OPTIMIZED PRECISION ALIGNMENT

COMMUNICATIONS
TRANSMITTER
MODEL HT-46

5/15/2021 WDØGOF Walt Cates

OPTIMIZING THE HT-46

INTRODUCTION

The HT-46 was and is a very well designed transmitter. At the time of its design, it featured the latest innovations such as; it used a balanced mixer for carrier suppression, utilized a 6 pole lattice filter for unwanted sideband rejection, AALC, metered plate current, metered RF output and with the addition of the HA-16, Vox operation. In addition, it could be slaved to an SX-146 for true transceiver operation. Or a receiver and the HT-46 could run independently for split frequency operation. Additional information can be found in the appendices.

This document is intended to be used in conjunction with the Hallicrafters OPERATING AND SERVICE INSTRUCTIONS manual. The document # is 094-90416C

In the 60's the frequency counter was not a common item in the ham shack. To accommodate the normal test equipment in the majority of shacks the set-up and alignment procedures used work arounds. For instance, setting up oscillators using a general coverage receiver. This worked fine with older designs like the phasing type sideband generation. With balanced mixers and lattice filters more precision is needed.

DISCLAIMER: This is tuning and alignment guide. It will be ASSUMED that all preliminary refurbishing tasks have been properly concluded. That is; tube checking, recapping; power supply tests for proper voltages and acceptable ripple levels; control, switch, and contact cleaning. Do not jump around changing the order of the tests and alignment.

TEST EQUIPMENT REQUIREMENT;
What is the minimum test equipment needed to ***super tune*** the HT-46?

1, Frequency counter:
In the 21st century you can get a very good HF counter for less than $100. You need 5 significant digits from 1 to 10MHz and 4 significant digits from 10 to 35MHz.

2, Oscilloscope:
You need a minimum 100MHz bandwidth, 1X and 10X probes good for 600v.

3, Multimeter:

DVM or analog whatever suits you. The 7 function DVM that Harbor Freight sells for $7 works fine. Just be sure it is the one with the 1000vdc range.

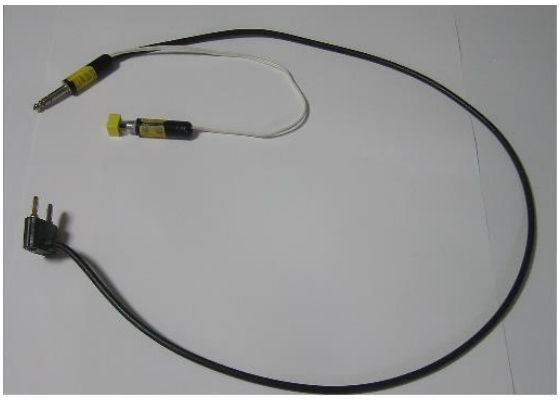
4, Audio oscillator:
It should have a 600Ω output Z_o and capable of providing a 20mvpp signal from 500 to 2200Hz.

5, Wattmeter/load:
Capable of accurately measuring in the range of 10 to 200 watts.

The next two items you will need to construct.

6, Coil DIP-STICK
The coil dip-stick is an insulated shaft with a brass element on one end and a ferrite element on the other. They are available commercially but difficult to find. They are simple to construct using a brass screw with the head cut off, a ferrite tuning slug and 4 or 5 inches of shrink tubing. Put the brass in one end, the ferrite in the other end and shrink the tube. How and when to use it will be discussed later.

7, MICROPHONE AUDIO/PPT PATCH CABLE.



WARNING!!!

AS WITH ALL TUBE TYPE RADIO EQUIPMENT ONCE THE COVERS ARE REMOVED YOU ARE EXPOSED TO VOLTAGES THAT WILL KILL YOU. OBSERVE THE FREE HAND RULE. THAT IS, IF YOU ARE RIGHT HANDED KEEP YOUR LEFT HAND IN YOUR HIP POCKET. IF YOU ARE LEFT

HANDED KEEP YOUR RIGHT HAND IN YOUR HIP POCKET.

ALWAYS KEEP A 50Ω LOAD ON THE OUTPUT OF THE TRANSMITTER.

