TEN-TEC

OWNER'S MANUAL

Model 2510

CONTENTS

TEN-TEC, INC.
SEVIERVILLE, TN 37862

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SECTION I

UNPACKING

Carefully remove your Model 2510 from the packing carton and examine it for signs of shipping damage. Should any damage be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. Retain all damaged cartons. Liability for shipping damage rests with the carrier.

It is recommended that you keep the shipping carton and fillers. In the event that storage, moving or reshipment becomes necessary, they come in handy. Accessory hardware, etc. are packed with the Model 2510. Make sure that you have not overlooked anything.

GENERAL DESCRIPTION

The TEN-TEC Model 2510 Mode B Satellite Station enables the Radio Amateur to communicate through any Mode B amateur satellite with a minimum of ancillary equipment and at a modest cost. (A Mode B satellite is one which uses the 435 MHz band as the transmitted uplink and the 145 MHz band as the received downlink.) Model 2510 incorporates a complete 435 MHz, ten watt output, single sideband or cw transmitter and a two meter to ten meter receiving converter, both tuned with a common frequency-adjusting knob.

The transmitter is VFO tuned across the 435.0 to 435.5 MHz segment of the 432 MHz amateur band. All present and anticipated amateur Mode B satellites will operate within this 500 kHz segment. Only this portion of the band is operational as received. In the event that satellites are launched that operate outside of this segment, TEN-TEC will make available an accessory printed circuit oscillator assembly that can be added at a future date that will extend operation up to 437.0 MHz. The band switch and interconnecting cable for the switch are already incorporated in Model 2510.

The transmitter features selections of cw or ssb modes and of upper or lower sideband. The rf output power level is automatically maintained at a preset level (ALC) so that overdrive is not possible. The preset level can be reduced from the factory set 10 watt level if a linear power amplifier with drive requirements below this level is used.

The receiving converter employs a gallium arsenide field effect transistor (GaAsFET) preamplifier for lowest noise figure and an output frequency of approximately 29.0 MHz.The ten meter band of any Amateur hf receiver or transceiver, or a high quality general coverage receiver, can be used in conjunction with the converter. Once the hf receiver is set to the correct frequency, all satellite tuning is performed with the Model 2510 main tuning knob. (Transmitter and receiving converter are automatically tracked, thus producing a pseudo-transceiver.)

Provisions are made to allow duplex operation so your transmitted signal can be received simultaneously for system and frequency checks. A front panel SPOT pushbutton switch places the transmitter in operation with carrier inserted. For cw operation, where an external sidetone oscillator is to be activated, or in other instances where a T/R switch is desired, the EXT KEY jack on the rear panel provides an access to the open collector of a NPN transistor that is turned on when transmitting. Model 2510 requires a 12 to 14 volt dc power source capable of supplying a continuous current of 3 Amperes.

SPECIFICATIONS

TRANSMITTER

FREQUENCY RANGE: 435.0 to 435.5 MHz, standard. Extendable to 437.0 MHz with optional oscillator assembly, available if required. (VFO over-run of approximately 30 kHz on each band edge.)

OUTPUT POWER: 10 Watts.

OUTPUT IMPEDANCE: 50 Ohms, unbalanced.

MODES: Upper and lower sidebands; cw.

SIDEBAND GENERATION: Balanced modulator through 4 pole monolithic filter.

SWITCHING MODE: Push-To-Talk switch on microphone.

AUTOMATIC LEVEL CONTROL: Factory set to 10 watts output. Can be adjusted downward with internal control.

CARRIER SUPPRESSION: 50 dB, minimum.

UNWANTED SIDEBAND SUPPRESSION: 30 dB, minimum @ 1 kHz.

SPURIOUS AND HARMONIC OUTPUT: Greater than 50 dB below full power rating.

MICROPHONE INPUT: Low or high impedance with 5 mV level, minimum. Polarizing voltage for electret types available at connector. Standard four terminal locking type connector.

RECEIVING CONVERTER

FREQUENCY RANGE: 145.5 to 146.0 MHz input converted to 29.0 MHz output. (VFO over-run of approximately 30 kHz on each band edge.)

CONVERSION GAIN: 25 dB, typical.

IMAGE REJECTION: Greater than 60 dB.

NOISE FIGURE: Less than 2.5 dB.

DYNAMIC RANGE: 85 dB, typical.

GENERAL

POWER REQUIREMENTS: 12 to 14 volts, dc; 3 amperes maximum, continuous.

SIZE: HWD 4-1/2" x 7-9/16" x 11"

WEIGHT: 6 lbs.

SECTION II

COMMUNICATING THROUGH SATELLITES

Communication through satellites is an exciting facet of Amateur Radio that presents challenge as well as satisfaction. Until recently, all amateur satellites were placed in near circular orbits close to the earth, with orbit periods of approximately 90 minutes. Station access time, although repeating every hour and a half for several passes, is merely 10 to 15 minutes, during which time constant antenna reorientation is necessary to keep the antenna pointed correctly. The newest AMSAT OSCAR satellite (AO-10) changed this since it is in a large eliptical orbit with a period of approximately 11-2/3 hours. Access time for a single pass is on the order of ten hours, once a day, so that antenna pointing need be updated no more than every hour or so. Although Model 2510 can be used with the low orbit satellites, the following discussion on installation and use is pointed toward its use with AO-10 and future high orbit satellites.

To best illustrate the difference between operating through AO-10 and ordinary hf land communications, consider these points:

1. Satellite communications are similar to VHF repeater systems in that they are point-to-point, line of sight contacts made through two direct paths, the first from the transmitting station to the satellite and the second from the satellite to the receiving station. However, the transponder's bandwidth is large so that many stations can work through the repeater at the same time, and the modes of operation are similar to hf ssb and cw. So long as both the transmitting and receiving stations are in view of the satellite, no matter where they are located on the earth, contacts are possible. Ssb and cw were chosen for technical reasons -- no FM is permitted.

2. Since our repeater is not fixed on top of a tall building or on a mountain top, but rather orbiting the earth, some means are necessary to direct our directional antennas to the satellite, not only in the asimuth or horizontal plane but also at various elevations from horizontal to vertical. An antenna system with two independent rotators serves this need (AZimuth/ELevation).

3. The transponder in the satellite has a limited amount of transmitter power, so that the signal strength of each of the signals it transmits depends on the number of stations operating in the passband and the relative power of each. If all signals transmitted to the satellite are of the same strength, and AMSAT is emphasizing that this should be the case, then all re-transmitted signals will have an equal portion of the available power and all contacts will be solid. If, however, too many powerful stations send up signals, the transponder AGC system will reduce all lower powered signals proportionally to the point where solid contacts are difficult, without actually increasing the strong ones. It has been demonstrated that less than 100 watts effective radiated power (ERP) is all that is needed under optimum conditions.

