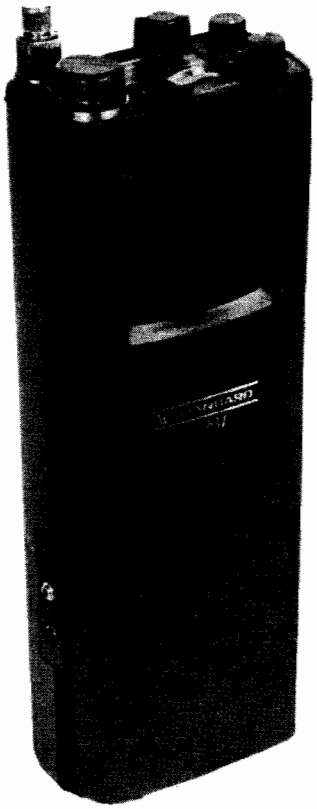
231

C146A

PRELIMINARY INSTRUCTION MANUAL



VHF/FM

AMATEUR

HANDHELD

TRANSCEIVER

Standard Communications Corp.

9/76

370856004

Limited Warranty

STANDARD COMMUNICATIONS CORP. (SCC) warrants each new radio product manufactured and/or supplied by it to be free from defects in material or workmanship under conditions of normal use and service. The SCC obligation under this warranty is limited to repairing or replacing, at its option, the radio product or part(s) therein, which upon examination by SCC are found to be defective or not up to the factory specifications, and contingent upon return of the radio product (transportation prepaid) to an authorized SCC FACTORY SERVICE CENTER.

SCC shall not be liable for any damages, consequential or otherwise, resulting from the use or operation of this radio product and makes no other warranty(s) either expressed or implied on this product, including any warranty of merchantability.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring (not our own), improper installation, or to use in violation of instructions furnished by us, nor extended to units which have been repaired or altered outside of our factory or authorized service center, not to cases where the equipment serial number has been removed, defaced, or changed, nor to accessories used therewith not of our own manufacture.

STANDARD COMMUNICATIONS CORP.

CUSTOMER RECORD

Purchase Date (Warranty Effectivity Date) _____

Purchase From _____

_____

Equipment Model No. _____

Equipment Serial No. _____

Warranty Serial No. _____

CONTENTS

GENERAL INFORMATION

INSPECTION OF EQUIPMENT

Your STANDARD COMMUNICATIONS 146A amateur handheld transceiver has been thoroughly tested prior to shipment and was delivered to the transportation company securely packed. Upon acceptance, they assumed responsibility for its safe arrival.

If possible, the equipment and its accessories should be unpacked and examined immediately upon receipt for any damage (or shortage) that may have occurred in transit. Any damage (or shortage) should be noted on the freight bill or delivery receipt and countersigned by the transportation company agent (the truck driver can act as agent). Where the equipment cannot be unpacked upon receipt, and subsequent damage (or shortage) is discovered, keep all packing materials and request the transportation company to inspect the shipment and give you a signed inspection report stating the condition. This must be done within 15 days of delivery.

Failure to observe these procedures will make it difficult, or impossible, to establish the transportation company's liability for claim purposes.

SERVICE

Your STANDARD COMMUNICATIONS 146A amateur handheld transceiver is warranted against defects for 180 days. The warranty card must be filled out and signed by the dealer at the time of purchase and returned within 10 days for the warranty to be in effect. If your set is out of warranty, or if you elect to have repairs made in the field (not covered by factory warranty) rather than returning it to the factory, contact your STANDARD COMMUNICATIONS dealer who will recommend a qualified repair facility to do the work.

DESCRIPTION

The STANDARD COMMUNICATIONS CORP. Model 146A VHF/FM Amateur Handheld Transceiver provides up to five channel operation within a 2 MHz portion of the 143 to 149 MHz frequency range. However, should operation be desired on frequencies outside of this bandwidth (i.e., for "MARS" operation) it may be possible without retuning, although a drop in sensitivity and/or output may occur. The Model 146A is completely solid-state and is designed to operate from a 12-volt DC power source (nominally an internal rechargeable 12-volt Ni-Cad battery) with an RF power output of two watts. Provision is included to install the optional TN3 Private Channel for activation of continuous tone coded squelched systems (CTCSS).

SPECIFICATIONS

All performance specifications are nominal unless otherwise specified.

General

FREQUENCY RANGE:	143 to 149 MHz
NUMBER OF CHANNELS:	5
CHANNEL SPREAD:	2 MHz Max.
INPUT VOLTAGE (NEGATIVE GROUND):	12.5V DC ± 20%
CIRCUITY:	All solid state
CURRENT DRAIN:	15ma squelched max., 100ma receive max., 0.62A transmit max.
MICROPHONE:	Internal dynamic type
DIMENSIONS:	9"h x 3"w x 1 5/8"d
WEIGHT:	32 oz. max. (including batteries)
SUPPLIED WITH 2 CHANNELS:	146.94Tx/Rx (national calling channel) 146.34Tx/146.94 Rx (repeater channel)
SPEAKER:	Internal 2" dynamic

Transmitter

POWER OUTPUT (INTO 50 OHMS):	2 Watts
SPURIOUS AND HARMONICS ATTENUATION:	50 dB Min.
HUM AND NOISE LEVEL ATTENUATION:	40 dB Min.
AUDIO RESPONSE:	Meets EIA specifications
AUDIO DISTORTION:	6% Max.
FREQUENCY STABILITY:	0.001% (-10° to + 50°C)
MODULATION:	16F3 ± 5 KHz

Receiver

SENSITIVITY (20 dB QUIETING):	0.4uV
SQUELCH SENSITIVITY (THRESHOLD):	0.2uV
SQUELCH TYPE:	Carrier
MODULATION ACCEPTANCE BANDWIDTH:	±8 KHz Min.
SELECTIVITY (20dB QUIETING 30 KHz Ch):	60 dB Min.
SPURIOUS AND IMAGE ATTENUATION:	55 dB Min.
AUDIO POWER OUTPUT:	0.3 Watts at 10% max. dist.
AUDIO RESPONSE:	Meets EIA specifications
FREQUENCY STABILITY:	0.001% (-10° to +50°C)
INTERMODULATION SPURIOUS ATTENUATION:	40 dB Min.

Optional TN-9 Private Channel

TONE DEVIATION:	700 Hz Min (using 77 Hz reed)
TONE SENSITIVITY:	-3 dB Max. (using 77 Hz reed, 300 Hz deviation)

ACCESSORIES

The following optional accessories for your C146A Transceiver are available at all SCC Dealers.

AT12	ANTENNA, flexible steel whip for VHF application.
AT19	ANTENNA, flexible rubber for VHF application.
AT21	ANTENNA, VHF/UHF, with gutter clip for mobile installation. Includes 8' cable with connector.
USA-2	BATTERY CHARGER, desk type, provides two charge rates and includes provision for base station antenna connection. Operates on 120 VAC/60 cycle power.
12/120-6	BATTERY CHARGER, wall mounted. Operates on 120 VAC/60 cycle power.
B0903002	BATTERY, NI-CAD, "AA" size cell, 1.2 volts, rechargeable. (Ten required per transceiver.)
BP-2	BATTERY PACK, NI-CAD 12 VDC, completely encapsulated (One required per transceiver).

NOTE

See your SCC Dealer for Rapid Charge and Alkaline Battery Packs with the new "Drop-In" feature.

UAD	CABLE ADAPTOR, adapts external antenna to H/H transceiver.
CMA	POWER ADAPTOR, adapts the H/H transceiver to mobile application using external power and antenna inputs.
A00416008	KIT, Microphone Clip Kit contains hardware to mount external mike on LCC-2 carrying case.
PT3644	CARRYING CASE, leather.
LCC-2 & 3	CARRYING CASE, leather, heavy-duty.
MP08	MICROPHONE, miniature external with coiled extension cord.
MP10	MICROPHONE/SPEAKER, external with coiled extension cord.
PE-1	TWO-TONE PAGING ENCODER.
TN-5	TONE BURST ENCODER.
TN-9	PRIVATE CHANNEL TONE BOARD, CTCSS encoder/decoder.
TN50	TWO-TONE SQUELCH DECODER.
TT-1	TOUCH TONE ENCODER.

AMATEUR FM COMMUNICATIONS

With your purchase of the all new 146A two meter FM transceiver, you have just entered the fascinating world of amateur FM - the Fun Mode.

If you have not experienced FM operation before, you will encounter a unique mode of amateur radio communications. If you are familiar with conventional high-frequency SSB or CW operation, you will have to re-orient yourself to FM.

Generally, your dealer or local FM'ers will know what the popular frequencies are in your area. One of the popular national simplex frequencies is 146.940 MHz ("nine-four"), unless there is a repeater output on this frequency in your area. The most popular national repeater channel is 146.340 transmit/146.940 receive. Both 146.94 simplex and the 34/94 repeater pair are included in your 146A. Other popular repeater pairs include:

146.16 transmit/146.76 receive
146.28 transmit/146.88 receive

In addition, we recommend that you install 146.520 MHz simplex, as it is the up-and-coming alternate national calling frequency.

Then, before you go "on-the-air", LISTEN TO THE CHANNELS IN USE FIRST to determine the accepted operating procedures on the frequency, or repeater, you plan to use.

Procedures - although very simple - vary from area to area. FM is a "break-in/break-out" operation with SHORT transmissions. Since the channels are shared by many people, this is very important. Many repeaters limit your transmission through the use of a "Time-Out" timer. These timers vary in length - generally 1 to 3 minutes.

It is not necessary, nor desirable, to call "CQ" as you would on other bands, since FM is channelized, and thus all those on a given channel are monitoring simultaneously. A simple "WA6XYZ 10-8" or "This is WA6XYZ on channel" will elicit a response from anyone who desires to talk. Some areas use the "10" codes or "Q" signals; however, you will find that if you talk as you would in a normal conversation, you will soon adapt to the free-and-easy manner of FM - the Fun Mode.

Repeaters are sponsored by either an individual or a club. Where an individual is responsible, it is generally advisable to obtain permission before using the system. A great number of repeaters today are sponsored by radio clubs or associations. Since repeaters are costly to build and require maintenance, many clubs require membership or support for their project. Since this responsibility is spread over many users, the individual user cost is negligible. Visit your local club, and you will find those with a similar interest eager to help.

We hope that this gets you off on the right foot. If you have any questions, just drop a note to: Standard Communications Corp., Attention: Amateur Radio Division, P. O. BOX 92151, Los Angeles, California, 90009.

OPERATION

GENERAL

All controls (except the Push-to-Talk button) are located on the top of the case. These consist of the Channel (CH), Volume/Off (VOL/OFF) control, and the Squelch/PC (SQL) control.

If the optional TN3 Private Channel board has been installed in your 146A, the effect will be to provide automatic continuous squelch until a signal containing a specific sub-audible tone is received. Thus, only transmissions from those within your system who also have the Private Channel (with the same tone-coding) will activate your receiver. When transmitting, the specific sub-audible tone is generated by the Private Channel circuit and supplied to the transmitted carrier as modulation, so that only the desired receiver(s) will be activated.

OPERATING PROCEDURES

Handheld Operation - Place the 146A transceiver in operation as follows:

(1) Extend the collapsible whip antenna, or install a SCC P/N AT12 or AT19 flexible whip antenna.

> NOTE:
>
> To install the AT12 or AT19 antennas, unscrew and remove the collapsible whip and install the appropriate flexible antenna in its place.

(2) Rotate the VOL/OFF control clockwise until a "click" is heard.

(3) Rotate the SQL control full counter-clockwise, but not to the point where a "click" is heard.

(4) Adjust the VOL control for the desired listening level (background noise, or a station if one is transmitting).

(5) Set the CH switch to the desired channel.

(6) If Private Channel operation is desired (TN3 installed), rotate the SQL control fully counter-clockwise until a "click" is heard: For normal operation (or if no TN3 board is installed), adjust the SQL control clockwise until the background noise just disappears.

> NOTE:
>
> Do not adjust the SQL control past the point of receiver silencing or the sensitivity will be degraded for weak signals.

(7) When ready to transmit, press the push-to-talk button and hold it. Speak slowly and clearly in a normal conversational level into the speaker grill: Release the button to listen.

FUNCTIONS OF 146A CONTROLS AND CONNECTIONS

(1) Volume/Off Control (VOL/OFF) - Applies power to set when rotated clockwise past OFF position; adjusts audio output level.

(2) Squelch Control (SQL) - Adjusts threshold point for "noise actuated" squelch circuit.

(3) Panel Meter - Indicates battery voltage in the "transmit" mode, and relative signal strength in the "receive" mode.

(4) Antenna Receptacle (ANT) - Provides connection to auxillary antenna.

(5) Push-To-Talk Switch (on side) - Switch unit to "transmit" mode when depressed.

(6) Battery Charger Contacts (on bottom) - Provide connection of charging contacts when unit is placed into handheld charger (Model SR-CSA or SC-UHHC-1).

(7) Auxillary Power Input Receptacle (PWR) - Allows connection of power source (12. 5 volt) other than internal battery or handheld charger. Circuitry allows charging of internal batteries.

(8) Earplug Receptacle (EAR) - For semi-private conversations, or listening ease in noisy environments.

(9) Microphone Receptacle - Allows separate microphone to be utilized for ease when unit is worn on side or placed in handheld charger.

(10) Collapsable Antenna - Removable for utilization of other special purpose antennas.

(11) Channel Selector Switch - Selects desired operating channel.