BIAS ADJUSTMENT:
The majority of the following tests will be with zero drive. However, to avoid over stressing the driver and PA tubes the idle current should be set to a little less than 40ma. Plug in the microphone. Power up the HT-44 in either USB or LSB, MIC GAIN at minimum and CARRIER LEVEL at minimum. Allow at least 10 minutes for the PA tube to get good and hot. Set the meter switch to MA. Key the mic and adjust the BIAS ADJ control on the rear of the radio for just under 40ma. When we get to the power out test later, we will set it exactly to 40ma.

OSCILLATORS

HETERODYNE OSCILLATOR TEST:
We will start with the Heterodyne oscillator. The triode section of a 6EA8 is used for the het oscillator. There is no direct connection from the het osc to the het mixer. The designers used the interelectrode capacitance of the tube to couple the het osc signal to the mixer. The 6EA8 data states that the triode plate to pentode grid capacitance is 1.9 uuf with the tube shield in place. If you have difficulty getting enough signal on pin 2 of V8 a 6U8A can be substituted for V8 to produce more signal. The 6U8A spec states the triode plate to pentode grid capacitance is 2.0 uuf.

Did you set the idle current BIAS ADJUSTMENT?

NOTE: The het osc is not used on the 80 and 20 meter bands.

PRETEST: Prior to turn on, pull the V7 (VFO) tube. Preset the following; MIC GAIN to minimum, CARRIER LEVEL to minimum, CAL to OFF, set the band selector to 7.0, VFO switch to XMTR and connect a 10X scope probe to pin 2 of V8 and the scope. Turn the operation control to standby and allow 15 minutes warm up. Advance the operation control to CW-TUNE, at which time you should observe at least 1vpp signal on the scope. Rotate the band selector to verify output on 21, and each of the 10 meter xtals that are installed. If there is no output at any of these 6 positions select the dead position and back out the slug of L23 until the signal appears. If any of the installed xtals fails to oscillate the xtal, the tube or the band switch is at fault. This fault must be cleared before you can proceed. If you have the required output on all bands move the 10x probe from the scope to the frequency counter. Check the frequency for all the installed xtals. The spec is +/- 0.003MHz.

HETERODYNE OSCILLATOR OUTPUT TEST: Set up as in the PRETEST. The coil L23, the crystals and the tube are the only variables you have to work with in this circuit. Move the 10X probe back to the scope. Move

the band selector to the highest 10meter position that has a xtal installed. Adjust the slug out until it is flush with the top of coil form. Slowly turn it clockwise until the oscillator drops out (quits oscillating). Now back it out until it starts oscillating again. Continue out 1/8 of a turn. This procedure works when all components are in spec and the xtals are new and have proper activity levels. Check the other bands to insure all the xtals are oscillating. If you have one that is not working repeat the procedure on that band. If arbitration of the L23 adjustment does not provide the desired improvement then grab a handful of 6EA8's (or 6U8A's) and start swapping. If adjustment of L23 and tube swapping does not provide desired results then individual testing of resistors and capacitors is indicated.

MINIMUM DESIRED RESULTS	
BAND	**PEAK TO PEAK VOLTAGE**
7.0	**2.5vpp**
21.0	**1.5vpp**
28.0	**2.0vpp**
28.5	**2.2vpp**
29.0	**1.6vpp**
29.5	**2.0vpp**

Power down and reinsert V7 when satisfied with oscillator function.

CARRIER OSCILLATOR TEST: Insure the MIC GAIN and CARRIER LEVEL controls are at minimum. Plug microphone into mic jack. Turn the function switch to LSB and allow 15 minutes warm up.

Extreme precision is required if the HT-46 is going to be slaved to the SX-146.

A, Connect the scope using a 10X probe, to test point A (pin 3 of T1). Key the mic and you should observe a minimum of 3.5vpp signal.
B, Turn the function switch to USB and key the mic and you should observe a minimum of 3.5vpp signal. C, Adjust T1 for peak value. Note that as you adjust T1 the signal falls off slowly in one direction of tuning and more rapidly the other. Adjust T1 in the slow fall off direction to 90% of the peak voltage.
D, Move the 10X probe from the scope to the frequency counter. Key the mic and you should observe 9.0015MHz on the counter. Adjust C13 to put it exactly on frequency.
E, Move the function switch back to LSB, key the mic and you should observe 8.9987MHz on the counter. Adjust C14 to put it exactly on frequency. If the oscillator fails to start in the LSB mode repeat step C in the LSB mode and make the C14 adjustment. Then return to USB mode and verify the frequency and signal level.

If you did not get the 3.0vpp signal or could not adjust to the exact desired frequency you have a fault that must be cleared before you can proceed.