4. Since we are in effect working crossband, we can have both transmitter and receiver operational at the same time (duplex mode). This allows us to hear our own signal coming back down but does require that both transmitted and received frequencies be adjusted independently of each other. We no longer have a transceiver. To further confuse the issue, since the transponder inverts the frequency scheme, raising the transmitted frequency requires a lowering of the received frequency to stay on the same channel. And also, so that we can receive the normal upper sideband, we must transmit the lower sideband. But because of the separate antenna systems needed, we can optimize each for best performance, such as adding a two meter preamplifer at the antenna without having to switch it in and out to transmit. Also, since our antennas are usually pointing upward from the horizon, height is not as great a factor in the antenna system, so long as the headings clear surrounding objects such as trees and buildings.

5. Since the orientation of the spacecraft with respect to the receiving site is constantly changing, a linearily polarized antenna system, (e.g. horizontal or vertical) is not the optimum for maximum QSB free signal transfer. To solve this problem, right hand circular polarization has been selected by AMSAT for both bands. With this scheme the ground station can use either circular polarization or linear with about a 3 dB lower system gain. Some slight QSB may be noticed when using linear polarization.

AMSAT-OSCAR 10

The only high orbit Amateur satellite presently operating is AO-10. Minor problems at launch time resulted in some less-than-optimum conditions, but the Mode B systems are functioning quite satisfactorily. The pertinent operating parameters are listed here.

Orbit - The planned orbit in a plane 57 degrees to the equatorial plane, with a 1,500 km perigee (closest distance to earth) was not attained. The inclination of the orbit plane is only 26 degrees, so it is traveling in a plane closer to the equatorial plane. The perigee is 3,950 km and apogee is about 35,520 km. The result of this difference is that only about 40% of the radio coverage expected is achievable. The low inclination angle results in antenna off-pointing and/or operational quiet times for about 40% of the time. Orbital information is available from both ARRL and AMSAT and computer programs are available through AMSAT for most of the popular home computers at modest cost. A revised OSCARLOCATOR is available after January, 1984.

Beacon - A beacon at 145.810 MHz transmits general information on the hour and half hour regarding QRP days, mode schedules, etc, and telemetry the rest of the time. Its reception is a good check on receiver and antenna performance and calibration.

Frequency Bands - The bandwidth of the transponder is 115 kHz. The uplink range for the general service band starts at 435.045 MHz and ends at 435.160 MHz. The two meter downlink correspondingly spans between 146.960 and 145.845 MHz. To obtain either the up or downlink frequencies for those in between these limits, subtract the known frequency from 581.005 MHz. (Example: 435.100 up is 581.005 - 435.100 = 145.905 MHz down.)

Power Requirements - In order to access the transponder so that solid communication is attained, something less than 100 watts ERP is all that is necessary on the transmitting end. An antenna with 12 or 13 dB gain and cable loss on the order of 2 or 3 dB will produce 100 watts ERP with 10 watts out of the 435 MHz transmitter. The Model 2510 running barefoot will produce this requirement, and in fact, solid contacts have been made using only 3 watts out to a mediocre antenna system. At times when many stations are operating and some are using high power, a 50 to 100 watt linear following the Model 2510 may be required to break through.

Receiver Requirements - As with all VHF receiving systems, the noise figure at these frequencies is all important to performance. In addition, the signal from the satellite travels distances much greater than land based systems, and may even reach a distance of 24,000 miles. It is recommended that the lowest possible noise figure be attained in the system. Model 2510 uses a GaAsFET front end to achieve this objective. If long lead-ins are required, signal attenuation in the cable may be excessive and an antenna mounted preamplifier is recommended.

Antennas - Antenna gains greater than 12 dB with modest lead lengths should be adequate, but here again, the higher the system gain, the better. It is more important to optimize the receiving antenna system than the transmitting since more than adequate power is easily achievable in the transmitter. Helix antennas are by nature circularily polarized, but the direction is dependent on the way the helix is wound and cannot be changed. Crossed yagis can easily be altered from right to left hand polarization by switching the feed system delay between the two sets of driven elements. This is preferable to the fixed helix if some doubt exists as to what the proper configuration should be.

The satellite carries several antennas for each frequency band. The directional 6-element phased array used to transmit the two meter signal down points directly at the earth when the satellite is at apogee and remains fixed in space in this position. Hence, at perigee, it points directly away from earth. But the more or less omnidirectional monopole antenna takes over sometime during the orbit to fill in when the beam is ineffectively pointing in the wrong direction. Therefore it can be expected that results will vary somewhat as the satellite travels from horizon to horizon.

Because of the 26 degree inclination, the maximum antenna elevation that will be necessary for your location will depend on your latitude. If your latitude falls between 26 degrees north and 26 degrees south, your antenna will have to cover all 90 degrees of elevation from the horizon to directly overhead. With latitudes greater than 26 degrees, the antenna will not have to point as high. A simple formula for roughly calculating how high it need point is Max Elevation=116-1.1xLat. (Example: At 40 degrees latitude, the maximum angle of elevation will be 116-44=72 degrees. At the north pole it will be 116-99=17 degrees off the horizon.)

SECTION III

STATION SET-UP

IMPORTANT - The dial skirt surrounding the 435 MHz main tuning knob is a friction type dial that can be rotated about its shaft without rotating the tuning knob. This dial is calibrated at the factory so that it correctly indicates the frequency in the 100 kHz segment indicated by the position of the LED in the slide rule dial. It is recommended that before any connections are made and before the unit is handled too much, which might result in losing calibration, the position of the skirt be logged by rotating the main tuning knob counterclockwise to the end of its travel and noting and recording the skirt reading at this point. End of travel is indicated when the skirt no longer rotates when the large knob is turned. In the event that the skirt is accidently moved, it can be reset to its calibrated position by again rotating the main tuning fully CCW and while holding the large knob so that it cannot rotate, turning the skirt to the correct reading. This is especially important if you do not have a frequency counter that covers 435 MHz.

The following procedures describe the interconnections that are necessary between Model 2510 and the additional equipment that is required to provide a working satellite station for both single sideband and cw communications. If only one mode of operation is contemplated, only those steps pertaining to that mode need be performed.

HF RECEIVER - A good quality 28 to 30 MHz receiver is required to complete the downlink. An Amateur Radio transceiver or general coverage short wave receiver will serve this purpose. Connect a coaxial cable between the phono connector on the rear panel marked 10 METER OUTPUT and the receiver's antenna input jack. If a transceiver is used, care must be taken so that the transmitter section is not activated if both transmitter and receiver sections use the same antenna connector. When using TEN-TEC transceivers, apply the converted downlink signal to the separate RX ANTENNA input jack and place the RX-TRX antenna switch in the RX position.

