INSTRUCTION

Manual

"DUO-BANDER II"

WORLD RADIO LABORATORIES, INC.
3415 WEST BROADWAY • COUNCIL BLUFFS, IOWA 51501



AN EXCLUSIVE PRODUCT OF WRL

WORLD RADIO LABORATORIES

COUNCIL BLUFFS, IOWA

Manual #183-88
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UNPACKING: It is assumed the owner has unpacked the unit, and we hope has started to carefully read the manual before proceeding with hook-up. NOTE! For safe arrival some parts may be packed separately and others held firmly in place with tape. CAREFULLY examine all parts, internal and external, for any sign of damage, however slight.

DAMAGE IN SHIPPING: The equipment has been packed for safe arrival IF properly handled enroute.

If the carton showed any signs of rough handling, you should have made a notation to this effect of possible internal damage on the delivery receipt. If careful inspection does disclose damage, such as loose parts, broken parts, etc., it is best to make a notation on the delivering carriers receipt if at all possible.

Where parcel post shipment is used and damage discovered, either obvious damage on arrival or hidden damage on later examination, be sure and save all original packing material. If the damage, on examination by a qualified person, is minor and repairs can be made in the field, we suggest you have your postmaster make an inspection so that a claim can be entered when final repair costs are known. If field service is not possible, the unit may be returned to WRL(AFTER AUTHORIZATION HAS BEEN OBTAINED FROM WRL) for the necessary service, at which time the costs can be determined, then the claim can be entered. Our warranty in no way covers damage due to shipping. Every unit is tested prior to shipment, so if failure is evident on arrival it is best to assume the probability of damage and proceed with the initial steps of a claim. To assume that failure is not due to damage in transit and you neglect to prepare a claim foundation, you may find later that it was shipping damage and be unable to enter a claim. Hidden damage should be reported to the carrier IMMEDIATELY!

In the case of delivery by other carriers, they normally have an inspector that will check the equipment with you and make a carriers "joint inspection". Though the cost of repairs may not be known at this time, the "joint inspection" has prepared the foundation for filing a claim later if it is found necessary.

Failure to take the necessary steps in handling damaged shipments can result in a loss the purchaser may have to assume. Prompt action on your part will safe-guard your investment and minimize the inconvenience that always exists in cases of carrier damage.

INTRODUCTION

WRL sincerely believes you will be very satisfied with your Duo-Bander II transceiver. It represents a significant achievement in the art, enabling us to provide you with a high performance transceiver covering the 75 and 40 meter SSB phone bands at unusually low cost.

THEORY OF OPERATION

TRANSMITTING: The microphone voice signal, from the microphone input jack, is amplified in the first 2N2926 amplifier stage and coupled to another 2N2926 operating as a phase inverter. This delivers a balanced signal to the bases of the two 2N2926's which are the balanced modulators. Also being fed into the balanced modulator is a signal at 5.55 mc. from the crystal oscillator, which is a multi-function 6GX6 tube. The balanced modulator combines the two signals, audio and RF, the product of which will be a double side-band, suppressed carrier signal at 5.55 mc.

The double-sideband suppressed carrier signal is then passed through the special crystal lattice filter. The frequency passband of this filter is such that it will allow the lower sideband signal to pass, but effectively rejects the upper-sideband component that was also present at the input. This then passes the lower sideband component to the 12BA6 IF amplifier tube where it is amplified and passed on to the 6EJ7 transmitting mixer tube. At this tube another signal from the VFO is also injected, which will be in the range of 1.75 to 1.55 mc. The output of this tube has tuned circuits which will effectively reject all but the desired sum or difference between the input signals. The sum is used for 40 meters, the difference for 75 meters. Additional bandpass circuits follow and couple the signal to the 12BY7 driver tube. This tube drives the final amplifier, which is a pair of 6LB6 .

The plates of the final amplifier tubes are connected in parallel and, through DC isolation blocking capacitors, through the Pi-network which matches the plate impedance of the final tubes to a fixed impedance of 50 Ohms. A diode detector is attached to this circuit to sample RF output voltage and thereby provide a means to tune the amplifier stage for maximum power output to the antenna system.

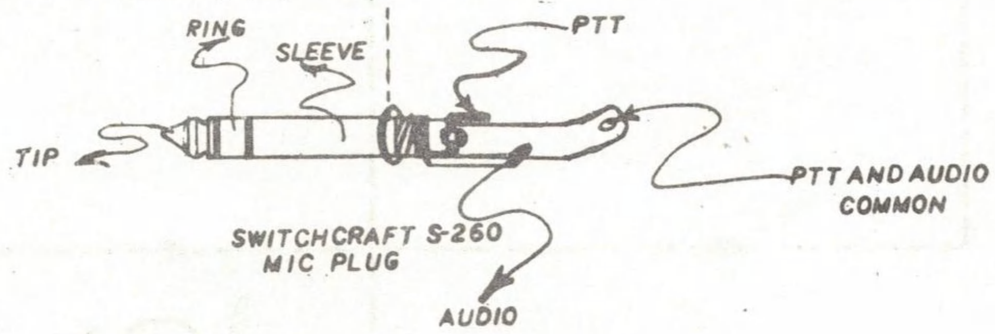
RECEIVING: The incoming signal from the antenna is coupled to the 12BY7 tube through the antenna relay. This was used as a driver when transmitting, but also serves as a receiving RF amplifier stage during reception. The output of this amplifier is connected to the 6HG8 receiving mixer tube. A signal from the VFO is also injected into the 6HG8 in the range of 1.55 to 1.75 mc. The product of these signals that equals 5.55 mc. will be selected by the crystal filter and further amplified by the 12BA6 IF amplifier. A second 12BA6 IF amplifier is then used.

The signal is then coupled to a 6GX6 combination oscillator-product detector. The output of this stage is audio, and coupled to both the 6JV8 output stage and the 2N2926 AVC amplifier. The output of the 6JV8 is connected to the internal loudspeaker. The DC output voltage of the 2N2926 AVC amplifier is coupled to the receiving RF, both IF amplifiers, and the triode section of the 6JV8, which controls the gain of these tubes to maintain a relatively constant audio output level, despite considerable variation of level of the incoming RF signal. The triode section of the 6JV8 is used as an "S" meter amplifying circuit, and drives the "S" meter for indicating incoming signal strength. The meter is switched automatically from transmit to receive functions by the internal circuitry.

POWER CONNECTIONS: The transceiver is furnished WITHOUT a power plug or cable to the supply. The supply used should provide adequate voltages for the transceiver, and we strongly urge the user to have a matching WRL AC or DC supply. The requirements are, for full power operation: 900VDC @445 ma. 。 peak(10% regulation 80 to 445 ma.);325 to 350VDC@ 200 ma. with 10% regulation;negative -100VDC @ 30 ma.;12VDC @ 200 ma.;12VAC/DC @ 5 Amp., all DC voltages being suitable filtered. WRL's power supplies will come with the power cable and plug. If others are used, a Cinch-Jones plug type S312CCT will be required, and we recommend that Belden #8469 cable be used(not to exceed 10' length).

