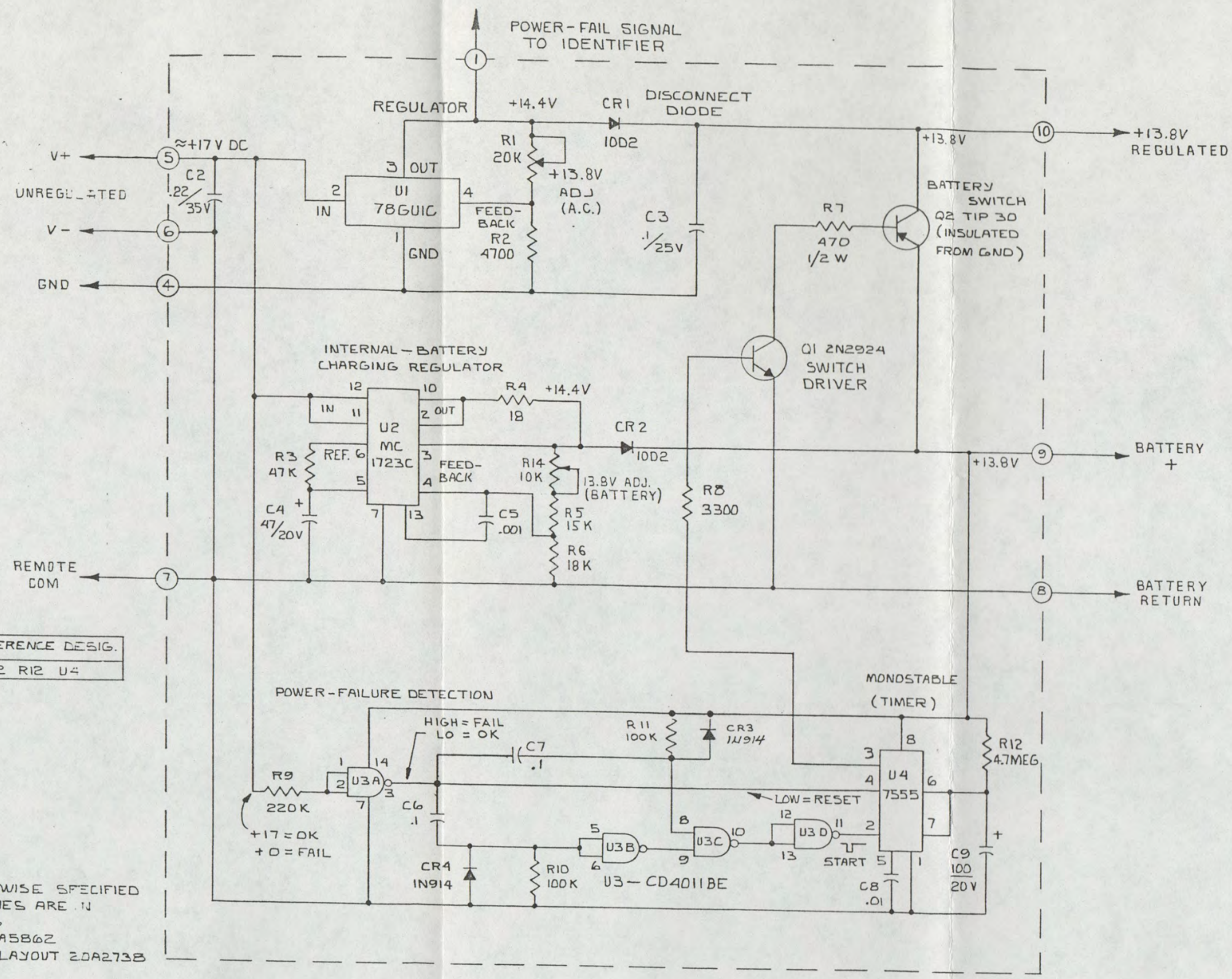
SCHEMATIC
TRL-1 XMTR IDENTIFIER

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°
DWN BWF
CHK
ENG
SCALE:
91C7203 D



NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/4, 10%
2. P.C. BOARD 51A5862
3. COMPONENT LAYOUT 20A2738

REV	REVISIONS	MGMT. APPR.	DATE
D	U3 WAS SCL 4011AE ECO 4257		
C	CR1 WAS CR2, CR2 WAS CR3, ADD CR3, C7, ECO 3730		5 JAN 82
B	RELEASED FOR PROD. ECO 1641		
A	CHANGES AS PER ECO 1522		23 JAN 80

