SERVICE MANUAL

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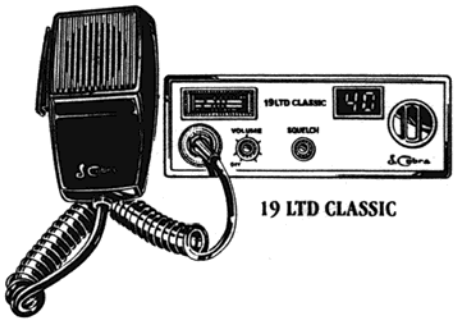
Cobra

19 LTD CLASSIC CB RADIO

America's Most Recognized Name In CB Communication



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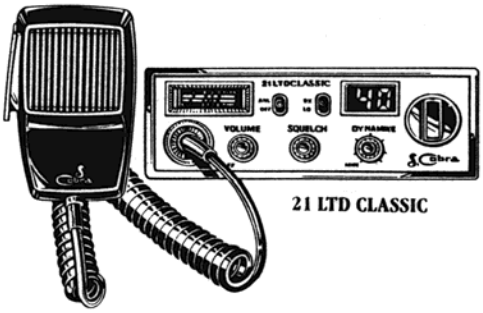

21 LTD CLASSIC

Cobra® CONSUMER ELECTRONICS GROUP

DYNASCAN CORPORATION

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MODELS 19 LTD CLASSIC & 21 LTD CLASSIC

TABLE OF CONTENTS
Models 19 LTD Classic & 21 LTD Classic

19/21 LTD CLASSIC

THEORY OF OPERATIONS

----- CIRCUIT DESCRIPTIONS -----
(REFER TO SCHEMATIC DIAGRAM AND BLOCK DIAGRAM)

1. BASIC PLL SYNTHESIS SCHEME

THE CRYSTAL FREQUENCY (10.240MHz) IS DIVIDED BY 4096 TO YIELD 2.5KHz, WHICH IS FED TO ONE SIDE OF THE PHASE DETECTOR. THE VCO OUTPUT IS DIVIDED BY A PROGRAMMABLE DIVIDER AND FED TO THE OTHER SIDE OF THE PHASE DETECTOR. THE FEEDBACK LOOP IS CLOSED BY PASSING THE PHASE DETECTOR OUTPUT THROUGH AN ACTIVE LOW PASS FILTER AND USING THE OUTPUT TO CONTROL THE VCO FREQUENCY THROUGH VARICAP D 14; THE NET RESULT IS A SECOND ORDER PHASE LOCKED LOOP. UNDER LOCKED CONDITIONS, THE FREQUENCY TO BOTH SIDES OF THE PHASE DETECTOR MUST BE IDENTICAL AT 2.5KHz. THE VCO FREQUENCY IS THEN GIVEN BY:

$$F_{VCO} / N = 0.0025\text{MHz} \text{ OR } F_{VCO} = 0.0025 \times N \text{ MHz}$$

SINCE N IS AN INTEGER, THE VCO FREQUENCY CAN BE STEPPED UP IN 2.5KHz INCREMENTS. BY SUITABLE CHOICE OF N, THE DESIRED OUTPUT FREQUENCIES ARE OBTAINED. THE VCO FREQUENCY IS FED TO Q 20 WHICH THEN DOUBLES THE FREQUENCY. FOR THE FIRST LOCAL OSCILLATION, THE BUFFER AMP Q 12 OUTPUT IS SUPPLIED. SINCE ALL FREQUENCIES ARE OBTAINED FROM THE CRYSTAL OSCILLATOR, ALL OUTPUT ARE COHERENT WITH THE CRYSTAL OSCILLATOR FREQUENCY AND MAINTAIN THE SAME PERCENTAGE ACCURACY.

2. PHASE DETECTOR AND VCO CONTROL

THE PHASE DETECTOR IS A DIGITAL PHASE COMPARATOR WHICH COMPARES THE LEADING EDGE OF THE REFERENCE WITH PROGRAMMABLE DIVIDER OUTPUT SQUARE WAVES AND DEVELOPS A SERIES OF PULSES WHOSE DC LEVEL DEPENDS ON WHETHER THE PHASE ERROR IS LEADING OR LAGGING. THE PHASE DETECTOR PULSE OUTPUT IS FED TO A CHARGE PUMP AND THEN PIN 15 OF IC 1. THE CHARGE PUMP OUTPUT IS FED TO AN ACTIVE LOW PASS FILTER WHICH CONSISTS OF R 88, R 89, C 104 AND THE AMPLIFIER BETWEEN PINS 16 AND 17 OF IC 1. THE LOW PASS FILTER OUTPUT AT PIN 17 OF IC 1 IS FURTHER FILTERED AND FED TO VARICAP D 14 TO CONTROL THE VCO FREQUENCY. THE RESULT IS A SECOND ORDER PLL WITH THE LOOP DYNAMICS ESSENTIALLY CONTROLLED BY THE ACTIVE LOW PASS FILTER.

3. TRANSMIT AND RECEIVE BUFFER AMP

THE VCO OUTPUT IS FED INTO BUFFER AMP Q 12 FROM THE SECONDARY COIL OF L 13.

4. TRANSMIT DOUBLER

THE Q 12 OUTPUT IS OBTAINED AS BASE OUTPUT AND FED TO THE BASE OF DOUBLER TRANSISTOR Q 20. AT THIS STAGE, THE FREQUENCY IS DOUBLED. THE Q 20 OUTPUT TANK IS A DOUBLE TUNED CIRCUIT CONSISTING OF L 11 AND L 12 TO STOP THE FUNDAMENTAL FREQUENCY.

5. SWITCHING OF TUNING CAPACITOR IN VCO OSCILLATOR TANK CIRCUIT

THE VCO CIRCUIT MUST TUNE WITH A WIDE RANGE OF FREQUENCIES, 13.4825 TO 13.7025MHz FOR TRANSMITTER AND 16.270 TO 16.710MHz FOR RECEIVER.

THE USE OF ONE TUNING CAPACITOR IN COMMON HAVE SUCH ADVERSE EFFECTS AS A DECREASE IN THE TUNING CIRCUIT AND THE OCCURENCE OF MANY SPURIOUS RESPONSES. TO ELIMINATE THESE EFFECTS, THE TUNING CAPACITANCE IS SWITCHED FOR TRANSMISSION OR RECEPTION.

THE TANK CIRCUIT CONSISTS OF THE PRIMARY OF L13, C 90 AND C 92. WHEN RECEIVING, Q 13 BECOMES OFF AND THEREFORE, THE PRIMARY OF L 13 PERFORMS THE TUNING FUNCTION. WHEN TRANSMITTING, Q 13 BECOMES ON AND THEREFORE, THE PRIMARY OF L 13 AND THE PARALLEL CAPACITANCE OF C 91 AND C 92 PERFORMS THE TUNING FUNCTION.

6. RECEIVER LOCAL OSCILLATOR OUTPUT

FIRST MIXER: THE SECONDARY OUTPUT OF VCO TANK CIRCUIT L 13 IS INJECTED THROUGH BUFFER AMP Q 12 AND THE BUFFER CIRCUIT OUTPUT THROUGH THE BASE OF Q 4.

SECOND MIXER: THE OSCILLATION OUTPUT, OSCILLATED WITH 10.240MHz CRYSTAL X 1 BY Q 15, IS INJECTED INTO THE BASE OF Q 4.

7. OUT OF LOCK PROTECTION

IC 1 INCLUDES AN AUXILLARY EXCLUSIVE OR PHASE DETECTOR WHICH FUNCTIONS AS A LOCK DETECTOR. IF LOCK IS LOST, PIN 14 GOES LOW AND THE BASE BIAS OF Q 19 IS CUT OFF TO PROHIBIT TRANSMISSION AND RECEPTION. TRANSMISSIONS CANNOT BE MADE IF A CODE OTHER THAN THOSE FOR THE 40 CHANNELS ARE INPUTED TO IC 1.

8. FREQUENCY STABILITY

LET: FXo = CRYSTAL OSCILLATOR FREQUENCY
FRef = PHASE DETECTOR REFERENCE FREQUENCY
FVCO = VCO FREQUENCY
XCMP = FRef = FO/4096

AND UNDER LOCKED CONDITIONS:
FRef = FVCO/N :N IS THE PROGRAMMABLE DIVIDE RATIO

XCMP: FVCO = N x FRef = n (FXo/4096)

FROM WHICH IT CAN BE SEEN, THE PERCENTAGE ERROR IN FTrn IS THE SAME AS THE PERCENTAGE ERROR IN FXo. THE STABILITY OF THE CRYSTAL OSCILLATOR IS DETERMINED PRIMARILY BY THE CRYSTAL AND TO A LESSER EXTENT BY THE ACTIVE AND PASSIVE COMPONENTS IS SUCH THAT THE REQUIRED FREQUENCY STABILITY IS MAINTAINED OVER THE REQUIRED VOLTAGE AND TEMPERATURE RANGE.

9. DETAILED DESCRIPTION

-1. INTRODUCTION

THE SYNTHESIZER IS IMPLEMENTED WITH THE FOLLOWING COMPONENTS:

PLL IC	(IC 1)
X-TAL	(X 1)
VARICAP DIODE	(D 14)
TRANSISTOR	(Q 13, 14)
LED DISPLAY	(LED DISPLAY)

-IC 1 IS A CMOS LSI THAT INCLUDES MOST OF THE PLL BLOCK.
-THE VCO WITH VARICAP DIODE D 14 IS PART OF THE OSCILLATOR TANK CIRCUIT.
-Q 13 IS A SWITCHING TRANSISTOR TO CONNECT OR DISCONNECT THE TUNING CAPACITOR C 91 IN THE VCO TANK CIRCUIT FOR TRANSMITTER OR RECEIVER.

-2. REFERENCE FREQUENCY

THE REFERENCE FREQUENCY IS PRODUCED BY X 1 AND OTHER COMPONENTS AT Q 15. THE OSCILLATOR OUTPUT IS FED TO PIN 11 AT IC 1 AND DIVIDED BY 4096 TO PRODUCE A 2.5KHz SQUARE WAVE WHICH IS THE REFERENCE INPUT TO THE PHASE DETECTOR.

-3. VCO

Q 14 IS CONSTRUCTED BY A COLPITTS TYPE OSCILLATOR WITH VARICAP DIODE D 14 AS A PART OF THE TANK CIRCUIT. WITH APPROPRIATE CONTROL VOLTAGE ON D 14, THE VCO CAN BE MADE TO OSCILLATE OVER THE REQUIRED RANGE OF 13.4825 TO 16.710MHz.

-4. PROGRAMMABLE DIVIDER AND CONTROL

THE PROGRAMMABLE INPUTS, CONSISTING OF A 7-SEGMENT CODE, ARE FED TO PINS 1 THROUGH 8 OF IC 1 TO LIGHT CHANNEL INDICATOR LED (LED 1). For CH. 1, "b" AND "c" OF THE FIRST LED ELEMENT WILL LIGHT. THE PROGRAMMABLE INPUT "b" GOES LOW TO PRODUCE CH. 1 DIVIDE (RX: N = 3254, TX: N = 5393). FOR EACH CHANNEL NUMBER INPUT, AN INTERNAL CODE CONVERTER ROM PROVIDES THE APPROPRIATE BINARY CONTROL TO THE PROGRAMMABLE DIVIDER FOR THAT CHANNEL. SINCE THE BINARY NUMBER REQUIRED IS DIFFERENT DURING TRANSMIT AND RECEIVE, AN ADDITIONAL BIT IS REQUIRED AT PIN 20 OF IC 1 TO ALLOW THE ROM TO RECOGNIZE THE TX/RX STATUS. DURING TRANSMIT, THE PUSH-TO-TALK SWITCH ROUNDS PIN 20 THROUGH RESISTOR WHICH IS THE TRANSMIT STATUS. THE PROGRAMMABLE DIVIDER OUTPUT IS FED TO THE PHASE DETECTOR FOR COMPARISON WITH THE 2.5KHz REFERENCE. (SEE TABLE 1 FOR ACTUAL INPUT AND DIVIDE RATIOS ON ALL CHANNELS.)

10. DESCRIPTION OF OTHER CIRCUITS

-1. RF AMPLIFICATION

THE OUTPUT OF DOUBLER CIRCUITS Q 20 IS FED THROUGH DOUBLE TUNING (27MHz) L 11 AND L 12 TO THE BASE OF PRE-AMPLIFIER Q 19. THE OUTPUT IS SUPPLIED THROUGH TUNING CIRCUIT L 10, C 72 AND C 73 TO RF DRIVER AMPLIFIER Q 18. THE Q 18 OUTPUT IS CAPACITANCE DIVIDED BY TUNING CIRCUIT C 69 AND C 70 PASSED THROUGH THE BASE OF FINAL RF STAGE. THE Q 17 OUTPUT IS SUPPLIED TO THE ANTENNA THROUGH L-C TUNING CIRCUIT.