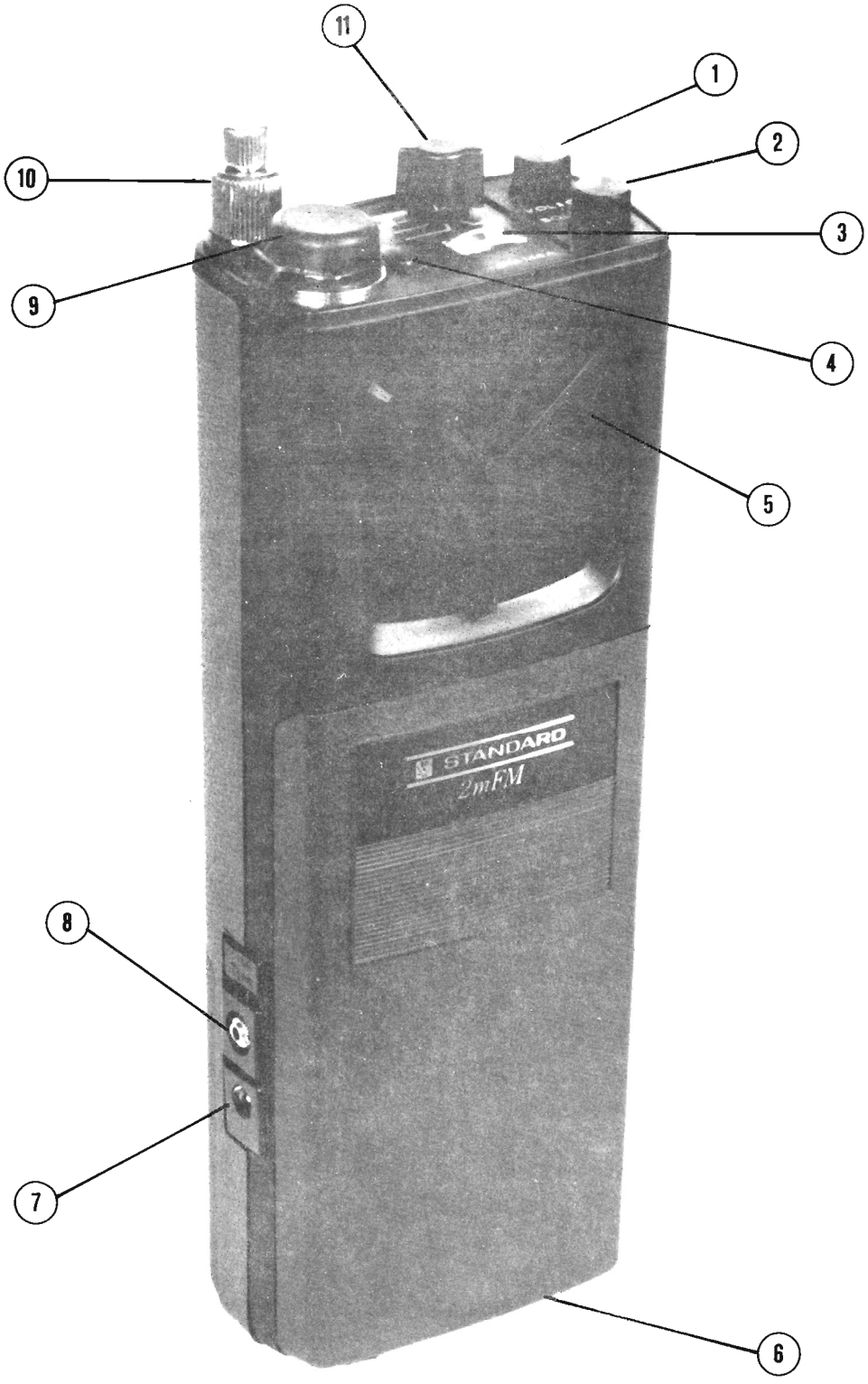


Figure 1: C146A CONTROLS AND CONNECTIONS

(8) If using the optional MP08 hand microphone (or MP10 speaker/microphone), remove the protective cap on the top of the case and install the microphone: Transmit as in step (7), but use the push-to-talk button on the microphone instead.

Base Operation - For base operation with the Model SA Desk Top Charger/AC Adapter, install the transceiver in the charger until it bottoms and connect to an appropriate AC power source: Install the interconnecting cable to the ANT receptacle on the 146A and connect the 50-ohm transmission line to the UHF connector on the Model SA. Operate in accordance with steps (2) thru (8) of "Handheld Operation".

Mobile Operation - For mobile operation with the Model MA Mobile Adapter, connect the power cable from the adapter to the PWR receptacle on the side of the case and connect the antenna cable to the ANT receptacle on the top: Connect the 50-ohm antenna transmission line to the UHF connector on the Model MA.

CAUTION:

IF OPERATING MOBILE WITHOUT THE MODEL MA MOBILE ADAPTER, INSERT A SUFFICIENT NUMBER OF POWER DIODES (1 AMP RATING) IN SERIES WITH THE POWER INPUT TO REDUCE THE DC INPUT TO THE 146A TO 15V DC WHEN THE ALTERNATOR/GENERATOR IS DEVELOPING MAXIMUM VOLTAGE. ALSO, INSERT A SCC P/N LF06 LINE FILTER (OR EQUIVALENT) IN SERIES WITH THE POWER INPUT TO REDUCE ALTERNATOR "WHINE".

BATTERY REPLACEMENT AND CHARGING

GENERAL - The Model 146A is designed to operate from an internal 12-volt battery source. The recommended power source is 10 "AA" size 1.2-volt rechargeable Ni-Cad batteries (SCC P/N B0903002). However, the transceiver may also be operated with 8 non-rechargeable "AA" size batteries if desired (Alkaline type preferable for longer service). Remove the battery pack from the transceiver if it is to be stored for a prolonged period.

BATTERY REPLACEMENT - To install batteries in the 146A, proceed as follows (refer to Fig. 2):

(1) Press down on the indention (OPEN) on the rear of the case and slide the battery compartment cover downward in the direction of the arrow: Remove the cover.

(2) Lift out the battery pack and disconnect the cable from the transceiver.

(3) Install the new batteries in the battery pack, observing the polarity markings.

> NOTE:
>
> When operating with 1.5-volt batteries the two dummy batteries (SCC P/N 3653121112) must be installed in the battery pack to complete the circuit.

(4) Reconnect the cable to the transceiver and replace the battery pack: Replace the battery compartment cover and latch in place.

BATTERY CHARGING - The operational characteristics of a Ni-Cad battery under load are different than those of a conventional Alkaline or lead-acid type The load voltage will be approximately the same until the battery approached complete discharge. At this time, there will be a marked decrease in the load voltage and the discharged condition will be reached abruptly. Therefore, it is difficult to determine the state of charge of a Ni-Cad battery with a voltmeter.

The battery may be stored in any condition of charge or discharge. No detrimental effects will occur. However, for storage periods in excess of six months or so, it is recommended that the battery be in a discharged condition.

If the battery is to be used after a prolonged storage period it should be initially charged for 14 to 16 hours at the full charging rate, then placed on trickle charge until need for use.

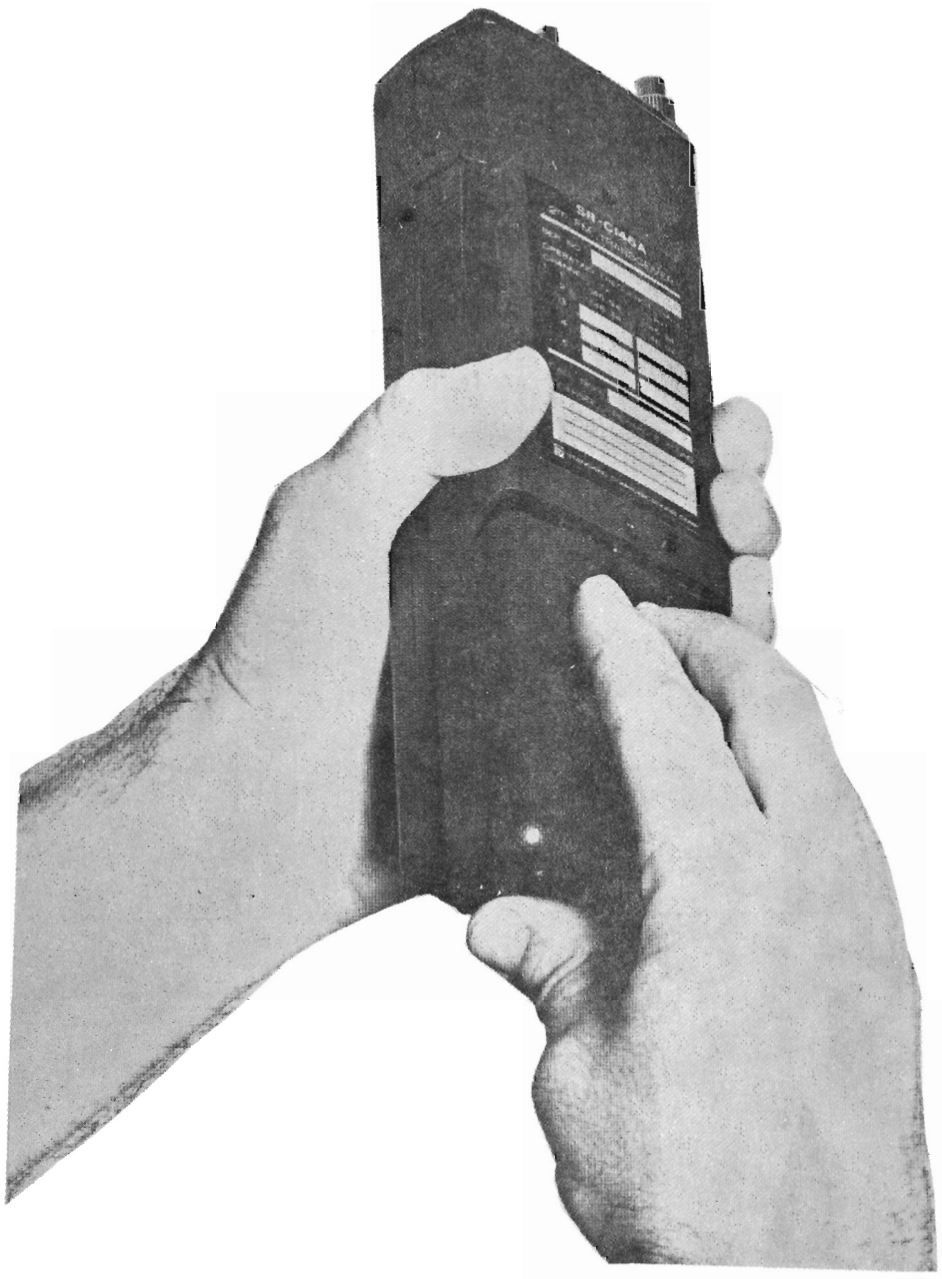
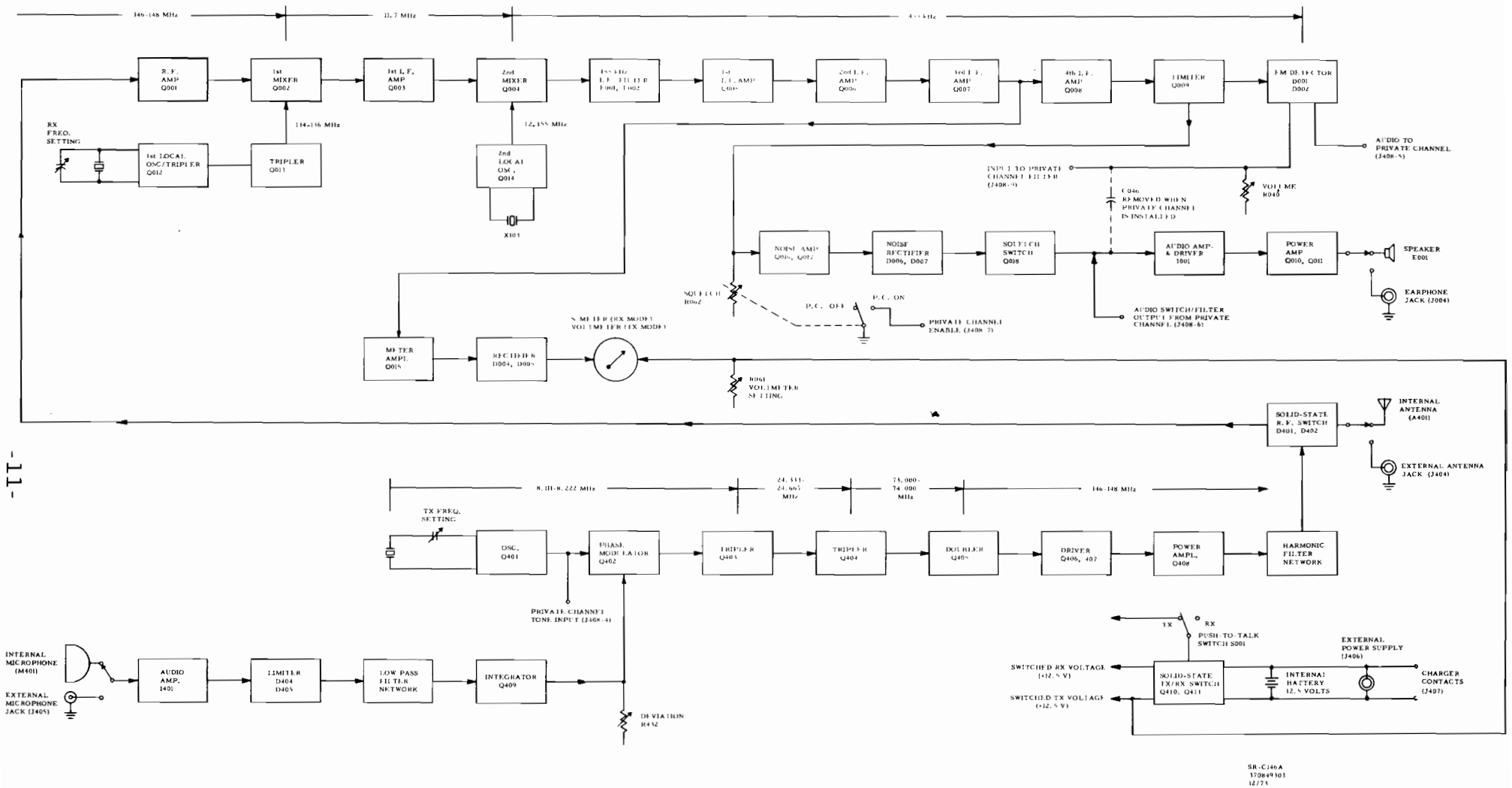


Figure 2: REMOVAL OF BATTERY COVER



C146A BLOCK DIAGRAM

THEORY OF OPERATION

TRANSMITTER

Refer to the Block Diagram and Schematic Diagram for the following description.

The oscillator, Q401, is crystal controlled and generates the initial RF signal in the frequency range of 8.111 to 8.222 MHz. The RF signal is then applied to the plase modulator, Q402, together with the audio modulating signal. The audio signal varies the internal and input capacitance of Q402, in turn causing the RF signal to be phase shifted at the audio rate.