MOSELEY ASSOCIATES, INC.
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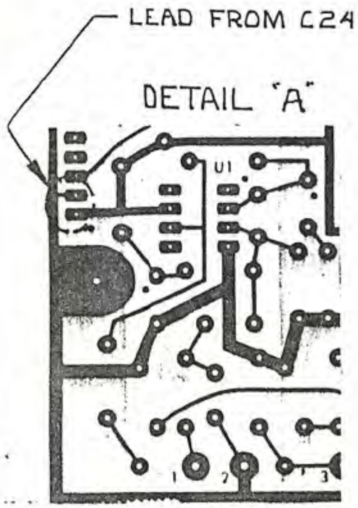
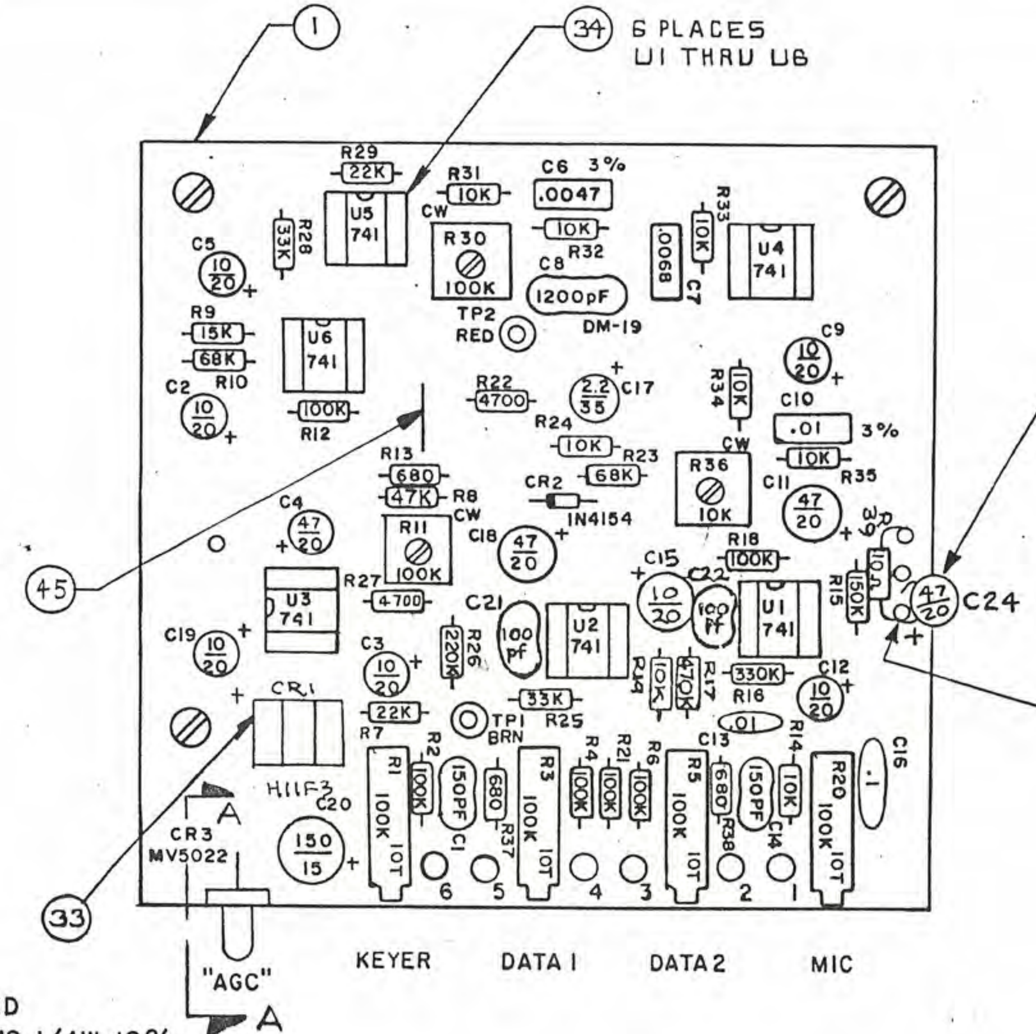
GOLETA, CALIFORNIA 93017

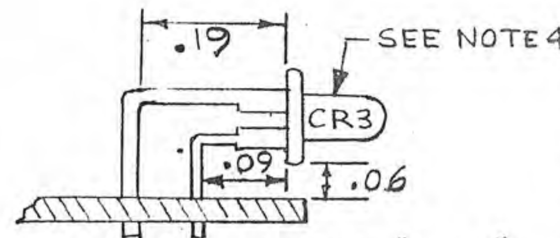
SCHEMATIC
TRL-1 TRANS. POWER SUPPLY

TOL: FRACT. ± 1/32, .XX ± .XX, .XXX ± .010, ∠ ± 1/2°
DWN A.J.B. NOV 4 '79
CHK
ENG 2 JAN 80
91C7262 D



VIEW FROM CIRCUIT SIDE





VIEW "A-A"

NOTES

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS 1/4W, 10%.
   CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51A5860
3. SCHEMATIC 91B7141
4. THE TIP OF CR3 MUST BE AT THE SAME HEIGHT ABOVE P.C. BOARD AS THE ADJUSTING SCREW OF TRIMPOT R1; CATHODE LEAD IS CLOSEST TO P.C. BD.

