HAMTRONICS® XV2 VHF TRANSMITTING CONVERTER: ASSEMBLY, INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS

➠ *Note: This manual only applies to the new version of the XV2, revised Nov 1993. If you have an older version of this unit, many of the components and the crystal type will be different.*

DESCRIPTION.

The XV2 is designed to convert 1mW of ten meter energy to provide 1.5-2 W p.e.p. ssb output on 2 meters. Because the XV2 is a linear translator, it may be used on any mode: ssb, cw, fm, am, etc.

Generally, a low power tap on the exciter is used in conjunction with an external attenuator circuit. For operation with higher power exciter signals, a simple external attenuator can be added to reduce the input level to 1 mW. (Attenuators are treated in detail later.)

Because of the simplicity and economy of a transmit converter separate from the receiver converter, the XV2 is ideal for satellite communications or versatile terrestrial operation.

SPECIFICATIONS.

Frequency Coverage:	
XV2-4	28-30 = 144-146
XV2-5	28-30 = 145-147
XV2-6	28-30 = 146-148
RF Bandpass	2 MHz
RF Input	1 mW p.e.p. into 50Ω (0dBm)
RF Output	1.5-2 W p.e.p.
Duty Cycle	100% ssb or keyed cw, 50% on fm
In/Out Impedance	50Ω
Power Required	Regulated +13.6Vdc at 400 mA
Spurious	Less than -53dB
IM Distortion	-30 dB at recommended drive level

CIRCUIT DESCRIPTION.

Frequency conversion is accomplished by two n-channel j-fet's operating in a balanced mixer configuration. Injection is generated by a 13 MHz crystal oscillator operated from a voltage regulator. The oscillator frequency is tripled once at the collector of the oscillator and again in Q2 to give a 116 MHz injection frequency for the mixer.

The vhf output of the mixer is amplified in two class A amplifiers and a class AB output stage to provide 1.5 - 2W output. This output may be used to drive a linear power amplifier to a higher level or it may be used directly with an antenna. A low pass filter in the output minimizes harmonics so that direct operation may be safely undertaken.

GENERAL CONSTRUCTION NOTES.

Use a small, but hot, pencil type soldering iron for this kit. Patience is required in mounting some of the components, and it helps to install a few parts, or in some cases only one, at a time and then soldering before proceeding.

With few exceptions, components must be mounted with the shortest possible leads to the board. This is especially true with bypass capacitors. An extra 1/8-inch lead acts as a large inductance; so a little extra care in construction makes a big difference.

Most pertinent construction details are given on the component location diagram. A complete parts list is given, too; but be sure to read construction notes in the text on these first two pages to be sure you do everything required. Be sure to follow all the step-by-step instructions, and don't ad lib. It may take a little longer to assemble the kit, but it will work when done.

Note that this unit has been very popular for OSCAR and terrestrial activity for many years. It is one of our oldest kits, yet still very popular because it works so well. When it was designed, all the slug tuned coils had to be hand wound by the builder on plastic coil forms supplied. In recent years, we have been using molded plastic coils in our transmitter and receiver modules, and customers have asked if we could also use them in the XV2. We have found a way to do so without adding to the cost of the kit. It requires forming the leads for different spacing, but saves the trouble of winding those coils. We hope you agree the little extra effort in mounting these coils is worth the advantages.

☹ *WARNING! The metal shield may have sharp edges. Use caution not to run your fingers along the edges.*

ASSEMBLY PROCEDURE.

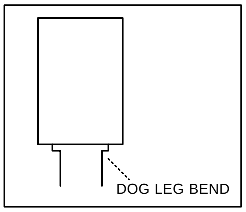
a. Begin construction by installing the "L" shaped metal shield as follows. Pieces of #22 tinned bus wire should be cut to 3/8 inch long and soldered to the board in the five places shown to support the shield. Insert each piece so that 1/16 inch extends through the foil side of the board, and solder in place. Approximately 1/4 inch should protrude on the component side of the board. After soldering the five pieces, straighten them.

b. Set the "L" shaped shield in place around the wire pins as shown. The shield may be a little out of square from shipping; so work it to proper shape with all wire pins contacting the shield.

c. Tack solder the inside (upper left) corner of the shield to the wire pin with a little solder. Make sure the shield is down against the board, and then tack solder the rest of the wire pins to the shield. Use a small tool to hold shield in place while soldering to avoid burning fingers.

d. Using a pair of wire cutters or scissors, clip a small diagonal piece off the corner of each shield end to remove the sharp pointed corners.

e. Install the seven slug-tuned coils as follows. Refer to parts list to determine values of coil for each position. Using these new pre-wound coils requires that their leads be formed a little to fit the narrower spacing of the holes on the board for the old-style coils. Do them one at a time as they are installed, but bend the leads as shown in the following sketch before installing them on the board.



