ALBA

PRELIMINARY SERVICE MANUAL

CB240 UK

27 MHz F3



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ALL SPECIFICATIONS, DIAGRAMS AND DRAWINGS ARE SUBJECT TO CHANGES WITHOUT PRIOR NOTICE.

SPECIFICATIONS

GENERAL :

1. Supply voltage	: 13.2 Volt D.C.	
2. Antenna impedance	: 50 Ohm	
3. Speaker impedance	: 8 Ohm	
4. Modulation (RX test)	: 1 KHz/1.5 KHz Deviation	
5. Audio reference	: 100 mW	

TRANSMITTER :

	Nominal	Limit
1. Frequency tolerance :	± 1 KHz	± 1.5 KHz
2. RF output power (50 Ohm) :	4 Watt	± 2 dB
3. Spurios response rejection (MPT 1320) :	- 86 dB	- 81 dB
4. Deviation @ 10 mV input :	± 2.5 KHz	± 2.0 KHz
5. Current drain :	800 mA	1 Amp
6. Meter indication for RF power output :	8 scale units	± 1 scale unit
7. Roger beep :	0.8 Sec	± 0.2 Sec
8. Limiter function : (Deviation @ 100 mV input)	< ± 2.5 KHz	< ± 2.5 KHz
9. Modulation distortion :	8 %	10 %
10. Modulation frequency response at - 6 dB:	0.3/2.5 KHz	0.35/2.0 KHz
11. Adjacent channel power (MPT 1320) :	1 uW /not to exceed 10 uW	

RECEIVER :

1. 10 dB S + N/N sensitivity :	0.5 uV	1.0 uV
2. 3 dB limiting sensitivity :	0.5 uV	1.0 uV
3. Audio output power :		
A. Unclipped :	1.5 Watt	1.0 Watt
B. 10 % THD :	1.8 Watt	1.5 Watt
4. Tight squelch sensitivity :	3 uV	± 10 dB
5. Meter indication for 'S 9' :	50 uV	± 6 dB
6. Bandwidth at - 6 dB :	± 2.0 KHz	± 1.8 KHz
7. Image rejection :	24 dB	18 dB
8. I.F. rejection :	80 dB	60 dB
9. Selectivity at ± 10 KHz :	60 dB	40 dB
10. Audio frequency response at - 6 dB :	0.35/3.5 KHz	0.4/3.0 KHz
11. THD @ 100 mV input :	8 %	10 %
12. Current drain :		
A. No signal :	160 mA	180 mA
B. Maximum power :	460 mA	500 mA
13. P.A. - A.F. sensitivity :	10 mV	20 mV
14. Receiver radiation (MPT 1320) :	62 dBm	57 dBm
15. RF gain control attenuation range :	0 to 40 dB	0 to 30 dB

DESCRIPTION

A. RECEIVER :

The incoming RF signal picked up by the antenna goes first through a tuned cct. T5 and C42, then amplified by RF amplifier Q7. The amplified signal goes into 1st. mixer stage Q8, coupled by tuned cct. T6, C46, mixed with the 16 MHz from the PLL synthesizer cct. It is then amplified by the 1st. IF amplifier Q9 with good selectivity through two 10.7 MHz ceramic filter on input and output. The 10.7 MHz signal is then passed through a limiter formed by D6, D7, to avoid signal overloading to the following IF IC (MC 3357).

The IC 1 (MC 3357) is a narrow band IF IC with second mixer to mix the 10.7 MHz signal with the 10.240 MHz signal from the PLL crystal oscillator to obtain the 455 KHz IF signal. It contains also a high gain 455 KHz IF amplifier and discriminator. Interstage coupling is done by the discriminator and the 455 KHz ceramic filter which gives further selectivity. A noise squelch cct. is integrated in the IC to mute the audio signal from the discriminator and controlled by squelch preset VR5.

Audio signal from IC 1 is then amplified by IC 2 (TDA 1905) to give audio power to the speaker. Power supply to the receiver cct is controlled by the relay RL 1.

B. TRANSMITTER :

The 27 MHz signal generated by the PLL frequency synthesizer is fed into the TX preamplifier Q3 through a double tuned cct. T9, C104, T4, C26. The collector voltage of this amplifier (Q3) is controlled by the control transistor Q20, by which the drive level in low power condition is adjusted with VR8 on the base of control transistor Q20, while in high power condition, Q20 is by passed by the HI - LO switch and Q3 is getting full voltage from B+ supply.

The RF signal delivered from preamplifier Q3 is than amplified by the class 'C' driver transistor Q2, he provides the required drive level for the RF final power transistor Q1. In this cct. coupling is done by tuned cct. T2, C18, which provides impedance matching and selectivity. Q1 is a class 'C' RF power amplifier and it's output passes through a four stage

harmonic filter to comply with MPT 1320 before fed to the antenna jack.
Speech or audio is picked up by the microphone and goes to a two stage class 'A' audio amplifier Q5, Q6, which amplifies the audio to a high level. The limiter cct formed by D2, D3 and the resistors around cut the signal level to avoid too high deviation - even if the sound level is increased up to 115 dBa. Deviation is good also at very low sound level.
The so processed audio signal goes then through an active low pass filter Q4 which restores the waveform and minimizes distortion created by the limiter. This audio signal then will pull the VCO of the frequency synthesizer for frequency modulation and deviation.

