SUPER-PRO COMMUNICATIONS RECEIVER

TECHNICAL DESCRIPTION
SP-400-X

2. POWER SOURCES

a. *A-C Operation* . . .
105-125 Volts, 50-60 cps
180 watts average power consumption

b. *Battery Operation* . . .
6-volt storage battery, drain
6.25 amperes for heaters.
Five 45-volt "B" batteries, drain
117 milliamperes at 225 volts;
4.5 milliamperes at 90 volts.
One 45-volt "C" battery, drain
10 milliamperes.

3. WEIGHTS AND DIMENSIONS

a. *Table Mounting:*
Receiver . . .
Cabinet Dimensions: 12¼" high, 21½" wide, 15¼" deep.
Weight, in cabinet: 67 pounds.
Power Supply . . .
Cabinet Dimensions: 7⅝" high, 13⅝" wide, 8 5/16" deep.
Weight, in cabinet: 28 pounds.
Loudspeaker . . .
Cabinet Dimensions: 12¼" high, 12½" wide, 7¼" deep.
Weight, in cabinet: 11 pounds.

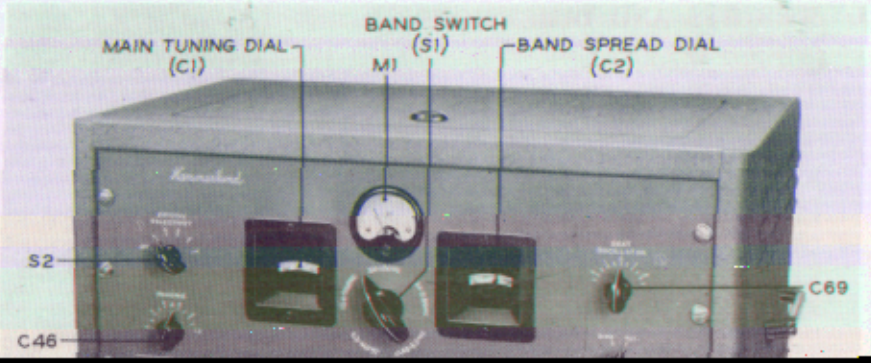
b. *Rack Mounting:*
Receiver . . .
Dust Cover Dimensions: 10" high, 17" wide, 14⅝" deep.

panel (Fig. 2). Select the desired band by turning the BAND SWITCH knob right or left to the band indicated.

These bands are:

540 to 1240 kilocycles
1.24 to 2.86 megacycles
2.85 to 6.3 megacycles
6.3 to 14.0 megacycles
13.4 to 30.0 megacycles

b. *Band Identification*—Besides the markings on the front panel, a mask with windows shows a calibrated scale on the MAIN TUNING dial to correspond with the band selected by the band switch. This operation is automatic. When the band switch is turned, the



TUNING dial at the high-frequeny end of the band which is to be *spread.*

d. *Dial Calibration*—The MAIN TUNING dial is directly calibrated as follows *and these calibrations hold true only when the BAND* SPREAD dial is set at 100:

BAND	CALIBRATION
540 kc.—1240 kc.	10 kc. per division
1.24 mc.—2.86 mc.	20 kc. per division
2.85 mc.—6.3 mc.	50 kc. per division
6.3 mc.—14.0 mc.	100 kc. per division
13.4 mc.—30.0 mc.	200 kc. per division

5. POWER OUTPUT

a. *Rating—The total power output is approximately 8 watts. The total harmonic distortion of the output stage is less than 10%* at this output and is, of course, less at lower levels. The Receiver has two output circuits with marked terminals along the rear of the chassis (FIG. 3).

b. *500 Ohm Terminals*—These are for use where large amounts of power are needed, such as for loudspeaker (See PAR. 7f), recorder or for a 500-ohm transmission line. All power output measurements and all audio-frequency fidelity readings are to be taken at these terminals.

c. *PHONES Terminals*—These are connected in parallel with the phone jack on the front panel, and provide reduced power for earphones (see PAR. 20b).

SECTION II—INSTALLATION AND OPERATION

6. INITIAL PROCEDURE

Precaution—UNPACK THE EQUIPMENT CAREFULLY. CHECK IT THOROUGHLY TO DETERMINE WHETHER IT HAS BEEN DAMAGED DURING SHIPMENT. If any of the equipment has been received in damaged condition immediately notify the carrier who *delivered it. File* a claim for damages with the carrier, because any damages incurred in transit are the responsibility of the carrier.

7. INSTALLATION

a. *Connection to Power Supply—Connect Receiver to Power Sup*ply as follows:

(1) Remove the sheet-metal covers from terminal strip (E4, FIG. 3) on rear of Receiver and from terminal strip (E1, FIG. 3) on Power Supply. See that all ten screws on each strip are unscrewed at least three turns. Then attach one end of the connector cable to each terminal strip *exactly* as shown in FIG. 3 and tighten all screws securely. Make certain that each slotted spade lug on the cable strips makes *contact with its respective screw terminal only, since a lug jammed* between *two* screws could cause considerable trouble. Immediately

replace *both metal covers and do not remove them while the* Power Supply is connected to the a-c power line.