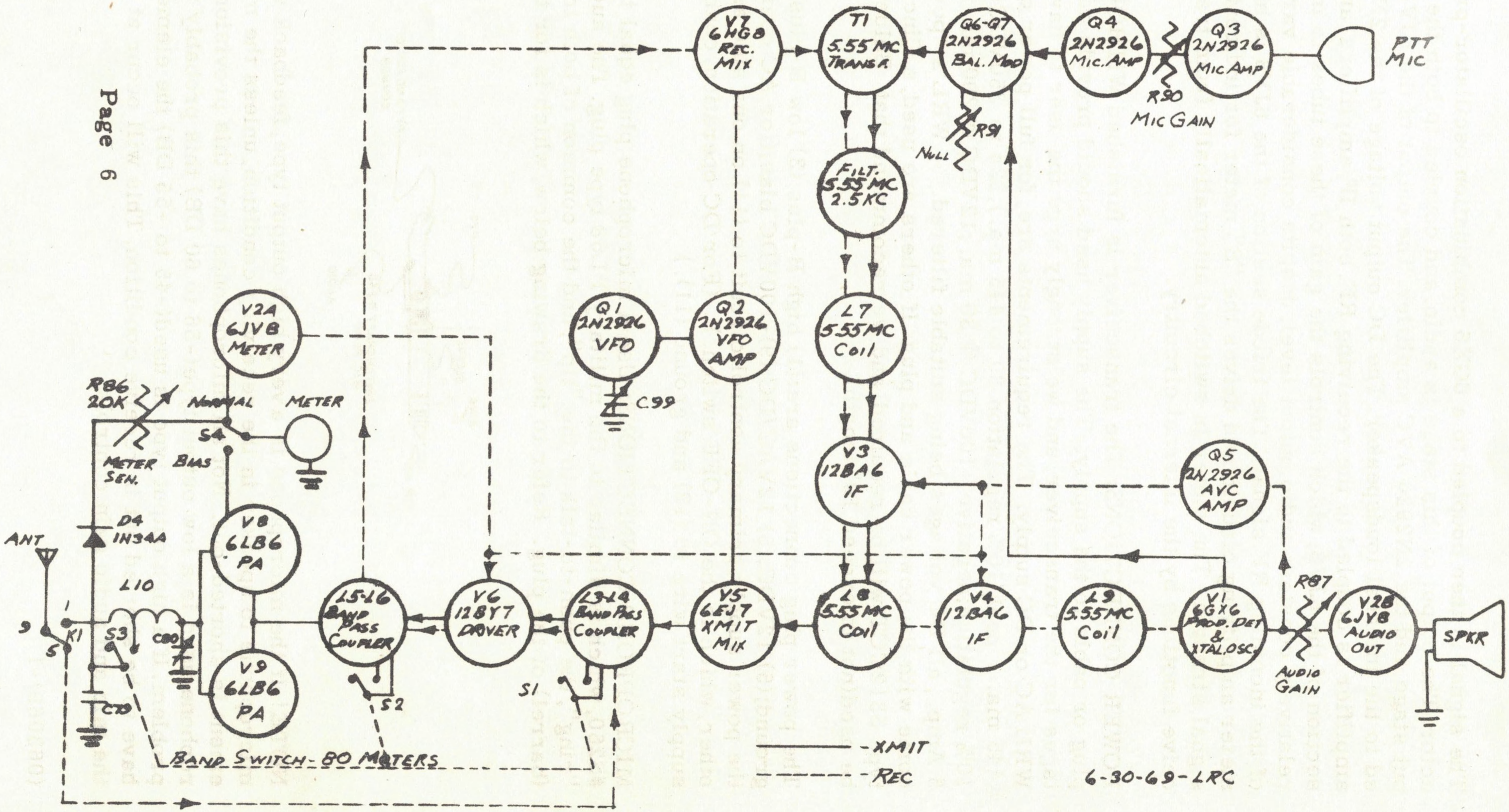
The power plug connections are:(1) high B-plus;(3) low B-plus;(7) common ground;(5) 12VDC;(6) 12VAC/DC;(9)-100VDC bias;(for AC operation connect the power supply primary control circuit to (11) on one side and (12) on the other, which is the ON-OFF switch.) (For DC operation, connect the DC supply start wire to (12) and ground (11).)

MICROPHONE CONNECTIONS: Use a microphone plug equal to Switch-Craft #S260, which is similar to the military PL68 type plug. The audio goes to the "ring", the push-to-talk to the "tip", and the common of both to the "sleeve" (barrel) of the plug. Refer to the drawing below, which is for the S260 plug.



NOTE! If the microphone is a very high output type, feedback will result from microphone to speaker in the receiving condition, unless the microphone element is shorted-out. Not all microphones have this provision. If the microphone used is a low output type(-56 to 60 DB) this probably will not be any problem. If a high output type is used(-45 to -55 DB) the element will probably have to be shorted out in receive condition. This will occur at high settings of the mic and audio gain controls.