VFO TEST:
MECHANICAL INDEX: With the dial reset lever centered in its panel slot, the pointer over travel at each end of the dial should be equal and the pointer should not engage the nylon pulleys at the extremes of travel.

STABILITY TEST: Connect the 10x probe from the scope, to pin6 of V8B (**caution B+ present, ensure your scope input is rated 400vdc or higher**). Set the MIC GAIN and CARRIER LEVEL to minimum, the VFO switch to XMTR, BAND SELECTOR to **3.5**, DRIVER TUNE fully clockwise and adjust the tuning dial to 3.75MHz. Set the FUNCTION switch to STBY. Allow 15 minutes warm up time. Set the operation switch to CW TUNE you should observe a 1.5vpp or better signal on the scope. Move the probe from the scope to the frequency counter and you should read approximately 5.25MHz on the counter. Fine tune the tuning dial for exactly 5.25MHz. Let it run for two hours, recording the counter reading every 10 minutes. In the first hour you should have no more than 500Hz change. In the second hour you should see no more than 100Hz. If it does not meet the spec replace the following capacitors:

C84 10pf N750
C85 82pf N80
C86 100pf NPO
C87 47pf NPO
C88 82pf NPO

BAND END TEST AND ALIGNMENT: Connect the 10x probe from the scope, to pin 2 of V8B. Set the MIC GAIN and CARRIER LEVEL to minimum, the VFO to XMTR, BAND SELECTOR to **3.5**, DRIVER TUNE fully clockwise and adjust the tuning dial to 3.5MHz. Adjust the dial reset lever so the pointer is directly over the 3.5MHz index marker. Set the FUNCTION switch to CW-TUNE. Allow 15 minutes warm up time, at the end of that time you should observe a 1.5vpp or better signal on the scope. Move the probe from the scope to the frequency counter and you should read approximately 5.5MHz on the counter. Adjust C82 or exactly 5.5MHz. Adjust the tuning dial to 4.0MHz on the dial. The counter should read 5.000MHz. If not adjust L24 to remove ½ the error. Tune back to 3.5MHz on the dial and adjust C82 for 5.500MHz again. Repeat the process over correcting or under-correcting at one end or the other until the spread is correct.

VF0 TRACKING: Connect the 10x probe from the counter, to pin 2 of V8B. Set the MIC GAIN and CARRIER LEVEL to minimum, the VFO to XMTR, BAND SELECTOR to **3.5**, DRIVER TUNE fully clockwise and adjust the tuning dial to 3.5MHz. Tune from 3.5 to 4.0 and check the dial against the following chart.

DIAL	FREQUENCY
3.5	5.500MHz
3.6	5.400MHz
3.7	5.300MHz
3.8	5.200MHz
3.9	5.100MHz
4.0	5.000MHz

If each point falls within 3KHz of the chart value it meets min spec. If not, it indicates “knifing” of C83 is required. Knifing should only be done by an experienced technician. **Knifing done improperly will destroy C83.**

Extreme precision is required if the HT-46 is going to be slaved to the SX-146.

This completes the OSC tests and alignments.

BE AWARE:

In the next section we will be aligning and tracking the mixers, driver and PA. Quite often you will be instructed to switch to CW-TUNE mode. It is highly recommended to plug a telegraph key into the rear of the unit, then switch to and leave the function switch in the CW-TUNE position. When you need to make an observation or adjustment all you need to do is press the key. You will save wear and tear on the function switch and avoid over stressing the keyed circuits. This simple process may keep you from destroying the driver and PA final tubes.

HETERODYNE MIXER TESTS AND ALIGNMENT:

The het mixer plate tuning is not adjustable on the 80m and 20m bands. A broad band fixed load is provided by L25 and R58

PROCESS: The het mixer is tuned by T2, T3 and T4. The 40 meter band is tuned by T2, 15 meter by T3 and 10 meters by T4. With the scope connected to pin 1 of V4 the 40m, 15m and 10 meter will be checked for output signal level at each end of the VFO spread for that band. If there is a 30% or more difference between the high and low end of the spread then adjustment is required. tune to the low end of the VFO segment. Then carefully adjust the top and bottom slug about 1/8 of a turn in each direction to determine which slug has the greatest effect on the signal. Then peak that slug. Tune to the high end of the VFO spread and adjust the other slug. The minimum signal level accepted is 0.85vpp. Any signal level above 4.0vpp will generate spurs in the output RF.