The angular phase shift produced by Q402 without distortion is relatively small. Therefore, the oscillator frequency is multiplied 18 times to obtain the desired deviation at the output frequency of 140 to 148 MHz.

Two tripler stages, Q403 and Q404, and one doubler, Q405, provide the necessary 18 times frequency multiplication. The drivers, Q406 and Q407, then amplify the 146 to 148 MHz signal prior to application to the RF power amplifier. The RF power amplifier, Q408, develops the output signal applied to a tri-filar wound broadband output circuit and a two-section pi-network. The pi-network matches the output impedance of Q408 to the 50-ohm antenna, through diode D401. The diode is forward biased in the "transmit" mode, functioning as a solid-state antenna relay.

The transmitter contains an instantaneous deviation control (IDC) circuit to prevent a higher than normal output level from the microphone from causing overdeviation in the output signal.

Under normal conditions, the speech signal from the built-in microphone is amplified by integrated circuit 1401 and a 6 dB/octave pre-emphasis is applied. The pre-emphasized signal is then applied through a peak limiter, D404, and D405, and low-pass filter to the integrator, Q409. At normal, or lower microphone output levels, the audio signal is not limited, and Q409 applies a 6 dB/octave de-emphasis to offset the pre-emphasis from the speech amplifier.

This results in a "flat" output in the audio signal applied to the phase modulator, Q402. The phase modulator in turn has an inherent 6 dB/octave pre-emphasis characteristic, resulting in a 6 dB/octave pre-emphasized output modulation from the transmitter.

When the microphone output level increases to a point where overdeviation could occur the positive and negative peaks of the waveform are clipped in the limiter, D404 and D405. This produces an essentially square wave constant amplitude output, removing the 6 dB/octave pre-emphasis applied to the signal in the amplifier. The limited signal is applied through the low-pass filter, which reshapes the audio waveform to the integrator. The integrator applies the 6 dB/octave de-emphasis which then offsets the inherent 6 dB/octave pre-emphasis of the phase modulator. This results in a transmitter output frequency deviation that is essentially flat over the range of modulating frequencies.

RECEIVER

The 146 to 148 MHz input signal is obtained at the junction of L414 and C443 in the transmitter, through C444. In the "transmit" mode D402 conducts to protect the receiver input from overload. The input signal is amplifier by a MOSFET RF stage, Q001, and applied to the first mixer, Q002. The MOSFET RF stage minimizes spurious and intermodulation responses.

The input signal is heterodyned with the output of the first local oscillator by Q002 and converted to the first IF, 11.7 MHz. The first local oscillator injection frequency is 11.7 MHz below the input signal frequency in all cases. The fundamental crystal frequency, however, is multiplied nine times to reach the injection frequency. The actual crystal operating frequency is in the 15 MHz range, and is determined from the equation:

$$f_c = \frac{f_i - 11.7}{9}$$

where: f_c = fundamental crystal frequency in MHz
f_i = receiver input signal frequency in MHz

The first local oscillator circuit consists of the crystal oscillator/tripler, Q012, and a second tripler stage, Q013. The resulting 11.7 MHz signal from Q002 is then amplified by Q003 and applied to the second mixer, Q004, where it is heterodyned with the 12.155 MHz output of the second local oscillator, Q014, and converted to the second IF, 455 kHz.

> NOTE:
>
> If interference is noted from stations operating 910 kHz above the input signal frequency, the second local oscillator crystal frequency can be changed to 11.245 MHz. This means the second IF image 1.82 MHz lower in frequency. To obtain the proper crystal, order SCC P/N XA1211245.

Two cascaded ceramic filters, F001 and F002, provide the selectivity for the 455 kHz IF, and the signal is amflified by four cascade stages, Q005 thru Q008, and applied to the limiter, Q009, and FM detector, D001 and D002. The limiter removes any vestige of amplitude modulation from the signal, while the FM detector functions to produce an audio output in response to the corresponding frequency (or phase) shift in the 455 kHz IF signal. The detector output is then applied to the integrated circuit audio amplifier, I001. The output of I001 is then applied to the built-in speaker, and the EAR and external MIC receptacles.

A "noise-actuated" squelch circuit is included to "quiet" the receiver when no carrier is present. This is accomplished by applying the collector detected AM (noise) signal from Q009 through two stages of noise amplification, Q016 and Q017, and detecting the noise component with D006 and D007. This produces a DC voltage that controls the squelch amplifier, Q018, which in turn produces a DC voltage that cuts off the audio amplifier, I001, until a signal overcomes the "noise" and "opens" the audio channel.

METER CIRCUIT

The relative received signal strength is indicated on the panel meter, M001, by sampling the 455 kHz signal at the output of Q007. This signal is amplified by Q015 and detected by D004 and D005. In the "transmit" mode M001 indicates the battery voltage.

POWER SWITCHING CIRCUIT

The +12V DC input power is filtered and applied through the switch (located on the VOL control) to the input buss. Diode D003 is connected across the power input to shunt the input voltage to ground if the power source (battery or external source) is connected with polarity reversed. Diode D010 prevents the battery from discharging back into the charger if it is shut off while the transceiver is still installed.

The +12V DC on the input buss is applied to two switching transistors, Q410 and Q411. The switching transistors function as series pass elements, with Q410 applying operating voltage to the receiver circuitry, and Q411 applying operating voltage to the transmitter circuitry.

PRIVATE CHANNEL

The optional TN3 Private Channel provides a tone-coded squelch function when connected to J408 in the transceiver. A DC switch "mutes" the receiver audio amplifier until a signal is received containing the specific sub-audible tone of the resonant reed in the TN3. This tone causes the DC switch to open, thus activating the audio amplifier. The same circuit is used to generate the sub-audible tone when transmitting. Placing the transceiver in the "transmit" mode applies the sub-audible tone as modulation on the transmitted carrier, to activate the desired receiver(s).

MAINTENANCE

GENERAL

The inherent lift of solid-state components used in the 146A will allow many years of continuous use without failure, provided the equipment is treated with reasonable care. Other than the routine maintenance procedures and precautions described in this section, it is not recommended that alignment and/or adjustments be performed unless degraded performance characteristics are noted.

The transceiver has been carefully aligned at the factory, using specialized test equipment that is not normally available to the average amateur owner. Therefore, in the event difficulty occurs, and your unit is out of warranty, or if you elect to have repairs made in the field (not covered by factory warranty) rather than returning it to the factory, a qualified service facility with the proper test instrumentation and technical capabilities should be engaged. An authorized STANDARD COMMUNICATIONS service dealer, or the factory should perform any service work if possible.

PRECAUTIONS

Certain precautions should be observed to prevent damage to the transceiver. The following abnormal conditions should be avoided to realize the maximum inherent life capabilities.

Transmitter Load - Never intentionally "key" the transmitter unless an antenna or suitable dummy load is connected to the ANT receptacle. Failure to observe this precaution may result in serious damage to the RF power amplifier transistors.

Proper Supply Voltage - Avoid excessive supply voltage when operating from an external source (see CAUTION following mobile operation). The maximum DC voltage should not exceed 15V DC for any appreciable period, nor should the unit be operated when the supply voltage drops below 11V DC. Check your voltage with the engine running fast enough for the ammeter to indicate "charge", and with the transmitter "keyed" to provide maximum load.

Exposure to Water - Avoid direct exposure to water. If the unit is accidentally subjected to heavy splash or immersion, permanent damage may be avoided by opening the case and drying in direct sunlight, or the warmth of a heated room. A drying period of 4 hours should be sufficient.

If exposure was to salt water, carefully flush with clean, fresh water before drying, then inspect for signs of salt deposits.

> CAUTION:
>
> AVOID WATER CONTACT WITH THE INTERNAL LOUDSPEAKER; THE CONE WILL BE PERMANENTLY DAMAGED.

ROUTINE MAINTENANCE

The exterior of the transceiver should be cleaned periodically to preserve its appearance. Use a cloth moistened with water and household detergent, finishing with an overall wipe with a cloth moistened with alcohol. If the unit has been used in a dusty environment, the interior should be cleaned with a low-pressure air hose, or vacuum cleaner. Excessive dirt or other soil should be removed from the interior with a soft brush and alcohol. Be sure and dry thoroughly before operating.

ROUTINE PERFORMANCE CHECKS

The transmitter RF output, and receiver 20 dB quieting and squelch sensitivities should be checked periodically to assure proper operation. These may be checked as follows:

> NOTE:
>
> Performance checks should be made with a fully charged set of batteries installed, or with an external source of 13.8V DC (under load).

Transmitter - Connect a suitable RF power meter/dummy load to the ANT receptacle and "key" the transmitter for each position of the Channel Selector switch. The power meter should indicate a minimum of 2 watts out on each channel.

Receiver - The receiver 20 dB quieting and squelch sensitivity measurements require use of an accurately calibrated FM signal generator covering the 143 to 149 MHz range, and an AC VTVM. These measurements should be made for all channels.

The 20 dB quieting sensitivity is measured by connecting the VTVM at the external SPK receptacle and noting the "noise voltage" output on the VTVM (no signal input and the SQL control adjusted for maximum noise). The unmodulated signal generator output is then applied at the ANT receptacle, set for the proper input frequency, and the output amplitude adjusted until the "noise voltage" on the VTVM drops to 1/10 of the previous reading (20 dB decrease). The signal generator output amplitude is then the 20 dB quieting sensitivity: The signal generator output should be 0.4 uV maximum.

The squelch sensitivity is measured by adjusting the SQL control (with no signal input) until the speaker "noise" just cuts out (squelch threshold), then applying signal and adjusting the signal generator output amplitude until speaker "noise" is heard. The signal generator output amplitude should be 0.2 uV maximum.

TROUBLESHOOTING

Conventional signal tracing techniques can be utilized to locate a fault within the 146A. The first step is to isolate the fault to a particular circuit within the transmitter or receiver. An oscilloscope provides the simplest method of such signal tracing, as a circuit malfunction will be immediately apparent.

Once the malfunction has been isolated to a particular circuit, voltage and resistance measurements may be used to isolate a defective component. Reference to the schematic diagram will assist in this operation. The diagram shows the circuit on the circuit board, together with the associated peripheral components (controls, crystals, etc.) required to illustrate the complete signal path through the circuit. Appropriate voltage measurements are also shown on the diagram to aid in locating a malfunctioning circuit or component.

ADJUSTMENTS AND ALIGNMENT

All adjustments and alignment procedures are conducted at 12.5 volts DC input power (under load) unless otherwise directed.

RECOMMENDED TEST EQUIPMENT AND TOOLS

(a) FM Communications Monitor - Cushman Electronics Model CE-3.
(b) FM signal generator - Motorola Model T1035A.
(c) Frequency counter - General Radio Model 1192-B.
(d) RF wattmeter/50-ohm dummy load (5 watts minimum) - Motorola Model 6154.
(e) VTVM-Hewlett-Packard Model 427A with 11096A probe.
(f) VOM - Simpson Model 260.
(g) Slug adjustment tool - SCC P/N AT-1.
(h) Slug adjustment tool - SCC P/N AT-3.
(i) Trimmer adjustment tool - SCC P/N AT-2.
(j) Plastic tweezer - SCC P/N PT-1.
(k) Antenna Adapter - SCC P/N SR-CAD.

ADJUSTMENTS

Adjustments should be limited to setting the detector "crossover" point in the receiver, "netting" the transmitter and receiver crystals to frequency, and setting the deviation.

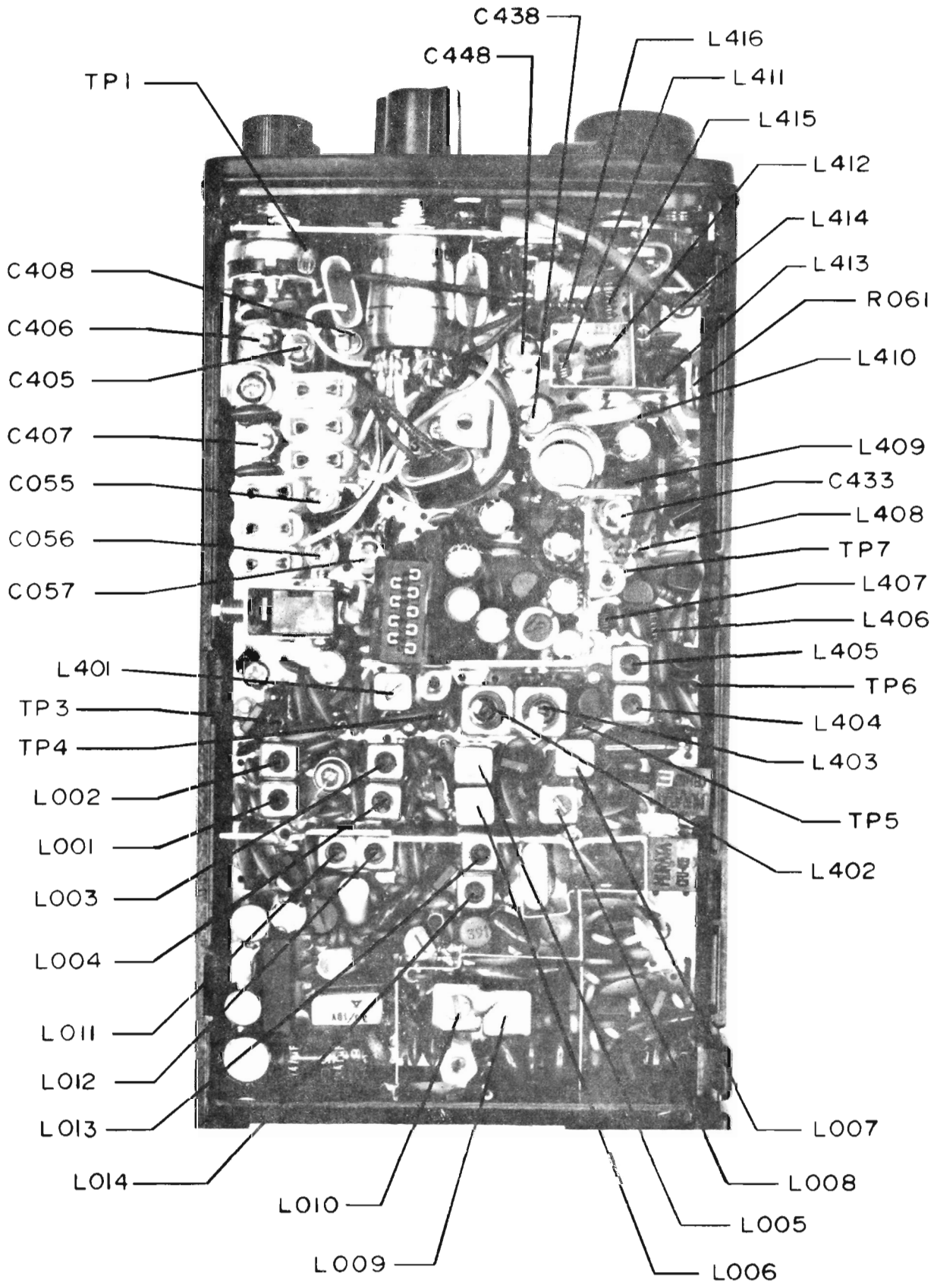
Setting "Crossover" Point - Set the detector "crossover" point as follows:

(1) Inject a 100 uV 455 kHz (±10Hz) signal through a 0.01 uf capacitor to the receiver second mixer stage at the collector of Q004.