DUO BANDER II BLOCK DIAGRAM

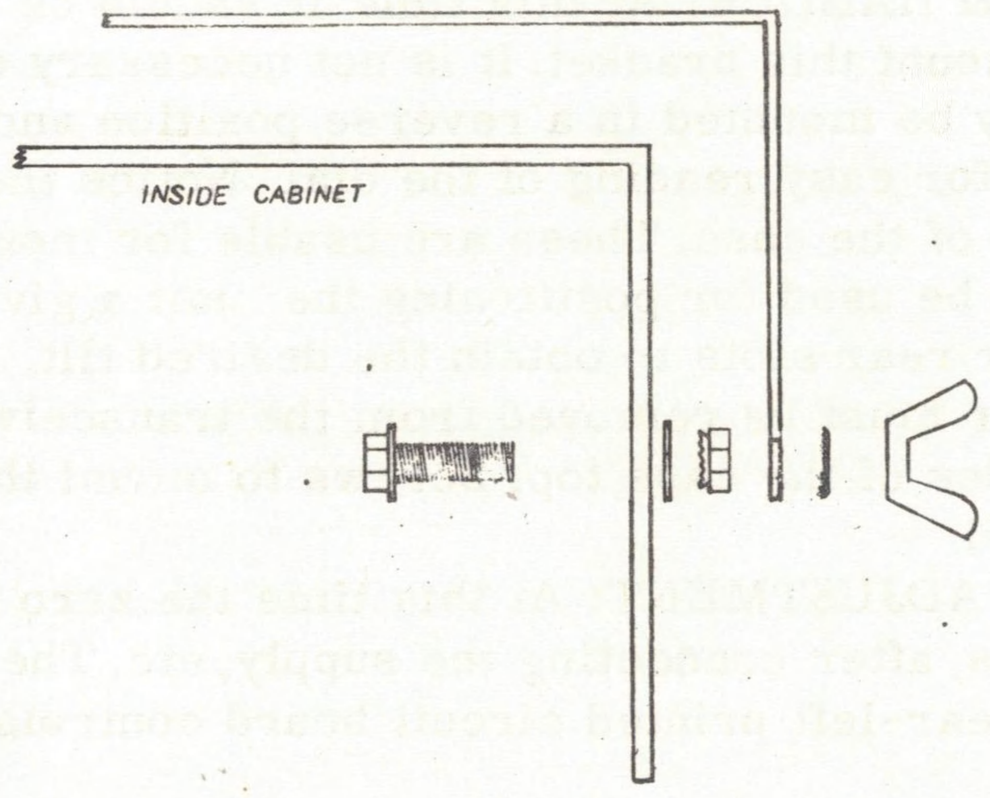


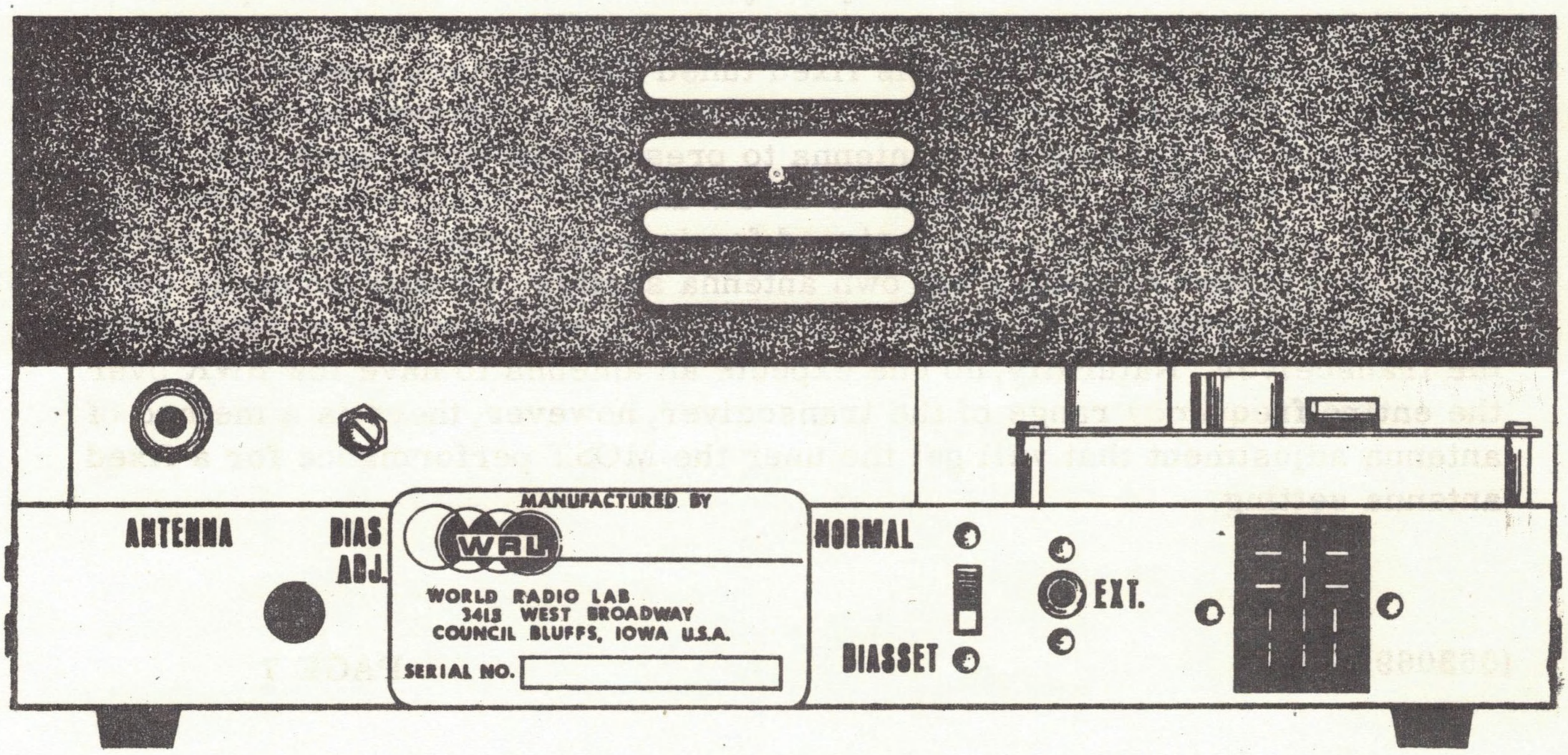
MOBILE BRACKET & HANDLE: At this time it should be determined if the user wishes to mount this bracket. It is not necessary except for mobile use, though it may be mounted in a reverse position and used to tilt the front up on the desk for easy reading of the dial. Notice there are several slots along the sides of the case. These are usable for mounting the bracket, and any of them may be used for positioning the unit a given distance under the dash--forward or rear slots to obtain the desired tilt. To mount the bracket, the top cover must be removed from the transceiver by removing the screws at the sides of the case top. Screws to mount the handle to the dash are not provided.
(NOTE! "S" METER ADJUSTMENT: At this time the zero adjust can be set if the user wishes, after connecting the supply, etc. The blue trimmer, R34, located on the rear-left printed circuit board controls this.)

The hardware for mounting the bracket is packed in a separate bag and contains the required parts. See the detailed drawing for method of assembly.

IMPORTANT ANTENNA INFORMATION:

The Duo-Bander is an extremely easy transceiver to tune and operate--in fact, you just insert carrier and adjust the TUNE control for maximum meter reading. The Pi-network is fixed tuned for optimum power transfer to a load of 50 Ohms, non-reactive. Consequently, best signal radiation will occur when the user tunes the antenna to present that impedance load. Actually, such a fixed system can be an advantage--because the commercial antennas generally in use are designed for just that impedance. If the operator assembles, tunes or makes his own antenna system, he will normally use 50 Ohm transmission line, so a match to the line will result in a match to the transceiver. Naturally, no one expects an antenna to have low SWR over the entire frequency range of the transceiver, however, there is a method of antenna adjustment that will get the user the MOST performance for a fixed antenna setting.


INSIDE CABINET


ANTENNA
BIAS ADJ.
MANUFACTURED BY
WRL
WORLD RADIO LAB
3415 WEST BROADWAY
COUNCIL BLUFFS, IOWA U.S.A.
SERIAL NO.
NORMAL
BIASSET
EXT.

If the resonant point of the antenna system (that is antenna and feed line) is lower than the lowest frequency operated, the power output will be better than if the user operates on a frequency that is less than the resonant point of the antenna system . In a mobile installation on the 75 and 40 meter bands the coax feedline is normally so short as to be a non-resonant part of the system, and the resonance that will be observed will be that of the antenna itself. However, in a fixed station with relatively long feed lines, the user, in making a check, may well see the resonance of the coax, etc. In any case , the resonant condition to be found and determined for frequency in the fixed station is that of the system as a whole. This will normally be evidenced as the point that exhibits the lowest impedance. After set-up checks and initial tuning done in the later steps, the following checks can be made to determine the best operating range for a particular antenna system, and if it should be changed. Starting at the top of the band, tune the transceiver as specified, then set the meter sensitivity control for a mid-scale reading. Now, repeat the final TUNE peaking about every 25 kc. going down the band, simply peaking for maximum meter reading----but do not change the meter sensitivity control setting. A progressively lower reading should result--reaching a minimum at some point in the band. This will be the lowest operating frequency that will give top results. (If, when moving down the band the readings went higher you were already under the resonant point of the system and the antenna system definitely should be adjusted for good operation lower in the band.) Loss of power output going higher than the resonant point will result in much less decrease than going lower in frequency than this point.