Extreme precision is required if the HT-46 is going to be slaved to the SX-146.

PROCEDURE:
Pull V2, this will leave only the het mixer signal at the grid of the V4 mixer and prevent any signal from reaching the driver. Set the MIC GAIN and CARRIER LEVEL to minimum. Set the function switch to CWTUNE, Connect the scope's 10x probe to V4 pin1. The minimum signal level for these adjustments is 0.85vpp.

A. Set the BAND SELECTOR to 7.0, tune the main tuning to 7.0MHz and note signal level. Tune the main tuning to 7.300MHz and note the signal level. Make necessary adjustment to the slugs of T2 to peak the voltage and balance the end points.

B. Set the BAND SELECTOR to 21.0, tune the main tuning to 21.0MHz and note signal level. Tune the main tuning to 21.450MHz and note the signal level. Make necessary adjustment to the slugs of T3 to peak the voltage and balance the end points.

C. Set the BAND SELECTOR to 28.000, tune the main tuning to 28.000MHz and note signal level. If all 4, 10 meter crystals are installed set the band selector to 29.500MHz. Tune the main tuning to 29.700MHz and

note the signal level. Make necessary adjustment to the slugs of T4 to peak the signal and balance the end points. If all crystals are not installed then adjust the process to what is present.

There is no alignment for the 80 and 20 meter bands, but the signal level on pin 1 of V4 must meet the minimum level of 0.85vpp.

9MEG IF ALIGNMENT

L3 ALIGNMENT: Tune up in CW-TUNE mode, on any band, for max RF power output. Reduce the CARRIER LEVEL for ½ the peak power reading. Adjust L3 for max RF power output. Lower the CARRIER LEVEL as needed to keep the driver and PA out of saturation.

LATTICE FILTER ALIGNMENT:

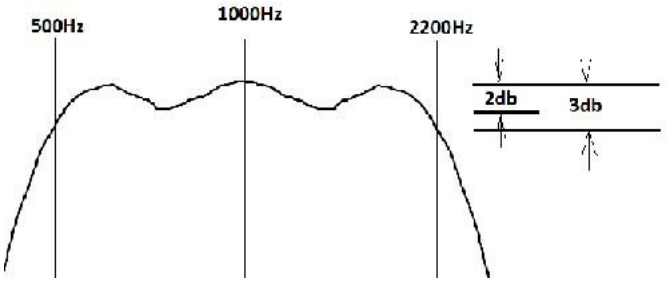
L1 & L2 ALIGNMENT: The input and output terminals of the lattice filter FL1 are tuned by L1 and L2.

A, Tune up on the 40 meter band in the CW-TUNE mode.

B, Switch to LSB mode. Using the microphone audio patch cable connect the audio oscillator to the radio. Set the audio oscillator for 20mvpp output at 1000Hz.

C, Key the mic and adjust the MIC GAIN to determine the max power output. Set the MIC GAIN for ½ the maximum power output.

D, Maintain the 20mvpp signal and reset the audio oscillator to 500Hz and record the RF power output. Observing the power output, track the audio oscillator from 500Hz to 2200Hz (once again maintaining the 20mvpp level) take note of the peaks and dips as you track.



NOTE: If the bandpass is too narrow and you cannot broaden it adjusting L1 and L2 check the alignment of L3 and the value of R25 (22K). R25 is a swamping resistor used to lower the Q of L3 and widen its bandpass.

MICROPHONE AMP

The microphone amp is comprised of V1 A and B and V2A. V1 has power in all modes. Measurements on V1 can be made at any time when the unit is on. V2A is biased off with a negative voltage applied the grid resistor. In the LSB or USB modes, when the PTT switch is pressed on the microphone the tube is biased on. V2A is a cathode follower and provides no gain.

TESTING: Turn on the radio in either LSB or USB. Turn the DRIVER TUNE fully clockwise to reduce the stress on the driver and PA. Turn the MIC GAIN to max. Using the microphone audio patch cable inject 20mvpp at 1000Hz. On pin 7 of V1 you should measure 500mvpp. On pin 7 of V2 you should measure 5vpp. With the unit still unkeyed there should be no audio on pin 8 of V2. Key the mic and you should measure 4vpp on pin 8 of V2.

From unit to unit these voltages may vary as much as 20%.

