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PRELIMINARY INSTRUCTION MANUAL

FOR THE

MODEL SR-C146A

VHF/FM AMATEUR HAND-HELD TRANSCEIVER

STANDARD COMMUNICATIONS CORP.

WARRANTY

"Standard Communications Corp." warrants each new radio product supplied by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to our authorized service center, intact, for examination, with all transportation charges prepaid, within the warranty period, provided that such examination discloses in our judgement that it is thus defective.

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, nor to cases where the serial number or manufacturing date have been removed, defaced, or changed, nor to accessories used therewith not of our own manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products.

STANDARD COMMUNICATIONS CORP.

CUSTOMER RECORD

Date Purchased (Warranty Effectivity Date): _____

Purchased From: _____

_____

_____

Warranty Card Number: _____

(Warranty card must be completed and returned within 10 days)

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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-3 Private Channel

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

ACCESSORIES

Optional accessories available for use with your Model 146A transceiver are as follows:

MODEL SA DESK TOP CHARGER/AC ADAPTER - Two rate trickle charger. Charges 146A with batteries or battery pack. Includes external antenna adapter for base station use.

MODEL 12/120-6 AC CHARGER - Provides trickle charge for 146A (wall mounted).

MODEL AD CABLE ADAPTER - Permits interconnection of external antenna to 146A.

MODEL AT09 3.0 dB GAIN ANTENNA - For vehicle use (cable and mount not supplied).

MODEL AT12 FLEXIBLE STEEL ANTENNA - Replaces collapsible internal antenna.

MODEL AT19 FLEXIBLE RUBBER ANTENNA - Replaces collapsible internal antenna (can be bent at different angles without materially affecting performance).

MODEL MA MOBILE ADAPTER - Charges transceiver battery in mobile installation. Includes external antenna adapter.

MODEL PT3644 CASE - Leather carrying case for 146A.

MODEL MP08 MINIATURE MICROPHONE - Dynamic hand microphone for external connection to 146A. With retractable neoprene covered cord and hi-impact cycolac case.

MODEL MP10 SPEAKER/MICROPHONE - Functions as both external speaker and microphone when used with 146A.

P/N B0903002 BATTERY CELL - "AA" size rechargeable Ni-Cad battery cell (10 required).

P/N TX1H - "Astropoint" transmit crystal.

P/N RX1H - "Astropoint" receive crystal.

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 325, Wilmington, California 90744. One of our resident FM'ers will send you a personal reply.

Suggested References

FM and Repeaters for the Radio Amateur	ARRL Publications
Radio Amateur FM Handbook	Ken Sessions, Jr. Editors & Engineers
How to Use FM	73 Magazine
73 Repeater Atlas (lists all current repeaters)	73 Magazine
ARRL Repeater Directory (lists all current repeaters)	ARRL Publications

We suggest you read Ham Radio, CQ, and 73 magazines for the latest FM happenings.

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.