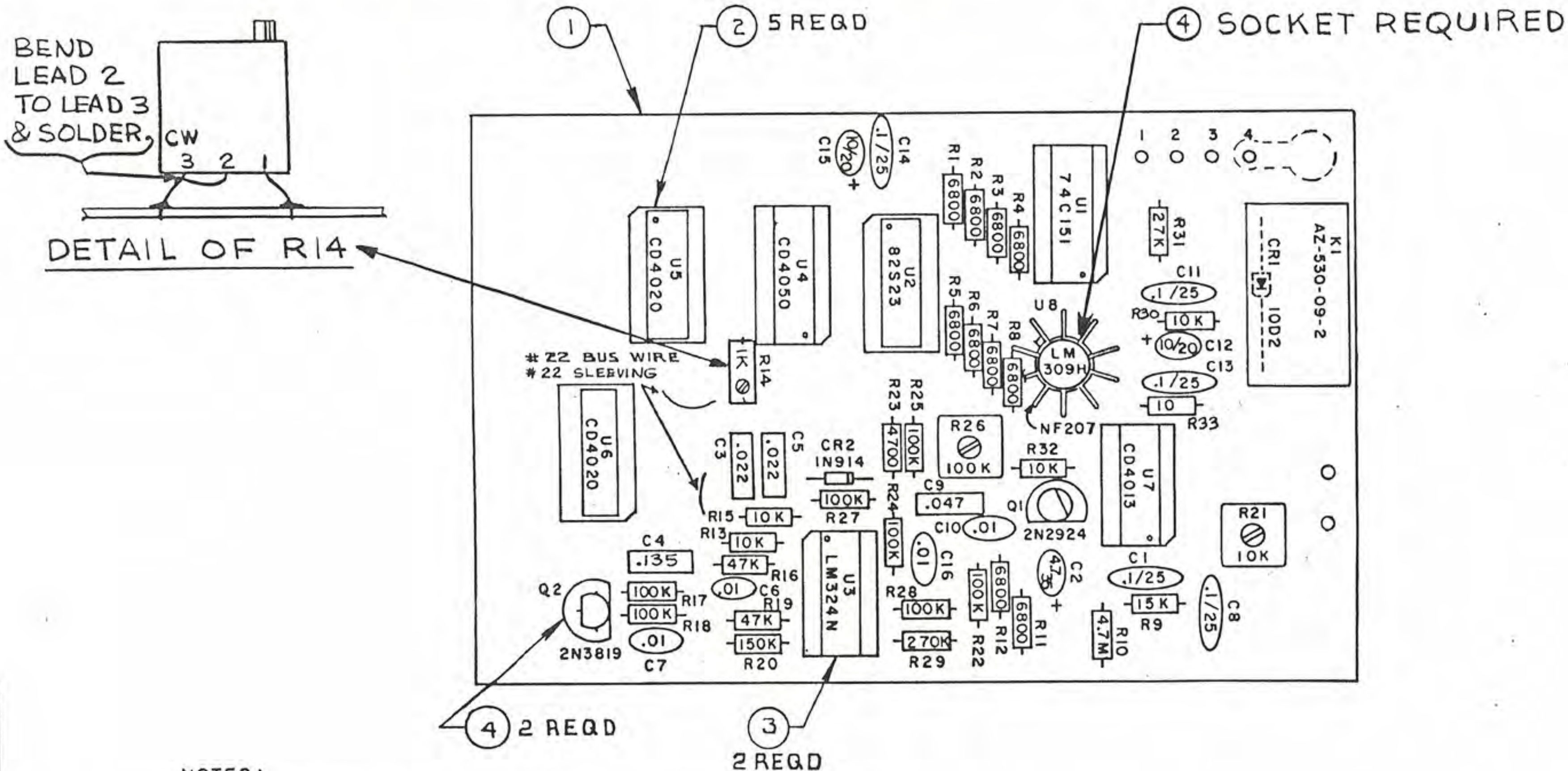
ITEM NO. 9200528

	REVISIONS	DATE	MGMT. APPR.
M	BOM CHANGES ECO4576-8-22-85		
L	ADD BALOON FOR JUMPER ECO 4498 6-11-85		
K	REVISE NOTE ON C24 REDIMENSION VIEW A-A 13 DEC 84-ECO4286-CH		
J	CHG. C17 WAS 10/20 NOW 2.2/35 ECO 3499 19 MAY 82 AJB.		
H3	ADDED POLARITY ON DWG. AT LOC. CR1 AND C15 PCO 3172 19 OCT 81 AJB		
H2	DELETE 9 TERMINALS & GND WG. INSTALL C24 TO BOARD. ECO 3004 5 MAY 81 AJB.		
G2	ADDED NEW A.W. OVERLAY & PROPER ASSY OF C21 ECO 1819 L.D.H. 28AUG80		
F2	DELETED #1 INSTALLATION NOTE; REDIMENSIONED VIEW A-A ECO 1702 5.7.80 JRM		
E2	ADD VIEW A-A & NOTE 4 PCO 1694 WPG 18APR80		
E1	RELEASED FOR PROD. ECO1641, 3-7-80		
D1	CHANGE AS PER ECO1522 2 JAN 1980 D.T.W.		
C1	UP-DATE FOR REVISION. 25 OCT. 79 ECO 1434 A.J.B.		
B1	FRONT PANEL WAS 5C2630 PCO1421 8OCT79 D.T.W.		
B	R8 WAS 470K. ECO 1204	19JUN79	JAM
A	RELEASED FOR PRODUCTION	21FEB79	JAM

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

COMPONENT LAYOUT
TRL-1 AUDIO XMTR

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°				
DWN	JAM	15DEC78	SCALE: FULL	
CHK	FXY	21FEB79	20A2726	M
ENG	DAC	21FEB79		



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/4 W, 10%.
   CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51A5861
3. SCHEMATIC 91C7203.
4. PARTS LIST ISSUED.
5. U2 TO BE PROGRAMMED BY TEST DEPT.

