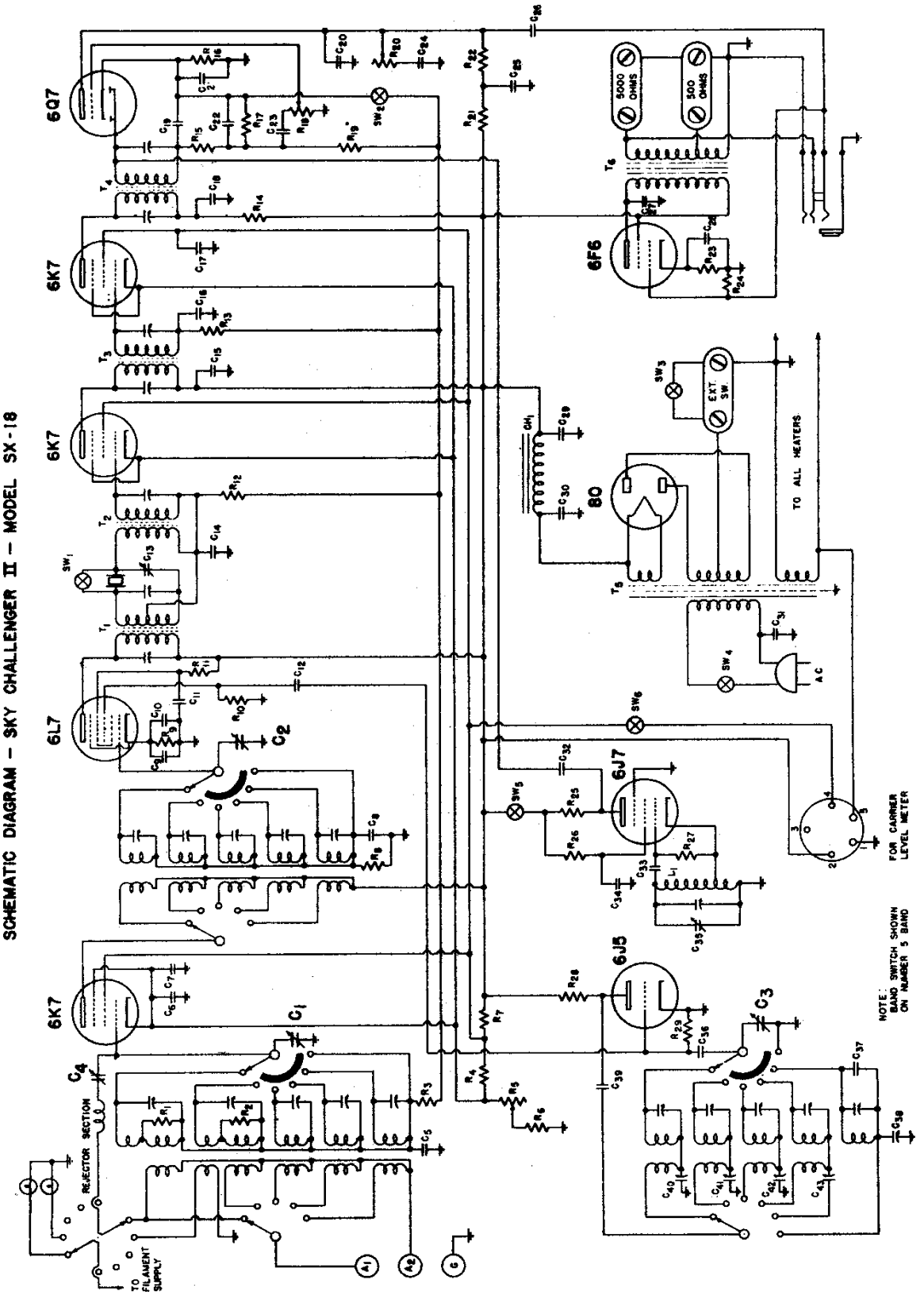
Hallicrafters, Inc.