(2) Connect a 25-0-25 uA DC meter between TP1 and ground (TP1 is the unconnected lead between the VOL control and the bracket).

(3) Using an SCC P/N AT-1 alignment tool, carefully adjust the cores in L009 (pink) and L010 (blue) to obtain a "zero" indication on the meter: These are the two shielded inductors at the bottom end of the circuit board.

ALIGNMENT REFERENCE POINTS



8-73
SR-C146A

CAUTION:

EXERCISE EXTREME CARE IN ADJUSTING THE INDUCTORS. THE CORES ARE BRITTLE, AND ARE SECURED WITH PAINT. APPLY A SMALL DROP OF ACETONE TO SOFTEN THE PAINT PRIOR TO ADJUSTING.

Netting Crystals - Net the transmitter and receiver crystals as follows:

(1) Apply the output of a precision frequency meter (0, 0001% maximum tolerance) to the ANT receptacle.

(2) Adjust the frequency meter to provide a signal at the exact frequency for the receive channel to be "netted".

(3) Using a Walsco No. 2525 (SCC P/N AT-2) alignment tool, adjust the proper trimmer capacitor for the crystal to be "netted" to obtain a "zero" indication on a 25-0-25 uA DC meter connected between TP1 and ground.

(4) Disconnect the frequency meter from the ANT receptacle, and connect a 50-ohm dummy load in its place.

(5) Adjust the frequency meter to indicate the exact frequency for the transmit channel to be "netted".

(6) "Key" the transceiver and adjust the proper trimmer capacitor for the crystal to be "netted" until the correct frequency is indicated on the frequency meter.

Setting Deviation - The deviation is factory set for a nominal ±7 kHz. Should you wish to change it to a value other than this (maximum ±15 kHz) the following procedure should be as follows:

(1) Locate the "deviation potentiometer", R432, and apply a drop of acetone to loosen the paint at the factory sealed setting.

(2) Using a suitable deviation scope or meter, apply a 1000 Hz tone (or whistle into the microphone), and adjust R432 for the desired setting for "speak" deviation.

(3) Apply a drop of paint or Red Glyptol to the control at that point to secure the setting.

ALIGNMENT PROCEDURE

Your 146A transceiver has been factory aligned for operation between 146 and 148 MHz to provide optimum performance within the portion of the band where most FM activity is found. If it is desired to shift the optimum operating range higher or lower than this portion, or if realignment of the RF circuits is required due to less of sensitivity, or power output, as indicated by the "Routine Performance Checks", it is recommended that this be done at the factory, or by an

authorized STANDARD COMMUNICATIONS CORP. service dealer.

If it is impractical to return the unit to the factory, or to a service dealer, realignment may be performed as follows:

(1) Connect the RF probe of a VTVM between TP2 and ground (TP2 is located between L012 and L013). Set the VTVM for 5.0 volts full scale range.

(2) Set the CH switch for a receive frequency in the middle of the overall range and adjust the cores in L011 thru L014 for maximum response on the VTVM.

(3) Disconnect the RF probe from TP2 and connect it between the collector of Q006 and ground. Connect the RF output of an RF signal generator to the ANT receptacle.

(4) Adjust the signal generator for approximately 10 uV output at the frequency used in step (2) and sequentially adjust the cores in L001 thru L008 for maximum response on the VTVM.

(5) Recheck to verify the 20 dB quieting and squelch sensitivities as described in "Routine Performance Checks".

(6) Disconnect the signal generator from the ANT receptacle and connect an RF power meter/dummy load in its place. Using SCC P/N AT-1 and AT-2 alignment tools, and an SCC P/N PT-1 plastic tweezer, adjust the transmitter RF stages in the following sequence; keying the transmitter and making the adjustments in each step to obtain maximum response on the appropriate meter.

(7) Connect the DC probe of the VTVM between TP5 and ground (TP5 is located between L403 and L404): Set the VTVM for 5.0 volts full scale range and sequentially adjust the cores in L402 and L403 for maximum response on the VTVM.

(8) Connect the DC probe between TP6 and ground (TP6 is located on the edge of the circuit board, adjacent to L404) and sequentially adjust the cores in L404 and L405 for maximum response on the VTVM.

(9) Connect the DC probe between TP7 and ground (TP7 is located adjacent to L405) and carefully adjust the spacing between turns of L406 and L407 for maximum response on the VTVM.

(10) Carefully adjust the spacing between turns of L408 and L409 and adjust C433 for maximum response on the RF power meter.

(11) Carefully adjust the spacing between turns of L411 thru L416, and adjust C438 and C448 for maximum response on the RF power meter.

CRYSTAL JUMPERING

GENERAL

The 146A has been designed so that one crystal position may be jumpered and used for two (or more) switch positions. This is especially useful where it is desired to provide for "simplex" operation on a repeater input (or output) frequency.

PROCEDURE

(1) Carefully unsolder the lead from the crystal socket on the circuit board to the CH switch terminal for the channel you wish to jumper.

> NOTE:
>
> Transmit crystals connect to the "1C" side of the CH switch, receive crystals to the "2C" side.

(2) Install a jumper between the terminal you removed the lead from, and the terminal corresponding to the desired frequency.

CHANNELIZATION INFORMATION

These additional channels can be added to your radio as required. Any additional channel utilizing an existing TX or RX will not require a new crystal. The existing crystal wiring may be jumpered to the new channel position, as set forth in the preceding section on CRYSTAL JUMPERING resulting in multiple use of the same crystal. The 146A may be adjusted for operation on any frequency within the Two-Meter Band, but will only deliver optimum performance over a 2 MHz spread of frequencies. It has been factory tuned to 146.94 MHz and will provide optimum performance for frequencies between 146 and 148 MHz as adjusted. Generally "MARS" and "CAP" crystals may be installed with some loss in sensitivity and power output. The degree of degradation will depend upon the spread. If the spread is too great, the oscillators may not function. STANDARD COMMUNICATIONS CORP. recommends that extra crystals be ordered through your SCC Dealer. The crystal you receive will be of the same quality as crystals utilized in SCC's Marine and Land/Mobile transceivers. In addition, the crystal manufacturer uses standard test fixtures supplied by SCC which insure that crystals supplied can be netted to frequency in your transceiver.

AMATEUR FM GLOSSARY

CAPTURE - The ability of an FM receiver to pick-out the strongest signal while totally rejecting the weaker one.

CARRIER OPERATED RELAY (COR) - A circuit which is activated by the reception of a signal by an associated receiver.

CHANNEL - Any specified operating frequency.

CHANNEL ELEMENT - An assembly used in place of a crystal in controlling either the transmitter or receiver.

CHANNELIZATION - The addition of extra channels to a transceiver.

CLOSED REPEATER - A repeater with a tone input or other device to limit use to certain individuals; a repeater for use by a specific club or group.

COFFIN SETS - Term used with old FM equipment utilizing a separate Tx and Rx.

CONTINUOUS TONE CONTROLLED SQUELCH SYSTEM (CTCSS) - An uninterrupted sub-audible tone superimposed on the carrier, for the purpose of opening receiver inputs (as on a repeater) for selective reception of desired transmissions, rather than all signals on a specific frequency.

DEVIATION - Limits to carrier deviation of frequency shift on either side of the center frequency expressed as ±kHz.

DEVIATION ACCEPTANCE - Ability of an FM receiver to pass information of a specific deviation.

DISCRIMINATOR - Circuitry in a receiver for FM detection. It connects the FM signal to AM and then demodulates the AM signal, producing the desired audio signal.

DUPLEX - To transmit and receive simultaneously on two separate frequencies to maintain communications, as with a repeater.

DUPLEXER - A device which allows simultaneous transmission and reception from a single antenna.

LIMITER - An IF circuit in an FM receiver which keeps the audio output from the discriminator at a constant output.

MACHINE - A term used to express a complete repeater system.

NARROW-BAND - ±5 kHz deviation (not to be confused with NB FM, same band width as AM/A3.)

OPEN REPEATER - A repeater that is open for use by all amateurs.

OVERLAP - The simultaneous coverage of at least two repeaters using the same input and output frequencies.

RADIO - FM'ers term for his rig.

REED - Frequency sensitive encased circuits used in selective tone signaling.

REMOTE - A unit used to control a base station at other than the base station's location.

REPEATER - A transmitter and receiver interconnected so as to simultaneously re-transmit signals received on one frequency to another. A repeater is generally located atop a high building or mountain top to gain the elevation advantage required for extended range on the VHF/UHF frequencies.

SIMPLE DUPLEX - To transmit and receive, but not simultaneously, on two separate frequencies.

SIMPLEX - Transmitting and receiving on the same frequency.

STRAPPING - The term used when two or more switch positions are jumpered to allow the use of a single crystal with a number of other crystals for various frequency combinations.

SWING - Total FM bandwidth, or frequency deviation X2.

TIME-OUT - Device on a repeater to limit transmission to a specified time. The normal time span is from 1 1/2 to 3 minutes.

TONE-BURST - A single tone of specified duration and frequency used to open repeater inputs.

WIDE-BAND - ±15 kHz deviation.

ZERO - To set a crystal for "0" reading on a uA meter connected to the discriminator output, to insure that you are receiving on the proper frequency.

ZERO OR NETTING - To set a crystal for "0" reading on a uA meter connected to the discriminator output, to insure that you are receiving on the proper frequency.

DRAWING NOTES

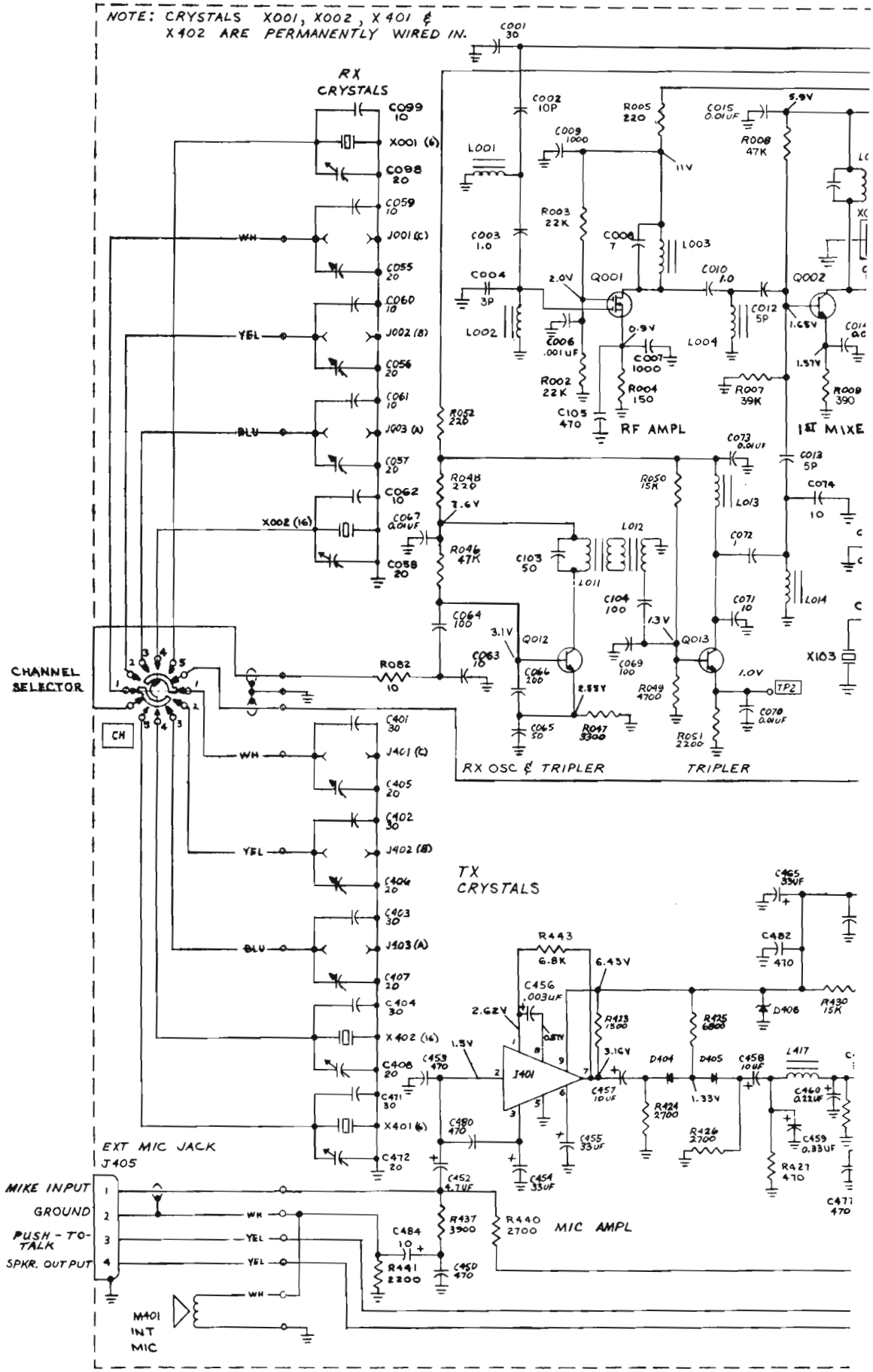
1. There are two different series of the schematic diagram and the P.C. boards. The major difference between the two series is that the receiver audio frequency integrated circuit of the first series is replaced with discrete transistors in the second series. The first series is made up of all units with serial numbers less than 512001. The second series begins at 512001 and includes all subsequent numbers, and all seven-digit serial numbers (U260001 and subsequent).