➠ *Note that shields should be removed from all coils before they are installed on the board in order to make lead forming and assembly easier. Some coils are supplied with shields already attached, but they slide off.*

f. Install shields over the seven coils and solder all coil leads and shield lugs under the board.

g. Install the two RCA-type coax connectors. Bend center conductor tab(s) over. Then, solder all the lugs. Use a generous amount of solder on the ground lugs to provide mechanical strength to hold the connectors in place.

h. Install the two crystal socket pins. Cut them from carrier strip. Grasp the end carefully with fine nose pliers (one wall only to avoid crushing). Push into hole until first flange snaps through board to lock in place. Solder lower side sparingly to avoid loading up socket with solder. Plug crystal into sockets.

i. Install R6 vertically, and leave an extra 1/16 inch of lead at the top when you loop the lead over to reach the board. The top lead of the resistor will serve as a test point; so be sure that resistor is oriented as shown.

j. Install jumper above crystal, using bus wire trimmed from R6.

k. Install resistors R7, R10, and R26, which are also used as test points. These resistors are installed vertically, but only the bottom lead is soldered to the board; the top lead is trimmed with 1/8 inch left as test point.

l. Install ferrite beads Z1-Z3 and Z5-Z7. Beads are prestrung; so you only need to form the leads and insert them. Z7 is installed over one lead of R24; so the factory lead must be clipped and removed from this ferrite bead.

m. Install all other resistors on the board as shown.

n. Install diodes VR1, CR1, and CR3. Be sure to observe polarity. Note the extra pad near VR1 which is not used.

o. Install variable capacitors C2, C37, C41, and C42, and potentiometer R11. Orient variable capacitors as shown so rotors are connected to ground.

p. Install transistors. Note that Q8 must be installed with about 1/8 inch of lead length exposed above the board and on a slight angle to avoid interference with variable capacitor C41. Heatsink should NOT be installed until all other parts have been assembled. Other transistors should be installed with leads as short as possible, and the base lead must be formed away from the case to match the hole pattern in the board.

q. Install disc capacitors, making sure all leads are as short as possible.

➠ *NOTE: C46 must be tack soldered across R20 on the rear of the board with short leads.*

r. Install electrolytic capacitor C40, observing polarity; long lead is positive.

s. Install rf chokes. They look like small resistors. L10 and L13 look like green 1/4 watt resistors. L12 looks like a green 1/2 watt resistor. L6 is about the same size but you can see the winding. Form the leads of L6 as shown.

t. Wind and install air wound coils, using #22 magnet wire. The coils must be wound in the proper direction to match the holes in the board so they are oriented properly; L11 is wound in direction opposite that of other coils. The coils must be wound with 1/8 inch i.d.; use a 1/8 inch drill bit or other forming tool for accuracy. Solder coils in place with 1/16 inch between the bottom of the coil and the top of the board.

➠ *NOTE: It is important that coils be mechanically aligned and spaced exactly as shown for proper inductance. Coils should start and end directly above the holes on the board, not bent one way or another. Turns should be tight together, with no space in-between. One exception is that L11 must be bent back away from Q8 a little so it is about 1/16 inch from the case of the transistor; it should not touch the transistor.*

The magnet wire supplied is designed to be stripped by applying heat and a little solder. Considerable heat is required to burn off the polyurethane; so a very hot iron is required. It should take about 30 seconds to tin each lead. Rather than try to apply this heat with the coil mounted on the board, it is best to wind and form all the coils and try them on the board. Then, remove them and heat strip and tin them all at once after the lead has been trimmed to proper length on the board. Hold each coil with hemostats or pliers or slide it over a mandrel, such as a drill bit, so the coil is steady. Then, simply tin the coil leads with a hot iron, applying solder liberally as the insulation burns off. It is important to get the heat into the copper of the wire; so start with the iron and solder contacting the bare end of the wire. Then, the heat will travel inside the wire and the insulation will begin to melt off. Once the leads have been tinned, the coils can be installed on the board and soldered in place. Be sure not to mix up the coils.

u. Install heatsink on Q8, and orient as shown in the photo. If it fits loosely, remove and pinch clamp together a little; then reinstall. Be careful not to apply too much pressure on the leads of the transistor or bend them by rotating the heatsink.

v. Pad E1 is used for B+ to operate the unit. You may wish to install a length of #22 hookup wire you can use for testing and later connection to power supply when you install the board in a cabinet.

w. Check that all parts are installed in proper positions. If you are short a part and have a similar part leftover, check to see if an incorrect value was installed somewhere.

CRYSTALS.