Model: S-18	Chassis:	Year: Pre March 1942
Power:	Circuit:	IF:
Tubes:		
Bands:		

Resources
Riders Volume 13 - HALLICRAFTERS 13-1
Riders Volume 13 - HALLICRAFTERS 13-2
Riders Volume 13 - HALLICRAFTERS 13-3
Riders Volume 13 - HALLICRAFTERS 13-4
Riders Volume 13 - HALLICRAFTERS 13-5
Riders Volume 13 - HALLICRAFTERS 13-6

THE HALLICRAFTERS INC.

MODELS S-18, SX-18
Sky Challenger II



SCHEMATIC DIAGRAM - SKY CHALLENGER II - MODEL SX-18

MODELS S-18, SX-18
Sky Challenger II

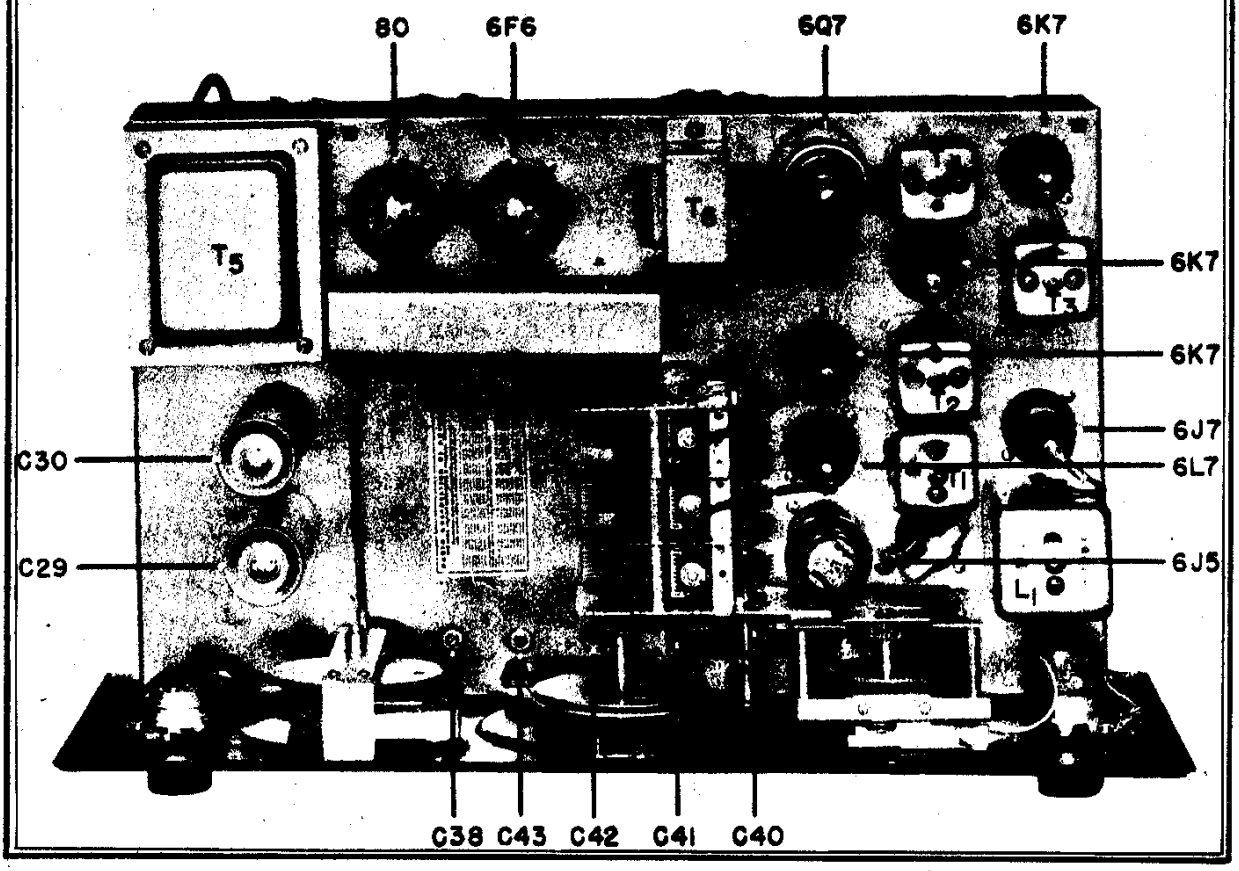
THE HALLICRAFTERS INC.