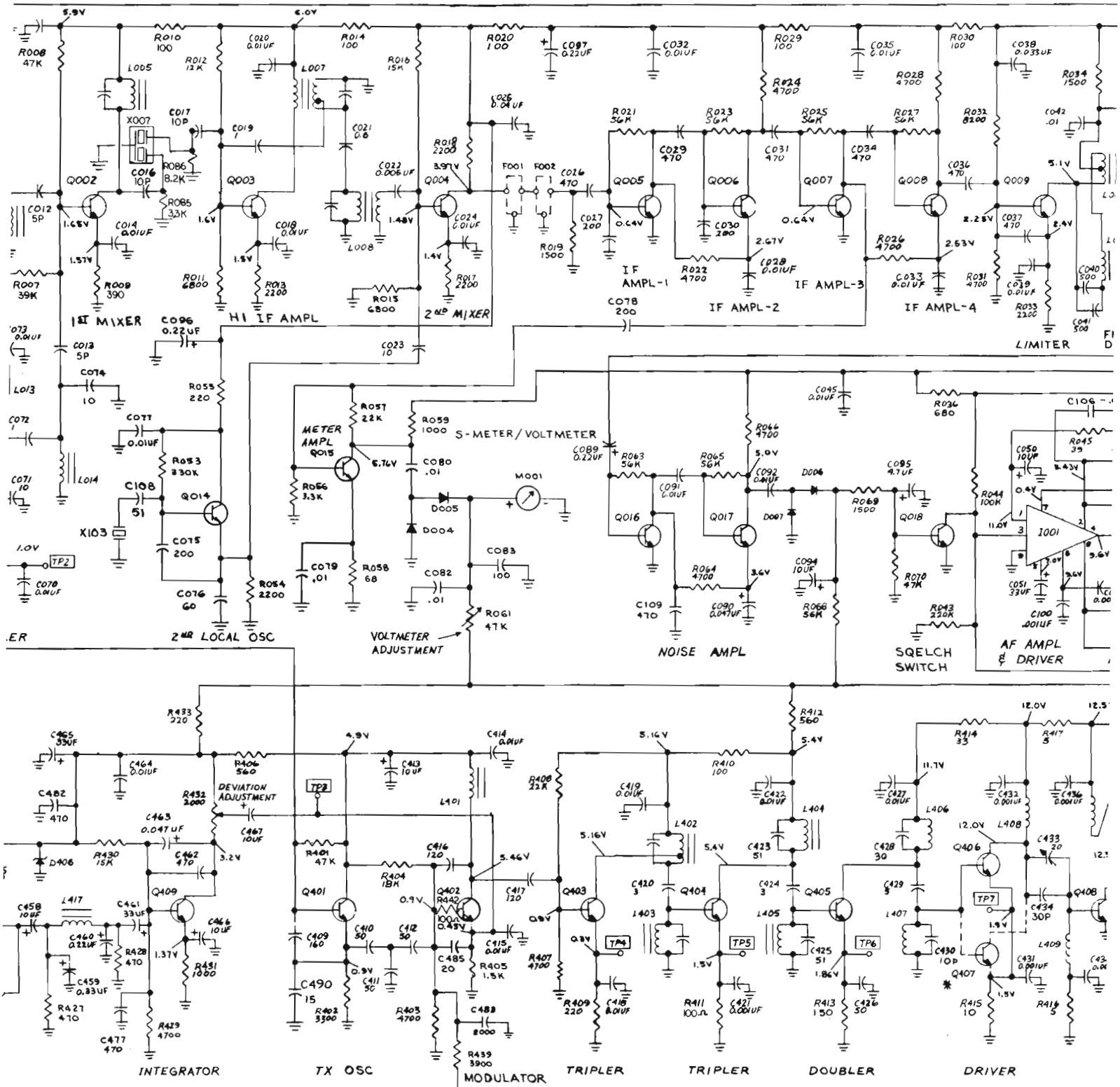
2. Capacitance values are in pico-farads when not marked and in micro-farads when followed by a "uF".

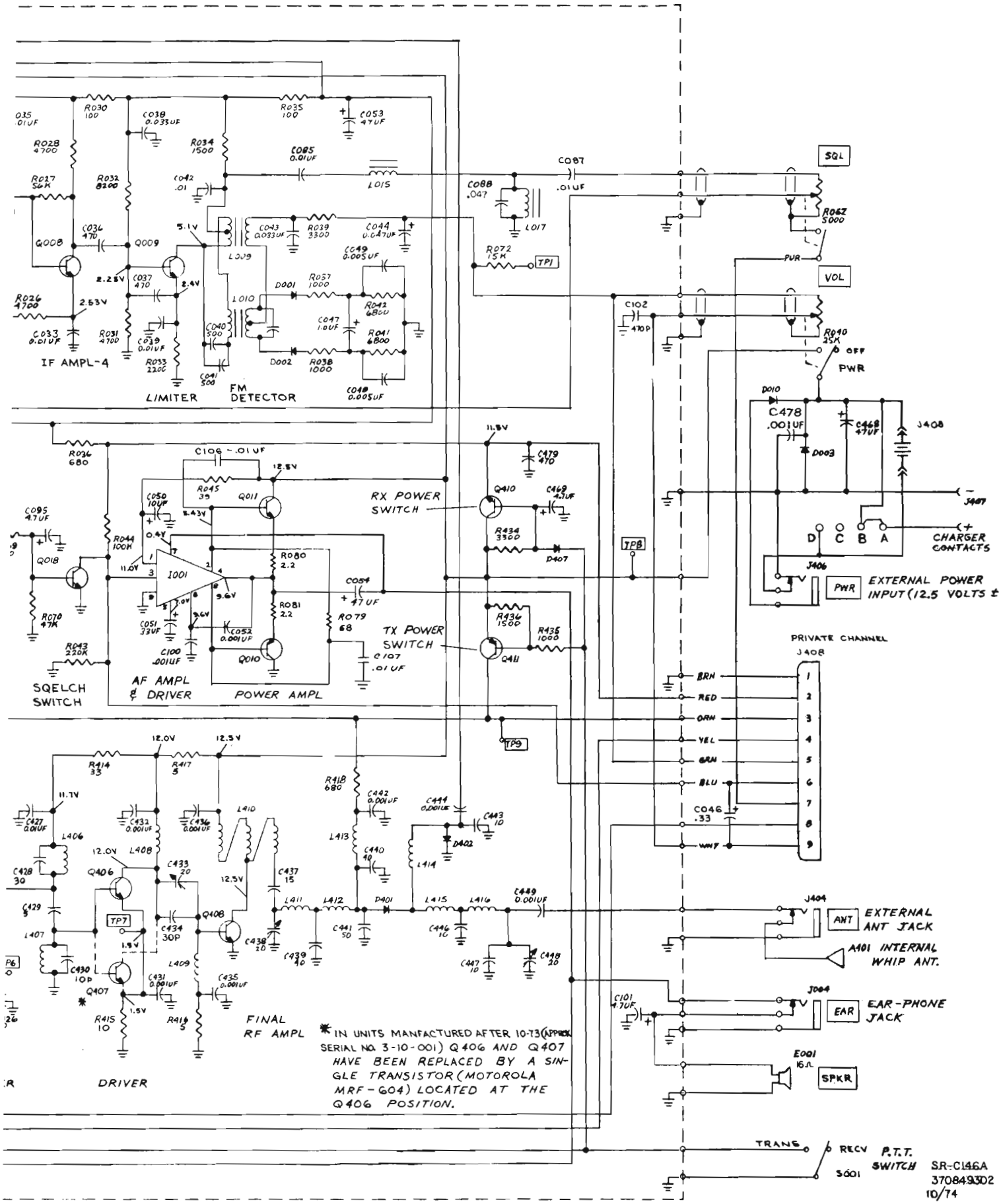
3. All schematic indicated voltages are to common ground (chassis), using a VTVM (HP427A or equivalent). Use RF probe when measuring RF circuits.

4. All voltage measurements are taken with 13.8 VDC (negative ground) regulated input as a power source.

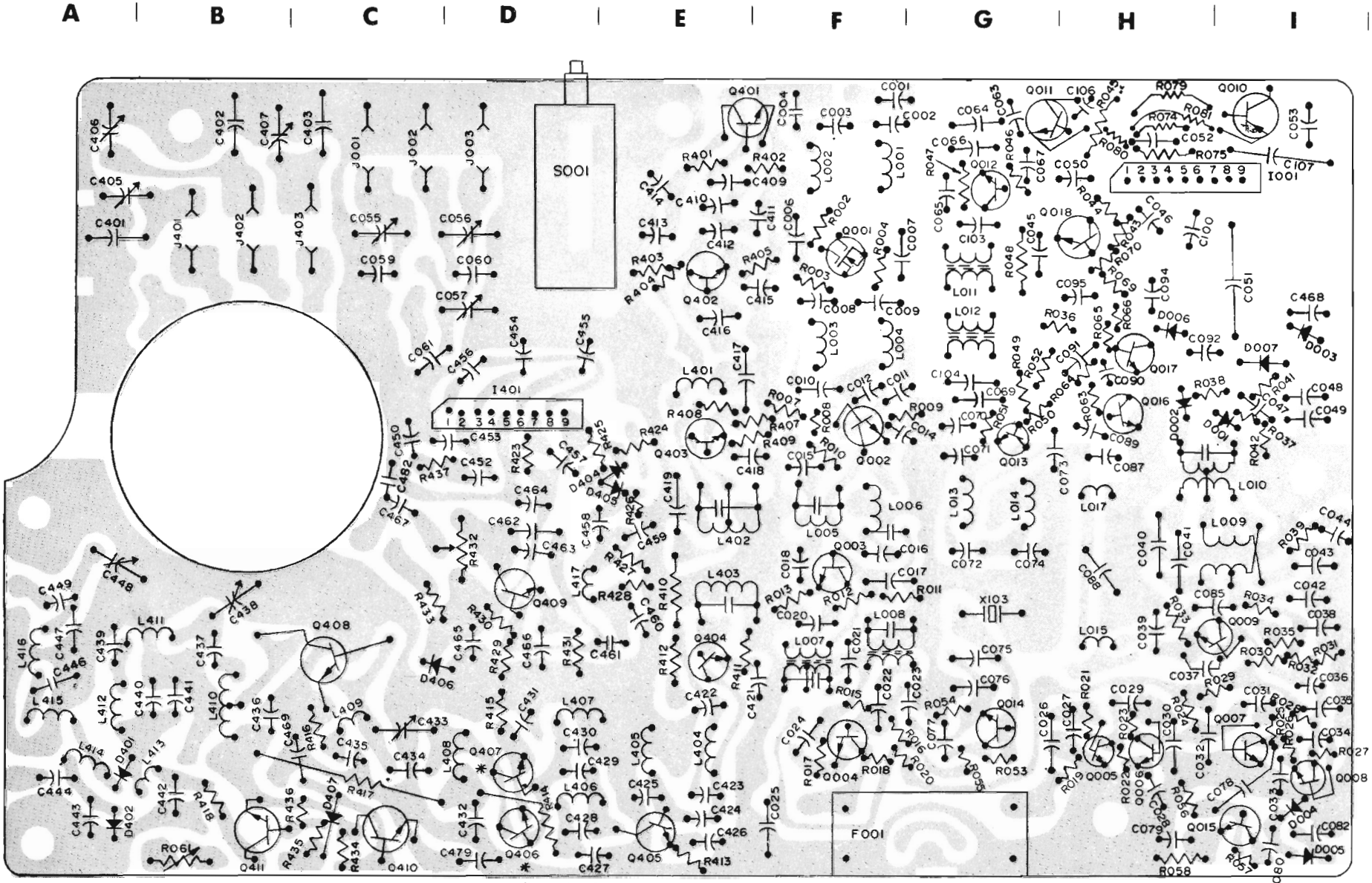
5. The printed circuit (P.C.) boards illustrate the layout of the electrical components as viewed from the bottom (foil) side of the board.