-2. CIRCUIT FOR SUPPRESSION OF SPURIOUS RADIATION

THE TUNING CIRCUIT BETWEEN FREQUENCY SYNTHESIZER AND FINAL AMPLIFIER Q 17 AND 2-STAGE "PI" NETWORK C 59, L 6, C 60, L 7 AND C 61 IN THE Q 17 OUTPUT CIRCUIT SERVE TO SUPPRESS SPURIOUS RADIATION. THE NETWORK CONSISTING OF L 8, C 62, AND C 63 SERVE TO MATCH THE IMPEDANCE OF Q 17 TO THE ANTENNA TO REDUCE THE SPURIOUS CONTENT TO ACCEPTABLE LEVELS IN THE FREQUENCY SYNTHESIZER.

-3. CIRCUITS FOR LIMITING POWER

DURING FACTORY ALIGNMENT, THE SERIES BASE RESISTOR OF FINAL AMPLIFIER Q 17 (R 66) IS SELECTED TO LIMIT THE AVAILABLE POWER TO SLIGHTLY MORE THAN 4 WATTS. THE TUNING IS ADJUSTED SO THAT THE ACTUAL POWER IS FROM 3.6 TO 4.4 WATTS. THERE ARE NO OTHER CONTROLS FOR ADJUSTING THE POWER.

-4. MODULATION

THE MIC INPUT IS FED TO C.R. AND THEN TO AUDIO POWER AMP IC 2 WHICH FEEDS MODULATION TRANSFORMER T 1. THE AUDIO OUTPUT AT THE SECONDARY OF T 1 IS FED IN SERIES WITH THE B+ VOLTAGE THROUGH DIODE D 8 TO THE COLLECTORS OF DRIVER Q 18 AND FINAL Q 17 TO COLLECTOR-MODULATE BOTH THESE STAGES.

-5. CIRCUITS FOR LIMITING MODULATION

A PORTION OF THE MODULATING VOLTAGE IS RECTIFIED BY D 7 WHICH TURNS ON Q 7 WHICH THEN ATTENUATES THE MIC INPUT TO AUDIO AMP IC 2. THE RESULTING FEEDBACK LOOP KEEPS THE MODULATION FROM EXCEEDING 100 PERCENT INPUTS, APPROXIMATELY 40dB GREATER THAN THAT REQUIRED TO PRODUCE 50 PERCENT MODULATION. THE ATTACK TIME IS ABOUT 100mS AND THE RELEASE TIME IS ABOUT 300mS.

TABLE 1

Program Data and Frequency Division

CHANNEL	U.S.A		
	FREQ	TX VCO FREQ (TX F IN)	RX VCO FREQ (RX F IN)
1	26.965	13.4825	16.27
2	26.975	13.4875	16.28
3	26.985	13.4925	16.29
4	27.005	13.5025	16.31
5	27.015	13.5075	16.32
6	27.025	13.5125	16.33
7	27.035	13.5175	16.34
8	27.055	13.5275	16.36
9	27.065	13.5325	16.37
10	27.075	13.5375	16.38
11	27.085	13.5425	16.39
12	27.105	13.5525	16.41
13	27.115	13.5575	16.42
14	27.125	13.5625	16.43
15	27.135	13.5675	16.44
16	27.155	13.5775	16.46
17	27.165	13.5825	16.47
18	27.175	13.5875	16.48
19	27.185	13.5925	16.49
20	27.205	13.6025	16.51
21	27.215	13.6075	16.52
22	27.225	13.6125	16.53
23	27.255	13.6275	16.56
24	27.235	13.6175	16.54
25	27.245	13.6225	16.55
26	27.265	13.6325	16.57
27	27.275	13.6375	16.58
28	27.285	13.6425	16.59
29	27.295	13.6475	16.60
30	27.305	13.6525	16.61
31	27.315	13.6575	16.62
32	27.325	13.6625	16.63
33	27.335	13.6675	16.64
34	27.345	13.6725	16.65
35	27.355	13.6775	16.66
36	27.365	13.6825	16.67
37	27.375	13.6875	16.68
38	27.385	13.6925	16.69
39	27.395	13.6975	16.70
40	27.405	13.7025	16.71

A L I G N M E N T P R O C E D U R E S

I. TRANSMITTER TUNE UP PROCEDURE

1. PRELIMINARY SYNTHESIZER ALIGNMENT

-CONNECT DC VOLTMETER (14) TO JUNCTION OF R85, R86 AND C93. TRANSMIT ON CHANNEL 1. ADJUST L13 SO THAT DC VOLTMETER READS 1.5 VOLTS. REMOVE DC VOLTMETER.

2. FINAL ALIGNMENT

A) WITH RF VOLTMETER (13) AT BASE OF Q19, TRANSMIT ON CHANNEL 18. ADJUST IN TURN L12 AND L11 FOR MAXIMUM READING ON RF VOLTMETER. REPEAT AS NEEDED. REMOVE RF VOLTMETER.

B) ADJUST IN TURN L10 AND L8 FOR MAXIMUM READING ON RF WATTMETER (5). REPEAT AS NEEDED.

* REPEAT STEPS 1 AND 2 AS NEEDED. OUTPUT POWER READING ON RF WATTMETER (5) SHOULD BE FROM 3.6 TO 4.0 WATTS. IF RF POWER EXCEEDS 4.0 WATTS, INCREASE R66 TO REDUCE POWER AND REPEAT PART B.

3. FINAL CHECK

IN TRANSMIT ON ALL 40 CHANNELS

-OUTPUT POWER SHOULD BE FROM 3.6 TO 4.0 WATTS.

-FREQUENCY SHOULD BE WITHIN +/-400Hz OF CHANNEL CENTER FREQUENCY.

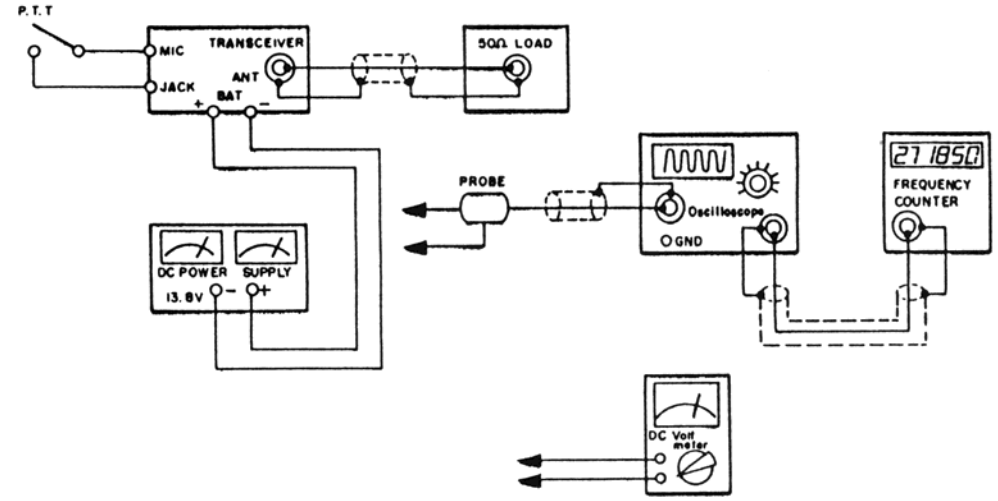
-SPURIOUS CONTENT AS OBSERVED ON SPECTRUM ANALYZER (10) SHOULD BE AT LEAST 60dB BELOW CARRIER.

-WITH 2500Hz MODULATION AT 16dB GREATER THAN THAT REQUIRED TO PRODUCE 50 PERCENT MODULATION WITH 1000Hz, OCCUPIED BANDWIDTH SHOULD BE AT LEAST 2dB BETTER THAN LIMIT SPEC.

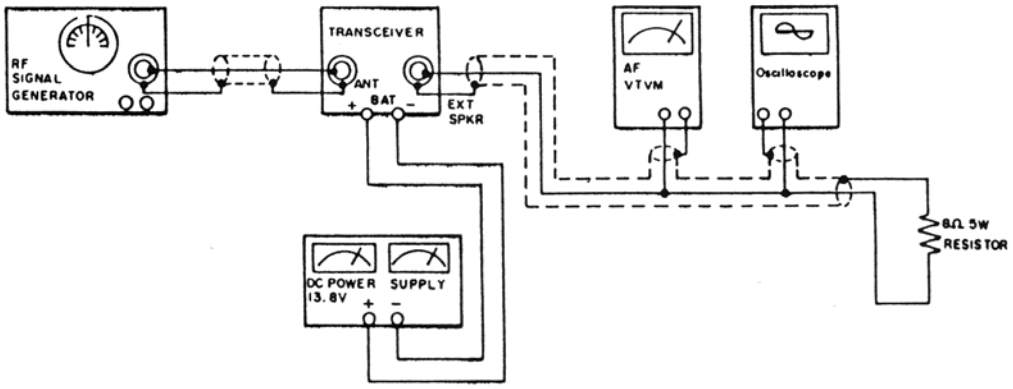
NOTE: DYNAMIKE KNOB MUST BE SET TO FULLY CLOCKWISE POSITION WHEN MODULATION IS APPLIED.

Test Equipment Setup
19 / 21 LTD CLASSIC

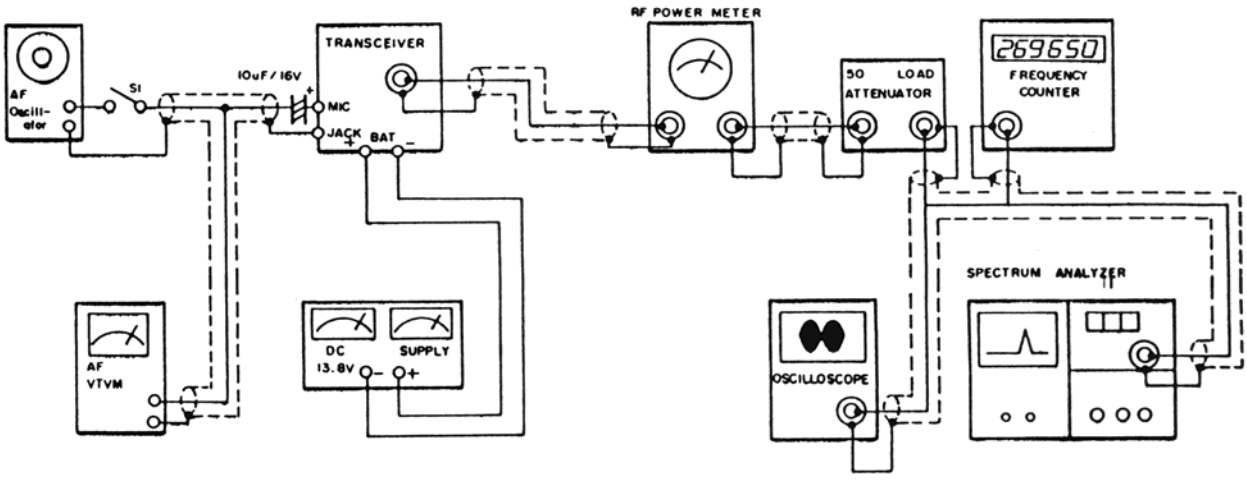
PLL and Carrier Section

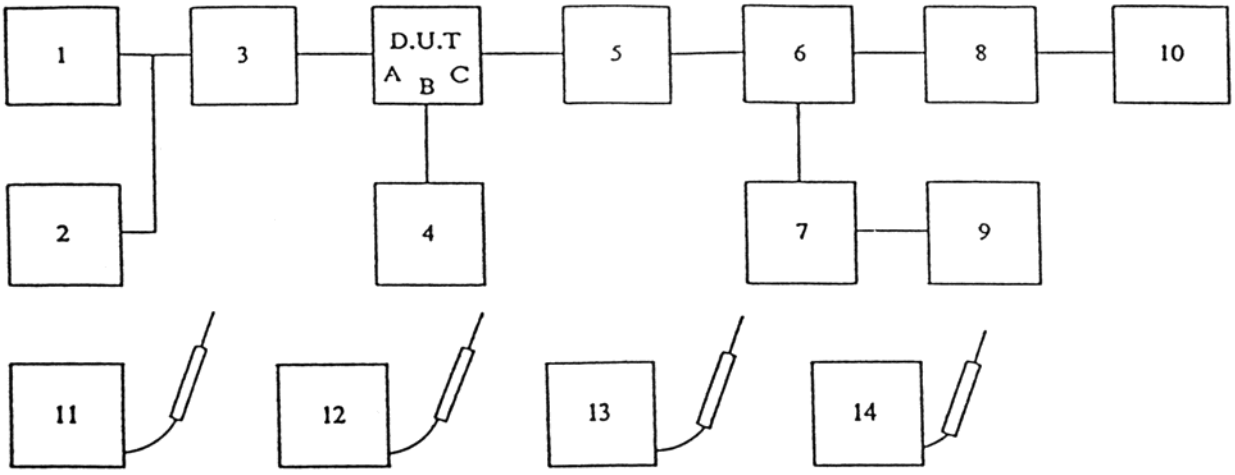


Receiver Section



Transmitter Section





D.U.T: Device Under Test
A: MIC Input
B: Antenna Jack
C: Power Input Leads

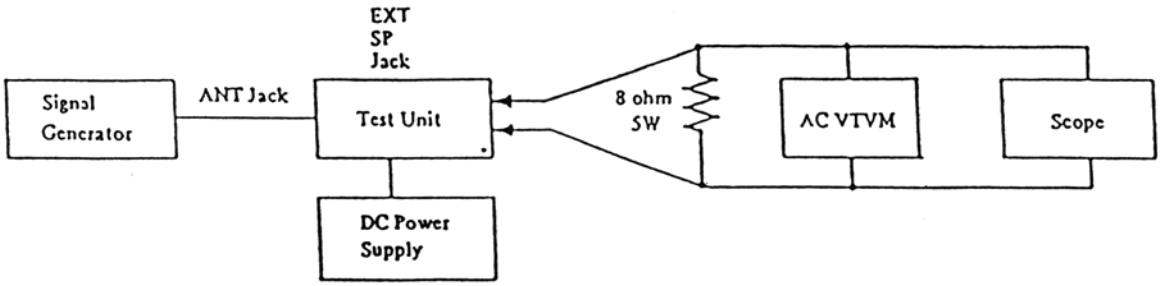
Item No.	Description
1	Audio Oscillator
2	Frequency Counter
3	Audio Attenuator
4	Regulated DC Supply
5	RF Wattmeter
6	Coupler
7	Oscilloscope
8	RF Attenuator
9	Frequency Counter
10	Spectrum Analyzer
11	Oscilloscope
12	Frequency Counter
13	RF Voltmeter
14	DC Voltmeter