Crystals are standard HC-25/u, fundamental, 32 pf parallel resonant, 5 ppm units.

Crystal frequencies can be calculated with the formula:
(OUT FREQ - IN FREQ)/9.

Common crystal frequencies are:

Model	Range	Xtal Freq.
XV2-4	144-146	12.8889
XV2-5	145-147	13.0000
XV2-6	146-148	13.1111

ALIGNMENT.

Equipment needed for alignment is a sensitive electronic dc voltmeter, a 50Ω 2W dummy load, and a ten meter signal generator capable of supplying 225 mV rms (0dBm, or 1 mW) into 50Ω. A 13.6Vdc regulated power supply with an internal or external milliammeter (up to 500mA) are required to power the XV2. You should have a receiver tuned to the output frequency of the XV2 to listen and measure relative signal strength.

If a signal generator is not available, the ten meter exciter to be used for transmission may be used to drive the XV2; however, caution must be used to avoid overdriving the XV2, and some means of varying the carrier level must be provided. Refer to the section, later in this instruction manual, which describes attenuators to be used with various exciters.

The slug tuned coils should be adjusted with the proper .062" square tuning tool to avoid cracking the powdered iron slugs. (See A28 tool in the rear of our catalog.) All variable capacitors should be set to the center of their range (turn them 90°) if they have not previously been aligned. Potentiometer R11 should be set to center of its range.

The variable capacitors should be adjusted with a small metal blade screwdriver or, preferably, an insulated tuning tool with a small metal blade. (See A2 tool in the rear of our catalog.)

Following are some ground rules to help avoid trouble. Always adhere to these guidelines.

1. Do not operate without a 50 ohm load.

2. Do not exceed 1.5 Watts output or 350mA total current drain for continuous duty operation. Do not exceed 2 Watts output or 400 mA total current drain for even momentary operation. Reduce 10 meter drive level if necessary.

3. If unit oscillates for some reason, and reducing drive does not reduce current, immediately turn off B+ and correct the problem before resuming. Evidence of oscillation would be full output without drive or output changing abruptly when tuning.

4. Always follow alignment procedure exactly. Do not repeak all controls for maximum output. Each multiplier stage has its own best monitoring test point for maximum drive to the following stage.

5. Begin tuning at low drive levels and increase drive gradually as proper response occurs and confidence builds. You should have no rf output at first until most of the stages are aligned, and current drain should be low (about 90mA) until alignment approaches completion.

6. Transistors Q7 and Q8 run hot at full drive, but not so hot that you can't touch them without being burned. Transistors should be only warm with no drive. Never run the unit without heatsink.

a. Connect 50 ohm dummy load to output jack J2 through some form of relative output meter.

b. Check output voltage of power supply, adjust it to 13.6 Vdc, and connect it to B+ terminal E1 and ground plane on the pc board. It is permissible to use the braid of the coax cable or the mounting hardware to the chassis as a ground if the power supply has a good low-impedance connection through this path to the ground on the board. **BE SURE TO OBSERVE POLARITY!** A 500 mA meter or suitable equivalent should be connected in the B+ line to monitor current drawn by the XV2. This is important to indicate potential trouble before it can overheat transistors.

Note: Meter indications used as references are typical but may vary widely due to many factors not related to performance, such as type of meter and circuit tolerances. Typical test point indications are given as measured on one sample unit. These measurements may vary widely without necessarily indicating any trouble.

c. Apply B+ with no rf drive applied. Check for approximate starting current of about 90mA. Set power supply, if variable, to 13.6Vdc; and if current limiting is available, set it to limit at just over 400 mA for safety.

d. Measure the voltage at the cathode of zener diode VR1; it should be approx. 9.1Vdc.

e. Connect voltmeter to TP1 (loop at top of R6). Adjust oscillator/tripler coil L2 for a peak. Reading on our sample unit was about +0.9Vdc, but exact reading is not important.

f. Connect voltmeter to TP2 (lead at top of R7). Alternately adjust L3 and L4 for maximum indication. You will not get any indication until both coils are somewhere near tuned, and the eventual reading will be very small. Our sample unit measured about -0.1Vdc.

g. Connect voltmeter to TP3 (top lead of R10). Adjust L5 for maximum indication. Our sample unit measured about +0.6Vdc.

h. If a frequency counter is available, it may be used to trim the oscillator crystal precisely to frequency. Connect counter to TP1, and adjust variable capacitor C2 to trim the oscillator frequency.