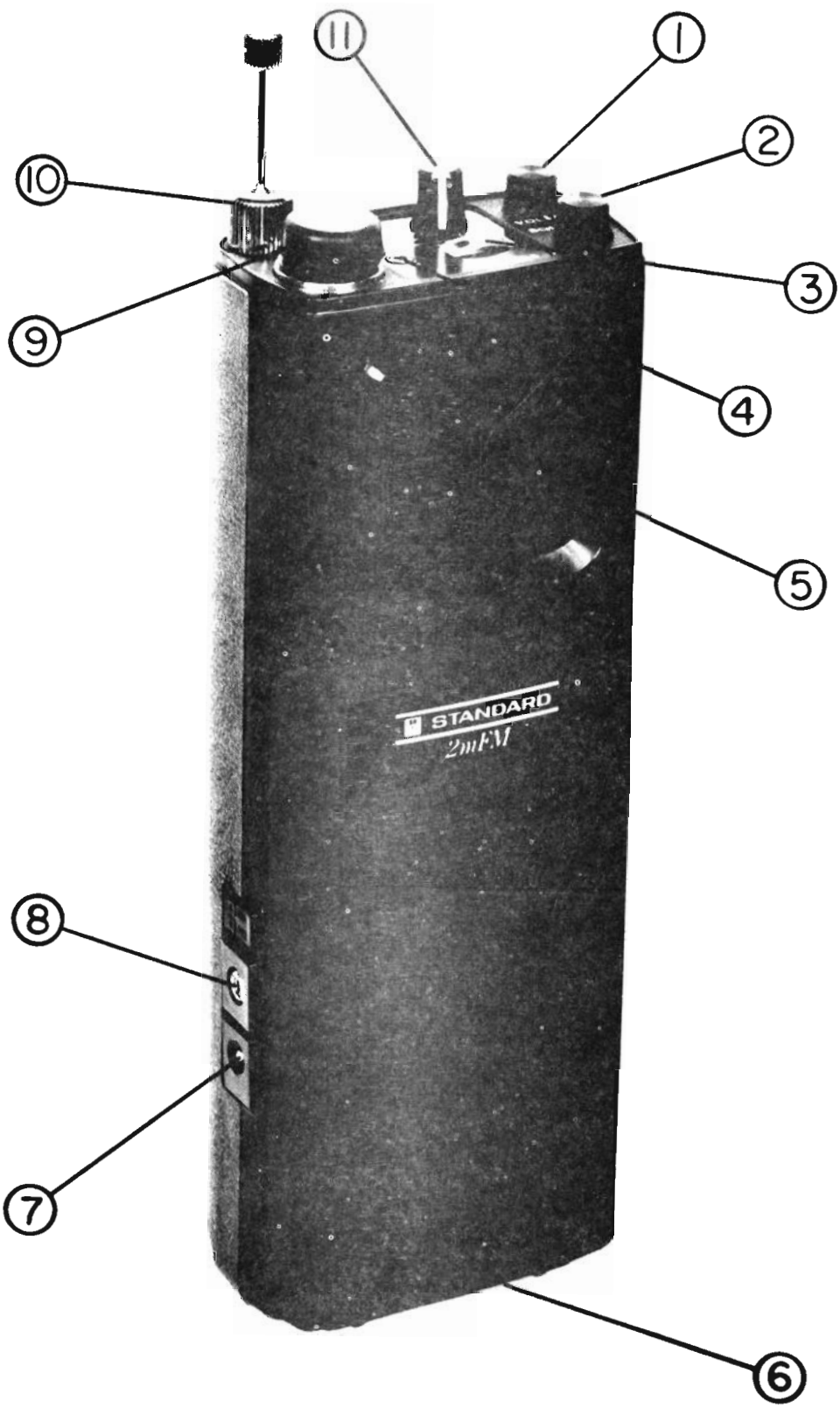


Figure 1: SR-C146A CONTROLS AND CONNECTIONS

(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 (supplied) 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

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.

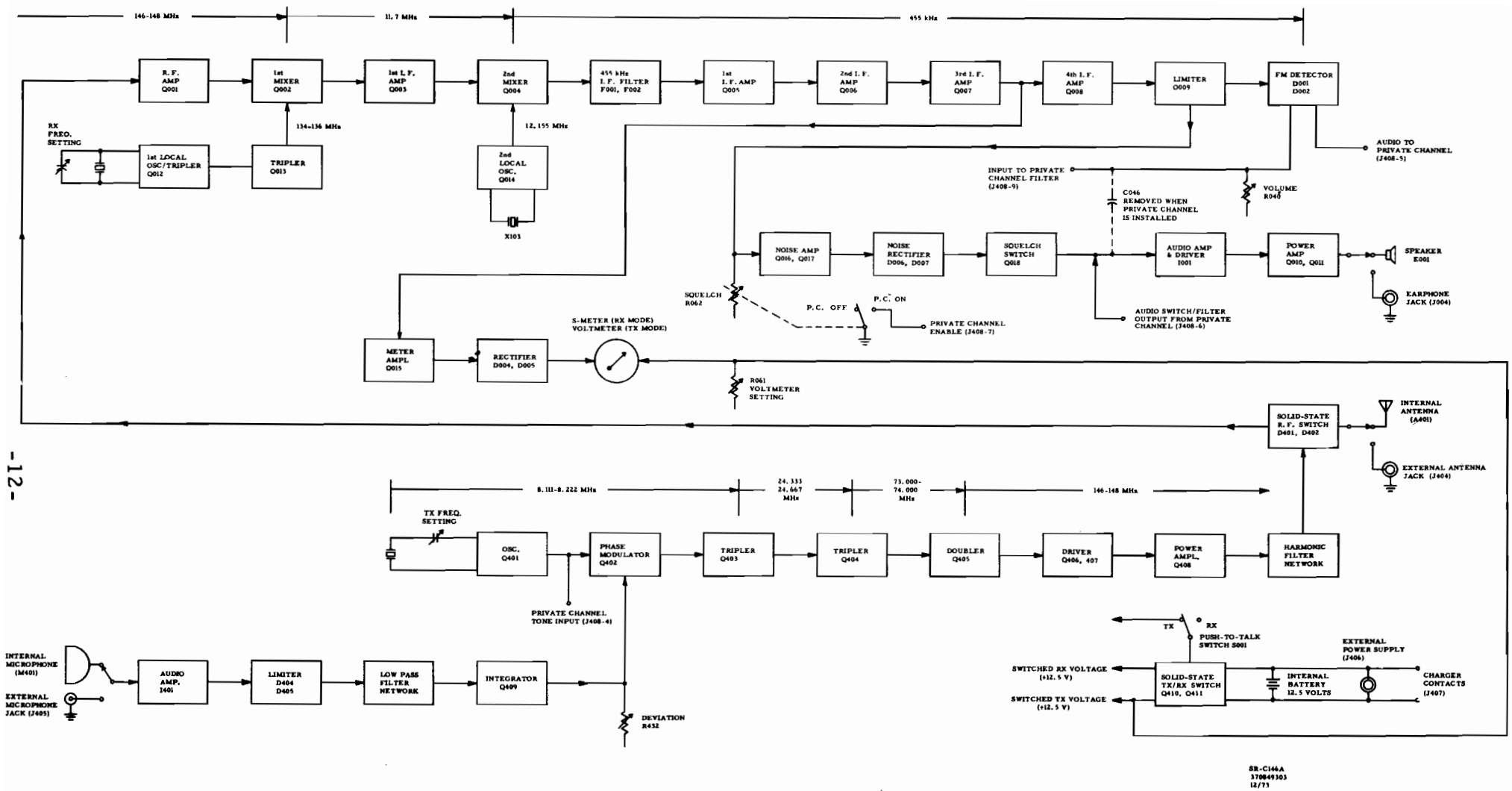
Two tripler stages, Q403 and Q404, and one doubler, Q405, provide the necessary 18 times frequency multiplication. The drivers, Q406 and Q407, then amplify the 146 to 148 MHz signal prior to application to the RF power amplifier. The RF power amplifier, Q408, develops the output signal applied to a tri-filar 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.