CONDENSERS

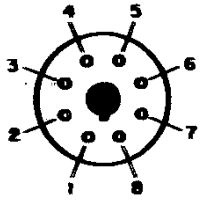
C1	250	MMFD			
C2	250	"			
C3	250	"			
C4	15	"	AIR VARIABLE		
C5	.002	MFD			
C6	.002	MFD	400 VOLT MICA		
C7	.25	"	200 "		
C8	.002	"	"		
C9-	.05	"	" "		
C10	.002	"	"		
C11	.05	"	400 "		
C12	50	MMFD	"		
C13	25	"	AIR VARIABLE		
C14	.02	MFD	200 VOLT		
C15	.25	"	400 "		
C16	.02	"	200 "		
C17	.1	"	400 "		
C18	.05	"	" "		
C19	250	MMFD			
C20	500	"			
C21	10	MFD	25 "	ELECTROLYTIC	
C22	250	MMFD			
C23	.05	MFD	200 "		
C24	.005	"	400 "		
C25	.1	"	" "		
C26	.05	"	" "		
C27	.003	"			
C28	10	"	25 "	"	
C29	16	"	400 "	"	WET
C30	16	"	" "	"	"
C31	.01	"	"		
C32	10	MMFD			
C33	250	"			
C34	.02	MFD	" "		
C35	25	MMFD	AIR VARIABLE		
C36	25	"			
C37	10	"			
C38	200	"	VARIABLE PAD		
C39	25	"	MICA		
C40	.0012	MFD	VARIABLE PAD		
C41	.0011	"	" "		
C42	.00093	"	" "		
C43	.00039	"	" "		

RESISTORS

No.	OHMS	
R1	250	
R2	125	
R3	100,000	
R4	30,000	
R5	10,000	R. F. GAIN CONTROL
R6	250	
R7	15,000	
R8	100,000	
R9	600	
R10	100,000	
R11	30,000	
R12	100,000	
R13	100,000	
R14	1,000	
R15	20,000	
R16	4,000	
R17	500,000	
R18	500,000	VOLUME CONTROL
R19	1,000,000	
R20	500,000	TONE CONTROL
R21	100,000	
R22	250,000	
R23	500	
R24	250,000	
R25	100,000	
R26	100,000	
R27	50,000	
R28	10,000	
R29	50,000	



The following measurements made with 1000 ohms per volt meter and taken from the point indicated to ground with the AVC switch in the "ON" position. Antenna and ground disconnected and R. F. and A. F. gain controls set at maximum. Line voltage of 115 at the time these measurements were taken. Normal tolerance allows variations of plus or minus 10% from the values indicated. "DL" indicates a Dead Lug but will indicate voltage when used as a tie.



Bottom view of socket

Tube	Function	1	2	3	4	5	6	7	8
6K7	R. F. Amp.			260	125	-5	DL	6.3	5
6L7	Mixer			260	105	-6	DL	6.3	4.5
6J5G	Osc.			168	DL	-19	DL	6.3	0
6K7	IF Amp (1)			265	125	5	DL	6.3	5
6K7	IF Amp (2)			250	125	5	250DL	6.3	5
6Q7G	2nd Det. A.V.C. 1st Audio			75	1	1		6.3	2
6F6G	2nd Audio			245	260	0	16DL	6.3	16
6J7	Beat Osc.			105	105	0	Osc.	6.3	0

INTERMEDIATE FREQUENCY ALIGNMENT (465 KC)

Have the controls set in the following positions:

B.F.O. switch "OFF"
A. F. and R. F. gain controls on full.
Crystal phasing condenser midway (pointer straight up).
A.V.C. switch "OFF".
Crystal switch "IN".
Band switch on #1 Band – tuning gang open (minimum capacity).
Remove 6J5G oscillator tube from its socket.
Remove the 6L7 grid cap.

