

ALLIED RADIO SHACK

3.5-30 MHz AM CW SSB COMMUNICATIONS RECEIVER

MODEL AX - 190 CAT. NO. 20 - 5155

MODEL SX - 190 CAT. NO. 20 - 5190

SERVICE MANUAL

A PRODUCT OF RADIO SHACK

 A TANDY CORPORATION COMPANY

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1. General Specification

Number of semiconductor	4FET, 22TR, 13 diode, 2 Zener and 2 thermister
IF Frequency	2.920 to 2.420 MHz (Variable) and 455 KHz
Reception.....	AM, CW, and SSB
Sensitivity (AM).....	Less than 1 microvolt for 10 db S/N ratio
Sensitivity (SSB).....	Less than 0.5 microvolt for 10db S/N ratio
Selectivity.....	4 KHz at 6 db down
Visual dial accuracy	±200 Hz
Calibration accuracy.....	Better than ±500 Hz adjacent 25 KHz calibration points after indexing
Stability	Better than 500 Hz after warm-up
Image rejection	More than 60 db
Spurious rejection.....	More than 50 db
Rejection tuning	More than 40 db
Selection tuning.....	500 Hz at -3 db
Audio output power.....	Maximum 1 watt at 8 ohm load
Audio output impedance.....	8 ohm and 600 ohm
Headphone output.....	8 ohm standard 1/4 inch plug
Ant impedance.....	50 to 75 ohm unbalanced
Power source	120 V AC 60 Hz and 12 VDC
Power consumption	10 watts
Remote stdby control.....	Rear-mounted: 2 pin connector
Dimensions.....	7" high, 15" wide and 10" deep

2. Disassembly Instructions

Remove all black screws then cabinet will be open.

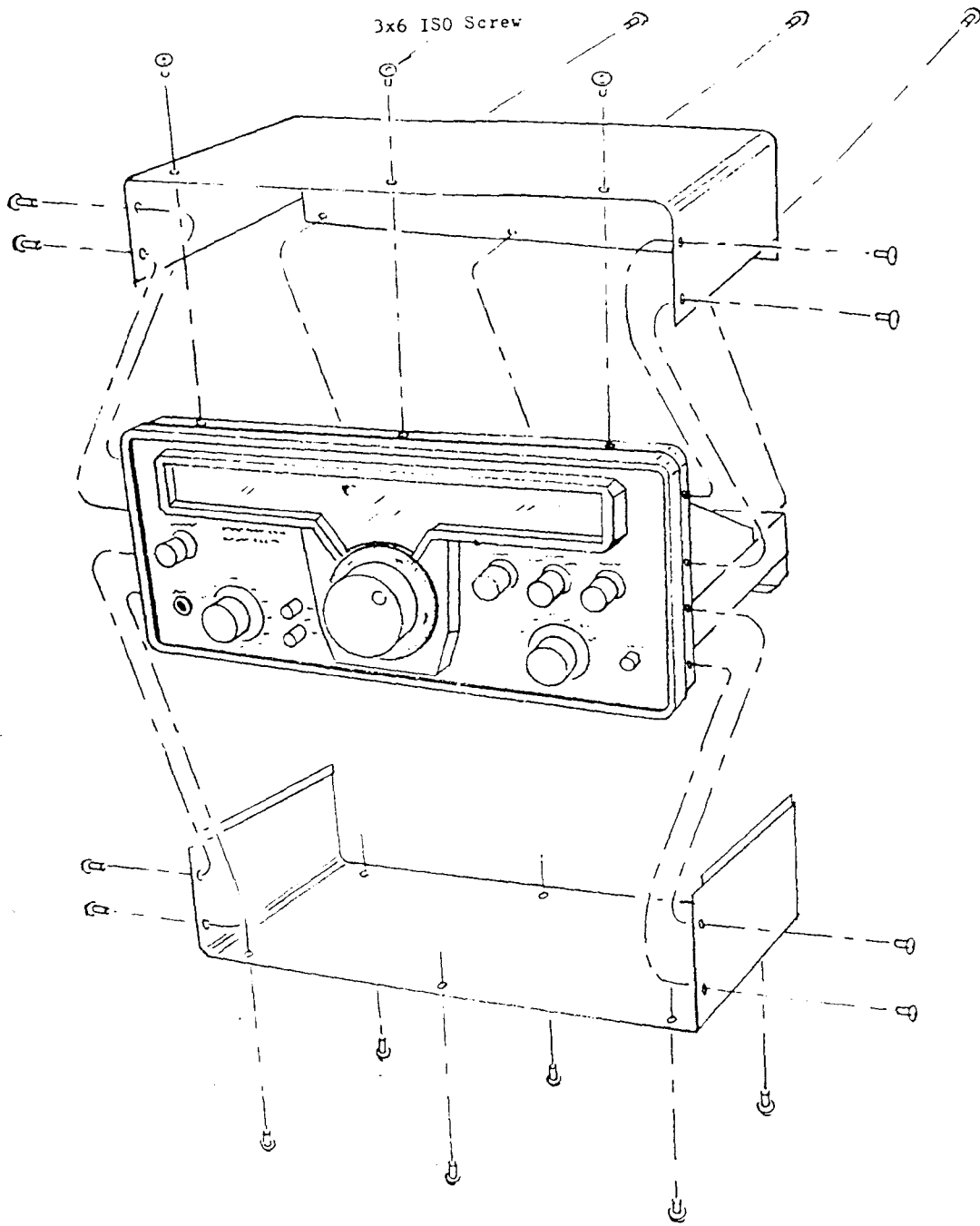


Fig. 1

3. Block Diagram

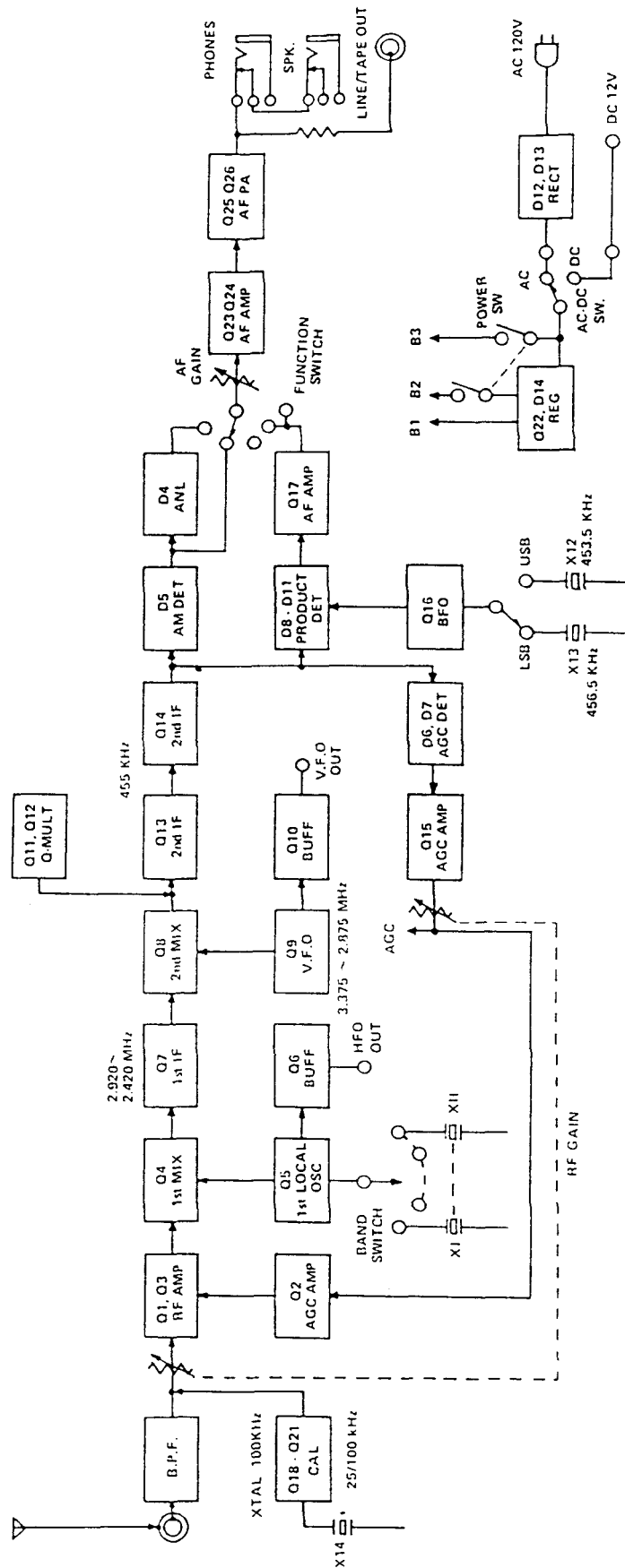


Fig. 2 BLOCK DIAGRAM

Alignment Procedure:

455 KHz 2nd IF Amplifier

Method 1 (Using Sweep Generator)

- (1) Control Settings:
 - RF Gain - Full Clockwise
 - AF Gain - Max. Counterclockwise
 - Band SW - Any band
 - Function - AM
 - Q-Multi - OFF
 - CAL - OFF
- (2) Connect the Sweep Generator output to the hot side of the VC5, which is located in VFO Box.
- (3) Connect the oscilloscope to the Pin 10 which is IF output and it is located on the IF PCB.
- (4) Adjust the Generator output to obtain a reading on the scope.
- (5) Tune MF1(RED), T9 (YEL), MF2 (RED), T10 (YEL) and T11 (BLK) for peak and symmetry on the scope.

Method 2 (Without using Sweep Generator)

- (1) Control Settings:
 - Band SW - Any band but additional band
 - Preselector - Adjust to the selected frequency band
 - Calibrator - 100 KHz ON
 - Main dial - Tune to receive calibration signal
 - Function - AM
 - Q-Multi - OFF
- (2) Adjust the RF Gain control to be read S 6 or 7 on the S-meter.
- (3) Tune MF1, T9, MF2, T10 and T11 for peak on the S-meter, at this time adjust the RF Gain control to read S 6 or S 7 on the S-meter.
- (4) Confirm that the S-meter reading is same or not when remove the main dial from "0" to -3 KHz and +3 KHz.
- (5) If it is not, repeat step (3) until no interaction is observed and all transformers are turned for maximum gain.

2) 2.920-2.420 MHz 1st variable IF Amplifier

- (1) Control settings:
 - RF Gain - Full clockwise
 - AF Gain - Adjust for desired audio level
 - Function - AM
 - Band SW - Any band but recommend 27.0 MHz for SX-190 or 29.5 MHz for AX-190
 - Preselector- Adjust to the selected frequency band
 - Q-Multi - OFF
- (2) Rotate the main tuning knob to "0" on the main dial.
- (3) Connect the VTVM and 8 ohms dummy load to SPK jack.
- (4) Connect the signal generator* to the antenna jack and adjust the frequency of the generator to the receiving frequency.
*The generator output must keep as low as possible during alignment.
- (5) Adjust TC12, TC13 In the VFO box and L8, L10 in the buffer amplifier to maximum output.
- (6) Rotate the main tuning knob to "500" on the main dial.
- (7) Adjust the frequency of the signal generator to the receiving frequency.
- (8) Adjust the T5, T6 in the VFO box and L9 in the buffer amplifier to maximum output.
- (9) Rotate the main tuning knob to "250" on the main dial.
- (10) Adjust the frequency of the signal generator to the receiving frequency.
- (11) Adjust the L7 to maximum output.
- (12) Repeat step (2) thru (10) until no interaction is observed and all transformers and trimmers are turned for maximum gain.

3) VFO Alignment

NOTE: Before the VFO alignment the set should be warmed up over 30 minutes.

Method 1 (Using frequency counter)

- (1) Connect the frequency counter to J4 (VFO OUT) located on rear side.
- (2) Tune the main dial to "100" to the centerline marked nothing.
- (3) Adjust TC14 in VFO Box, to 3.275 MHz on the frequency counter.

- (4) Tune the main dial to 450 to the center tine.
- (5) Adjust the T7, in the VFO Box, to the exactly 2.925 MHz on the frequency counter.
- (6) Repeat steps 2) thru 5) as necessary to obtain a frequency of 2.375 MHz when the dial indicates "100" and a frequency of 2.925 MHz when the dial indicates "450".

Method 2 (Without using frequency counter)

- (1) Control settings:
 - RF Gain - Full clock-wise
 - AF Gain - Adjust for desired audio level
 - Band SW - 15 MHz Band
 - Preselector - 15 MHz
 - Function - AM
 - Q-Multi - OFF
- (2) Connect the antenna to The J1 ANT jack.
- (3) Tune the main dial to receive WWV signal that is exactly 15.000 MHz. Normally it will be heard at dial "0" on the main dial.
- (4) If it is not there, adjust the TC14 in the VFO Box to be receiving the WWV signal on the dial "0".
- (5) Before using the calibrator signal, make sure that the 100 KHz calibration signal is correct or not. If it is correct zero beat sound is heard, if not adjust the TC17 on the CAL PCB to be hear zero beat sound.
- (6) Remove the antenna; push the 100 KHz CAL knob and if the S-meter indicates over S 9 adjust the RF Gain control to be read S 6 or S 7.
- (7) Rotate the main timing knob and to receive the 4th calibration signal, it will be appeared near the "400" on the main dial.
- (8) Adjust the T7 to receive "400" KHz calibration signal on the "400" on the main dial.
- (9) Repeat steps (4) thru (8) as necessary to obtain a correct frequency on the main dial.

4) 1st local crystal oscillator (HFO)

- (1) Connect the RF VTVM and frequency counter to the HFO OUT J2 located on rear side of the panel.

- (2) Set the band SW to 29.5 MHz position for AX-190 or 27.0 MHz position for SX-190.
- (3) Tune T4, located on the RF PCB, for peak as indicated on the VTVM and also correct frequency. 32.420 MHz for AX-190 or 29.920 MHz for SX-190.
- (4) Rotate the band SW to 29.0, 28.5, 28.0, 27, 21 and 15 MHz Band for AX-190 or 27.0, 17.5 and 15 MHz Band for SX-190 make sure that those frequency error are within 1 KHz.
- (5) Rotate the band SW to 14 MHz and adjust TC7 to 17.920 MHz, rotate the band SW to 7 MHz and adjust TC6 to 9.920 MHz, rotate the band SW to 3.5 MHz and adjust TC5 to 6.420 MHz for AX-190.

Or, rotate the band SW to 14 MHz and adjust TC10 to 16.920 MHz, rotate the band SW to 11.5 MHz and adjust TC9 to 14.420 MHz, rotate the band SW to 9.5 MHz and adjust TC8 to 12.420 MHz, rotate the band SW to 7.0 MHz and adjust TC7 to 9.920 MHz, rotate the band SW to 5.7 MHz and adjust TC6 to 8.620 MHz, rotate the band SW to 3.5 MHz and adjust TC5 to 6.420 MHz for SX-190.

The oscillation frequency of each bands are follow.

Band	OSC Freq.
3.5 MHz	6.420 MHz
5.7	8.620
7	9.920
9.5	12.420
11.5	14.420
14	16.920
15	17.920
17.5	20.420
21	23.920
27	29.920
28.0	30.920
28.5	31.420
29.0	31.920
29.5	32.420

5) Preselector (RF) Amplifier

- (1) Control settings:
 - RF Gain - Full clockwise
 - AF Gain - Adjust for desired audio level
 - Function - AM
 - Q-Multi - OFF
 - Band SW - 14 MHz Band
 - Preselector- Just on mark "14"
 - Main dial - Marked "0"

- (2) Connect the VTVM and 8 ohms dummy load to SPK jack.
 - (3) Connect the signal generator to the antenna jack and adjust the frequency to 14 MHz.
 - (4) Adjust L4, L5 and L6 on the RF PCB to maximum output.
 - (5) Rotate the Band SW to 27 MHz Band, the preselector dial to just on marked "27" and main dial to marked "500".
 - (6) Adjust the frequency of the signal generator to 27 MHz.
 - (7) Adjust TC1, TC2, and TC3 on the 3 gangs preselector variable capacitor to maximum output.
 - (8) Rotate the Band SW to 3.5 MHz, the preselector dial to just on marked "3.5" and main dial to marked "0".
 - (9) Adjust the frequency of the signal generator to 3.5 MHz.
 - (10) Adjust the Ti, T2 and T3 on the RF PCB to maximum output.
 - (11) Repeat steps (3) thru (10) until no interaction is obtained and all transformers and trimmers are turned for maximum output.
- 6) 100 KHz crystal calibrator
- (1) Control settings:
 - RF Gain - Maximum clockwise
 - AF Gain - Adjust for desired audio level
 - Band SW - 15 MHz Band
 - Preselector - 15 MHz
 - Q-Multi - OFF
 - Function - AM
 - CAL - OFF
 - (2) Connect the speaker to the SPK jack.
 - (3) Connect the antenna to the ANT jack.
 - (4) Turn the main dial to 15.000 MHz to receive the WWV signal.
 - (5) Push the 100 KHz CAL knob listen for beat sound.
 - (6) Adjust the TC17, on the CAL PCB, to get zero beat sound.

7) Reject and Select Alignment

- (1) Control settings:
 - RF Gain - Full clockwise
 - AF Gain - Full counterclockwise
 - Function - AM
- (2) Receive one of the calibration signals.
- (3) Q-multiplier SW to Reject position and set the tune knob to the center.
- (4) Adjust VR15 on the IF PCB to minimum reading on the S-meter.
- (5) Q-Multiplier SW to Select position.
- (6) Adjust the RF Gain control to indicate S3 or S4.
- (7) Adjust VR16 on the IF PCB to maximum reading on the S-meter but no oscillation when rotating the tuning knob.

8) LSB and USB Crystal oscillator

- (1) Control settings:
 - RF Gain - Full clockwise
 - AF Gain - Adjust for desired audio level
 - Band SW - Any band but additional band
 - Preselector - Adjust to the selected frequency band.
 - Q-Multi - OFF
 - CAL SW - Push the 100 KHz knob
 - Main dial - Set to receive one of the calibration signal
 - Function - USB or LSB
- (2) Connect the speaker to the SPK Jack.
- (3) Tune lower core of T12 to get beat sound.
- (4) The activity of the LSB and USB crystals (X11 and X12) should be approximately the same for both positions of the Function switch.
- (5) Adjust the upper core of T12 to maximum audio output.

9) Trap Coil (L1, L2, L3)

- (1) Control settings:
 - RF Gain - Full clockwise
 - AF Gain - Adjust for desired audio level
 - Band SW - 3.5 MHz
 - Preselector - 3.5 MHz
 - Main dial - "0"
 - Function - AM

- (2) Connect the VTVM and 8 ohms load to the SPK jack.
- (3) Connect the signal generator to the ANT jack and adjust the frequency to 2.920 MHz.
- (4) Adjust L1 to minimum reading on the VTVM.
- (5) Change the frequency of the signal generator to 3.500 MHz.
- (6) Adjust L3 to 3 dB decrease point on the VTVM.
- (7) Change the frequency of the signal generator to 30 MHz.
- (8) Band SW rotate to 29.5 MHz, preselector dial to 30 MHz and main dial to "500"
- (9) Adjust L2 to 3 dB decrease point on the VTVM.