GROUNDING: Naturally, before ever connecting either power or antenna, a good external ground system should be connected to the rear case of the transceiver. Frequently, a single ground wire will be inadequate. This is especially true if it is to a water pipe(not recommended) or were appreciable in length. In the case where a single ground wire is not very short and to an external ground rod, we recommend that a second ground wire be added, grounding to a different point outside the house, and , as possible, making it nearly as possible, double the length of the first. This may break-up a ground wire resonance.

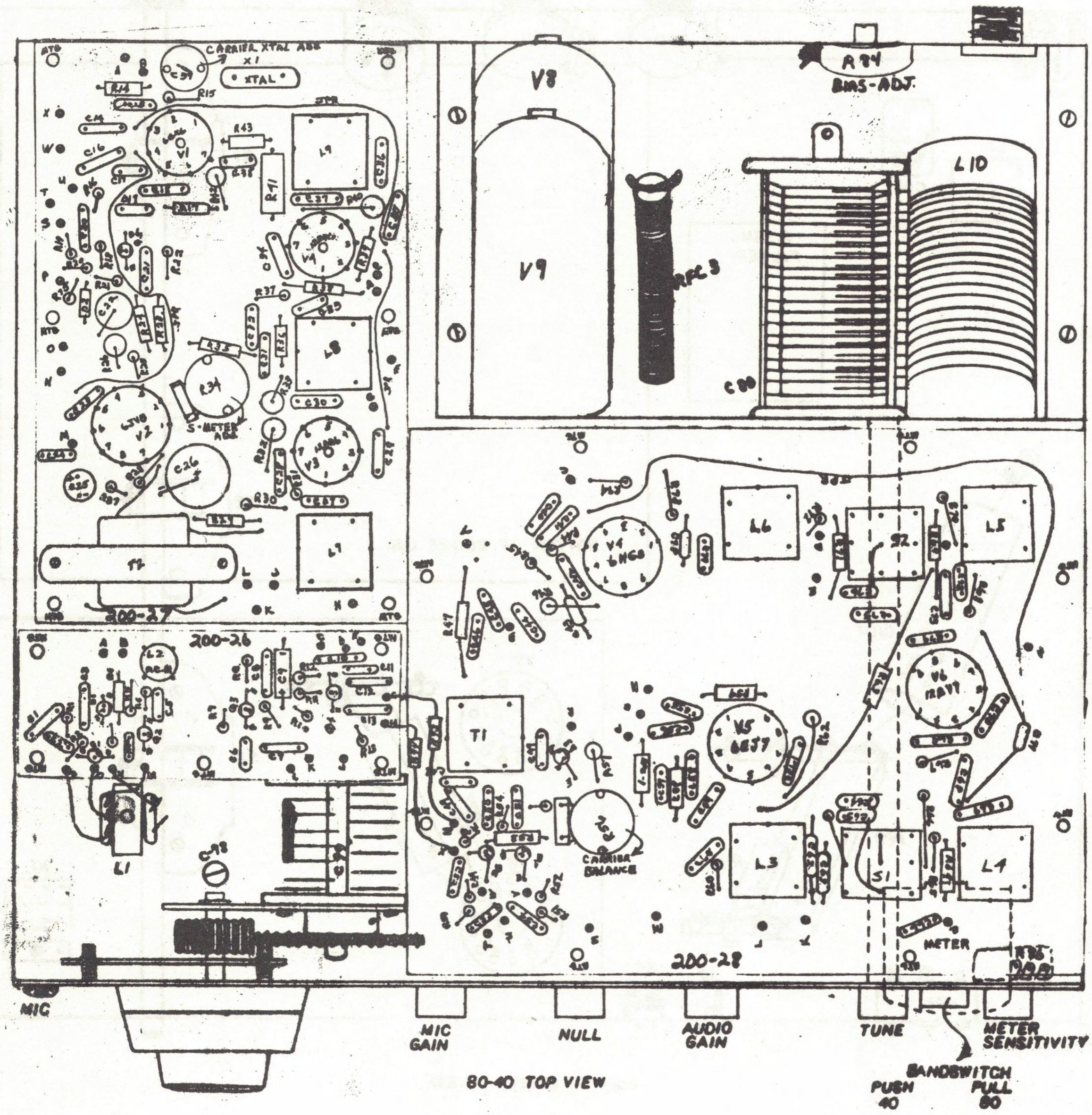
BALUNS: We highly recommend that all doublet type antennas that are used, that is--a balanced type antenna--and coax feedline used, a suitable 1:1 balun be installed at the antenna. This is not particularly for this transceiver, but good practice at any station designed for unbalanced antenna operation(ie: a Pi-net and coax) connected to a balanced antenna(ie: a dipole-balanced beam or any antenna radiating element that is not operated against ground rather than against a similar 1/2 element.)