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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.

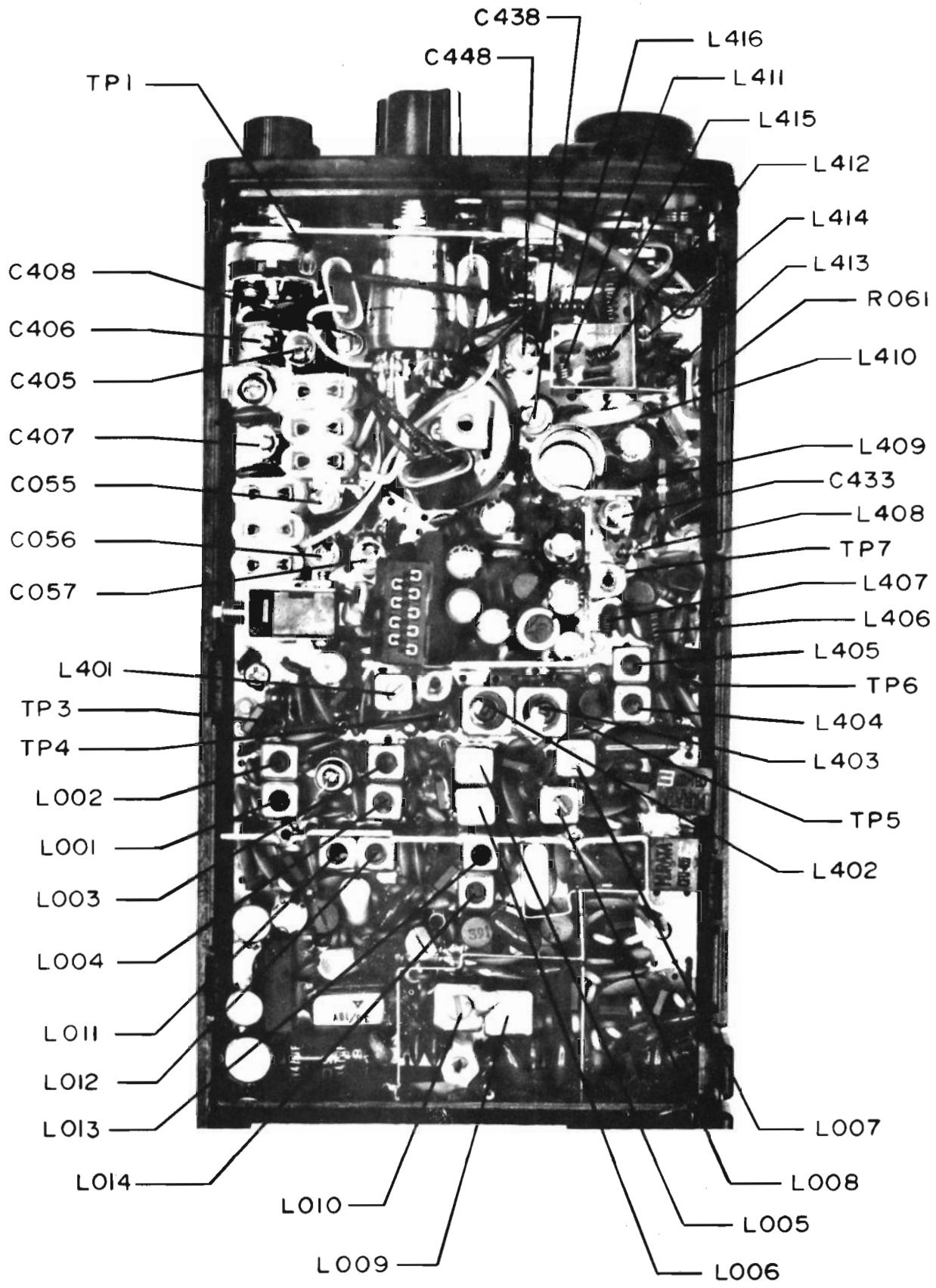
Setting "Crossover" Point - Set the detector "crossover" point as follows:

(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



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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.

PARTS LIST

REF. DESIG.	VALUE	TYPE	SCC PART NO.	RESPECTIVE P.C. BOARD LOCATION
CAPACITORS				
C001	30 pf	Fixed ceramic	DD15300020	F1
C002	15 pf	Fixed ceramic	DD16150060	G1
C003, 010, 019, 072	1 pf	Fixed ceramic	DD10010020	F1, F3, F4r, G4
C004, 008	7 pf	Fixed ceramic	DD12070030	F1, F2
C006, 007, 009, 100, 421, 431, 432, 435, 436, 442, 444, 449, 478	0.001 uf	Fixed ceramic	DK17102010	F2, G2, F2, H2 F5, D5, D6, C5 B5, B5, A5, A4 *
C011, 012	20 pf	Fixed ceramic	DD16200040	F3, F3
C013	1 pf	Fixed ceramic	DD10010010	G3r
C014, 015, 018, 028, 033, 035, 067, 070, 073, 077, 079, 087, 415, 418	0.01 uf	Fixed ceramic	DK78103010	G3, F3, F4, H5, I5, I5, G1, G3, H3, G5, H6, H3, F2, F3
C016, 021	0.6 pf	Fixed ceramic	DD16006010	G4, F4
C017	300 pf	Fixed ceramic	DD15301020	G4
C020, 024, 032, 045, 414, 419, 422, 427, 464	0.01 uf	Fixed ceramic	DK18103030	G4, F5, H5, G2, E1, E3, E5, E6, D3
C022	0.005 uf	Fixed ceramic	DK17502010	F5
C023, 059, 060, 061 062, 063, 071, 074, 099, 437	10 pf	Fixed ceramic	DD12100060	G5, C2, D2, C3, G1, G3, G4, B4
C025	0.04 uf	Fixed film	DF17403010	F6
C026, 029, 031, 034, 036, 037, 102, 105, 450, 453, 462, 477, 479, 480, 482	470 pf	Fixed ceramic	DK16471010	G5, H5, I5, I5, I5, H5, *, C3, D3, D4, D6,
C027, 030, 066, 075, 078	200 pf	Fixed ceramic	DD16201030	H5, H5, G1, G4 I5
C038, 043	0.033 uf	Fixed film	DF17333010	I4, I4
C039, 042, 080, 082 091, 092	0.01 uf	Fixed film	DF17103010	H4, I4, I6, I6, H3, H2
C040, 041	500 pf	Fixed ceramic	DD16501010	H4, H4
C044, 090, 463	0.047 uf; 35 VDC	Fixed electrolytic	EW47303510	I4, H3, D4
C046, 459	0.33 uf; 25 VDC	Fixed electrolytic	EW33402510	H2, E4
C047	1.0 uf; 25 VDC	Fixed electrolytic	EW10501510	I3
C048, 049	0.0047 uf	Fixed film	DF17472010	I3, I3
C050, 413, 457, 458, 466, 467	10 uf; 16 VDC	Fixed electrolytic	EA10601690	H1, E2, D3, D4, D4, C4
C051	33 uf; 10 VDC	Fixed electrolytic	EW33601010	I2
C052	0.001 uf	Fixed film	DF17102010	H1
C053, 054, 468	47 uf; 16VDC	Fixed electrolytic	EA47601690	I1, I2, I2
C055, 056, 057, 058 098, 405, 406, 407 408, 433, 438, 448, 472	0-20 pf	Variable ceramic	CT12000020	C2, D2, D2, A1, A1, B1, C5, B4, A4,

