

SKY CHALLENGEROPERATING INSTRUCTIONS

The new 1937 SKY CHALLENGER is a 5 band, 9 tube superheterodyne receiver covering the following frequency ranges.

- No. 1 Band -- 545 KC to 1230 KC (550 to 243 meters.)
 - No. 2 Band -- 1.18 MC to 2.85 MC (254 to 105 meters.)
 - No. 3 Band -- 2.75 MC to 6.82 MC (109 to 44 meters.)
 - No. 4 Band -- 6.75 MC to 16.40 MC (45 to 18.3 meters.)
 - No. 5 Band -- 15.40 MC to 38.10 MC (19.5 to 7.85 meters.)
- No. 1 Band covers the American Broadcast range up to 1,230 KC. (243 meters.)
- No. 2 Band covers from 1.18 megacycles (254 meters) to 2.85 megacycles (105 meters.) With the receiver operating in this position the remainder of the broadcast band can be covered. From 1.50 megacycles up in frequency you will receive high-fidelity experimental broadcast, aircraft, amateur and police stations.
- No. 3 Band covers from 2.75 megacycles (109 meters) to 6.82 megacycles (44 meters). Operation in this position will allow you to receive the 3.5 megacycle (80 meter) amateur band, standard frequency transmissions, aircraft, police and the 6. megacycle (49 meter) short wave broadcast band.
- No. 4 Band covers from 6.75 megacycles (45 meters) to 16.40 megacycles (18.3 meters.) With the receiver operating in this position you will receive 7000 KC amateur code stations; 9.5 megacycles (31 meter) broadcast; 12.00 megacycles (25 meters) broadcast; 14.00 megacycle (20 meters) amateur code and phone stations; 15.80 megacycles (19 meters) broadcast. On this band will be found the greatest number of broadcast transmissions, both foreign and local.
- No. 5 Band covers from 15.40 megacycles (19.5 meters) to 38.10 megacycles (7.85 meters.)

Operation with the receiver in this position will allow reception of 15.80 megacycle (19 meters) broadcast. It is suggested that band No. 4 be used for reception of this band. You will find that reception on this band is most seriously affected by changeable radio conditions on these frequencies. The 38.00 megacycle (10 meters) amateur band will allow reception of signals only over relatively great distances (seldom less than 1500 miles) when this band is "open." It will be easier to receive signals on this band during the daylight hours.

TO OPERATE

On the lower right hand corner on the back of the chassis you will find a terminal strip marked 5000 ohms. To this strip connect the permanent magnet speaker. The terminal strip marked 500 ohms directly above the 5000 ohm strip can be connected to a load of that impedance. The other terminal strip to the right of these two and marked EXT. SW. is used to turn the set on and off for a stand-by. This strip when connected to a relay or a separate set of contacts on an external switch will turn the set on and off temporarily when the send - receive switch on the front panel is in the "send" position.

In the back to the left of the chassis will be found the antenna and ground binding post strip. If a doublet antenna is used, remove the jumper from the post marked A2 to the post marked G and connect the two wires from the doublet to the posts marked A1 and A2. Please remember that the regular short wave doublet antenna is designed to work best on the short-wave broadcast frequencies. This means that it will not perform equally well on the amateur bands or frequencies in between the short-wave broadcast channels. When using the conventional flat-top and lead-in type of antenna, connect the lead-in to the post marked A1, being sure that the wire jumper is connected to the post marked A2 and G. Antenna location, length and type play a most important part in the successful operation of the set, especially on the two high frequency ranges. It is suggested that a little experimenting be done with the antenna so that maximum performance will be secured.