Connect the signal generator to grid of the 6L7 tube through a .1 mfd condenser. Tune the signal generator to 465 KC and then adjust the condensers on the intermediate frequency transformers T1, T2, T3, T4, respectively. Now throw the crystal switch to the "OUT" position and readjust T1 for maximum output. As an output indicator it is suggested that a rectifier type meter be used.

Alignment using a 465 KC crystal

Should the receiver be a crystal model it is necessary that the crystal be used in an external oscillator in place of a signal generator such as the above. The output of this crystal controlled oscillator is then fed to the grid of the 6L7 tube and the above procedure followed. When the IF amplifier has been aligned from the crystal oscillator's output, re-inserting the crystal in its socket in the receiver will show little difference in output whether the crystal is "IN" or "OUT" of the circuit as indicated by the crystal switch.

R. F. Alignment Procedure

On Band #1, or Broadcast, use a .0002 mfd condenser in series with the output lead from the generator to A1 on the receiver. On the other bands a 400 ohm resistor should be used. Be sure the jumper from the doublet, or A2 post, to Ground remains connected when aligning the receiver.
All PAD adjustments (located on the top of the chassis) are for the low frequency ends of the bands.
All TRIMMER adjustments (located on the bottom of the chassis) are for the high frequency ends of the bands.
Reduce R.F. gain control below the point of blocking or overloading; also be sure that the Crystal Switch is in the "OUT" position and the AVC switch is in the "OFF" position.
<u>BE SURE TO CHECK IMAGES</u> – Images will fall a little less than 1 MC lower in frequency on bands 1 to 4 inclusive. On band 5 the image will fall about 1 MC higher in frequency than the fundamental.
<u>REJECTOR ADJUSTMENT</u> – On bands 1, 2 and 3 the Rejector circuit should be left at 34 MC. On bands 4 and 5 the rejector is in the circuit. Care should be exercised to see that the rejector circuit is not adjusted so that it will reject the signal frequency. If this occurs very low sensitivity will result which can be cured by detuning the rejector about 1 MC.
When aligning the R.F. end of the receiver the tuning gang should be rocked back and forth across the signal so that you are sure your adjustments are such that you have obtained maximum gain and accurate tracking.

Note #1 Harmonics of suitable frequencies may be used if the following frequencies suggested are not available.

Note #2 It is necessary to repeat each pair of operations several times until no change is noted.

MODELS S-18, SX-18
Sky Challenger II

THE HALLICRAFTERS INC.

OPR.	BAND	RECEIVER DIAL SETTING	SIGNAL GENERATOR FREQUENCY	ADJUST OSC. WITH	TRIMMERS R. F. & MIXER WITH	ADJUST OSC. PAD WITH	SET REJECTOR DIAL AT
1	1	600KC	600KC	------	--------	C38	-------
2	1	1100KC	1100KC	CA	CC - CB	------	-------
3	2	1300KC	1300KC	------	--------	C43	-------
4	2	2600KC	2600KC	CD	CF - CE	------	-------
5	3	3000KC	3000KC	------	--------	C42	-------
6	3	6000KC	6000KC	CG	CI - CH	------	-------
7	4	7000KC	7000KC	------	--------	C41	9 MC
8	4	14000KC	14000KC	CJ	CL - CK	------	14MC
9	5	17000KC	17000KC	------	--------	C40	24MC
10	5	34000KC	34000KC	CM	CO - CN	------	34MC

IT IS HELPFUL TO REMEMBER THAT THE CARTRIDGE TYPE AIR TRIMMING CONDENSERS WILL SHOW AN INCREASE OF CAPACITY WHEN THE SCREW IS ROTATED COUNTER-CLOCKWISE.