(2) The spacing of spade lugs on cable terminal strips is exactly *the same as the spacing of screws on Receiver and Power Supply. If* the two fail to go together easily, DON'T USE FORCE. Be sure *all* screws are unscrewed far enough. If a spade lug has been bent or pushed out of place by rough handling, straighten it and try again. Spade lugs should slip under screws from the top.

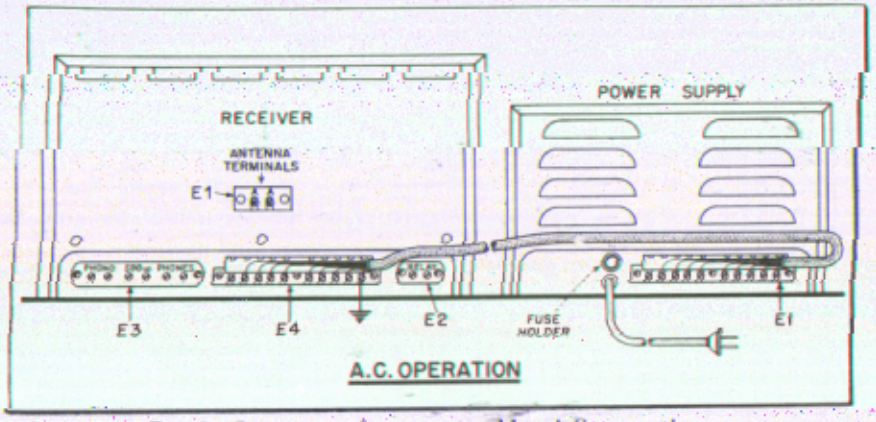


Fig. 5—Connections for power cable—A.C. operation.

consist of a horizontal wire 50 to 75 feet long suspended between insulators and located *in the clear* and as far off the ground as practicable. *Avoid running the* antenna close to and especially *parallel* to an electric power line. If the antenna *must* run near a power line, run the antenna at *right angles* to the line.

Connect a single-wire lead-in to the end of the antenna nearest the Receiver *and try to have the lead-in wire leave the antenna* approximately at right angles. Connect the lead-in to one of the "A" terminals (on terminal strip E1, FIG. 3) at the rear of the Receiver. Connect the other "A" terminal to a good ground, preferably not to the Receiver chassis. Run this ground lead to a water pipe or to a metal *rod driven into the ground deep enough to reach moist earth. Keep* the length of the ground lead as short as possible. Make the best possible electrical connections between the antenna and its lead-in and between the ground lead and "ground."

(2) *Narrow-Band Antenna:* For high receiving efficiency over a narrow band of high frequencies, a tuned antenna connected to the Receiver through a balanced lead-in is desirable. The tuned antenna may be a doublet consisting of two lengths of horizontal wire each approximately one-fourth the wavelength at the middle of the desired band and connected by an insulator. The balanced lead-in may be a twisted pair of well insulated wires each connected to one of the halves of the doublet either *side of the center insulator. For the Super-Pro* this lead-in should have approximately 100 ohms impedance. At the Receiver, connect each wire of the twisted pair to one of the "A" terminals. Do not ground *either* "A" terminal. Doublets are "directive" in that they receive best those signals which come from a point at right angles to their length. Remember that tuned antennas, while excellent for the particular narrow band they were designed to cover, may be very much *less* efficient than the long simple antenna described above when signals are sought in some *other* band.

d. *Chassis Ground:* It is not usually necessary to ground the Receiver chassis, but this can be done by connecting the ground lead to the left-hand PHONO or to the left-hand PHONES terminal (located on terminal strip E3, FIG. 3). These two terminals *are grounded to* the inside of the chassis.

e. *Earphones:* Plug a headset into the PHONES jack (J1, FIG. 2), or connect it to screw terminals marked PHONES on rear of chassis. *No matching transformer is necessary* (see PAR. 20b).

f. *Loudspeaker:* The permanent magnet dynamic loudspeaker supplied with the Receiver has a transformer mounted on its housing. This transformer matches the voice coil of the loudspeaker to the

connect the two-wire lead attached to the terminals of the loudspeaker transformer to the 500-ohm terminals on the Receiver. Disconnecting the loudspeaker will not impair the operation of the Receiver.

g. *Power Transformer Primary Tap:* Before plugging the power cord into the a-c line, remove bottom plate from Power Supply to see that power cord is properly connected for the a-c voltage of the power line being used. One wire of the power cord is permanently connected to the fuse-holder (E3, FIG. 5); the other wire is connected at the factory to one of the screw terminals on terminal strip E2 (FIG. 5). These screw terminals are marked 105, 115 and 125, and are connected to primary taps on the power transformer. See that the power cord is connected to the screw terminal most closely agreeing with the available a-c line voltage and replace the bottom cover plate.

h. *Line Switch:* Turn the OFF-ON switch (S7, FIG. 2) on the Receiver front panel to OFF and plug the power cord of the Power Supply into the a-c powerline.

8. PREPARATION FOR USE

a. *Recheck:* After installation, *again* look over the equipment for mechanical defects or damage caused by shipping, handling and so forth.

b. *Tubes:* Receiver and Power Supply tubes are in their proper

sockets when this equipment is packed for shipment. Remove cardboard jackets from tubes in Power Supply and check to see that all tubes are in proper position before attempting to operate the Receiver.

