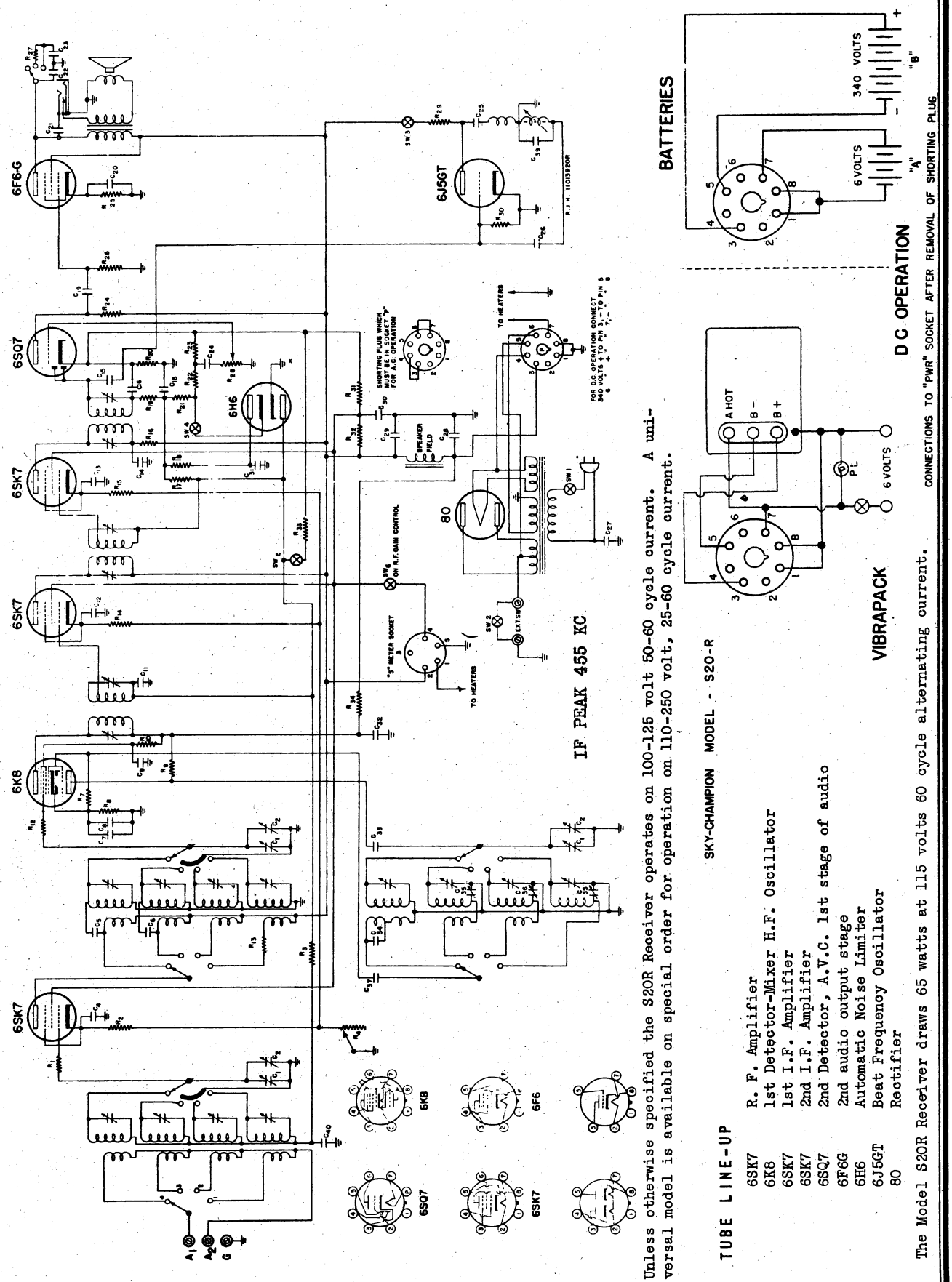
THE HALLICRAFTERS INC.

MODEL S20-R
Schematic, Notes



Unless otherwise specified the S20R Receiver operates on 100-125 volt 50-60 cycle current. A universal model is available on special order for operation on 110-250 volt, 25-60 cycle current.