C. PLL (PHASE LOCK LOOP) FREQUENCY SYNTHESIZER :

This cct. consist of five major components :
- BCD code switch
- PLL IC (LC 7137)
- VCO (Voltage Controlled Oscillator)
- Frequency doubler
- Preamplifier

The VCO Q12 is oscillating at 16 MHz in RX mode and at 13 MHz in TX mode. This signal goes into IC3 (LC 7137) which is controlled by the codeswitch. The codeswitch gives the channel code to the programmable divider through a decoder ROM. The VCO frequency is divided by the programmable divider by compared with a signal divided from 10.240 MHz x'tal frequency. If there is a frequency difference between the two frequencies injected, the difference will go through a charge pump and the output at PD out (pin 15/LC 7137) as a voltage change. This voltage change is processed by a active low pass filter, fed back to control the VCO until the channel frequency is correct.
In RX mode, the 16 MHz is fed into the 1st mixer, in TX mode the 13MHz goes into the frequency doubler Q13, the 27 MHz signal selected out by tuned cct. T8, C101, then amplified by Q14 and coupled through a double tuned cct. T9, C104, and T4, C26 to the transmitter cct.
In case the VCO frequency is out of lock range of the PLL

system, for whatever reason such as wrong code from switch, out of authorized 40 channels, switch during transition, etc., the switching cct. (pin 14/LC 7137) and miscode protection (pin 10/LC 7137) will switch off the preamplifier and the transmitter automatically. Only if correct frequency is achieved, LM and MC go high and enable the transmitter cct. (MPT 1320 requirement)

D. ROGER BEEP & RELAY CCT. :

With roger beep switch in "off" position, the relay will switch the unit to TX mode when PTT switch at the mobile hand microphone is pushed thru D16 and change back to RX mode immediately after PTT switch is released.
When roger beep switch is in "on" position thru SW3, transmitter will still remain in TX mode for one second after PTT switch is released, in this time period an audio beep will be sent out automatically. This is performed by the one second delay cct. Q18, Q19, the relay driver Q17 and the tone generator. After completion of this function, the relay will switch back to RX mode automatically.

E. ENGINE NOISE SUPPRESSION CCT. :

It consists of an electronic filter Q21 which is basically a power supply regulator cct. biased by a zener diode. Together with the big capacitor in front and after this configuration, it suppresses the engine noise including spark plug noise, alternator noise and generator noise from various sources in the vehicle.

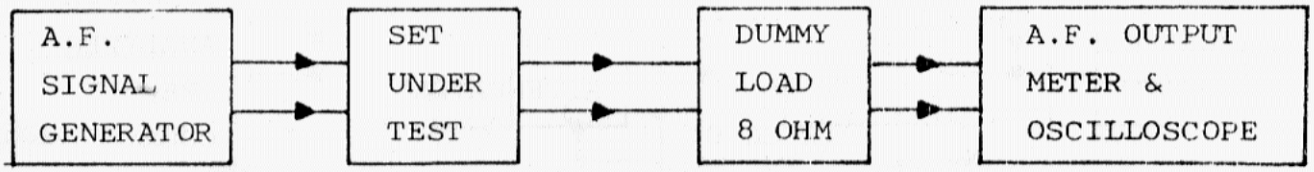
ALIGNMENT

1. GENERAL TEST CONDITIONS :

a. Supply voltage : 13.2 Volt DC
b. Speaker impedance : 8 Ohm
c. Antenna impedance : 50 Ohm
d. Modulation (RX test) : mod. frequency 1 KHz/1.5 KHz deviati
e. Audio reference output : 100 mW
f. Recommended test equipment : AF output meter, oscilloscope (30 MHz), RF power meter, deviation meter, spectrum analyzer (2 GHz), frequency counter, high impedance voltmeter, audio signal generator, RF - FM signal generator, I.F. sweeper/marker generator with scope.

2. AUDIO TEST :

Audio test set-up



a. Set volume control VR6 to maximum position (i.e. fully clock wise) and squelch control VR5 to minimum position (i.e. fully counter clock wise).
b. Connect audio signal generator to the center arm of volume control VR6 with 1 KHz audio signal and the AF output meter and oscilloscope to the speaker terminals with 8 Ohm dummy load.
c. Adjust the audio signal generator output level until the output waveform displayed on the scope is just before clipping.
d. Measure the audio output of the set, it should be approx. 1.5 Watt.
e. Check the DC current drain of the set at maximum volume, it should be approx. 450 mA.

3. I.F. TEST :

a. Connect the I.F. sweeper/marker generator to the mixer output pin 3 of IC 1 through a 0.01 mF capacitor and the scope input to the hot arm of volume control VR6. Set squelch control VR5 to minimum position.