Plug the cord on the receiver into the power socket. (Unless otherwise specified the receiver operated on 60 cycle, 110 volt alternating current.) Turn the control marked "Tone" to the right. This will connect the receiver to the A.C. line. During the time the receiver is warming up also turn the "R.F. Gain" and the "A.F. Gain" knobs to the right. The receiver is shipped with the band-change switch in the highest frequency range. Adjust the "Bands" switch until the pointer on the band change switch indicates the band you wish to tune. We suggest that you familiarize yourself with operation of the receiver on Bands No. 1 and No. 2 before trying the higher frequencies. Turn the larger knob marked "BAND SET" until the desired frequency is reached. When listening for distant or possibly weak stations, it is recommended that the "BFO" be used by snapping the toggle switch to "on" position. Once these signals are located, it should be turned off or a continuous whistle will result. When listening to C.W. transmissions the B.F.O. must be left turned on. The "PITCH CONTROL" knob directly above this switch will prove most helpful in changing the beat note to one most pleasing to the operator.

When receiving voice, whether broadcast or short wave, it is recommended that the "A.V.C." switch be left in the "ON" position. The "R.F. GAIN" control with the "A.V.C." switch in the "ON" position should be turned as far as it will go to the right. It will be noticed that with the "A.V.C." switch "OFF" and the "R.F. GAIN" wide open the set will block on strong signals. If maximum sensitivity is desired the "A.V.C." switch can be left in the "OFF" position. The sensitivity may be manually controlled with the "R.F. GAIN" control. It will be found that by optional adjustment of both "R.F." and "A.F." gain controls the most favorable ratio of signal to noise will be secured.

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CRYSTAL OPERATION

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

Be sure that the "BFO" switch is in the "OFF" position.

Tune to some station transmitting continuously, being very careful to get the signal on the nose. After you are sure you have the signal resonated perfectly, snap "ON" the "BFO."

Check your tuning and be sure you still have the signal perfectly tuned-in.

Now change the "PITCH CONTROL" being sure that it is operating properly. Proper operation of this control will be indicated by hearing the signal twice in one complete rotation of the knob, there being two positions in which no signal will be heard. These are known as the zero beat positions.

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, with normal volume a gain obtained. 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 "PHASING" condenser control until the weaker signal is inaudible. Retuning to the other side of the signal should find no change in its volume and knife-like selectivity resulting. Whichever side of the zero-beat adjustment of the "PITCH CONTROL" gives the greater rejection of the image, that is the adjustment to be used for maximum selectivity. The phasing condenser affects the selectivity of the receiver whether the crystal is in the circuit or not. The crystal may be used in the reception of phone signals with some sacrifice in their quality.

Again you are reminded to tune this receiver with care. Because of its extreme selectivity, you may expect the most satisfactory results only after familiarizing yourself with its operation.

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The tube line-up in the new 1937 SKY CHALLENGER is as follows:

6K7 Pre-selector, R.F. Amplifier
6L7 1st Detector-mixer
6C5 Signal Frequency Oscillator
6K7 1st I.F. Amplifier
6K7 2nd I.F. Amplifier
6Q7G 2nd Detector; A.V.C.; 1st stage of Audio
6F6G 2nd Audio stage
6K7 Beat Oscillator
80 full-wave Rectifier

Separate coils are used to cover each band. Inductive coupling of the signal picked up by the antenna permits the maximum transfer of energy from each separate primary to the particular secondary range in the circuit. The unused coils are shorted.

The 6K7 r.f. stage gives maximum gain in relation to frequency and provides pre-selection which gives an image ratio of 80 to 1 on the highest frequency range.

The first detector-mixer is a 6L7. The output from the 6C5 signal frequency oscillator is electron coupled to the injector, or No. 3 grid, of the 6L7. Because no oscillator plate current flows in the 1st detector, the ratio of translation 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 6C5 oscillator has separate coils for each band. The superior overall performance is the result of not using any harmonics of the signal frequency oscillator throughout the tuning range of the receiver.

All intermediate frequency transformers are of the iron-core type and resonate at 465 KC. This type of transformer has so definitely demonstrated its superiority over the air core type as to warrant its use in the new 1937 SKY CHALLENGER. Tremendous gain, better signal to noise ratio, extreme selectivity are but a few of the advantages of the iron core system.