(1) *Receiver:* To inspect tubes in the rack-mounting type Receiver it is necessary to remove the dust cover. Do this by removing thumb nuts which hold cover to front panel and rear edge of chassis. Leave dust cover off until Receiver is operating satisfactorily. If Receiver is mounted in a cabinet, just raise lid in top of cabinet. The Receiver uses the following tubes:

Ref. No.	Type	Function
V1	6K7	1st RF Amplifier
V2	6K7	2nd RF Amplifier
V3	6L7	1st Detector (mixer)
V4	6J7	H-F Oscillator
V5	6K7	1st IF Amplifier
V6	6SK7	2nd IF Amplifier
V7	6SK7	3rd IF Amplifier
V8	6H6	2nd Detector
V9	6N7	Noise Limiter
V10	6SJ7	Beat Oscillator
V11	6SK7	AVC Amplifier
V12	6H6	AVC Rectifier
V13	6J5	1st AF Amplifier
V14	6F6	2nd AF Amplifier (driver)
V15	6F6	3rd AF Amplifier (output)
V16	6F6	3rd AF Amplifier (output)

The proper location of these tubes is shown in Fig. 7 and on the diagram attached to the top of the tuning unit. Make sure that tubes V1, V2, V3, V4 and V5 have leads connected to their grid caps.

(2) *Power Supply:* Remove the cabinet or dust cover from the Power Supply and remove the cardboard jackets from the two rectifier tubes. The Power Supply uses the following tubes:

Ref. No.	Type	Function
V1	5U4G	"B" Rectifier
V2	5Y3GT/G	"C" Rectifier

Tube 5U4G goes into the socket nearest the corner of the Power Supply chassis (see Fig. 6).

c. *Adjustments:* The Super-Pro is adjusted before shipping. No adjusting should be necessary except to check for the correct primary tap on the power transformer (Par. 7g).

9. OPERATION

a. Radiophone Reception: Set the front panel controls (Fig. 2) as follows:

Control	Position
CRYSTAL SELECTIVITY	OFF
PHASING	on arrow
BAND WIDTH	3
LIMITER	Off
AVC-MANUAL	AVC
SENSITIVITY	10
BAND SPREAD	100
SIGNAL-MOD-CW	MOD
AUDIO GAIN	6
SEND-REC	REC
BEAT OSCILLATOR	0

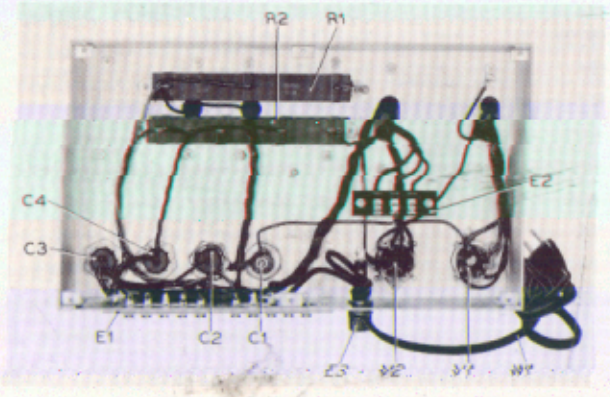


Fig. 5—Bottom view of power supply.

Fig. 6—

(1) Throw OFF-ON power switch in center of panel to ON. This puts Receiver *in operation.*

(2) Adjust band switch (S1, FIG. 2) to a band which is likely to be very active. This will facilitate the process of getting familiar with the various adjustments. If interference is not serious, BAND WIDTH control can be adjusted to a wider band width (higher number), depending upon the degree of fidelity desired. In general, adjust this control to band width giving best tone with least interference.

(3) Do all tuning, with or without the meter with BAND WIDTH control set at 3. Other settings give wider bands, making exact tuning difficult. Make band width adjustments *after* signal is tuned properly.

(4) LIMITER-OFF-ON control cuts noise limiter out and off


S6
M1
V4

g. Earphone Operation: For earphone operation, plug earphones

11. HF OSCILLATOR

The HF oscillator operates at a frequency 455 kc. (the frequency for which the IF amplifier is adjusted) *higher* than that of the incoming signal. The oscillator section of the variable tuning capacitor (C1D) has the same capacitance and plate shape as the RF sections (C1A, C1B, C1C). The constant 455 kc. frequency difference is maintained by means of a padding capacitor in series with the variable, together with appropriate values of oscillator inductance and parallel trimmer capacitance.

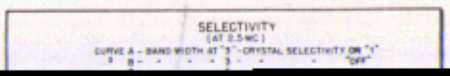
12. *FIRST DETECTOR*

The 1st detector employs a 6L7 pentagrid mixer (V3). Its injection grid (grid No. 3) is coupled to the HF oscillator cathode, and its signal grid (grid cap) is coupled to the plate of the second RF amplifier tube (V2) by means of the second RF transformer.