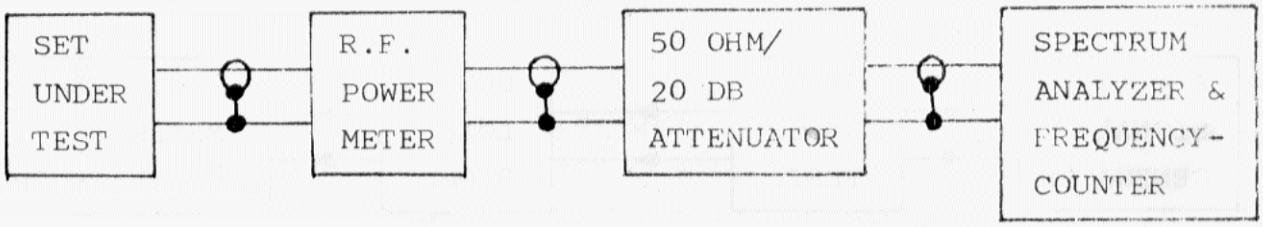
b. A symmetrical "S" curve at 455 KHz marker should be displayed on scope.

4. PLL ALIGNMENT :

a. Connect the high impedance voltmeter to test-point TP1.
b. Connect the frequency counter and oscilloscope to the secondary of transformer T10.
c. Adjust T7 until voltmeter reads approx. 2.8 Volt DC at channel 20 in TX mode and observe the maximum adjustment on the scope.
d. Adjust trimmer VC2 to a reading of 10.240 MHz on the frequency counter and observe the waveform on the scope.

IMPORTANT : This adjustment determinates the frequency accuracy of the unit and must be done accurately.

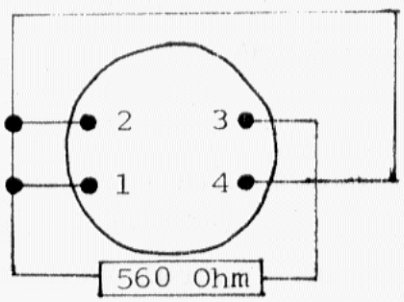
5. TRANSMITTER ALIGNMENT :



Transmitter test set-up

a. Connect RF power meter to the 50 Ohm antenna socket of the set. Connect in line with the power meter through a 50 Ohm/20 dB power attenuator the spectrum analyzer and frequency counter. Set roger beep switch SW2 to off position. Plug mike with configuration as shown below to the microphone jack for transmission.

Configuration of dummy mike plug



b. Adjust T2, T4, T8, T9 and VC1 for maximum output (27 MHz) displayed on the spectrum analyzer and a reading of 3.8 Watt ($\pm$ 2 dB) on the RF power meter.

c. Readjust trimmer VC2 for correct frequency on all channels.

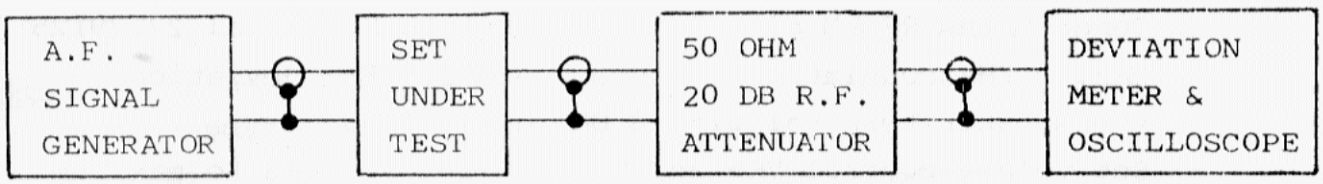
d. Repeat steps b and c if necessary.

e. Check the attenuation of second harmonic (54 MHz) on the spectrum analyzer, the attenuation should be more than -80 dB below the fundamental signal at 27 MHz. (MPT 1320 requirement)

f. Adjust VR1 for RF power meter reading to figure '9' on the unit's meter at 3.8 Watt output power.

IMPORTANT : The above adjustments should be carried out by experienced technicians or engineers with the recommended equipment and test set-up, in order to comply with MPT 1320 regulation.

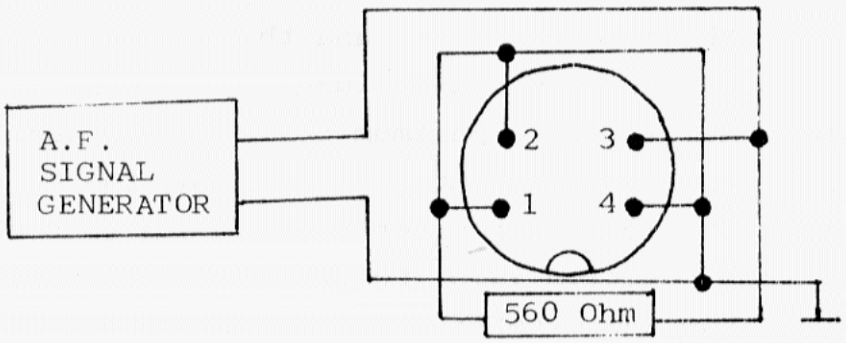
6. MODULATION ADJUSTMENT/ROGER BEEP CHECK :



Modulation test set-up

a. Connect audio signal generator to the dummy mike plug as shown below and the deviation meter to the RF attenuator. Connect the oscilloscope to the A.F. output of the deviation meter.