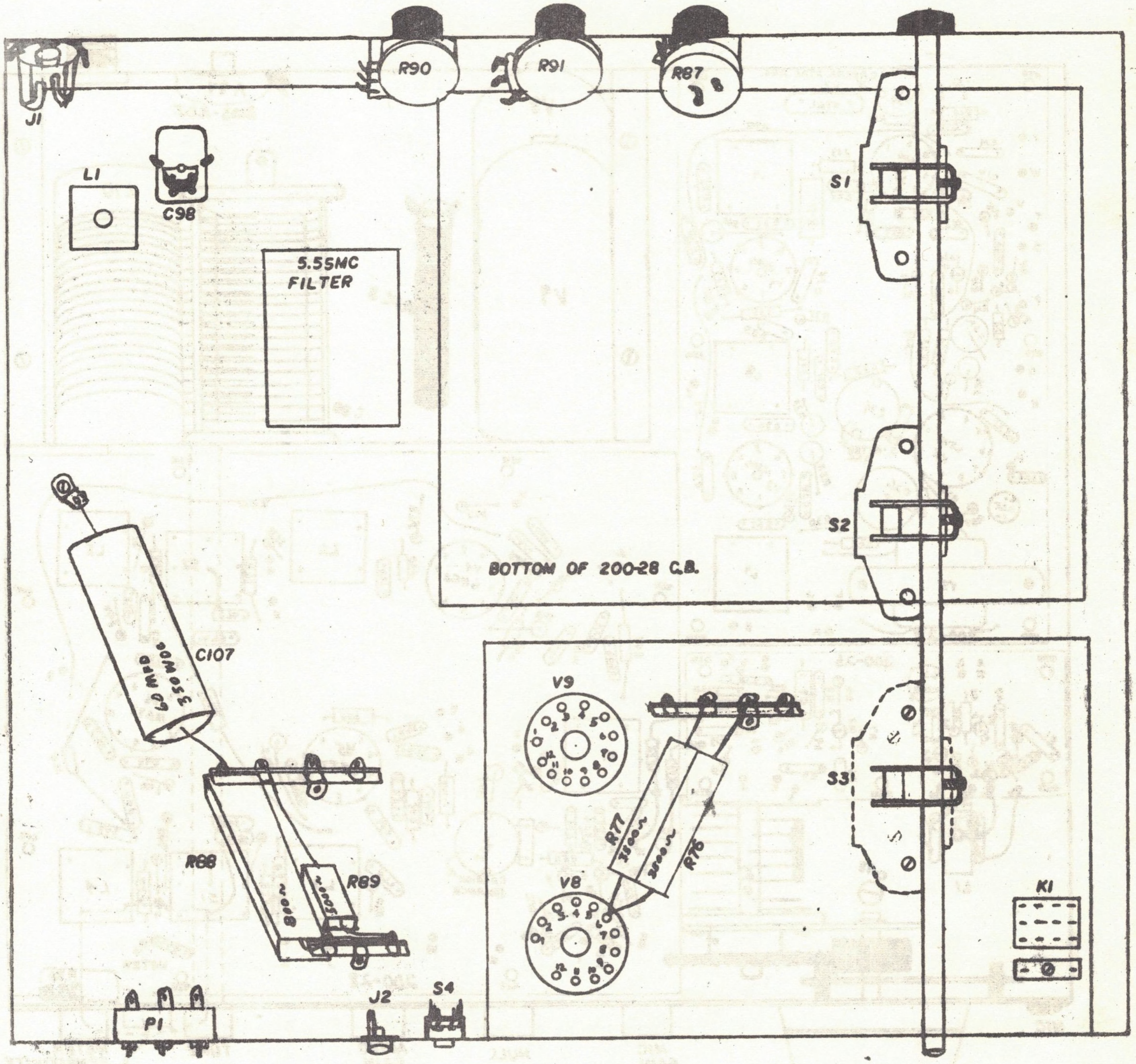
BIAS SET: The bias adjustment MUST be re-set when installed in any different station, or when the primary voltage changes appreciably, or if the final tubes are replaced. ALWAYS replace the final tubes as a matched set of the same brand ! Energize the unit by turning the receiver audio gain control slightly clockwise until the switch "clicks" on. Allow at least one minute warm-up. Set the meter slide switch on the rear of the chassis to the bias-set(down) position. Operate the PTT switch on your mic to place the unit in a transmit condition--adjust the NULL control for a MINIMUM meter reading--adjust the bias potentiometer(rear of chassis near final) so the meter reads on the "bias" mark on it's scale. Release the PTT for receive condition. Set the meter switch back to the"hormal"(up) position. The set is now ready for reception or to be tuned for transmitting.

NORMAL TUNE-UP : Select the desired band with the push-pull bandswitch: push in for 40 meters and pull out for 80 meters. Set the desired frequency on the VFO dial. Rotate the NULL control to maximum direction either side. Now close the PTT circuit and quickly adjust the plate TUNE control for maximum meter reading--adjusting the SENSITIVITY control as necessary to keep the meter on scale. When the TUNE control has been adjusted for maximum meter reading, then adjust the SENSITIVITY control for a full scale meter reading---then set the NULL control for minimum reading, which is indication of the carrier suppression. Now, speak into the mic and slowly advance the MIC GAIN control until the meter peaks are about 1/3 of full scale on the meter, which will normally represent about 400 watts PEP input. To return to a receiving condition, just open the mic PTT circuit and adjust the AUDIO GAIN control for a pleasing level.

If you change frequency more than a few kHz, then momentarily insert carrier with the NULL control and adjust the plate TUNE for maximum meter reading, as in the normal tune-up instructions above.

EXTERNAL CONTROL: On the rear of the chassis is a phono type jack that may be used to control external devices, such as the relay system in a linear, etc. It is marked EXT. When the transceiver is in a receiving condition this jack(center pin) is an open circuit. But when in a transmit condition this jack is grounded to the chassis to complete the circuit. But it is IMPORTANT the user understand that this control circuit has a MAXIMUM rating of 70 volts AC/DC and 200 Ma. , which must not be exceeded , or the isolating choke in the circuit will open and the contacts of the realy may be damaged.


CARRIER XTAL ADJ
X1
XTAL
R15
R43
R11
L9
V1
V4
V9
V8
R37
L8
L7
T2
200-27
S-METER ADJ
C26
V2
V3
L2
L1
200-26
T1
V4 6HG8
L6
L5
V2
V6 6BY7
V5 6EJ7
CARRIER BALANCE
L3
L4
S1
METER
200-28
R84
BIAS-ADJ.
L10
RFC 3
C30
MIC
MIC GAIN
NULL
AUDIO GAIN
TUNE
METER SENSITIVITY
BANDSWITCH
PUSH 40
PULL 80
80-40 TOP VIEW



80-40 BOTTOM VIEW

FREQUENCY COVERAGE: The Duo-Bander II was designed with a specific purpose in mind;to provide coverage of the main U.S.A. phone bands on 75 and 40 meters. To do this most economically, a special I.F. filter was designed, and it happens that the spurious responses, attenuated by four tuned circuits, are suppressed reasonably using this particular I.F. frequency and coverage. However, any attempt to open up the frequency coverage will result in crossing with 3rd, 4th, or 6th order products and spurious output will result. Therefor , one should not attempt to operate outside of the coverage provided,to avoid improper operation.

ACCESSORIES: To maintain simplicity and minimize costs, the Duo-Bander II. was not designed to incorporate accessories such as a calibrator, VOX, CW, etc. A user can use one of the many self-powered calibrators on the market, and just being close to the set should be sufficient.

ALIGNMENT:

Alignment in the field, even by a good technician, is at best a difficult job. Without the proper test equipment it becomes a nearly hopeless task. There for, it should not be attempted without the proper test equipment or, at best, the results will be questionable.

TEST EQUIPMENT REQUIRED--
VTVM with RF probe for 100VRMS.
SIGNAL GENERATOR with calibrated output covering at least 1 to 6 mc.
AUDIO GENERATOR with less than 2% distortion and covering 200 to 2000 CPS.
DUMMY LOAD for 50 Ohms resistive and capable of 200 watts for several min.
SWEEP GENERATOR with 1CPS sweep and covering 5.53 to 5.57 mc.
SCOPE with low capacity detector probe.
CALIBRATOR for 100 kc. markers

A....I.F. ALIGNMENT

Zero the "S" meter with no signal applied..... Apply a 3.9 mc. signal to the antenna jack of about 100 uv ..... Tune the VFO to 3.9 mc. approx. until the signal is found and a 1000 cycle tone is heard in the speaker..... With the meter slide switch in the NORMAL position you should have an "S" meter reading of about S-9..... Peak the coils L9, L8, L7 in that order for maximum sensitivity..... (NOTE! if you adjust L7 and the bottom slug in T1 you MUST also do the filter alignment section)

B....FILTER ALIGNMENT

Connect the dummy load to the antenna jack and also connect the scope probe to the dummy load..... Tune-up the transmitter on 3.9 mc..... Peak the top slug of T1.....