13. CRYSTAL FILTER

a. *Controls*: The Quartz Crystal Filter (T1) couples the 1st detector (V3) to the 1st IF amplifier (V5). Its selectivity can be varied in definite steps by the CRYSTAL SELECTIVITY switch (S2) controlled from the front panel by knob and pointer. In addition, its selectivity characteristic can be greatly sharpened *on one side* or the other (to avoid heterodyne "whistle") by adjusting the PHASING capacitor (C46), also controlled by a knob on the front panel.

b. *Variable Selectivity:* Curves A and B, FIG. 8, show Receiver selectivity curves which indicate certain effects of



17. AVC AMPLIFIER AND RECTIFIER

Special amplifier and rectifier stages are employed in order to

frequency falls within the audio-frequency range. Fine adjustment of the beat frequency pitch is accomplished by means of the BEAT OSCILLATOR control on the front panel which turns a small variable capacitor (C69) in transformer T5. The beat oscillator is turned on by throwing the SIGNAL-MOD-CW switch (S4) to CW. In addition to being necessary for proper reception of CW signals, the beat oscillator is useful for locating weak signals of any kind.

TABLE 1 - INTERNAL CONNECTIONS TO TUBE BASE PINS

TUBE TYPE	BASE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
6J5	octal	shell	heater	plate		grid		heater	cathode
6F6	octal	shell	heater	plate	screen	grid		heater	cathode
5Y3GT/G	octal	no conn.	filament		plate		plate		filament
*6K7	octal	shell	heater	plate	screen	suppressor		heater	cathode
*6L7	octal	shell	heater	plate	screen	inj. grid		heater	cathode
6N6	octal	shell	heater	plate (2)	cathode (2)	plate (1)		heater	cathode (1)
*6J7	octal	shell	heater	plate	screen	suppressor		heater	cathode
6N7	octal	shell	heater	plate (2)	grid (2)	grid (1)	plate (1)	heater	cathode
6SJ7	octal	shell	heater	suppressor	grid	cathode	screen	heater	plate
6SK7	octal	shell	heater	suppressor	grid	cathode	screen	heater	plate
5U4G	octal	no conn.	filament		plate		plate		filament

* These types have grid caps

TABLE 3 - SOCKET TERMINAL RESISTANCE VALUES

(ATE measurements made between socket terminal and chassis)

TERMINAL NAME	PIN NO.	VARIABLE		RESISTANCE IN OHMS
		REF. NO.	SETTING	
V6 screen	6			11,500

TABLE 2 - TUBE SOCKET VOLTAGES (RECEIVER)

Socket No.	Tube No.	VOLTS AT SOCKET TERMINAL NUMBER*					
		3	4	5	6	7	8
X1	V1	+250	+135		+135	6.3AC	0
X2	V2	+250	+135		+135	6.3AC	0
X3	V3	+250	+115			6.3AC	0
X4	V4	+150**	+150**	+150**		6.3AC	
X5	V5	+250	+135	0		6.3AC	0
X6	V6	0	-43	0	+135	6.3AC	+250
X7	V7	0	-1.5	0	+100	6.3AC	+240
X8	V8	-.2	+.4	-.2		6.3AC	+.4
X9	V9	+.4	0	0	+.4	4.0AC	-.2
X10	V10	0		0	+40	6.3AC	+155
X11	V11	0	-1.5	0	+110	6.3AC	+240
X12	V12	-3.2	0	-3.2		6.3AC	0
X13	V13	+110			-3.2	6.3AC	0
X14	V14	+240	+240		-20	6.3AC	0
X15	V15	+380	+380	0		6.3AC	+38
X16	V16	+380	+380	0		6.3AC	+38

*Terminals 1 and 2 of all sockets are at zero potential with respect to chassis.

**Varies widely with different tubes; also with dial setting.

The above voltage readings are based on an a-c line voltage exactly equal to the primary tap on the power transformer - higher or lower line voltage should result in corresponding variations in these readings.

All d-c readings are based on the use of a meter having a resistance of 1000 ohms per volt, and are taken between socket terminals and chassis.

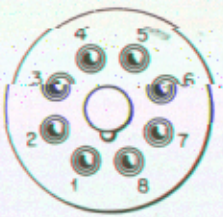
SENSITIVITY and AUDIO GAIN should be set at a 0.

SIGNAL-MOD-CW switch should be on CW.

AVC-MANUAL switch should be on MANUAL.

SEND-REC switch should be on REC.

LIMITER switch should be ON.



OCTAL BASE

(BOTTOM VIEW)

TABLE 4

SOCKET TERMINAL RESISTANCE VALUES

(All measurements made between socket terminal and chassis)

POWER SUPPLY

TERMINAL NAME	PIN NO.	RESISTANCE IN OHMS
V1 plate	4	40
V1 plate	6	40
V1 filament	2, 8	19,500
V2 plates	4, 6	28,500
V2 filament	2, 8	22

FIG. 11—Tube socket terminals.

from a tap (9) on the high-voltage secondary connected to the filament of the "C" rectifier tube (V2). The rectified output from the plates of tube V2 is filtered by the three sections of resistor R2 and the three sections of filter capacitor C4. When connected to the Receiver, the voltage at the end of this filter is approximately minus 50.