The crystal input transformer is made up of three coils so placed that a signal of maximum strength is impressed on the low impedance primary of the crystal output transformer. The crystal

filter with its phasing condenser is inserted between these transformers. With proper adjustment of the phasing condenser single signal operation can be secured. When the crystal is shorted, or the crystal switch is in the "OUT" position, the signal is impressed directly on the crystal output transformer which feeds the grid of the 6K7 first I.F. stage.

The second and third I.F. transformers are identical and provide maximum stabilized gain. The use of two iron-core I.F. stages gives an order of gain and selectivity which has heretofore never been obtained in communication receivers. The I.F. selectivity of the 1937 SKY CHALLENGER, without crystal, at 100 times input is 11 KC.

The 6Q7G second detector gives half-wave diode detection, A.V.C., and the triode section of this tube is the first stage of audio amplification. The plate of this section of this multi-purpose tube is resistance coupled to the grid of the 6F6G output tube.

The audio power output of this receiver is 3.5 watts, Class A.

The beat oscillator is a 6K7 electron-coupled to the diode section of the 6Q7G.

The 80 rectifier provides ample current for the complete receiver.

In this receiver the speaker is not a portion of the filter system. This allows the receiver to be operated independently of the speaker itself. A permanent magnet 5000 ohm speaker is the type we recommend being used with this receiver.

The headphone jack is connected to the input of the 6F6G output tube. The possibility of shock to the operator is eliminated by having no direct current on the phones.

SYMBOLS MODEL S-15, SKY CHALLENGERCondensers

<u>No.</u>	<u>Value</u> <u>Mfd.</u>	<u>Rating</u> <u>Volts</u>	<u>Part</u> <u>No.</u>
C1	250 mmfd	Rear Section gang	48011
C2	250 mmfd	Middle Section gang	48011
C3	250 mmfd	Front Section gang	48011
C4	.0012 mfd	Var. Pad	44012
C5	.0011 mfd	Var. Pad	44012
C6	.00093 mmfd	Var. Pad	44012
C7	.00039 mmfd	Var. Pad	44008
C8	.0002 mfd	Var. Pad	44006
C9	.002 mfd	400	Mica 40013
C10	.25 mfd	200	41008
C11	.002 mfd		Mica 5% 43012
C12	.05 mfd	400	41005
C13	50 mmfd		Mica 40002
C14	.002 mfd		Mica 5% 43012
C15	.002 mfd		Mica 40013
C16	100 mmfd		Mica 40003
C17	.05 mfd	200	41004
C18	25 mmfd	Air Var.	48012
C19	.02 mfd	200	41002
C20	.25 mfd	400	41009
C21	.02 mfd	200	41002
C22	25 mmfd	Air Var.	48012
C23	250 mmfd		Mica 40007
C24	10 mmfd	Twisted Leads	
C25	.02 mfd	400	41003
C26	.05 mfd	400	41005
C27	.1 mfd	400	41007
C28	250 mmfd		Mica 40007
C29	250 mmfd		Mica 40007
C30	10 mfd	25 Electrolytic	42004
C31	500 mmfd		Mica 40009
C32	.05 mfd	200	41004
C33	.1 mfd	400	41007
C34	.01 mfd	200	41000
C35	.05 mfd	400	41005
C36	10 mfd	25 Electrolytic	42004
C37	.005 mfd	600	45003
C38	16 mfd	400 Wet Electrolytic	42019
C39	16 mfd	400 Wet Electrolytic	42019
C40	.01 mfd	400	41001
C41	10 mmfd		Mica 10% 43020
C42	.05 mfd	200	41004
C43	.002 mfd		Mica 40013