II. RECEIVER ALIGNMENT SETUP

1. RECEIVER CIRCUIT ALIGNMENT

-TEST SETUP

-REFER TO THE DIAGRAM SHOWN BELOW



RECEIVER ALIGNMENT SETUP

2. RECEIVER CIRCUIT

-IN THE RECEIVER MODE OF OPERATION, Q11 TRANSISTOR IS TURNED OFF. ALSO, BIAS VOLTAGE IS APPLIED TO Q4 AND A PROPER BIAS AND AGC VOLTAGE IS ESTABLISHED TO Q1,Q2,Q3,Q4 AND Q5.

-Q1 IS THE RF ATTENUATOR.

-Q2 IS A 27MHz RF INPUT AMPLIFIER, AND ANY EXCESSIVE INPUT SIGNAL IS LIMITED BY DIODES D1 AND D2. THE AMPLIFIED 27MHz IS MIXED WITH VCO FREQUENCY SELECTED BY CHANNEL SWITCH. FOR CHANNEL 1 VCO IS SET AT 16.27MHz. THE RESULTING FIRST IF IS 26.965 - 16.27 = 10.695MHz.

-Q3 IS THE FIRST CONVERTER, AND THE 10.695MHz IS SHARPLY FILTERED BY L3 AND A CERAMIC FILTER CF1. THE FIRST IF IS AGAIN MIXED WITH A SECOND LOCAL OSCILLATOR OF 10.24MHz. 10.695 - 10.24 = 0.455MHz.

-Q4 IS THE SECOND CONVERTER. SECOND IF IS FILTERED BY A RAZOR SHARP CERAMIC FILTER OF CF2 COUPLED WITH L4.

-Q5 IS A FIRST 455kHz AMPLIFIER, AND THE Q6 BEING THE LAST AMPLIFIER.

-D3 IS A DETECTOR DIODE WHICH PRODUCED AUDIO SIGNAL AS WELL AS A NEGATIVE DC VOLTAGE FOR AGC ACTION. THE NEGATIVE VOLTAGE ALSO PROVIDES FORWARD BIASING TO THE ANODE OF THE ANL DIODE. THE BIASING VOLTAGE HAS A TIME CONSTANT DETERMINED BY R27 AND C25. THEREFORE, ANY SHARP NEGATIVE GOING PULSE FROM D3 WILL BACK BIAS D5 AND BE CLIPPED.

3. SENSITIVITY ALIGNMENT

-SET THE SIGNAL GENERATOR TO PROVIDE 27.185MHz, 1kHz 30% MODULATION. PLACE THE CHANNEL SELECTOR IN CHANNEL 19 POSITION.

-ADJUST L1,L2,L3,L4 AND L5 FOR MAXIMUM AUDIO OUTPUT ACROSS THE 8 OHM DUMMY LOAD RESISTOR. THIS ALIGNMENT SHOULD BE PERFORMED BY GRADUALLY DECREASING THE SIGNAL, OUTPUT SIGNAL TO MINIMUM LEVEL REQUIRED FOR TUNING TO AVOID INACCURATE ALIGNMENT DUE TO AGC ACTION.

4. SQUELCH CIRCUIT ALIGNMENT

-SET THE SIGNAL GENERATOR TO PROVIDE 60dBu, 1kHz 30% MODULATION ANTENNA INPUT.

-ROTATE THE SQUELCH CONTROL IN FULL CLOCKWISE DIRECTION.

-TEMPORARILY ADJUST VR3 FOR MAXIMUM AUDIO OUTPUT, AND NOTE THE AUDIO OUTPUT LEVEL. THEN ADJUST VR3 SO THAT THE AUDIO OUTPUT LEVEL DECREASES BY 6dB.

-NEXT, REDUCE THE ANTENNA INPUT SIGNAL LEVEL FROM 53 TO 58dB AND MAKE SURE THAT THE AUDIO OUTPUT DECREASES TO ZERO.

-REDUCE ANTENNA SIGNAL INPUT LEVEL TO ZERO AND ADJUST THE SQUELCH CONTROL UNTIL THE NOISE OUTPUT DECREASES UNTIL JUST DISAPPEARING.

TROUBLE SHOOTING GUIDE FOR 19/21 LTD CLASSIC

Check the following components to see if they are defective or not. Replace the defective one if any.

Symptom	Relative circuit symbol
1. UNIT WILL NOT TURN ON	
A) Blown Fuse	
B) Defective Power Switch	
C) Defect in Power Supply Circuit	Q10,Q11,Q16
2. NO SOUND RECEIVED	
A) Defective External Speaker Jack	J2
B) Bad Contact in the Microphone Jack	J3
C) Unlocked PLL Circuit or Improper Alignment	Q12,Q13,Q14,Q15,IC1
D) Defect in Audio/Squelch Circuit	Q8,IC2
E) Defect in Relative Receiver Circuit	Q1,Q2,Q3,Q4,Q5,Q6
3. NO TRANSMISSION	
A) Bad Contact in the Microphone Jack	J3
B) Defective PTT Switch on Microphone	
C) Bad Contact in the ANT Jack	J1
D) Unlocked PLL Circuit or Improper Alignment	Q12,Q13,Q14,Q15,IC1
E) Defect in Relative Transmitter Circuit	Q17,Q18,Q19,Q20
4. NO TX MODULATION	
A) Defective Microphone and/or Circuit	
B) Defect in Modulation Circuit	Q7,IC2,D8

TROUBLE SHOOTING GUIDE FOR 19/21 LTD CLASSIC

For more hints, see below:

DEFECTIVE PLL?

Check voltage at Pin 14 of IC1. If less than 4V, PLL is unlocked. If more than 4V, PLL is OK.

NO TRANSMISSION

Connect current meter in series with power cable. Check current reading for transmit mode. If current reads more than 1 ampere (but less than 2A), the final output transistor is OK. Check for bad contact or short circuits between PC Board and Antenna Connector. A current reading of less than 0.5A indicates no drive to Final Transistor, check drive or early RF stages.

NO SOUND RECEIVED

Connect RF Signal Generator with modulation and set it's output level more that 10uV, or select channel to which RF signal is coming in apparently. If the S/RF meter shows incoming signal but no sound, check the Squelch and/or Audio circuit. If the S/RF meter does not show incoming signal, check the receiver RF and IF stages.

19 LTD CLASSIC
V O L T A G E C H A R T

CONDITIONS MEASURED ON 19CH
NO MODULATION
NO SIGNAL
(UNIT : VOLT)

1. TRANSISTOR

TR NO		B	C	E	TR NO		B	C	E	TR NO		B	C	E
Q1	RX	0.74	0.61	0	Q8	SQ	0.10	3.42	0	Q16	RX	6.09	10.90	5.42
	TX	0.49	0.07	0		TX	0.38	3.39	0		TX	6.13	10.72	5.47
Q2	RX	0.77	5.87	0.09	Q10	RX	9.19	13.53	8.52	Q17	RX	0	13.40	0
	TX	0.46	0.80	0		TX	9.24	12.78	8.55		TX	0	12.09	0
Q3	RX	0.85	13.26	0.24	Q11	RX	8.52	0	8.52	Q18	RX	0	13.40	0
	TX	0.63	12.92	0.46		TX	7.84	8.49	8.55		TX	0	12.08	0
Q4	RX	0.80	6.66	0.14	Q12	RX	0.75	4.60	0	Q19	RX	0	13.36	0
	TX	0.46	0.81	0		TX	0.75	4.60	0		TX	1.25	12.95	0.70
Q5	RX	0.69	1.51	0.02	Q13	RX	0	0	0	Q20	RX	0	0	0
	TX	0.12	0.76	0		TX	0.78	0	0		TX	2.19	8.12	1.49
Q6	RX	1.51	12.97	0.81	Q14	RX	3.59	7.78	2.89					
	TX	0.76	12.89	0.12		TX	3.60	7.80	2.89					
Q7	RX	0.04	0	0	Q15	RX	3.99	5.04	3.34					
	TX	0.08	0	0		TX	4.01	5.08	3.39					

2. INTEGRATED CIRCUIT

N.C = NO CONNECTION

IC NO.	PIN	RX	TX	IC NO.	PIN	RX	TX	IC NO.	PIN	RX	TX
IC 1	1	0	0	IC 1	11	2.81	2.84	IC 2	1	13.74	13.50
	2	0	0		12	N.C	N.C.		2	12.51	12.29
	3	0	0		13	0	0		3	4.00	3.96
	4	12.18	11.96		14	8.52	8.55		4	8.18	8.08
	5	0	0		15	1.52	1.67		5	1.51	1.52
	6	0	0		16	1.53	1.66		6	3.42	3.40
	7	12.20	11.98		17	2.63	1.59		7	3.42	3.41
	8	12.15	11.93		18	5.41	5.46		8	1.27	1.29
	9	0	0		19	2.77	2.83		9	0	0
	10	N.C	N.C		20	5.41	0.49		10	6.90	6.28

21 LTD CLASSIC
V O L T A G E C H A R T

CONDITIONS MEASURED ON 19CH
NO MODULATION
NO SIGNAL
(UNIT : VOLT)