Note: For the following tests, a signal generator set for cw output or a similar driving source should be used with variable output level of about 0 - 225 mV rms. Be careful, if using exciter, to take steps to avoid damage to XV2 from severe overdrive. The frequency of the signal generator should be the center of the normal exciter frequency range to be used. For example, if your exciter will be used over a range of 28-30 MHz, set signal generator for 29 MHz. If you will use only the 28-29 MHz range, set the signal generator to 28.5 MHz to optimize the unit for the frequencies you really want to use.

i. Connect voltmeter to TP4 (outside lead of R21). On our sample unit, this test point measured about +0.13Vdc with no drive applied and about +0.25Vdc with full drive. With 1 mW (225 mV) of ten-meter drive applied to J1, alternately adjust L7, L8, and L9 for maximum. If you have any difficulty observing a change of reading, you may also try picking up the radiated output signal with your 2M receiver and observing the S-meter; however, use the TP4 reading for the final adjustment.

Reminder: Keep drive reduced to

prevent current drain over 400mA. Also, operate for no more than 1 minute out of every two at a time to avoid overheating. (XV2 is rated at 50% duty cycle for full carrier signals.)

j. Connect voltmeter to TP5. If an rf wattmeter is available, it may be used instead to measure relative rf output. Our sample unit measured about +1.3Vdc with 2W output.

k. Alternately, adjust driver, C37, and output stage, C41 and C42, for maximum output.

l. With unit fully tuned and ten-meter drive high enough to saturate the output stage, you should have about 2W output with about 350-400mA of current drain. As the input signal is reduced and increased, the output level should vary smoothly up until saturation level.

➠ *Note that full output may not be possible with less than 13.6Vdc B+. Power output falls rapidly as operating voltage is reduced. This does not necessarily mean that the unit cannot be used on lower B+ voltage, however, since it is hard to distinguish even a 2:1 reduction in power on the air.*

TYPICAL DC VOLTAGES

The following dc levels were measured with an 11 megohm fet vm on a sample 2M unit with 13.6Vdc B+ applied, but no rf drive. Where it changes, readings are shown both with crystal installed and crystal removed.

All voltages may vary considerably without necessarily indicating trouble. The chart should be used with a logical troubleshooting plan.

STAGE	E	B	C
Q1 w/ xtal	+2.8	+2.2	+9.1
Q1 w/o xtal	+1.6	+2.3	+9.1
Q2 w/ xtal	+0.9	-0.6	+13.6
Q2 w/o xtal	0	0	+13.6
Q3 w/ xtal	0	-0.1	+13.6
Q3 w/o xtal	0	0	+13.6
Q4 & Q5	+2.5	0	+13.6
Q6	+1.5	+2.2	+13.6
Q7	+0.28	+1.0	+13.6
Q8	0	+0.6	+13.6

m. Mixer balance control R11 is a fine tune adjustment to null the spurious mixer products. Adjustment is optional. If a spectrum analyzer is available, R11 may be adjusted for best suppression of mixer injection at 116 MHz or similar spurs. Otherwise, it works OK to simply adjust R11 for peak output, which should occur near the center of the range.

TROUBLESHOOTING.

The usual troubleshooting techniques of checking dc voltages and signal tracing with an rf voltmeter probe will work well in troubleshooting the XV2. A dc voltage chart and a list of typical test point levels are given to act as a guide to troubleshooting. Although voltages may vary widely from unit to unit and under various operating and measurement conditions, the indications may be helpful when used in a logical troubleshooting procedure.

The XV2 should draw about 90 mA at idle with no drive applied and about 350-400mA at full output.

Be careful, when operating or troubleshooting, to avoid driving the unit to levels over 2 Watts or operating the unit at dc current drain levels over 400 mA for extended periods. The unit is rated for 50% duty cycle at full output.

INPUT ATTENUATORS.

There are many ways to come up with 1 mW of drive at 10 or 11 meters. It is beyond the scope of these instructions to attempt to describe modifications for every possible exciter. However, general information is presented to allow you to design the attenuator connections you need for your particular situation. The primary things to remember are as follows:

1. Be very careful to start on the conservative side when experimenting to find the best values to use. If you accidentally apply a massive amount of power to the transmitting converter, you may end up with smoke signals instead of radio signals.

2. Do not reduce the audio gain of the exciter to keep drive down except for fine adjustment. Design an attenuator to let you use the full range of the exciter. Then, you won't inadvertently blast the transmitting converter during operation, and you can have peace of mind.

3. Be prepared to experiment to find the ideal attenuator. You will be rewarded with a fine sounding signal with little carrier and low IM distortion. If you have too much drive, your signal will be wide and splattery.

4. Using the full dynamic range of your exciter instead of cutting back on audio gain drastically will result in minimum carrier level (maximum ssb carrier suppression) and minimum feedthrough of spurs because the relative level is lower if you use full sideband range.