REF. DESIG.	VALUE	TYPE	SCC PART NO.	RESPECTIVE P.C. BOARD LOCATION
C064, 069, 104	100 pf	Fixed ceramic	DD15101020	G1, G3, G3
C065, 410, 411, 412, 426	50 pf	Fixed ceramic	DD15500040	G2, E2, F2, E2 E6
C072	1 pf	Fixed ceramic	DD10010020	
C076	60 pf	Fixed ceramic	DD15600010	G5
C083	100 uf;10 VDC	Fixed electrolytic	EA10701090	I6r
C088	0.04 uf	Fixed film	DF17403030	H4
C089, 096, 097, 460	0.22 uf; 25 VDC	Fixed electrolytic	EW22402510	G3, F5r, G5r, E4
C094	10 uf;10 VDC	Fixed electrolytic	EV10601030	H2
C095	4.7 uf; 16 VDC	Fixed electrolytic	EV47501610	H2
C101, 452, 469	4.7 uf; 35 VDC	Fixed electrolytic	EA47503590	* , D3, C5
C103	50 pf	Fixed ceramic	DD16500020	G2
C401, 402, 403, 404, 428, 471	30 pf	Fixed mica	DF36300020	A2, B1, C1, D6,
C409	160 pf	Fixed mica	DF35161500	F1
C416, 417	120 pf	Fixed ceramic	DD16121010	E2, E3
C420, 424	3 pf	Fixed ceramic	DD11030010	E4r, E6
C423, 425, 434	51 pf	Fixed mica	DF36510010	E5, E5, C5
C429	5 pf	Fixed ceramic	DD11050030	E5
C430, 473	20 pf	Fixed mica	DF36200020	D5, E1r
C439, 440	40 pf	Fixed ceramic	DD15400010	A4, B5
C441	50 pf	Fixed ceramic	DD16500010	B5
C443, 446, 447	10 pf	Fixed ceramic	DD12100010	A6, A5, A4
C454, 455, 461	33 uf; 3 VDC	Fixed electrolytic	EV33500310	D2, D2, E5
C456	0.0033 uf	Fixed flim	DF17332010	D3
C465	33 uf; 10VDC	Fixed electrolytic	EA33601090	D4
C483	0.002 uf	Fixed ceramic	DC18202020	
C484	10 uf; 10VDC	Fixed electrolytic	EW10601010	
DIODES				
D001, 002	1N60	Germanium	HD10001050	I3, H3
D003, 010		Silicon	HD20001100	I2, *
D004, 005	1N34A	Germanium	HD10001010	I6, I6
D006, 007, 404, 405 407		Silicon	HD20011050	H2, I3, E3, E3, C5
D401, 402		Silicon	HD20001200	A5, A6
D406		Zener	HD30023090	C5
INDUCTORS				
L001, 003, 003, 004		RF tuning	LA50018020	F1, F1, F2, F2
L005		11.7 MHz IF	LI55016152	F4
L006		11.7 MHz IF	LI55016182	F4
L007		11.7 MHz IF	LI55016132	F4
L008		11.7 MHz IF	LI55016140	F4
L009		455 kHz IF	LI70030360	I4
L010		455 kHz IF	LI70030350	I3

REF. DESIG.	VALUE	TYPE	SCC PART NO.	RESPECTIVE P.C. BOARD LOCATION
L011, 012		RF (1st tripler)	LI50028012	G2, G2
L013, 014		RF (2nd tripler)	LA50018030	G4, G4
L015, 017		RF choke	LC13940010	H4, H4
L401		RF (phase modul.)	LA55016010	E3
L402		RF (1st tripler)	LA40196040	E4
L403		RF (1st tripler)	LA70196050	E4
L404, 405		RF (2nd tripler)	LA50018030	E5, E5
L406, 407, 412		RF choke	LC15000012	D5, D5, A5
L408		RF choke	LC12800010	D5
L409		RF choke	LC13810020	C5
L410		Tri-filar	LM13422010	B5
L411, 415, 416		RF output		
		RF choke	LC14000010	B4, A5, A5
L413		RF choke	LC13810010	B5
L414		RF choke	LC11610010	A5
L417	22 mH	AF choke	LC22260020	D4
TRANSISTORS				
Q001		MOSFET	HF900011OO	F2
Q002, 003, 004, 005, 006, 007, 008, 009, 012, 013, 014, 015, 401, 402, 403		NPN silicon	HT305351BO	F3, F4, F5, H5, H5, I5, I5, I4, G1, G3, G5, I6, E1, E2, E3
Q010		PNP silicon	HT106831BO	I1
Q011		NPN silicon	HT313831BO	H1
Q016, 017, 018, 409		NPN silicon	HT309451QO	H3, H3, H2, D4
Q404, 405, 406, 407		NPN silicon	HT303871OO	E4, E6, D6, D5
Q408		NPN silicon	HT31001OO	C4
Q410		NPN silicon	HT312131BO	C6
Q411		PNP silicon	HT106731BO	B6
MISCELLANEOUS				
A401		Collapsible ant.	YR04049012	*
E001		Speaker	QK00503050	*
F001, 002	455 kHz	Ceramic filter	FF10045120	F6,
I001		Integrated circuit	HC10013030	I1
I401		Integrated circuit	HC10014030	D3
J004		Receptacle (earph.)	YJ01000140	*
J005		Receptacle (TN3 P.C. Board)	YF10000520	*
J404		Receptacle (ex. ant.)	YJ01000740	*
J405		Receptacle (ex. mic)	YJ10000560	*
J406		Receptacle (ex. power)	YJ04000010	*
M001		Meter	IM11014032	*