WHEN MAKING ADJUSTMENTS ON THIS RECEIVER IT IS SUGGESTED THAT GAIN BE CONTROLLED BY USING THE R.F. GAIN CONTROL ONLY. LEAVE THE A.F. GAIN CONTROL ON FULL AT ALL TIMES.

TO MAKE A RAPID CHECK OF THE RECEIVER REMOVE THE GRID CAP OF THE 6Q7 TUBE AND TOUCH THE GRID OF THE TUBE WITH YOUR FINGER. IF A LOUD HUM IS HEARD THE AUDIO END OF THE RECEIVER IS OK.

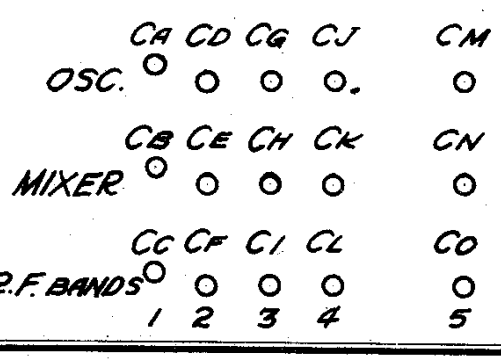
DEAD SET. CHECK BIAS ON THE R. F. TUBES. IF THIS BIAS IS TOO HIGH CHECK THE R.F. GAIN CONTROL FOR AN OPEN CIRCUIT. ADDITIONALLY, CHECK THE PLATE AND SCREEN VOLTAGE OF THE R.F. TUBES - (SEE CHART). CHECK B PLUS FOR A SHORT TO GROUND - IF SO CHECK ALL TUBES.

IF THE TUNING GANG IS NOISY WHEN THE SET IS JARRED, INCREASE THE TENSION ON THE GANG WIPERS.

NOISY COIL ASSEMBLY - CHECK SWITCH CONTACTS. ALSO CHECK THE TRIMMERS ON THE PARTICULAR BAND IN WHICH NOISE OCCURS. IT IS POSSIBLE THAT THE TRIMMER HAS DEVELOPED A PARTIAL SHORT.

IF LOW SIGNAL AND HIGH NOISE LEVEL DEVELOPS, REPLACE THE 6L7 TUBE.

DEAD BEAT OSCILLATOR - IF THE 6J7 SHOULD SHORT TO GROUND THE BEAT OSCILLATOR WILL BE DEFECTIVE. CHECK B PLUS TO BO COIL FOR A GROUND. IN MOST CASES A NEW 6J7 WILL CORRECT A DEAD BO.



BOTTOM VIEW SHOWING ADJUSTMENT SCREWS

SPEAKER - HEADPHONES ETC.

On the lower right hand corner of the back of the chassis you will find a terminal strip marked 5000 ohms. To this strip should be connected the HALLICRAFTERS permanent magnet dynamic speaker. The terminal strip directly above the 5000 ohm strip and marked 500 ohms can be connected to a load of that impedance value. The other terminal strip to the right of these two, and marked "EXT SW", is used to make the receiver temporarily inoperative for stand-by during transmission periods. These two terminals should be connected to anexternal switch wither in conjunction with the power switch on your transmitter or a manually operated switch at your operating position. When using an external switch the SEND RECEIVE switch on the receiver should be in the SEND position.

In this receiver the speaker is not a portion of the filter system. This allows the receiver to be operated independently of the speaker. For most satisfactory results an 8 inch HALLICRAFTERS speaker should be used with the SKY CHALLENGER II .

The headphone jack is connected to the plate of the 6Q7 tube through a condenser. The possibility of shock to the operator is eliminated by having no direct current flowing through the headphones. Crystal type headphones can be used with this receiver without using a special coupling transformer.