. . . . . Balance out the carrier by adjusting the front panel NULL control R91 and also adjusting the trimmer potentiometer R56 on the 200-28 board(See section on CARRIER BALANCE). . . . . Connect the sweep generator through a 10K, 1/2 watt resistor to the input of the filter on board 200-28, setting the sweep frequency from 5.53 to 5.57 mc. at a 1 cycle sweep rate. . . . . Key the set with the PTT. . . . . Adjust the output of the sweep generator until the filter bandpass can be seen on the scope in its maximum gain setting. . . . . Adjust the slug in L7 and also the bottom slug in T1 for minimum ripple in the filter bandpass. NOTE! The left side of the filter bandpass may be slightly higher than the right side. Be careful not to decrease the output of the radio in trying to align the filter .

CARRIER CRYSTAL ALIGNMENT:

Connect the dummy load to the output antenna jack and attach the RF probe for the VTVM to the dummy load. . . . . Tune-up the transmitter at 3.9 mc. and then balance out the carrier. . . . . Connect the audio oscillator to the microphone input jack and set the oscillator at 1200 cycles. . . . . Key the PTT circuit. . . . . Set the MIC. GAIN control about 1/2 open and adjust the audio generator output until about 50 VRMS is read on the VTVM. . . . . Set the audio generator to 200 cycles. . . . . Adjust the carrier crystal trimmer C39 until about 25 VRMS is read on the VTVM. . . . . Repeat the carrier balance steps as given above(R56 and R91). .

CARRIER BALANCE:

Connect the dummy load to the antenna jack and attach the RF probe with your VTVM to the dummy load. . . . . Tune-up the transmitter on 3.9 mc. . . . . Balance the carrier out using the front panel NULL control , R91, and also the adjustment R56 on board 200-28. It should be possible to reduce residual carrier to less than 3/10ths of a volts RMS as read on the VTVM. It is preferable that you first start with the panel NULL control at center position and then adjust R56. However, if insufficient suppression results it may be necessary to set the panel control other than at center position to obtain best suppression.

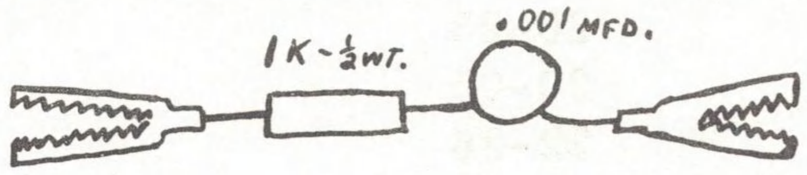
VFO ALIGNMENT & TRACKING:

Loop the output wire from the 100 kc. calibrator source around the 12BY7 tube(RF amplifier tube) and tune the receiver to pick-up the 39th harmonic, which is 3.9 mc. Adjust the tuning further until a 1000 cycle tone is heard. . . . . .

.....Peak the VFO output coil L2 for maximum "S" meter reading. (Tracking).....Tune-in the 40th harmonic of the oscillator, which is 4.0 mc. and adjust L1 until the dial is at 4.0 mc. when this signal is zero-beat.....Tune-in the 38th harmonic at 3.8 mc. and adjust C98 until the dial reads 3.8 mc when this signal is zero-beat..... ...Repeat these two adjustments until the dial reads correctly at both 3.8 and 4.0 mc.....There is no separate tracking adjustment for 40 meters , but the tracking error there should be very small and well within the tolerance of overall accuracy.

R.F. TRANSFORMER ALIGNMENT:

The 40 meter alignment must always be done before the 80 meter alignment!.....A test fixture must be made-up for this alignment, as shown below. Use miniature clips and keep leads short.....



Tune-up the unit at 7.2 mc., then connect the fixture from the output of L4(driver grid) to ground.....Peak the bottom slug in L3..... Tune-up the unit at 3.9 mc.....Peak the top slug in L3..... Remove the fixture and re-connect it from L3 to ground.(mixer plate).. ....Tune-up the transmitter at 7.2 mc.....Peak the bottom slug in L4. ...Re-tune the transmitter at 3.9 mc.....Peak the top slug of L4.... Re-connect the fixture from L6 to ground(PA grid).....Tune-up the transmitter at 7.2 mc.....Peak the bottom slug of L5.....Tune-up the transmitter at 3.9 mc.....Peak the top slug of L5..... Re-connect the fixture from L5 to ground.(driver plate).....Tune-up the transmitter at 7.2 mc.....Peak the bottom slug of L6..... Tune-up the transmitter at 3.9 mc.....Peak the top slug of L6.....

The signals on which the adjustments above are being made are the harmonics of the external 100 kc. calibrator and adjustments for peaking refer to tuning these adjustments for maximum R.F. output to the dummy load as read by the attached VTVM with R.F. probe.

If in doubt as to the effectiveness of a single alignment, it is advisable to repeat the complete sequence. It will be noticed there is a slight reduction of receiving gain on the low-end of the band , compared to the high end.

PARTS LIST DUO-BANDER II

This parts list is to serve as a guide for parts specifications only. Prices will be quoted on request, F.O.B. Council Bluffs, Iowa. Also, see page 21 for ordering information.

SYMBOL	DESCRIPTION	WRL PART #
Capacitors disc ceramic @ 600VDC unless noted in individual listing		
C 1	.1mfd @ 50V.	20-38
C 2	100pf	22-21
C 3	.01mfd	20-05
C 4	.001mfd	20-24
C 5	160pf	22-50
C 6	470pf	20-39
C 7-8	.01mfd	20-05
C 9	2mfd @ 50V. electrolytic	29-06
C 10	.01mfd	20-05
C 11	100pf	20-23
C12-13-14	.01mfd	20-05
C 15	150pf	22-26
C 16	.01mfd	20-05
C 17	220pf	22-23
C 18	.01mfd	20-05
C 19	.005mfd	20-03
C 20	.01mfd	20-05
C 21	.02mfd @ 50V	20-49
C 22	.22mfd mylar @ 500V	23-15
C 23	.01mfd	20-05
C 24	100pf	20-23
C 25	100mfd electrolytic @ 15V	29-13
C 26	4mfd electrolytic @ 350V	24-18
C 27 to 32	.01mfd	20-05
C 33	470pf	20-39
C 34 to 37	.01mfd	20-05
C 38	5pf	22-42
C 39	8/50pf ceramic trimmer; spec.	26-11
C 40 to 42	.01mfd	20-05
C 43	100pf	20-23
C 44	200pf	22-49
C 45	560pf	22-36
C 46	.01mfd	20-05
C 47 & 48	330pf	22-39
C 49	.01mfd	20-05