NOTE: CRYSTALS X001, X002, X401 & X402 ARE PERMANENTLY WIRED IN.
RX CRYSTALS
TX CRYSTALS
CHANNEL SELECTOR
CH
RF AMPL
1ST MIXE
RX OSC & TRIPLER
TRIPLER
MIC AMPL
EXT MIC JACK J405
MIKE INPUT
GROUND
PUSH-TO-TALK
SPKR. OUTPUT
M401 INT MIC
WH
YEL
BLU
X001 (6)
X002 (16)
J001 (C)
J002 (B)
J003 (A)
X402 (16)
J401 (C)
J402 (B)
J403 (A)
X401 (6)
Q001
Q002
Q012
Q013
J401
X103
TP2

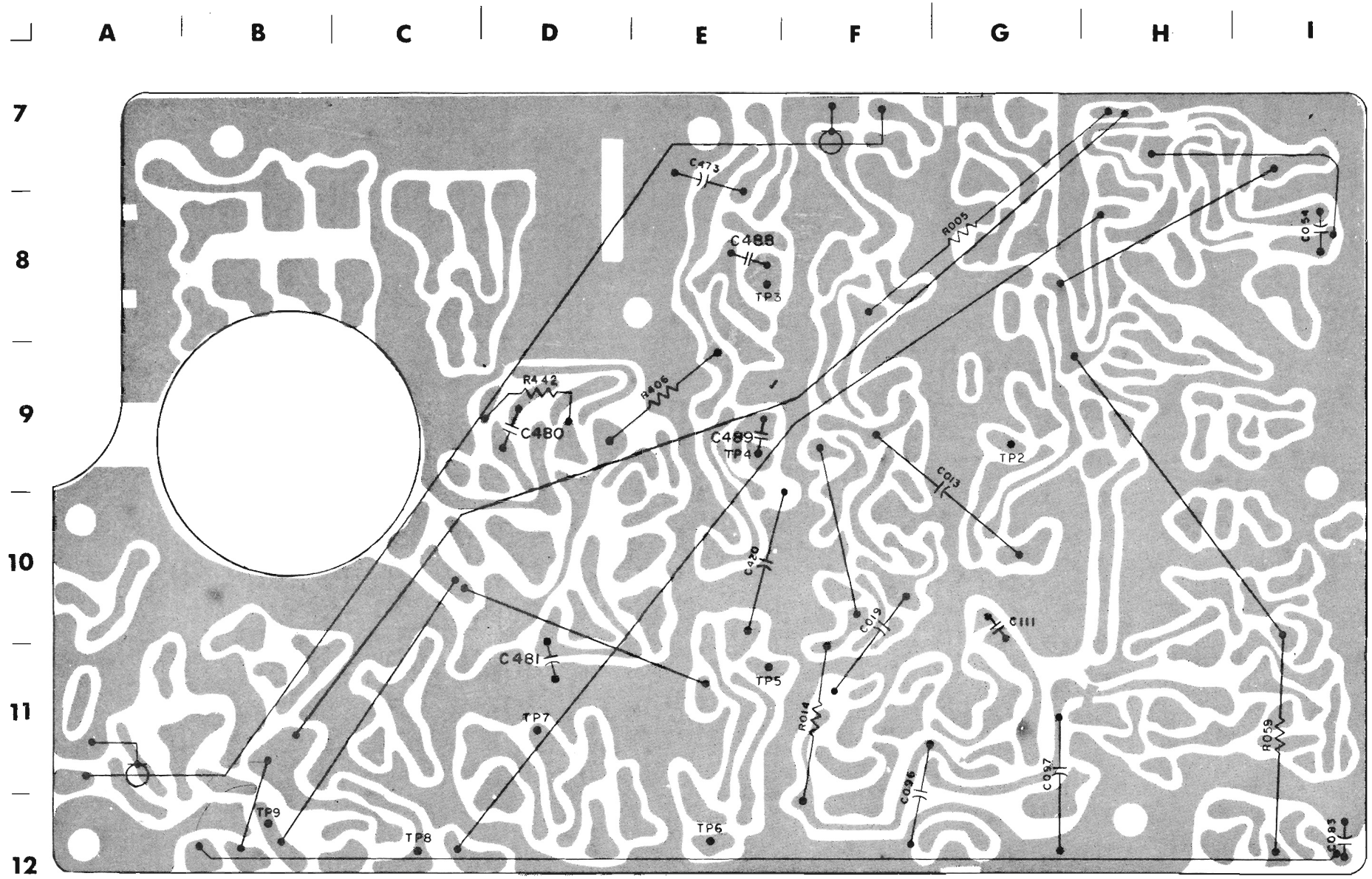

1ST MIXER
HI IF AMPL
2ND MIXER
IF AMPL-1
IF AMPL-2
IF AMPL-3
IF AMPL-4
LIMITER
S-METER/VOLTMETER
METER AMPL Q015
VOLTMETER ADJUSTMENT
2ND LOCAL OSC
NOISE AMPL
SQELCH SWITCH
AF AMPL & DRIVER
DEVIATION ADJUSTMENT
INTEGRATOR
TX OSC
MODULATOR
TRIPLER
TRIPLER
DOUBLER
DRIVER



C146A SCHEMATIC DIAGRAM (PREVIOUS TO S/N 512001)



C146A P.C. BOARD - FOIL SIDE VIEW WITH COMPONENT OVERLAY
(PREVIOUS TO S/N 512001)



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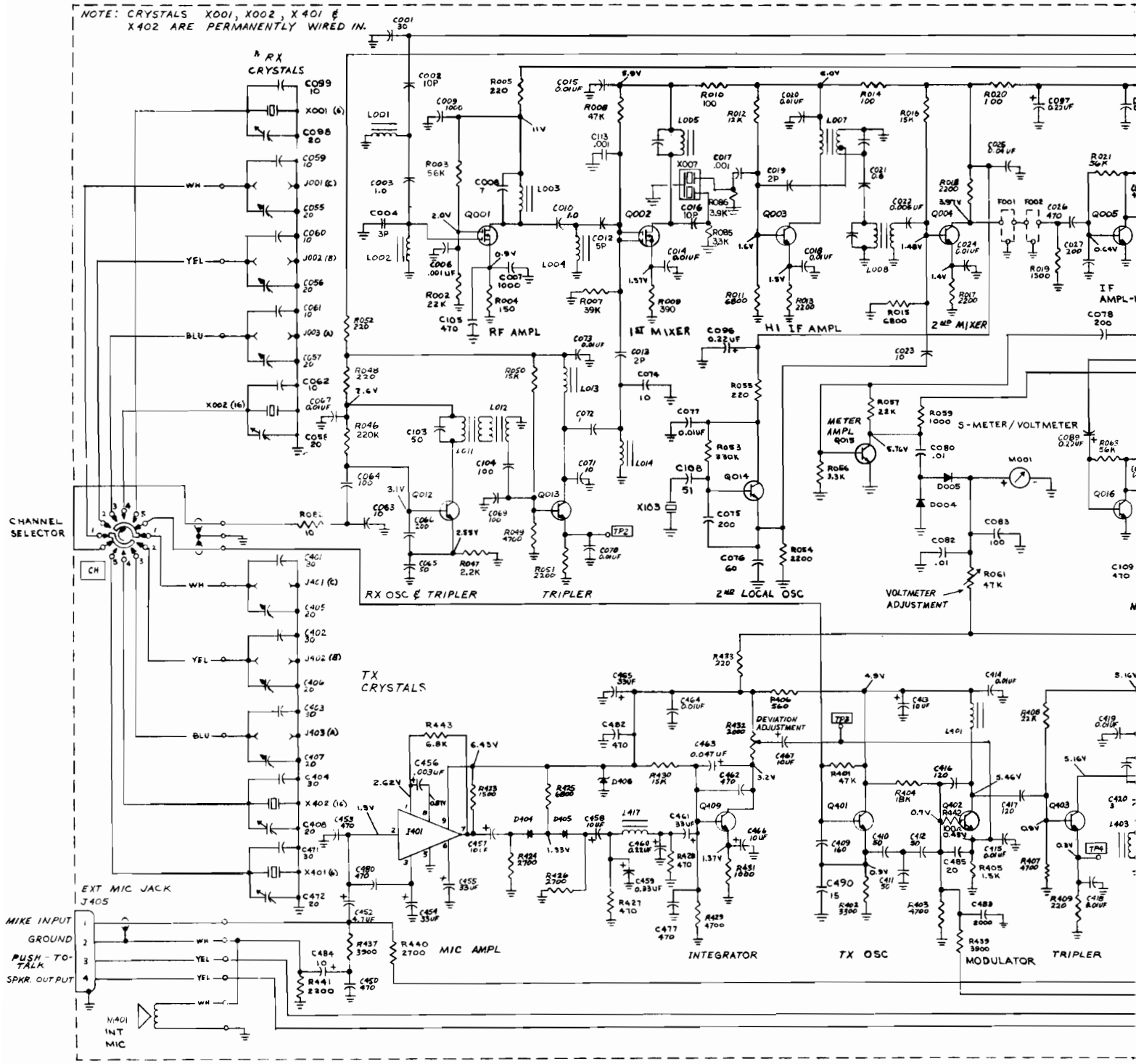
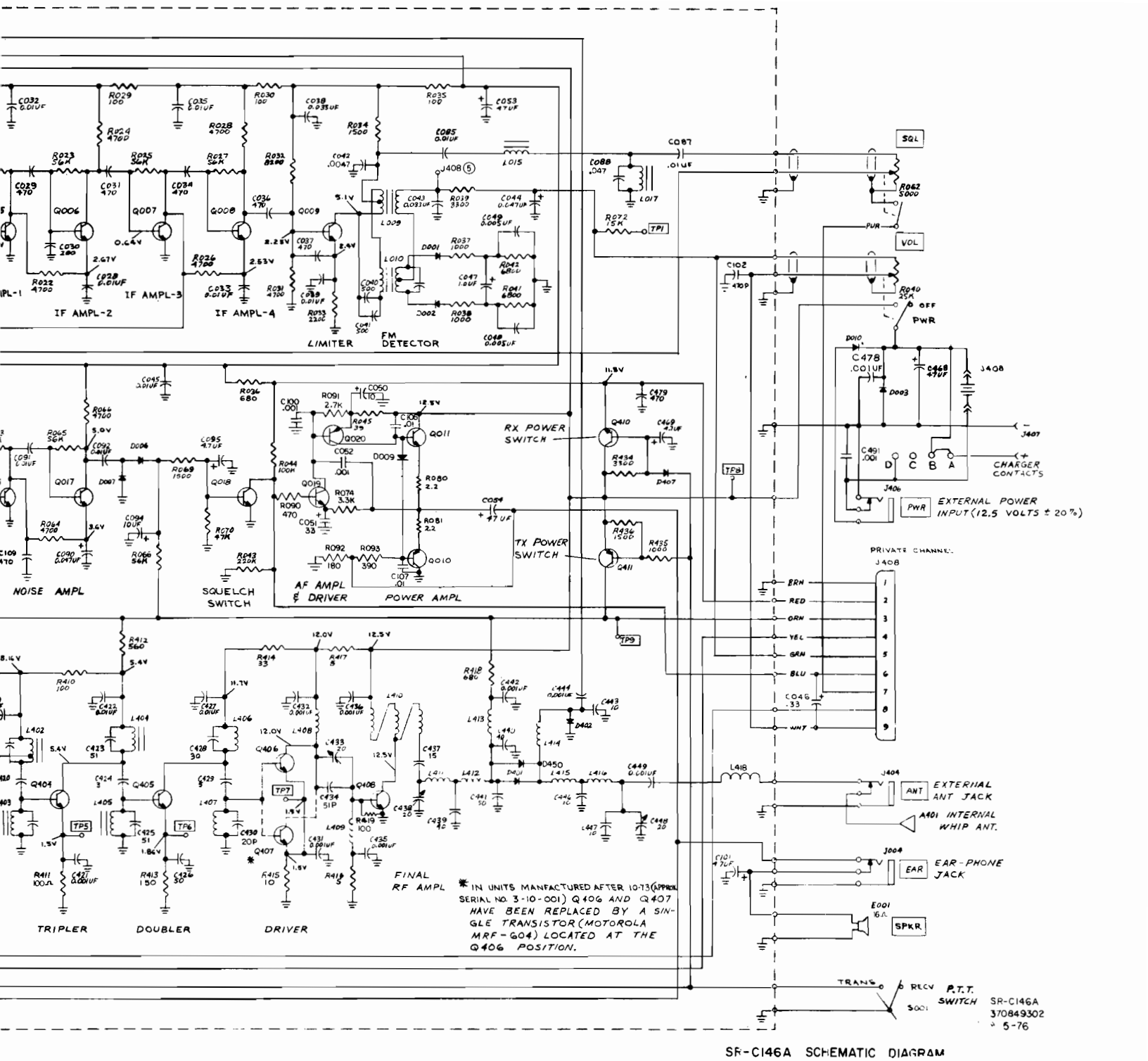
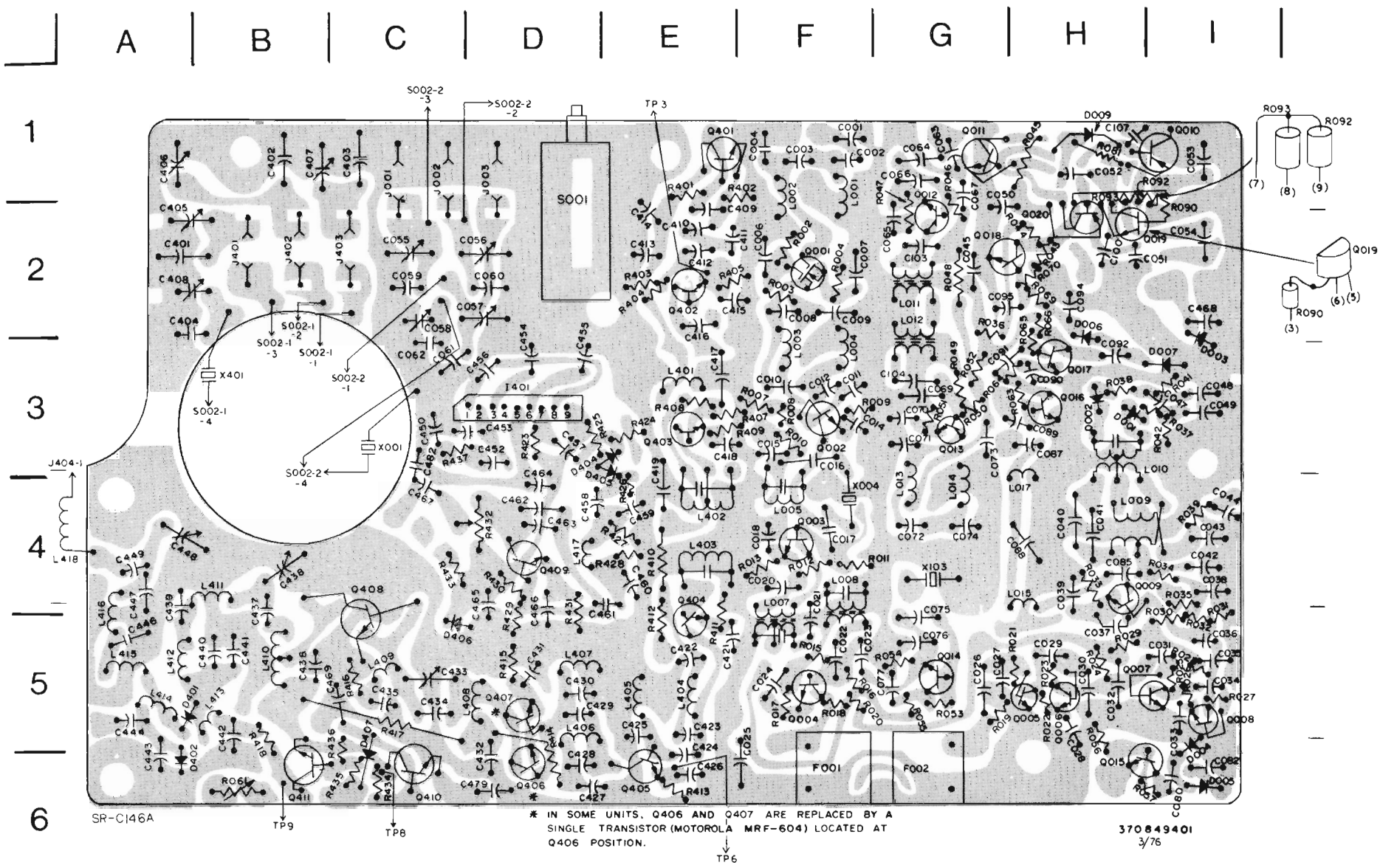
C146A P.C. BOARD - FOIL SIDE VIEW
(PREVIOUS TO S/N 512001)