1. TRANSISTOR

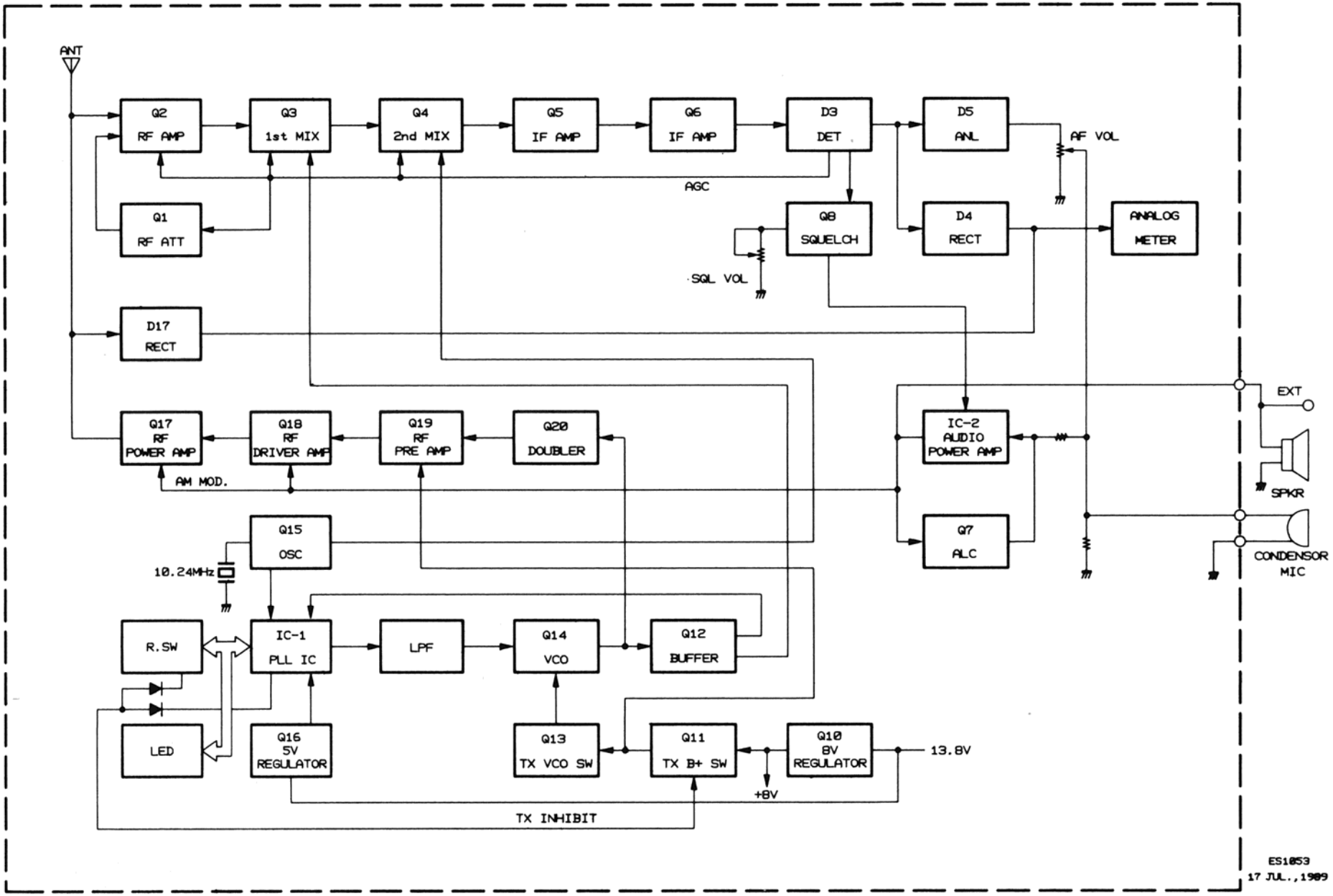
TR NO		B	C	E	TR NO		B	C	E	TR NO		B	C	E
Q1	RX	0.72	0.59	0	Q8	SQ	0.10	3.41	0	Q16	RX	6.08	10.84	5.41
	TX	0.30	0.02	0		TX	0.33	3.32	0		TX	6.07	10.54	5.41
Q2	RX	0.77	6.43	0.09	Q10	RX	9.21	13.57	8.52	Q17	RX	0	13.44	0
	TX	0.41	0.75	0		TX	9.20	12.56	8.49		TX	0	11.97	0
Q3	RX	0.78	13.29	0.23	Q11	RX	8.52	0	8.52	Q18	RX	0	13.44	0
	TX	0.41	12.79	0.05		TX	7.76	8.41	8.49		TX	0	11.99	0
Q4	RX	0.81	6.66	0.14	Q12	RX	0.74	4.59	0	Q19	RX	0	13.38	0
	TX	0.41	0.76	0		TX	0.73	4.62	0		TX	1.20	13.00	0.73
Q5	RX	0.69	1.50	0.02	Q13	RX	0	0	0	Q20	RX	0	0	0
	TX	0.08	0.69	0		TX	0.73	0	0		TX	2	8.05	1.53
Q6	RX	1.50	13.01	0.79	Q14	RX	3.52	7.77	2.84					
	TX	0.69	12.77	0.07		TX	3.52	7.75	2.89					
Q7	RX	0.06	0	0	Q15	RX	3.98	5.02	3.31					
	TX	0.06	0	0		TX	3.99	5.02	3.34					

2. INTEGRATED CIRCUIT

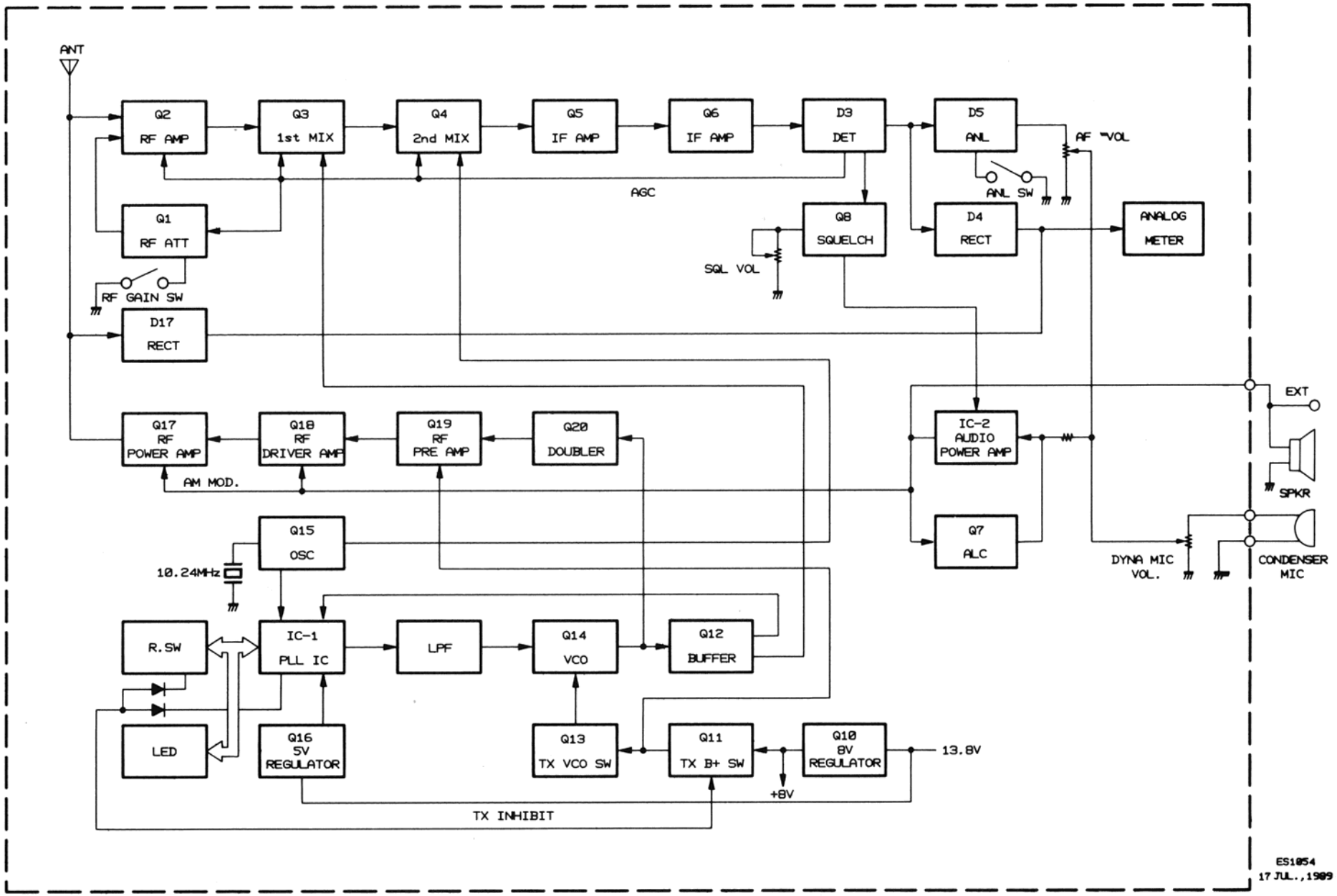
N.C = NO CONNECTION

IC NO.	PIN	RX	TX	IC NO.	PIN	RX	TX	IC NO.	PIN	RX	TX
IC 1	1	0	0	IC 1	11	2.81	2.80	IC 2	1	13.75	13.44
	2	0	0		12	N.C	N.C.		2	12.54	12.23
	3	0	0		13	0	0		3	3.99	3.91
	4	12.15	11.85		14	8.52	8.52		4	8.18	8.01
	5	0	0		15	1.45	1.59		5	1.53	1.48
	6	0	0		16	1.47	1.59		6	3.40	3.32
	7	12.16	11.87		17	3.08	1.58		7	3.41	3.35
	8	12.15	11.86		18	5.40	5.41		8	1.29	1.25
	9	0	0		19	2.71	2.75		9	0	0
	10	N.C	N.C		20	5.39	0.45		10	6.89	6.74