VHF ANTENNA - The two meter downlink antenna is connected to the type SO239 connector marked 2 METER ANTENNA on the rear panel. If a circularily polarized antenna is used, it should have provisions to switch between right and left hand polarization. If crossed yagis are used to achieve the circular polarization, this is easily accomplished. It has been confirmed that the signal being returned from the satellite and the aspect of the receiving antenna to it will alter the direction of polarization to the point that increased signals may result with left hand polarization. If you do not wish to provide an antenna with switchable polarization, it is best to use linear polarization. (Orbit Magazine, Sept/Oct 1983, pg 15.)

TWO METER PREAMPLIFIER - Long cable runs from antenna to converter will result in appreciable signal loss prior to amplification. This reduction in signal-to-noise ratio may degrade performance to an unusable level. The solution is an antenna mounted preamplifier. Care must be taken to maintain the gain of the amplifier to a reasonable level -- on the order of 6 to 10 dB maximum -- especially if a preamplifier with a GaAsFET is used. They have poorer overload characteristics that may introduce IM components, especially in large cities. If high quality cable is used and it is less than 50' in length, an antenna mounted preamplifier may not result in any improvement in S/N ratio. An alternative to a preamplifier is a larger antenna array.

UHF ANTENNA - The same comments regarding polarization of the two meter antenna hold for the 435 MHz antenna system. The higher the antenna gain and shorter the cable, the better.

LINEAR POWER AMPLIFIER - This optional accessory will insure more consistent contacts, especially at times when many stations are working through the satellite and when the satellite is in a position other than at apogee (its antenna pointing directly at earth). A 50 or 100 watt amplifier is sufficient, and powers greater than this are considered impolite and the mark of an inexperienced operator. Certain days of the week are considered QRP days (announced through the beacon reports) and only 100 watts ERP (10 watts to a 10 dB antenna) are permitted.

If a linear is included in your setup, make provisions to by-pass it whenever conditions permit. The 435 MHz output connector is the type BNC connector mounted on the heat sink. Use high quality cable since losses at 435 MHz are much greater than at two meters.

POWER SUPPLY - A 12 to 14 volt dc supply will be required to power Model 2510. Maximum continuous current from the supply will range up to 3 amperes. If other equipment requires 12 volts, such as a linear amplifier, receiver, etc, available current from the supply should be high enough to cover all requirements. The dc input connector is the phono jack marked 12 VDC INPUT. The AUX jack next to it is a parallel connection to it and provides means for powering additional station equipment.

MICROPHONE - The microphone input has been designed for high or low impedance microphones that produce approximately 5 mV, minimum. The cable, which preferably should provide shielding for all leads, is terminated in a standard four pin microphone connector with locking ring. Pin connections are as follows: Pin 1 = microphone signal; Pin 2 = shield/chassis ground; Pin 3 = Push-To-Talk switch, normally open. Pin 4 is used with electret type microphones that require a positive polarizing voltage. TEN-TEC Model 214 Desk Microphone and Model 700-C Handheld Microphone both are electret types that are directly compatible with the MIC connector wiring of Model 2510.

KEY - Connect a straight key, bug or electronic keyer to the jack on the rear panel marked KEY. Do not confuse this jack with the one marked EXT KEY. The key line in Model 2510 is low POSITIVE voltage that requires a reed relay or NPN transistor switch in the output of the keyer. Keyers designed for "grid block" circuits (negative key line) will not work. The key line is a fairly high impedance circuit that requires very little current in the closed condition. For maximum shielding, use miniature coaxial cable for the key line.

SIDETONE - There is no sidetone oscillator in the Model 2510. If the keyer that you are using does not have one built in, it is possible to key the hf transceiver so that its sidetone can be used to monitor your cw sending. To do this, make sure that the transceiver rf drive control is turned completely off so that no rf is generated. Connect a miniature coaxial cable between the EXT KEY jack on the Model 2510 and the KEY input of the transceiver. NOTE: This connection should be made only if the transceiver incorporates a positive, low voltage cw keying input line. (Will not work with "grid block" circuit.)

GND POST - Strap all station equipment chassis together and then to a good earth ground system. Use the GND post on the rear panel for this connection, using short heavy leads, preferably braid.

SECTION IV

OPERATION

FRONT PANEL CONTROLS

BAND Switch - This switch is operational only in the event that future satellites will require transmissions higher than 435.5 MHz and an accessory oscillator PC assembly is installed in the Model 2510. As received from the factory only the 435.0 to 435.5 MHz range is operational and the switch must be in the 435.0 position.

Main Tuning Knob and Slide Rule Dial - The transmitted and received frequencies are controlled using the large tuning knob. The dial skirt, divided into 1 kHz markings ranging from 0 to 99 kHz, in conjunction with the slide rule dial, permits setting the channel frequency to ± 5 kHz accuracy, provided that the skirt position is properly set (see Section III). The scale of the slide rule dial represents the 145.5 to 146.0 MHz portion of the two meter band. The position of the red LED indicates in which 100 kHz segment of this range the VFO is tuned. The reading on the skirt determines the exact kHz frequency. Example: If the LED is located in the segment between 8 and 9 on the slide rule dial and the dial skirt reads 75, the tuned frequency is then 145.875 MHz for the receiver (435.130 MHz for the transmitter). Working through AO-10, the only frequency range that is used is 145.845 through 145.960.

SPOT Pushbutton - When the SPOT switch is depressed, the 435 MHz transmitter is activated with carrier inserted, in essence placing the unit in the cw key down/duplex mode. This allows you to properly set the hf receiver tuning to compensate for doppler shift due to the satellite's relative motion and crystal tolerance variations in the converter. During a suitable pass and with the antennas orientated toward the satellite, depress the SPOT switch. With the ten meter receiver set for upper sideband reception, tune around the 29.0 MHz setting until you hear your own signal coming back on the downlink. Release the switch. The returned signal should linger for a fraction of a second before stopping. This ensures that you are hearing the satellite downlink and not a birdie in the receiving system. It should also have a delay in coming on when you depress the SPOT switch. Set the received beat to 750 Hz. Further adjustment of the receiver will not be necessry unless the doppler changes or you want to offset the received frequency of a sation being worked that is slightly off your frequency (similar to RIT control function in hf operation). The RIT control on the receiver may also be used for these purposes.

DRIVE Control - The cw output power can be adjusted from 0 to 10 watts with this control. While depressing the SPOT switch rotate it clockwise. At the 10 watt setting the ALC LED lights and further clockwise rotation of the DRIVE control will not increase output power beyond the 10 watt level. The keying waveshape will deteriorate if it is set appreciably higher than the ALC point.

MIC GAIN Control - After the DRIVE control is adjusted, the MIC GAIN control is used when operating ssb. Full output is developed when the ALC LED flashes on voice peaks. Increasing the MIC GAIN or DRIVE control beyond the ALC settings only degrades the quality of the ssb signal without increasing output power. Note that it is necessary that the DRIVE control be set to the ALC position before the MIC GAIN control will permit full ALC output.