SKY-CHAMPION MODEL - S20-R

TUBE LINE-UP

6SK7	R. F. Amplifier
6K8	1st Detector-Mixer H.F. Oscillator
6SK7	1st I.F. Amplifier
6SK7	2nd I.F. Amplifier
6SQ7	2nd Detector, A.V.C. 1st stage of audio
6F6G	2nd audio output stage
6H6	Automatic Noise Limiter
6J5GT	Beat Frequency Oscillator
80	Rectifier

The Model S20R Receiver draws 65 watts at 115 volts 60 cycle alternating current.

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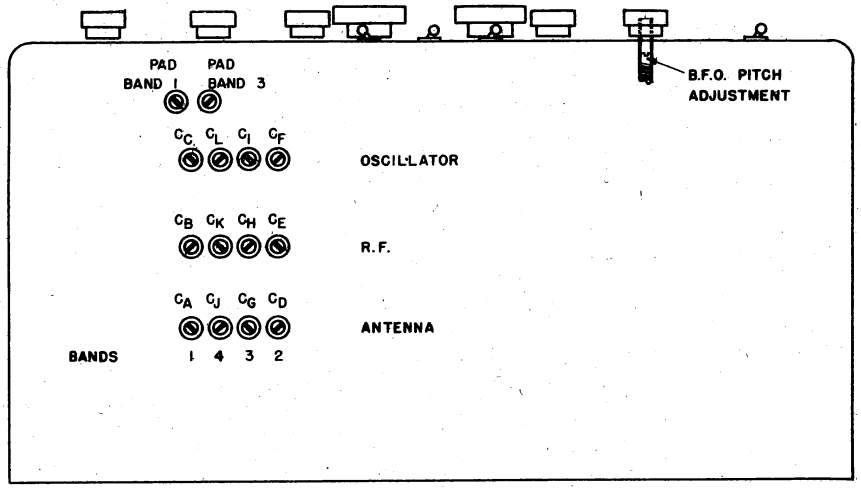
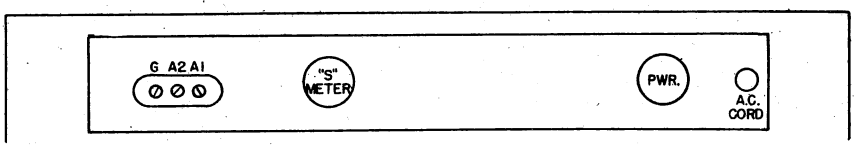
MODEL S20-R
Socket, Trimmers
Parts

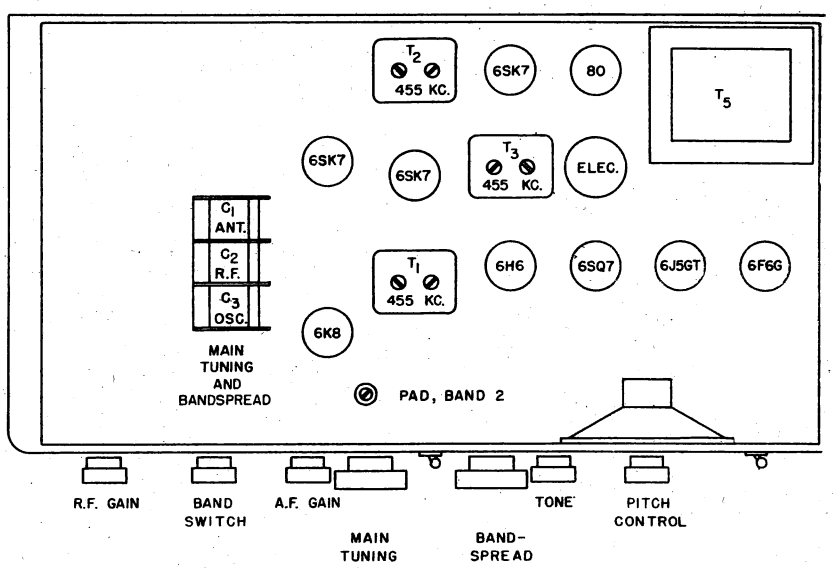
THE HALLICRAFTERS INC.