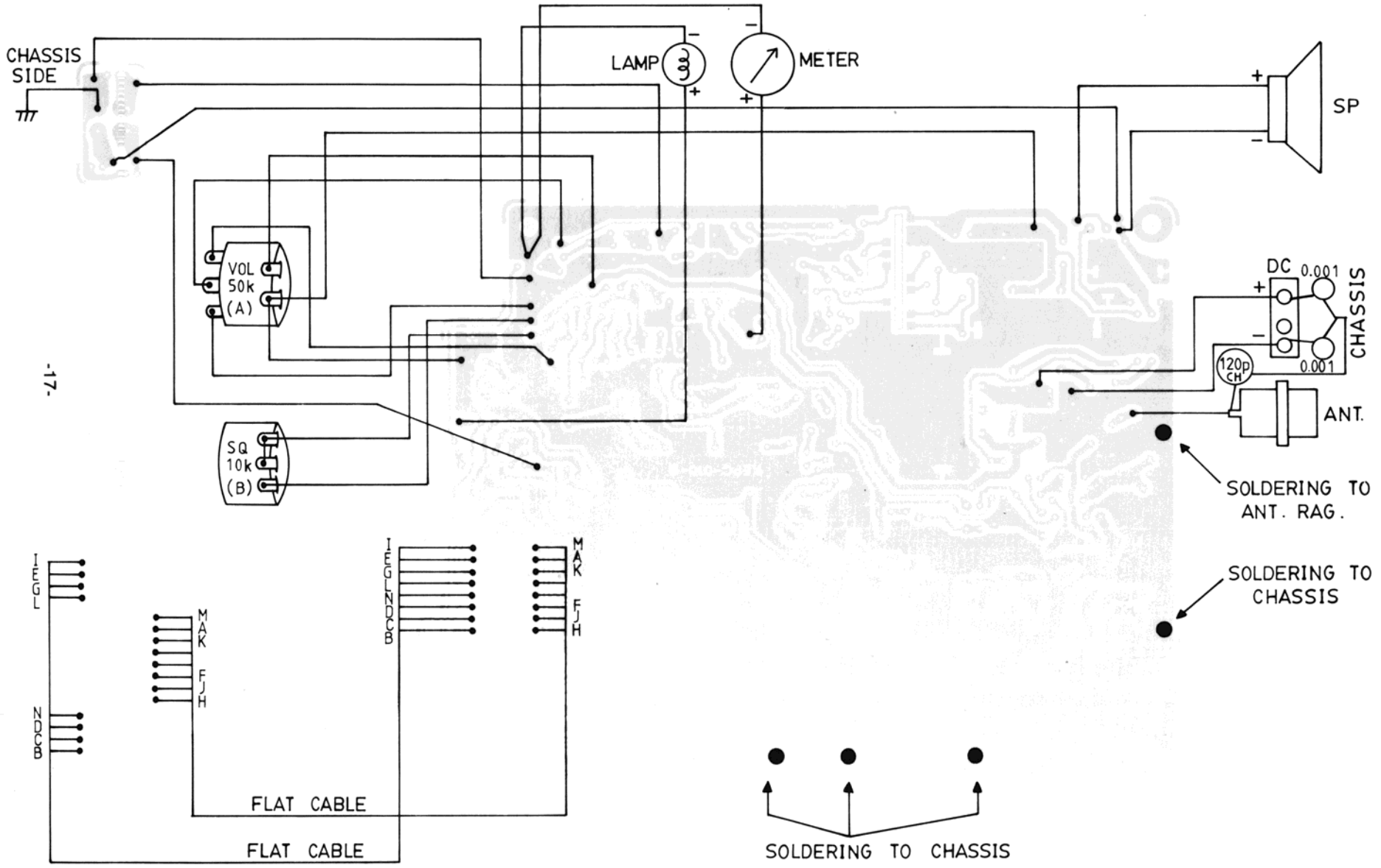
BLOCK DIAGRAM
19 LTD CLASSIC



BLOCK DIAGRAM
21 LTD CLASSIC

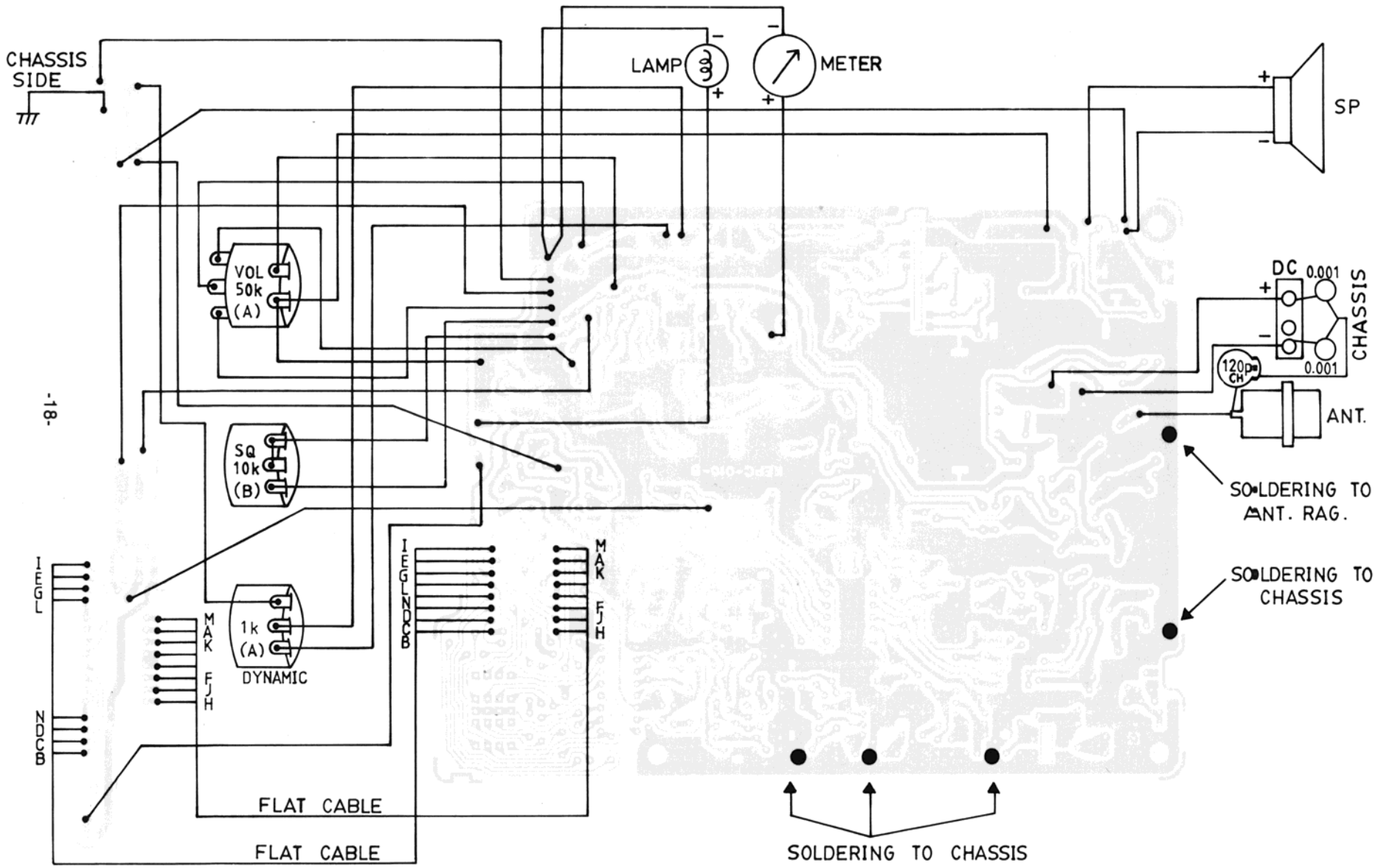


WIRING DIAGRAM
19 LTD CLASSIC

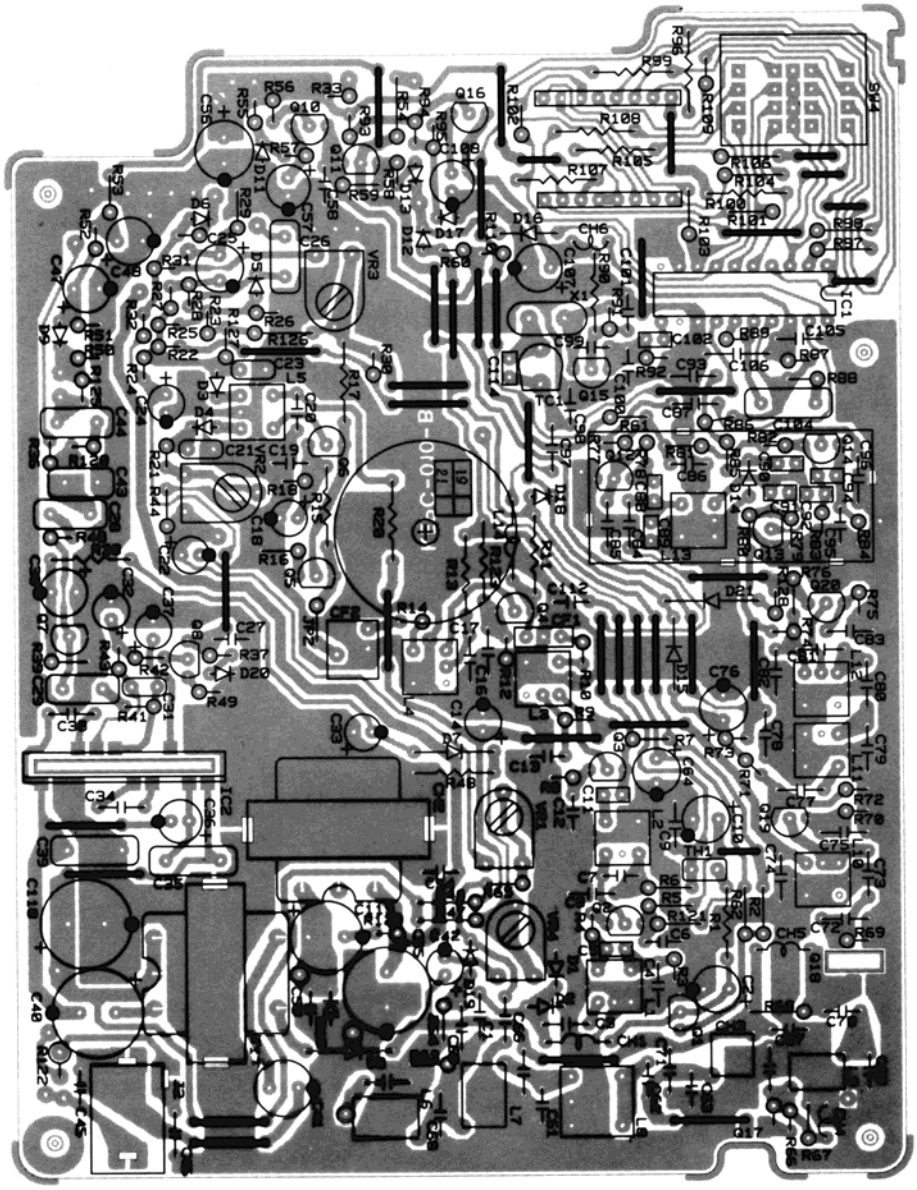


WIRING DIAGRAM

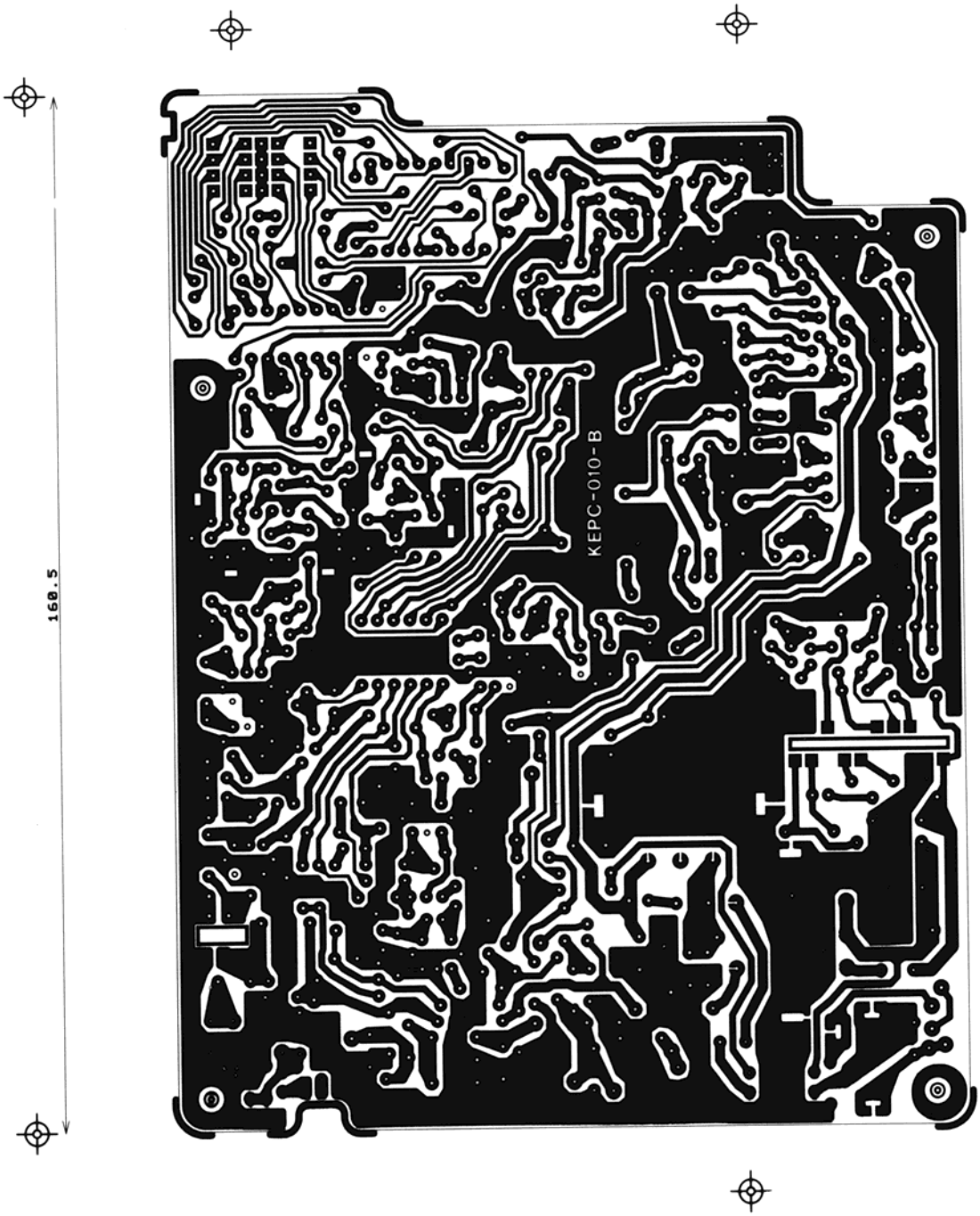
21 LTD CLASSIC



PARTS LAYOUT COMPOSITE
TOP VIEW—MAIN PCB
19/21 LTD CLASSIC

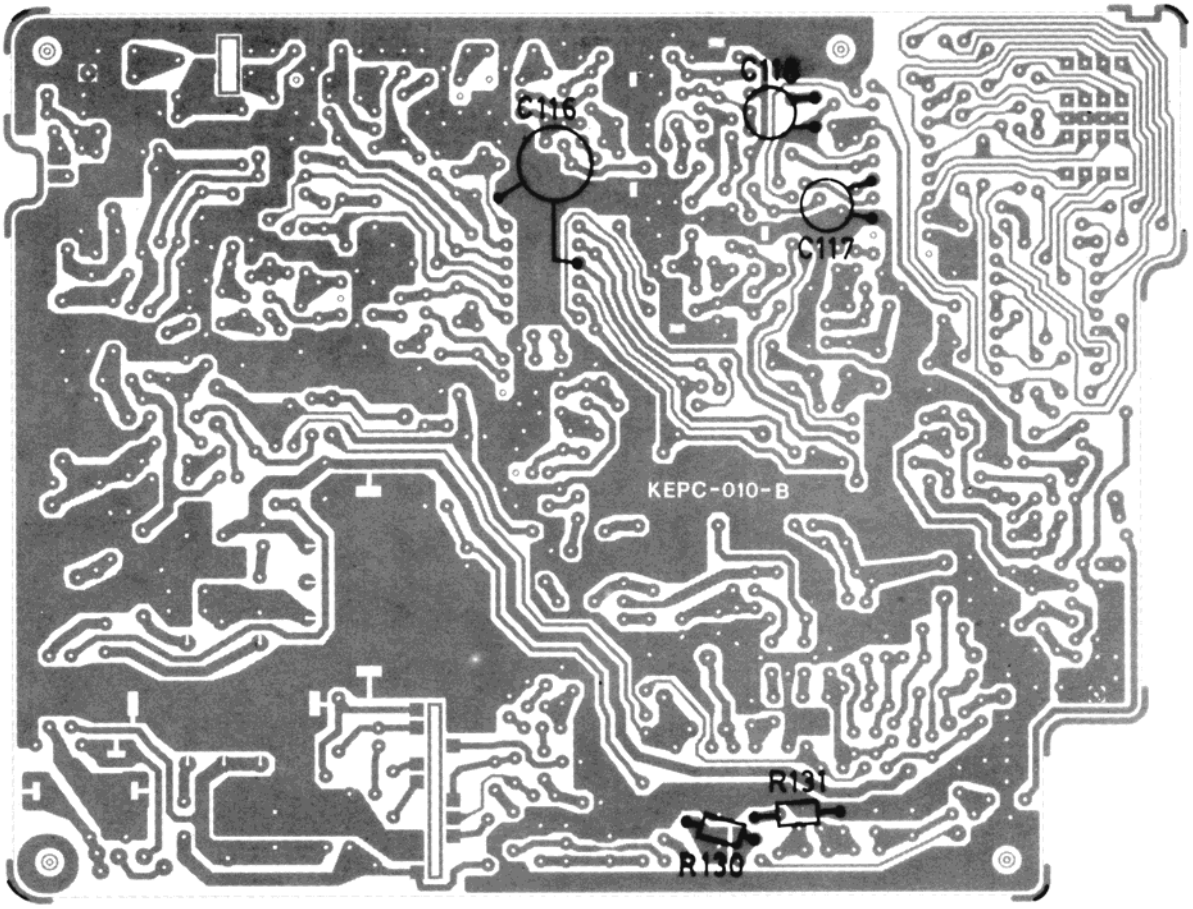


COPPER PATTERN LAYOUT
BOTTOM VIEW – MAIN PCB
19 / 21 LTD CLASSIC

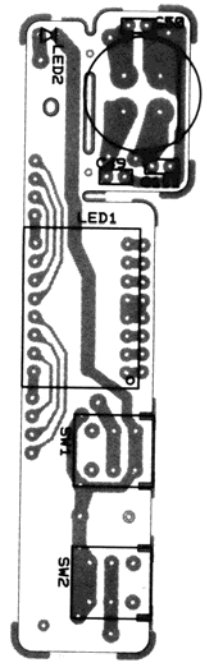


ADDED DISCRETE PARTS VIEW - MAIN PCB

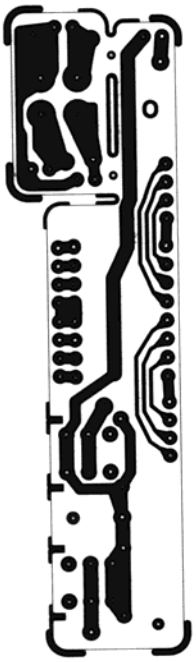