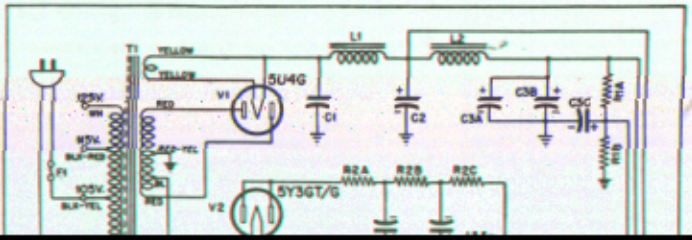


FIG. 10—Power supply diagram.

by-pass capacitor or an open resistor. Remove the cabinet or bottom cover plate to get at all parts. Measure socket voltages and compare them with TABLE 2. (Consult FIG. 11 and TABLE 1 for key to tube base pin connections.) If this measurement does not reveal the trouble, start checking socket terminal resistance values against TABLE 3. (*Receiver*) *or* TABLE 4 (*Power Supply*). *Obtain values of resistors* and capacitors by locating the reference number on the proper circuit diagram and looking it up in the Table of Parts, Section V. In checking these resistance values be sure to set the "variable" controls to the positions specified in the table.

E3 V11 E4 R40 V8 E2

circuits, which should NOT be disturbed unless the MAIN TUNING dial is definitely known to be off calibration.

a. *Signal Generator:* This should be an accurately calibrated instrument producing amplitude-modulated radio-frequency signals. In addition to 455 kc. (the IF), the frequency range required of the signal generator depends on the tuning range of the receiver to be aligned. The RF alignment frequencies required for the Series 400-X Super-Pro are shown in FIG. 13. The second harmonic can generally be used when the fundamental frequency is not available. For example, a signal generator covering all frequencies from 455 kc to 15 mc could be used to check the highest frequency band by using the second harmonic of 15 mc to provide the 30 mc called for in FIG. 13. The signal generator should have an output of approximately 100 microvolts and an output impedence of approximately 100 ohms for best results when aligning the RF and HF Oscillator circuits. For IF alignment these values are not critical. The frequency calibration of the signal generator is extremely important *if* the Receiver dial calibration is to be correct.

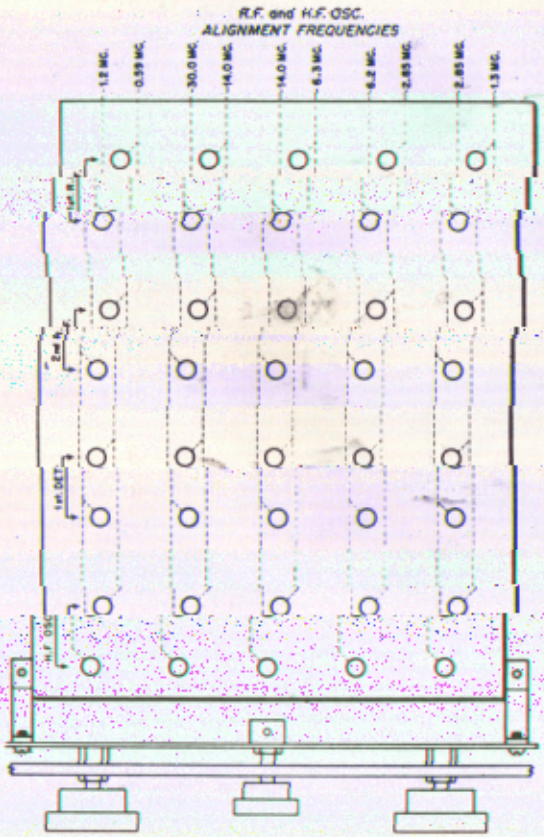


FIG. 13—R.F. and H.F. osc. alignment frequencies and location of adjustments

b. *Output Meter:* The output meter should respond to the modulation frequency of the signal generator, preferably 400 cps, and should provide at least half-scale deflection for 10 volts. Its resistance should be greater than 500 ohms.

c. *Tools:* An insulated screwdriver .9/64" wide and .025" thick at the bit, is required for alignment of the Receiver.

d. *Preliminary Procedure:* Throw the OFF-ON switch to ON and permit the Receiver to warm up for about an hour before beginning adjustments. Connect the output meter to the 500-ohm terminals located at the rear of the Receiver chassis (see PAR. 7f).

26. ALIGNMENT PROCEDURE

a. Preliminary Setup: Adjust the signal generator to approximately

generator and cathode-ray oscilloscope. If this equipment is available, proceed as follows:

(3) Connect the input of the vertical amplifier of the oscilloscope to the PHONO connections on Terminal strip E3 (FIG. 7) on the rear skirt of the Receiver chassis. The "high" terminal is the second one from the edge of the strip; the first screw is connected to the chassis. Set the frequency-modulated signal generator to approximately 455 kc and connect its output to the control grid cap of the 1st detector (V3) through a fixed capacitor (100 mmf or larger). With the CRYSTAL SELECTIVITY switch at OFF, readjust the signal generator frequency to produce the conventional single-peaked resonance curve on the screen of the oscilloscope. Then turn the CRYSTAL SELECTIVITY switch to position 1. If the grid coil (L27) is correctly tuned the image on the oscilloscope screen will remain symmetrical but will be only about two-thirds as wide as before, indicating an increase in selectivity. The oscilloscope image is also affected by the PHASING control, maximum symmetry occurring at or very near the arrow on its scale. Therefore, when tuning L27, rock the PHASING control back and forth at the same time to secure the best adjustment.