CW/SSB Switch - This pushbutton switch selects the mode of operation, cw in the depressed position and ssb in the 'out' position.

LSB/USB Switch - Lower sideband (normal setting for AO-10) is selected with this switch in the depressed position, upper sideband when 'out'.

MUTE/DUPLEX Switch - When in the MUTE ('in') position, the receiver converter is disabled during transmit. DUPLEX allows both transmitter and receiver to operate simultaneously. After setting your frequencies in the DUPLEX mode, you may want to switch to MUTE to eliminate hearing your signal coming in on the down link since it may be delayed up to a quarter of a second (apogee) and cause an echo effect.

SETTING ALC BELOW 10 WATT LEVEL

If continued operation below the 10 watt level is desired, such as using Model 2510 to drive a linear power amplifier, it becomes difficult to maintain a given lower output below the limiting action of ALC. It is possible to change the ALC power level by means of an internal potentiometer, accessible through the round cutout in the bottom cover, so that ALC is restored at this lower power level. To do this:

1. Log the position of the DRIVE control where the LED just comes on when the SPOT switch is depressed. This should be done with the transmitter properly loaded into 50 ohms. Note and record the pointer position of the DRIVE control so that you can easily reset the ALC control to the 10 watt level if desired.

2. If you desire only to operate at a lower power to the antenna, connect a reliable wattmeter to the 435 MHz output connector and load the transmitter with either a 50 ohm dummy load or your matched antenna. If you are driving a linear power amplifier, connect the output from the 435 MHz transmitter to the input of the linear and the antenna to its output connector.

3. Locate the ALC potentiometer through the bottom cutout. IT IS THE POTENTIOMETER THAT IS CLOSEST TO THE REAR PANEL OF THE UNIT. Do not mistake it for another potentiometer approximately 1/2" away. This control should NOT be changed and it is sealed with sealing wax.

4. With the unit upright and facing you, rotate the ALC potentiometer with the forefinger fully counterclockwise (finger motion from left to right).

5. Rotate DRIVE control to position logged in step 1. If a linear is used, turn it on and depress SPOT switch. ALC LED should light.

6. While observing wattmeter or dc current to the linear, rotate ALC potentiometer in opposite direction until desired rf power is obtained or linear is fully driven.

7. Reduce setting of DRIVE control to point where LED just comes on and check again to see if desired level of power is developed. A slight resetting of the ALC pot may be necessary. When correctly adjusted, the ALC LED should come on at the DRIVE setting that develops the required output, and further rotation of the DRIVE control should maintain output at this level.

If you desire to return to the 10 watt level, reset the DRIVE control to the logged setting and adjust the ALC potentiometer so that the LED just lights.

OPERATING HINTS

1. The ten meter receiver setting should be within two or three kilohertz of 29.0 MHz. Doppler shift ranges between $\pm$ 2 kHz.

2. It is only possible to work through the satellite when it is in a position above the horizon at your location and when the Mode B transponder is turned on. During certain portions of each orbit and when Mode L is enabled, the Mode B transponder is turned off. Check QST and ORBIT magazines and beacon messages for schedules. (Currently, Model L is enabled one hour either side of apogee on Wednesdays and Saturdays. Mode B is disabled every operating orbit for approximately one hour and 50 minutes either side of perigee. Therefore the transponder is on for approximately eight hours of the 11-2/3 hour orbit.)

3. Although the satellite makes slightly more than two orbits a day, only one of the two is normally visible at a given location. This is the result of the combined motions of the earth's rotation and the satellite, placing the satellite below the horizon for the second orbit. Approximately every 18 days the visible orbits will switch from odd numbered orbits to even, or vice versa, with portions of both orbits visible during this transition day.

4. Check the beacon signal at approximately 145.81 MHz for propogation conditions, antenna heading and messages concerning AO-10 schedules.

5. The sum of the transmitted and received frequencies is 581.005. Therefore TX=581.005-RX and RX=581.005-TX.

6. Due to path delay, quick frequency changes while listening to your downlink signal will produce a momentary loss of signal until tuning stops or slows to the point where the received signal can catch up with the receiving converter's new setting. This phenomenon can be used to verify that you are indeed hearing the downlink signal and not a birdie.

7. Weather conditions, local noise and the position of the satellite in its orbit all affect how successful communications will be. Returning signals at their best are still weak compared to land communications. Do not be disturbed if the 'S' Meter doesn't come off the pin consistently.

8. More solid contacts will be made when the satellite's elevation angle is large. This condition minimizes land originated noise from being picked up with the highly directional antenna and produces the path with least atmospheric attenuation for both links.

9. Antenna orientation need be checked occasionally, every half hour or so.

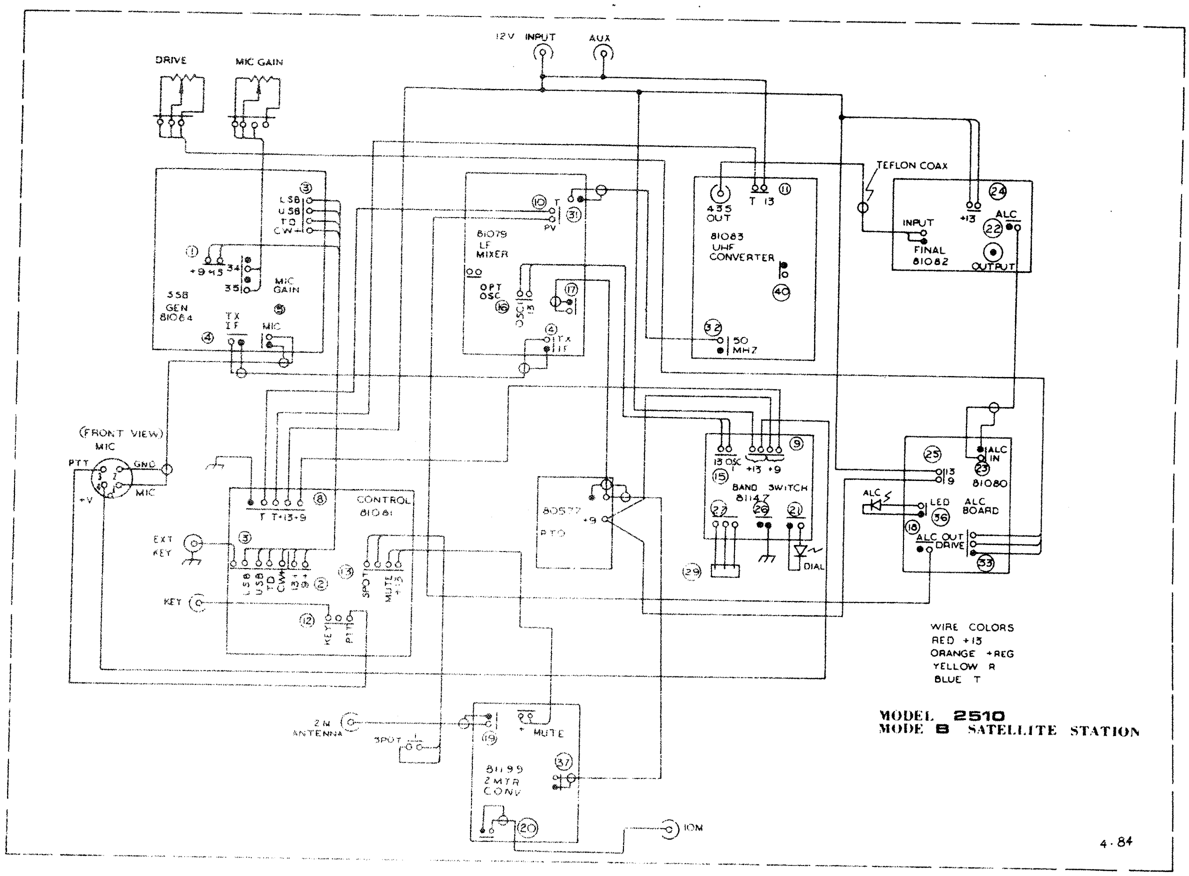
10. In some instances it is possible that the station layout, cable runs and system grounding may allow some transmitter power to affect the receiving converter or hf receiver sensitivity. This condition can easily be checked by listening to an incoming signal or the beacon and then pressing the SPOT switch. If the received signal strength decreases appeciably, or the background noise rises to where it adversely affects reception, the converter is being desensed. Relocating the equipment and cabling may improve or eliminate this problem. Keep linear amplifiers and antenna cables as far as is practical from the Model 2510 and try various grounding systems.