At this point, it is time to properly set the BIAS, carrier balance and the neutralization. Refer to the OPERATING AND SERVICE INSTRUCTIONS manual sections 8-3, 8-4 and 8-5 for instructions. Sometimes the neutralization process can be difficult. If you struggle with the process in section 8-5 of the factory manual see the neutralization article in APPENDIX 1 of this document. The proper results of the neutralization process are of extreme importance to the success of the tracking and alignment of the driver and PA. When all these tasks are completed return to MIXER/DRIVER TEST AND ALIGNMENT

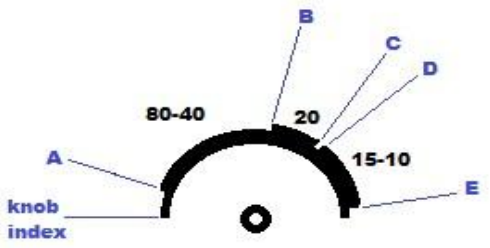
Be aware, the max screen current for the 12BY7 is 6ma. The max screen voltage is 190vdc. Once near spec power output is attained calculate the screen current using the voltage drop across R38. If the screen current exceeds 6ma or the screen voltage is higher than 190vdc then raise the value of R38. A more reasonable value for R38 is 6.8K 1w

MIXER/DRIVER TEST AND ALIGNMENT:

At the time this document was written the HT-46 was 56 years old. Over the years small errors in alignment have been compounding. In this next process, we will attempt to correct these errors.

NOTE: Just in case you missed it in the system schematic, note that S2E rear and S2E front each have a little black dot. This dot indicated that rotors of the front and rear section are electrically connected. This means that C34, 56pf is shorted out of the circuit on the 80 meter band. That gives you C40A, C40C, C41 and C42 all in parallel on the 80 meter band. On the 40 meter band you have {C34 in series with [C40A in parallel with C40C]} in parallel with C41 in parallel with C44 and L8. You have the same situation with S2F front and S2F rear and I will let you trace that one out.

As indicated by the following drawing:
The low end of the 80 and 40 meter bands is point A.
The high end of the 80 and 40 meter bands is point B.
The low end of the 20 meter band is point B.
The high end of the 20 meter band is point C.
The low end of the 15 and 10 meter bands is point D.
And finally, the high end of the 15 and 10 meter bands is point E.



DRIVER TUNE

Note: The circuits controlled by S2E tune the plate of the mixer and the grid of the driver.
The circuits controlled by S2F tune the plate of the driver and the grid of the PA.

L4 and L9 tune 80 meters.
L8 , L13and C40-C tune 40 meters.
L7 and L12 tune 20 meters.
L5 and L10 tune 10 meters.

The 15 meter band is tuned by the fixed coils L6 and L11 and require the use of the tuning dip stick. It is recommended that you locate each of these coils and C40-C on the schematic and in the radio before starting the alignment.

ALIGNMENT PROCESS:

Preset C40-C approximately ½ turn from tight.
Connect a 50 ohm load to the ANTENNA jack, J4.
Plug a telegraph key into the KEY jack J2.
Set the MIC GAIN and CARRIER LEVEL controls to max counter clockwise.
Set the METER switch to MA.
Set the VFO switch to XMTR.
Set the FUNCTION switch to CW-TUNE and allow at least 10 minutes for the PA to come up to temp.

80 METER ALIGNMENT.

Set the band selector to 3.5. Set the tuning dial to 3.500MHz. Adjust the DRIVER TUNE so the index mark on the knob aligns with point **A** on the panel. Advance the CARRIER LEVEL to the 12 o'clock position. Key the transmitter and remember to keep the duty cycle short. No more than 5 to 8 seconds keyed to 15 seconds of rest. Observe the meter and tune the FINAL TUNE control for a rise in plate current. By adjusting the CARRIER LEVEL keep the current at about 200ma. Adjust L4 and L9 for max current. Reduce the CARRIER LEVEL as needed to keep the current at about 200ma. Readjust the FINAL TUNE for a dip in current. (If the PA has not been properly neutralized you may not get a proper dip in current that coincides with the power out peak.)
Readjust L4 and L9 to insure they are on peak. Repeat until no further gain is achieved.