c. *AVC Alignment Check:* Leaving all other controls as in PAR. 26a, and without changing the signal generator frequency, reduce AUDIO GAIN to 0, switch to AVC and increase SENSITIVITY to 10. Increase AUDIO GAIN to restore half-scale reading on the output meter and adjust the single trimmer capacitor in T6 for *minimum* output meter reading. The "S" meter reading should "peak" at the same time the output meter reading "dips."

d. *Beat Oscillator Alignment Check:* Continuing with controls as above (PAR. 26c), switch off the output meter and plug in a pair of earphones, or replace the meter with a suitable loudspeaker. Turn the SIGNAL-MOD-CW switch to CW and see that the BEAT OSCILLATOR control is exactly on 0 (zero). If tone in earphones or speaker is not very low in pitch, readjust the trimmer capacitor near the bottom of T5 until it is. If the beat oscillator is in perfect alignment when this test is made, no sound will be heard since the signal generator and the beat oscillator will be oscillating at the same frequency and there will be no audible differnce or "beat." Check this by turning the BEAT OSCILLATOR control knob slightly off 0 (zero) toward one side or the other. If this results in a tone rising in pitch as the pointer is turned away from 0 (zero) to either side, the beat frequency oscillator is perfectly aligned. If no audible tone can be obtained within the range of the BEAT OSCILLATOR control, adjust the trimmer capacitor near the bottom of T5 until an approximate "zero beat" occurs at 0 (zero) setting of the BEAT OSCILLATOR control.

e. HF Oscillator Calibration Check: The accuracy of the MAIN DIAL calibration depends solely on the HF oscillator frequency, which in this Receiver is 455 kc. (the IF) *higher* than the signal frequency. Although the frequency of the HF oscillator can be measured directly if accurate frequency-measuring equipment is on hand, it is far simpler to check it by tuning in signals of known frequency and noting the MAIN DIAL readings. CAUTION: BE SURE THE BAND SPREAD DIAL IS SET AT *100* WHEN MAKING THIS TEST.

(1) To correct dial calibration, refer to alignment chart (FIG. 13) for location of HF oscillator adjustments as well as signal frequencies at which settings should be made. The output of the signal generator should be unmodulated and SIGNAL-MOD-CW switch on Receiver turned to CW. Set BEAT OSCILLATOR at 0, AUDIO GAIN at 10, AVC-MANUAL on MANUAL, BAND WIDTH at 16. Disconnect output meter and use earphones or loudspeaker to make necessary adjustments by "zero beat" method. Connect signal generator to antenna *terminals for this test.*

as a separate operation. Efficient weak-signal reception with low receiver noise level and high image rejection ratios, depends on the relative alignment of these three circuits with respect to the HF oscillator and without regard to calibration accuracy.

(1) Accurate calibration of the signal generator is not required to check these adjustments. Modulation of the signal generator, while convenient, is not strictly necessary. Input to antenna terminals should be through 100 ohms (approximate) including output resistance of signal generator. If signal generator is modulated, Receiver controls should be set as for IF alignment; if unmodulated, set BEAT OSCILLATOR to 2 (either side) and SIGNAL-MOD-CW to CW. Adjust SENSITIVITY for half-scale reading on output meter when signals are exactly in tune.

(2) Starting with 2.85-6.3 mc band, set main dial at 6.3 mc (BAND SPREAD at 100) and adjust frequency of signal generator for peak deflection of output meter. Then check setting of trimmer marked 1st DET 6.3 mc (FIG. 13). Repeat this procedure on trimmers designated as 2nd RF and 1st RF in same row. If readjustments on one of these settings greatly increases output meter reading, alter SENSITIVITY slightly to reduce reading to half-scale. After each adjustment check tuning of Receiver to make sure test signal is still accurately tuned. BAND SPREAD may be used as a vernier for this purpose.

CAUTION: THIS TUNING CHECK IS EXTREMELY IMPORTANT AT HIGH END OF 6.3-14.0 MC AND 13.4-30.0 MC BANDS WHERE THERE IS SOME SLIGHT INTERACTION BETWEEN 1ST DET AND HF OSC CIRCUITS. After checking the three trimmers at high end of this band, turn main dial to 2.85 mc and retune signal generator to suit. Then check the three inductance adjuster settings marked 2.85 mc (FIG. 13) in the same row. Since adjustments at one end of a band also affect the other end of the band (as described under HF OSC alignment), repeat above procedure until no further improvement can be secured. The number of repetitions necessary depends on how much mistuning existed initially. Other bands may be checked in the same manner.