11. Performance improvements result more from improved receiving capabilities and less from transmitting improvements. Better two meter antenna arrays, low noise environments and a sensitive high quality 28-30 MHz receiver are several areas to be considered for improvements. Narrow band filters for cw reception also help if local noise is a problem.

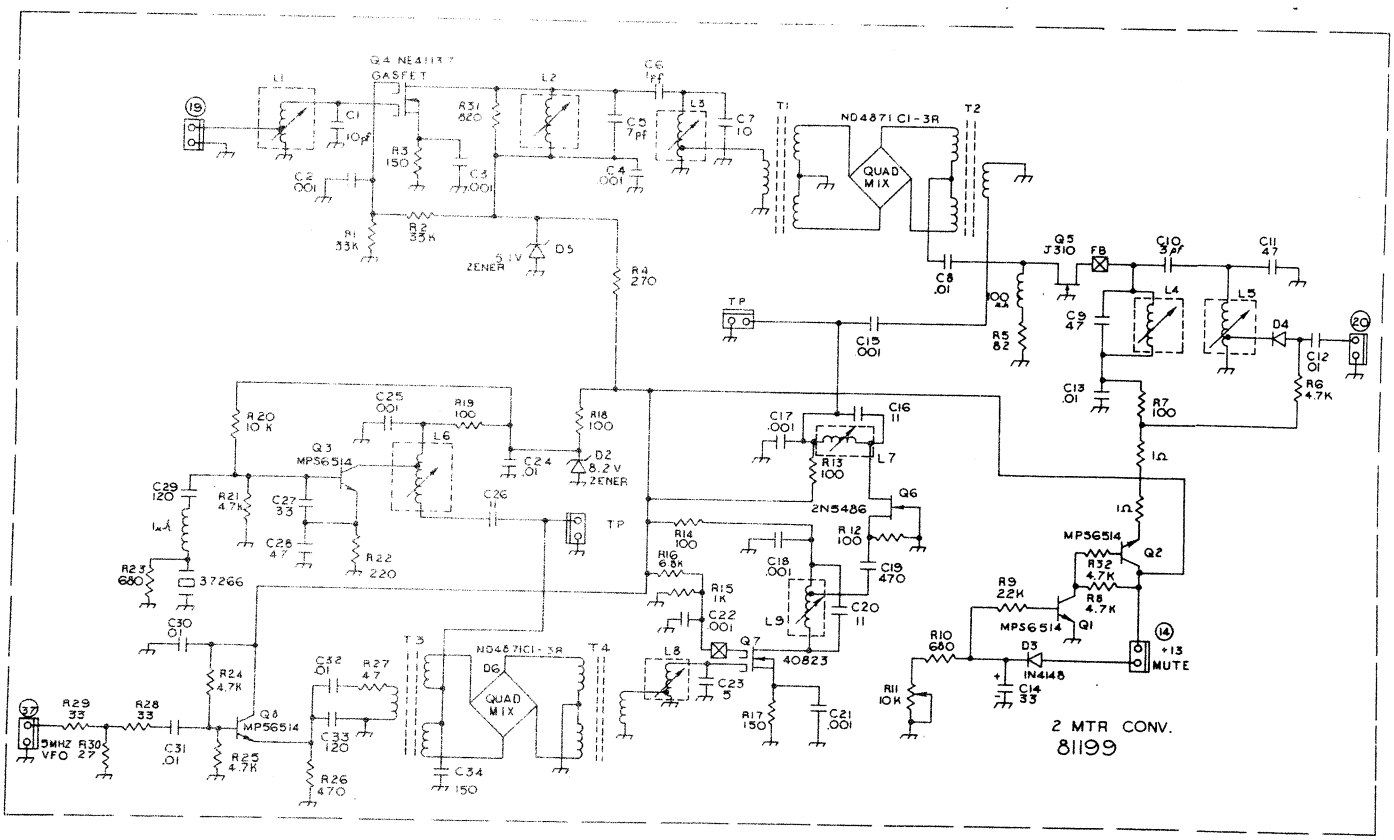
12. For additional reading, Orbit Magazine, QST (especially the April 1983 issue), the ARRL Handbook and Antenna Handbook are all recommended.