Configuration of dummy mike



b. Adjust audio signal generator to 1.250 KHz and 10 mV output.
c. Plug dummy mike plug with connected audio signal generator to the mike jack for transmission.
d. Adjust VR2 on PCB for 2.2 KHz deviation on the deviation meter. An undistorted AF waveform should be seen on the oscilloscope.
e. Increase audio input level by 20 dB to ensure that deviation cannot exceed 2.5 KHz (MPT 1320), readjust VR2 if needed.
f. Disconnect the dummy mike plug.
g. Plug the supplied microphone into the mike jack. Set roger beep switch SW3 to on position. Push the PTT knob for transmission and release PTT knob. The unit under test should remain in transmission mode, the deviation should remain as adjusted under 'e' at 2.2 KHz and a A.F. waveform should be seen until a period of approx. 1 second.

7. RECEIVER ALIGNMENT

a. Connect the RF FM signal generator with RF signal 27.79125 MHz, 1 KHz modulation frequency and 1.5 KHz deviation to the speaker terminal with 8 Ohm dummy load.
b. Set volume control VR6 and RF gain control VR3 to maximum position (i.e. fully clock wise), meanwhile the squelch control VR5 is set to minimum position (i.e. fully counter clock wise).
c. Adjust T5 and T6 for maximum output on the monitoring instruments. Keep the RF signal from the RF signal generator as low as possible.
d. Adjust VR3 for 'S' meter reading to figure '9' on the unit's meter. For this procedure, the RF signal generator is adjusted to 100 uV output level and the audio to the reference output by adjusting volume control VR6.
e. Set volume control VR6 to maximum position and audio output level to the reference output by decreasing the RF signal generator output level, then set the RF gain control control VR3 to minimum position (i.e. fully counter clock wise). To gain back the audio reference output, the output level of the RF signal generator must be increased by approx. 40 dB.

8. SQUELCH ADJUSTMENT :

a. Apply 27 MHz (any channel) and audio monitoring instruments as under para '7a' to the set.
b. Set volume control VR6, RF gain control VR3 and squelch control VR5 to maximum position (i.e. fully clock wise).
c. Set RF signal generator level to 1 uV output. Adjust VR4 on the PCB until audio just become audible.

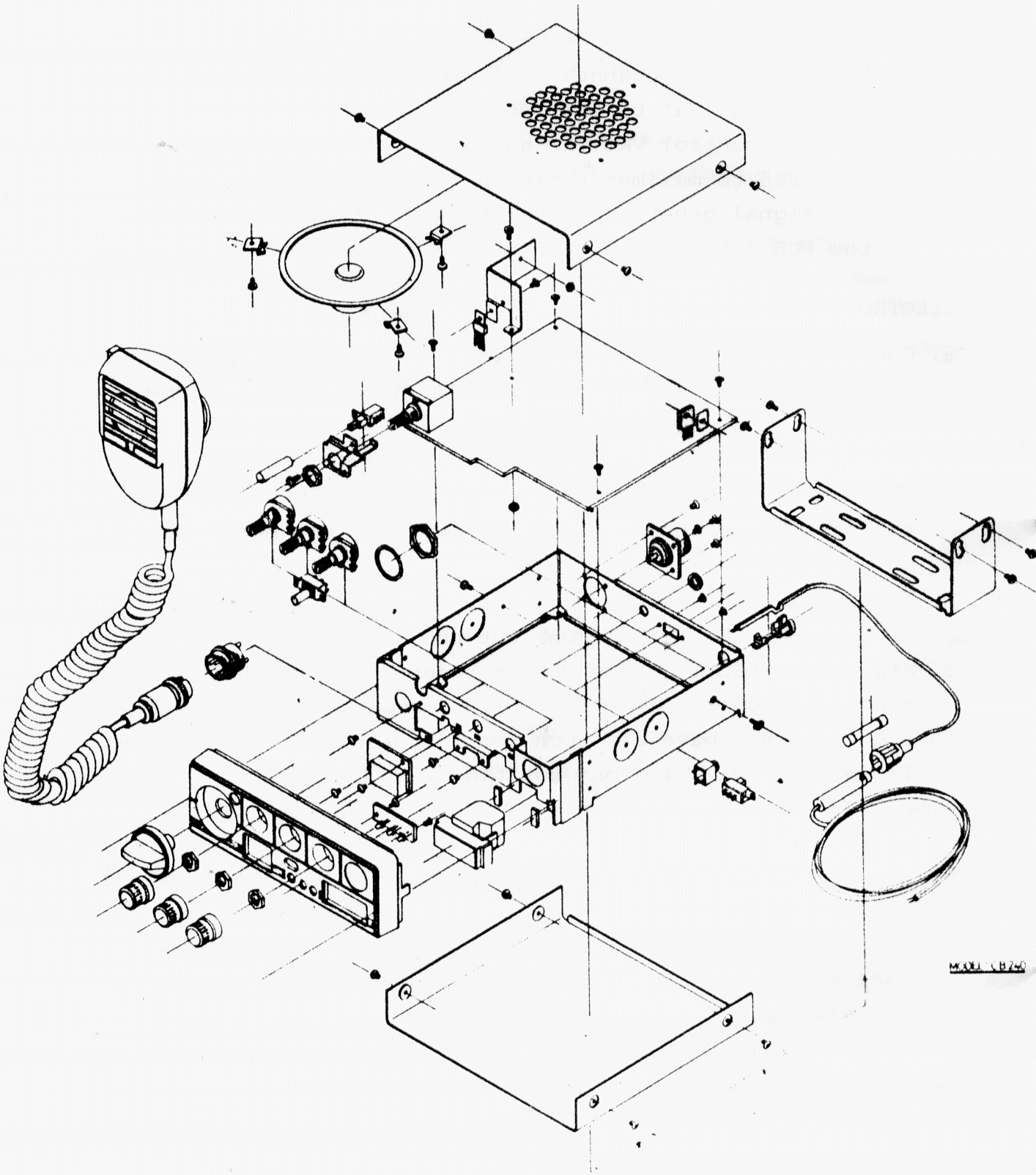
9. ELECTRONIC FILTER CHECK :