TABLE OF PARTS

Circuit Ref. No.	Description		Part No.
	CAPACITORS		
C1	Main Tuning		
C2	Band Spread		
C3	620 mmf, Mica		23005-86
C4	.02 mf, Paper		23912-1
C5	.05 mf, Paper		23912-2
C6	Trimmer, Mica, 3-30 mmf	Part of 29529-G1	
C7	Trimmer, Mica, 3-30 mmf	Part of 29532-G1	
C8	Trimmer, Mica, 3-30 mmf	Part of 29538-G1	
C9	Trimmer, Mica, 3-30 mmf	Part of 29520-G1	
C10	Trimmer, Mica, 3-30 mmf	Part of 29535-G1	
C11	Trimmer, Mica, 3-30 mmf	Part of 29530-G1	
C12	Trimmer, Mica, 3-30 mmf	Part of 29533-G1	
C13	Trimmer, Mica, 3-30 mmf	Part of 29539-G1	
C14	Trimmer, Mica, 3-30 mmf	Part of 29521-G1	
C15	Trimmer, Mica, 3-30 mmf	Part of 29536-G1	
C16	Trimmer, Mica, 3-30 mmf	Part of 29530-G1	
C17	Trimmer, Mica, 3-30 mmf	Part of 29533-G1	
C18	Trimmer, Mica, 3-30 mmf	Part of 29539-G1	
C19	Trimmer, Mica, 3-30 mmf	Part of 29521-G1	
C20	Trimmer, Mica, 3-30 mmf	Part of 29536-G1	
C21	Trimmer, Air, 4-25 mmf	Part of 29531-G1	
C22	Trimmer, Air, 4-25 mmf	Part of 29534-G1	
C23	Trimmer, Air, 4-25 mmf	Part of 29540-G1	
C24	Trimmer, Air, 4-25 mmf	Part of 29528-G1	
C25	Trimmer, Air, 4-25 mmf	Part of 29537-G1	
C26	300 mmf, Silver Mica		23003-105D
C27	620 mmf, Mica		23005-86
C28	.02 mf, Paper		23912-1
C29	.05 mf, Paper		23912-2
C30	300 mmf, Silvered Mica		23003-105D
C31	620 mmf, Mica		23005-86
C32	.02 mf, Paper		23912-1
C33	.05 mf, Paper		23912-2
C34	95 mmf, Silvered Mica		6195
C35	673 mmf, Silvered Mica	Part of 29531-G1	
C36	1500 mmf, Silvered Mica	Part of 29534-G1	
C37	3300 mmf, Silvered Mica	Part of 29537-G1	
C38	300 mmf, Silvered Mica	Part of 29528-G1	
C39	51 mmf, Silvered Mica		23003-56
C40	.05 mf, Paper		23912-2
C41	.05 mf, Paper		23912-2
C42	120 mmf, Silvered Mica		23003-96
C43	100 mmf, Mica		23001-48
C44	100 mmf, Mica		23001-48
C45	NOT USED		
C46	Trimming, Air, 2-6 mmf (ea.)		SA-179
C47	.02 mf, Paper		23912-1
C48	85 mmf, Silvered Mica, 2%		6180
C49	.05 mf, Paper		23912-2
C50	Variable, Air, 100 mmf		SA-1
C51	.05 mf, Paper		23912-2
C52	.05 mf, Paper		23912-2
C53	Variable, Air, 100 mmf		SA-1
C54	.05 mf, Paper		23912-2
C55	Variable, Air, 100 mmf		SA-1
C56	.05 mf, Paper		23912-2
C57	.05 mf, Paper		23912-2
C58	Variable, Air, 100 mmf		SA-1