5. Printed circuit board part location and its schematic diagram

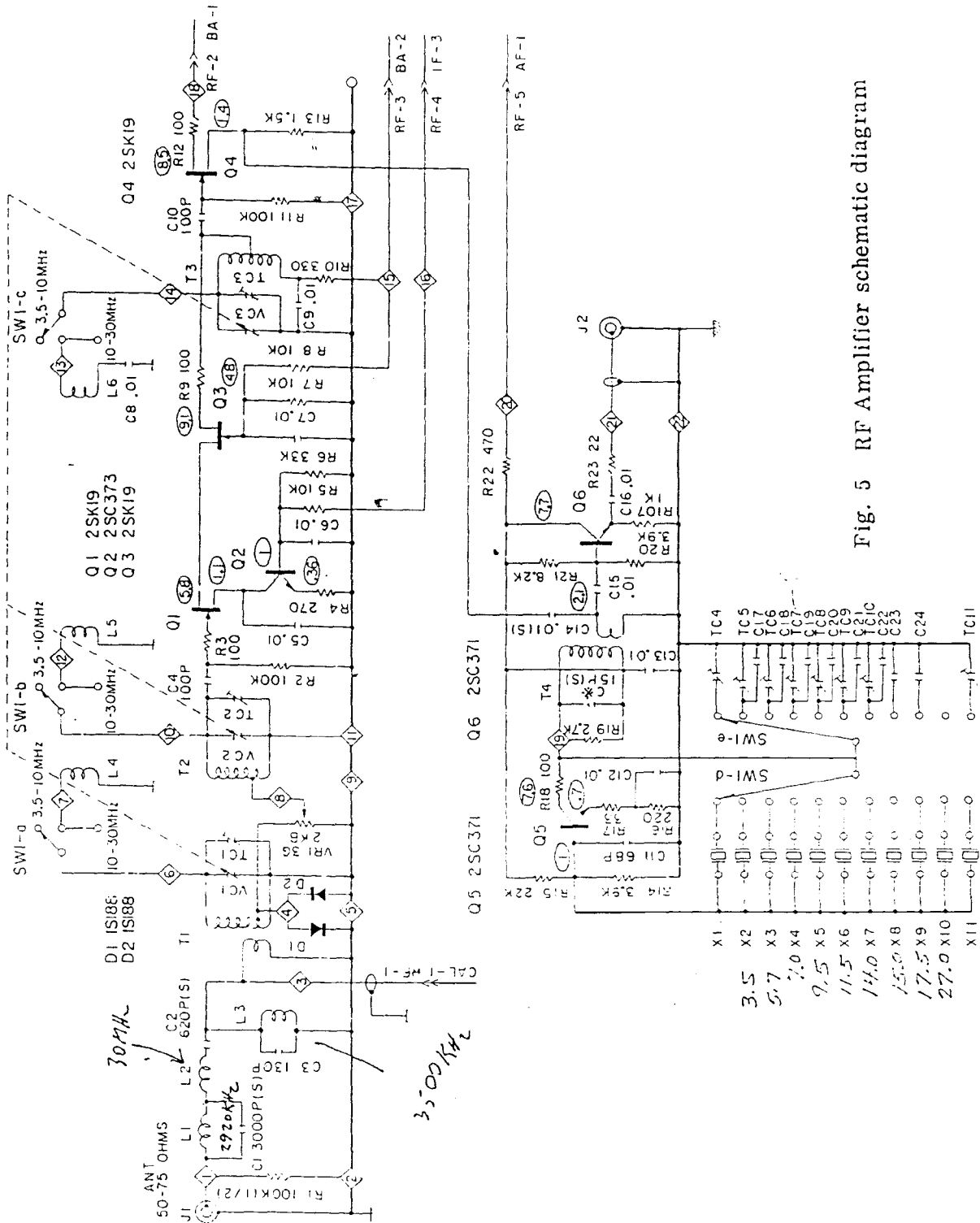


Fig. 5 RF Amplifier schematic diagram

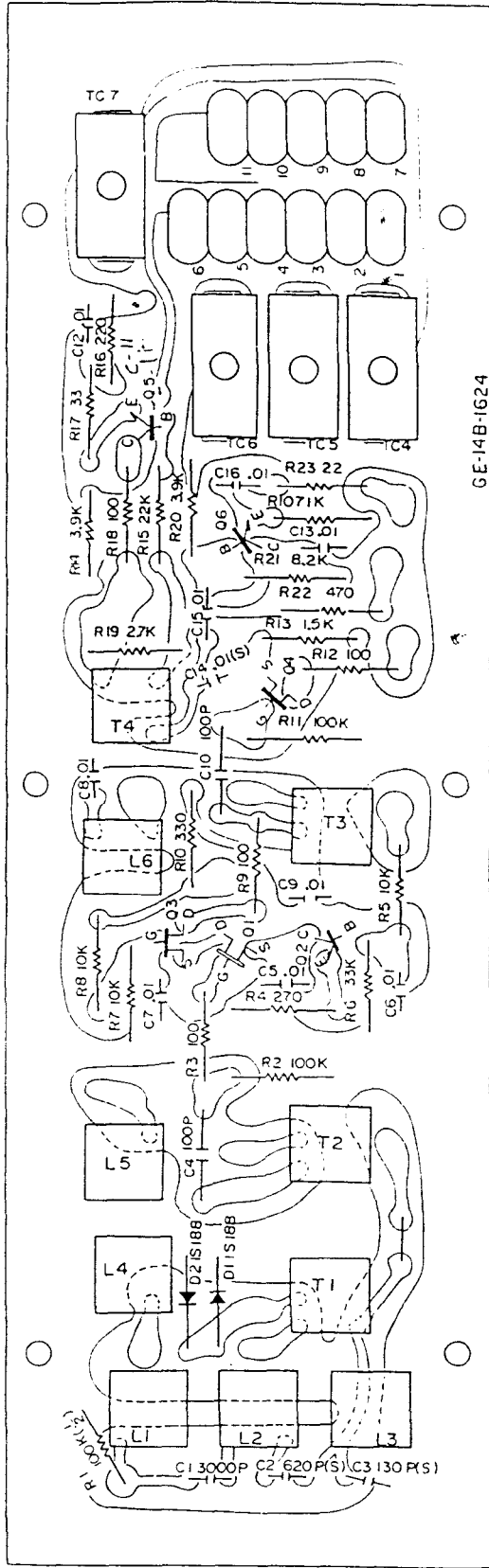


Fig. 6 RF PCB top view

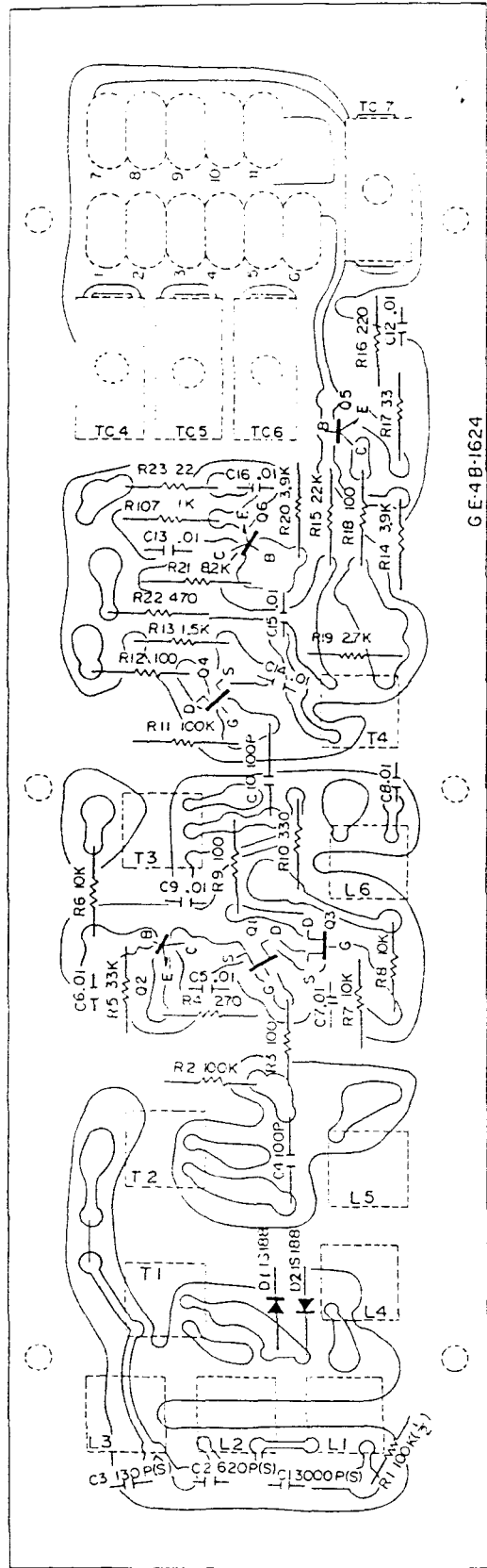


Fig. 7 RF PCB rear view

Q7 2SC372

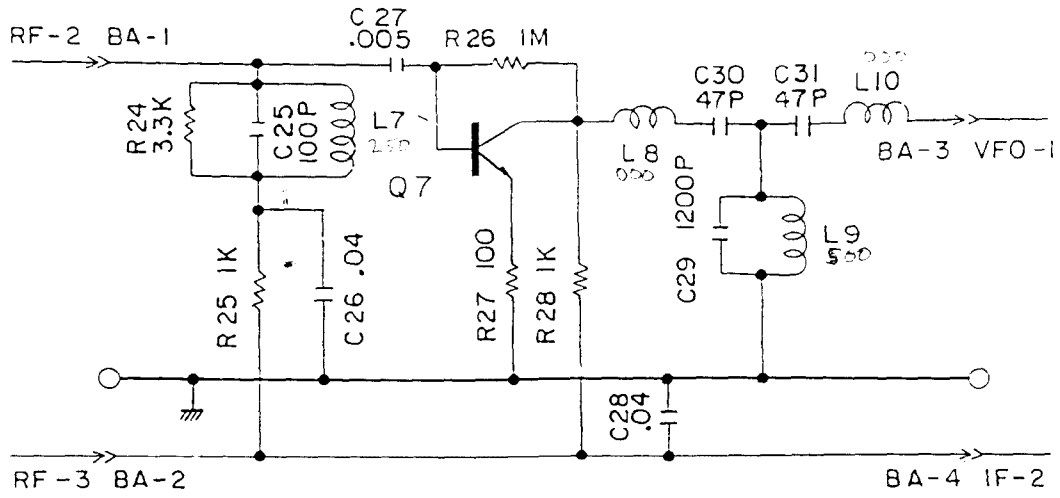
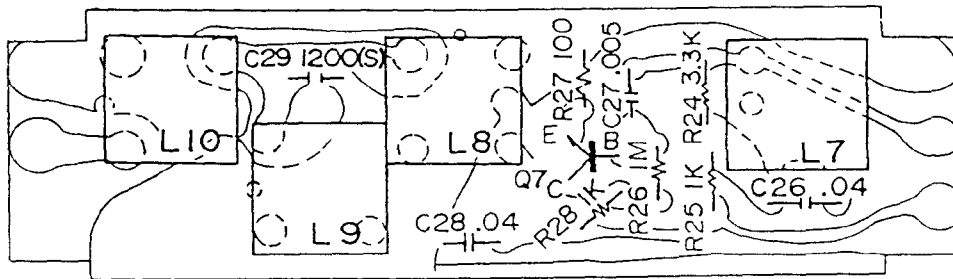


Fig. 8 Buffer Amplifier schematic diagram.



GE-15D-1661

Fig. 9 Buffer Amplifier PCB top view.

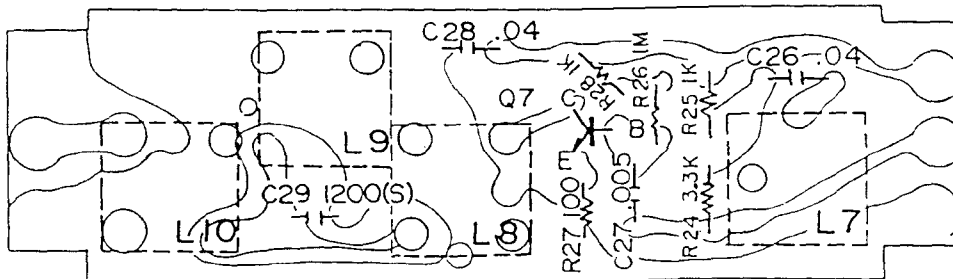


Fig. 10 Buffer Amplifier PCB rear view

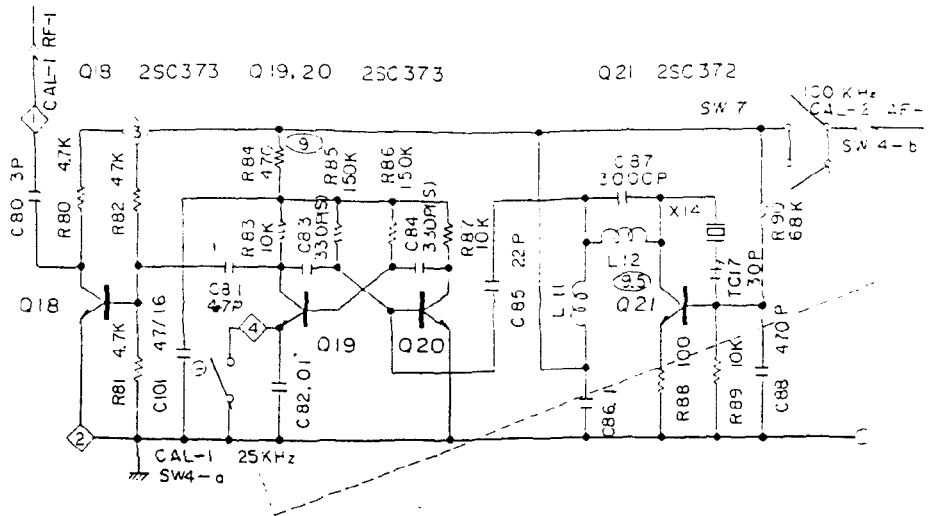
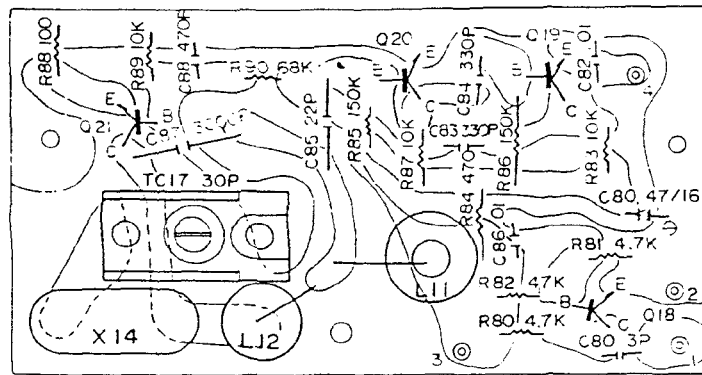