19 / 21 LTD CLASSIC



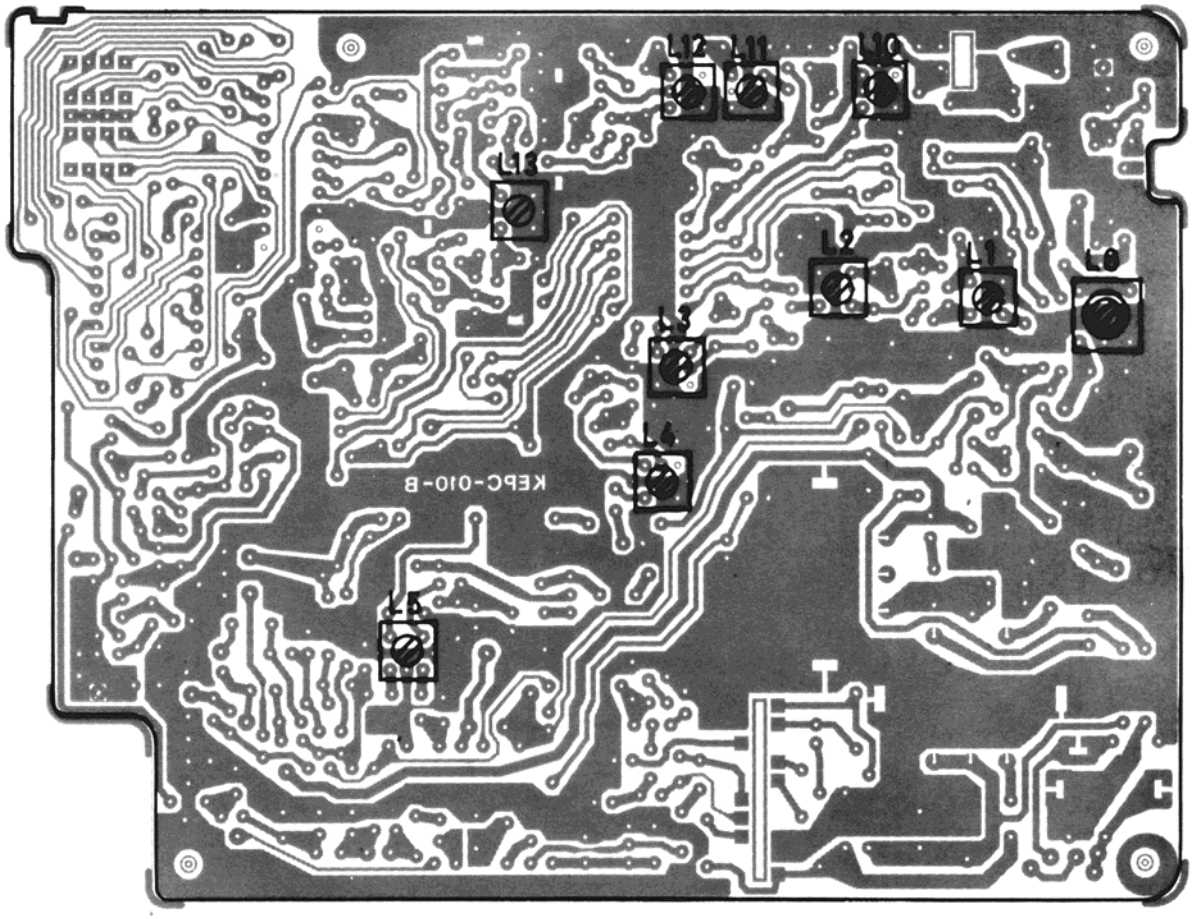
PARTS LAYOUT COMPOSITE
TOP VIEW– LED PCB
19 / 21 LTD CLASSIC



COPPER PATTERN LAYOUT
BOTTOM VIEW – LED PCB
19 / 21 LTD CLASSIC



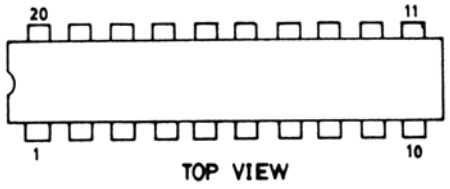
ALIGNMENT LAYOUT
19 / 21 LTD CLASSIC



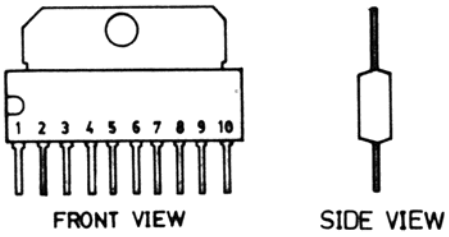
PIN CONFIGURATION

INTEGRATED CIRCUIT

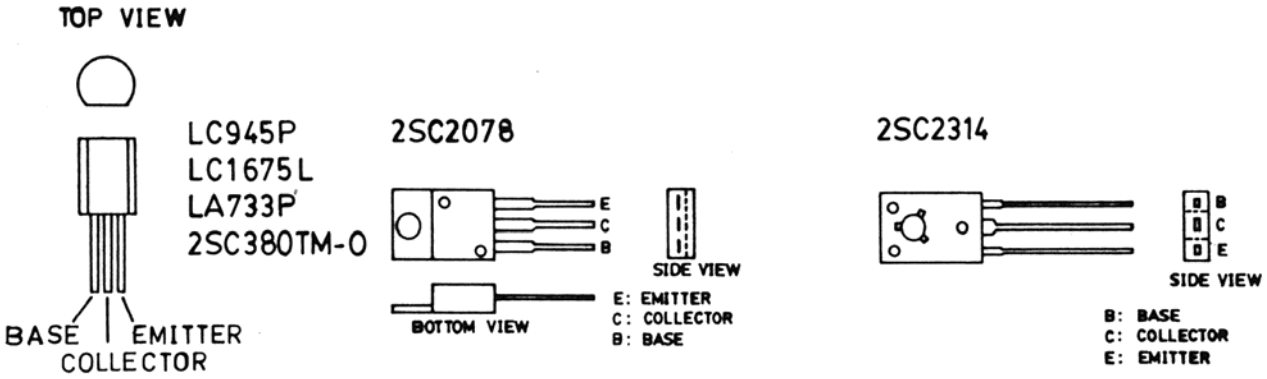
LC7132



KIA7217AP



TRANSISTOR



DIODE

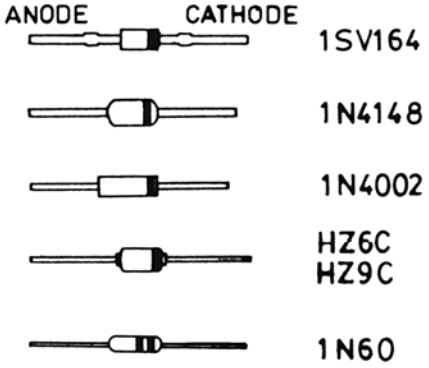
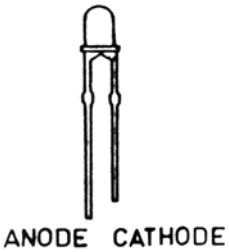
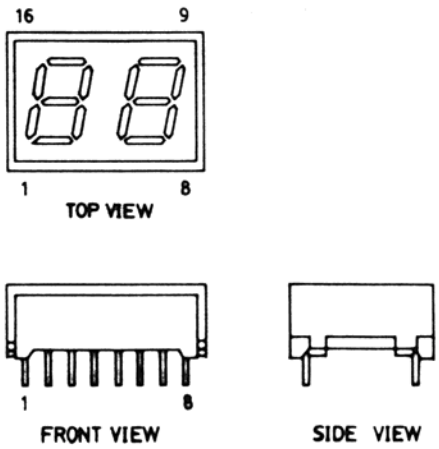