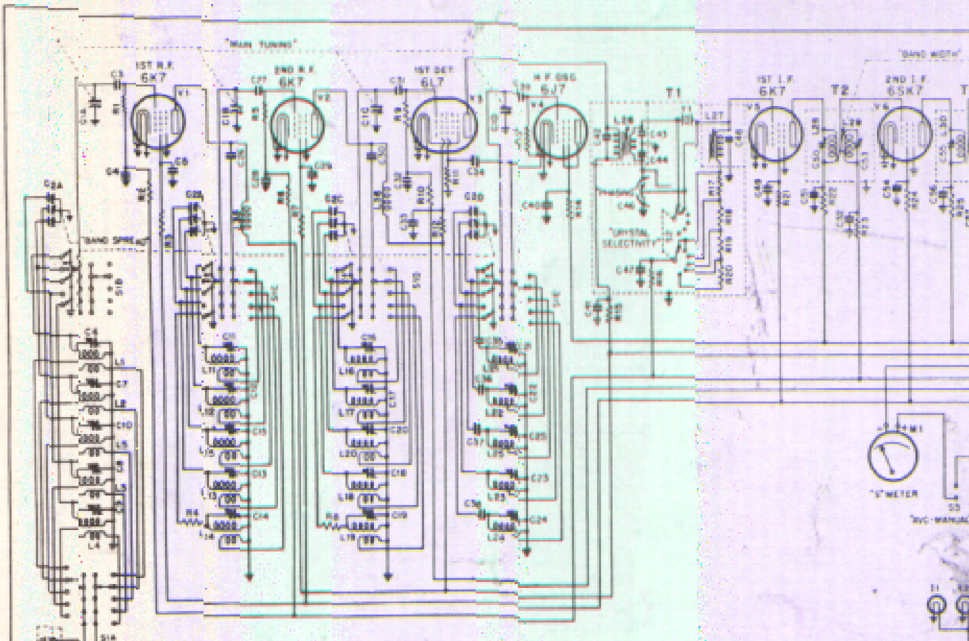
TABLE OF PARTS—*Cont.*

Circuit Ref. No.	Description	Part No.
	CAPACITORS—Continued	
C59	.05 mf, Paper	23912-2
C60	5 mmf, Silvered Mica	23003-75
C61	Variable, Air, 100 mmf	SA-1
C62	.05 mf, Paper	23912-2
C63	51 mmf, Mica	23001-59
C64	51 mmf, Mica	23001-59
C65	.05 mf, Paper	23912-2
C66	51 mmf, Mica	23001-59
C67	Variable, Air, 100 mmf	SA-197
C68	100 mmf, Mica	23001-48
C69	Variable Air, 9 mmf	SA-170
C70	95 mmf, Silvered Mica	6195
C71	620 mmf, Mica	23005-86
C72	.25 mf, Paper	23912-38
C73	.05 mf, Paper	23912-2
C74	.05 mf, Paper	23912-2
C75	Variable, Air, 100 mmf	SA-1
C76	5100 mmf, Mica	23015-16
C77	.05 mf, Paper	23912-2
C78	.05 mf, Paper	23912-2
C79	.05 mf, Paper	23912-2
C80	.05 mf, Paper	23912-2
C81	.05 mf, Paper	23912-2
C82	.02 mf, Paper	23912-1
C83	.05 mf, Paper	23912-2
C84	40 mf, Electrolytic, Dry	6171
C85	.25 mf, Paper	23912-38
C86	.25 mf, Paper	23912-38
	COILS	
L1	Assembly, Antenna transformer, 1.24-2.86 mc	29529-G1
L2	Assembly, Antenna transformer, 2.85-6.3 mc	29532-G1
L3	Assembly, Antenna transformer, 13.4-30.0 mc	29538-G1
L4	Assembly, Antenna transformer, 540-1240 kc	29520-G1
L5	Assembly, Antenna transformer, 6.3-14.0 mc	29535-G1
L6	Not Used	
L7	Not Used	
L8	Not Used	
L9	Not Used	
L10	Not Used	
L11	Assembly, R.F. transformer, 1.24-2.86 mc	29530-G1
L12	Assembly, R.F. transformer, 2.85-6.3 mc	29533-G1
L13	Assembly, R.F. transformer, 13.4-30.0 mc	29539-G1

Circuit Ref. No.	Description	Part No.
	COILS—Continued	
L29	3 pie universal 7/41 Litz., ceramic coil	3990
L30	Same as L28	2903-A
L31	Same as L29	3990
L32	Universal, 7/41 Litz., ceramic core	4907
L33	3 pie universal 7/41 Litz., ceramic coil	2931
L34	Universal, 7/41 Litz., ceramic core	4906
L35	Choke Coil, 5 pie universal R.F. choke, ceramic core, wire leads	609-1
L36	Choke Coil, Same as L35	609-1
J1	JACK, JK-34-A, Phone Jack (headset)	5066
M1	Meter, 0-200 micro-ampere movement	4903
	RESISTORS	
R1	500,000 ohms, ⅓ W	4959
R2	10,000 ohms, ½ W	19309-73
R3	2,000 ohms, ½ W	19301-206
R4	20 ohms, ½ W	19301-183
R5	500,000 ohms, ⅓ W	4959
R6	10,000 ohms, ½ W	19309-73
R7	2,000 ohms, ½ W	19301-206
R8	20 ohms, ½ W	19301-183
R9	500,000 ohms, ⅓ W	4959
R10	10,000 ohms, ½ W	19309-73
R11	50,000 ohms, ⅓ W	4960
R12	24,000 ohms, 2 W	19304-202
R13	50,000 ohms, ⅓ W	4960
R14	12,000 ohms, 2 W	19304-44
R15	2,000 ohms, ½ W	19301-206
R16	10,000 ohms, ½ W	19309-73
R17	24 ohms, ½ W	19301-178
R18	51 ohms, ½ W	19301-187
R19	300 ohms, ½ W	19301-196
R20	2,000 ohms, ½ W	19301-206
R21	2,000 ohms, ½ W	19301-206
R22	2,000 ohms, ½ W	19301-206
R23	10,000 ohms, ½ W	19309-73
R24	2,000 ohms, ½ W	19301-206
R25	2,000 ohms, ½ W	19301-206
R26	10,000 ohms, ½ W	19309-73
R27	51,000 ohms, 1 W	19305-182
R28	2,000 ohms, ½ W	19301-206
R29	100,000 ohms, ½ W	19301-80
R30	75,000 ohms, ½ W	19301-215
R31	51,000 ohms, ½ W	19301-171
R32	1 Megohm, ½ W	19301-104
R33	240,000 ohms, ½ W	19301-155
R34	4 ohms, 5 W	19431-1
R35	100,000 ohms, ½ W	19301-80
R36	510,000 ohms, ½ W	19309-159
R37	5,100 ohms, ½ W	19301-210
R38	51,000 ohms, ½ W	19301-171
R39	51,000 ohms, 1 W	19303-182
R40	1,000 ohms, Potentiometer	4932
R41	2,000 ohms, ½ W	19301-206
R42	24,000 ohms, ½ W	19301-213
R43	10,000 ohms, ½ W	19309-73
R44	1 Megohm, ½ W	19301-104
R45	2 Megohm, ½ W	19301-169

TABLE OF PARTS—*Cont.*

Circuit Ref. No.	Description	Part No.
	RESISTORS—Continued	



SUPER-PRO
SP-400-X
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