Fig. 11 Calibrator schematic diagram



GE-15D-2163

Fig. 12 Calibrator PCB top view

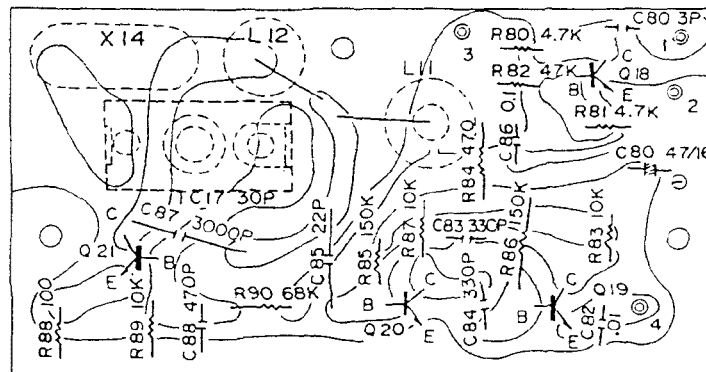


Fig. 13 Calibrator PCB rear view

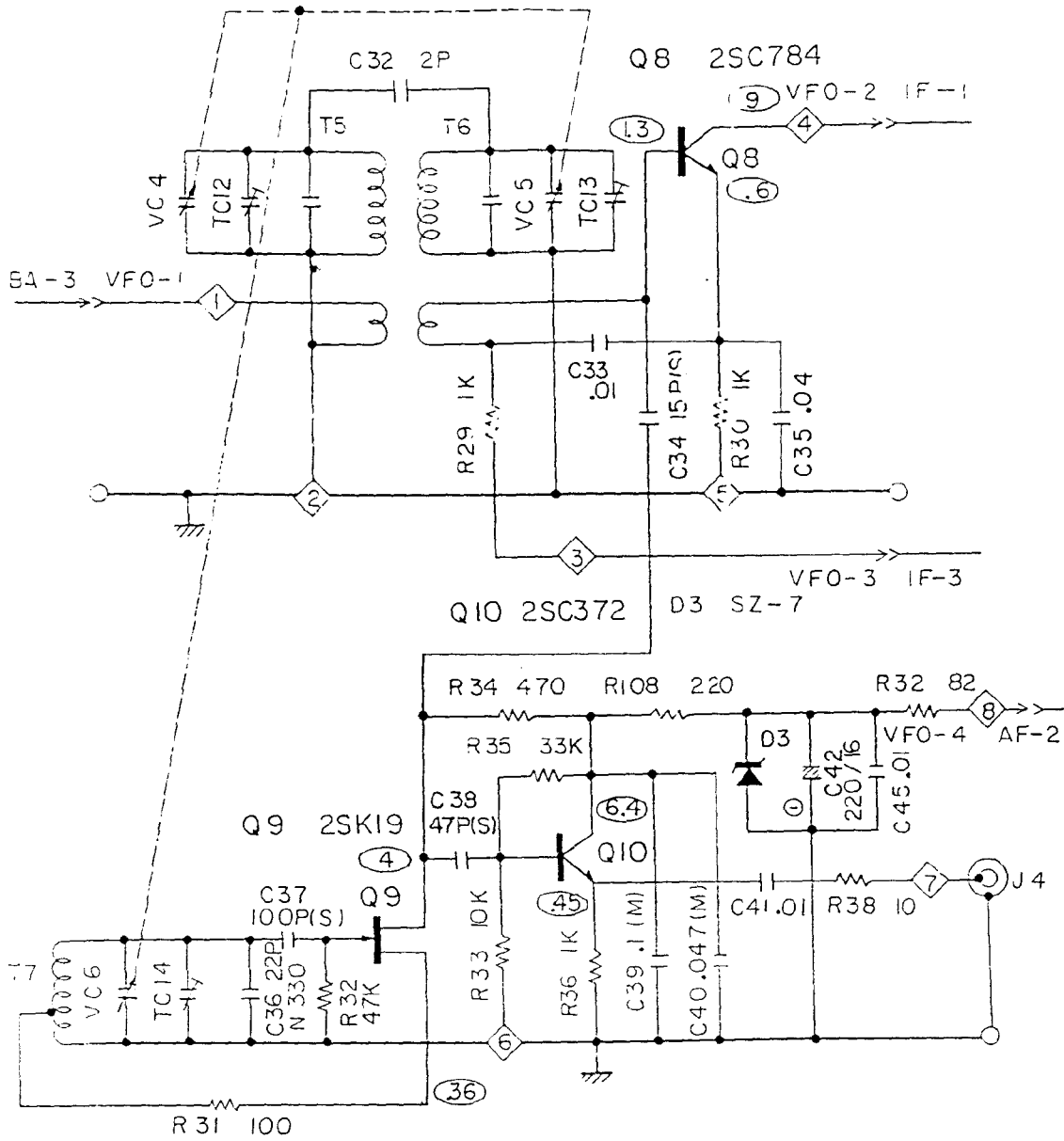


Fig. 14 VFO schematic diagram

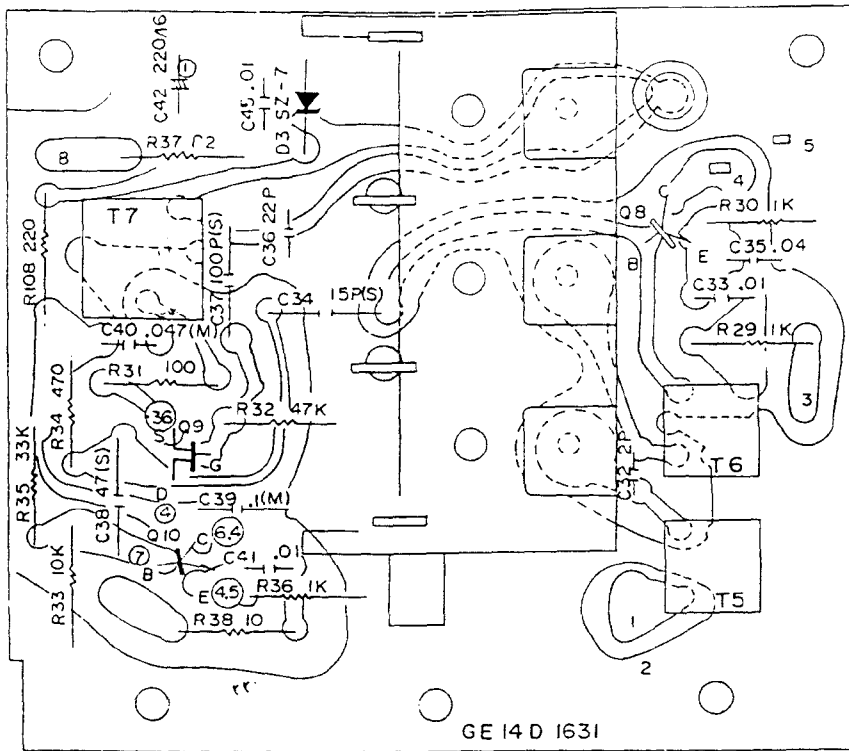


Fig. 15 VFO PCB top view

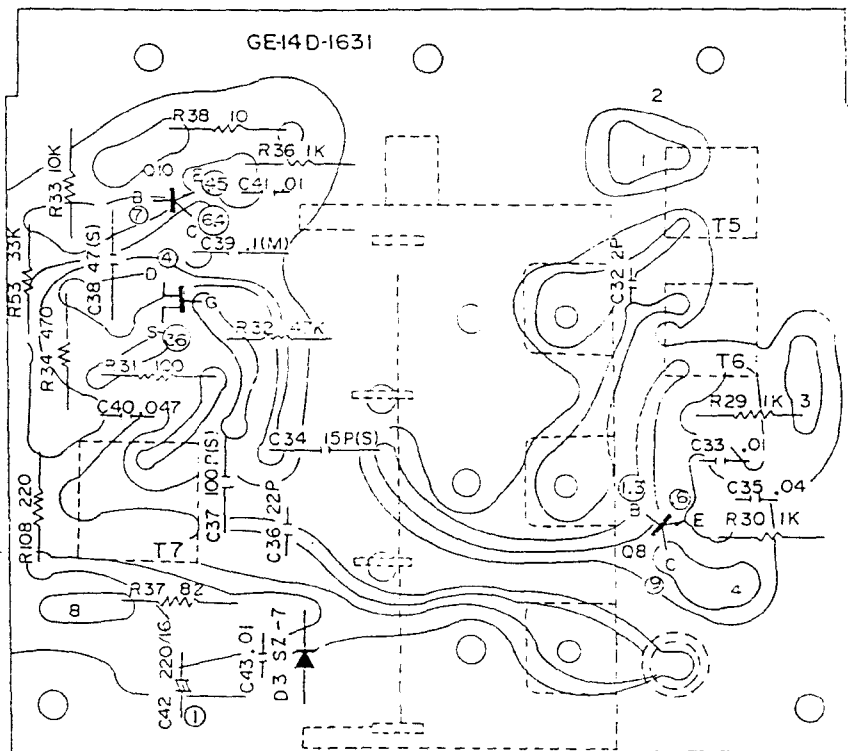


Fig. 16 VFO PCB rear view

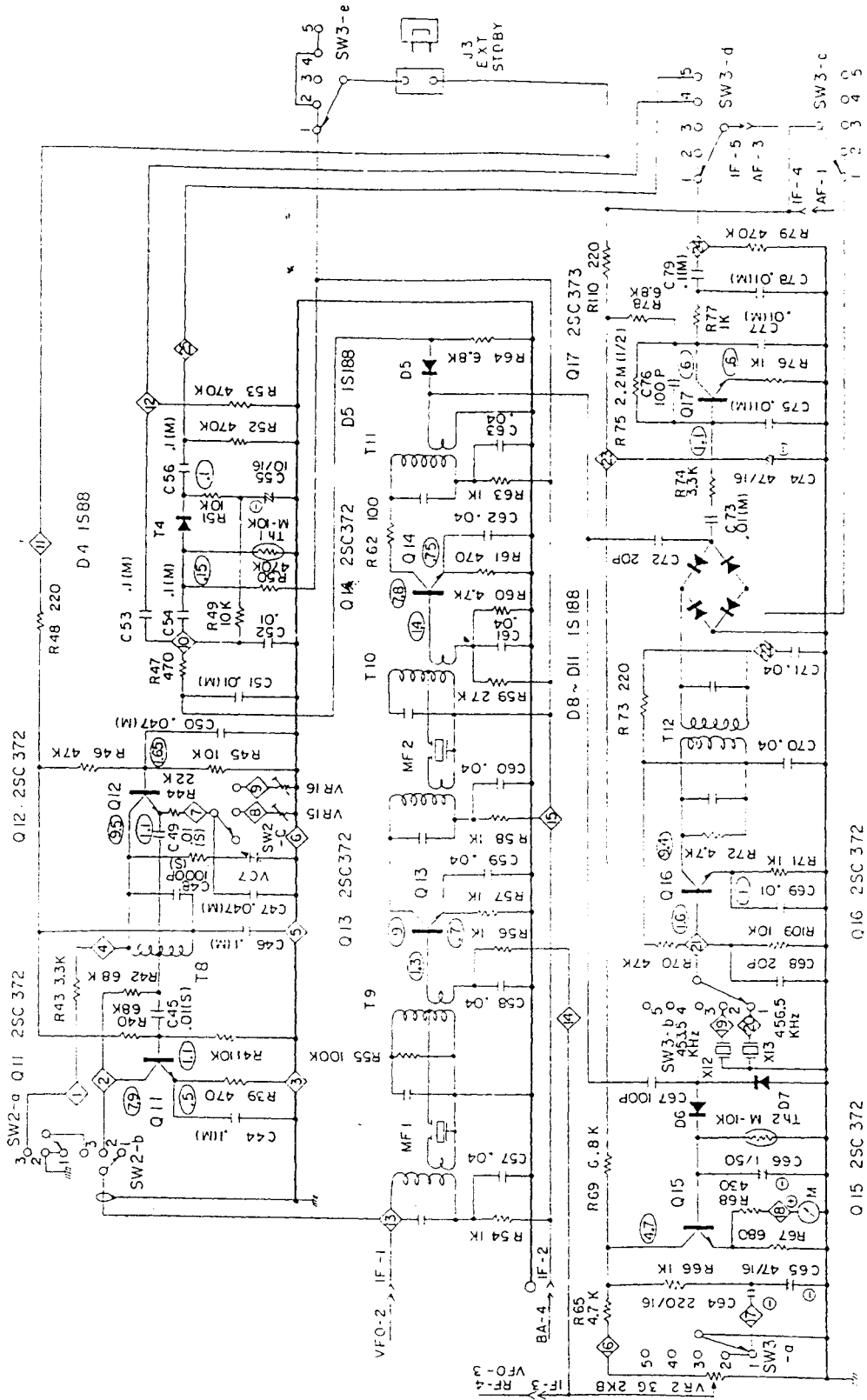


Fig. 17 IF schematic diagram

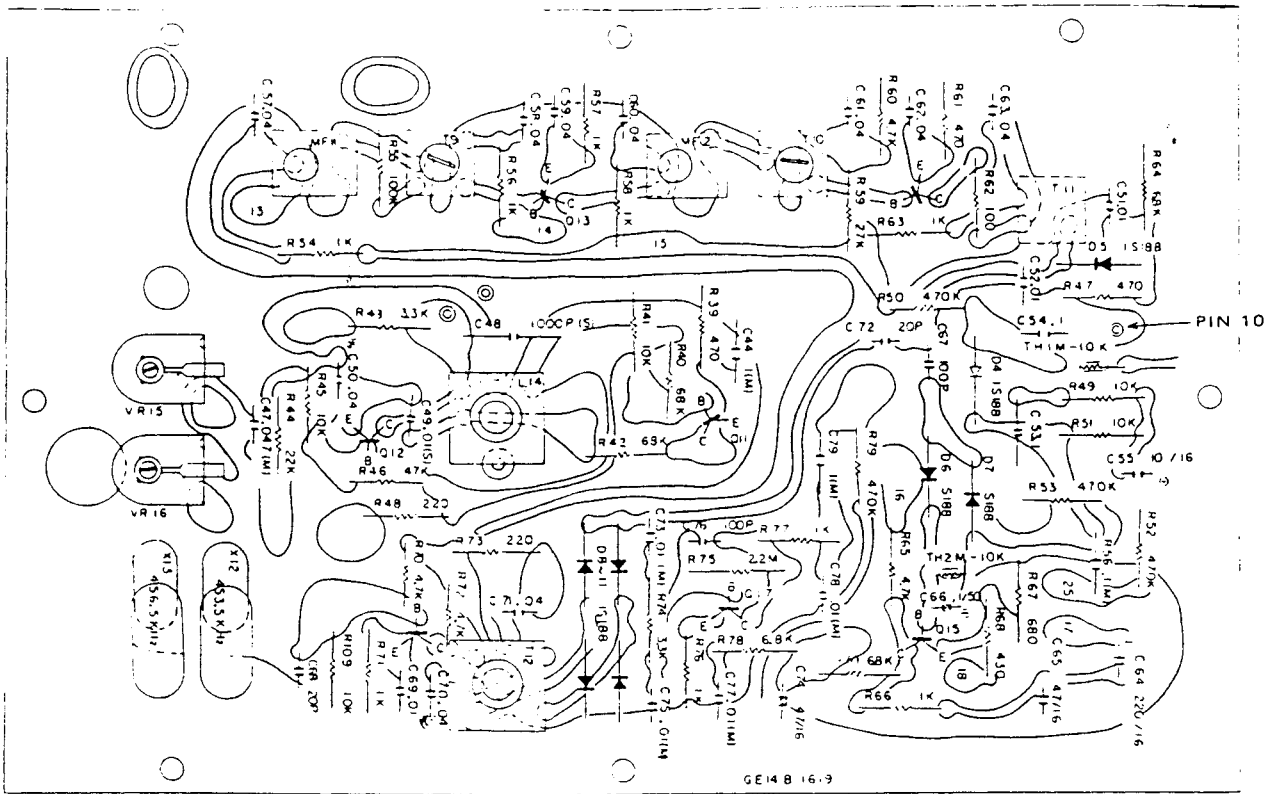


Fig. 18 IF PCB top view

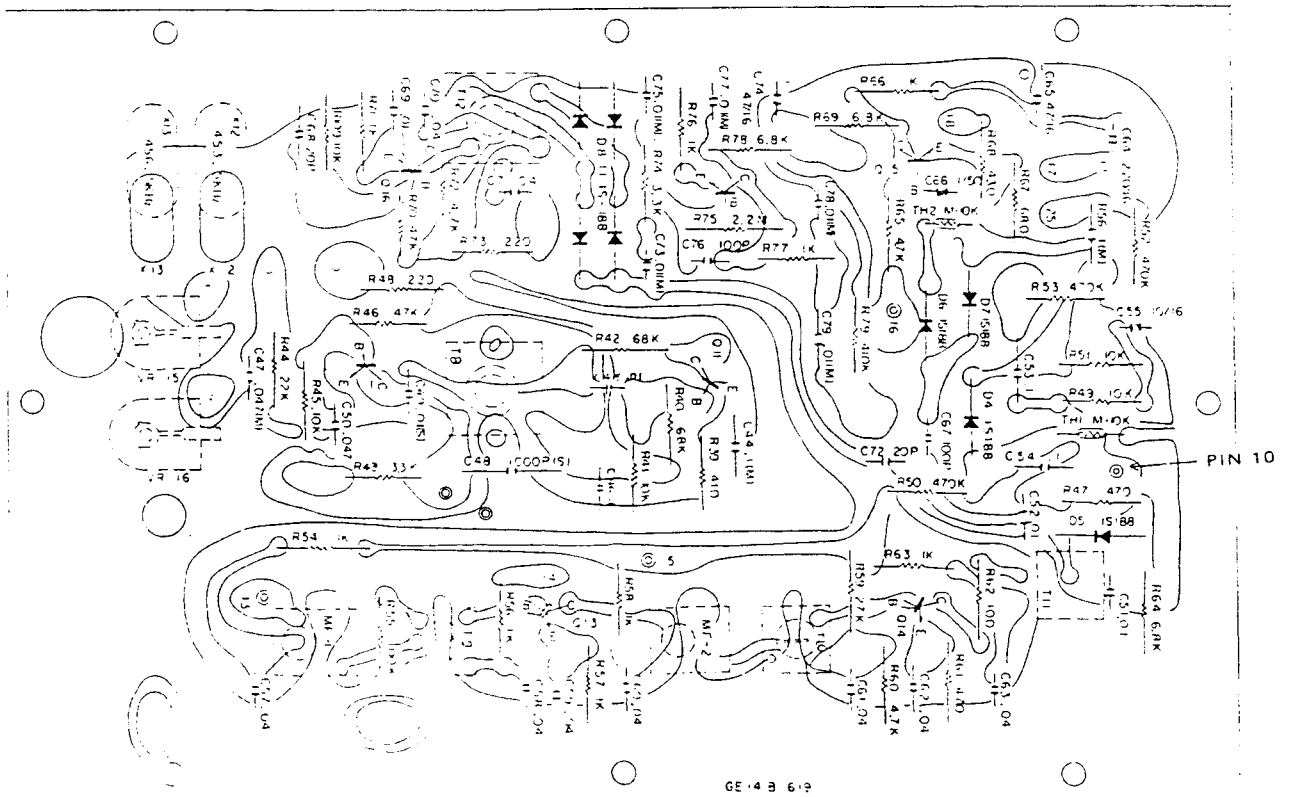


Fig. 19 IF PCB rear view

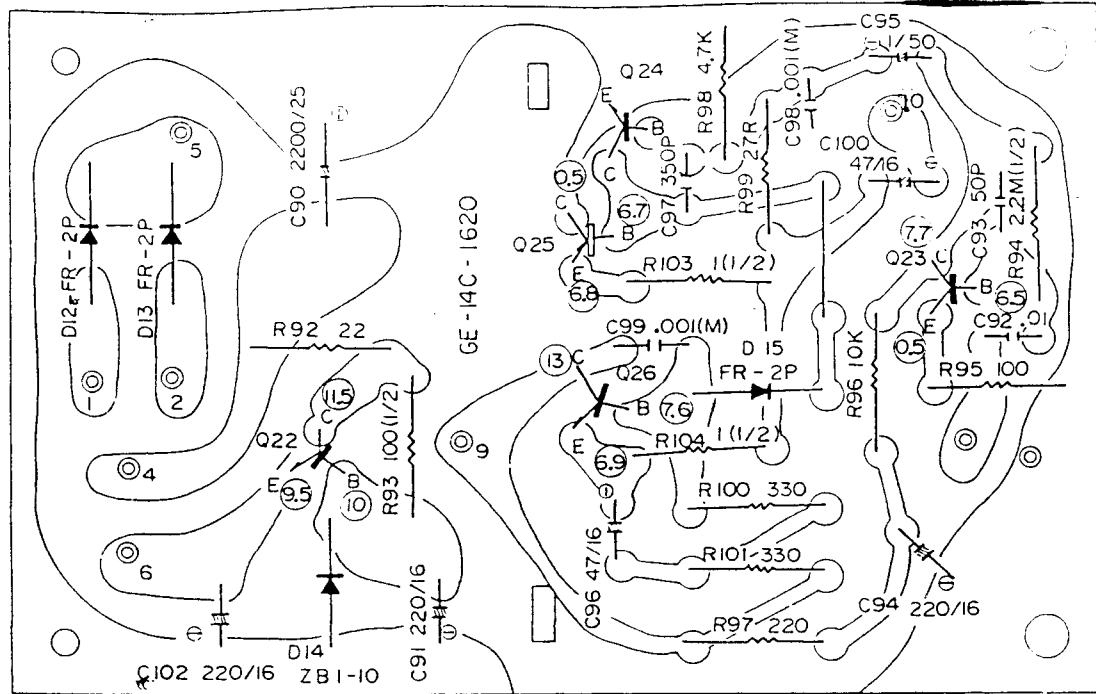


Fig. 21 AF PCB top view

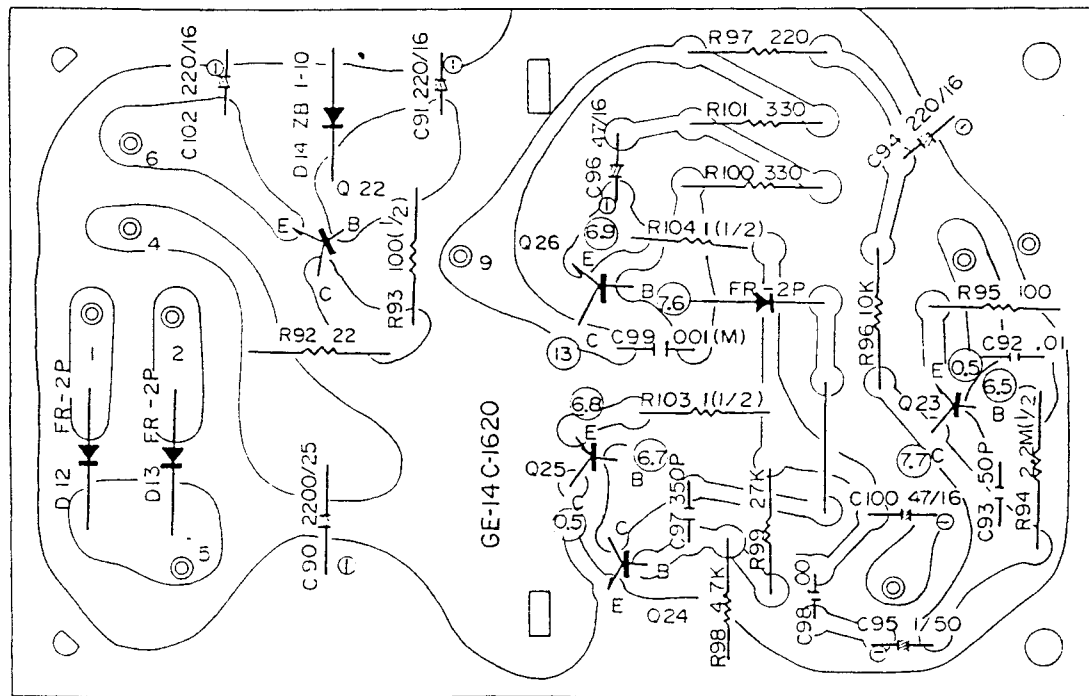


Fig. 22 AF PCB rear view

6. General schematic diagram

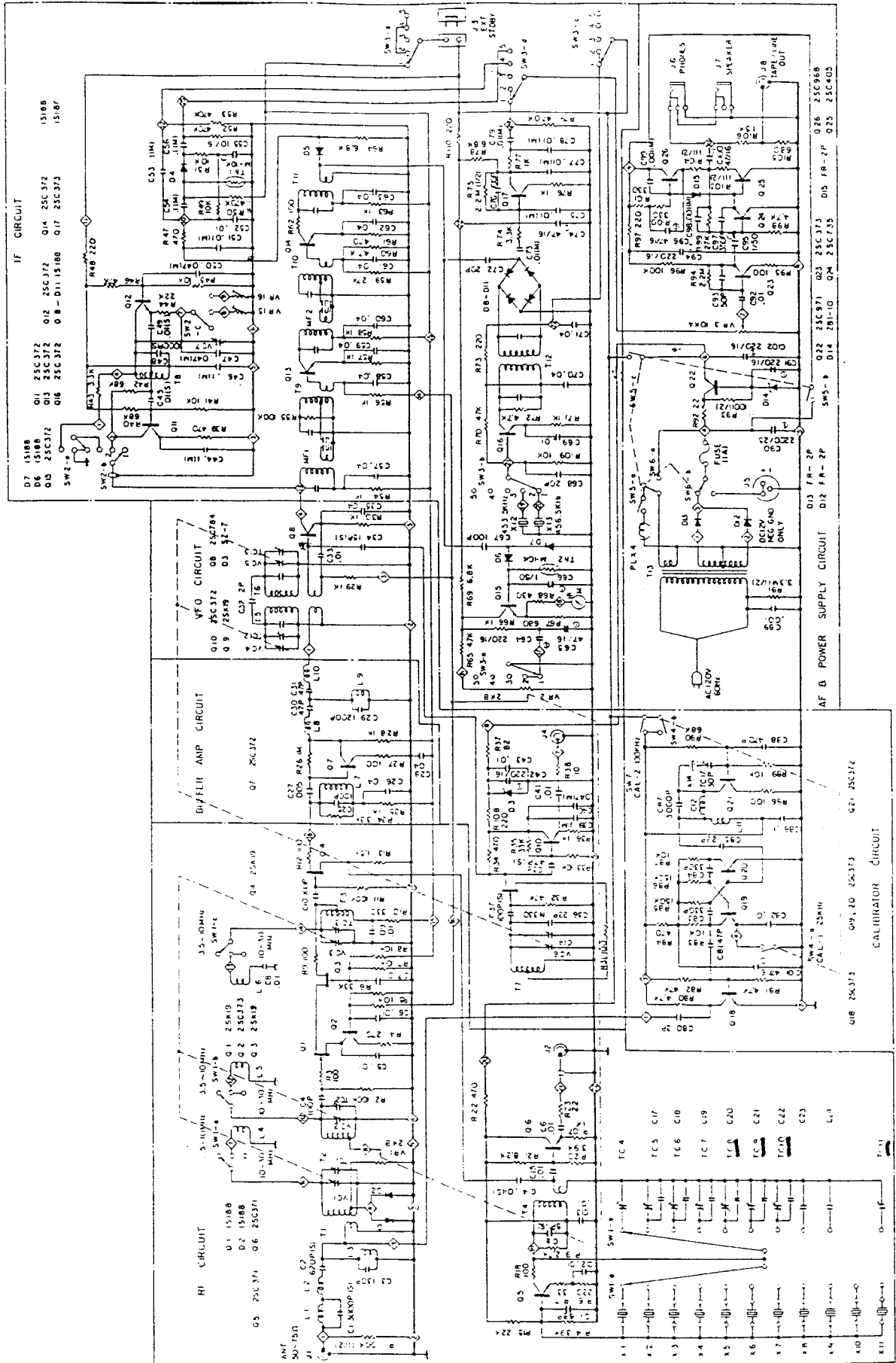


Fig. 23 General schematic diagram

REMARKS: RESISTANCE VALUES IN OHMS K=1000 M=1000000 CAPACITANCE VALUES IN MF P. MMF

5X190. ONLY.

7. PARTS LIST

SYMBOL NO.	DESCRIPTION	RATING OR STOCK NO.	REMARKS
Q1	FET	2 SK 19 (V)	
Q2	Transistor	2 SC 373	
Q3, 1	FET	2 SK 19 (V)	
Q5	Transistor	2 SC 371 (O)	
Q6	"	2 SC 371 (V)	
Q7	"	2 SC 372 (V)	
Q8	"	2 SC 784 (O)	
Q9	FET	2 SK 19 (V)	
Q10, 11, 12, 13	Transistor	2 SC 372 (V)	
14, 15, 16			
Q17, 18, 19, 20	Transistor	2 SC 373	
Q21	"	2 SC 372 (V)	
Q22	"	2 SC 371 (C)	
Q23	"	2 SC 372 (V)	
Q24	"	2 SC 735 (V)	
Q25	"	2 SC 405	
Q26	"	2 SC 968 (C)	
D1, 2	DIODE	1S 188 FM	
D3	"	SZ-710%	
D4 - 11	"	1S 188 FM	
D12, 13	"	FR-2	
D14	"	ZD-1-10	
D15	"	FR-2	
T111, 2	Thermistor	M-10K	
R1	Fixed Resistor 1/2W	100 K ohm	
R2	"	100 K ohm	
R3	"	100 ohm	
R4	"	270 ohm	
R5	"	10 K ohm	
R6	"	33 K ohm	
R7, 8	"	10 K ohm	
R9	"	100 ohm	
R10	"	330 ohm	
R11	"	100 K ohm	
R12	"	100 ohm	
R13	"	1.5 K ohm	
R14	"	3.9 K ohm	
R15	"	22 K ohm	
R16	"	220 ohm	
R17	"	33 ohm	
R18	"	100 ohm	
R19	"	2.7 K ohm	
R20	"	3.9 K ohm	
R21	"	8.2 K ohm	

SYMBOL NO.	DESCRIPTION	RATING OR STOCK NO.	REMARKS
R22	Fixed Resistor 1/4W	470 ohm	
R23	"	22 ohm	
R24	"	3.3 K ohm	
R25	"	1 K ohm	
R26	"	1 M ohm	
R27	"	100 ohm	
R28	"	1 K ohm	
R29	"	1 K ohm	
R30	"	1 K ohm	
R31	"	100 ohm	
R32	"	47 K ohm	
R33	"	10 K ohm	
R34	"	470 ohm	
R35	"	33 K ohm	
R36	"	1 K ohm	
R37	"	82 ohm	
R38	"	10 ohm	
R39	"	470 ohm	
R40	"	68 K ohm	
R41	"	10 K ohm	
R42	"	68 K ohm	
R43	"	3.3 K ohm	
R44	"	22 K ohm	
R45	"	10 K ohm	
R46	"	47 K ohm	
R47	"	470 ohm	
R48	"	220 ohm	
R49	"	10 K ohm	
R50	"	470 K ohm	
R51	"	10 K ohm	
R52, 53	"	470 K ohm	
R54	"	1 K ohm	
R55	"	100 K ohm	
R56	"	1 K ohm	
R57	"	1 K ohm	
R58	"	27 K ohm	
R59	"	4.7 K ohm	
R60	"	470 ohm	
R61	"	100 ohm	
R62	"	1 K ohm	
R63	"	6.8 K ohm	
R64	"	4.7 K ohm	
R65	"	1 K ohm	
R66	"	680 ohm	
R67	"	430 ohm	
R68	"		

SYMBOL NO.	DESCRIPTION	RATING OR STOCK NO.	REMARKS
R69	Fixed Resistor 1/4W	6.8 K ohm	
R70	"	47 K ohm	
R71	"	1 K ohm	
R72	"	4.7 K ohm	
R73	"	220 ohm	
R74	"	3.3 K ohm	
R75	"	2.2 M ohm	
R76	"	1 K ohm	
R77	"	1 K ohm	
R78	"	6.8 K ohm	
R79	"	470 K ohm	
R80	"	4.7 K ohm	
R81	"	4.7 K ohm	
R82	"	47 K ohm	
R83	"	10 K ohm	
R84	"	470 ohm	
R85	"	150 K ohm	
R86	Fixed Resistor 1/4W	150 K ohm	
R87	"	10 K ohm	
R88	"	100 ohm	
R89	"	10 K ohm	
R90	"	68 K ohm	
R91	"	3.3 M ohm	
R92	"	22 ohm	
R93	"	100 ohm	
R94	"	2.2 M ohm	
R95	"	100 ohm	
R96	"	10 K ohm	
R97	"	220 ohm	
R98	"	4.7 K ohm	
R99	"	27 K ohm	
R100	"	330 ohm	
R101	"	330 ohm	
R102	"	4.7 ohm	
R103	"	4.7 ohm	
R104	"	680 ohm	
R105	"	1.5 K ohm	
R106	"	1 K ohm	
R107	"	1 K ohm	
C1	Styrol capacitor	3000PF	SOA-III-302J
C2	"	620PF	SOC-III-621J
C3	"	130PF	SOC-III-131J
C4	Styrol or Disc ceramic	100PF	SOA-III-101J or FCC 100PF
C5	Disc ceramic	.01MF	MMC-50 .01
C6 - C9	"	.01MF	MMC-50 .01