If your exciter already has a low power output (up to 5W), you can simply build a symmetrical pi attenuator, as shown below, to reduce the drive for the XV2 to 1mW. Mechanically, the attenuator is made of composition resistors of appropriate power rating (be conservative) soldered to a copper clad board. Make sure you have a good ground plane. Keep connections short, and install any convenient type of coax cable and connectors to do the job. Shielding usually is not needed. The table below gives approximate values, and you can interpolate to find values for in-between amounts of attenuation. It is sufficient to come close to values given. It is not necessary to be exact. Make sure the resistors are large enough to dissipate the power of the exciter safely, especially the shunt resistor on the exciter side of the circuit, which dissipates most of the heat.

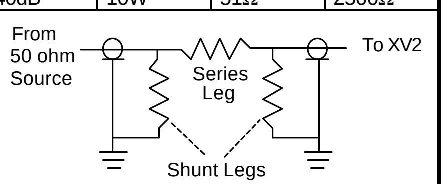
For 30dB or greater, the 50Ω (approx.) resistor on the exciter side could be a Cantenna or similar dummy load. Actually, you could use a dummy load in this fashion for power levels up to 100W; although this is a rather brute force approach. In such a case, a two-section attenuator, for example a 30dB and a 20dB, should be used to get the required attenuation. Otherwise, the series leg would have such a high resistance that leakage and stray coupling might cause problems. Merely couple the two sections together, one working into the next. Remember that the end connected to the exciter dissipates most of the power.

When building your attenuator, the best thing to do is to choose values as closely as possible from the chart. However, for trial purposes, you would like to start with less drive than necessary and work up to a safe amount. This is especially true if you are using the exciter as a test signal to align the XV2 in place of a signal generator. You can either turn the drive down on the exciter at first or use a higher value of series resistor in the attenuator temporarily. Using a higher value in the attenuator should not affect the load impedance on the exciter enough to matter; so don't worry about changing to the correct value of shunt resistor until you are through testing.

For exciters without a low-power output (5W or less), you may wish to modify the exciter to provide a low power tap. You need some way to disable the output stage on the exciter when you want to use it for driving the XV2, and then couple a little of the signal from the driver circuit through a small value capacitor to a jack on the rear of the exciter. You can experiment with the value of the coupling capacitor to establish a useable level of rf at the jack, but about 5pF would be a good starting value. Connect a 75Ω, ½W resistor across the output jack as a termination to work in conjunction with the series capacitor to provide some attenuation. At 10 meters, a 5pF series capacitor terminated with a 75Ω shunt resistor provides about 20dB of attenuation. If you know about how much power the driver stage is capable of providing, you can estimate the output at the jack. 20dB is 1/100th of the original power level.

Symmetrical 50W Pi Attenuators.

Attenu-ation	Good For Power	Shunt Resist-ance	Series Resist-ance
0dB	1mW	Open	Short
3dB	2mW	300Ω	18Ω
6dB	4mW	160Ω	40Ω
10dB	10mW	100Ω	72Ω
14dB	25mW	75Ω	120Ω
20dB	100mW	61Ω	250Ω
30dB	1W	53Ω	790Ω
40dB	10W	51Ω	2500Ω



Schematic of Attenuator You Can Build

MOUNTING.

The XV2 board is designed to be mounted in a chassis using 6 threaded standoffs (not supplied) in the corners and center of the board. Any convenient chassis or panel arrangement may be used; it is normally not necessary to shield the board except from any power amplifier which may be used with it. See our catalog for mounting hardware, cables, and plugs to use with the XV2.

SYSTEM OPERATION.

Operation is fairly simple. You apply the correct level of 28 MHz ssb, cw, am, or fm energy, and the XV2 provides 1½-2W p.e.p. output on two meters. The frequency is controlled by the frequency of the vfo on the exciter. The calibration can be checked by listening on a separate two-meter receiver in the shack.

B+ should be applied to the XV2 during both transmit and receive to maintain stability of the crystal oscillator. Also, the B+ should be well regulated, despite the fact that the oscillator supply is regulated again at 9.1V.

The XV2 should not be set on top of another piece of equipment which generates heat. Vhf oscillators and the subsequent multiplying to get up to two meters require a conscious effort to minimize voltage and temperature variations for best stability. The ideal situation is to operate from a well regulated power supply, to keep B+ applied constantly, and to be located in a constant room temperature environment. If the XV2 is housed in the same cabinet as a linear power amplifier unit, adequate ventilation should be provided as well as shielding the pa from the XV2 to avoid feedback.

After tuning the XV2 into a known good 50Ω dummy load, it should not be retuned when the XV2 later is connected to the antenna or linear amplifier. Of course, the antenna or pa should present a good 50Ω load to the XV2. Check to see that the current drain of the XV2 board does not exceed 400 mA at full drive on cw, and check that the output level goes up and down smoothly when the cw drive level is varied (no oscillations). Then, simply operate.