SECTION V

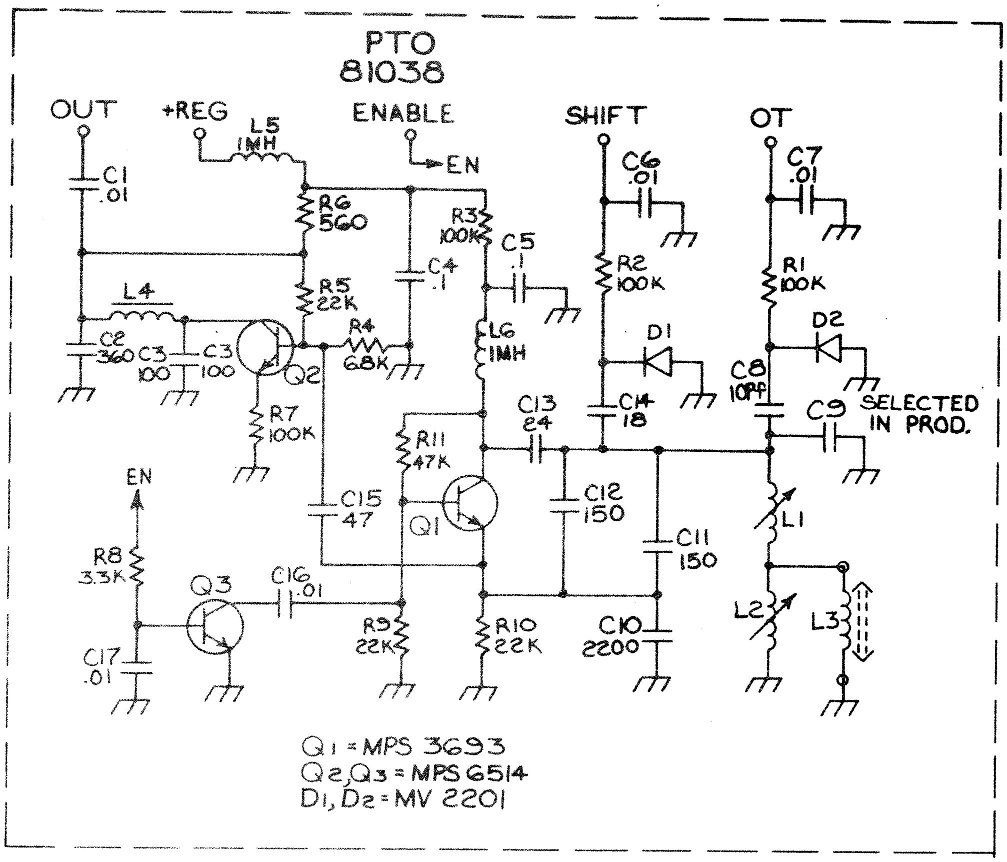
SCHEMATIC DIAGRAMS



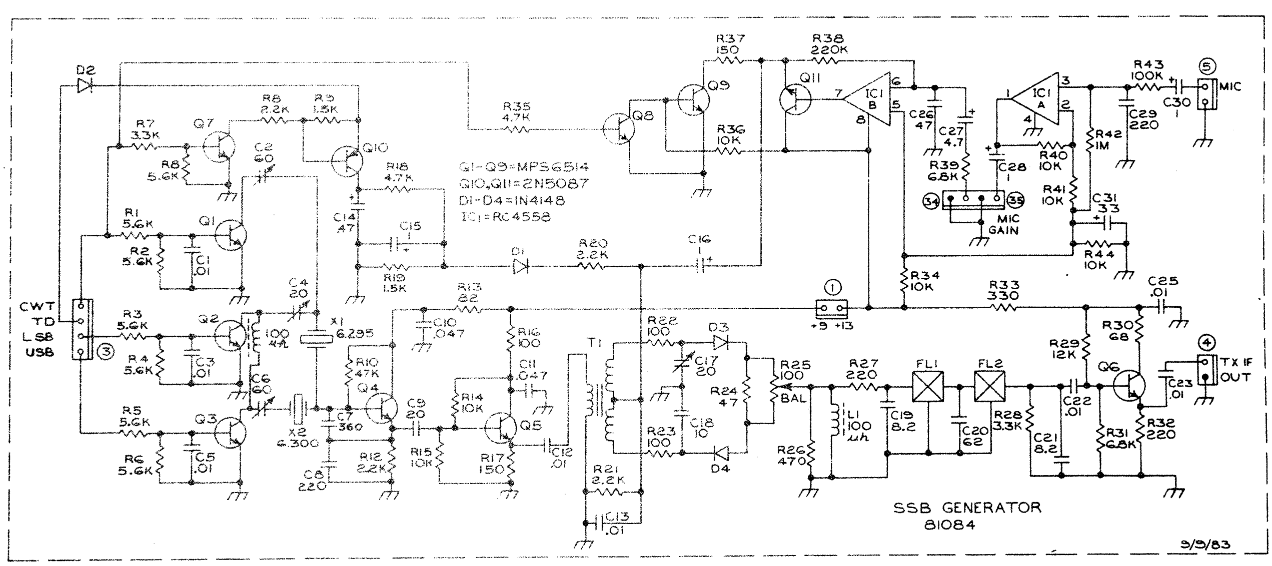
CHASSIS WIRING DIAGRAM



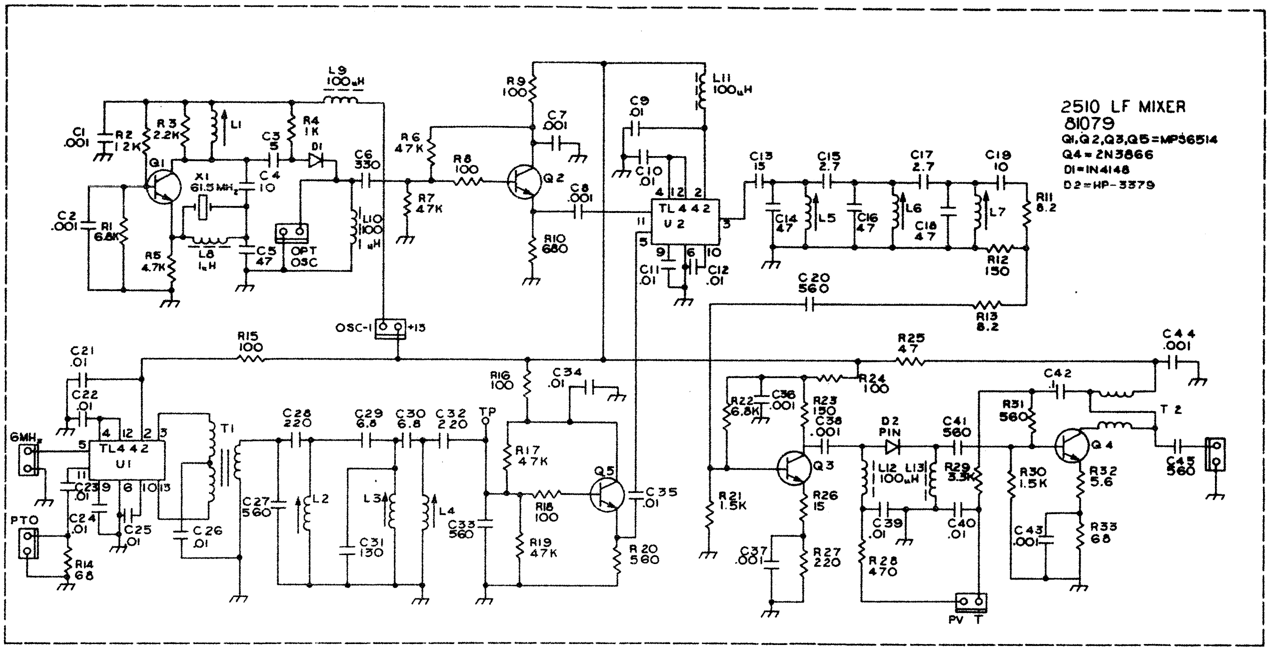
TWO METER RECEIVING CONVERTER SUBASSEMBLY



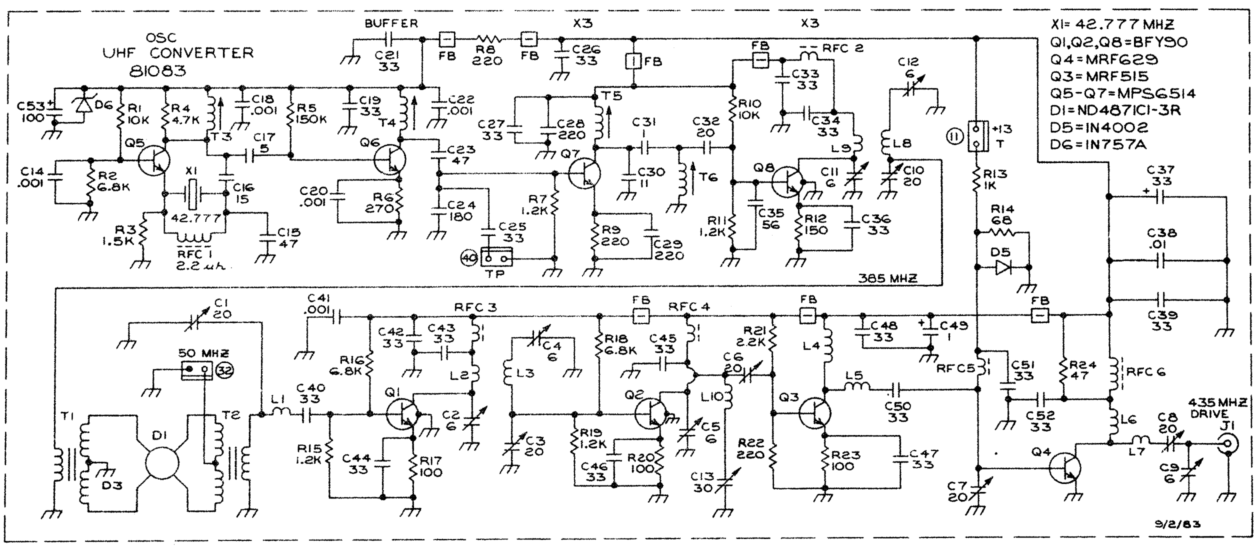
TRANSMITTER PTO SUBASSEMBLY



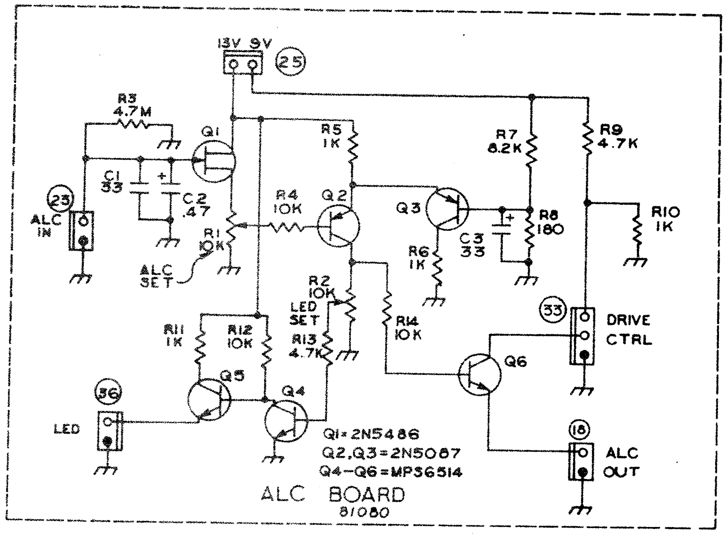
SSB GENERATOR SUBASSEMBLY



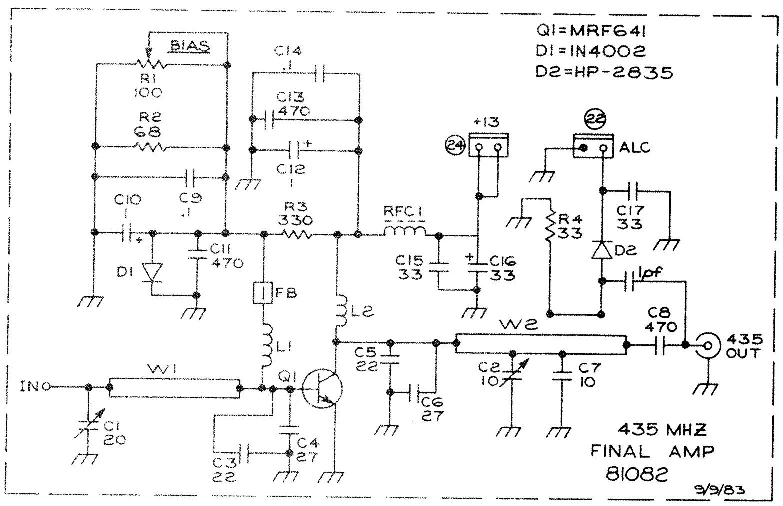
TRANSMITTER LOW FREQUENCY MIXER SUBASSEMBLY



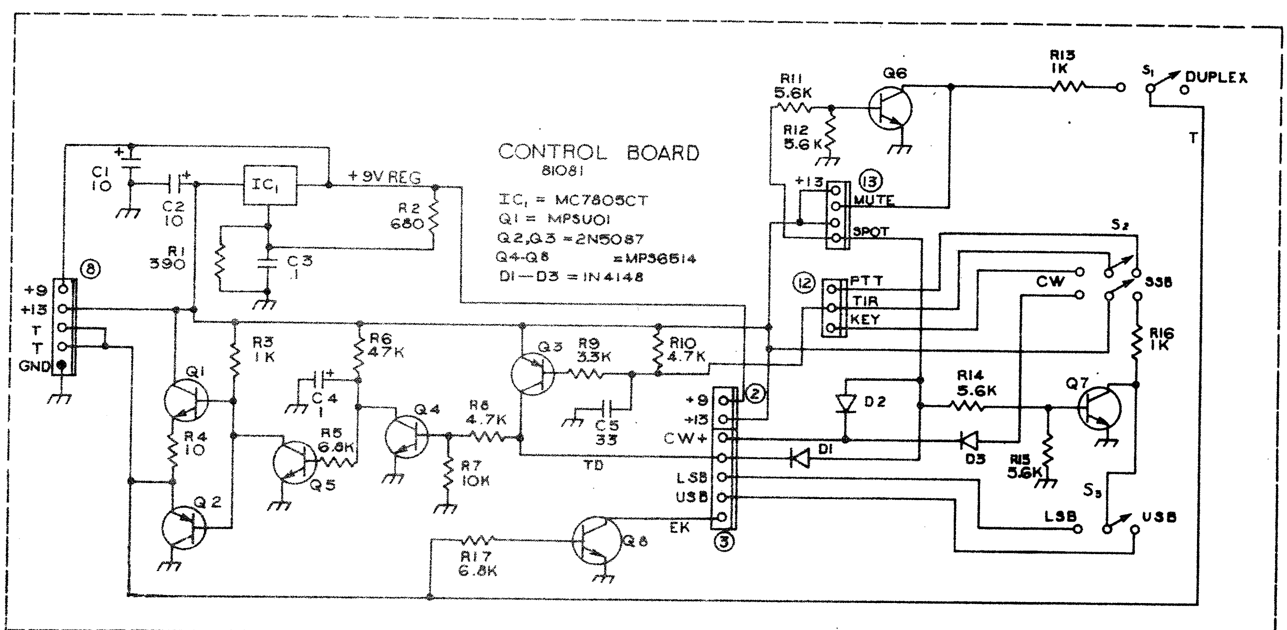
TRANSMITTER UHF CONVERTER SUBASSEMBLY



ALC BOARD SUBASSEMBLY



FINAL AMPLIFIER SUBASSEMBLY



CONTROL SUBASSEMBLY

MODEL 2511 SATELLITE EXPANSION BOARD

FOR MODEL 2510

1. Disconnect all power from the 2510.

2. Remove top and bottom covers.

3. Locate the three mounting holes on the front left of the top chassis.