SYMBOL NO.	DESCRIPTION	RATING OR STOCK NO.	REMARKS
C10	Styrol or Disc ceramic	100PF	SOA-III-101J or FCC 100PF
C11	"	68PF	SOA-III-680J or FCC 68PF
C12, 13	Disc ceramic	.01MF	MMC-50 .01
C14	"	.01MF	"
C15	Styrol capacitor	.01MF	SOC-III-103J
C16	Disc ceramic	.01MF	MMC-50 .01
C17	Styrol capacitor	510PF	For AX-190
C18	Styrol or Disc ceramic	150PF	"
C19	"	47PF	"
C20	"	68PF	"
C21	"	47PF	"
C22	"	10PF	"
C17	Styrol capacitor	510PF	For SX-190
C18	"	250PF	"
C19	Styrol or Disc ceramic	220PF	"
C20	"	100PF	"
C21	"	68PF	"
C22	"	47PF	"
C23	"	68PF	"
C24	"	57PF	"
C25	"	100PF	with in 1.7
C26	Disc ceramic	.04MF	MMC-90 .04
C27	"	.05MF	MMC-50 .005
C28	"	.04MF	MMC-90 .04
C29	Styrol capacitor	1200PF	SOC-III-122J
C30	"	47PF	with in L8
C31	"	47PF	with in L10
C32	Disc ceramic	2PF	FC-50 2P (M)
C33	"	.01MF	MMC-50 .01
C34	Styrol capacitor	15PF	SOA-III-150M
C35	Disc ceramic	.01MF	MMC-90 .01
C36	"	22PF	FCS-60 marked GRN
C37	Styrol capacitor	100PF	SOA-III-101J
C38	"	47PF	SOA-III-170K
C39	Mylar capacitor	.1MF	"
C40	"	.017MF	"
C41	Disc ceramic	.01MF	MMC-50 .01
C42	Electrolytic	220MF 16VV	CE-01WIC 220
C43	Disc ceramic	.01MF	MMC-50 .01
C44	Mylar capacitor	.1MF	"
C45	Styrol capacitor	.01MF	SOC-III-103J
C46	Mylar capacitor	.1MF	"
C47	"	.017MF	"

top f 200
 top f 100
 30
 40

700
 100
 30

SYMBOL NO.	DESCRIPTION	RATING OR STOCK NO.	REMARKS
C48	Syrol capacitor	1000PF	SOA-III-102J
C49	"	.01MF	SOA-III-103J
C50	Mylar capacitor	.047MF	
C51	Disc ceramic	.02MF	MMC-50 .02
C52	"	.02MF	MMC-50 .02
C53	Mylar capacitor	.1MF	
C54	"	.1MF	
C55	Electrolytic	10MF 16VV	CE-04WIC 100
C56	Mylar capacitor	.1MF	
C57 - 63	Disc ceramic	.01MF	MMC-90 .04
C61	Electrolytic	220MF 16VV	CE-04WIC 220
C65	"	47MF 16VV	CE-04WIC 470
C66	"	1MF 50VV	CE-04WH 010
C67	Disc ceramic	100PF	FC-70 100P (M)
C68	"	20PF	FC-50 20P (M)
C69	"	.01MF	MMC-50 .01
C70 - 71	"	.04MF	MMC-90 .04
C72	"	20PF	FC-50 20P (M)
C73	Mylar capacitor	.01MF	CE-04WIC 470
C74	Electrolytic	.01MF	
C75	Mylar capacitor	100PF	FC-70 100P (M)
C76	Disc ceramic	.01MF	
C77	Mylar capacitor	.01MF	
C78	Mylar capacitor	.1MF	
C79	"	.1MF	
C80	Disc ceramic	3PF	FC-50 3P (M)
C81	Syrol capacitor	47PF	SOA-III 470K
C82	Disc ceramic	.01MF	MMC-50 .01
C83, 84	Syrol capacitor	330PF	SOC-III-331J
C85	"	22PF	SOA-III-220M
C86	Disc ceramic	.1MF	MMC-135 .1
C87	"	3000PF	SOA-III 302J
C88	"	470PF	SOC-III-471J
C89	Oil capacitor	0.001 600VV	UL
VCI, 2, 3	Variable capacitor	C635AH9	
VC4, 5, 6	"	C532CH5	
VC6	"	100PF	with VCI, 2, 3
TC1, 2, 3	Trimmer capacitor	30P BIM-2	
TC4	"	200P B2M	
TC5	"	100P B4M	
TC6	"	30P BIM-2	
TC7	"	30P BIM-2	
TC8	"	30P BIM-2	
TC9	"	30P BIM-2	only with SX-190
TC10	"	30P BIM-2	"
TC11	"	30P BIM-2	"

SYMBOL NO.	DESCRIPTION	RATING OR STOCK NO.	REMARKS
TC12	Trimmer capacitor		
TC13	"		
TC14	"		
TC17	"		
TI, 2, 3	3.5-10 MHz ANT/RF coil		
T4	HFO Coil		
T5, 6	1st IF Coil		
T7	VFO Coil		
T8	Q-Multiplier		
T9, 10	455 KHz IF		
TI1	"		
TI2	DFO Coil		
TI3	Power Transformer		
L1	2.920 MHz Trap		
L2	LPF		
L3	HPF		
L4, 5, 6	10-30 MHz ANT/RF		
L7	Buffer Amp		
L8	"		
L9	"		
L10	"		
L11	2 mH		
L12	250 μ H		
MF1	Mechanical Filter		
MF2	"		
PCB	RF		
Xtal	Buffer Amp		

SYMBOL NO.	DESCRIPTION	RATING OR STOCK NO.	REMARKS
ATI-7			on the VC4
ATI-7			" VC5
ATI-6			
30P BIM-2			
R2970			
R2910			
R2906			
VGAQR2007FBU			
IY8012B			
R2907 (YEL)			
R8579C (BLK)			
R2923			
Y0135			
R2910			
R2912			
R2911			
R2908			
R2904			
R2909			
R2905			
R2909			
9LNC-009			
4LNC-025			
MFIH-40K			
"			
GE-14B-1624			For 3.5 MHz Band
GE-14D-1661			For 5.7 MHz Band
GE-14D-1631			For 7.0 MHz Band
GE-14B-1618			For 9.5 MHz Band
GE-14C-1620			For 11.5 MHz Band
GE-14D-1621			For 14.0 MHz Band
8.620 MHz			For 15.0 MHz Band
9.920 MHz			For 17.5 MHz Band
12.420 MHz			For 21.0 MHz Band
14.420 MHz			For 27.0 MHz Band
16.920 MHz			For 28.0 MHz Band
17.920 MHz			For 28.5 MHz Band
20.420 MHz			For 29.0 MHz Band
23.920 MHz			For 29.5 MHz Band
29.920 MHz			
30.920 MHz			
31.420 MHz			
31.920 MHz			
32.420 MHz			

SYMBOL NO.	DESCRIPTION	RATING OR STOCK NO.	REMARKS
	IIC 6/11	456.5 KHz	
	"	453.5 KHz	
	IIC 13/11	100 KHz	
	Xtal socket	SD-0105	(UL)
	Fuse Holder	SN-1301	
	Coupling	SX-3501	
SW1	Rotary switch	Y5511 3801166	SX-190
	"	" 3801165	AX-190
SW2	"	F365	
SW3	"	F133	
SW4	CAL SW	2FS-1 - 17B	
SW5	Power SW	1FS-1 - 7B	
SW6	AC/DC SW	GP9L	
VR 1, 2, 3	RF/AF Volume	2KX2 10KA JF10A	
VR 15, 16	Semifixed Volume	50K ohm B	
J1	Ant jack	UIHF R-3	
J2	HFO Out jack	15D-2066	# 19406
J3	EXT STDBY jack	No 3822	
J4, 8	VFO/TAPE Out jack	#9203	
J5	DC jack	No 1476 3P	
J6, 7	Phone jack	SG-7615	
	Fuse	1A-125V	
	Station	1L 2P	
	Feet	#7109	
	"	#2192	additional one
	Pilot lamp	14V 80mA	310 L
	"	"	220 L
	"	"	190 L
	S-meter	S10 200 μ A	
	AC cord	6 feet	UL
	Cord Strain Relief	3P-1	Heyco
	Pully	40 ϕ	
	Spring	25 L	
	Knob		
	Main dial	GE-15D-1674A	
	Control W/mark	GE-15D-1911	
	" WO/mark	GE-15D-1911A	
	Band SW	GE-15D-2061	
	Function SW	GE-15D-2061	
	AF/RF	GE-15D-1912-1	
		GE-15D-1912-2	
	Preslector shaft	GE-15D-2211	
	Preslector dial	GE-15D-2565	For AX-190 or SX-190
	Main dial	GE-15D-1676	

SYMBOL NO.	DESCRIPTION	RATING OR STOCK NO.	REMARKS
	T Panel Assembly	GE-15A-2053	
	Spread dial	GE-15D-2043	
	Front Panel	GE-15B-2047	For AX-190 or SX-190
	Flame	GE-15B-2169	
	Shassis	GE-15A-2063	
	Back Plate Right	GE-15D-2167	
	" Left	GE-15B-2168	
	Cabinet Upper	GE-15B-2166	
	" Lower	GE-15B-2165	
	Main dial pointer	GE-15D-2213	
	Preslector pointer	GE-15D-2212	
	VFO box	GE-15B-1665	
	VFO box cover Upper	GE-15D-1666	
	" Lower	GE-15D-1667	
	Buffer Amp Case	GE-15D-2000	
	Heat sink saddle	GE-13A-972	
	" plate	GE-15D-2209	
	3C VC bracket	GE-15D-1667	
	" shield plate	GE-15D-2208	
	Preslector cover	GE-15D-2211	
	Pilot lamp mount bracket	GE-15D-2210	
	Gear	GE-15D-2198	
	PCB Stud	GE-15D-2175	
	Sleeve for main dial	GE-15D-2115	
	Sleeve for preslector	GE-11C-617	
	Fiber cover		
	Caution label		
	Model label		

8. Trouble shooting

Difficulty	Possible cause and check point
Completely does not work	<ul style="list-style-type: none"> a. Blow 1A fuse b. Faulty silicon diode D13, D14 c. Faulty power transformer T13 d. Faulty AC/DC switch e. Check the supply voltage f. Check the AF circuit
Completely does not work but remained little noise or hum.	<ul style="list-style-type: none"> a. Defective Q22 2SC971 b. Check the VFO c. Check the HFO d. Check each supply voltage
Extremely low sensitivity all Bands	<ul style="list-style-type: none"> a. Check each transistor voltage of IF PCB b. Check each transistor voltage of 1st IF circuit (Buffer amp and variable IF circuit) c. Check each transistor voltage of RF PCB
10-30 MHz Band does not work but 3.5-10 MHz works	<ul style="list-style-type: none"> a. Faulty L4, L5 or L6 b. Faulty band switch
10-30 MHz Band does not work and also 3.5-10 MHz too	<ul style="list-style-type: none"> a. Faulty T1, T2 or T3 b. Faulty band switch
3.5-10 MHz Band does not work but 10-30 MHz Band works	<ul style="list-style-type: none"> a. Faulty T1, T2 or T3 b. Faulty band switch
One or two Band does not work	<ul style="list-style-type: none"> a. Faulty one or two crystal of 1st local oscillator b. Faulty capacitor C17-C24 or TC4-TC11 c. Faulty band switch
Does not work Rejection and Selection	<ul style="list-style-type: none"> a. Check the voltage of Q12 b. Faulty Q12 c. Faulty T8 d. Faulty Q-Multi SW
Does not work Selection	<ul style="list-style-type: none"> a. Faulty VR16 b. Faulty Q-Multi SW
Does not work Rejection	<ul style="list-style-type: none"> a. Check the voltage of Q11 b. Faulty VR15 c. Faulty Q-Multi SW

Difficulty	Possible cause and check point
Both 100 KHz/25 KHz CAL does not work	<ul style="list-style-type: none"> a. Check the voltage of Q21 b. Faulty Q21 c. Faulty L11 or 12 d. Faulty Xtal
25 KHz CAL does not work	<ul style="list-style-type: none"> a. Check the voltage of Q19 & 20 b. Faulty Q19 or 20 c. Faulty C83, C84 or C85
No USB or LSB	<ul style="list-style-type: none"> a. Check the voltage of Q16 b. Faulty Q16 c. Faulty T12 d. Faulty X12 or X13 e. Faulty Function SW
Sound distorted on AM	<ul style="list-style-type: none"> a. Check the voltage of Q23, 24, 25 and 26 b. Faulty one or two of them
BFO works but sound distorted on SSB	<ul style="list-style-type: none"> a. Check the voltage of Q17 b. Faulty Q17 c. Faulty D8, 9, 10 or 10
No HFO output	<ul style="list-style-type: none"> a. Check the voltage of Q6 b. Faulty Q6 c. Faulty output jack J2
No VFO output	<ul style="list-style-type: none"> a. Check the voltage of Q10 b. Faulty Q10 c. Faulty output jack J4
Too mach frequency drift	<ul style="list-style-type: none"> a. Check the supply voltage to Q9 and 10 b. Faulty Q22, D14 or D3
S-meter does not work even strong signals	<ul style="list-style-type: none"> a. Check the voltage of Q15 b. Faulty Q15 c. Faulty D6 or 7 d. Faulty S-meter

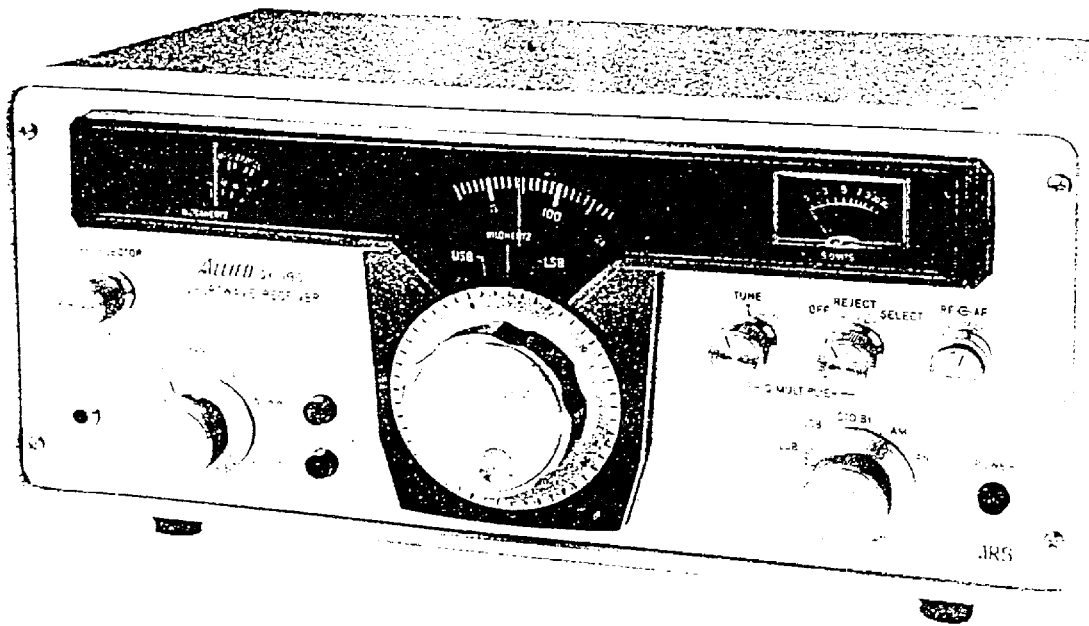
INSTRUCTION MANUAL

ALLIED[®]

SX-190

SOLID STATE

11 BAND SHORTWAVE RECEIVER



CAT. NO. 218

CUSTOM MANUFACTURED FOR
ALLIED RADIO SHACK  A TANDY CORPORATION COMPANY

UFDI OJDBMTQFDJGJDBUJPO!

Cbtjd!Gsf r v f odz!Dpwf sbhf !

+BeejypobrtCboe //611!L I {!cboe!x jeü !

+Dszt ubrtoputvqqrf e//4/6!up!21!N I {!

91!n f ú s!Cboe//4/6!up!5/1!N I {!

5: !n f ú s!Cboe//6/8!up!7/3!N I {!

51!n f ú s!Cboe!)I BN *//8/1!up!8/6! N I {!

42!n f ú s!Cboe!)X X WA !21!N I { *//: /6!up!21/1!N I {!

36!n f ú s!Cboe//22/6!up!23/1!N I {!

31!n f ú s!Cboe!)I BN *//25/1!up!25/6!N I {!

2: !n f ú s!Cboe!)X X WA 26!N I { *//26/1!up!26/6!N I {!

27!n f ú s!Cboe//28/6!up!29/1!N I {!

22!n f ú s!Cboe!)DC*//38/1!up!38/6!N I {!

+Dszt ubrtoputvqqrf e//21/1!up!41/1!N I {!

Ovn cf slpdt f n jdpoevdust ///5!GFU!33!US-!24!ejpef t-!3!{ f of st !boe!3!ú f sn jt ú st !

JG!Gsf r v f odj f t //3/531!N I {!up!3/: 31!N I {!}Wbsjbcfrn*!boe!566!L I {!

Sf df qjpo //BN -!DX -!boe!Tjohrft jef cboe!)TTC*!

Tf otjwjuz!.!BN //Mf tt!ú bo!2!n jdspwprdgps21!ec!T00!sbjyp!

Tf otjwjuz!TTC0DX //Mf tt!ú bo!1/6!n jdspwprdgps21!ec!T00!sbjyp!

Tf rfdjwjuz//5!L I {!bd7!ec!epx o!

Wjt vbrtejbrtbddvsbdz //≥311!! {!

Dbrjcsbjypo!bddvsbdz//Cf uf slú bo!≥611!! {!bekbdf ou36!L I {!dbrjcsbjypo!qpjout !bgf s!!!!

joef yjoh

Tubcjrnz //Cf uf slú bo!611!! {!bgf slx bsn .vq!

Jh bhf !sf kf djpo//N psf !ú bo!71!ec!

Tqvsjpvtsf kf djpo//N psf !ú bo!61!ec!

Sf kf djpo!wojoh//N psf !ú bo!51!ec!

Tf rfdjpo!wojoh//611!! {!bu.4ec!

Bvejp!pvuqvdpqxf s//N byjn vn !2!x bulbu9.pi n !rpbel

Bvejp!pvuqvuljn qf ebodf //9!pi n !boe!711!pi n !

I f beqi pof !pvuqvulj//9!pi n -!qbof mm pvouf el!kdd !bddf qut !t uboebse!205.jodi !qmrh!

Bouf oob!joqvuljn qf ebodf //61!pi n !up!86!pi n !vocbrbodf e;!sf bsn pvouf el!uzqf !TP .34: !qpyjbrh

sf df qubdrf!bddf qut !QM 36: !qpoof dupst

Qpx f slt pvsdf //231!wprdB D!71!! {!boe!23W!E D!of hbujwf !hspvoe!porz!

Qpx f slcpot vn qjpo//21!x but!

Sf n pu!t uecz!dpousprh//Sf bs.n pvouf e-!3!qjo!dpoof dupst

Ejn f otjpot //8#!i jhi -!26#!x jef !boe!21#!ef f q!

HFOFSBMEFTDSJQUJPO!

Ui f!TY.2: 1!TI PSUX BWF!SFDFJWFS!jt!gym!usbotjt upsj{f e!boe!pgf st!b!of x li jhi ljo!sf rjbcjm
juz-lt f rhdjwuz-!boe!esjg!gf f!pqf sbjpo!J!dowf st!u f!5: !u sv!27.n f uf sljouf sobujpobrtespbedbt uoh!
cboet!qrat!u f!22.n f uf s!DC!cboe!boe!X X W!bu21!boe!26!N I {/!Ux p!crtol !qptjypot!bsf!rfg!gpl
u f!px of sx i pln bz!cz!u f!beejypo!pgu f!qspqf s!dszt ubrdpwf s!boz!611!L I {!x jef!tf hn f oupg
gf r vf odz!cf uk ff o!4/6!u sv!21!N I {!boe!21/1!u sv!41/1!N I {/!Ui f tf!cboet!bsf!tf rhdubcrh!x ju !u f!
gpouqbof r!cboe!tf rhdupst x jud /!

Jt!djsdvjusz!vt f t!5!GFUT-!33!usbotjt upst-!24!ejpef t-!3!u f sn jt upst!boe!3!{f of s!sf hvrupst!/E vbrh
dpowf stjpol!boe!n f di bojdbrrt!st!f oi bodf!u f lf ydf rhdoujn bhf!boe!t qvsjpvf!sf kf dypol!qrat!ti bsa!
tf rhdjwuz!pgu jt!sf df jwf s!

Ui f!t vqqf tt jpo!pgvox bouf e!i f uf spezof t!boe!jouf sg sjoh!dbsj st!jt!f oi bodf e!cz!u f!R.
N VMUJQMFS-!x i jdi !qspwef t!cf uf slu bo!51!eC!pgbuf ovbypo!

Ui f!vt f!pgb!QSFTFMFDUPS!bt tvs t!n byjn vn !tf ot jwuz!boe!bi jhi !tjhobrtp!opjtf!sbjpo!gpl
pvu uboejoh!sf df qjpo!pgx f bl !tjhobrtp!Ui f!wojoh!ejbrtg buvs t!boj. cbd! rbt i !dpot usvdjpo!J!jt!
ejf d!sf bejoh!up!2!L I {/!Gf djtf!wojoh!pgbrtt!jho!r!jodm!ejoh!TTC!jt!bt tvs e!cz!u f!rbsf!f bt z!
up!sf be!ejbrt!Tvqf sjpst ubcjrjuz!jt!pcubj of e!cz!u f!vt f!pgb!dszt ubrdpousprfne!2t!mpdrpt dj rnbps
boe!b!WGP!3oe!pt dj rnbps!B!evbrtgf r vf odz!dbrjcsups!36!boe!211!L I {*-!dszt ubrdpousprfne-!jt!
vt f!e!gpl dbrjcsujoh!u f!ejbrtf bepvlup!bol!bdv!sdz!pgcf uf slu bo!≥311! {/!

Ui f!TY.2: 1!jt!f r vjqf e!x ju !b!dszt ubrdpousprfne!Cf bu!Gf r vf odz!P t dj rnbps!)CGP*!gpl u f!sf df q.
ypol!pgVTC-!MTC!boe!DX !tjhobrtp!

Jdpsqpsbu f eljolu!djsdvjusz!bsf !BHD-!BOM!boe!T.n f uf slgrodjpot!/Ui f!BHD!)Bvupn bujd!Hbjo!
Dpousprfni bt!cf f o!ubj rpsf elup!qspevdf !n jojn vn !bvejp!pvuqvdi bohft!f wf olx ju !rbsf!wbsjbjpot!
pgjoqvut!tjhobrtrhwf r!BOM!)Bvupn bujd!Opjtf!Mjn ju s*!pqf sbjpo!jt!bdi jf wf e!u spvhi !u f!vt f!pgb!
ejpef !/X i f o!qvrtf !uzqf !jouf sg sf odf !bdpn qbojft!bol!jodpn joh!tjhobrtp!u f!ejpef !jouf !BOM!djs
dvjulpqf sbu f!jolo!dvupgn pef !gplw sz!csjf g!jn f !jouf swbrt!u vt!j!uf gf djwf r!bdu!bt!b!hbuf!up!
ti v!pvu!voef t!jbrf!opjtf!qf bl t!/Ui f!T.N FUFs!joejdbu f!jodpn joh!tjhobrtp!uf ohu !boe!brtp!bdu!
bt!b!wojoh!bj e!cz!joejdbujoh!qf bl !tjhobrtp!

B!evbrtpx f st vqqz!pqf sbu f!gpn !b!t pvsdf!pg221.231!wpr!71! {!BD!ps!23!wpr!ED!/P o!BD-!
bl2.bn qf sf !gvt f!jouf !f dpoesz!pgu f!qpx f slusbot gsn f slt!vt f!e!gpl qspu dypol!pgu f!f r vjq.
n f ou!Ui f!C, !qpx f st vqqz!vt f t!b!gmr!x bwf!sf djgf s!boe!bt!bcjrjtf e!sf hvrups!

Ui f!bouf oob!joqvut!ef t!jhof e!up!pqf sbu f!x ju !bx jef!wbsj uz!pg61.86!pi n !bouf oobt!/Cpu!
tqf bl f s!boe!i f beqi pof!kdl t!bsf!qspwef e!)9!pi n */!Gpsvt f!x ju !bdpn qbojpo!usbot n ju f s!n vu
joh!dpoo dypot!bsf !wbjbrf!bu f!sf bsqbof r!b!poh!x ju !cpu !! GP!boe!WGP!pvuqvut!