REF. DESIG.	VALUE	TYPE	SCC PART NO.	RESPECTIVE P.C. BOARD LOCATION
M401		Microphone	MS4000020	*
R040	25,000 ohms; w/switch	Variable composition (VOL)	RB12530022	*
R061	47,000 ohms	Variable composition	RA04730010	B6
R062	5,000 ohms; w/switch	Variable composition (SQL)	RB15020220	*
R432	2000 ohms	Variable composition	RA02020090	D4
S001		Switch(push-to-talk)	SC01020060	D1
S002	5-position	Switch(ch. select)	SR02050050	*
X001	145.94 MHz	Crystal (receive)	XC41502661	*
X003	12.155 MHz	Crystal (2nd LO)	XA21215505	*
X401	146.94 MHz	Crystal (transmit)	XP48163332	*
X402	146.34 MHz	Crystal (transmit)	XP48130002	*

SELECTED MECHANICAL PARTS

0105	Channel position plate	3708265012
0111, 0112	Knob (VOL and SQL)	3653154012
0114	Knob (channel select)	3782154010
0121	Moulding (rear cover)	3653257015
0123	Lid (battery compartment)	3653257022
0127	Moulding (escutcheon)	3653063024
0232	Battery tray	3653163016

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.

SR-C146A

* IN SOME UNITS, Q406 AND Q407 ARE REPLACED BY A SINGLE TRANSISTOR (MOTOROLA MRF-604) LOCATED AT Q406 POSITION.

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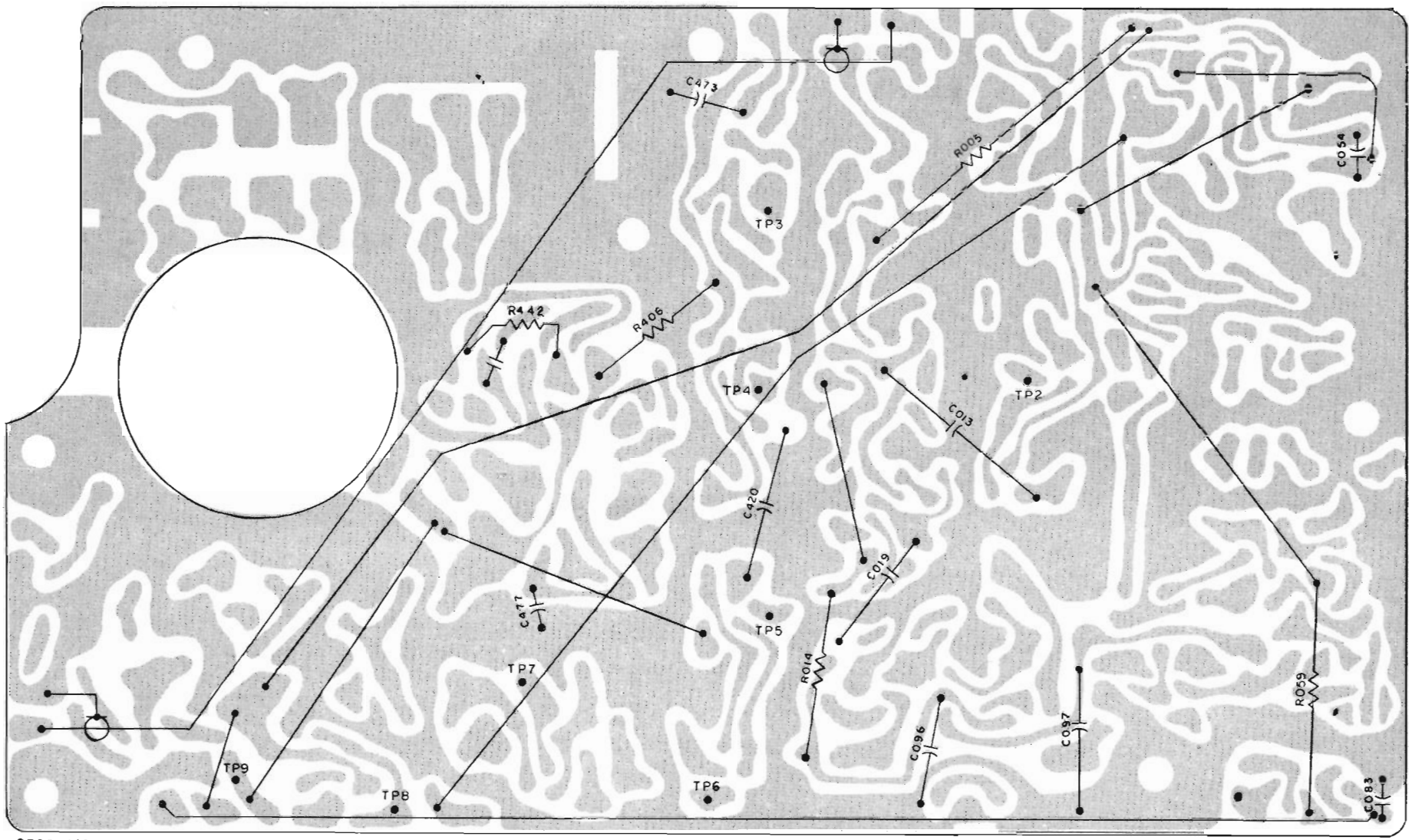
SR-C146A P.C. BOARD - COMPONENT SIDE LAYOUT
(VIEWED FROM FOIL SIDE)