CRYSTAL OPERATION

To properly adjust the crystal circuit for best performance the following procedure should be carefully followed:

Tune in some station transmitting continuously. Be very careful to get the signal right on the nose. After you are sure that you have the signal resonated perfectly, snap the "BFO" switch to the "ON" position. You should hear a whistle, or beat note. After the BFO is on rotation of the "PITCH CONTROL" will change the tone of the beat note. Proper operation of this control will be indicated by hearing the signal twice in one complete rotation of the knob; there being two positions at which no signal, or whistle, will be heard. These two positions are known as the "zero beat" positions.

Now snap the "CRYSTAL SWITCH" to the "ON" position. You will notice a great reduction in noise. Carefully retune the signal on the BAND SPREAD dial. Notice how sharply the signal peaks. Now tune through the signal and find which side of the signal is the weaker. Tune in the weaker side and then carefully adjust the "CRYSTAL PHASING" control until the signal is inaudible. Going back to the other side of the signal should find no change in its volume, and knife-like selectivity resulting. Use whichever side of zero-beat adjustment of the PITCH CONTROL, in conjunction with the PHASING CONTROL gives the greater rejection of the interfering signal.

The phasing control affects the sensitivity and selectivity of the receiver whether the crystal is in the circuit or not. The crystal may be used when receiving telephone signals with some sacrifice in their quality due to the extreme selectivity developed.

THE IMAGE REJECTOR

The REJECTOR circuit incorporated in the SKY CHALLENGER II represents a noteworthy contribution by the HALLICRAFTERS to image-free high-frequency reception. It has long been appreciated that additional stages of radio frequency amplification was not the correct answer to image suppression. Through the use of the "INFINITE IMAGE REJECTOR" in the SKY CHALLENGER II all previous image ratios are out-moded. Image rejection of infinity/1 is now possible.

The REJECTOR is unique. Because of that your attention is closely drawn to the proper operation of the control as well as what to expect from its use.

The REJECTOR is switched into the circuit only when the receiver is operated on bands #4 and #5. You will notice a light appear behind the particular calibrated scale that should be used.

Let us operate the receiver on the 14 mc, or 20 meter amateur band. In tuning across the band you run across the image of some commercial station, The fundamental of this station as we all know is removed from the 20 meter band by double the frequency to which the I. F. amplifier of the receiver is tuned. Now adjust the rejector control carefully in the vicinity of 14 mc on the calibrated rejector dial. When properly adjusted the image will be completely eliminated without seriously affecting the sensitivity of the receiver on the frequency to which it had been tuned.

Should you be listening at a frequency not being bothered with images, and you do not wish to use the REJECTOR leave the control as follows for the two amateur bands covered by the rejector circuit.

20 meters - Leave the rejector at approximately 15 mc. (On this band the
14 mc high frequency oscillator is on the high-frequency side).
NOTE: The 7 mc or 40 meter band is also on band #4 of the receiver. When receiving on 40 meters the REJECTOR control should be left 9 mc. Use of the rejector circuit on this band is not necessary.

10 meters - Leave the rejector at approximately 27 mc. (The oscillator
28 mc is on the low frequency side on this band).

CAUTION: Should you not be able to get signals through at all check thesetting of the REJECTOR control. It is possible that you have the REJECTOR control at a point where the frequency to which you wish to listen is being rejected, or "being dropped in the slot".

ALWAYS REMEMBER TO KEEP the REJECTOR CONTROL SET AT APPROXIMATELY THE SAME FREQUENCY AS THAT TO WHICH YOU ARE LISTENING. WHEN YOU MOVE THE MAIN TUNING CONTROL FOLLOW UP WITH THE REJECTOR OR OTHERWISE YOU WILL RUN INTO THE POSSIBILITY OF LEAVING YOUR MAIN TUNING DIAL AT A GROUP OF FREQUENCIES BEING REJECTED.

The total power consumption of the SKY CHALLENGER II is 75 watts at 115 volts 60 cycle alternating current.