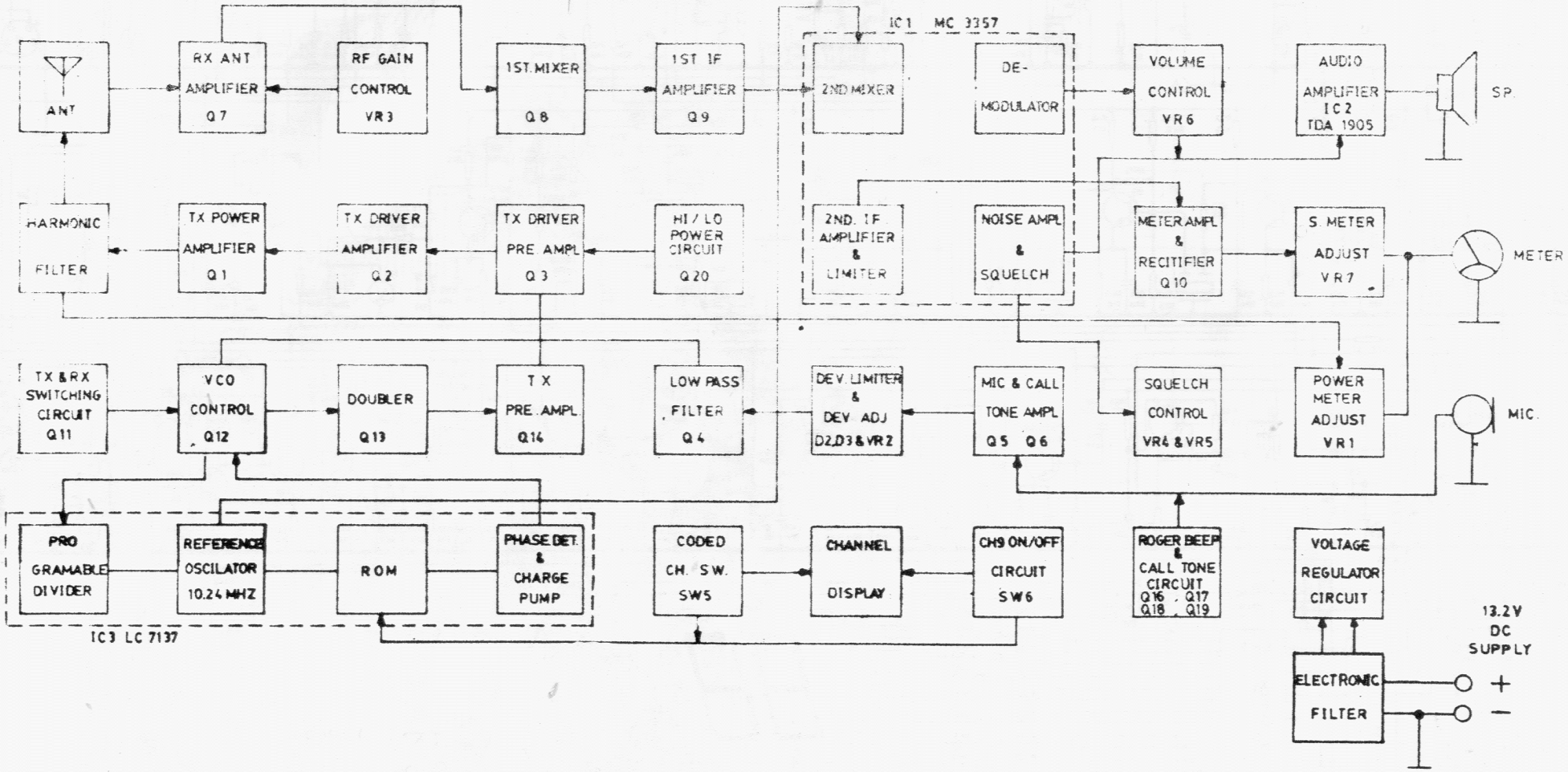
a. Connect voltmeter between emitter of Q21 and ground, there should be approx. 11.2 Volt DC indicated on the voltmeter.