830S-146A

SR-C146A P.C. BOARD - FOIL SIDE LAYOUT
(VIEWED FROM FOIL SIDE)

370849402
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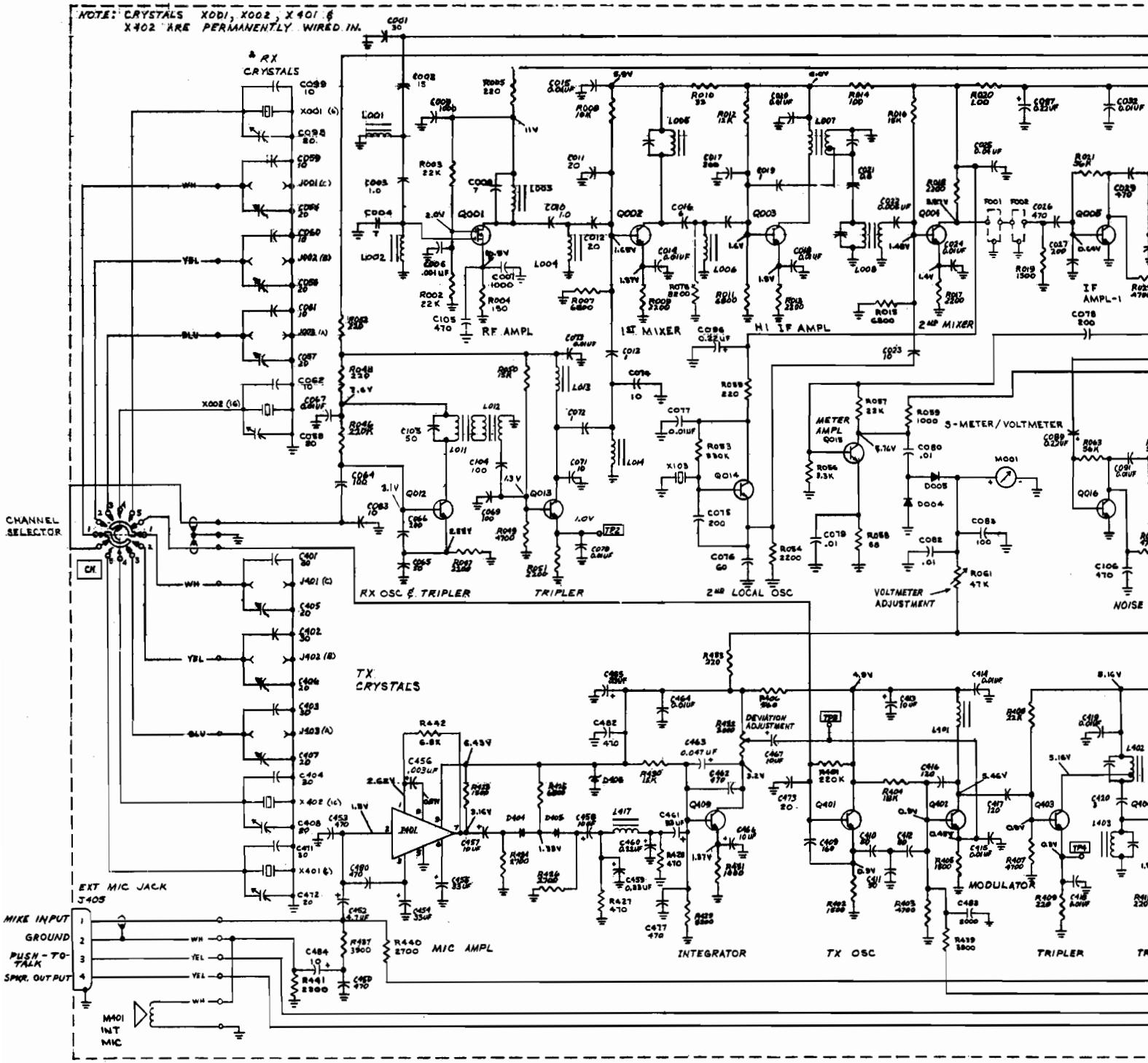
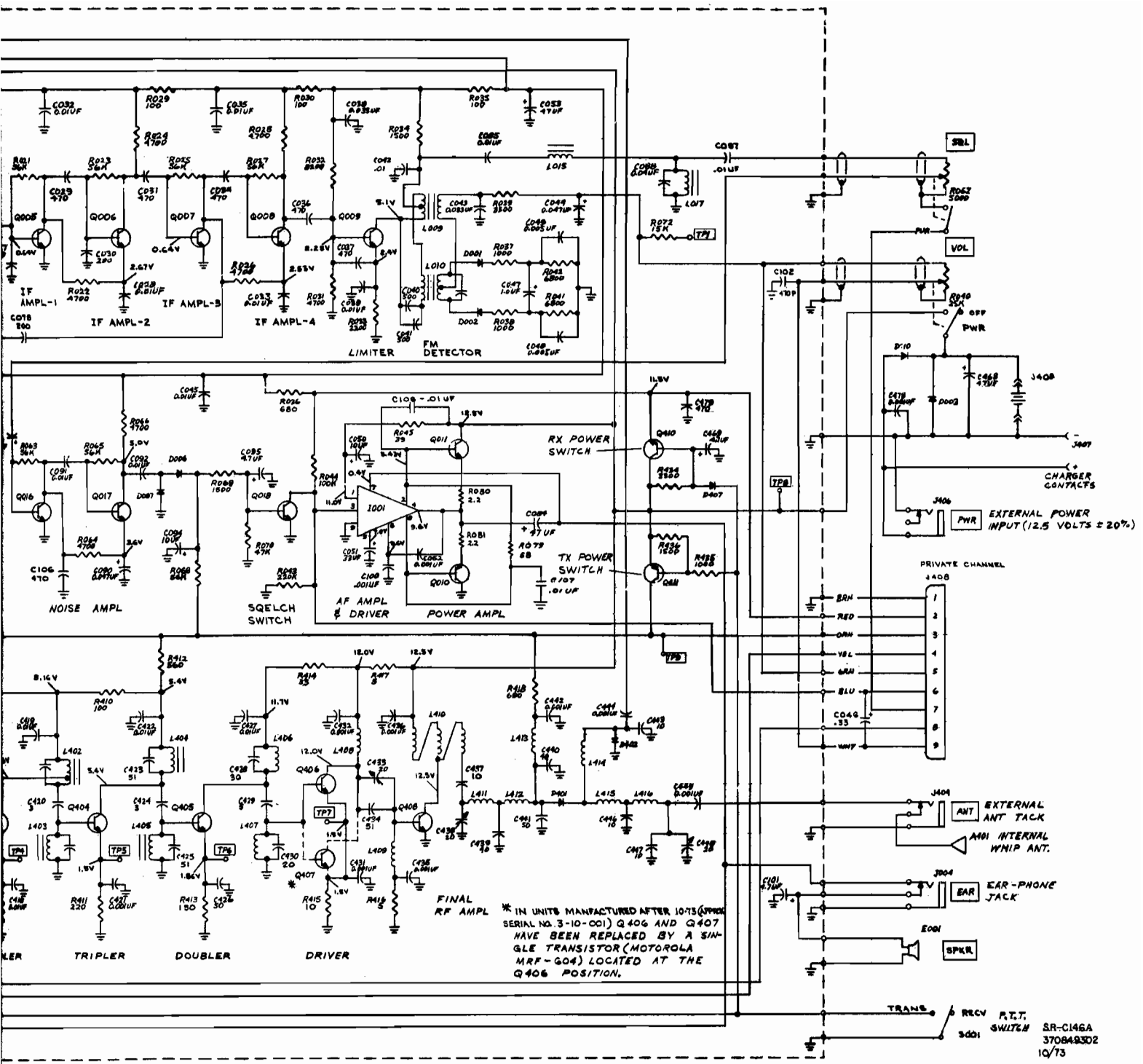


SR-C146A SCHEM



CHEMATIC DIAGRAM