OPERATING INSTRUCTIONS – SKY CHALLENGER II MODELS S-18, SX-18

THE SKY CHALLENGER II IS A 5 BAND 9 TUBE SUPERHETERODYNE RECEIVER COVERING THE FOLLOWING FREQUENCIES:

Bands	Coverage							
1	545	to	1230	kc	(550	to	243	meters)
2	1.18	to	2.85	mc	(254	to	105	meters)
3	2.75	to	6.82	mc	(109	to	44	meters)
4	6.75	to	16.40	mc	(45	to	18.3	meters)
5	15.40	to	38.10	mc	(19.5	to	7.85	meters)

SEPARATE COILS ARE USED TO COVER EACH BAND. INDUCTIVE COUPLING TO THE ANTENNA PERMITS THE MAXIMUM TRANSFER OF SIGNAL ENERGY FROM EACH SEPARATE PRIMARY TO THE PARTICULAR SECONDARY COIL IN THE CIRCUIT. THE UNUSED COILS ARE SHORTED.

THE MAIN DIAL IS CALIBRATED IN KILOCYCLES ON BAND #1 AND IN MEGACYCLES ON THE REMAINING FOUR BANDS. THE CALIBRATION OF THE MAIN DIAL WILL HOLD ACCURACY ONLY WHEN THE BAND-SPREAD DIAL IS SET AT "0", WHICH IS THE POSITION OF MINIMUM CAPACITY OF THE BAND-SPREAD SECTION.

ANTENNA

IN THE BACK OF THE CHASSIS WILL BE FOUND THE ANTENNA, DOUBLET AND GROUND TERMINAL STRIP. WHEN A CONVENTIONAL ANTENNA IS USED IT SHOULD BE CONNECTED TO A1. WHEN USING THIS TYPE OF ANTENNA BE SURE THE JUMPER REMAINS CONNECTED TO A2 AND G. IF A DOUBLET ANTENNA IS USED THE JUMPER SHOULD BE REMOVED AND THE TWO WIRES OF THE DOUBLET LEAD-IN CONNECTED TO A1 AND A2 RESPECTIVELY. PLEASE REMEMBER THAT THE NORMAL SHORT WAVE DOUBLET ANTENNA IS DESIGNED TO WORK BEST ON THE SHORT WAVE BROADCAST FREQUENCIES. IT WILL NOT PERFORM EQUALLY WELL ON THE AMATEUR BANDS, OR FREQUENCIES IN BETWEEN THE SHORT WAVE BROADCAST CHANNELS. ANTENNA LOCATION, LENGTH AND TYPE PLAY A MOST IMPORTANT PART IN THE SUCCESSFUL OPERATION OF THE RECEIVER. ON THE HIGHER FREQUENCIES COVERED BY THIS UNIT IT IS PARTICULARLY IMPORTANT TO USE THE PROPER TYPE OF ANTENNA. FOR MOST EFFICIENT ANTENNA SYSTEMS YOU ARE REFERRED TO THE ANTENNA DESIGN SECTION OF THE A.R.R.L. HANDBOOK, AS WELL AS CURRENT RADIO PERIODICALS. IT IS SUGGESTED THAT A LITTLE EXPERIMENTING BE DONE WITH ANTENNAE SO THAT YOU WILL EXPERIENCE THE MAXIMUM IN PERFORMANCE FROM YOUR RECEIVER.