10. L.E.D. CHECK :

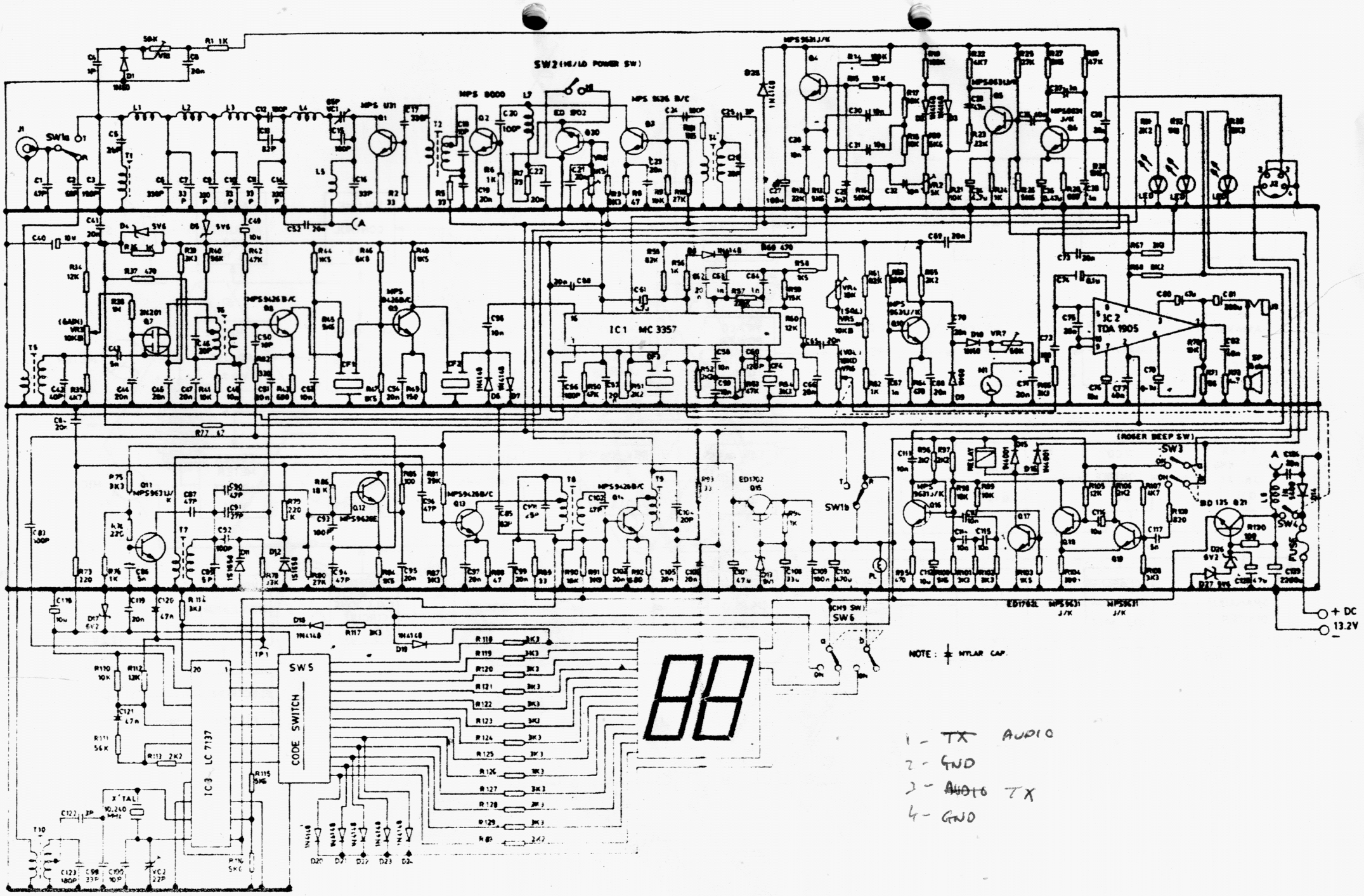
a. Whenever the set is tuned on, the display LED lights up and the selected channel number is shown and the meter lamp and RX LED light up.
b. At Tx mode, the Rx LED goes out and Tx LED lights up.
c. At Rx mode, the Tx LED goes out and Rx LED lights up.
d. Roger beep LED lights whenever roger beep switch is in "on" position.