4. Mount the board using these three holes with the sheet metal screws provided. Tighten the screws to insure proper ground for the expansion board.

5. There is a three conductor cable, with connectors on both ends, factory installed at the front panel transmit frequency select switch. The unused end plugs to the three pin connector on the expansion board.

6. The coax lead supplied with the expansion board kit is routed through the large grommeted hole in the center of the chassis. One end plugs into the two pin connector on the expansion board and the other plugs into the 81079 low frequency mixer board. This board is on the bottom chassis. With the unit upside down and facing you, this board is on the right side. The connector is the only unused two pin connector on the board.

7. Replace the top and bottom covers.

Use the 435.0 band switch position for OSCAR 10.

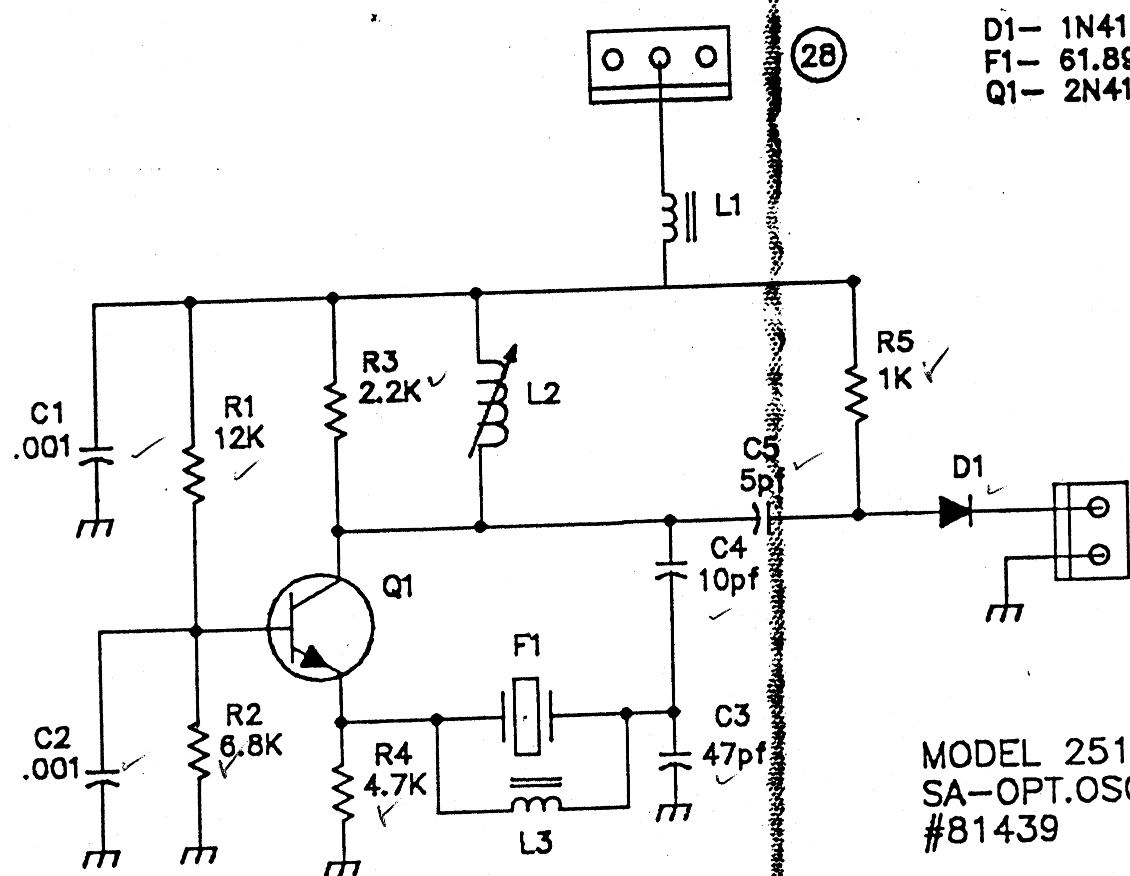
Use the 435.5 band switch position for OSCAR 13.

NOTE: Some 2510 units do not have a passband, at 11.0 to 11.5 MHz, that is broad enough to pass the required transmit signal. These may be modified by changing 4 components and realignment of the filter. Refer to "TRANSMITTER LOW FREQUENCY MIXER SUBASSEMBLY" on page 11 of the manual. Make the following changes:

C32 from 220 pf to .01 mfd
C33 from 560 pf to 150 pf
R17 from 47 k to 10 k
R18 from 47 k to 10 k

<u>Alignment</u>:

Temporarily connect a 150 ohm resistor to the junction of C19, C30 and ground. Tune the 2510 to the middle of the scale (145.750) and adjust L2 and L4 for maximum output as indicated by a power meter in the output or by the current drawn by a linear amp. Remove the 150 ohm resistor and adjust L3 for maximum output.



D1– 1N4148
F1– 61.895
Q1– 2N4124

MODEL 2511
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