40 METER ALIGNMENT.

Set the band selector to 7.0. Set the tuning dial to 7.000MHz. Adjust the DRIVER TUNE so the index mark on the knob aligns with point **A** on the panel. Advance the CARRIER LEVEL to the 12 o'clock position. Key the transmitter and remember to keep the duty cycle short. No more than 5 to 8 seconds keyed to 15 seconds of rest. Observe the meter and tune the FINAL TUNE control for a rise in plate current. By adjusting the CARRIER LEVEL keep the current at about 200ma. Adjust L8 and L13 for max current. Reduce the CARRIER LEVEL as needed to keep the current at about 200ma. Readjust the FINAL TUNE for a dip in current. Readjust L8 and L13 to insure they are on peak. Repeat until no further gain is achieved.

C40-C FINAL ADJUSTMENT.

Set the band selector to 7.0. Set the tuning dial to 7.400. Advance the DRIVER TUNE control at or near tuning point **B**. Observe the meter and tune the FINAL TUNE control for a rise in plate current. By adjusting the CARRIER LEVEL keep the current at about 200ma. Once the DRIVER TUNE and the FINAL TUNE have been peaked and dipped adjust C40-C for max current.

Recheck the 80 meter and 40 meter coil adjustments.

20 METER ALIGNMENT.
Set the band selector to 14.0. Set the tuning dial to 14.000MHz. Adjust the DRIVER TUNE so the index mark on the knob aligns with point **B** on the panel. Advance the CARRIER LEVEL to the 12 o'clock position. Key the transmitter and remember to keep the duty cycle short. No more than 5 to 8 seconds keyed to 15 seconds of rest. Observe the meter and tune the FINAL TUNE control for a rise in plate current. By adjusting the CARRIER LEVEL keep the current at about 200ma. Adjust L7 and L12 for max current. Reduce the CARRIER LEVEL as needed to keep the current at about 200ma. Readjust the FINAL TUNE for a dip in current. Readjust L7 and L12 to insure they are on peak. Repeat until no further gain is achieved.

10 METER ALIGNMENT
Set the band selector to 28.0. Set the tuning dial to 28.000MHz. Adjust the DRIVER TUNE so the index mark on the knob aligns with point **D** on the panel. Advance the CARRIER LEVEL to the 12 o'clock position. Key the transmitter and remember to keep the duty cycle short. No more than 5 to 8 seconds keyed to 15 seconds of rest. Observe the meter and tune the FINAL TUNE control for a rise in plate current. By adjusting the CARRIER LEVEL keep the current at about 200ma. Adjust L5 and L10 for max current. Reduce the CARRIER LEVEL as needed to keep the current at about 200ma. Readjust the FINAL TUNE for a dip in current. Readjust L5 and L10 to insure they are on peak. Repeat until no further gain is achieved.

15 METER ALIGNMENT
The 15 meter coils L6 and L11 are fixed coils and should not require any action. Tuning of these two coils requires adding turns from the coil or spreading the coil turns. This is normally not required unless a coil has been damaged. You can and should test to see how well these two coils are performing. Here is where you use the coil dip-stick. With the band selector set to 21 and the dial set to 21.000MHz. set the DRIVER TUNE to find a peak in current, approximately position **D**. Adjust the CARRIER LEVEL for 200ma, dip the FINAL TUNE, readjust for 200 mills. Place the brass end of the dip stick into L6 and L11 and observe the current. If the current increases the coils need to be spread. Now place the ferrite end of the dip stick into each coil. If the current increases you need more turns. Any adjustment of the coils is discouraged unless there is a 25% or more change. If you have a large error recheck the 10 meter alignment before making any change.

This completes the optimizing process. Good luck with your HT-46.

ACKNOWLEDGMENT: Thanks to Mike/K5MGR for the loan of an HT-46 for test and analysis in the development of this document.

73, WDØGOF

APPENDIX 1

PA NEUTRALIZATION

The following process was developed in the 1940's. It is a bit labor intensive, but the most precise method of neutralization. In this process the high voltage and screen voltage is removed from the PA tube in such a way that the RF energy path is not broken. The tube is then driven and the neutralization capacitor is adjusted for minimum capacitive feed through from the grid to the plate.

A, Tune the radio for max power out on 15meters at 21.3 MHz.

From this point on be careful not to move the FINAL TUNE, DRIVER TUNE or the VFO.

B, Power down, allow the high voltage to discharge and unsolder the red wire from the base L17 (RFC in the plate circuit. Tape up the wire and insure it is out of harm's way.