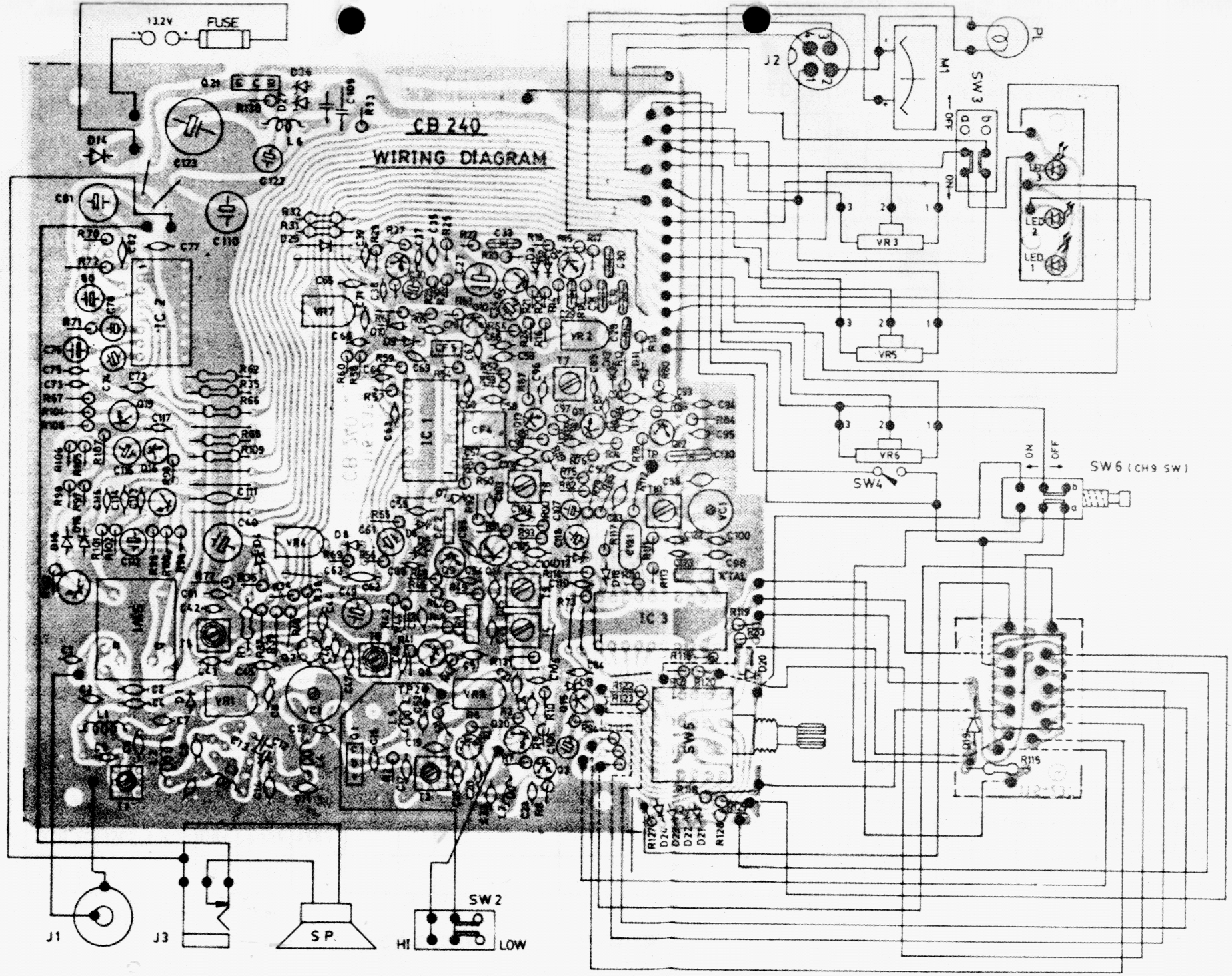
Some unit do not have a switch for "Roger beep". It is then built in and always in "on" position.