FREQUENCY RANGE

Band	Coverage
1	540 KC to 1,770 KC
2	1.72 MC to 5.4 MC
3	5.3 MC to 15.7 MC
4	15.2 MC to 44. MC







SWITCHES

SW1 – AC On-Off On Tone Control Switch
SW2 – Send Receive Switch
SW3 – BFO On-Off
SW4 – ANL On-Off
SW5 – AVC On-Off
SW6 – "S" Meter On R.F. Gain Control

RESISTORS

NO.	OHMS	WATTAGE
1	30	1/3
2	200	"
3	100,000	"
4	10,000	R.F. Gain
7	50,000	1/3
8	200	"
9	20,000	1
10	30,000	1
12	30	1/3
13	500	"
14	1,000	"
15	300	"
16	1,000	"
17	2,000,000	"
18	1,000,000	"
19	50,000	"
20	100	1/3
21	100,000	"
22	250,000	"
23	250,000	"
24	250,000	"
25	500	1
26	500,000	1/3
27	5,000	1
28	500,000	A.F. Gain
29	15,000	1-1/2
30	50,000	1/3
31	13,000	1-1/2
32	10,000	3
33	150	1/3
34	10,000	1-1/2

CONDENSERS

NO.	CAPACITY	VOLTAGE	TYPE
1	400 mmf	Main tuning	
2	27 "	Band Spread	
4	.05 mfd	200	
5	25 mmf		Ceramic
6	5 "		"
7	.002 mfd		Mica
8	.05 "	200	
9	.02 "	400	
11	.02 "	400	
12	.05 "	200	
13	.05 "	200	
14	.02 "	400	
15	2 mmf		Twisted Pair
16	50 "		Mica
18	50 "		"
19	.02 mfd	400	
20	10 "	25	Electrolytic
21	.01 "	400	
22	.01 "	800	
23	.02 mfd	600	
24	.02 "	400	
25	.01 "	400	
26	100 mmf		Mica
27	.01 mfd	800	
28	30 "	450	Electrolytic
29	10 "	400	"
30	.1 "	200	
31	.05 "	200	
32	10 "	450	Electrolytic
33	100 mmf		Ceramic
34	105 "		"
35	2400 and 450 "		Pad
36	1400 "		"
37	.002 mfd		Mica
39	.0005 "		"
40	.05 "	200	

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MODEL S20-R
Alignment, Antenna Notes
MODEL SX-25
Antenna Notes

ANTENNA

The Sky Champion has an antenna input circuit which will allow the use of either a doublet or Marconi (inverted "L") antenna. The approximate antenna input impedance of the S20R is 400 ohms.

A very serviceable antenna will be the inverted "L", or Marconi type. This antenna should be approximately 75 feet long overall, including the lead-in to the set. Satisfactory operation of the Sky Champion is obtained throughout its tuning range with this type of antenna and because of that fact as well as its ease of construction it is highly recommended.

With the inverted "L" type of antenna A_2 must remain connected to G for best operation. While a ground connection is usually not necessary it might prove to be helpful in reducing noise. A cold water pipe or 6' foot rod driven in moist soil will be a very satisfactory ground when connected to the G terminal on the receiver. Connections to a radiator or gas piping are not recommended.

Should a doublet antenna be used it is suggested that a transmission line of 400 ohms value of impedance be constructed so that a most efficient transfer of energy is obtained. The commercially available all wave doublet antennas are usually provided with a coupling transformer which matches the transmission line to the receiver. This transformer connects to the A_1 and A_2 terminals on the antenna strip. The half-wave length-doublet antenna cut for a particular frequency can be computed by the following formula.

$$\text{Length in feet} = \frac{463}{\text{Frequency in megacycles}}$$

or for example, a half wave 20 meter or 14 megacycle antenna would be

$$\frac{463}{14} \text{ or } 33.7 \text{ feet long overall}$$

This type of antenna is broken in the center with an insulator and has the transmission line connected to each resulting quarter wave section at that point. This antenna is a very good performer, in a direction broadside to its length, only on the relatively narrow group of frequencies for which it was cut. It does not function well on harmonic frequencies.

When using either type of doublet antennas the transmission line should be connected to A_1 and A_2 binding posts. The wire connecting the A_2 to ground or G can be left connected if the performance of the receiver is improved.

ALIGNMENT PROCEDURE

455 KC, Intermediate-Frequency Alignment.
Have the controls set as follows:
AF and RF gain controls for maximum volume.
B.F.O. switch in the "OFF" position.
Set band switch to #2 band.
Set main dial to 2 megacycles, band spread to zero.

Remove 6K8 grid cap and connect the hot side of your 455 KC generator to this tube. Connect the ground terminal of the signal generator to the chassis of the receiver. Now feed a 455 KC signal into the receiver. Adjust all I.F. transformer trimmers on T1, T2, T3, for maximum gain.