OPERATION

PLUG THE CORD ON THE RECEIVER INTO THE POWER SOCKET. (UNLESS OTHERWISE SPECIFIED THE RECEIVER OPERATES ON 60 CYCLE 110-120 VOLT ALTERNATING CURRENT.) TURN THE CONTROL MARKED "TONE" TO THE RIGHT. THIS WILL TURN THE RECEIVER ON. DURING THE TIME THE RECEIVER IS WARMING UP ALSO TURN THE "R.F. GAIN" AND "A.F.GAIN" KNOBS TO THE RIGHT. THE RECEIVER IS SHIPPED WITH THE BAND CHANGE SWITCH IN THE HIGHEST FREQUENCY POSITION. ADJUST THE "BANDS" SWITCH UNTIL THE POINTER ON THE KNOB INDICATES THAT YOU HAVE THE BAND YOU WISH TO TUNE IN THE CIRCUIT. WHEN LISTENING FOR DISTANT OR POSSIBLY WEAK STATIONS, IT IS RECOMMENDED THAT THE CONTROL MARKED "BFO" BE USED BY SNAPPING THE SWITCH TO THE "ON" POSITION. ONCE THE TELEPHONE SIGNALS HAVE BEEN LOCATED THE BFO SHOULD BE TURNED OFF OR A CONTINUOUS WHISTLE WILL RESULT. WHEN LISTENING FOR CW OR TO CW CODE TRANSMISSIONS THE BFO MUST BE LEFT ON. THE "PITCH CONTROL" WILL PROVE MOST HELPFUL IN CHOOSING THE BEAT NOTE TO ONE MOST PLEASING TO THE OPERATOR. IT IS ADVISABLE TO HAVE THE "AVC" SWITCH IN THE OFF POSITION WHENEVER THE BFO SWITCH IS ON.

THE TUBE LINE-UP

6K7 PRE-SELECTOR, R.F. AMPLIFIER

6L7 1ST DETECTOR-MIXER

6J5 SIGNAL FREQUENCY OSCILLATOR

6K7 1ST I. F. AMPLIFIER

6K7 2ND I. F. AMPLIFIER

6Q7 2ND DETECTOR, AVC, 1ST STAGE OF AUDIO

6F6 2ND AUDIO STAGE

6J7 BEAT FREQUENCY OSCILLATOR

80 FULL WAVE RECTIFIER

THE 6K7 R. F. STAGE GIVES MAXIMUM GAIN IN INVERSE RELATION TO FREQUENCY AND PROVIDES INCREASED SELECTIVITY.

THE FIRST DETECTOR-MIXER IS A 6L7. THE OUTPUT OF THE 6J5 SIGNAL FREQUENCY OSCILLATOR IS ELECTRON COUPLED TO THE INJECTOR, OR # 3 GRID, OF THE 6L7. BECAUSE NO OSCILLATOR PLATE CURRENT FLOWS IN THE 1ST DETECTOR THE RATIO OF SIGNAL TO NOISE IS MORE FAVORABLE THAN THAT OBTAINED IN A COMPOSITE TUBE, OR IN CIRCUITS WHERE THE CATHODES OF TWO TUBES ARE TIED TOGETHER.

THE 6J5 OSCILLATOR HAS SEPARATE COILS FOR EACH BAND. SUPERIOR OVERALL PERFORMANCE OF THE SKY CHALLENGER II IS IN PART DUE TO THE DESIGN OF THE SIGNAL FREQUENCY OSCILLATOR. NO HARMONICS OF THE OSCILLATOR ARE USED ON ANY OF THE BANDS COVERED BY THIS RECEIVER.

THE TWO 6K7 I. F. AMPLIFIER STAGES USE IRON-CORE TRANSFORMERS WHICH RESONATE AT 465 KC. THIS TYPE OF TRANSFORMER HAS SO DEFINITELY SHOWN ITS SUPERIORITY OVER THE AIR CORE TYPE AS TO WARRANT ITS USE IN THE SKY CHALLENGER II . TREMENDOUS GAIN, AND A BETTER SIGNAL TO NOISE RATIO ARE BUT TWO OF THE MANY ADVANTAGES OF THE IRON-CORE SYSTEM.

THE 6J7 BEAT OSCILLATOR OUTPUT IS COUPLED TO THE DIODE PLATES OF THE 6Q7 SECOND DETECTOR. THE 6J7 OSCILLATOR IS ELECTRON COUPLED.

THE 6F6 AUDIO OUTPUT STAGE IS CAPABLE OF DELIVERING 3.5 WATTS OF AUDIO.