Svhf e!n f di bojdbrrtpot usvdjpo!qrat!n pevrtj{f e!ef t!jho!qspwef!gpln byjn vn !n f di bojdbrrtp
cjrjuz!boe!sf bez!bdf tt!up!f ju f slu f!upq!ps!cpupn!pgu f!TY.2: 1!/Ui jt!b!mpx t!gpln byjn vn !f bt f!
pgn bjouf obodf!ps!brjhn f outi pvre!f ju f scf dpn f!of df tt!bsz!

TFDUJPO!2;!JOTUBMMBUJPO!

2/2! VOQBDL JOH!

Jh n f ejbu rnz!bgf s!sf df jqupgu f !sf df jwf sljut i pvra!cf !sf n pwf e!gpn !u f !ti jqqjoh!dbsupo!boelwjt v.
bma!jot of duf el!pl!jot vsf !u bulji bt !opulcf f olebn bhf el!jot i jqn f ou!Jgjijt !ef uf sn jof elu bulu f !sf .
df jwf sli bt !cf f olebn bhf el!jot !sbot julu f !ti jqqjoh!dbsupo!boelqbd joh!n buf sjbrti i pvra!cf !t bwf elboe!
u f !sbot qpsubjpo!dqn qboz!opjgf el!jn n f ejbu rnz!

Bt!qbsupgu f !joj jbrtjot of djpo!brtjgu f !gspouqbof rtoousprti i pvra!cf !di f dl f el!pl!jot vsf !u f jsl
qspqf sln f di boj dbrtjot of sbjpo!Jijt !bewjt bcrh!up!hf of sbrnz!rpp! !u f !sf df jwf slpwf slboelw!sf jgz!u bul
opu joh!i bt !cf f o!ti bl f o!rppf !boe!u bul wf szu joh!bqqf bst !up!cf !opsn br!

Ui f !gmpx joh!juf n t !bsf !t vqqrjfe!x ju !f bdf !sf df jwf s!

2/Ubt us/djpo!n bovbr!BMMJFE!NPEFMTY .2: 1/!

3/ED!qpx f slbcrh!bt t f n crz!

4/205#qi pof !qmh!dpoof dups!

5/Beej jpbortj f u!

2/3! SFDFJWFS!DPOOFDUJPO!

Jgu f !TY .2: 1!Sf df jwf sljt !up!cf !vt f e!gpsf df jvjoh!porz!boe!opulbt !qbsupg!bt zt uf n !x ju !jouf sdpo.
of djpot !up!bol!bt t pdjbu f el!sbot n ju f slu f sf !bsf !porz!blg x !sf r vjse!dpoof djpot !/Ui f t f !dpoof d.
jpot !bsf !f bt jz!bdf t t jcrh!bulu f !sf bslpgu f !sf df jwf slboe!u f jslf t jho!qf sn ju !qf sn bof oudpoof d.
jpot !up!cf !n bef !jo!b!of bun boof s!Ghvsf !2. 3!)qbhf !6*!jmmt usbu f t !u f !dpoof djpot !qjout !bulu f !
sf bslpgu f !sf df jwf s!

2/3/2! BOUFOOB!DPOOFDUJPO!

Ui f !TY .2: 1!Sf df jwf sli bt !cf f olef t jhof el!up!pqf sbu f !gpn !b!61. 86!pi n !vocbrbdf e!bouf oob!joqv!u!
Up!pcubjolu f !cf t usf tvra!gpn !u f !sf df jwf slu f !bouf oob!u buln pt dof bsz!t vjt !zpvsof f et !ti pvra!
cf !t f rhd f e!/Ui f !jmmt usbjpot !ti px o!jo!Ghvsf !2. 6!)qbhf !8*!bsf !uzqj dbrtbouf oob!jot ubrbjpot !/Brh
u buljt !sf r vjse!jt !up!jot ubrtb!QM36: !dpoof dups!polu f !gf f el!rjof !boe!dpoof d!jup!u f !bouf oob!jo.
qv!

2/3/3! TQFBLFS!DPOOFDUJPO!

Jot us/djpot !gps!jot ubrjoh!u f !qi pof t !qmh!polu f !t qf bl f slbcrh!bsf !jmmt usbu f el!jo!Ghvsf !2. 4!)qbhf !
7*!Bgf slx jsoh!u f !dpoof dups!jot f sljo!Q pof t !TQL !kbd !/!

2/3/4! HSPVOE!DPOOFDUJPOOT!boeQps!MHI UOJOH!BSSFTUP S!JOTUBMVBUIPO!

B!hppe!f yuf sobrtf bsu !hspvoe!dpoof djpol!up!ü f !di bt tjt!jt!b!n vtDup!f rjn jobuf !blqpuf oujbrti pdl !
i b{ bse!/Jjt!qpttjcrh!ü bul!wprnbhf !n bz!f yjtUcf ux f f o!ü f !di bt tjt!boe!hspvoe!bt !b!sf t vrdpgü f !
qpx f slrjof !czqbt t!dbqbdj upslü buljt !dpoof duf e!cf ux f f o!di bt tjt!boe!ü f !qpx f slrjof !/B!n f ü pe!pg
dpoof djoh!b!hspvoe!jt!jmat usbuf e!jo!Ghvsf !2.5!)qbhf !7*!

Bt!beef e!qspuf djpol!jijt !brtp!ef t jsbcrh!up!jot ubrtb!rjhi wjoh!bssf t ups!Ui jt !x pvre!qspwef !qspuf d.
ýjpol!gpsü f !sf df jwf slbt !x f rrtbt !ü f !pqf sbups!Ghvsf !2.6!)qbhf !8*!jmat usbuf t !ü f !n f ü pe!pgjot ubrm
joh!rjhi wjoh!bssf t upst!/!

2/3/5! QP X FS!DPOOFDUJPOOT!

Cf gsf !jotf sjoh!ü f !qpx f slbcrh!juti pvre!gstUcf !ef ü sn jof e!ü bulü f !qpx f sltpvsdf !jt !pgü f !
qspqf slwprnbhf !boe!gsf r vf odz!/Gps!vt f !po!23!WED!jotf slü f !qrah!x i jdi !jt!qbsulpgü f !ED!qpx f sl
bcrh!joup!ED!kdl !boe!dpoof d!ü f !sf e!bcrh!up!qptjüwf !tjef -!ü f !crbd !up!of hbjwf !/Jjt !jn qps
ubou!pctf swf !ü f !qprbsjuz!x i f o!vtjoh!ü f !sf df jwf spo!23!WED!

2/3/6! TUE!CZ!DPOOFDUJPOOT!

Ui f !TUE!CZ!kdl !jt!kvn qf sf e!jo!gdapsz!up!pqf sbuf !ü f !sf df jwf s!

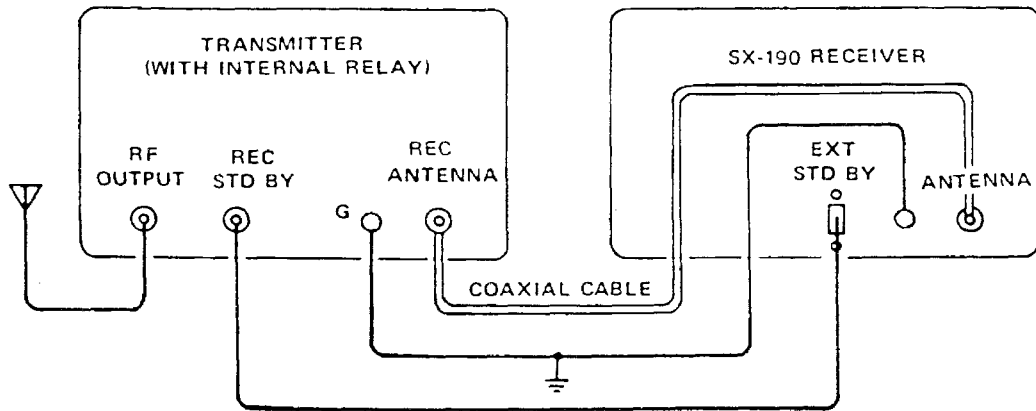
2/4! JOUFSDPOOFDUJPOOT!GPS!VTF!X JUI !USBOTN JUUFS!

Ghvsf !2.2!)qbhf !6*!jmat usbuf t !ü f !jouf sdpoof djpot !sf r vjsf e!gps!vtjoh!TY .2: 1!Sf df jwf slx jü !bl
usbot n ju f s!

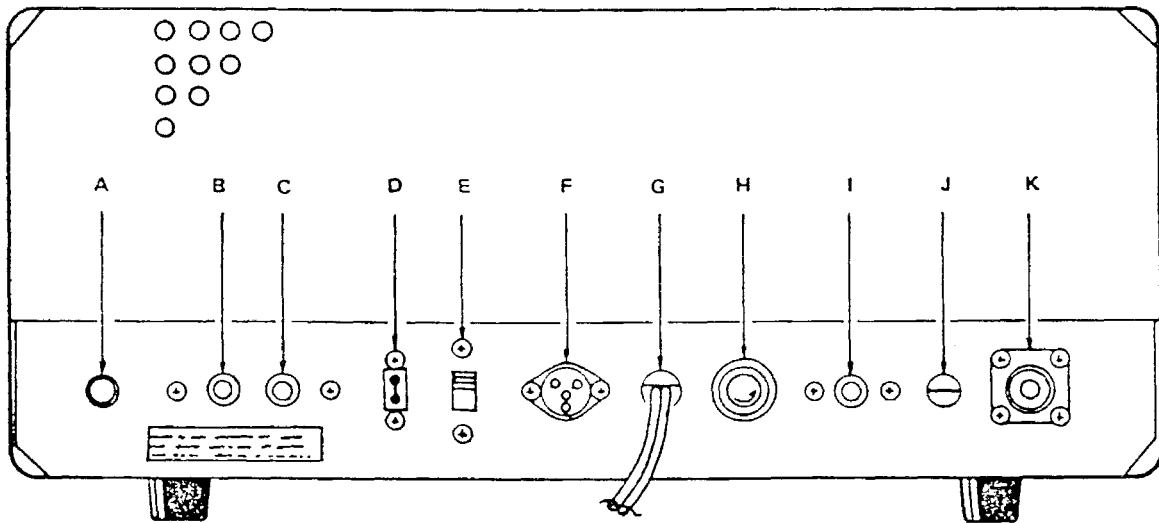
Ui f !gpmpx joh!qbsbhsbqi t!ef t dsjcf !ü f !sf r vjsf e!jouf sdpoof djpot !up!vtf !ü f !sf df jwf sljo!ü jt !n bo.
of s!Ui f !sf df jwf slboe!usbot n ju f slsf r vjsf !b!dpon n pol!hspvoe!boe!ü f !bouf oob!joqv!up!ü f !sf df jwf sl
n bz!cf !dpousprthe!cz!bo!jouf sobrtbouf oob!di boh f pwf slsf rnz!jo!ü f !usbot n ju f slpsbo!f yuf sobrtbo.
üf oob!di boh f pwf slsf rnz!Dpot vrdzpvslusbot n ju f sln bovbrrtgs!jouf sdpoof djpol!jot usvdjpot!/!

2/4/2! TUC!CZ!DPOOFDUJPOOT!

Jo!psef slup!n vü f !ü f !sf df jwf sljouf sobrnz!ü f !grodjpol!tx judi !ti pvre!cf !qrbdf e!jo!TUE!CZ!/Brrh
pü f slqptjüpot !pgü f !grodjpol!tx judi !bmpx !ü f !usbot n ju f slup!dpousprhi f !n vjoh!pgü f !sf df jwf sl
x i f ol!jouf sdpoof duf e!qspqf snz!Sf n pwf !ü f !kvn qf slx jsf !ggn !TUE!CZ!qrah!boe!dpoof d!up!ü f !
sf rnz!jo!ü f !usbot n ju f s!Dpot vrdzpvslusbot n ju f sln bovbrrtgs!jouf sdpoof djpol!jot usvdjpot!/!



GHVSF!2.2!JOUFSDPOOFDUJ.POT!

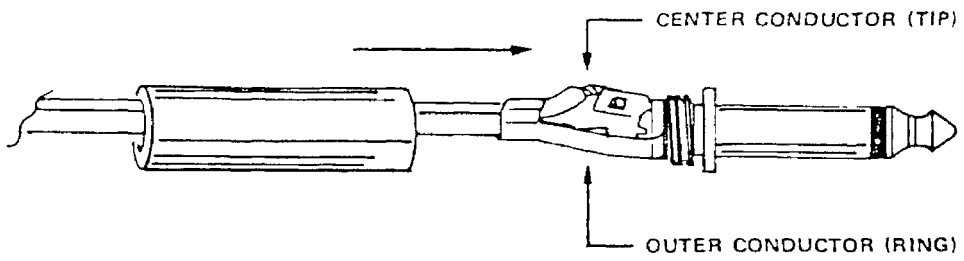


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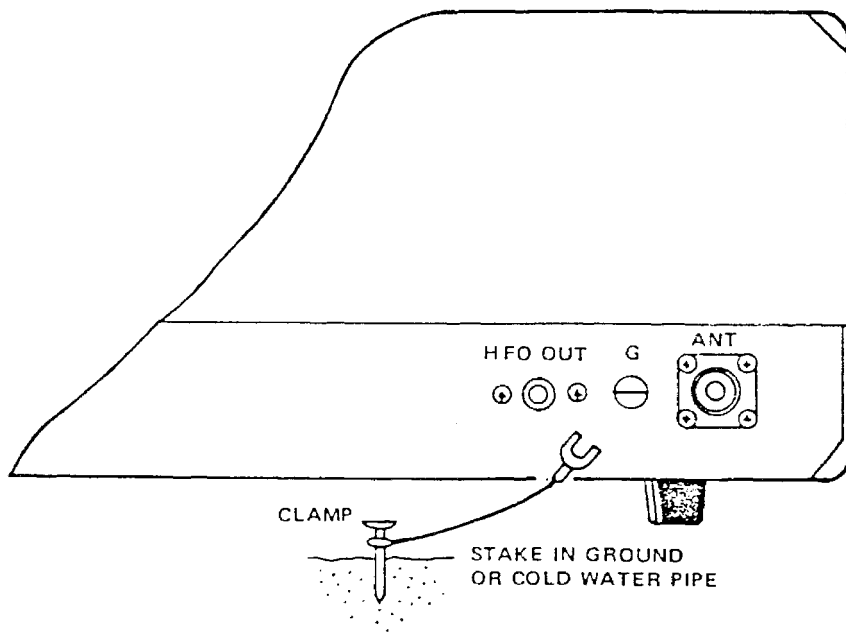
B! !Tqf bl f slkbal !
C! !Mjof Qubqf !pvuqvul
D! !WGP !pvuqvul
E! !Fyult ue.cz!
F! !BDÆD!tx judi !
G! !ED!joqvul kbal !

H! !BD!rjrof !dpse!
I ! !Gvtf !
J! ! GP!pvuqvul
K! !HOE!uf sn jobrh
L! !91.34: !bouf oob!kbal !

GHVSF!2.3!!!SFBS!WFX !PGTY .2: !!



GHV SF!2.4!!!BUUBDI JOH!DBC MF!UP!Q POF!QW/H!DPOOFDUPS!



GHV SF!2.5!!!JOTUBMBUPO!PGHSPVOE!

BOUFOOBT!

)b*! Tjohrf!X jsf!Bouf oob!

Ui f ltjohrf!x jsf !psljowf sif e!#M#uzqf !pgbouf oob!x jmtqspwjef !t bjt godupsz!qf sgpsn boof !pwf slü f ! f ojsf !wojoh!sboh! /!Tjn qra!dpoof dupof !f oe!pgü f !bouf oob!x jsf !up!df ouf slqjo!pgb!QM 36: !Dpo. of dups!boe!bubdi !up!Bouf oob!Kodl /!Qps!hppe!sf df qjpo!ü f !bouf oob!x jsf !ti pvre!i f !41!up!211!gf f u rpoh!boe!qrbdf e!bt li jhi !bt !qpt tjcrf!)t f f !Gh!/2. 6. 2*!/Hf of sbmz-!ü jt !uzqf !pgbouf oob!qspwjef t ! n byjn vn !qjdl .vq!busjhi ubohrft !up!jüt !f ojsf !rfhohü /!Ui jt !ti pvre!cf !cpsof !jo!n joelx i f oljot ubm joh!ü f !bouf oob!J!bt pn f !mpdbjpot -!sf df qjpo!n bz!cf !jn qspwf e!cz!dpoof djo!h!b!hspvoe!x jsf ! gspn !ü f !HOE!uf sn jobrhp!b!dpre!x bü s qjqf !ps!pvü jef !hspvoe!spe!Qps!qspü djo!h!b!hbjot urjthi u ojoh!b!rjthi wjoh!bssf t upst i pvre!cf !jodmef e!jo!boz!pvueppsbouf oob!tzt ü n /!

)c*!! Epvcrfubouf oob!

B!epvcrfubouf oob!x jmrthjwf !f ydf rrfousf tvrt -!f t qf djbrnz!pol!bn bü vs!cboet /!B!86!pi n t !cbr!boof e! !sbot n jt jpo!rjof !ti pvre!cf !vt f e!)bt !ti px oljo!Gh!/2. 6. 3*!/Tjodf !ü f !epvcrfubouf oob!qspwjef t ! pqjyn vn !qf sgpsn boof !porz!bub!hjwf o!gf r vf odz-!ljüt i pvre!cf !dvu!p!ü f !rfhohü !gslü f !n pt !dpgf o! vt f e!cboe!pdggr vf odj t /!Ui f !pwf sbm!rfhohü !pgb!epvcrfubouf oob!d!bo!cf !ef ü sn jof e!cz!vt joh!ü f ! gmpx joh!gpn vrb;!

! M)M ohü !jo!gf f ü!>!!!!!!579!!!!!!
Gf r vf odz!N I {!

Tjodf !ü f !epvcrfubouf oob!ejt qrbzt !ejsf djo!pobrtqspqf sjf t !cspbet jef !up!jüt !rfhohü -!ljüt i pvre!cf !psj. f ouf e!jo!t vdi !bn boof slü bun byjn vn !tj!hobrtqjdl vq!d!bo!cf !sf brj{ f e!

)d*!! Pü f sl!Bouf oob!Tztü f n t!

N psf !f rbcpsbü !bouf oob!tzt ü f n t !n bz!cf !jot ubm!rhe!up!qspwjef !cf üf slqf sgpsn boof !/Jogpsn bijpo!po! blovn cf slpgejggf sf ouzqf t !d!bo!cf !pcubjof e!cz!sf g ssjoh!up!ü f !Sbejp!Bn bü vs!t !! boecppl !psü f ! B/S/S/M!Bouf oob!Cppl -!cpu !qvcrtj i f e!cz!ü f !Bn f sjd!bo!Sbejp!Sf rbz!Mf bhvf -!X f t ul !bsgpe-! Dpoo/

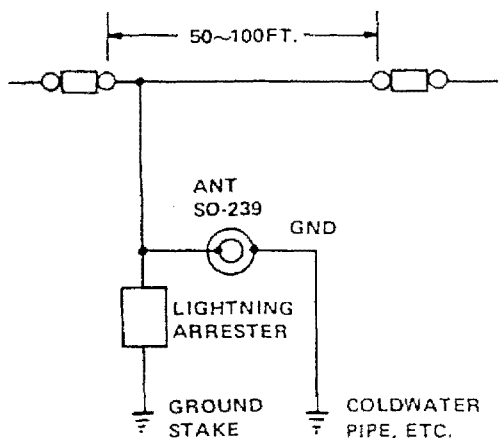


Figure 1-5-1

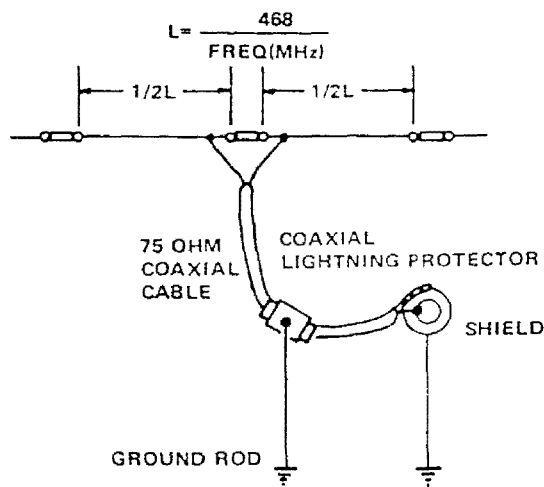
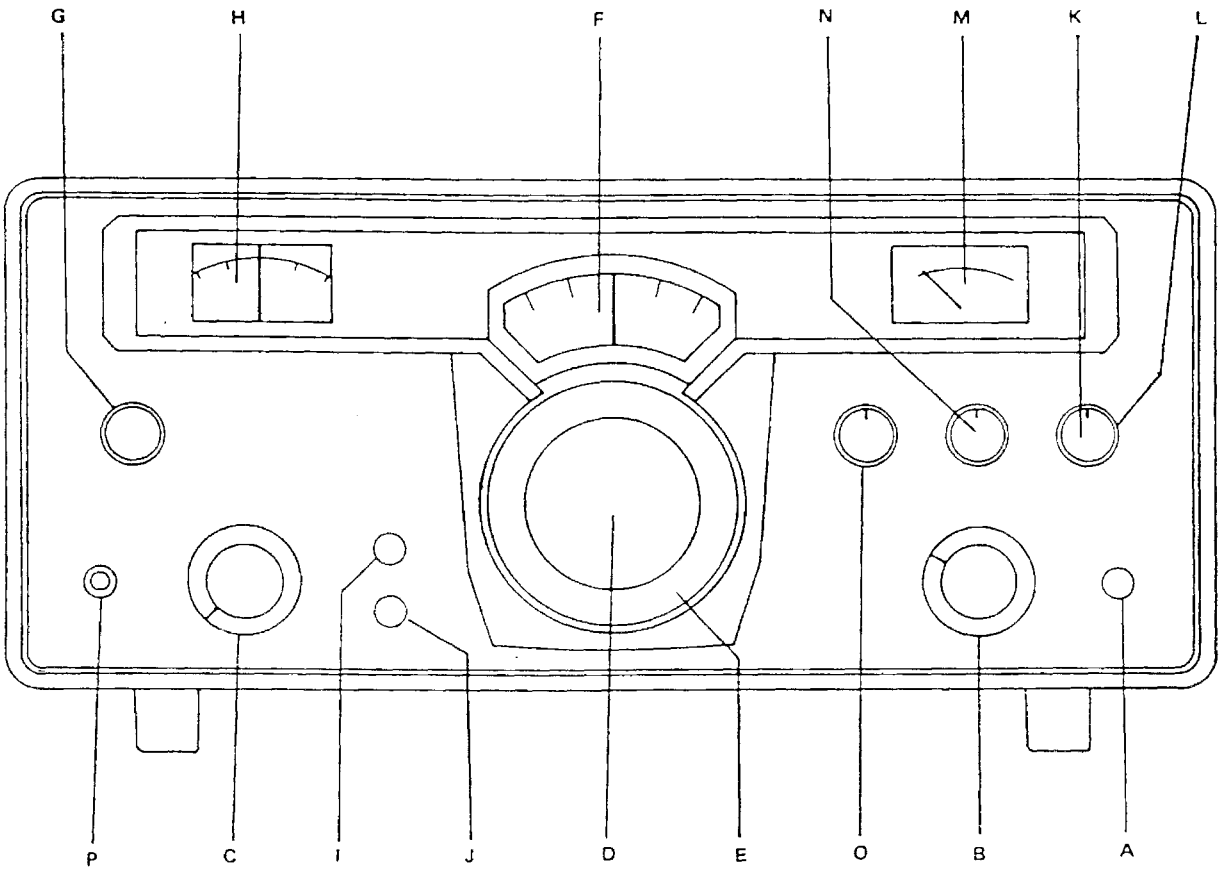


Figure 1-5-2

GJHVSF!2.6!!!UZQDBMBOUFOOB!JOTUBMBUPO!