PHOTO DIODE

TLR124

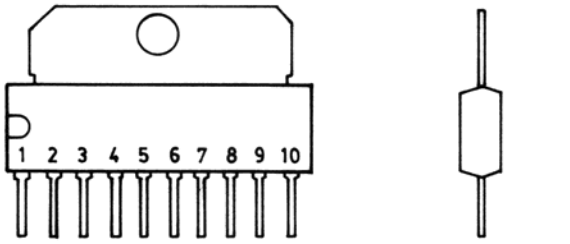


LTD-482GC

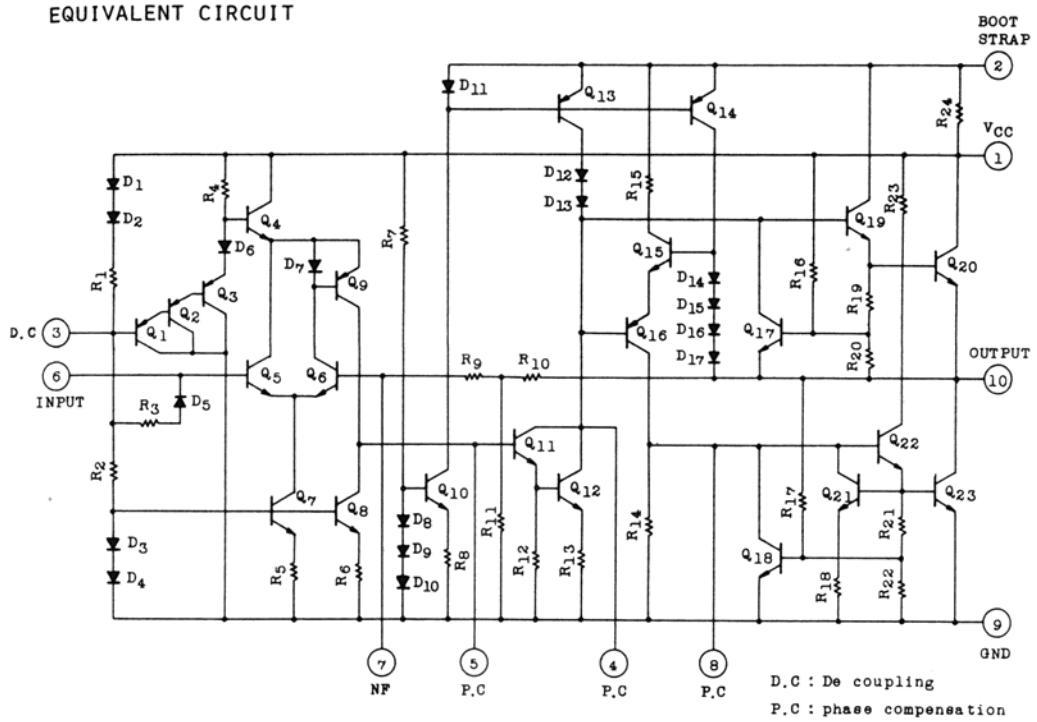


INTERNAL DIAGRAM

KIA7217AP

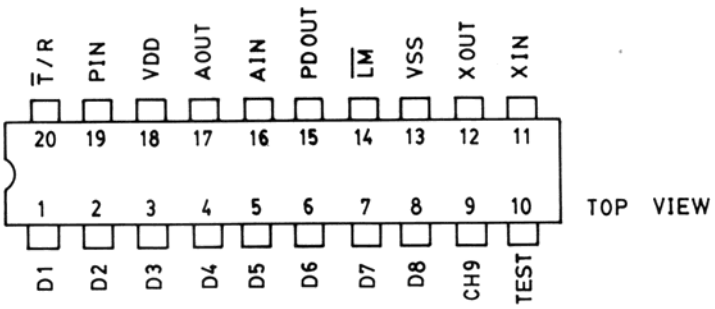


EQUIVALENT CIRCUIT

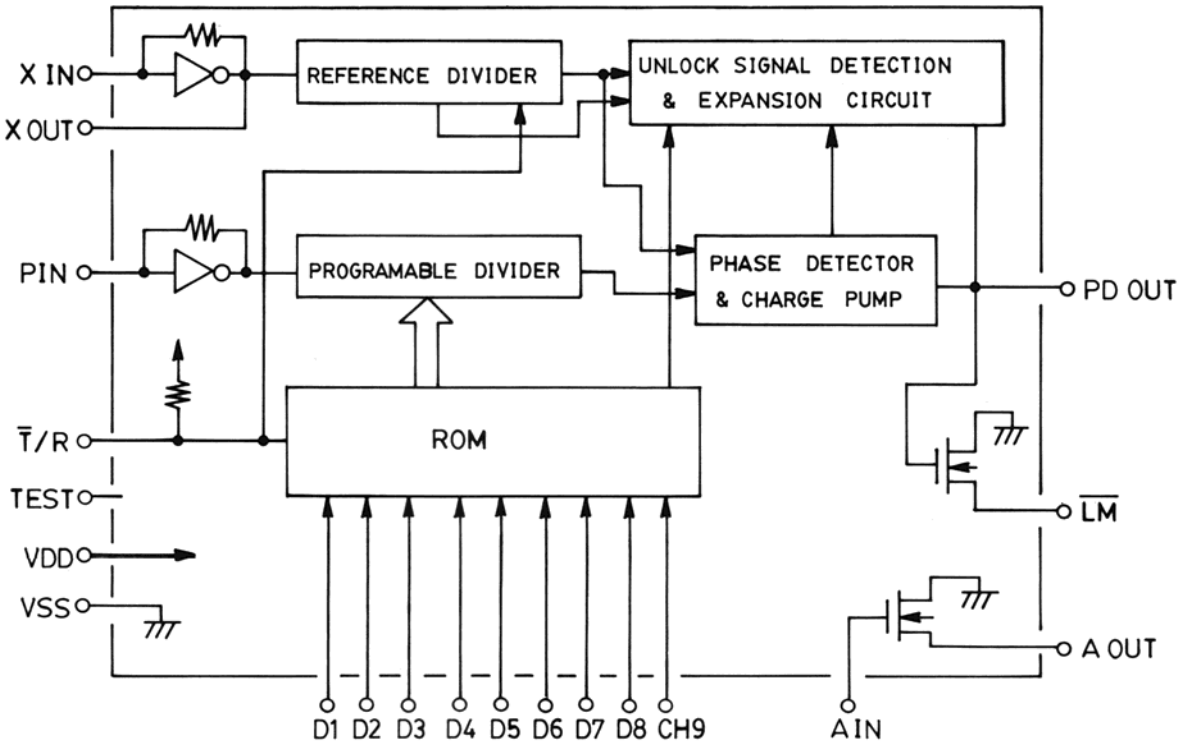


INTERNAL DIAGRAM

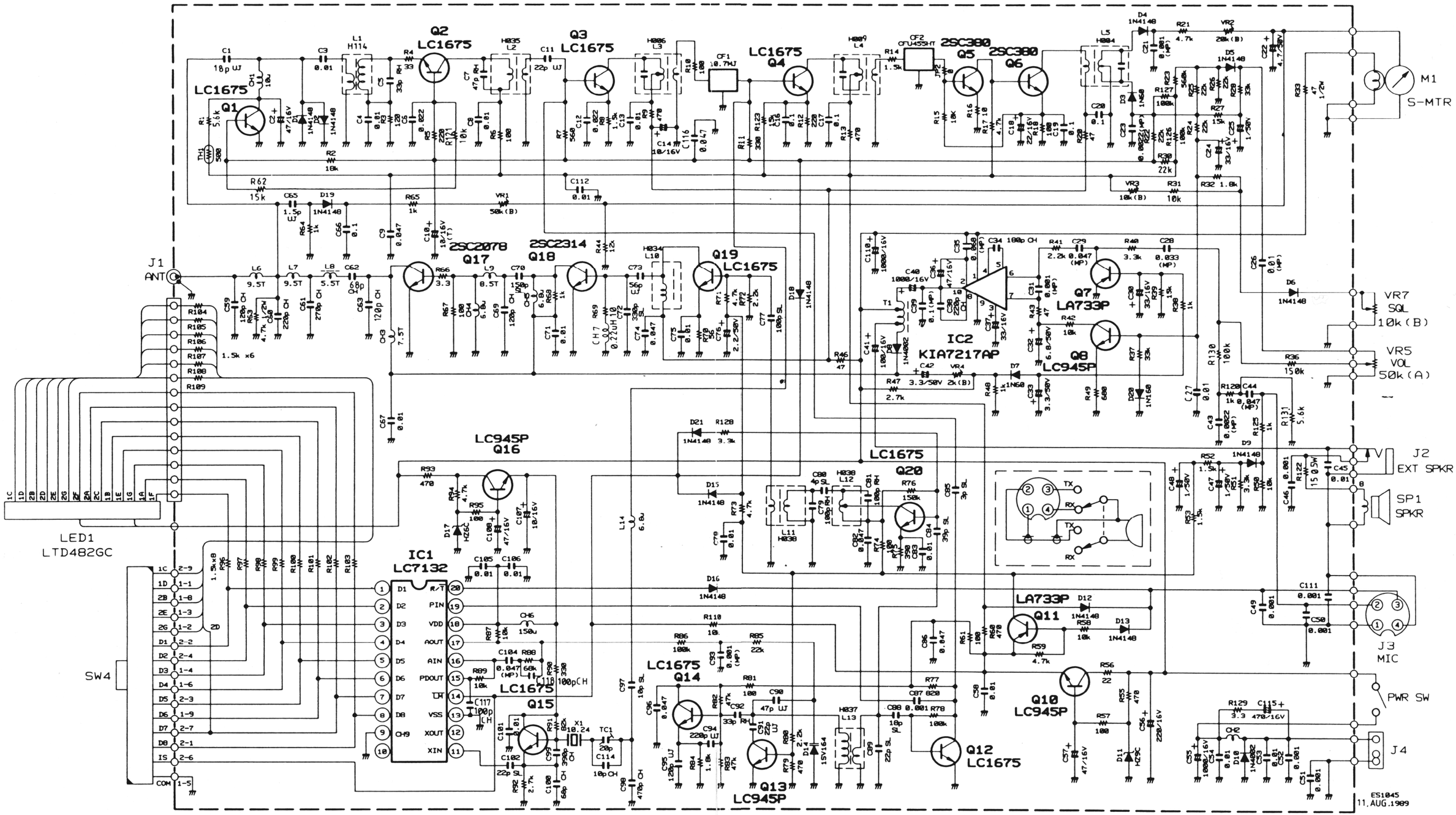
LC7132



EQUIVALENT CIRCUIT AND BLOCK DIAGRAM

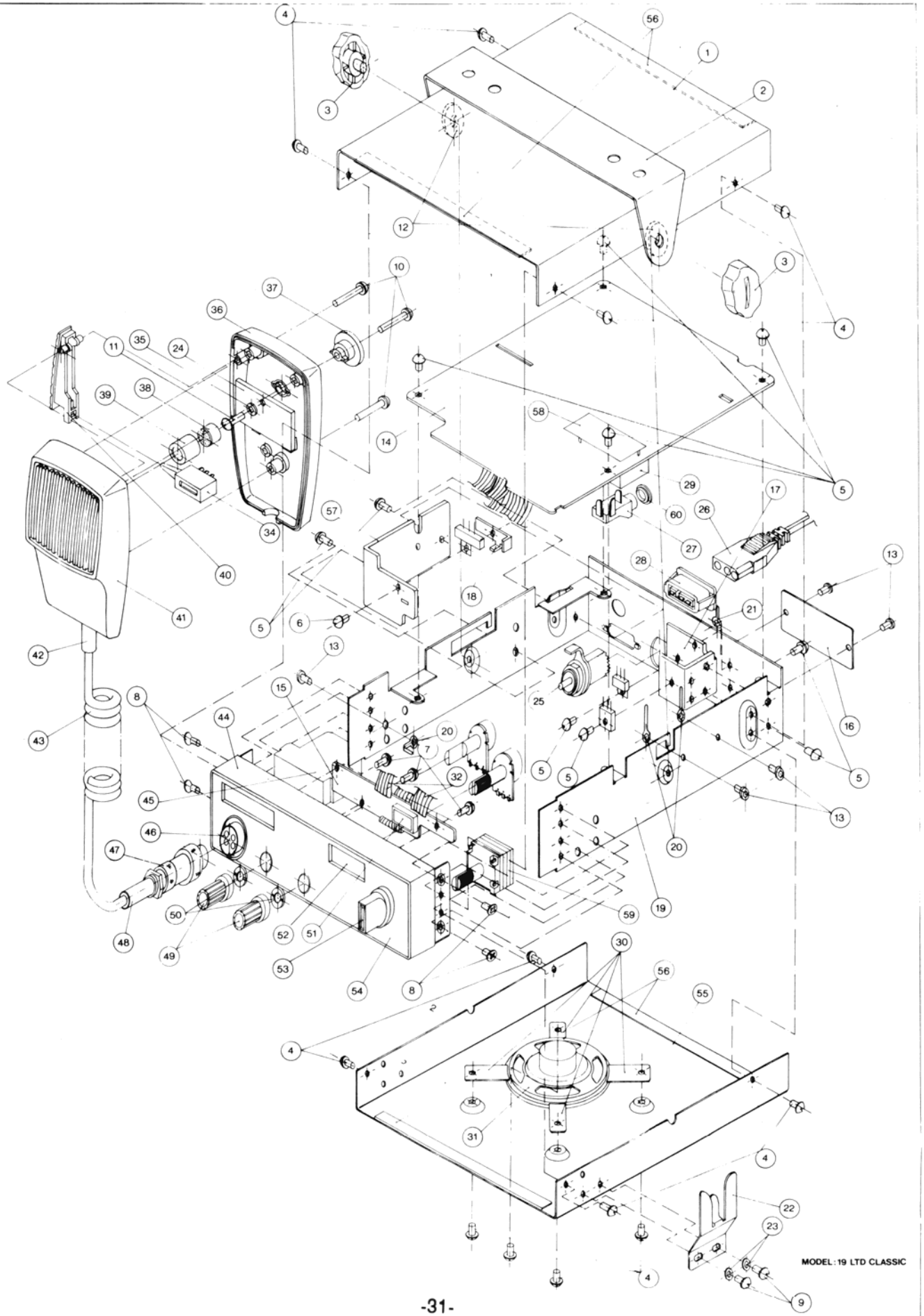


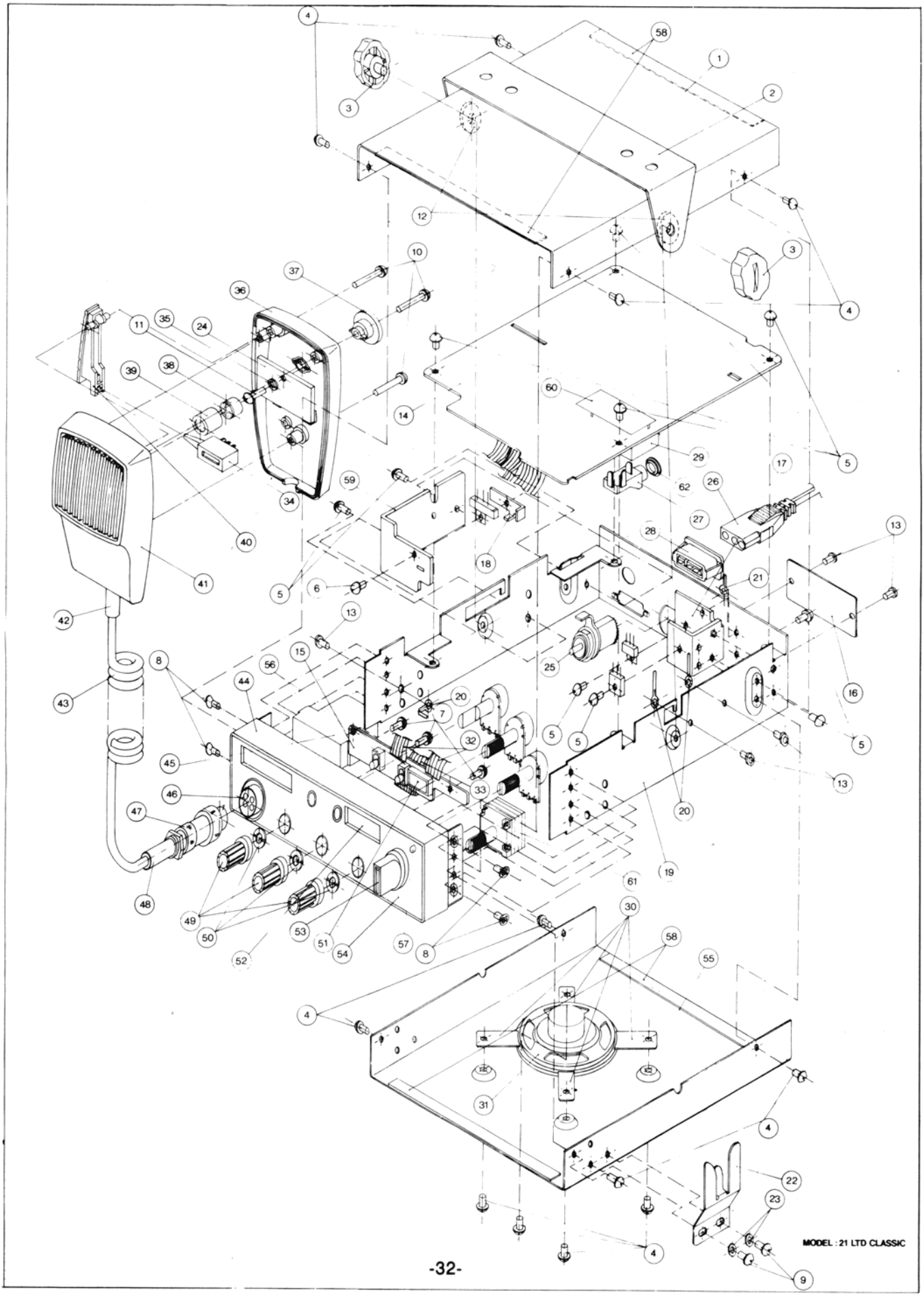
CIRCUIT DIAGRAM FOR COBRA 19LTD CLASSIC



NOTES :