It is a good practice to have a 500 mA or similar panel meter connected in the B+ line to the XV2 at all times. It is a handy operating aid, and it may help to avoid trouble from overdrive or load impedance troubles developing later during operation. The milliammeter is even handier to watch than an output indicator as an all around operating aid.

Remember that the XV2 is rated for continuous duty on ssb, but it is rated for 50% duty cycle (1 minute on and 1 minute off) for single tone modes, such as constant carrier cw or fm. Take care not to overheat the power transistors in the XV2.

The point which must be stressed most about any ssb device, such as the XV2, is that you must regulate the drive level applied from the exciter to a point below the maximum capability of the XV2 or pa. Normally, it is good practice to keep the peak output of the signal at a level below about 90% of the level at which it saturates to avoid intermodulation distortion (IM) caused by flat topping.

In a transmitter which is complete in one package, such as your low-band transmitter, automatic gain control circuits can be used to limit peak drive to the linear region. How-

TYPICAL TEST POINT VOLTAGES.

Following are test point readings taken on a sample unit with 1mW drive and 2W output. Some readings change without drive; so those are shown for both conditions. Readings for TP1-TP3 are zero with crystal removed.

Test Point	Reading
TP1	+0.9V
TP2	-0.1V
TP3	+0.6V
TP4 with no drive	+0.13V
TP4 with full drive	+0.25V
TP5 with no drive	0
TP5 with full 2W output	+1.3V

ever, when you use an external transmitting converter, there is no way to limit the drive automatically; so you must be alert to manually regulate the gain of the exciter to prevent overdriving the XV2. As you increase the audio gain on your exciter, you will reach a point beyond which the vhf output signal will begin to widen out and splatter due to flat topping. You want to always stay below this level so you have a nice clean signal on the air. Once you find this point, make a note of the gain control setting so you can know how to operate in the future without splatter.

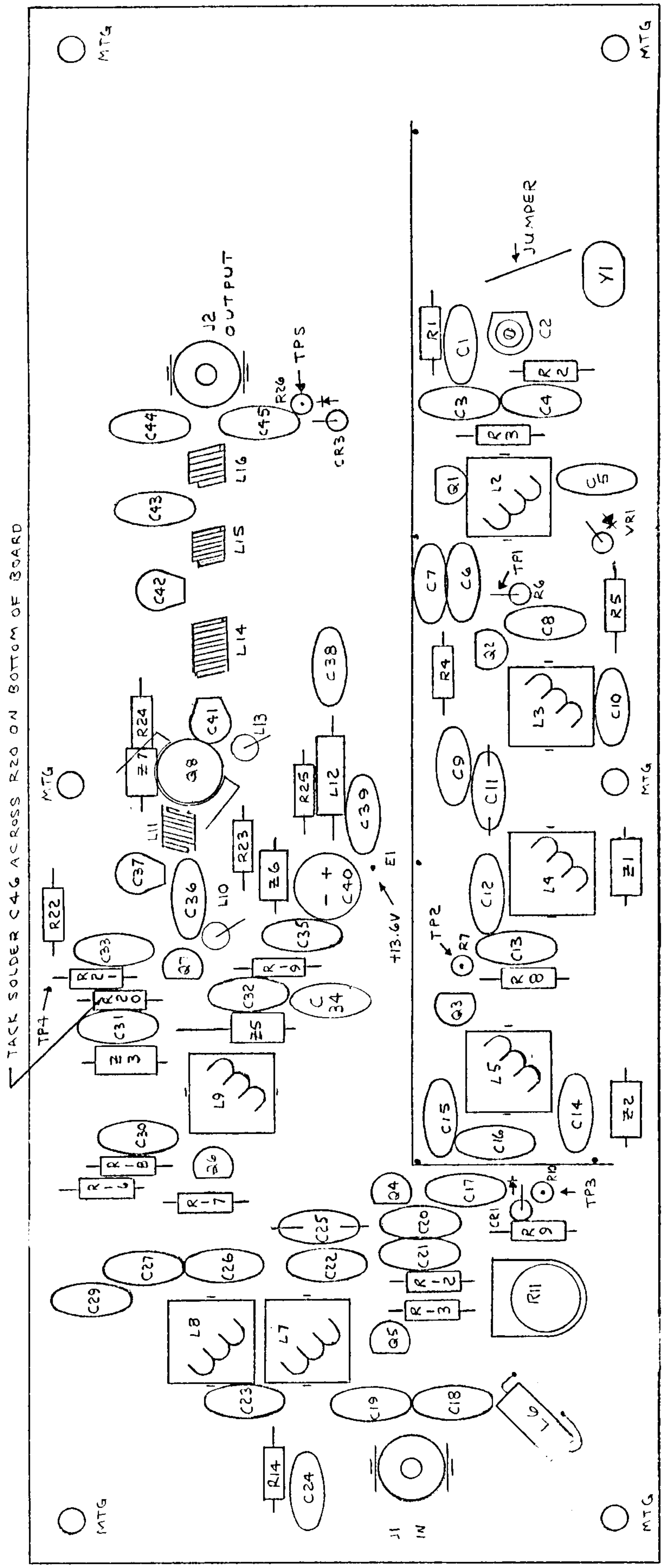
LINKING WITH RECEIVE CONVERTER.