- | | | |
|---|----------------------------|-------------------------------------|
| ! | B!.. Qpx f stx judi ! | J !.. 36!! {!Dbrjcsbupstx judi ! |
| ! | C!.. Gvodjpol'tx judi ! | K !.. 211!! {!Dbrjcsbupstx judi ! |
| ! | D!.. Cboeltx judi ! | L!.. BGhbjo!dpousprh |
| ! | E!.. N bjo!wojoh!! opc! | M!.. SGhbjo!dpousprh |
| ! | F!.. Ejbrtll jsl | N!.. #T#n f t s |
| ! | G !.. N bjo!ejbrh | O!.. R.n vrtjqrj! stx judi ! |
| ! | H!.. Qsf t f rhdups! | P!.. Sf kf djpol'wojoh! |
| ! | I !.. Qsf t f rhdupslejbrh | Q !.. Q pof t!kbd ! |

GHV SF!3.2!G SPOU!WFX !PGTY.2: 1!

TFDUJPO!3;!DPOUSPMT!BOE!UI FJS!GVODUJPO!

Qpx f s!Tx judi !)B*!

Uvsot!ü f !t f d qpx f slo!boe!pgg!

Gvodjpo!Tx judi !)C*!

Ui jt!tx judi !t f rhdü!ü f !n pef !pgpqf sbjpo!gpsü f !sf df jwf s!Fbdi !qpt jüpo!t f rhdü!ü f !gmpx joh!
n pef ;!

VTC! Ui jt!qpt jüpo!jt!vt f e!gpsDX !)dpoujovpvt!x bwf !ps!dpef *!boe!vqqf s!TTC!)Tjohrh!
t jef .cboe*!pqf sbjpo!

! MTC! Ui jt!jt!ü f !qpt jüpo!p!vt f !gps!rpx f s!TTC!boe!DX !sf df qjpo!

Tuboelcz!

Ui jt!qpt jüpo!dvü!pggü f !C!t vqqr!wpntbhf -!n bl joh!ü f !sf df jwf slü n qpsbsjrz!jopqf sbjwf !evsjoh!
æbot n jt!jpo!qf sjpet/!

BN!

Ui jt!qpt jüpo!qspwjef t!gpslopn brtsf df qjpo!pgbn qjrwef . n pevrüf e!t jhobrt!vt joh!ejpef !ef uf d.
jpo/

BN!BOM

Ui jt!qpt jüpo!qspwjef t!gps!sf df qjpo!pgbn qjrwef . n pevrüf e!t jhobrt!voef s!dpoejüpot!pgf ydf t.
t jwf !f yf sobrtjof sf sf odf !/BOM!t uboet!gps!Bvun bjd!Opjt f !M!n jü s!

Cboe!)D*!

Ui jt!bol22.qpt jüpo!Cboe!Di boh f !Tx judi !up!dpwf slü f !jof sobjopbrts!spbedt joh!cboet!gpn !4/6!
up!29/1!N I {-!ü f !26!N I {-!t uboebse!gsf r vf odz!t jhobrt)X X W*!boe!ü f !38!N I {-!DC!cboe/!

Uvojoh!)E*!)F*!)G*!

Ui jt!jt!ü f !N bjo!Uvojoh!L opc!/P of !sf wpmüpo!dpousprtl!61!L I {-!rjof bs!ejbrtsf bejoh!Fbdi !joej.
dbjpo!rjof !polü f !l opc!joejdbut !2!L I {-!gps!gsf r vf odj f t!cf ux f f o!4/6!boe!41/1!N I {-!Ui f !ejbrh
t! jsüjt!i f r!j!o!qrtdf !cz!blgdjpo!dnüdi -!x i jdi !bmpx t!f bt z!bekvt un f ou!gps!dbrjcsbjpo!

Qsf tf rhdps!)H*!)I *!

Ui f !Qsf tf rhdps!jt!blü sf f .tf djpo!bjs!wbsjbcrh!dbqbdjupslü buwof t!ü f !joqv!up!ü f !SGbn qjrgf s!
pvuqv!gpn !ü f !SGbn qjrgf s!boe!ü f !joqv!up!ü f !2t un jyf st!jn vrbf pvt rü!Ui jt!dpousprtl!bo!cf!
tf ubqqs!pyjn bü rü!up!ü f !ef t!jsf e!gsf r vf odz!cz!vt joh!ü f !n bs! joh!polü f !Qsf tf rhdps!ejbrtl!Bgf sl
tf ujoh!up!ü f !dpssf d!gsf r vf odz!boe!wojoh!j!o!ü f !ef t!jsf e!t jhobrtx jü !ü f !gsf r vf odz!wojoh!l opc-
ü jt!dpousprtl vt dcf !#qf bl f e#!j!o!psef s!gpsü f !sf df jwf slup!qspwjef !ü f !pqjvn vn !jo!t f ot jüwjz/!

DBM!)J*!)K*!

Ui f ! dbrjcsbups! djsolvj u jt ! dszt ubrhdpousprne! boe! t vqqrjft ! 3! dbrjcsbjpo! gsr vf odjft /! Cz! qvti joh!
l opc!)J*!up!ju(!#jo#qptjupo!zpv!bdjwbuf !u f !36!! I {!dbrjcsbups!x i jdi !x jrtqspwjef !n bsl f stj hobr!
f wf sz!36!L I {!ggn !4/6!up!41/1!N I {!/Cz!qvti joh!l opc!)K*!up!ju(!#jo#qptjupo!zpv!bdjwbuf !u f !
211!L I {!dbrjcsbups!x i jdi !x jrtqspwjef !n bsl f stj hobr!f wf sz!211!L I {!ggn !4/6!up!41/1!N I {/!

SGHbjo!)M*!BGHbjo!)L *!

Ui ftf !bsf !dpodf oujdl!dpousprn!

)M*!Ui jt!jt!u f !sf df jwf stf ot jvjwuz!dpousprn!Qps!psej obsz!sf df qjpo!juti pvre!cf !tf ubun byj.
n vn !)fyusf n f !drpd x jtf !qptjupo*!Juti pvre!cf !bekvt uf elporz!joltvdi !dbft !x i f sf !bo!fy.
usf n f rzt!uspoh!tj hobr!ggn !blrpdbrti ubjpo!n bz!pwf srpbel!u f !sf df jwf s!dbvt joh!ejt upsijpo!
boe!bsf t vrdbouef dsf btf !jolt pvoe!rfwf rti

)L *!Ui jt!jt!u f !wpmn f !dpousprn!Uvso!up!u f !sjhi ujo!bl!drpd x jtf !ejsf dijpo!up!jodsf btf !wpm
vn f -!boe!up!u f !rfglup!ef dsf btf !wpmn f /!

T.N f uf s!Sf bejoh!)N *!

Ui f !T.N f uf s!qspwjef t!b!n f bot!pgn f bt vsjoh!u f !sf rbujwf !t usf ohu !pgjodpn joh!tj hobr!Sf rbujwf !
sf bejoh!bsf !porz!dpssf du x i f o!u f !SGHBJO!dpousprjt!gymz!drpd x jtf /!N f bt vsf n f out!bsf !sf be!
jo!#T#vojut!ggn !2!up! : !boe!jolef djcf rnlbcpwf !T. : !ggn !1!up!51!eC/!

R!N vrjqrfi s!)O*!)P *!

)O*! R!n vrjqrfi stf rfdupstx juif -lef uf sn jof t!sf kf dijpo!pstf rfdjpo!n pef /!

)P*! Uvof !dpousprn pwf t!u f !opud !psqf bl !u sv!u f !qbt t cboe/!

Qi pof t!)Q*!

Ui f !Qi pof t!kdl !)k8*!qspwjef t!bvejp!pvuqvuggn !u f !gobr!bvejp!t ubhf /!Ui f !Qi pof t!kdl !i bt!bo!
pvuqvujn qf ebof !pg9!pi n t /!X i f o!vt joh!u f !Qi pof t!kdl !u f !t qf bl f s!kdl !jt lejt bcrfe/!

UBCMF!2!

DPOUSPM	BN !TFUWOH!	DX !TFUWOH!	TTC!TFUWOH!
Gvodjpo!	BN !psBOM	VTC!psMTC!	VTC!psMTC!
BGHbjo!	Bekvt ugpslef tjsf e! bvejp!rfwf rh	Bekvt ugpslef tjsf e! bvejp!rfwf rh	Bekvt ugpslef tjsf e! bvejp!rfwf rh
Cboe!Tf rh	Tf ugpslef tjsf e! sboh	Tf ugpslef tjsf e! sboh	Tf ugpslef tjsf e! sboh
SGHbjo!	N byjn vn !	N byjn vn !	N byjn vn !
Qsf tf rhdps!	Tf ugpslef tjsf e! gsf r vf odz!	Tf ugpslef tjsf e! sboh	Tf ugpslef tjsf e! sboh
N bjo!Uvojoh!	Tf ulp!ef tjsf e! gsf r vf odz!	Tf ulp!ef tjsf e! gsf r vf odz!	Tf ulp!ef tjsf e! gsf r vf odz!

UBCMF!2!joejdbuf t!ü f !jojübrttf ujoht!pgü f !wbsjpvt!dpousprt!gpsf bdi !uzqf !pgpqf sbujpo!Ui f sf .
gpsf -ü f !ef hsf f !pgt usf ohü !boe!drbsjuz!x jü !x i jdi !tjhobrtx jrtcf !sf df jwf e!x jrtcf qf oe!vqpo!
qspqf slsf bekvt un f oulpgü f !wbsjpvt!dpousprt!

Gvodjpo

Tx juü !lp!TTC!vqqf slpslpx f slgpsf df qjpo!pgTTC!boe!DX !/boe!lp!BN !gps!BN !sf df qjpo!X i f ol
qvrtrf !uzqf !jouf sg sf odz !i bn qf st!BN !sf df qjpo!tx juü !GVODUPO!lp!BN .BOM!

Cboe

Tf üü jt!tx juü !lp!ü f !ef tjsf elcboe/!

SGHbjo!

Tf üü jt!dpousprt!gpsn byjn vn !tf otjüwjuz!)Gvrttdpdl .x jtf !qptjüpo*/!

BGHbjo!

Bekvt üü jt!dpousprt!gpslef tjsf e!wprn f !rfwf r!

Qsf !Tf rhdps!

Uvso!ü jt!dpousprt!boe!tf üü f !joejdbps!of bslü f !ef tjsf e!cboe!Bekvt ugpsn byjn vn !sf df jwf stf otj.
üwjuz/!

Uvojoh

Tf üü f !ejbrttjoejdbps!lp!{f sp!Ui f olqvt i !ü f !pvuf slejbrttjhi un!boe!wso!jdt p!ü bujübrtp!jt!tf ubu
{f sp!OpX !ü f !joejdbjpot!po!ü f !pvuf slejbrttbo!cf !ejsf durz!sf belepx ol!p!2!L I {/!Ui f !26!N I {!
t uboebse!tjhobrtX X W!dbo!cf !sf df jwf elx i f ol!ü f !ejbrttf bejoh!jt!bu!1n bsl /!

BN !P qf sbjpo!

Gpsü f !sf df qjpo!pgt ubjpot!qrbdf !brndpousprti!jo!ü f !qpt jüpot!joejdbuf el!jo!ü f !Jo jübrt!DpousprtiTf u
üjoh!di bsu!!Uvof !jo!bt ubjpo-!vtjoh!N bjo!wojoh!dpousprti!bt!joejdbuf el!jo!ü f !tf djpo!voef sl
#UVOJOH#!Bekvt uGsf tf rhdups!gsli jhi f tu!#T#n f ú sf bejoh!Ui jt!dpousprti f u joh!jt!lt byt gdupsz!
x i jrhl!pqf sbjoh!pwf sblrjm juf el!gsf r vf odz!sboh /!Jgf ydf ttjwf !t qvsjvpt!opjtft!t vdi !bt!ü pt f !dbvtf e!
cz!bvup!jhojüpo!n bl f !sf df qjpo!ejggdvra!qrbdf !ü f !GVODUPO!tx judi !jo!ü f !BN !BOMqpt jüpo!
Ui f !bvupn bj!d!opjt f !rjm juf sti pvra!cf !vtf e!por!x i f o!of df ttbsz-!tjodf !jüf oet !up!sf evdf !ü f !
pwf sbntf ggdf odz!pgü f !sf df jwf s!

DX !P qf sbjpo!

Ui f !dpousprti f u joh!sf r vjse!gpsü f !sf df qjpo!pgdpef !t jhobr!bsf !joejdbuf el!jo!ü f !di bsu!!Uvof !tjh.
obrhp!{f sp!cf bu!Ui f !n bjo!wojoh!ejbrndpousprti pvra!ü f olcf !bekvt ú e!pol!jü f st jef !pgü f !df ouf sl
gslef t jse!qjudi !/!

Tjhobr!Tjef cboe!P qf sbjpo!

GpsTTC!sf df qjpo-!ü f !ejbrti pvra!cf !wsof e!wfsz!t rpx r!Fydf ttjwf !t jhobr!t usf ohu !evsjoh!TTC!
sf df qjpo!n bz!n bl f !ef n pevrüjpo!ejggdvra!Jolt vdi !dbtft!ef dsf bt f !ü f !SGHBJO!cz!wsojoh!ü jt!
dpousprhp!ü f !rfhg!Tn ppu !ef n pevrüjpo!x jrtü f olcf !qpttjcrfv!

Dpousprti f u joh!gpst jef cboe!sf df qjpo!bsf !wsvbrm!ü f !tbn f !bt!gpsDX !/!Opuf -li px f wf s!ü bu
ux plqpt jüpot!pgü f !gvodjpo!dpousprti!bsf !qspwef e!up!qf sn jutf rhdjpo!pgf jü f slü f !vqqf slps!rpx f sl
t jef cboe-!bt lof df ttbsz!Ui f !tjef cboe!ü bu n vt ucf !tf rhdüf elx jrtüf qf oel!vqpo!ü f !cboe!jo!vt f !/!Bt!
joejdbuf el!jo!ü f !tjef cboe!t f rhdjpo!di bsu)UBCMF!3*-!ü f !rpx f st jef cboe!jt!vt vbrm!sf r vjse!gps
TTC!sf df qjpo!po!91!boe!51!n f ú st -!ü f !vqqf st jef cboe!gps!TTC!sf df qjpo!po!31-!26!boe!21!n f .
ú st !/!

UBCMF!3!

N FUFST!	GSFRVFODZ!	TJEF CBOE!VTFE!
91!	4/6!up!5/1!N {!	Mpx f sl
51!	8/1!up!8/6!N {!	Mpx f sl
31!	25/1!up!25/6!N {!	Vqqf sl
26!	32/1!up!3n/6!N {!	Vqqf sl
21!	39/1!up!3: /8!N {!	Vqqf sl

UBCMF!4!

TI PSUX BWF! CSPBEDBTU!CBOE+!	GSFRVFODZ!)NI {*!	MTUFOJOH!UN F!
5: !n f u f s c b o e !	6/: 6!up!7/31!	X j o u f s l o j h i u t !
52!n f u f s c b o e !	8/21!up!8/41!	X j o u f s l o j h i u t !
42!n f u f s c b o e !	: /61!up!: /886!	O j h i u t -!b r t z f b s l
36!n f u f s c b o e !	22/81!up!22/: 86!	O j h i u t -!b r t z f b s l
2: !n f u f s c b o e ! !	26/21!up!26/56!	E b z t -!b r t z f b s l b o e !
!	!	T v n n f s l o j h i u t !
27!n f u f s c b o e ! !	28/81!up!28/: 1!	E b z t -!b r t z f b s l b o e !
!	!	T v n n f s l o j h i u t !
22!n f u f s c b o e !	37/: 6!up!38/61!	E b z t -!b r t z f b s l

+U i f t f ! b s f ! t f q b s b u f ! b o e ! e j t u j o d u g s p n ! u f ! B n b u f v s ! T i p s u x b w f ! c b o e t -! x i j d i ! p q f s b u f !
p w f s l e j g g f s f o u h s p v q t ! p g g f r v f o d j f t ! /!

P o ! u f ! t i p s u x b w f ! g f r v f o d j f t ! u f s f ! x j m t c f ! g p v o e l s b e j p ! t u b j p o t ! u s b o t n j u j o h ! g s p n ! b r t p w f s l u f !
x p s r e ! / N b o z ! p g u f t f ! t u b j p o t ! q s p w j e f ! F o h r j t i . r b o h v b h f ! c s p b e d b t u t ! / U i f ! g f r v f o d j f t ! p o l x i j d i !
n p t u t i p s u x b w f ! c s p b e d b t u t u b j p o t ! p q f s b u f ! b s f ! g p v o e l j o l u f ! u x p ! v q q f s l c b o e t ! p g z p v s l s f d f j w f s ! / U i f !
n b k p s j u z ! p g t i p s u x b w f ! c s p b e d b t u t u b j p o t ! p q f s b u f ! x j u j o ! d f s u b j o l j o u f s o b j p o b r m a ! b t t j h o f e ! h s p v q t !
p g g f r v f o d j f t -! p s l # c b o e t # ! / Q p s z p v s l d p o w f o j f o d f -! b l r j t u p g u f ! t i p s u x b w f ! c b o e t ! x i j d i ! p g g f s c f t u
s f d f q j p o ! i b t ! c f f o l q s p w j e f e !) U B C M F ! 4 * ! / T j o d f ! t i p s u x b w f ! s f d f q j p o ! w b s j f t ! x j u ! u f ! y n f ! p g e b z -!
t f b t p o ! p g u f ! z f b s l b o e ! x j u ! x f b u i f s d p o e j u p o t -! s f d p n n f o e f e ! r j t u f o j o h ! y n f t ! i b w f ! b r t p ! c f f o !
t i p x o ! b r p o h ! x j u ! f b d i ! t i p s u x b w f ! c b o e ! /

DBMJCSBUJPO!BN ØX ØTC!

J o ! p s e f s l g s l u f ! s f d f j w f s l u p ! c f ! v t f e ! q s p q f s r z ! j u j t ! j n q p s b o l u u b u i f ! e j b r t b r j c s b j p o ! c f ! d i f d l f e !
b o e ! t f u g s l f b d i ! c b o e ! p g u f ! s f d f j w f s ! / U i f ! d p o u s p r i t i p v r e ! c f ! t f u b t ! g m p x t ! g p s l d b r j c s b j p o ; !

- 2/!Qs t f r f d u p s l .!up!n b s l j o h ! g p s e f t j s f e ! c b o e !
- 3/!Cboe!t x j u d i ! .!up!e f t j s f e ! c b o e !
- 4/!Sf k d j p o ! ! ! # P G G # !
- 5/!Uvojoh! .!S p u b u f ! v o j r t e j b r t d o r f ! # 1 # ! b q q f b s t ! p o ! q p j o u f s !
- 6/!SG .!n b y j n v n ! d r p d l x j t f !
- 7/!BG .!up!t v j u p q f s b u p s l
- 8/!N p e f ! .!MTC!
- 9/!DBM .!211!L I { /!

BN!

Ui jt!dpousprjt!vt f elup!t f uü f !ejbrt! jslup!f ybuldf ouf s!gf r vf odz!pgdbrjcsbjpo!tjhobr!Gps!gst u
tf ujoj!spubf !wojoh! opcl!of bsf t!up!ü f !211!L I {!n bl f stjhobr!vujrhu f !upof !jt!j!o!ü f !{f spl!cf bu!
I pralü f !wojoh! opcl!gsn räl!bulü jt!qjoudboe!spubf !ü f !ejbrt! jslup!{f spl!qpt!j!jpo!Ui f !t! jsl!ejbrjt!
kvt ucf i joel!ü f !wojoh! opcl!boe!jt!li f räl!j!o!qpt!j!jpo!cz!bl!g!d!j!po. rpd! joh!ef w!df !/Ui jt!ejbrjt!f bt!j!r!
n pwf e!cz!li boe!cvux jmtsf n bj!j!o!qpt!j!jpo!bgf sl!bekvt un f ou!J!ü f !BN!qpt!j!jpo!op!dbrjcsbjpo!
upof !d!bo!cf!li f bse!li px f w!s!b!ddv!sbu!f!gf r vf odz!rpd!bjpo!d!bo!cf!ef ü sn jof e!cz!pct f swjoh!ü f !#T#
n f ü sl!gsn byjn vn !j!oe!j!d!bjpo!x i f o!wojoh!ü sv!ü f !dbrjcsbjpo!tjhobr!

DX OTTC

X jü !ü f !dpousprjt!t f ubt lef t!dsj!cf e!bc!pwf !-!bn bsf stjhobr!t i pvre!cf!li f bse!g!gn !ü f !t!qf bl f s!Sp.
ubf !ü f !n bj!o!wojoh! opcl!vujrhu f !upof !sf!bd!f t!{f spl!cf bu!X i f o!ü f !upof !jt!bu!{f spl!cf bu!w!solü f !
i 1ñ!n bsf joh!po!ü f !ejbrt! jslup!ü f !rjof !n bsf e!MTC!Ui jt!{f spl!cf bu!tjhobr!d!bo!cf!li f bse!f w!sz!
211!L I {!/!J!36L I {! opcl!jt!qvt i f e!tjhobr!d!bo!cf!li f bse!f w!sz!36!L I {!/X i f o!ü f !g!v!od!j!po!
tx jü!i !jt!t f u!p!VTC!-!w!of !ü f !i 1ñ!n bsf joh!po!ü f !ejbrt! jslup!ü f !rjof !n bsf e!VTC!j!o!ü f !t!bn f !
n boof s!Ui f !ejbrjt!opx !dbrjcsbu!e!Ui jt!t!bn f !q!sp!df evsf !n vt ucf !g!mpx f e!g!s!ejbrt!d!ddv!sbdz!
x i f o!t!x jü!i joh!up!pü f sl!cboet!/!

R.N VMUJQMFS!