C, Unsolder R42 (100_{Ω} in the screen circuit) from the terminal strip. Leave it attached to the tube socket and dress it out of harm's way.

D, Connect the scope to the RF output jack J4.

E, Power up, allow time for the PA tube to reach max temp. Move the function switch to the CW-TUNE position.

F, Adjust CARRIER LEVEL and the scope gain for a good presentation of the RF on the scope.

G, Adjust C62 (neutralization capacitor) for a null in the signal feed through. Increase the gain of the scope and the CARRIER LEVEL as you approach the null to maintain a clear presentation on the scope. H, Power down, resolder the screen and plate connections.

APPENDIX 2

ENGINEERING BULLETIN FOR MODEL HT-46 TRANSMITTER

hallicrafters

PURPOSE

The following modification instructions have been prepared for owners of Hallicrafters Model HT-46 Transmitter. The modification serves to rectify a small frequency shift noted on the 40M, 15M, and 10M bands when switching from stand-by to transmit, and to correct the calibrate switching function for CW operation.

TOOLS REQUIRED

Straight blade screwdriver
Philips Screwdriver
Wire Cutters
Long Noise Pliers
Soldering Iron and Rosin Core Solder

COMPONENTS REQUIRED

1 ea	Single terminal tie lug. (6-32 mounting hole)
1 ea	3300 ohm 1/2 W composition resistor
2 inches	No. 22 AWG Tinned copper wire
10 inches	No. 22 AWG stranded wire (Gray)

MODIFICATION PROCEDURE

1. Remove cabinet cover (6 screws at cabinet sides).

2. Remove bottom cover (7 screws).

3. At the VFO switch (S-5), clip the white-black lead 3 inches from the switch terminal. Strip the insulation back about 3/8 inch and solder the lead to the ground buss on the heterodyning crystal socket.

4. Carefully pull the remainder of the white-black lead out of the wiring harness. The white-black lead terminates at the center terminal of the CAL switch (S-3). Clip off this white-black lead only at the switch terminal. (Leave the remaining white-black lead connected to the switch.)

5. At the CAL switch (S-3), clip the ground jumper wire connected between the switch lugs at the CAL ON side of the switch. Also disconnect the green-black lead from the switch arm terminal.

6. Connect a No. 22 tinned wire jumper from the switch lug with the two black ground leads to the switch arm terminal left vacant when the green-black lead was disconnected in step 5.

7. Connect the green-black lead to the switch lug left vacant when the jumper wire was removed in step 5.

8. Add a gray No. 22 stranded wire lead to the unused terminal on the CAL switch (S-3), lay it along the wiring harness and bring it up to the OPERATION switch (S-1).

9. At the OPERATION switch (S-1) clip off the ground wire jumper running from contact 4 on the rear wafer (S-1B) to contact 4 on the front wafer (S-1A). Do not disturb the wiring on the front switch wafer.

10. Mount a single terminal tie lug to the chassis using one of the VFO capacitor mounting screws as shown.

11. Disconnect the green-black lead from its terminal on switch wafer S-1B and connect it to the tie lug.

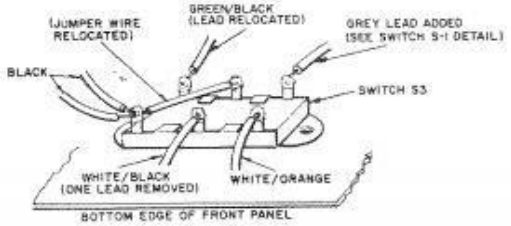
12. Connect the gray lead from the CAL switch (S-3) to the switch terminal left vacant when the green-black lead was removed in step 11.

13. Connect the 3300-ohm 1/2 watt resistor between the tie lug and the switch contact left vacant when the jumper wire was removed in step 9.

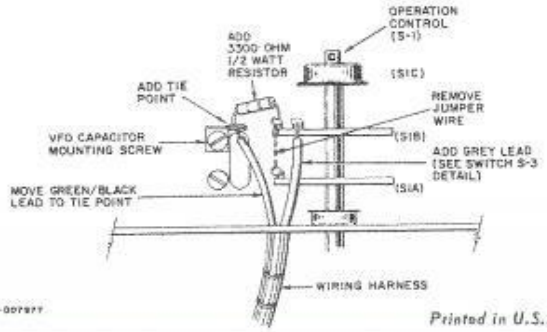
14. Replace the bottom cabinet cover and top cabinet cover. Make sure the long sheet metal screw is driven into the shield foot to ground the bottom cover.