ITEM NO: 9200510

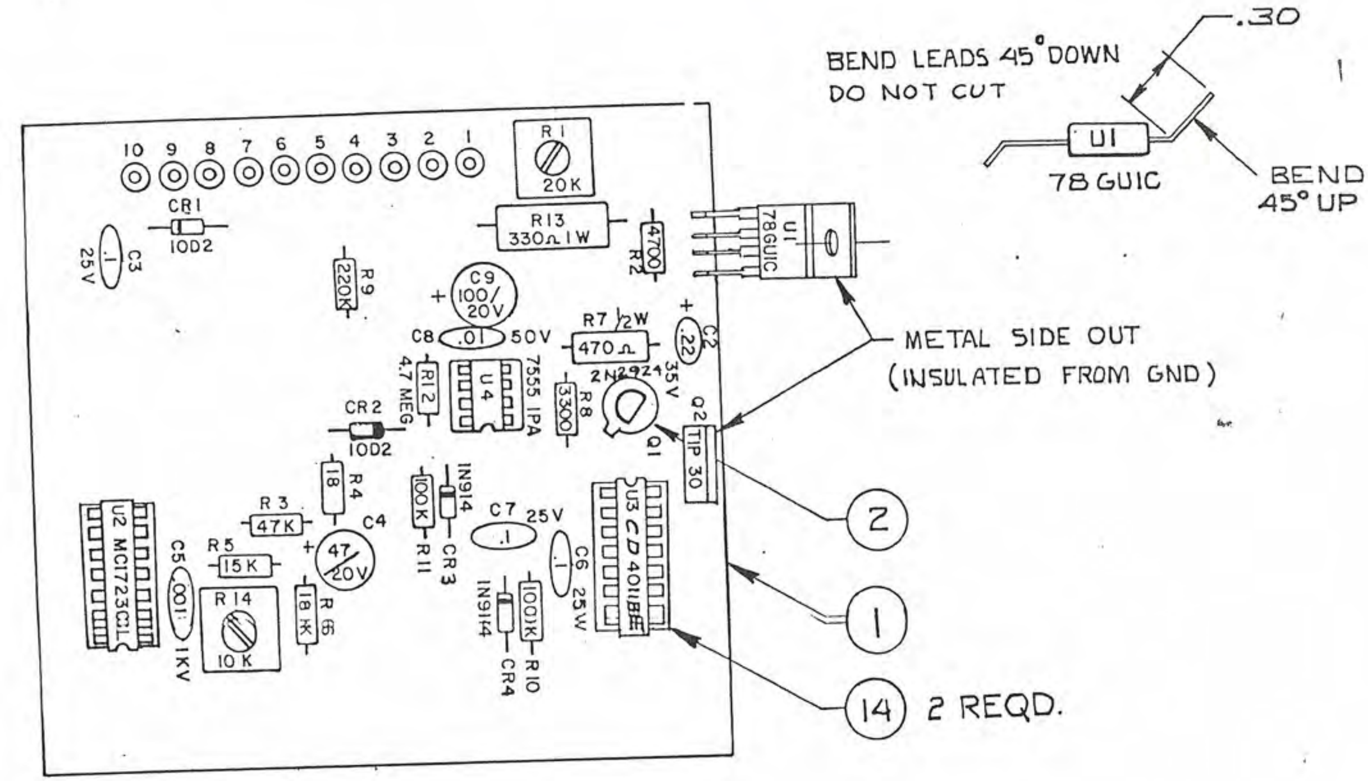
REVISIONS	DATE
RELEASED FOR PRODUCTION. 21 FEB 79 F.X.Y.	
R24 WAS R22. JUMPERS ADDED. ECO1400 3OCT79 D.T.W.	
UP-DATE FOR REVISION. 25 OCT. 79 ECO 1434 A.J.B.	
CHANGES AS PER ECO1522 2JAN80 D.T.W.	
RELEASED FOR PROD. ECO 1641, 3-7-80,	
ADDED SOLDER LUGS PER ECO 1703 L.D.H. 25 APR 80	
ADD SOCKET TO U8 ECO 2066 18MAR81 CH	
ADDED NOTE 5 TO DWG. PCO 2087 1APR.81 AJD.	
UNDER-LAY WAS: -00 DELETE TONE FREQ. OPTION JUMPER WAS: U6-4 TO CR-2 ADD JUMPER: AUD. TO #3 R32 WAS 27K DELETE 2 SOLDER LUGS. ECO 3438 7APR82 C.H.	
ECO 3596 Jul 21 '82 CH	
R14 WAS 8.2K. ADD R14 DETAIL. ADD GND LUGS FOR -00 P.C. BDS ONLY	
INCORP. ECO 4259 MOVE 1 LUG TO TERM#4 DELETE LUG NEAR Q2 UPDATE TO CO STD REVISE NOTE 5. ECO 4408 20 MAR 85 CH	

MGMT. APPR.

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

COMPONENT LAYOUT
TRL-1 XMTR IDENTIFIER

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°
DWN F X Y 8 JAN 79 SCALE: 1:1
CHK
20A2727 K



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS, 1/4 W, 10 % CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51A5862
3. SCHEMATIC 91C7202

ITEM NO: 9200452

REV.	REVISIONS / DATE
L	U3 WAS SCL4011AE ECO 4257, 11-5-84
K	POLARITY ON CR2 WAS SHOWN WRONG. ECO 3908. S.J. 6/9/83
J	DELETE 1/32 BEND DIM. ON U1 CR4 WAS CR3 CR3 WAS CR4 ECO 3730 5JAN82 CH
H	CHANGED ORIETATION OF Q1. ECO 3656 10-19-82 S.J.
G	P.C. BD. ITEM NO WAS 9200452 ECO3615 8-19-82 JCR
F	R4 WAS 18K PCO 3479, 4-27-82
Ø	OLD BOARD WERE (-00) UP-DATE BOARD TO (-01) 2 OCT. 81 ECO 3143 AJB.
Ø	RELEASED FOR PROD. ECO 1641 3-7-80
ØØ	CHANGES AS PER ECO. 3 JAN 80 ECO 1434 D.T.W.
Ø	CHANGES AS PER ECO. 2 JAN 80 ECO 1522 D.T.W.
3	R4 WAS 10Ω. R5 WAS 18K,5% U4 WAS NE555. 18 JUN79 ECO 1203 JAM
A	RELEASED FOR PRODUCTION 27 FEB. 79 AJB.

MGMT. APPR.

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

COMPONENT LAYOUT
TRL-1 POWER SUPPLY

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°			
DWN	A.J.B.	12 JAN 79	SCALE: 1:1
CHK	FXY	27 FEB 79	20A2738 L

TRL-1 TRANSMITTER TEST PROCEDURE 3/3/83

TEST EQUIPMENT FOR TRL

1. Signal Generator (HP 8640B or equivalent)
2. Spectrum Analyzer (Tektronix 7L12 or equivalent)
3. Distortion Analyzer (HP 339A or equivalent)
4. Frequency Counter (capable of counting 500 MHz)
5. Audio Oscillator (if not included in the Distortion Analyzer)
6. Oscilloscope (15 MHz B-W)
7. DVM or VOM
8. Wattmeter and slug (Bird Model 43 and 10E or equivalent)
9. Feedthrough Load (50 Ohm 2-5 Watt)
10. 30 dB Directional Coupler

Option

1. Moseley 606 Test Fixture consisting of:

   a. FM Demod
   b. Mono Baseband Processor
   c. 606 Rx Power Supply
   d. LO Mixer
   e. 3 MHz Filter

   With this Test Fixture, TRL-1 Txs can be checked by themselves.