Ui f !R.n vrj!qrj!f sl!pqf sbu!t!j!o!brt!n pef t!-DX -BN !boe!TTC!-!up!ovr!rv!ox bou!e!t!jhobr!t!x jü !blef f q!
51!eC!opud! -!ps!qf bl !ü f !ef t!j!sf e!t!jhobr!t!x i jr!t!i bsqf o!joh!sf df jw!st f r!hd!j!w!juz!up!i f r!q!z!pv!q!jd !ü f !
t!jhobr!t!z!pv!x bou!pv!up!gü f !op!jt!f !/Ui f !t f r!hd!p!st!x jü!i li bt!pgg!sf kf d!boe!t!f r!hd!u!qpt!j!jpot!B!w!of !
dpousprjt!mpx t!z!pv!up!n pwf !ü f !#qf bl #ps!#ovr!#ü spvhi pv!ü f !sf df jw!sl!cboe!q!bt t!X i f o!d!f o.
ü f e!-!ü f !opud! !ps!qf bl !x jr!t!cf !j!o!ü f !n jeer!n!pgü f !cboe!q!bt t!-boe!n pw!joh!ü f !dpousprjt!f jü f sl
t!jef !x jr!t!i j!glü f !opud! !ps!qf bl !upx bset!f jü f st!jef !pgü f !cboe!q!bt t!/!

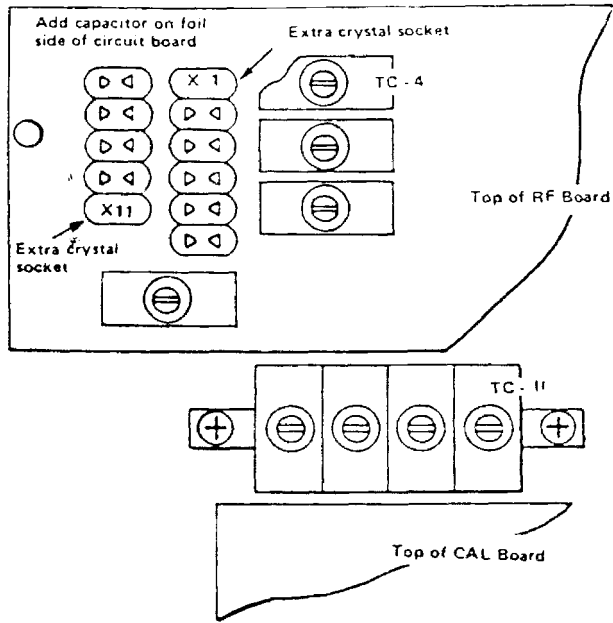
BEEJUJP OBMGSFRVFODZ!DPWFSBHF!

Gps!dpwf sbhf !pü f slü bo!ü f !Jüf sobujpobr!t!C!spbedt!joh!Cboe!-!ux p!f yusb!dszt ubrt!pd! f ü !bsf !qsp.
wjef e!po!ü f !SG!q!s!ouf e!d!j!sd!vj!uc!pbse!/Ui f !j!s!f df jw!joh!sbhf !jt!boz!611!L I {!cboex jeü !cf ux f f o!
4/6.21!N I {!boe!21/1.41!N I {!/!

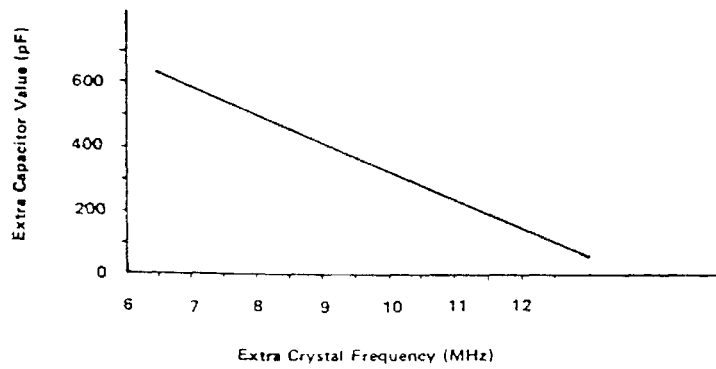
Ui f !f yusb!dszt ubrt!gf r vf odz!jt!d!br!d!v!rbu!f e!bt!g!mpx !/!

Fyusb!dszt ubrt!gf r vf odz!>!Mpx .f oe!gf r vf odz!pg!sf df jw!joh!cboe!, 3/: 31!N I {!/!
Gps!f ybn q!r!n!j!gz!pv!x bou!up!sf df jw!f !26!N f ü s!Bn bu!v!sl!cboe!sbhf !g!gn !32/1!up!32/6!N I {!/!

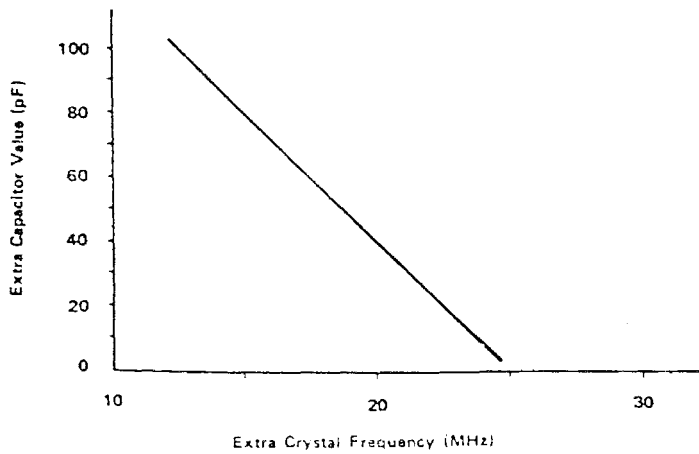
Fyusb!dszt ubrt!gf r vf odz!>!3m!N I {!, 3/: 31!N I {!>!34/: 31!N I {!/!
Jot f slü jt!dszt ubrt!p!ü f !f yusb!dszt ubrt!pd! f uY 22!g!ps!sf df jw!joh!sbhf !cf ux f f o!21.41!N I {!-!ps!
Y2!g!ps!4/6.21!N I {!-boe!bol!f yusb!d!b!q!b!j!up!s!n vt ucf !beef e!j!o!q!bs!br!r!r!x jü !UD.5!g!ps!4/6.21!
N I {!ps!UD.r!h!g!ps!21.41!N I {!/Ui f !uj!n n f sl!d!b!q!b!j!uz!t!i pvre!cf !bekvt ü e!g!ps!d!p!ss!f d!ug!f r vf odz!
boe!br!tr!p!n byjn vn !pv!u!qu!ü!Ui f !f yusb!d!b!q!b!j!up!s!w!br!mf !jt!t!i px o!j!o!G!h!3.4!boe!G!h!3.5!/!



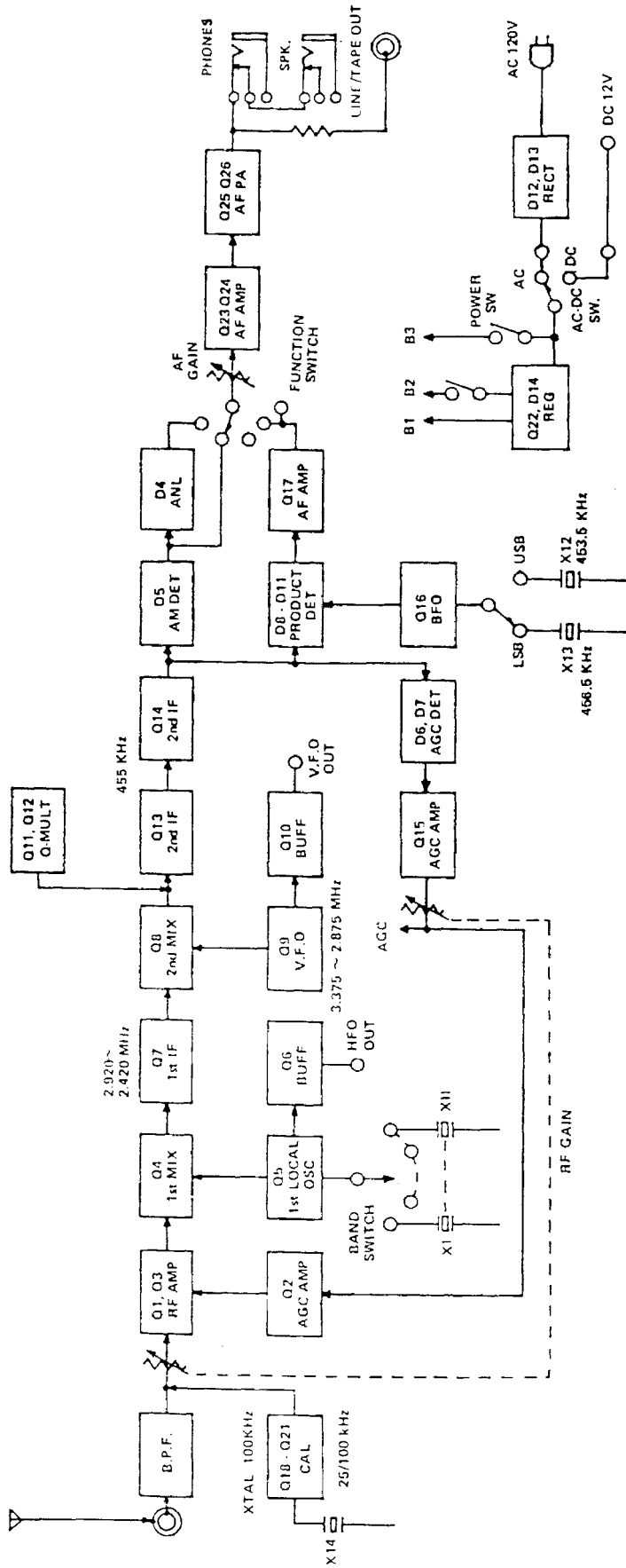
G!HVSF!3.3!MPDBU!POT!PGFYUSB!DSZTUBMBOE!DBQBDJUPS!



G!HVSF!3.4!DI BSU!PGFYUSB!DSZTUBMGSFRVFODZ!WT!DBQBDJUPS!WBMW/F!
GPS!4/6!21!NI {!SBOHF!



G!HVSF!3.5!DI BSU!PGFYUSB!DSZTUBMGSFRVFODZ!WT!DBQBDJUPS!WBMW/F!
GPS!21/1!41!NI {!



BLOCK DIAGRAM OF THE SX-190

TFDUJPO!4;!UI FPSZ!PGPQFSBUJPO!

4/2! HFOFSBM

Ui jt!tf dypolx jrtbje!jo!voef st uboejoh!ü f!pqf sbjpolpgü f!wbsjpvtdj sdvjü ljolü jt!sf df jwf slbt!x f rth
bt!bolbjeljoltf swjdjoh!boe!ejbhoptjoh!upvcrft!Ui f!TY.2: 1!jt!b!evbrtpowf stjpol!sf df jwf slvtjoh!bl
dszt ubrdpousprfhe!pt djrtbups!qspwjef!ü f!g!st un jyjoh!Ui f!g!st uboe!tf dpoe!n jyf st!bsf!dpvqrhe!
cz!bl!cboe.qbt t!JG!dj sdvjü611!! I {!x jef!Ui f!tf dpoe!dpowf stjpolpddvst!x jü !ü f!n jyjoh!pgü f!2t u
JGboe!ü f!WGP!Ui f!rpx!ps3oe!JG!jt!bn qrrjgf el!boe!ü f!o!ef uf düf el!cz!ü sf!ejggf sf oulef uf dupst!
Ui f!g!st ulef uf dupsqspwjef t!ü f!of df tt bsz!BHD!wprbhf t!-ü f!tf dpoe!lef uf dupsjt!vtf e!gps!BN!sf .
df qjpol!boe!ü f!ü jse!ef uf dupsjt!vtf e!gps!DX !boe!TTC!sf df qjpo!Ui f!ef uf düf e!tj hobrjt!ü f!o!bn .
qrrjgf el!boe!bqrrjgf el!up!ü f!lbej!p!pvuqvu!

Ui f!dpn qrhuf!dj sdvjüpgü f!TY.2: 1!jt!ti px ol!jo!ü f!tdi f n bujdlejhbson !bulü f!sf bslpgü f!n bovbrf!
B!crpd! lejhbson !jt!brtp!qspwjef el!up!bjel!jo!voef st uboejoh!ü jt!sf df jwf s!X i jrnf!sf bejoh!ü f!luf yujü
jt!t vhhf tuf elü bulcpü !lejhbson t!cf!gmpx f e!Ui f!crpd! lejhbson !x jrtf wf brtñi f!pwf sbrrtñi di f n f-!
x i f sf bt!ü f!tdi f n bujdlejhbson !x jrtf qspwjef!ü f!ef ubjrhel!dj sdvjusz/!

4/3! SGBN QWJGFST!BOE!! JHI !GSFRVFODZ!P TDJMMBUP S!

Ui f!SG!tj hobrñsf df jwf el!bulü f!bof oob!jt!bqrrjgf el!up!ü f!hbf!pgR2!)dbt dpof!SGBn qrrjgf s*!ü sv!
ü f!bof oob!joqvudpooof dupsk2!Ui f!QSFTFMFDUP S!dpousprjt!bl4. tf dypol!bjs!wbsjbcrrf!dbqbdj upsl
ü bulwof t!ü f!hbf!boe!esj!pgü f!SGbn qrrjgf slbt!x f rttbt!ü f!hbf!pgü f!g!st un jyf s!R5*!Ui f!
sf r vjsf el!wojoh!sboh!pgü f!tf!dj sdvjü!jt!pcubjof el!cz!tx jüi joh!bo!bqspqsbüf!wbrmf!pdj oevd.
ubodf!jo!qbsbrfrtx jü !ü f!QSFTFMFDUP S!wojoh!dbqbdj upslboe!jü!bt t pdjbf el!dpjrt!)U2-U3-' !
U4*!Ui f!dpn qrhuf!sboh!pg4/6!.!41!N I {!jt!dpwf sf el!cz!3!wojoh!sboh t!pgü f!QSFTFMFDUP S!
boe!cz!22!sboh t!pgü f!dszt ubrdpousprfhe!i jhi !gf r vf odz!pt djrtbups!)R6*!Ui f!pvuqvu!pgü f!li jhi !
gf r vf odz!pt djrtbups!) GP*!jt!dpvqrhe!up!ü f!tpvsdf!pgü f!2t un jyf slbt!x f rttbt!ü f!cbt f!pgbo!
f n ju!f slgmpx f s!R7*-!x i jdi !jt!dpvqrhe!up!k3!po!ü f!sf bslqbof rtpgü f!sf df jwf s!Ui f!f n ju!f slgmp
rpx f slbmpx t!ü f!pvuqvu!pgü f!! GP!up!cf!vtf elx jü pvuboz!rpbjoh!f gg dufc joh!qrbd f el!po!ü f!
I GP!Ui f!SGHBJO!dpouspr!)WS2-!3*!wbsjft!ü f!BHD!wprbhf!gf el!up!ü f!cbt f!pgü f!BHD!Bn qrrj
gf s!R3!boe!brtp!buf ovbüt!ü f!dpvqrñh!cf ux f f o!U2!boe!U3!Bt!ü f!tf ujoj!jt!di boh f el!jo!b!dpvo.
uf sdmpd x jtf!e!jsf dypol!ü f!cjb!t!ef dsf bt f t!dbvt joh!blsf evdypol!jo!hbj!pgü f!SGBn qrrjgf st ubhf !/
Ui f!ltn f!dpoejypol!f yjt!x i f o!ü f!ltn uf ohü !pgü f!jodpn joh!tj hobrñods f bt f t!Ui f!pvuqvu!pgü f!
SGBn qrrjgf stj!dpvqrhe!cz!U3!boe!wof el!cz!ü f!QSFTFMFDUP S!wojoh!dbqbdj upsl!ü f!hbf!pg
R5-!ü f!g!st un jyf s!

Ui f!pvuqvu!pgü f!! GP!jt!bn bzt!3: 31!N I {!li jhi f slü bo!ü f!rpx f sf ehf!pgü f!tf rfdüf el!cboe!Po!
gf r vf odj f t!cf rpx !28: 31!N I {!ü f!pt djrtbups!dprñdups!dj sdvjüjt!wof el!up!ü f!gyoebn f oubrrñdszt ubrh
gf r vf odz!bulgf r vf odj f t!bcpwf !31/531!N I {!ü f!dprñdups!dj sdvjüjt!wof el!up!ü f!ü jse!pwf supof!pg
ü f!dszt ubrñ

4/4! GJSTU!N JYFS!BOE!CBOEQBTT!JG!

Ui f!pvuqvlpgü f!SGBn qrrjg sljt!bqqrjfe!up!ü f!hbf!pgü f!gstun jyf s!R5!Bü f!tbn f!ün f!ü f!
pvuqvlpgü f!! GP!dpvqrhe!ü sv!U5!jt!bqqrjfe!up!ü f!t pvsdf!pgü f!gstun jyf s!Ui f!lx p!tjhobrnlbsf!
n jyf elboe!ü f!jlsqspvdt!bsf!tfrfdüf eljölü f!lesbjo!djsdvjupgR5!Ui f!djsdvjölü f!lesbjo!pgR4!jt!
wof e!bt!blcboeqbttdjsdvjüqbt tjoh!brngs r v f odjft!cf ux ff ol!3/: 31!N I {!boe!3/531!N I {!Ui jt!jt!
ü f!gsf r vf odz!sbhof!pgü f!611!L I {!cboeqbt!JG!Ui f!sbot gsn f st!M9-! :boe!Mm!boe!ü f!jstbt p.
djbu f el!dpn qpof out!dpn qsjtf!ü f!cboeqbt!JG!Ui f!pvuqvlpgü jt!JGjt!bqqrjfe!up!ü f!cbtf!pgR9-
ü f!tf dpoe!n jyf s!

4/5! TFDPOE!N JYFS!BOE!WBSJBCMF!GSFRVFODZ!PTDJMMBUPS!

Ui f!tf dpoe!n jyf sl!dpn cjoft!ü f!pvuqvlpgü f!cboeqbt!JGx jü !ü f!pvuqvlpgü f!wbsjbcrf!gsf .
r vf odz!pt djrmpsl)WGP*!up!qspvdf!ü f!566!L I {!JG!

Ui f!WGP!qspvdf t!ü f!sf r vjse!gsf r vf odjft!gplwvjoh!MTC-!VTC-!DX !boe!BN !tjhobrnl!Jbevdups!
U8!qbsbrfrtl!dbqbdjups!WD7-!jölü f!gsf r vf odz. ef ü sn jöjoh!of ux psl !/Ui f!pvuqvlpgf r vf odz!jt !rpx .
f sf e!dbvtjoh!ü f!WGP!up!wof!gpn !4/486.3/986!N I {!/!

Ui f!n jyjoh!qspvdt!pgü f!cboeqbt!JGboe!WGP!bsf!tfrfdüf eljölü f!dprfdups!djsdvjupgR9!)tf d.
poel n jyf s*!Ui f!pvuqvlpgü f!WGP!jt!qspwef e!buü f!sf bslqbof r!buk5!/! f sf !ü f!WGP!jt!jt prbu f e!
cz!f n ju f sl!gmpx f sl)R21*!/!

4/6! 566!L I {!JG!EFUF DUPS!DJS DVJUT!BOE!OP JTF!MUN JUFS!

Jh n f ejbu f rz!gmpx jöh!ü f!3oel n jyf s!)R9*!bsf !ü f!n f di bojdbrt!G rnf st!)N G2-!N G3*!Pvuqvlpgpn !
ü f!N G2!jt!bn qrrjg e!cz!R24!boe!dpooft!up!N G3!boe!jt!wof e!cz!ü f!ü f!sf f!sbot gsn f st!U: -!
U21!boe!U22!Ui f!tjhobrjt!ubl f ol!gpn !ü f!tf dpoebsz!pgU22!up!cf!ef ü duf e!boe!vt f e!bt!ü f!BHD!
wprdbf /

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ü spvhi !ü f!gvodjpot!x ju f !-!pol!up!ü f!BGHBJO!boe!up!ü f!2t!ubvejp!bn qrrjg s!

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4/:! SFKFDUJPO!GJMJFS!

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pgü f!opudi !/

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4/21! DBMJCSBUJPO!DJS DVJU!