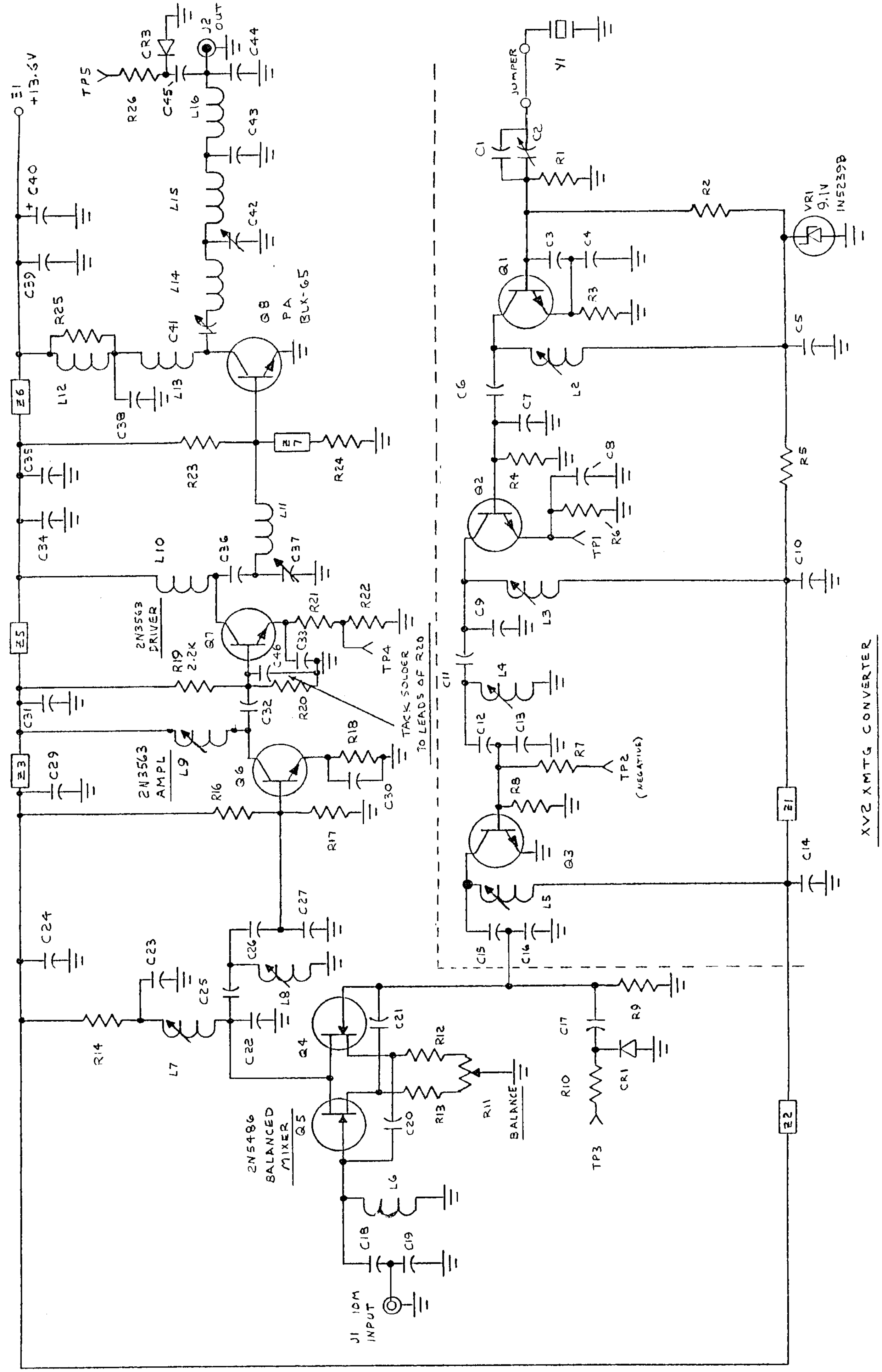
If desired, you can use the oscillator in the transmitting converter to drive the oscillator in the receive converter so both units are exactly on the same frequency.