R. F. ALIGNMENT

Re-connect the grid cap to the 6K8 tube. Connect the hot side of the generator to the A_1 antenna terminal on the rear of the chassis through a 400 ohm resistor. Be sure a jumper is connected to A_2 and G. Leave signal generator ground connected to the chassis of the receiver.

The location of the following trimmers and padders can be determined by referring to the top and bottom chassis views. All pad adjustments are for the low frequency end of each band while the trimmers are for the high frequency ends.

In order to get at the RF trimmers the guarantee card can be removed by placing a knife under the small snap fasteners holding it in place. So that most satisfactory adjustment of the trimmers and padders can be made, it is advisable to "Rock" the condenser gang across the signal being delivered by the generator until that particular circuit has been accurately peaked at all frequencies except 1400 KC and 4 MC.

Bands	Trim at	Pad at
1	1400 KC Adjust C_A C_B C_C	600 KC Adjust Pad Band 1
2	4 MC Adjust C_D C_E C_F	2 MC Adjust Pad Band 2 (Top Chassis)
3	14 MC Adjust C_G C_H C_I	7 MC Adjust Pad Band 3
4	34 MC Adjust C_J C_K C_L	17 MC No pad on this Band

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MODEL SX-25, Super Defiant
Schematic

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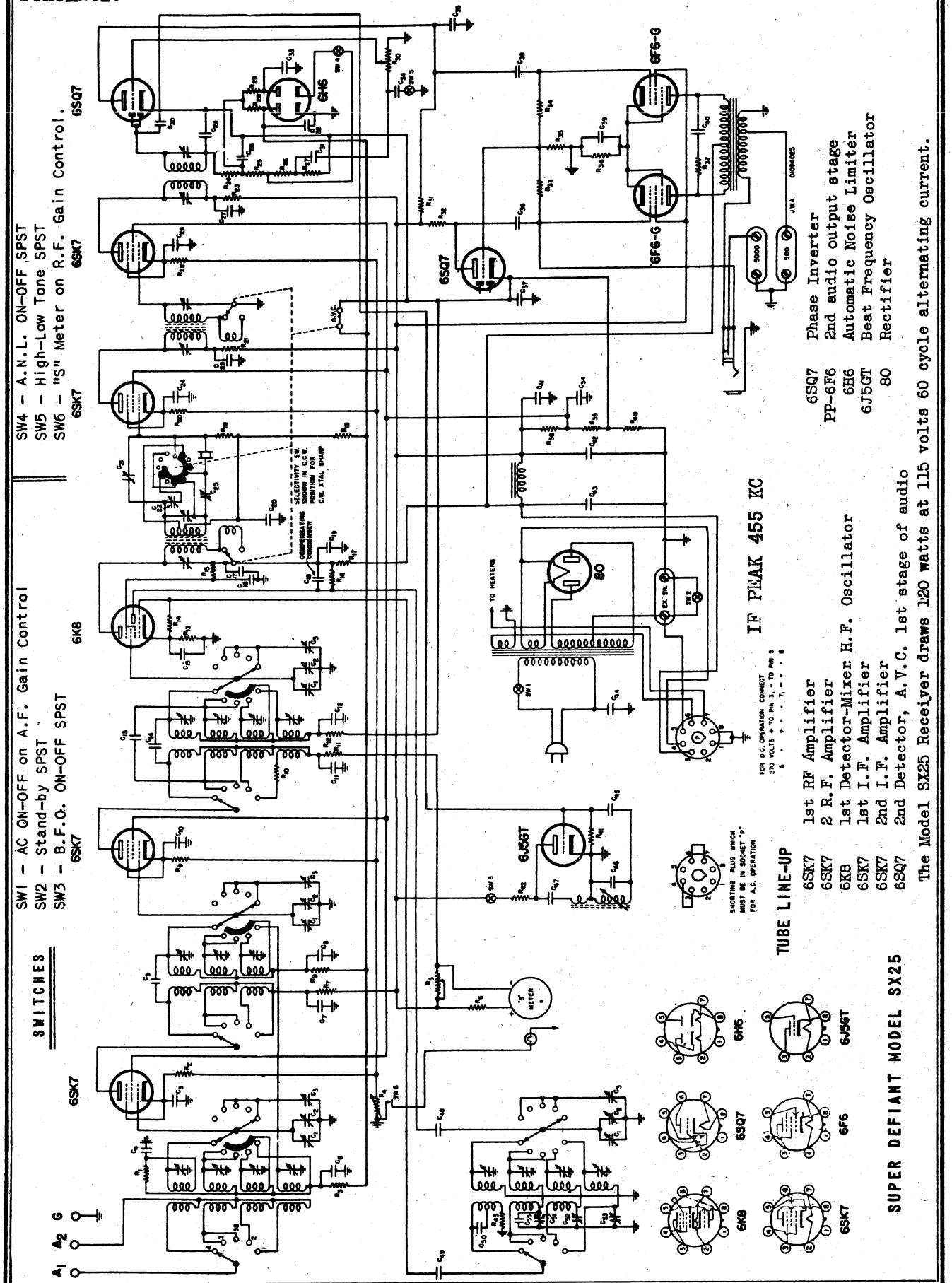