1. RESISTANCE VALUES ARE SHOWN IN OHMS UNLESS OTHERWISE NOTED.
   (K=KILO OHM , M=MEG OHM)
2. RESISTOR WATTAGES ARE 1/4W UNLESS OTHERWISE NOTED.
3. CAPACITANCE VALUES ARE INDICATED IN MICROFARADS UNLESS OTHERWISE NOTED.
   (P=MICRO-MICRO FARAD)
4. CIRCUIT AND COMPONENTS ARE SUBJECT TO CHANGE WITHOUT NOTICE.


MODEL : 19 LTD CLASSIC


MODEL : 21 LTD CLASSIC

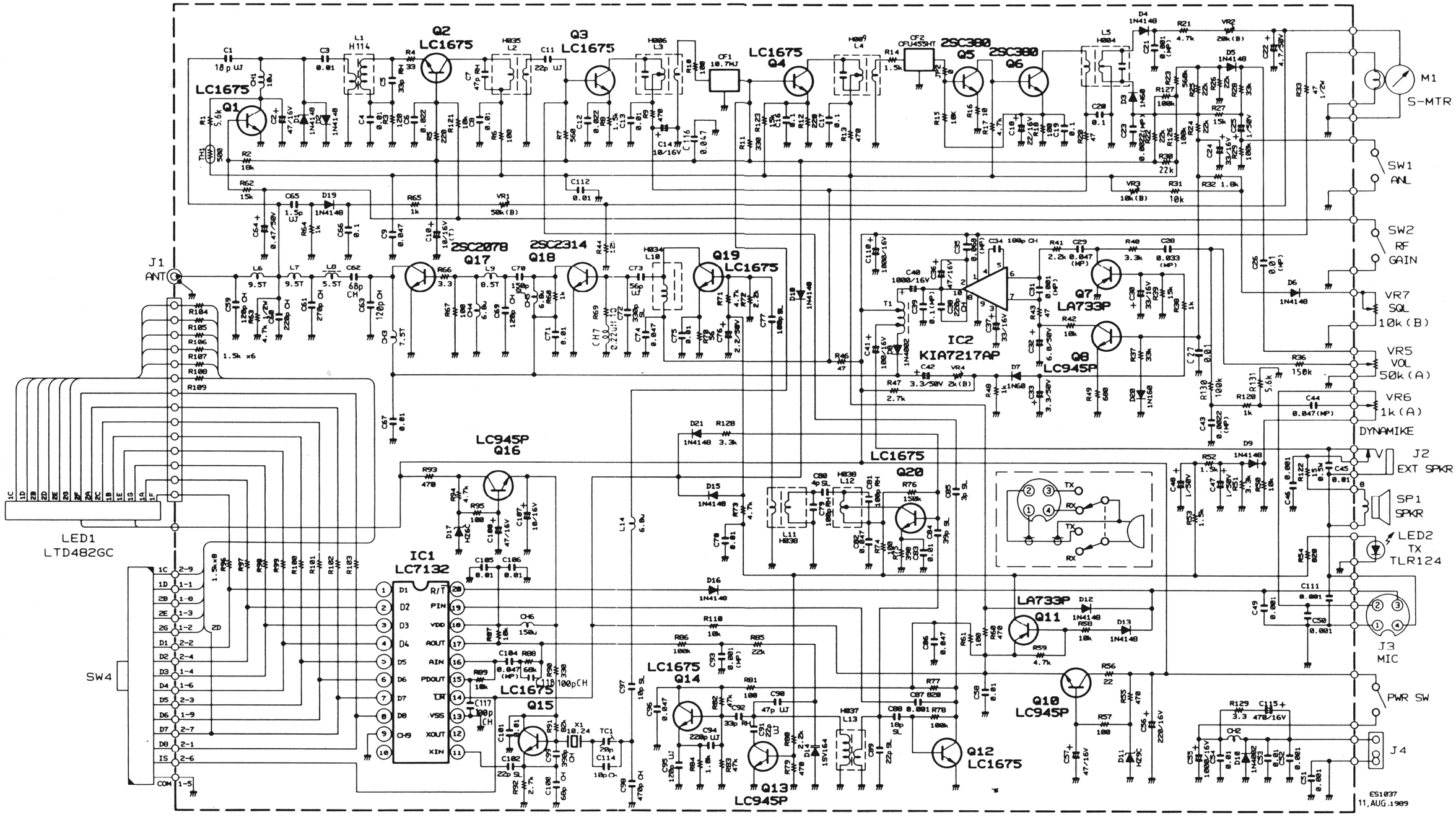
Model 19 LTD CLASSIC
Exploded View Parts List

No.	Part No.	Description
1	253-005-N-001	Cover Top
2	250-010-N-001	Bracket
14	303-022-N-001	PCB Main Board
15	303-023-N-001	PCB LED Board
25	773-003-N-001	Antenna Receptacle 16-173B
26	420-005-N-001	DC Cord
27	773-002-N-001	Speaker Jack JC-304B
28	773-004-N-001	DC Jack YC-JK329
31	580-006-N-001	Speaker 8 OHM 66R 15
34	088-006-N-001	Switch Push 2P2T PR122A-16
44	380-018-N-001	Panel Front
45	320-001-N-001	Analog Meter H-12
46	773-005-N-001	Socket Mic 4 Pin 16-174C
49	751-007-N-001	Knob-Volume
51	158-006-N-001	LED 7 Seg. 2 Digit LTD482GC
52	380-019-N-001	Filter-Display
53	751-006-N-001	Knob-Channel
54	260-006-N-001	Inlay (A)
55	252-006-N-001	Cover-Bottom
59	083-001-N-001	Channel Selector GPS-0477 40CH

PARTS LIST 19 LTD CLASSIC

SYMBOL	DESCRIPTION	PART NO.
D14	DIODE VARACTOR 1SV164	153 046 9 001
D3,7,20	DIODE 1N60	150 001 9 005
D17	DIODE ZENER HZ6C2 6.2V 0.5W	152 145 9 003
D11	DIODE ZENER HZ9C1 9.1V 0.5W	152 014 N 001
IC1	IC LC7132	308 012 N 001
J2	SPEAKER JACK JC-304B	773 002 N 001
VR3	SEMI-FIXED RES. 10K OHM B 30%	010 003 N 001
VR4	SEMI-FIXED RES. 2K OHM B 30%	010 0003 N 002
VR2	SEMI-FIXED RES. 20K OHM B 30%	010 003 N 003
VR1	SEMI-FIXED RES. 50K OHM B 30%	010 003 N 004
TH1	THERMISTER 500 OHM 112-501-2	005 002 N 001
SW4	CHANNEL SELECTOR GPS-0477 40 CH	083 001 N 001
Q5,6	TRANSISTOR 2SC380-0	176 082 9 001
Q1,2,3,4,12,14,15, 19,20	TRANSISTOR LC1675L	176 065 9 001
Q7,11	TRANSISTOR LA733P	177 020 9 001
Q8,10,13,16	TRANSISTOR LC945P	176 055 9 002
T1	MOD TRANSFORMER AEC-607/892	061 003 N 001
CH2	CHOKE TRANSFORMER AEC-608/893	061 004 N 001
X1	CRYSTAL 10.24MHZ	135 005 N 001
IC2	IC KIA7217AP	307 169 9 002
J1	ANTENNA RECEPTACLE 16-173B	773 003 N 001
J4	DC JACK YC-JK329	773 004 N 001
M1	ANALOG METER H-12	320 001 N 001
Q17	TRANSISTOR 2SC2078(E)	172 062 9 001
VR7	POT. V16LN 20KQ B 10K OHM	008 005 N 001
VR5	POT. V16LS 20KQ A 50K OHM	008 006 N 001
Q18	TRANSISTOR 2SC2314(E)	176 120 9 001
LED 1	LED 7 SEG. 2 DIGIT LTD482GC	158 006 N 001
J3	SOCKET MIC 4 PIN 16-174C	773 005 N 001
SP1	SPEAKER 8 OHM 66R15	580 006 N 001

CIRCUIT DIAGRAM FOR COBRA 21LTD CLASSIC



NOTES:
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Model 21 LTD CLASSIC
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34	088-006-N-001	Switch Push 2P2T PR122A-16
40	751-010-N-001	Knob-Lever
44	380-018-N-001	Panel Front
45	320-001-N-001	Analog Meter H-12
46	773-005-N-001	Socket Mic 4 Pin 16-174C
49	751-007-N-001	Knob-Volume
51	158-006-N-001	LED 7 Seg. 2 Digit LTD482GC
52	380-019-N-001	Filter-Display
53	751-006-N-001	Knob-Channel
54	260-007-N-001	Inlay (B)
55	252-006-N-001	Cover-Bottom
56	084-010-N-001	Slide Switch SS-22F05-AT9.4
57	158-021-9-001	LED TLR 124
61	083-001-N-001	Channel Selector GPS-0477 40CH

PARTS LIST 21 LTD CLASSIC

SYMBOL	DESCRIPTION	PART NO.
TC1	TRIM. CAP. TZ03R200ER110 20PF	028 001 N 001
D14	DIODE VARACTOR 1SV164	153 046 9 001
D3,7,20	DIODE 1N60	150 001 9 005
D17	DIODE ZENER HZ6C2 6.2V 0.5W	152 145 9 003
D11	DIODE ZENER HZ9C1 9.1V 0.5W	152 014 N 001
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VR4	SEMI-FIXED RES. 2K OHM B 30%	010 0003 N 002
VR2	SEMI-FIXED RES. 20K OHM B 30%	010 003 N 003
VR1	SEMI-FIXED RES. 50K OHM B 30%	010 003 N 004
TH1	THERMISTER 500 OHM 112-501-2	005 002 N 001
SW4	CHANNEL SELECTOR GPS-0477 40 CH	083 001 N 001
Q5,6	TRANSISTOR 2SC 380 (0)	176 082 9 001
Q1,2,3,4,12,14,15, 19,20	TRANSISTOR LC1675L	176 065 9 001
Q7,11	TRANSISTOR LA733P	177 020 9 001
Q8,10,13,16	TRANSISTOR LC945P	176 055 9 002
T1	MOD TRANSFORMER AEC-607/892	061 003 N 001
CH2	CHOKE TRANSFORMER AEC-608/893	061 004 N 001
X1	CRYSTAL 10.24MHZ	135 005 N 001
IC2	IC KIA7217AP	307 169 9 002
J1	ANTENNA RECEPTACLE 16-173B	773 003 N 001
J4	DC JACK YC-JK329	773 004 N 001
M1	ANALOG METER H-12	320 001 N 001
Q17	TRANSISTOR 2SC2078(E)	172 062 9 001
VR6	POT. V16LN 20KQ A 1K OHM	008 007 N 001
VR7	POT. V16LN 20KQ B 10K OHM	008 005 N 001
VR5	POT. V16LS 20KQ A 50K OHM	008 006 N 001
Q18	TRANSISTOR 2SC2314(E)	176 120 9 001
LED 2	LED TLR124	158 021 9 001
LED 1	LED 7 SEG. 2 DIGIT LTD482GC	158 006 N 001
J3	SOCKET MIC 4 PIN 16-174C	773 005 N 001
SP1	SPEAKER 8 OHM 66R15	580 006 N 001