TEST PROCEDURE

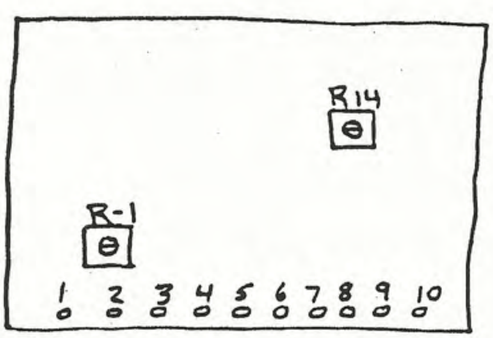
1. Plug in crystal and install heater.

2. Connect wattmeter and load to antenna port (5 watt slug, 450 MHz).

Power Supply

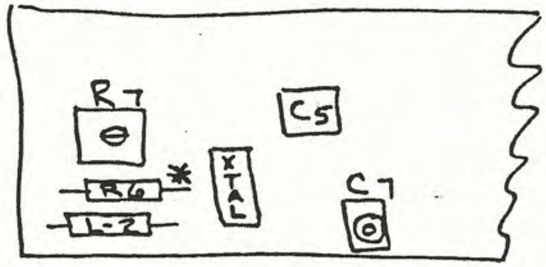
3. Initial set-up. Turn power supply adjustments, R1 and R14, fully clockwise. Adjustments work backwards on power supply board. This is to ensure that the power (Vdc) does not come on full and destroy Q4 on the power-amp and VCXO board.

4. Monitor between pin 10 (+) and ground with a VOM, plug unit in and turn on. Meter should read approximately +4.25 Vdc. Adjust R1 for +12.00 Vdc. Monitor between pin 9 (+) and ground. Meter should read approximately +12.25 Vdc, adjust R14 for +14.00 Vdc.



VCXO - Power Amp Board

1. With voltmeter on R6 (+) (end closest to crystal), adjust R7 for approximately +1.25 Vdc.



2. Open C7 all the way and tune C5 for maximum dc at TP1 (brown).

3. Open C14, C16 and C19 about 3/4, then tune for maximum dc at TP2 (red), approximately .65 to .90 Vdc. Adjust L10 as needed for C19 to peak.

4. Open C23 and C24 about 3/4. With voltmeter probe (+) on the junction of R20, R21 and the base of Q4; tune for maximum dip in voltage. Voltage will be approximately .53 Vdc and should dip to approximately .43 Vdc.

5. Connect output of feedthrough load to a spectrum analyzer. Tune C27, C33, C42 and C45 for maximum output. Wattmeter should read between 1.2 to 2.0 watts.

6. Go back and retune all variable caps for maximum output.

7. Looking at the spectrum analyzer, you will see the carrier, a second and third harmonic. All harmonics and spurs must be down 50 dB from the carrier. Use C33 and C45 to tune out the harmonics. Use C16, 14, 19, 23 and 24 for spurs. (Spread inductor L20 for more power output if necessary.)

8. Screw on a tuning cover and recheck the harmonics. Retune if necessary.

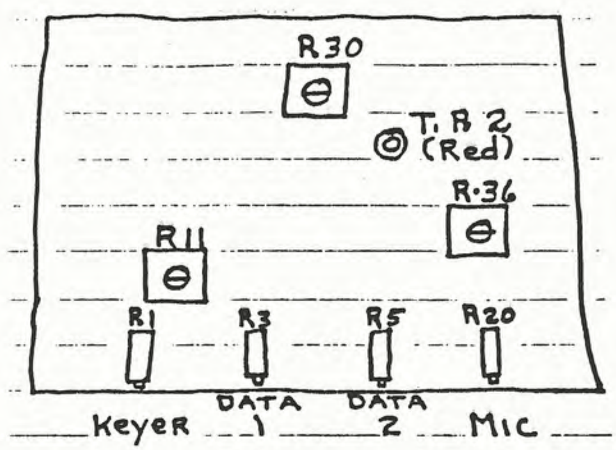
9. Check voltage at TPT terminal on the barrier strip. Voltage should be ≥2.25 Vdc. If not, C33 and C45 are not tuned properly.

10. Connect the output of the load to a frequency counter. Tune C5 and C7 for frequency. Use R7 only if frequency is high, after using C5 and C7.

Audio Board

1. Turn all the front panel adjustments fully clockwise (Keyer, Data 1, Data 2 and Mic).

2. Adjust R11 (audio board) to mid-range. Adjust R30 and R36 fully clockwise.



3. Apply a 1000 Hz tone at 0 dBm to Data 1 input (back panel).

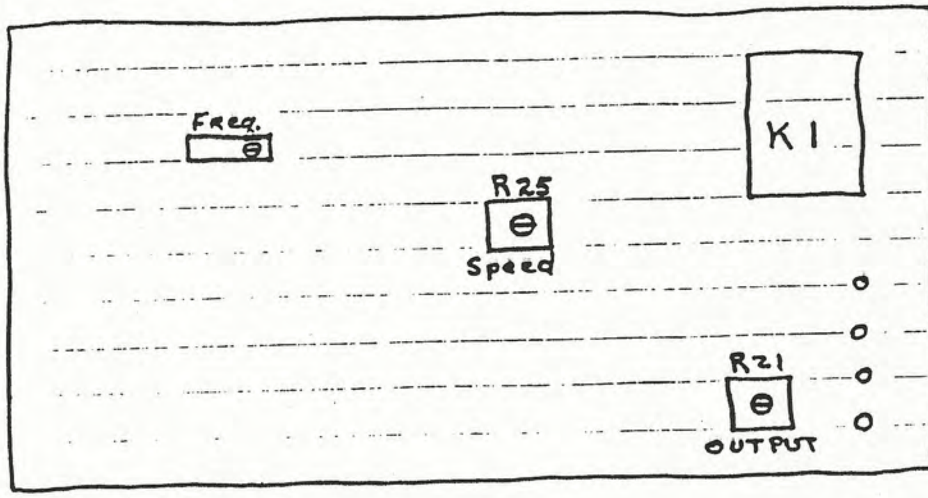
4. Monitor TP2 (red) with a scope probe (2 V/division). Adjust R11 for symmetry of clipped sinewave. Readjust R30 until clipping stops, approximately 9.0 V p-p. Readjust R3 (Data 1 - Front Panel) just until AGC has no effect, approximately 8.0 V p-p. Apply 1000 Hz tone at 0 dBm to input of Data 2. Readjust R5 (Data 2 - Front Panel) same as Data 1, approximately 8.0 V p-p. Apply 1000 Hz tone at -40 dBm to Mic input (back panel). Readjust R20 (Mic - Front Panel) same as R3 and R5 (Data 1 and Data 2), approximately 8.0 V p-p. R36 will be adjusted later when unit is mated to it's receiver or to a Moseley 606 Test Fixture and checked for distortion and frequency response.