C 50 & 51	.01mfd	22-19
C 52 to 54	.01mfd	20-05
C 55	7pf tubular ceramic	20-21
C 56	25pf	20-08
C 57	130pf	22-47
C 58 to 61	.01mfd	20-05
C 62	150pf (1 KV)	22-53
C 63	.002mfd	22-27
C 64 & 65	2.2pf tubular ceramic	20-33
C 66	.01mfd	20-05
C 67	120pf	22-12
C 68	.001mfd	22-19
C 69 & 70	.01mfd	20-05
C 71	3.3pf	20-35
C 72	130pf	22-47
C 73 & 74	.01mfd	20-05
C 75	4.7pf	20-53
C 76	7pf	20-21
C 77	82pf	22-48
C 78	100pf	20-23
C 79	560pf	22-36
C 80	300pf variable	22-15
C 81	.01mfd @ 1.6KV ceramic	20-29
C82/85 & C90	.001 mfd	20-24
C 94	.01mfd @ 1.6KV	20-29
C 95	6.8pf @ 6KV	20-80
C 96	820pf	22-14
C 97	.005mfd	20-03
C 98	13pf variable	25-24
C 99	50pf variable	25-17A
C100	82pf NPO	20-55
C101	.005mfd	20-03
C102	300pf	22-44
C103	33pf	22-07
C104 to 106	.01mfd	20-05
C107	60mfd electrolytic @ 350V	24-31
C108 & 109	.01mfd	20-05
C110	.001mfd	20-24
D 1 &3	2N2926 diode connected	111-6 Orange
D 2 & 4	1N34A diode	112-1N34A
J 1	mic. jack, Switchcraft S12B	103-3
J 2	phono pin jack	100-4
J 3	SO239 coax jack	101-1

NOTE! C86, C89, C91, C93 not used

K 1	4PDT spec relay, 12V.	116-5
L 1	special coil	42-55
L 2	special coil	42-56
L 3	special coil	42-51
L 4	special coil	42-49
L 5	special coil	42-48
L 6	special coil	42-50
L 7	special coil	42-52
L 8	special coil	42-53
L 9	special coil	42-54
L10	special coil	42-25E
M 1	special meter, 1ma. movement	115-9
P 1	12 pin chassis plug	104-5
Q 1 to 5	2N2926 Orange	111-6 Orange
Q 6 & 7	2N2926 Green	111-6 Green

All resistors are 1/2 watt and 10% tolerance , unless specified .

R 1	150K	10-05
R 2	1K	10-42
R 3	330K	10-69
R 4	330	10-28
R 5	1K	10-42
R 6	68	10-18
R 7	680K	10-82
R 8	1.5K	10-03
R 9 & 10	270K	10-12
R 11	10K	10-56
R 12	1.5 meg	10-89
R 13	10K	10-56
R 14	1K	10-42
R 15	2.2 meg	10-02
R 16	680K	10-82
R 17	220K	10-04
R 18 & 19	47K	10-13
R 20	100K	10-32
R 21	1K	10-42
R 22	33K	10-65
R 23	1.5 meg	10-89
R 24	fact. select(820K/1.5M)	-----

R 25	27K		10-14
R 26	120K	2 watt	10-80B
R 27	68		10-18
R 28	820		10-75
R 29	68K		10-33
R 30	10K		10-56
R 31	68		10-18
R 32	22K	2 watt	10-41B
R 33	28K	2 watt	10-53B
R 34	2.5K	PC trimpot	13-26
R 35	100		10-07
R 36	1K		10-42
R 37	100K		10-32
R 38	68		10-18
R 39	1K		10-42
R 40	28K	2 watt	10-53B
R 41	22K	2 watt	10-41B
R 42	47K	1 watt	10-46A
R 43	27K		10-14
R 44	150		10-43
R 45	100K		10-32
R 46	47K	1 watt	10-46A
R 47	1K		10-42
R 48	820K		10-64
R 49	560		10-67
R 50 & 51	220		10-58
R 52	560		10-67
R 53	1.5K		10-03
R 54	820K		10-64
R 55	1.5K		10-03
R 56	2.5K	PC trimpot	13-26
R 57	68K	2 watt	10-63B
R 58	680		10-72
R 59	10K		10-56
R 60	8.2K		10-86
R 61	68K		10-33
R 62	39K	2 watt	10-68B
R 63	1K		10-42
R 64	10K		10-56
R 65	8.2K		10-86

R 66	68K	10-33
R 67	150	10-43
R 68	10K	10-56
R 69	68K	10-33
R 70	8. 2K	10-86
R 71	68K	10-33
R 72	8. 2K	10-86
R 73	100K	10-32
R 74	150	10-43
R 75	15K	10-81
R 76 &77	3. 5K 10 watt	11-01D
R78/79	10 1 watt, 5%	10-71A (carbon, non-inductive only)
R 82	1. 8K	10-1
R 83	4. 7K	10-36
R 84	7. 5K potentiometer	13-12
R 85	4. 7K 1 watt	10-35A
R 86	20K potentiometer	13-29
R 87	500K potentiometer with SW	13-27
R 88	800 15 watt	11-1G
R 89	5K 5 watt	11-18D
R 90	1 meg potentiometer	13-28
R 91	2. 5K potentiometer	13-13
R93/94	1K	10-42
RFC1	special choke	30-19
RFC2	special choke	30-03
RFC3	special choke	30-13
RFC4&5	2. 5mh choke	30-09
RFC6	special choke	30-20
S 1&2	3PDT slide switch	51-06
S 3&4	DPDT slide switch	51-04
T 1	special transformer	76-08
T 2	audio output xfmr, spec.	76-9
V 1	6GX6 tube	110-6GX6
V 2	6JV8 tube	110-6JV8
V 3&4	12BA6 tubes	1 0-12BA6

NOTE! R80, R81, R92 not used.

V 5	6EJ7 tube	110-6EJ7	
V 6	12BY7A tube	110-12BY7A	
V 7	6HG8 tube	110-6HG8	
V 8 & 9	6LB6 tubes(use matched pair)	110-6LB6	(USE GE ONLY)
X 1	special filter 5.5 mc. (CFN)	117-20	
X 1A	crystal for filter 5.5mc.	117-20A	
--	speaker	118-4	
--	calibrated dial scale	133-29	
--	dial backing plate, plastic	133-2M	
--	hair line for dial	133-28	
--	speaker grill, metal	145-3	
--	dial drive gear	115-11	
--	anti backlash gear	151-3	
--	vernier drive assembly	172-11A	
--	small knobs	130-14-6	
--	large fixed ring on VFO	130-14-1	
--	large ring knob on VFO	130-14-2	
--	VFO slow tune knob	130-14-3	
--	feet, short	133-7	
--	feet, long	133-6	
--	panel	141-20	
--	cabinet, both pieces only	140-21	
--	handle for cabinet, less hdwr.	140-21A	
--	hardward for handle	126-1	
--	packing carton & liners	182-25	
--	bulb for VFO dial light, 6V	113-12	
--	PC1 &2 parasitic choke	33-03	

Should replacement parts be required, the parts should be ordered by specifying the WRL part number, the schematic symbol where given, and the description of the part (ie: capacity--resistance--mechanical description) so there will be no misunderstanding of your needs. Also, give the serial number of your unit and model number, as there may be production variations, etc.