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FREQUENCY METER TUNING

MODEL SX-25, Super Defiant
Alignment, Trimmers, Parts
Frequency Meter Tuning

Around the outer edge of the main tuning dial the amateur bands for which "Frequency Meter Tuning" is available are marked with the red numerals; 10 - 20 - 40 and 80. Set the red line beneath these numerals directly opposite the hair-line on the window and switch to the correct band. The band spread scale will indicate correct frequency within the limits of the accuracy of the setting and calibration.

The band spread dial of the SX25 Model is calibrated so that the operator may determine quite closely the frequency of the signal to which he is listening on the 10 to 80 meter amateur bands inclusive. The outer edge of this dial is marked off in 100 divisions for additional ease in logging and locating stations.

BAND 3B -- Special reference is called to this position of the Band Switch so that no confusion will be experienced. Band 3B is the same as Band 3 and is used in order to have the band spreading of the 40 meter band accomplished through approximately the same number of degrees on the Band Spread Scale as occupied by the other amateur bands for which calibration appears. When the Band Switch is placed in position 3B another section of the band spread condenser is paralleled in the circuit. Band 3 main scale calibration will read somewhat high when the Band Switch is set on 3B.

Note: The accuracy of the main dial calibration will hold only if the BAND SPREAD condenser is set at minimum capacity, or the position indicated by 100 on the Band Spread dial which has been approached by turning the Band Spread Knob in a clockwise direction, or to the right, as far as it will go.

CONDENSERS

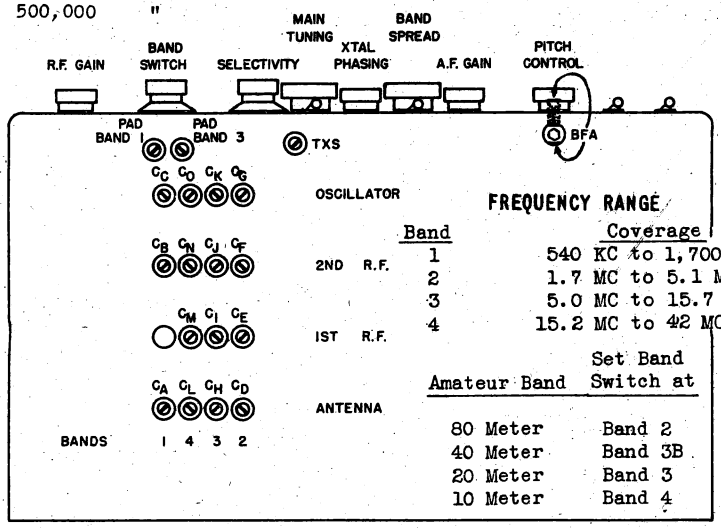
NO.	CAPACITY	VOLTAGE	TYPE
C1	Main Tuning Gang		
2	2 PL.Bd.Spr.Sec.		
3	5 " " " "		
4	.01 mfd	200	Paper
5	.05 mfd	200	
6	.05 mfd	200	Paper
7	.02 mfd	400	Paper
8	.05 mfd	200	Paper
9	35 mmfd		Ceramicon
10	.05 mfd	200	Paper
11	.02 mfd	400	Paper
12	.05 mfd	200	Paper
13	5 mmfd		Ceramicon
14	35 mmfd		Ceramicon
15	.05	200	
16	.05 mfd	400	Paper
17	.02 mfd	400	Paper
18	4.5 mmfd		Compensating
19	10 mfd	350	Electrolytic
20	.05 mfd	200	Paper
21	25 mmfd		Phasing
22	1.5 to 18 mmfd	"TXS"	Trimmer
23	1.5 to 18 mmfd		Trimmer
24	.05 mfd	200	Paper
25	.02 mfd	400	Paper
26	.05 mfd	200	Paper
27	.02 mfd	400	Paper
28	50 mmfd		Mica
29	100 mmfd		Mica
30	3 mmfd		Twisted Pair
31	.02 mfd	400	Paper
32	.02 mfd	400	Paper
33	.05 mfd	200	Paper
34	.002 mfd	1,600	Tubular Oil
35	250 mmfd		Mica
36	.05 mfd	400	Paper
37	10 mfd	25	Electrolytic
38	.05 mfd	400	Paper
39	10 mfd	25	Electrolytic
40	.002 mfd	1,600	Tubular Oil
41	.1 mfd	400	Paper
42	10 mfd	350	Electrolytic
43	30 mfd	350	Electrolytic
44	.01 mfd	600	Paper
45	100 mmfd		Mica
46	500 mmfd		Mica
47	.02 mfd	400	Paper
48	105 mmfd		Ceramicon
49	.002 mfd		Mica
50	105 mmfd		Ceramicon
51	2300 mmfd		Dual Pad
52	1400 mmfd		Single Pad
53	450 mmfd		Dual Pad
54	.1 mfd	200	Paper
55	700 mmfd		Mica