Option - ID and Battery Backup

The object of this procedure is to test the power fail and restart of the battery backup option. Also, for setting up the identifier board once the audio board has been set up.

1. On the identifier board, remove U2 (82523), also adjust R25 (speed pot-WPM) fully counterclockwise. Adjust R21 to mid-range (identifier output), and on the front panel adjust the Keyer pot fully clockwise.

2. With the battery and the battery jumper (Rear Panel) installed, monitor with a voltmeter pin 10 on the power supply board. Unit plugged in should read +12.00 Vdc. Unplug the unit, volts should drop down to approximately +8.5 Vdc then come back up to approximately +12.5 Vdc. If not, and volts on pin 10 drop down to 0 Vdc, probable cause is U3 (SCL4011BE) on the power supply board.



3. Monitor TP2 (red) on the audio board with a scope probe (2 V/division). After the unit has been unplugged for approximately 30 secons to 1 minute, there should be a sinewave, spproximately 750 Hz, 4.00 to 8.0 V p-p. Adjust R21 for 8.00 V p-p at TP2 (red). Adjust front panel pot (Keyer) for 3.2 V p-p (40% of 8.0 V p-p). Note: 8.00 V p-p ≈ 100% mod.

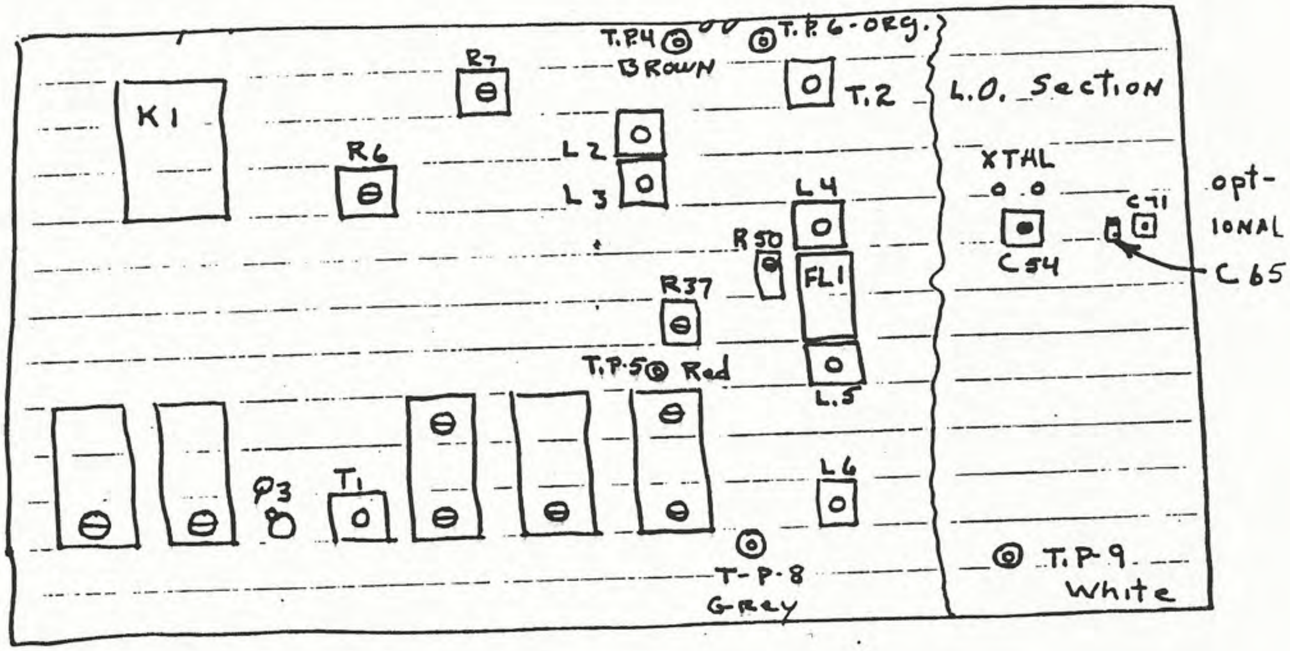
4. Connect TP2 (red) on the audio board to a frequency counter, adjust frequency pot (R_) for 750 Hz. R25 (speed pot-WPM) will be adjusted when unit is mated to it's receiver or when checked with a Moseley 606 Test Fixture (18 words per minute).

5. Reconnect the line cord. Volts at pin 10 (power supply board) should return to +12.00 Vdc. After approximately 1 minute sinewave at TP2 (red audio board) should disappear.

TRL-1 RECEIVER TEST PROCEDURE

1. Plug in Xtal and install heater.

2. Adjust R7 fully clockwise. Adjust R6 to mid-range. Adjust R37 fully clockwise. Adjust C53, C54, C57, C58, C61, C67, C71 one-half turn (LO section). Connect output to distortion analyzer, 1000 ohm load.



3. Monitor TP5 (red) with a voltmeter. Plug unit in, voltage should be approximately +12.75. Adjust R37 for +13.80. Allow a few minutes for heater to warm up.

4. Connect TP9 (white) to a spectrum analyzer. 300 kHz res/2 MHz/division. Reference level ±10 dBm. Adjust C53, C57, C58, C61 and C67 for maximum output (may have to tune C71 to get oscillator started). Connect TP9 to a frequency counter and adjust C54 and C71 to frequency (Fc -10.7). If frequency low (450.010), may need to add optional C65 (10 pf). Disconnect TP9.