Where a customer has an established account to charge at WRL, we can ship the parts and bill on our normal terms. Otherwise, parts orders will be handled on a cash basis. You can request a quote which we'll gladly provide, then full payment (add adequate shipping allowance to payment) can be sent for the needed parts. Or, send $5.00 with your parts request and we'll send C.O.D. for cost over the $5.00, or refund any credit left after shipment for costs under the $5.00.

VOLTAGE AND RESISTANCE CHART

In these listings there are three sets of values. The values are, from top to bottom, (top) voltage in receive condition, (middle)voltage in transmitting, (bottom)resistance to ground--chassis--unless otherwise noted.

The voltage readings in receive are with the following control settings and conditions. Tuned to 3. 9 mc. ;the MIC. GAIN and AUDIO GAIN controls fully counter-clockwise;METER SENSITIVITY control full clockwise;slide switch in NORMAL position;AC384 power supply connected and radio ON. --------
In transmit, the only difference is that the PTTis operated for transmit condition and the carrier NULL set for minimum carrier. ----------
For the resistance checks the power supply is completely dis-connected. All measurements are made with a Hewlet-Packard 410B VTVM or equal.(*AC)

V1	V2	V3	V4	V5	V6	V7	V8	V9	PIN#
-1. 2	3. 3	. 08	. 1	11	4	. 74	6*	12*	
. 06	0	-. 08	-. 08	3	3. 4	55	6*	12*	(1)
200K	500	120K	240K	inf.	150	150	. 8	1. 8	
4. 8	. 04	0	0	0	1. 1	-. 18	----	0	
4. 3	-. 4	0	0	0	-. 07	0	----	0	(2)
1K	750K	0	0	9K	150K	100K	----	220	
12*	265	12*	12*	11	0	. 74	0	0	
12*	0	12*	12*	3	0	55	180	180	(3)
1	42	1	1	inf	0	150	3K	3K	
6*	6*	0	0	7. 1*	0	12*	0	0	
6*	6*	0	0	7. 1*	0	12*	. 05	. 05	(4)
1. 8	1	0	0	1. 8	0	. 8	2. 5	2. 5	
160	0	285	285	0	12*	7*	-74	-74	
180	0	280	300	0	12*	7*	-74	-74	(5)
200K	0	15K	16K	0	1	1. 5	13K	13K	
160	1. 4	110	110	0	----	-. 87	0	0	
150	1. 4	110	175	0	----	0	180	180	(6)
50K	70	15K	15K	0	----	100K	3K	3K	
0	0	1. 3	1	250	250	40	----	0	
0	0	1. 3	54	230	235	300	----	0	(7)
27K	20	68	68	22K	20K	68K	----	100	
	130			250	210	300	0	0	
	130			180	195	300	180	180	(8)
	80K			50K	28K	20K	3K	3K	
	280			0	0	40	-74	-74	
	280			0	0	300	-74	-74	(9)
	20K			0	0	70K	13K	13K	

VOLTAGE AND RESISTANCE CHART, CONTINUED

V8	V9	PIN #
0	0	
.05	.05	(10)
2.5	2.5	
0	0	
180	180	(11)
3K	3K	
0	6*	
0	6*	(12)
0	.8	

The readings below are for the transistors used in the set. The readings can vary considerably due to the high voltage feed used, along with other factors influencing transistors, so somewhat more latitude to readings should be allowed before assuming an abnormal condition. Usually, a transistor will completely short or open, then the readings will vary considerably. The top set of readings are taken in a receiving condition, to chassis. The letter for each column(E--Emitter ;C--Collector ;B--Base) refer to the transistor elements.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	
0	.16	1.8	10	-22.5	0	0	E
5	6.8	8.2	13	.3	-.46	-.45	C
5	.7	2.3	11	-22.5	-.46	-.45	B
The readings below are taken with the set in a transmit condition							
0	.16	1.8	10	.22	.58	.7	E
5	6.8	8.2	13	-.05	5.9	5	C
5	.7	2.3	11	.22	1	.7	B

You will notice that there are no resistance readings given for the transistors. This is because the resistance will vary too much to be helpful, due to diode conduction with different meters. In fact, in most cases the readings will vary considerably by just switching the VTVM from one resistance range to another while measuring the same circuit.

FIELD SERVICING: Should a problem develop, we will try and assist you in making field service repairs, providing we can be supplied with sufficient information about the trouble. Simply stating generalaties , such as , "the transmitter doesn't work--I can't get the carrier out--the receiver is dead", etc. just does not provide sufficient information to work from. In any such cases, please describe how all functions operate, how the control settings differ from normal, substitutions tried, voltage and/or resistance checks made. If you do not have the equipment or experience to make thorough checks, then there is little hope that anything we can advise will be very helpful for field servicing.

Please note! The alignment information given in this manual is there more for some very distant future date when this product may not be produced and our personnel not as familiar with the alignment required , rather than for the present. Frankly, it is seldom, if ever, that alignment is a field problem except when there is total failure in a coil, etc. Other than for VFO frequency , we suggest you do not even attempt alignment in the field. It is a bandpass circuit that requires exactly what we specify in the way of equipment for proper alignment, and this is seldom available in the amateur station.

RETURNS FOR SERVICE: In the event that field service can not be accomplished with information we can supply by mail, and you wish to return the set to us for service, please obtain authorization in advance . We will provide you with suitable shipping labels which will help expedite. At the time shipment is made, be sure that your full name and address is both on a note inside the carton and well affixed to the outside.

For return authorization, write to:

WORLD RADIO LABORATORIES
SERVICE DEPARTMENT
3415 West Broadway St.
Council Bluffs, Iowa 51501

We do NOT recommend shipment by parcel post! Other means should be used, but what-ever means are used be sure the carrier does insure the unit for full value to protect YOUR investment.

ALL SHIPMENTS TO US ARE TO BE PREPAID!

WARRANTY ON WRL "DUO-BANDER

Failures in this equipment, either on initial operation or subsequently, are provided for in this warranty and should not be construed to be exceptions to it. We will exercise reasonable care in the manufacture of this equipment and any failure of part or error of workmanship will be covered by the terms of this warranty, which are: WORLD RADIO LABORATORIES, INC. warrants that defective components will, at our option, be repaired or replaced where the defective part is delivered to us with all transportation charges paid, and which in our opinion failed from normal use and installation, with adjustment and liability limited to 90 days from the date of sale to the original purchaser.

This warranty does not extend to any of our products which have been subjected to accident, mis-use, neglect, incorrect wiring not our own, improper installation, where the serial has been removed-defaced-or changed, to accessories not of our manufacture ,nor do we authorize the purchase of replacement parts by the user or reimburse for un-authorized purchase of such parts, nor can we reimburse the owner for any transportation charges connected with the purchase or servicing of this equipment under warranty.

This warranty applies only to the original purchaser and is not trans-ferable. This warranty is in lieu of all other warr anties, either expressed or implied, and no person or representative is authorized to assume for us any other liability in connection with the sale of this equipment.

We reserve the right to make any changes deemed advisable without advance notice or any liability to make similar changes to similar units previously manufactured and sold.