A schematic diagram and parts list incorporating these changes is enclosed.

CAL SWITCH WIRING



OPERATION SWITCH WIRING



094-904451
566
154-007877
Printed in U.S.A.

APPENDIX 3

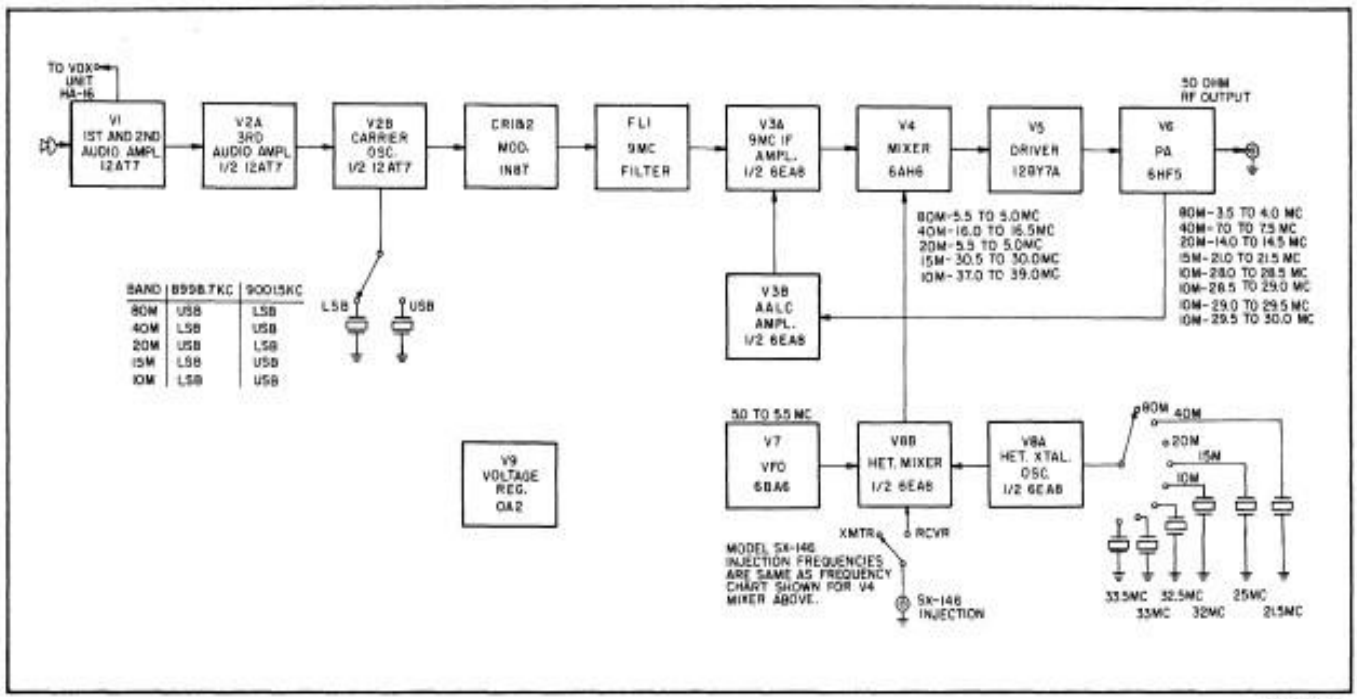
HT-46 FREQUENCY SYNTHESIS

BAND	ALGORITHM	OUTPUT
80 meters	**CARRIER OSC - VFO**	**4.O MHz to 3.5 MHz**
40	**(HET – VFO) – CARRIER OSC**	**7.5 to 7.0**
20	**CARRIER OSC + VFO**	**14 to 14.5**
15	**(HET OSC + VFO) – CARRIER OSC**	**21 to 21.5**
10 #1	**(HET OSC + VFO) – CARRIER OSC**	**28 to 28.5**

VFO = 5MHz TO 5.5MHz

CARRIER OSC – LSB 8.99870MHz USB 9.00150MHz

HET OSC – 80M NOT USED
40M 21.5MHz
20M NOT USED
15M 25MHz
10M[1] 32MHz
10M[2] 32.5MHz
10M[3] 33MHz
10M[4] 33.5MHz



156-006856

Figure 6. Block Diagram of Model HT-46 Transmitter.