5. Connect TP6 (orange) to a signal generator. Inject a CW signal at 10.7 MHz, 0 dBm. Lock frequency so that the generator won't drift.

6. Modulate the signal with a 1000 Hz tone at 1 kHz deviation.

7. Monitor TP4 (brown) with a voltmeter. Voltage should be approximately +4.28. Tune L2 for maximum audio output (may have to adjust R6 counter-clockwise to get output to show up on distortion analyzer). Should tune at the top of the can. Tune L3 for +6.0 Vdc. It should also tune at the top of the can.

8. Readjust R6 for 0 dBm on the distortion analyzer. Check distortion; should be approximately ≤.15% (.20% is usable). Adjust L2 for distortion. Adjust L3 for +6.00 Vdc. Go back and forth to minimize distortion; also check audio output for 0 dBm. Once this is accomplished, disconnect TP6.

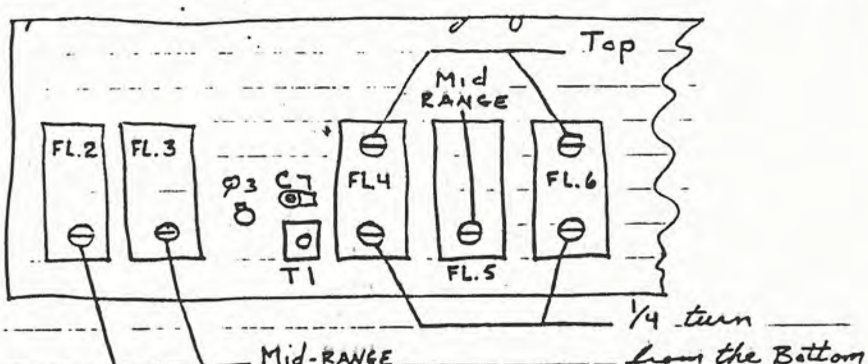
9. Turn signal generator output off. Adjust L4 and L5 to the top of their cans. Adjust R50 to mid-range.

10. Tune T2 and L6 for maximum output noise (approximately +6 dBm to +10 dBm).

11. Connect TP8 (grey) to the signal generator. Inject a CW signal, 10.7 MHz at 0 dBm. Modulate the signal with a 1000 Hz tone, 1 kHz deviation.

12. Check the output level, should be 0 dBm. Check the brown test point (TP4), should be +6.00 Vdc. Check the distortion, should be ≤ 1.00%. Adjust L4, L5 and R50 for minimum distortion. Recheck voltage at TP4 (+6.00 Vdc), readjust if necessary (L3). Recheck output (0 dBm), readjust if necessary (R6). Disconnect TP8.

13. Preset the tuning caps on the filters ans open C7. Remove the slug from T1.



14. Check output noise. Should be +6 to +10 dBm. Take a reference and back off input level by 20 dB on the distortion analyzer. Connect signal generator to the antenna connector of the TRL-1 Receiver. Tune the frequency of the generator to the carrier frequency of the receiver. Lock the frequency so that it won't drift.

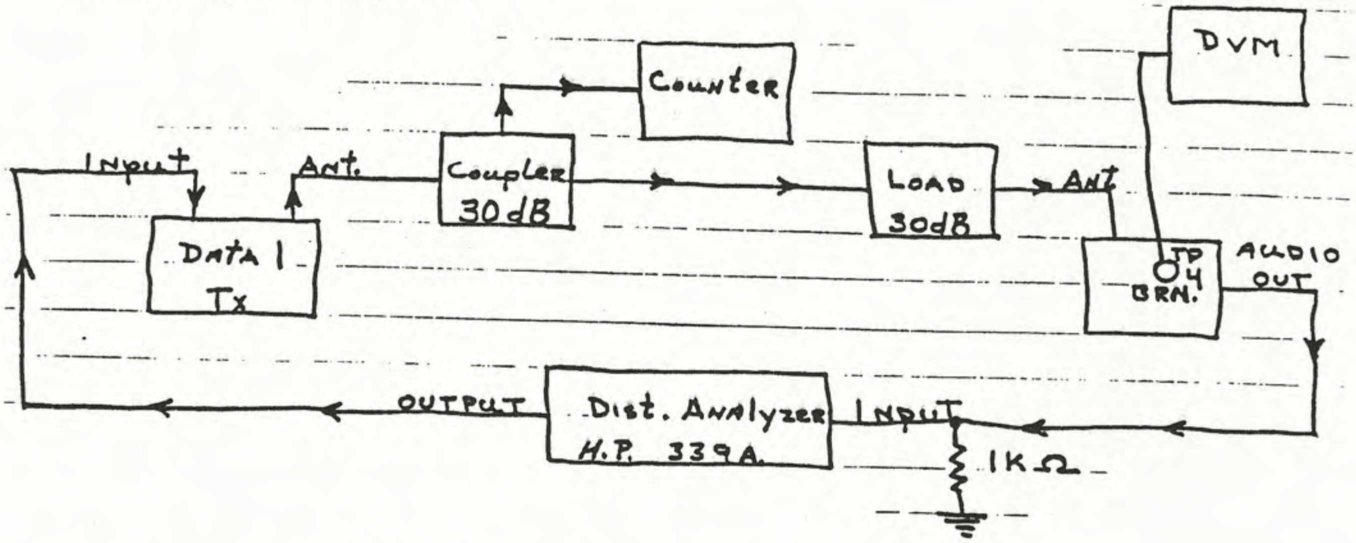
15. Turn down RF level on the signal generator till you get to the -20 dB reference. Tune caps for minimum noise, reduce RF level again and tune again. Keep tuning and reducing till you get 1 μV or less for 20 dB of quieting.

    Note: 20 dB quieting = -20 dB from reference noise level (without RF signal) on distortion analyzer input.