To do so, remove the base-emitter feedback capacitor in the receive converter oscillator circuit. Connect a short length of 50Ω coax cable (not more than 1 foot) with the center conductor to the base of the oscillator and the shield to the ground plane on the receiving converter board. At the XV2, connect the center conductor through a .001µf disc capacitor to the collector of Q1, and connect the shield to the ground plane. Keep all stripped coax leads and the capacitor leads very short to avoid adding inductance in the path. You may need to retune oscillator coil L2 after the cable is connected due to the additional capacitive loading.

PARTS LIST.

Ref Desig	Description (marking)
C1	43 pf NP0
C2	10 pf variable (white)
C3-C4	150 pf NP0 (151)
C5-C6	.001 uf (102 or 1nK)
C7	110 pf NP0 (111)
C8	220 pf (221)
C9	20 pf NP0
C10	.001 uf (102 or 1nK)
C11	0.5 pf
C12	43 pf NP0
C13	62 pf NP0
C14	.001 uf (102 or 1nK)
C15	33 pf NP0
C16	62 pf NP0
C17	0.5 pf
C18	15 pf NP0
C19	33 pf NP0
C20-C21	.001 uf (102 or 1nK)
C22	15 pf NP0
C23	.001 uf (102 or 1nK)
C24	.01 uf (103)
C25	0.5 pf
C26	22 pf NP0
C27	62 pf
C28	not assigned
C29	.001 uf (102 or 1nK)
C30	220 pf
C31	.001 uf (102 or 1nK)
C32	15 pf NP0
C33	220 pf
C34	.001 uf (102 or 1nK)
C35	.01 uf (103)
C36	10 pf NP0
C37	30 pf variable (green)
C38	220 pf
C39	.001 uf (102 or 1nK)
C40	47 uf electrolytic
C41	50 pf variable (orange)
C42	30 pf variable (green)
C43	43 pf NP0
C44	39 pf NP0
C45	0.5 pf
C46	62 pf NP0
CR1	1N4148
CR2	not assigned
CR3	1N4148
J1-J2	RCA Jack
L1	not assigned
L2	6½ turn slug-tuned (blue)
L3-L5	2½ turn slug-tuned (red)
L6	3 uH rf choke (unmarked)
L7-L9	2½ turn slug-tuned (red)
L10	0.33 uH rf choke (orn-orn-sil-red)
L11	4T air wound coil (see text)
L12	15 uH rf choke (brn-grn)
L13	0.33 uH rf choke (orn-orn-sil-red)
L14-L15	5T air wound coil (see text)
L16	4T air wound coil (see text)
Q1-Q3	2N4124 OR 2N3904
Q4-Q5	2N5486
Q6-Q7	2N3563
Q8	BLX-65
R1	10K
R2	27K
R3	680Ω
R4	3.3K
R5	270Ω
R6	100Ω
R7	10K
R8-R9	1.2K
R10	10K
R11	1K Pot.
R12-R14	100Ω
R15	not assigned
R16	10K
R17	2.2K
R18	180Ω
R19	2.2K
R20	180Ω
R21-R22	10Ω
R23	1K
R24	47Ω
R25	10Ω
R26	10K
VR1	1N5239B (9.1V) zener
Y1	Crystal, see text
Z1-Z3	Ferrite Bead
Z4	not assigned
Z5-Z7	Ferrite Bead


TACK SOLDER C46 ACROSS R20 ON BOTTOM OF BOARD
J2 OUTPUT
JUMPER
+13.6V
J1 IN
MTG


XV2 XMTG CONVERTER
E1 +13.5V
J2 OUT
TP5
R26
CR3
C45
C44
L16
C43
C40
C39
L15
C42
L14
Q8 PA BLX-65
R25
C41
L12
L13
C38
E6
E7
R23
R24
C35
C34
L10
C36
L11
C37
E5
2N3563 DRIVER
Q7
R21
R22
C33
C46
TP4
R19 2.2K
TACK SOLDER TO LEADS OF R20
R20
C32
C31
E3
C29
2N3563 AMPL
L9
Q6
R18
C30
R16
R17
C24
C23
C25
C26
C27
L8
C22
L7
R14
Q4
C21
R12
R11
BALANCE
R13
C20
Q5
2N5486 BALANCED MIXER
L6
C18
C19
J1 10M INPUT
R10
CR1
TP3
C17
R9
E2
E1
C14
C15
C16
L5
Q3
R8
R7
TP2 (NEGATIVE)
C12
C13
L4
C11
C9
L3
C10
TP1
R6
R4
C8
Q2
R5
C7
C6
L2
C5
Q1
R3
C3
C4
R2
VR1 9.1V 1N5239B
R1
C1
C2
JUMPER
Y1