RESISTORS

NO.	OHMS	WATTAGE
R1	100,000	1/3
2	400	"
3	100,000	"
4	10,000	R. F. Gain
5	500	S Meter
6	100	1/3
7	3,000	"
8	100,000	"
9	400	"
10	500	"
11	3,000	"
12	100,000	"
13	400	"
14	50,000	"
15	30,000	1
16	15,000	1
17	4,000	1
18	100,000	1/3
19	500,000	"
20	800	1/3
21	3,000	"
22	1,000	"
23	3,000	1/3
24	50,000	"
25	250,000	"
26	100,000	"
27	250,000	"
28	2,000,000	"
29	1,000,000	"
30	500,000	A.F. Gain
31	250,000	1/3
32	250,000	1/3
33	250,000	"
34	250,000	"
35	200,000	"
36	250	1
37	20,000	1
38	15,000	1
39	15,000	1
40	150	1/3
41	50,000	"
42	20,000	1
43	8	1/3

ANTENNA

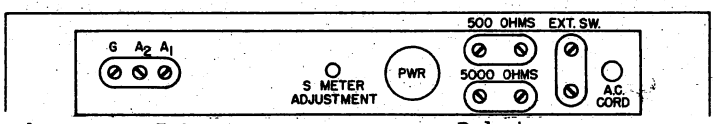
SEE ANTENNA DATA
FOR MODEL S20-R



FREQUENCY RANGE

Band	Coverage
1	540 KC to 1,700 KC
2	1.7 MC to 5.1 MC
3	5.0 MC to 15.7 MC
4	15.2 MC to 42 MC

Amateur Band	Set Band Switch at
80 Meter	Band 2
40 Meter	Band 3B
20 Meter	Band 3
10 Meter	Band 4



Bands	Trim at	Pad at
1	1500 KC Adjust C_A C_B C_C	600 KC Adjust Pad Band 1
2	14 MC Adjust C_H C_I C_J C_K	6 MC Adjust Pad Band 3
3	4 MC Adjust C_D C_E C_F C_G	1.8 MC Adjust Pad Band 2 (Top Chassis)
4	30 MC Adjust C_L C_M C_N C_O	18 MC No pad on this Band

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MODEL SX-25 Super Defiant
Alignment Procedure, Notes

THE HALLICRAFTERS INC.

"S" METER

When the R.F. gain control is advanced until a switch is heard to operate, a light will appear behind the translucent scale of the meter itself. Only when this light is on will the meter indicate in "S" units. When so adjusted the meter can be used as a resonance indicator. With the R.F. gain control backed off from maximum the meter is still in the circuit but will not indicate carrier level accurately. On the rear apron of the chassis is the "S" meter adjustment screw. To set the "S" meter, disconnect the antenna and have the R.F. Gain Control on full and the selectivity switch in the "I.F. SHARP A.V.C. ON" position. Now, adjust this knurled knob until the meter reads zero. Reconnecting the antenna and tuning in a station will show its relative carrier intensity.