RESISTOR AND CONDENSER LISTMODEL S-15 KEY CHALLENGERResistors

<u>No.</u>	<u>Value Ohms</u>	<u>Rating Watts</u>	<u>Tolerance</u>	<u>Part No.</u>
R1	100,000	1/3		20093
R2	30,000	1	10%	22075
R3	10,000	R.F. Gain		25009
R4	250	1/3	10%	22017
R5	15,000	2	10%	24034
R6	100,000	1/3		20093
R7	600	1/3	10%	22125
R8	10,000	2		24033
R9	50,000	1/3		20084
R10	100,000	1/3		20093
R11	100,000	1/3		20093
R12	1,000	1/3		20033
R13	20,000	1/3		20072
R14	500,000	1/3		20102
R15	4,000	1/3		20051
R16	500,000	Volume Control		24012
R17	250,000	1/3		20079
R18	100,000	1/3		20093
R19	1,000,000	Tone Control		25013
R20	500	1	10%	22024
R21	1,000,000	1/3		20108
R23	50,000	1/3		20084
R24	50,000	1/3		20084
R25	100,000	1/3		20093

ALIGNMENT PROCEDURE FOR SKY CHALLENGER S-15

Intermediate frequency alignment.

If the receiver is equipped with a crystal, use the crystal in a separate oscillator.

If the receiver is not an SX 11 model set the signal generator for 465 KC output.

Before I.F. or R.F. alignment see that:

AVC switch is off

Crystal switch is off

B.F.O. switch is off

Audio gain control set at maximum

R. F. gain control set at maximum

Crystal phasing condenser adjusted for maximum noise level.

Do not remove bottom plate from chassis.

Remove 6C5 oscillator tube from its socket and connect generator output directly to the grid of the 6L7 1st. detector.

As an output indicator, it is suggested an 0-3 volt A.C. voltmeter be connected across the speaker voice coil.

Now adjust all I.F. transformers for maximum output.

R. F. Alignment

Check dial- at maximum capacity of condenser the black line on the dial should be under the black line on the "V" indicator.

Set band spread condenser at minimum capacity or so that it reads 100 degrees.

Put the 6C5 oscillator tube back in its socket.

Connect generator output through 400 Ohm resistor to antenna and ground posts on receiver (Jumper should remain connected.)

Set generator for 600 KC

Put receiver on Band #1

Set dial to reading of 600 KC

Now adjust .6 MC pot on top of chassis until signal is resonated.

Reset dial to 1100 KC

Reset generator to 1100 KC

Adjust 1.1 megacycle osc. trimmer condenser beneath the chassis until this signal is properly resonated.

Now adjust R.F. and detector trimmers for maximum gain.

Now reset dial and generator to 600 KC and re-pad above chassis.

It may be necessary to pad and trim at 600 KC and 1100 KC a few times as a change of capacity at one end will affect the other end. Re-check on R.F. and detector trimmers and peck for maximum gain.

Band #2

Same procedure as on Band #1 except pad (above chassis) at 1.3 MC.
Trim at 2.6 M.C.

Band #3

Same procedure as before except pad oscillator at 3. M.C.
Trim at 6 MC

Rock the gang when making these adjustments.

Band #4

Same procedure as before except pad oscillator at 7. M.C.
Trim at 14 M.C.

Rock gang when making these adjustments.

Band #5

Same procedure as before except pad osciallator at 17. MC
Trim at 34 MC

Rock gang while making these adjustments.

It may be necessary to go through the above procedure several times before maximum performance is secured. A small change at one end of each band will affect the other end.

When making adjustments on this receiver back off on R. F. gain leaving A. F. gain at maximum at all times.

Be sure and turn the trimmers all the way in (clockwise rotation) (except as noted below) and back out to find the signal. On these air-dielectric trimmers capacity is Reduced when turning the screws in a clockwise direction.

Detector trimmers on bands 4 & 5 should be backed out all the way and screwed clockwise to find the signal. This will help to eliminate phasing on the wrong side.

Be sure and check images on bands 3, 4, & 5. These images will fall approximately 1. megacycle lower in frequency on all bands.