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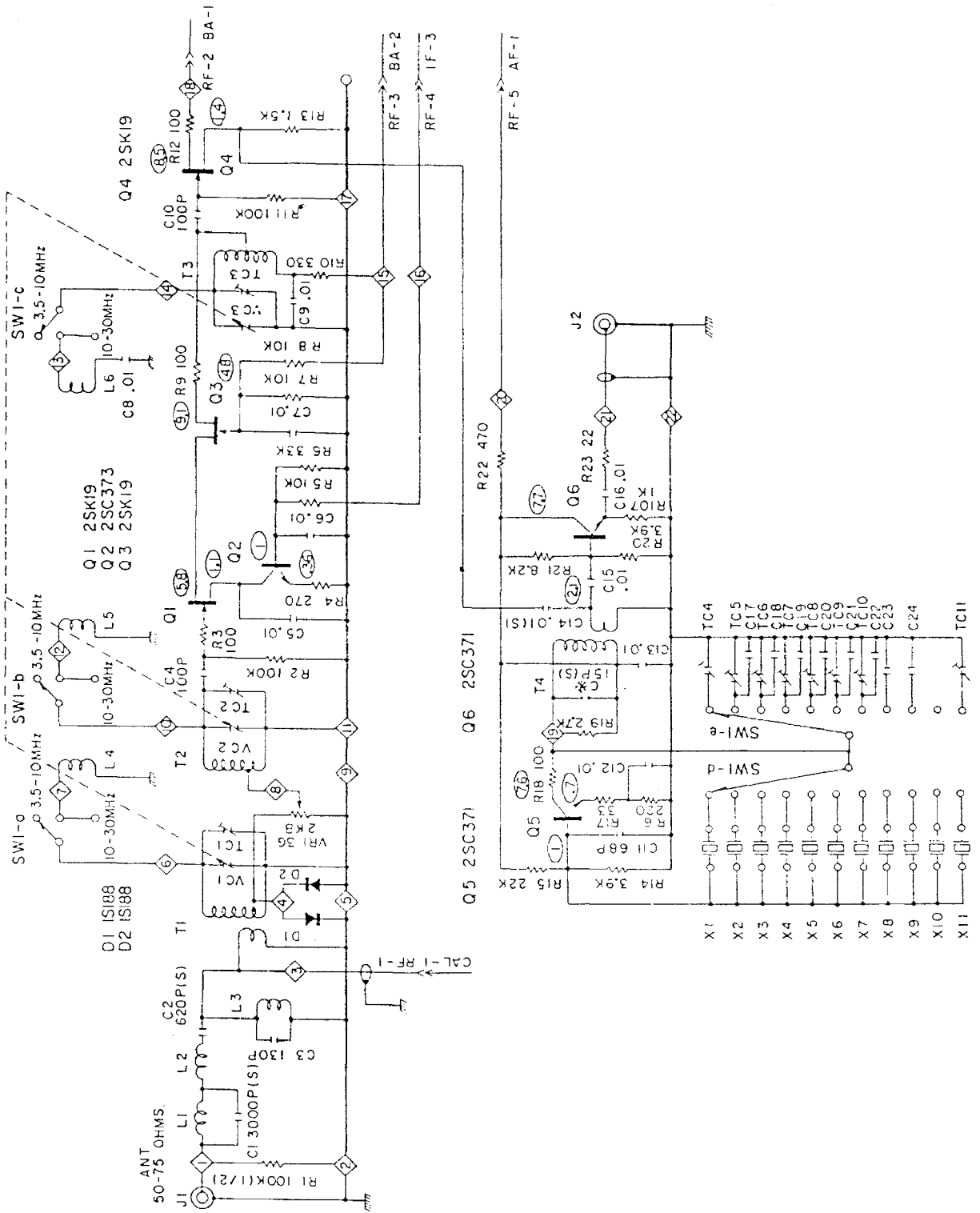
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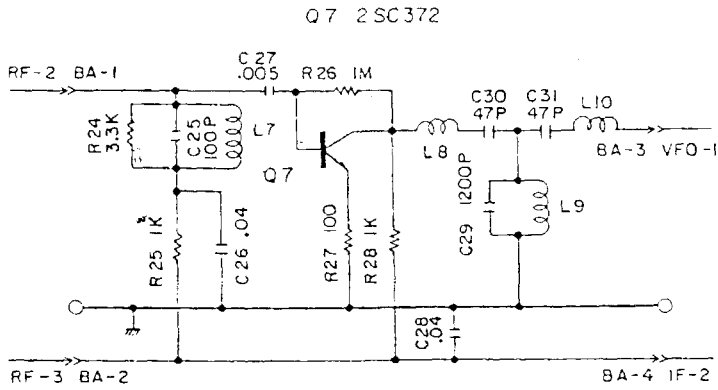
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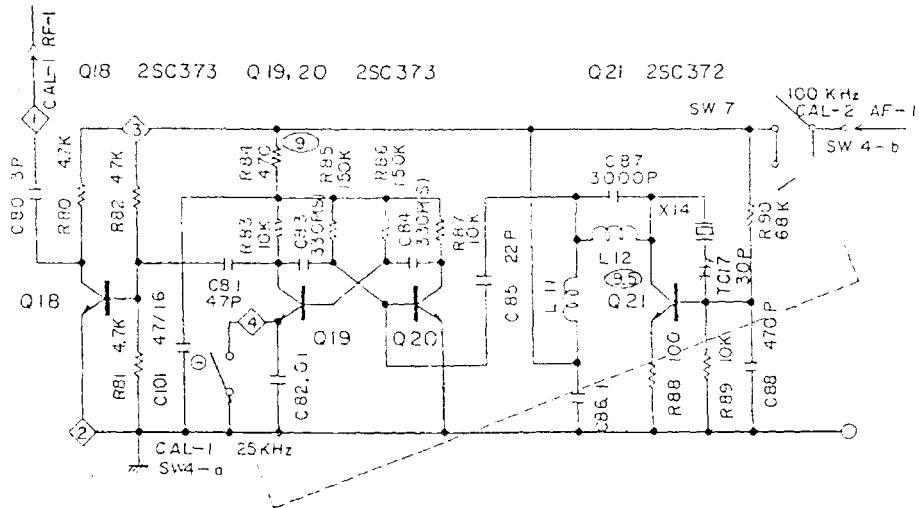
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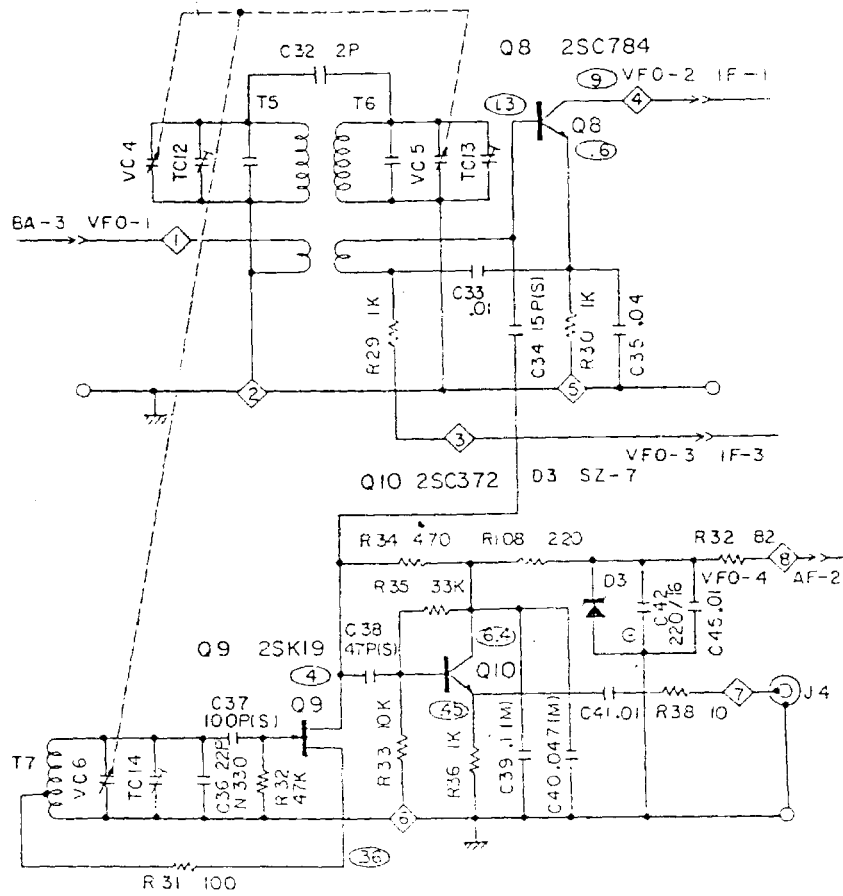
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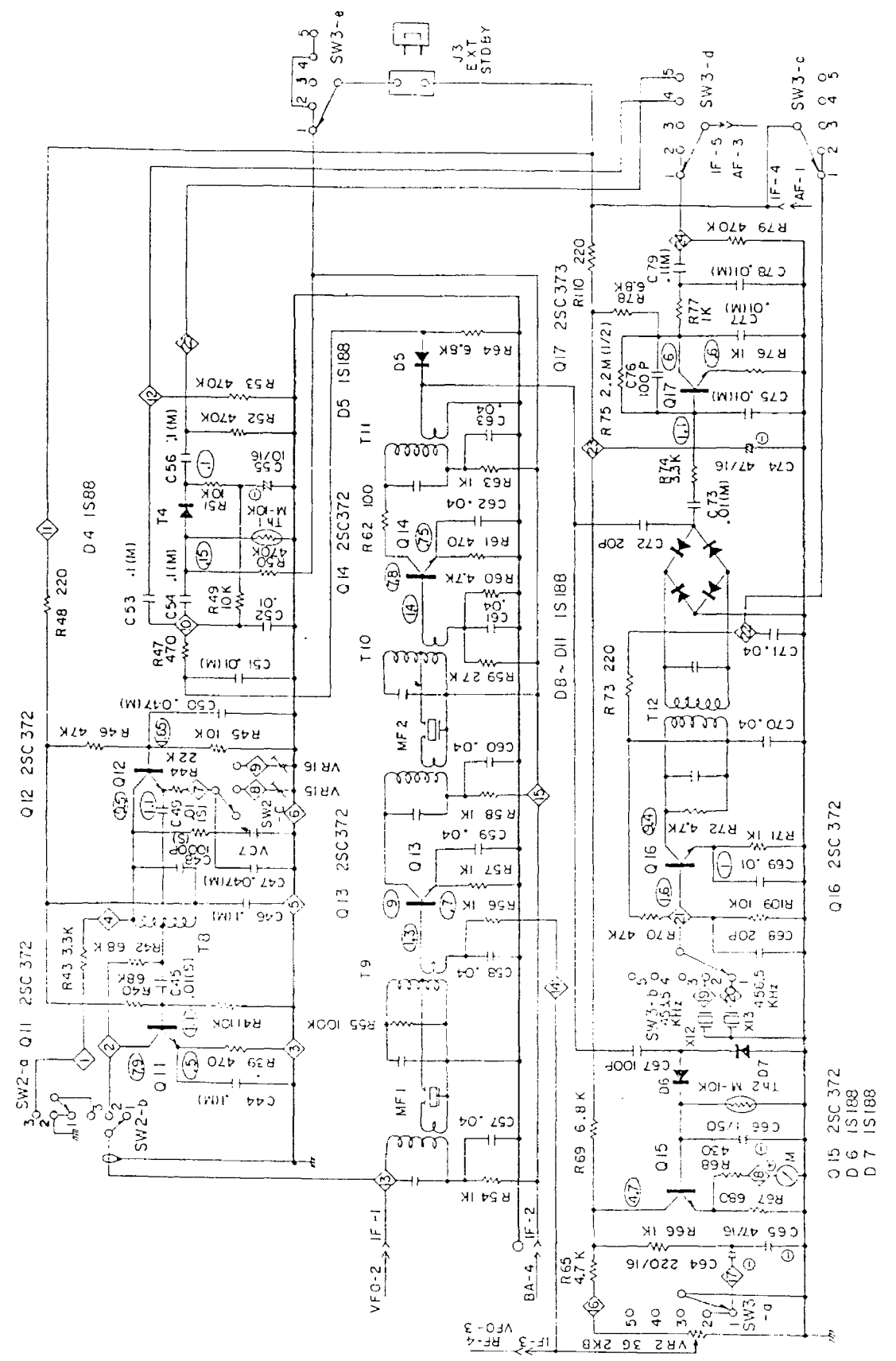
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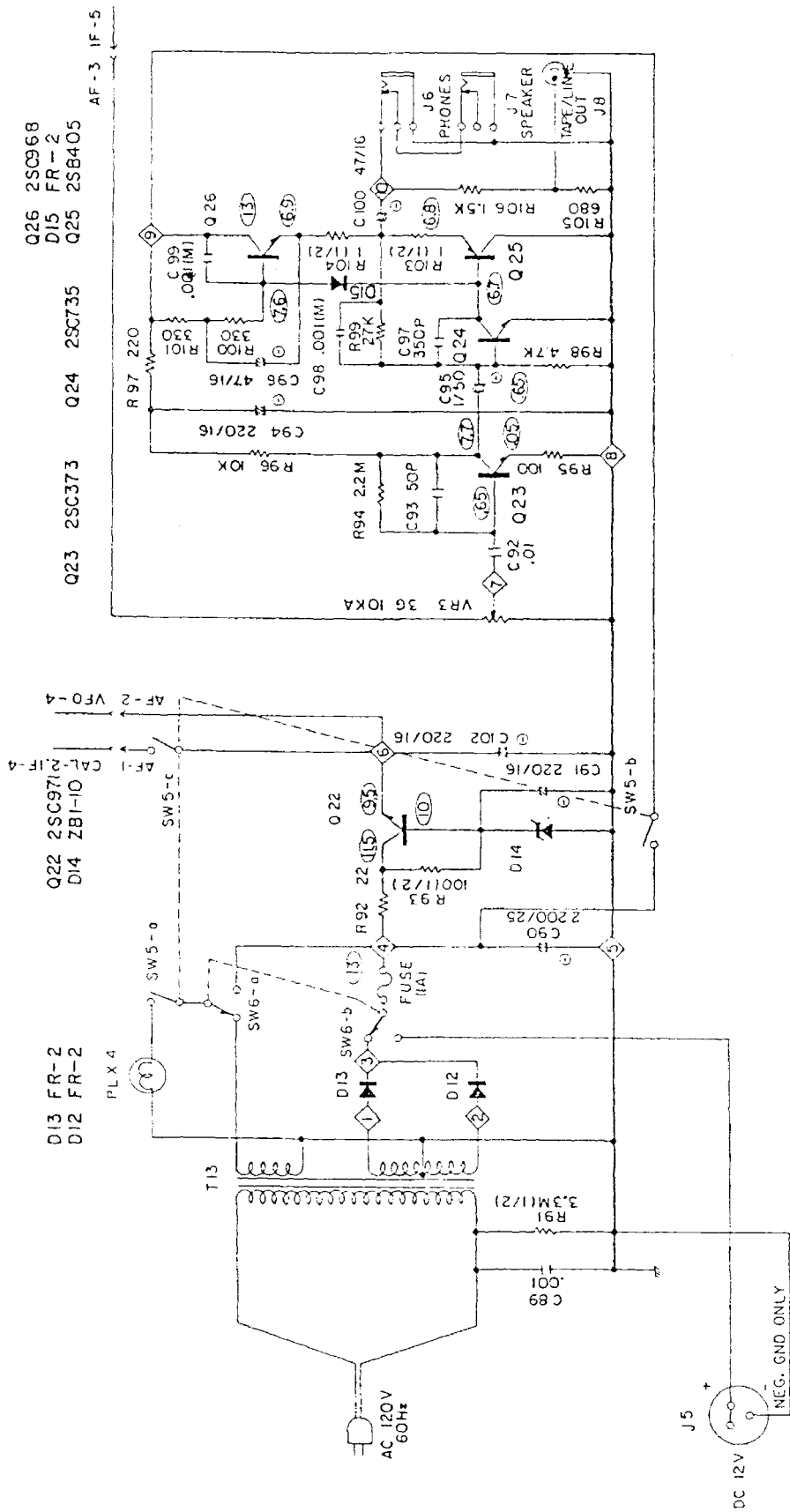
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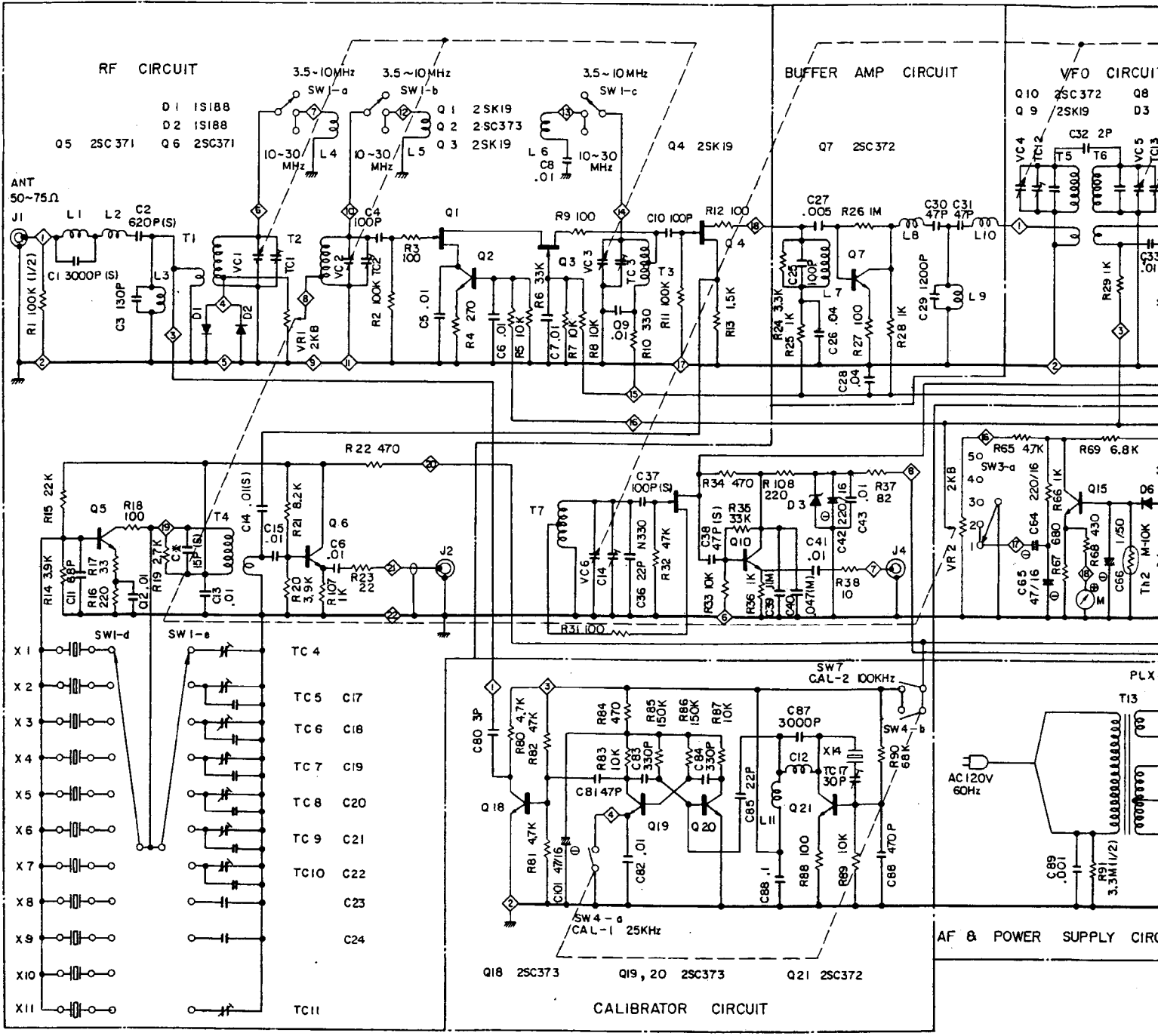


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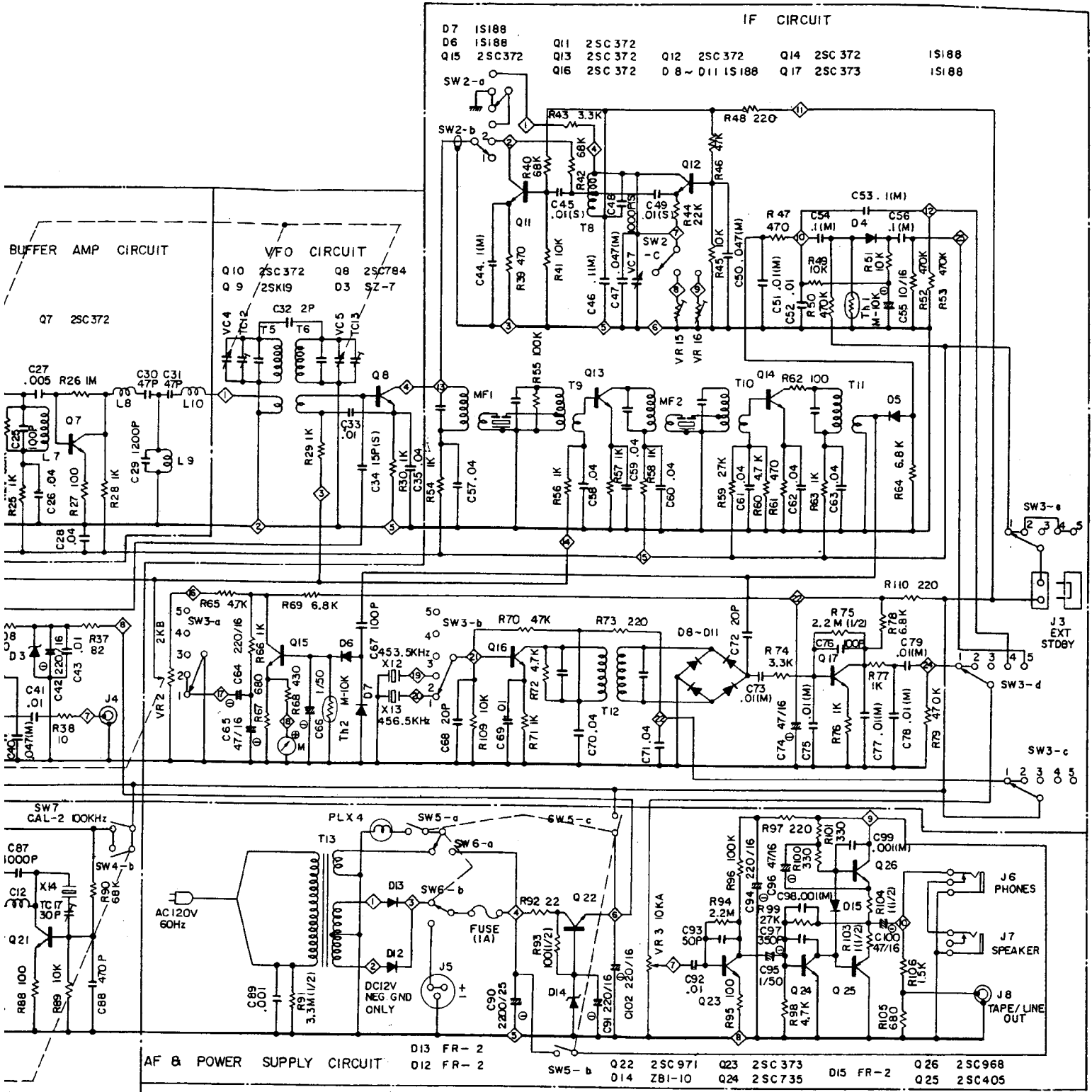
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R!4!	3TL 2: !	Dbt dpef !SGTubhf !
R!5!	3TL 2: !	2t uN jyf sl
R!6!	3TD482!	2t uMpobrPtd/!
R!7!	3TD482!	2t uMpobrPtd/!Fn juif slGmpx f sl
R!8!	3TD483!	2TuJGCboe!Qbt t!Bn q/!
R!9!	3TD895!	3oe!N jyf sl
R!: !	3TL 2: !	Wosjbcrf!Gsf r vf odz!Ptd/!
R21!	3TD483!	Wosjbcrf!Gsf r vf odz!Ptd/!Fn juif slGmpx f sl
R22!	3TD483!	#R#N vrjqrfi slJwf sl sl
R23!	3TD483!	#R#N vrjqrfi sl
R24!	3TD483!	3oe!JGBn q/!
R25!	3TD483!	3oe!JGBn q/!
R26!	3TD484!	BHD!Bn q/!
R27!	3TD483!	CGP!
R28!	3TD484!	BGBn q/!
R29!	3TD484!	DBM!Cvggf slBn q/!
R2: !	3TD484!	36l i {!N vrjwjcsbupsl
R31!	3TD484!	36l l {!N vrjwjcsbupsl
R32!	3TD483!	211l l {!Dbrjcsbupsl
R33!	3TD: 82!	Sf hvrbupsl
R34!	3TD484!	BGBn q/!
R35!	3TD846!	BGEsjwf slBn q/!
R36!	3TC516!	BGQpx f slBn q/!
R37!	3TD: 79!	BGQpx f slBn q/!

E!rh	2T299!	Pwf srpbe!Qspuf dups!
E!3!	2T299!	Pwf srpbe!Qspuf dups!
E!4!	T[8!	8W!Wprnbhf !Sf hvrbups!
E!5!	2T299!	BOM
E!6!	2T299!	BN !Ef uf dups!
E!7!	2T299!	BHD!Ef uf dups!
E!8!	2T299!	BHD!Ef uf dups!
E!9!	29299!	QspevduEf uf dups!
E!: !	29299!	QspevduEf uf dups!
E21!	2T299!	QspevduEf uf dups!
E22!	2T299!	QspevduEf uf dups!
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UI !2!	N .21L!	Uf n qf sbwrsf !Dpn qf ot bups!
UI !3!	N .21L!	Uf n qf sbwrsf !Dpn qf ot bups!




REMARKS:
 RESISTANCE VALUES IN OHMS. K=1000 M=1000000
 CAPASITANCE VALUES IN MF. P=MMF



VALUES IN OHMS. K=1000 M=1000000
 E VALUES IN MF. P=MMF

COMPLETE SCHEMATIC DIAGRAM OF RECEIVER

ALLIED RADIO SHACK  A TANDY CORPORATION COMPANY
FORT WORTH, TEXAS 76107

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