The 500 and 5000 ohm terminals are for connections to a loud speaker or other load of those impedance values. The matching SX25 speaker should be connected to the 5000 ohm strip. When headphones are plugged into the phone jack the 5000 ohm speaker connection is automatically disconnected.

The "EXT. SWITCH" terminal strip is for external switch provisions should the receiver be controlled by a remote switch or relay. The SEND-REC switch on the panel must be in the Send Position when an external relay is used for stand-by operation.

Unless otherwise specified the SX25 Receiver operates on 100-125 volt 50-60 cycle current. A universal model is available on special order for operation on 110-250 volt, 25-60 cycle current.

ALIGNMENT PROCEDURE

455 KC, Intermediate-Frequency Alignment.
Have the controls set as follows:
AF and RF gain controls for maximum volume.
B.F.O. switch in the "ON" position.
Set band switch to #2 band.
Set main dial to 2 megacycles, band spread to 100.
Selectivity switch in "AVC OFF" xtal phone position.

Remove the 6K8 tube grid cap. Connect a 1 megohm resistor between grid cap and grid of 6K8 tube. Now connect the hot side of the signal generator to the grid of the 6K8 tube through a .1 MFD condenser. Connect the ground terminal of the signal generator to the chassis of the receiver. Remove modulation from generator and feed a 455 KC signal into the receiver and set the pitch control to give a beat note of approximately 1000 cycles. Adjust all I.F. transformer trimmers for maximum gain with the exception of the secondary trimmer on transformer T1. Identified on top chassis view as T1S. In adjusting this trimmer it will be noted that the output reaches a maximum goes through a dip and then back to maximum again. Wobbulate the IF frequency and align to the dip between the two maximum points. A distinct change in the crystal note sounding like an apparent broadening of the crystal action will be noted when the correct adjustment has been reached. At this point in the alignment it is necessary to make an adjustment on the phasing control as follows: Tune the signal generator so that its signal will go through zero beat and then to the other side of zero beat until a signal of approximately 5000 cycles is heard in the speaker or headphones. Now carefully adjust the "PHASING CONTROL" until this signal is reduced in volume to a minimum. Reset the signal generator to its original frequency and recheck the adjustment of T1S. Now repeak carefully the other trimmers on I.F. transformers for maximum gain. Place the selectivity switch in the "CW. XTAL" position leaving all controls on the receiver as previously adjusted. Again wobbulate the frequency of the signal generator carefully through the very narrow range of the crystal peak. Adjust small trimmer through hole in the bottom plate marked "TXS" until the sharp crystal peak reaches maximum output. At this point the crystal is extremely sharp and maximum output is possible. If this setting gives too sharp crystal filter action this "TXS" trimmer can be adjusted counter-clockwise for broader crystal response to suit the operator.

B.F.O. ADJUSTMENT

In the center of the "PITCH CONTROL" shaft, after the knob has been removed, you will find a recessed screw for adjustment of the Beat Frequency Oscillator.

Before rotating this screw with a suitable screw-driver loosen the set screw on this shaft. This set screw can be reached through a hole in the bottom plate directly under the B.F.O. Assembly marked "BFA".

Now tune in a signal on the receiver with the BFO off. Exact resonance can be determined with the controls so adjusted that the "S" meter will indicate. After you have assured yourself that you have the signal properly tuned in place the selectivity switch in anyone of the three "AVC OFF" positions. Turn the BFO switch to the "ON" position. You now can adjust the screw in the center of the pitch control shaft until a beat note is heard. Tighten the set screw through the bottom plate, replace the knob and the BFO adjustment is completed.

R. F. ALIGNMENT

Re-connect the grid cap to the 6K8 tube. Connect the hot side of the generator to the A_1 antenna terminal on the rear of the chassis. Be sure a jumper is connected to A_2 and G. Leave signal generator ground connected to the chassis of the receiver.

The location of the following trimmers and padders can be determined by referring to the top and bottom chassis views. All pad adjustments are for the low frequency end of each band while the trimmers are for the high frequency ends.

In order to get at the RF trimmers the guarantee card can be removed by placing a knife under the small snap fasteners holding it in place. So that most satisfactory adjustment of the trimmers and padders can be made, it is advisable to "Rock" the condenser gang across the signal being delivered by the generator until that particular circuit has been accurately peaked.

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