NOTE: CRYSTALS X001, X002, X401 & X402 ARE PERMANENTLY WIRED IN.
RX CRYSTALS
TX CRYSTALS
CHANNEL SELECTOR
RF AMPL
1ST MIXER
HI IF AMPL
2ND MIXER
IF AMPL
RX OSC & TRIPLER
TRIPLER
2ND LOCAL OSC
METER AMPL Q015
S-METER/VOLTMETER
VOLTMETER ADJUSTMENT
DEVIATION ADJUSTMENT
EXT MIC JACK J405
MIKE INPUT
GROUND
PUSH-TO-TALK
SPKR. OUTPUT
MIC AMPL
INTEGRATOR
TX OSC
MODULATOR
TRIPLER
INT MIC

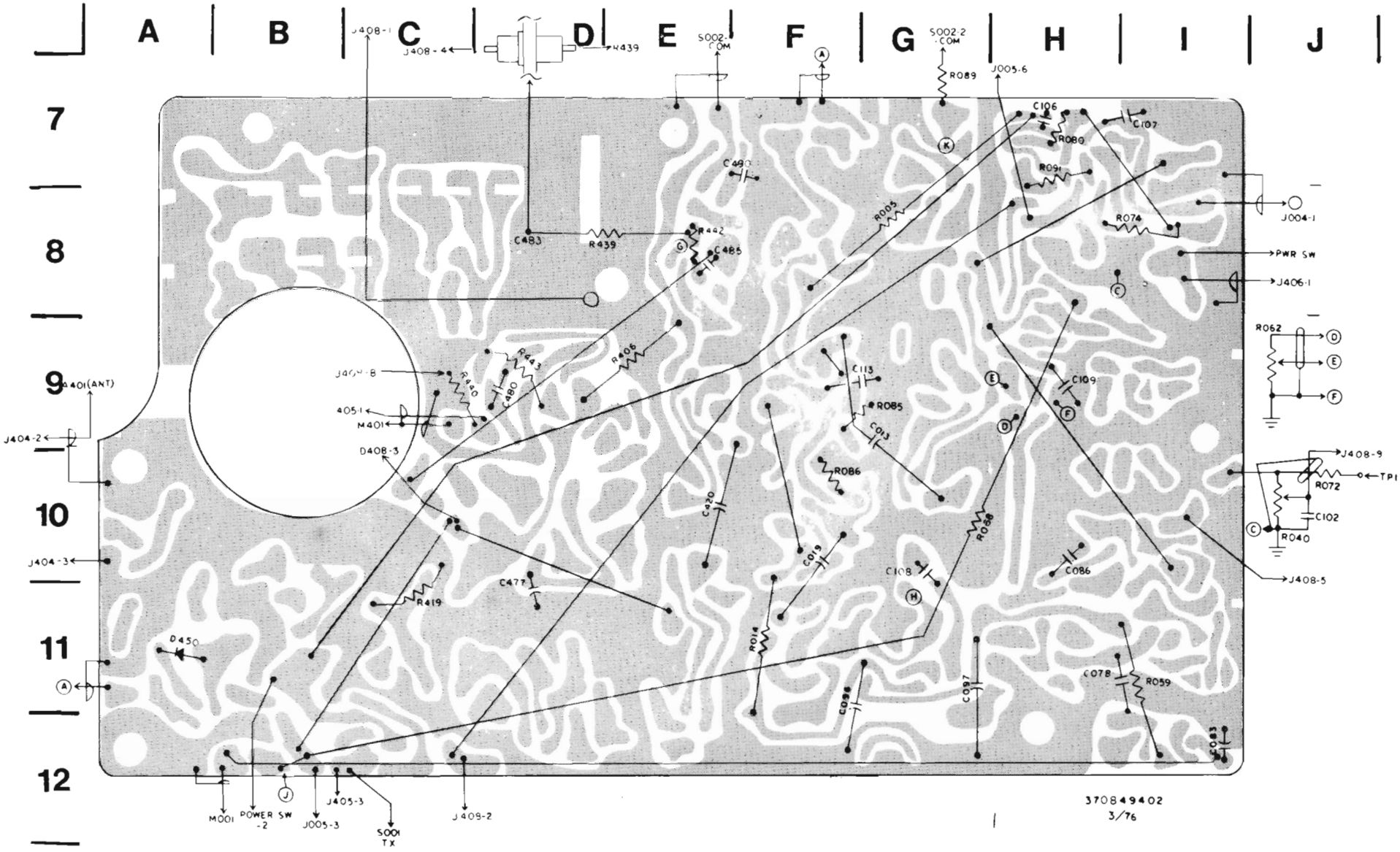


SR-C146A SCHEMATIC DIAGRAM

C146A SCHEMATIC DIAGRAM
(S/N 512001 & SUBSEQUENT - U26001 & SUBSEQUENT)



C146A P.C. BOARD - FOIL SIDE VIEW WITH COMPONENT OVERLAY
(S/N 512001 & SUBSEQUENT)



C146A P.C. BOARD - FOIL SIDE VIEW
(S/N 512001 AND SUBSEQUENT)

PARTS LIST

1. The following parts list includes all electrical parts except 1/8 watt, ±10%, fixed composition resistors. Values (ohms) for unlisted resistors are shown on the schematic diagram.

2. Selected mechanical parts, as illustrated by the Exploded Parts View, are listed in the Mechanical Parts List.

3. The P.C. BOARD LOCATION column references each part to a corresponding location on the printed circuit board. An "EPV" in this column indicates that the part is shown on the Exploded Parts View. An asterisk (*) in this column indicates that the part is not mounted on a printed circuit (P.C.) board.

4. Components preceeded by a double asterisk (**) in the REFERENCE DESIGNATION column apply only to units with serial numbers prior to 512001. Where a reference designator is listed twice, the value without the double asterisk applies to units with serial numbers 512001 and subsequent (includes also serial numbers U260001 and subsequent).

C146A ELECTRICAL PARTS LIST

REFERENCE DESIGNATION	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION	SUGG. LIST PRICE
CAPACITORS:					
C001	30pF	Fixed Ceramic	DD15300020	F1	$ .17
C002	10pF	Fixed Ceramic	DD12100060	F1	.17
C003,010 **019,072	1pF	Fixed Ceramic	DD10010020	F1,F3 F10,G4	.17
C004	3pF	Fixed Ceramic	DD11030010	F1	.17
C006,007,009 013,017	0.001uF	Fixed Ceramic	DK17102010	F2,F2,F2 F4,F10	.17
C008	7pF	Fixed Ceramic	DD12070040	F2	.17
**C011	20pF	Fixed Ceramic	DD16200040	F3	.17
C012	5pF	Fixed Ceramic	DD11050020	F3	TBD
**C013	5pF	Fixed Ceramic	DD11050010	F10	TBD
C014,015,018 028,033,035 067,070,073 077,**079,085 087	0.01uF	Fixed Ceramic	DK78103010	F3,F3,F4 H5,I5,I5 G1,G3,G3 G5,H6,H4 H3	.76
C016	10pF	Fixed Ceramic	DD16100010	F4	.17
**C017	10pF	Fixed Ceramic	DD15100020	F4	TBD
C019	2pF	Fixed Ceramic	DD11020010	F10	.17
C020,024,032 045	0.01uF	Fixed Ceramic	DK18103030	F4,F5,H5 G2	.17
**C021	0.6pF	Fixed Ceramic	DD16006010	F5	.17
C022	0.005uF	Fixed Ceramic	DK17502010	F5	.17
C023,059,060 061,063,071 074,099	10pF	Fixed Ceramic	DD12100060	F5,C2,D2 C3,G1,G3 G4,*	.17
C025	0.04uF	Fixed Film	DK17403010	F6	.17
C026,029,031 034,036,037	470pF	Fixed Ceramic	DK16471010	G5,H5,I5 I5,I5,H5	.17
C027,030,066 075,078	200pF	Fixed Ceramic	DD16201030	H5,H5,G1 G5,I5	.17

REFERENCE DESIGNATION	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION	SUGG. LIST PRICE
C038,043	0.033uF	Fixed Film	DK17333010	I4,I4	$ .17
C039,042,080 082,091,092	0.01uF	Fixed Film	DF17103010	H4,I4,I6 I6,H3,H3	.17
C040,041	500pF	Fixed Ceramic	DD16501010	H4,H4	.17
C044,090	0.047uF/35VDC	Fixed Electrolytic	EW47303510	I4,H3	.92
C046	0.33uF/25VDC	Fixed Electrolytic	EW33402510	H2	.94
C047	1uF/25VDC	Fixed Electrolytic	EW10501510	I3	1.02
C048,049	0.0047uF	Fixed Film	DF17472010	I3,I3	.17
C050	10uF/16VDC	Fixed Electrolytic	EV10601660	H1	.18
C051	33uF/10VDC	Fixed Electrolytic	EW33601010	I2	2.67
C052	0.001uF	Fixed Film	DF17102010	H1	.17
C053,054	47uF/16VDC	Fixed Electrolytic	EA47601690	I1,I8	2.67
C055,056,057 058,098	20pF	Trimming	CT12000020	C2,D2,D2 *,*	.83
C062	20pF	Fixed Ceramic	DD15200060	*	.17
C064,069	100pF	Fixed Ceramic	DD15101020	G1,G3	.17
C065	50pF	Fixed Ceramic	DD15500040	G2	.17
C076	60pF	Fixed Ceramic	DD15600010	G5	.17
C083	100uF/10VDC	Fixed Electrolytic	EA10701090	I12	.25
C088	0.047uF	Fixed Ceramic	DF17473010	H4	TBD
C089,096,097	0.22uF/25VDC	Fixed Electrolytic	EW22402510	H3,F12,G12	1.35
C094	10uF/10VDC	Fixed Electrolytic	EW10601060	H2	1.57
C095	4.7uF/16VDC	Fixed Electrolytic	EV47501610	H2	1.14
C100	0.001uF	Fixed Ceramic	DK17102010	H2	.17
C101	4.7uF/35VDC	Fixed Electrolytic	EA47503590	*	.21
C102,105	470pF	Fixed Ceramic	DK16471010	*,*	.17
C103	50pF	Fixed Ceramic	DD16500020	G2	.17
C104	100pF	Fixed Ceramic	DD15101020	G3	.17

REFERENCE DESIGNATION	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION	SUGG. LIST PRICE
C106,107	0.01uF	Fixed Ceramic	DK18103030	H1,I1	$ .17
C108	51pF	Fixed Mica	DF36510010	*	.18
C109	470pF	Fixed Ceramic	DK10471010	*	TBD
C401,402,403 404,428,471 **434	30pF	Fixed Mica	DF36300020	A2,B1,C1 *,D6,* C5	.18
C405,406,407 408,433,438 448,472	20pF	Trimming	CT12000020	A2,A1,B1 *,C5,B4 A4,*	.83
C409	160pF	Fixed Mica	DF35161500	F2	.43
C410,411,412 426	50pF	Fixed Ceramic	DD15500040	E2,F2,E2 E6	.17
**C413,491	0.001uF	Fixed Ceramic	DK17102010	E2,*	.17
C413	10uF/16VDC	Fixed Electrolytic	EA10601690	E2	.18
C414,419,422 427,464	0.01uF	Fixed Ceramic	DK18103030	E2,E3,E5 D6,D4	.17
C415,418	0.01uF	Fixed Ceramic	DK78103010	E2,E3	.76
C416,417	120pF	Fixed Ceramic	DD16121010	E2,E3	.17
C420,424	3pF	Fixed Ceramic	DD11030010	*,E6	.17
C421,431,432 435,436,442 444,449,478	0.001uF	Fixed Ceramic	DK17102010	E5,D5,D6 C5,B5,B6 A5,A4,*	.17
C423,425	51pF	Fixed Mica	DF36510010	E5,E5	.18
C429	5pF	Fixed Ceramic	DD11050030	D5	.17
**C430	10pF	Fixed Mica	DD12100010	D5	TBD
C430	20pF	Fixed Mica	DF36200020	D5	.17
C434	51pF	Fixed Mica	DF36510020	C5	.25
C437,490	15pF	Fixed Ceramic	DD16150030	B4,*	.17
C439,440	40pF	Fixed Ceramic	DD15400010	A5,B5	.17
C441	50pF	Fixed Ceramic	DD16500010	B5	.17
C443,446,447	10pF	Fixed Ceramic	DD12100010	A6,A5,A4	.17

REFERENCE DESIGNATION	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION	SUGG. LIST PRICE
C450,453,462 477,479,480 482	470pF	Fixed Ceramic	DK16471010	C3,D3,D4 *,D6,D9 C3	$ .17
C452,469	4.7uF/16VDC	Fixed Electrolytic	EA47503590	D3,B5	.25
C454,455,461	33uF/3VDC	Fixed Electrolytic	EV33600310	D3,D3,E4	1.22
C456	0.0033uF	Fixed Electrolytic	DF17332010	D3	.17
C457,458,466 467	10uF/16VDC	Fixed Electrolytic	EA10601690	D3,D4,D4 C4	.18
C459	0.33uF/25VDC	Fixed Electrolytic	EW33402510	E4	.94
C460	0.22uF/25VDC	Fixed Electrolytic	EW22402510	E4	1.35
C463	0.047uF/35VDC	Fixed Electrolytic	EW47303510	D4	.92
C465	33uF/10VDC	Fixed Electrolytic	EA33601090	D4	.21
C468	47uF/16VDC	Fixed Electrolytic	EA47601690	I1	.23
C483	0.002uF	Fixed Ceramic	DC18202020	*	.51
C484	10uF/10VDC	Fixed Electrolytic	EW10601010	*	1.22
C485,**486	20pF	Fixed Ceramic	DD16200010	*,*	.17
DIODES:					
D001,002		Germanium	HD10001050	I3,H3	$ .20
D003,010		Silicon	HD20001100	I2,*	.43
D004,005		Germanium	HD10001010	I6,I6	.43
D006,007		Silicon	HD20011050	H2,I3	.26
D009		Varistor	HV00004060	H1	TBD
D401,402,450		Silicon	HD20001200	*,A6,H2	1.91
D404,405,407		Silicon	HD20011050	D3,E4,E3	.26
D406		Zener	HD30023090	C5	.76