16. Set squelch for 25 dB SNR (R7) approximately 5 μV.

TRL-1 SYSTEM CHECK

1. Set up as in Figure 1.



2. Ensure that the Transmitter is on frequency.

3. Monitor TP4 (brown) on Rx with voltmeter (10 Vdc scale). Adjust C54 (receiver LO frequency adjust) for 6 Vdc at TP4.

4. Apply a 1000 Hz tone at 0 dBm to the transmitter, Data 1 input. Check the output of the receiver on the distortion analyzer. Should be 0 dBm, if not, adjust R36 on the transmitter audio board.

5. Check frequency response. Should be ±3 dB, 20 Hz to 3 kHz. If necessary, adjust C5, C7 and R7. These adjustments also affect frequency and distortion. Only make these adjustments if the response does not meet specs. Keep in mind the voltage on R6 must be ≥ .8 Vdc.

6. Check distortion at 1000 Hz. Make sure that the transmitter is on frequency and the voltage at TP4 is 6.00 Vdc. Now adjust L4, L5, and R50 (one quarter turn at a time) for minimum distortion. Should be less than 2%.

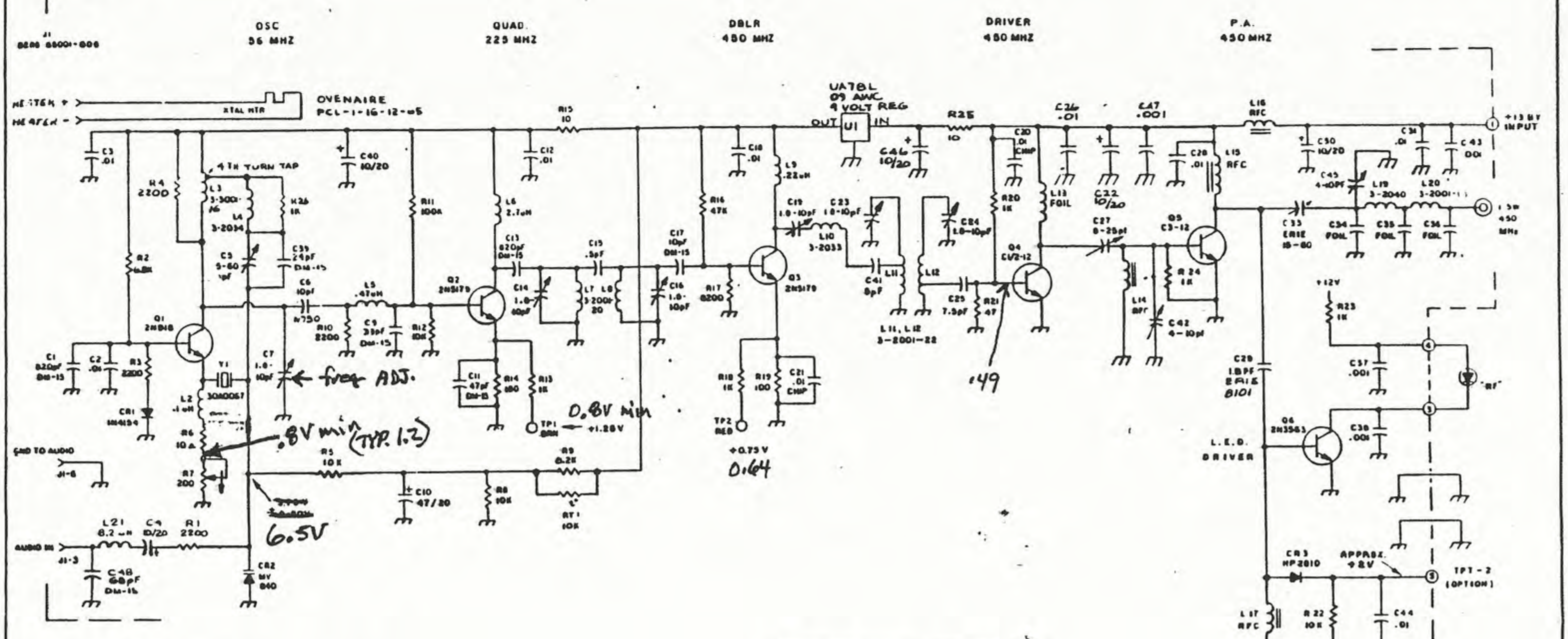
7. Check distortion at 400 Hz and 100 Hz; don't readjust L4, L5 or R50. Distortion should be ≤ 3%.

8. Check SNR. Should be ≥ 45 dB.

Signal Vs Voltage
at TP-7 (GREEN)

3 MV	.872 VDC
1 mV	1.512
300 µV	2.150
150	2.461
100 µV	2.767
50	3.09
30	3.53
~~15 µV~~	~~4.06~~
10 µV	4.37 Max
5 µV	4.38

Green
TP-7



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/4W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 01A5859
3. COMPONENT LAYOUT 2082725.
4. ALL RFC'S ARE VK200.

HIGHEST REFERENCE DESIGNATIONS					
C49	CR3	L21	Q6	R26	TP2

REFERENCE DESIGNATIONS NOT USED
L1, L10, C32

REV	DESCRIPTION
N	C6 WAS DM-15 ECO 4346 4 JAN 85 CH
M	NOTE 3 WAS 2082725
L	C39 WAS 81PF
K	C6, C9, C39 WERE N750 DISC. DELETE C49 ADD R4 R26, RT1
J	ADD: L21, C48, C49 C9 WAS N750 R2 WAS 10K R4 WAS 8.2K C39 WAS 68PF R7 WAS DIST. ADJ. ECO 3578 CH
H	CHG REF C27 NEW VALUES
G	[illegible]
F	[illegible]
E	[illegible]
D	CHGD PER ECO 1701
C	RELEASED FOR PROD
B	[illegible]
A	[illegible]

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

SCHEMATIC
POWER AMP & VCXO
TRL-1

C7149 N