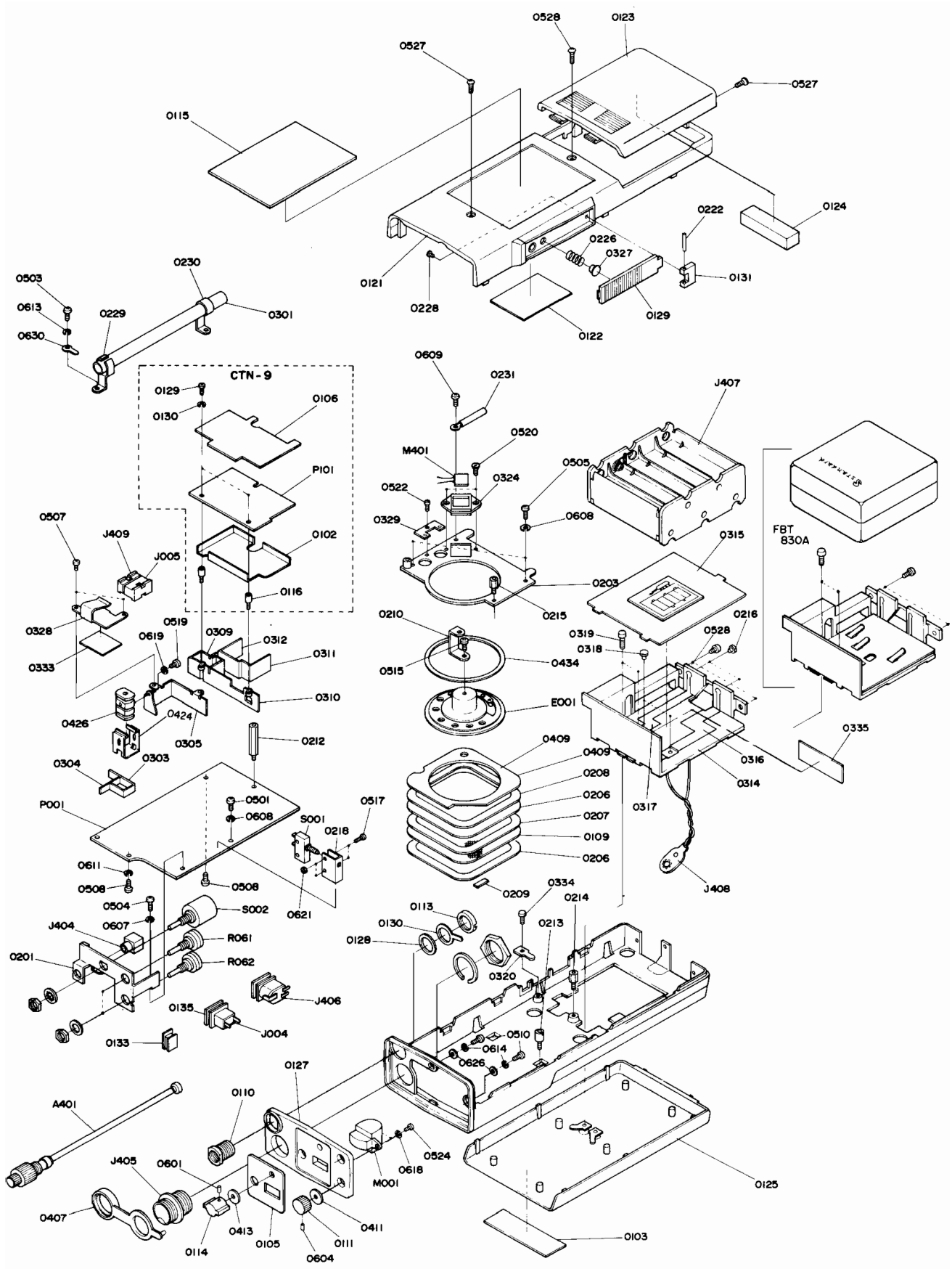
REFERENCE DESIGNATION	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION	SUGG. LIST PRICE
INDUCTORS:					
L001,002,003 004		Antenna Coil	LA50018020	F1,F1,F3 F3	TBD
L005		IF Coil	LI55016152	F4	TBD
**L006		IF Coil	LI55016182	F4	$ 1.39
L007		IF Coil	LI55016132	F4	TBD
L008		IF Coil	LI55016140	F4	1.27
L009		IF Coil	LI70030360	I4	.60
L010		IF Coil	LI70030350	I3	.69
L011,012		RF Coil	LI50028012	G2,G2	1.12
L013,014		Antenna Coil	LA50018030	G4,G4	1.12
L015,017		Choke Coil	LC13940010	H4,H3	.32
L401		RF Coil	LA55016010	E3	1.39
L402,403		RF Coil	LA70196040	E4,E4	.94
L404,405		Antenna Coil	LA50018030	E5,E5	1.12
L406,407,411 412		Choke Coil	LC15000012	D5,D5,B4 A5	.18
L408		Choke Coil	LC12800010	D5	.21
L409		Choke Coil	LC13810020	C5	.33
L410		Twist Coil	LM13422010	B5	.92
L413		Choke Coil	LC13810010	B5	.41
L414		Choke Coil	LC11610010	A5	.18
L415,416		Choke Coil	LC14000010	A5,A5	.21
L417		Choke Coil	LC22260020	D4	.51
L418		Choke Coil	LC14000010	E3	.25

REFERENCE DESIGNATION	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION	SUGG. LIST PRICE
RESISTORS:					
R040	25K ohm w/Switch	Variable Comp.	RB12530023	*	$ 1.16
R061	47K ohm	Variable Comp.	RA04730010	*	TBD
R062	5000 ohm	Variable Comp.	RB15020220	*	1.49
R080,081	2.2K ohm/ 1/4 watt	Fixed Composition	RC10022140	H1,H1	TBD
R415	10 ohm/ 1/4 watt	Fixed Composition	RC10100140	D5	.17
R416	5 ohm/1/4 watt	Fixed Composition	RC10050140	C5	.17
R417	39 ohm/ 1/4 watt	Fixed Composition	RC10390140	C5	TBD
R432	2000 ohm	Trimming	RA02020090	D4	.33
R901	5 ohm/1/4 watt	Fixed Composition	RC10050140	*	.17
R902	10 ohm/ 1/4 watt	Fixed Composition	RC10100140	*	.17
R903	22 ohm/ 1/4 watt	Fixed Composition	RC10220140	*	.17
R904	33 ohm/ 1/4 watt	Fixed Composition	RC10330140	*	.17

NOTE: Resistors not listed are standard fixed composition, ±10%, 1/8 watt. The resistance values (ohms) are shown on the schematic diagrams.

REFERENCE DESIGNATION	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION	SUGG. LIST PRICE
TRANSISTORS:					
Q001,002		Mosfet	HF40051100	F2,F3	$ 2.24
Q003,004,005 006,007,008 009,012,013 014,015		NPN Silicon	HT305351B0	F4,F5,H5 H5,H5,I5 H4,G1,G3 G5,H6	.76
Q010		PNP Germanium	HT106831B0	I1	.99
Q011		NPN Silicon	HT313831B0	G1	.83
Q016,017,018 019		NPN Silicon	HT309451Q0	H3,H3,H2 I2	TBD
Q020		NPN Silicon	HT106731B0	H2	TBD
Q401,402		NPN Silicon	HT305351B0	E1,E2	.76
Q403		NPN Silicon	HT304601B0	E3	.41
Q404,405,406 407		NPN Silicon	HT30387100	E5,E6,D6 D5	1.29
Q408		NPN Silicon	HT31001100	C5	14.44
Q409		NPN Silicon	HT309451Q0	D4	.91
Q410		NPN Silicon	HT312131B0	C6	.66
Q411		PNP Germanium	HT106731B0	B6	.83

REFERENCE DESIGNATION	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION	SUGG. LIST PRICE
MISCELLANEOUS ELECTRICAL:					
A401		Whip Antenna	YR04049012	EPV	$ 3.71
E001	16 ohms	Speaker	QK00503082	EPV	3.71
F001,002		Ceramic Filter	FG455304E0	F6,*	5.36
**I001		Integrated Circuit	HC10013030	I1	2.64
I401		Integrated Circuit	HC10014030	D3	2.64
J001,002,003		Crystal Socket	YJ03000020	C1,C1,D1	.17
J004		Jack, Earphone	JY01001020	*	.26
J401,402,403		Crystal Socket	YJ03000020	B2,B1,C2	.17
J404		Jack, Antenna	YJ01001020	EPV	.26
J405		Jack, Microphone	YJ10000650	EPV	2.56
J406		Jack, Power	YJ04000540	EPV	.66
J407		Battery Case	YJ14000020	EPV	1.75
J408		Snap	YJ09000082	EPV	.25
J409		9-pin plug	YP10001060	*	TBD
J410		Jack	YJ10000520	*	2.28
M001		DC Meter	IM11014032	EPV	4.95
M401		Microphone	MS40000020	EPV	9.08
X001		Crystal (RX)	Selected Value	C3	6.50
X003		Crystal (RX-2nd Osc.)	Selected Value	*	6.50
X007		Crystal Filter	XU411700N5	*	TBD
X401		Crystal (TX)	Selected Value	B3	6.50
X402		Crystal (TX)	Selected Value	*	6.50
S001		Microphone Switch	SC01020060	D1	1.24
S002		Rotary Switch	SR02050092	EPV	11.55



C146A EXPLODED PARTS VIEW

C146A MECHANICAL PARTS LIST

REFERENCE DESIGNATION	TYPE	SCC PART NO.	SUGG. LIST PRICE
0102	Case, Front	3729064016	$ 10.31
0103	Plate	3653203013	.38
0105	Indicator	3708265013	.26
0108	Indicator	3708265032	.66
0109	Plate	3653003010	.41
0110	Knob	3782154012	TBD
0111,0112	Knob	3653154012	1.32
0113	Escutcheon K	3653063500	TBD
0114	Knob	3782154010	1.16
0115	Contractor	4596123030	TBD
0116	Indicator	3708265024	TBD
0121	Cover	3653257111	1.83
0122	Collar	3729055034	1.14
0123	Cover	3653257024	.65
0124	Nut	53228089E2	.51
0125	Cover	3653063016	.83
0127	Cover	3653063026	2.30
0128	Terminal	YL03010220	TBD
0129	Button	3512270013	.25
0130	Buffer	4596056010	TBD
0131	Holder	3512271013	.25
0132	Contactor	4596123030	TBD
0133	Indicator	3653265032	.17
0135	Bracket	3653160013	.14
0201	Chassis	5759105010	1.65
0203	Chassis	3653105504	1.65
0204	Chassis	3653105024	TBD

REFERENCE DESIGNATION	TYPE	SCC PART NO.	SUGG. LIST PRICE
0205	Support	3653101030	TBD
0206,0207,0208 0209	Seal	3653122010	$ .17
0210	Bracket	3653160030	TBD
0211	Bracket	3653160045	.33
0212	Support	3653101010	.18
0123	Support	3653101042	.17
0214,0215	Support	3653101022	.17
0216,0217	Contractor	3653123010	.17
0218	Bracket	3512160500	.99
0219	Bracket	3514160010	TBD
0220	Bracket	3512104010	TBD
0222	Pin	3512254020	.17
0223	Case, Battery Tray	4667064012	TBD
0224	Cover	4596053010	TBD
0226	Spring	71101599L0	.10
0227	Label	3792861010	TBD
0228	Bracket	3512160100	.17
0229	Holder	3653271010	.46
0230	Holder	3653271020	.46
0231	Clamper	1382005030	.17
0232,0233	Contractor, Battery Tray	4596123010	TBD
0234	Eyelet, Battery Tray	56483030G0	TBD
0235	Screw, Battery Tray	51100204B0	.10
0301	Shield	3653109013	.38
0303	Shield	3729109030	.26
0304	Shield	3653109030	.17
0305	Shield	3729109022	.43

REFERENCE DESIGNATION	TYPE	SCC PART NO.	SUGG. LIST PRICE
0309	Shield	3653109062	$ .25
0311	Shield	3653109070	.21
0312	Shield	3553109083	TBD
0314,0315,0316 0317,0318,0319 0320	Shield	3620109010	.17
0323	Protector	3653269010	.17
0325	Lever	3653354010	.36
0327	Lever	3653354022	.39
0328	Bracket	3730160022	.69
0329	Bracket	3527160500	TBD
0333	Contactor	4596123500	TBD
0334	Contractor	4596123040	TBD
0335	Eyelet	56332020G0	.10
0401,0402	Indicator	3653265102	.28
0404,0405	Indicator	3653265112	.25
0406	Indicator	3653265120	.25
0407	Cover, Mic. Recp.	3653053022	.38
0409	Spacer	3653118012	.25
0411,0413	Spacer	3539118020	.17
0420	Terminal	YL14020020	.17
0426	Insulator	3653120110	TBD
0428	Heat Sink	3653267012	.30
0432,0433	Spacer	3653118020	.17
0434	Spacer	3653118030	TBD
0501,0503	PHM Screw	51062606E0	.17
0504,0505,0507 0508	PHM Screw	51062605E0	.17
0510	PHM Screw	51062604E0	.17

REFERENCE DESIGNATION	TYPE	SCC PART NO.	SUGG. LIST PRICE
0517	PHM Screw	51060210E0	$ .17
0520	FHM Screw	51040204E0	.17
0522	PHM Screw	51060203E0	.17
0524	PHM Screw	51061704E0	.17
0527,0528	Screw	51142606B0	.10
0530	Screw	51142604B0	.10
0532,0533	Screw	51042604H0	.10
0534,0535	Screw	50042604B0	.10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