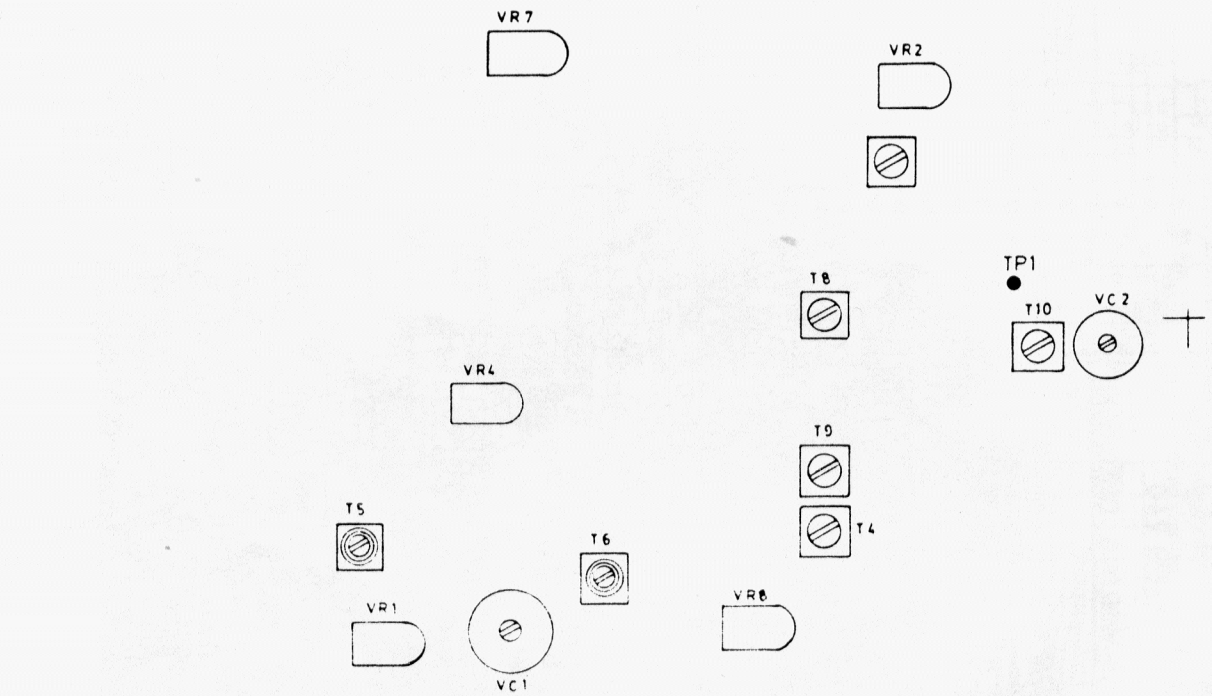




CB 240 BLOCK DIAGRAM


SW2(HI/LO POWER SW)
IC1 MC 3357
IC 2 TDA 1905
IC3 LC 7137
CODE SWITCH
SW5
SW6
SW1a
SW1b
SW3
SW4
(ROGER BEEP SW)
X'TAL 10.240 MHz
+ DC 13.2V
NOTE : MYLAR CAP
1 - TX AUDIO
2 - GND
3 - AUDIO TX
4 - GND


CB 240
WIRING DIAGRAM
13.2V
FUSE
J1
J2
J3
SP
SW2
HI
LOW
SW3
SW4
SW5
SW6 (CH9 SW)
ON
OFF
VR3
VR5
VR6
VR7
VR2
IC 1
IC 2
IC 3
XTAL
LED 1
LED 2
LED 3
PL
M1


VR7
VR2
TP1
T8
T10
VC2
VR4
T9
T5
T4
T6
VR1
VR8
VC1
T1
T2

D C VOLTAGE CHART (D C AVERAGE VOLTAGE MEASURED WITH HIGH IMPEDANCE VOLT METER)

	C	B	E				PIN				PIN				PIN	
Q1 MPS U 31	12.1V	0V	0V			IC 1 MC 3357	1	6V		IC 2 TDA 1905	1	6.76V		IC 3 LC 7137	1	
Q2 MPS 8000	10.8V	0V	0V				2	5.6V			2	13.2V			2	
Q3 MPS 9426 B/C	11.3V	4.06V	3.63V				3	5.9V			3	11.7V			3	
Q4 MPS 9631 J/K	11.3V	9V	9.68V				4	6.1V			4	3.76V			4	
Q5 MPS 9631 J/K	5.4V	2.1V	1.45V				5	1.06V			5	0V			5	
Q6 MPS 9631 J/K	6.14V	1.35V	0.7V				6	1.06V			6	2.58V			6	
Q7 3N 201	D 11.3V	S 2.1V	G1 5.3V	G2 5.3V			7	1.09V			7	2.55V			7	
Q8 MPS 9426 B/C	2.8V	1V	0.32V				8	6.1V			8	2.58V			8	0V
Q9 MPS 9426 B/C	3.12V	1.04V	0.32V				9	2.15V			9	0V			9	
Q10 MPS 9631 J/K	3.14V	1.3V	0.63V				10	1.99V			10	0V			10	
Q11 MPS 9631 J/K	0V	0.83V	0V				11	2.09V			11	0V			11	2.45V
Q12 MPS 9626 E	8.1V	2.99V	1.92V				12	0.77V			12	0V			12	2.8V
Q13 MPS 9426 B/C	12.6V	0.94V	0.62V				13	0V			13	0V			13	0V
Q14 MPS 9426 B/C	11.3V	1.92V	1.7V				14	1.28V			14	0V			14	
Q15 ED 1702 L	11.8V	9.1V	8.7V				15	0V			15	0V			15	1.5V
Q16 MPS 9631 J/K	11.3V	0.5V	0.08V				16	2V			16	0V			16	1.5V
Q17 ED 1702 L	1V.	0.27V	0V								17	0V			17	3V
Q18 MPS 9631 J/K	2V	2.8V	2V								18	0V			18	6V
Q19 MPS 9631 J/K	11.3V	0.86V	2V								19	0V			19	2.8V
Q20 ED 1702 L	11.8V	5.32V	4.66V								20	0V			20	RX 6.33V TX 0.72V
Q21 BD 135	13.2V	11.8V	11.1V													

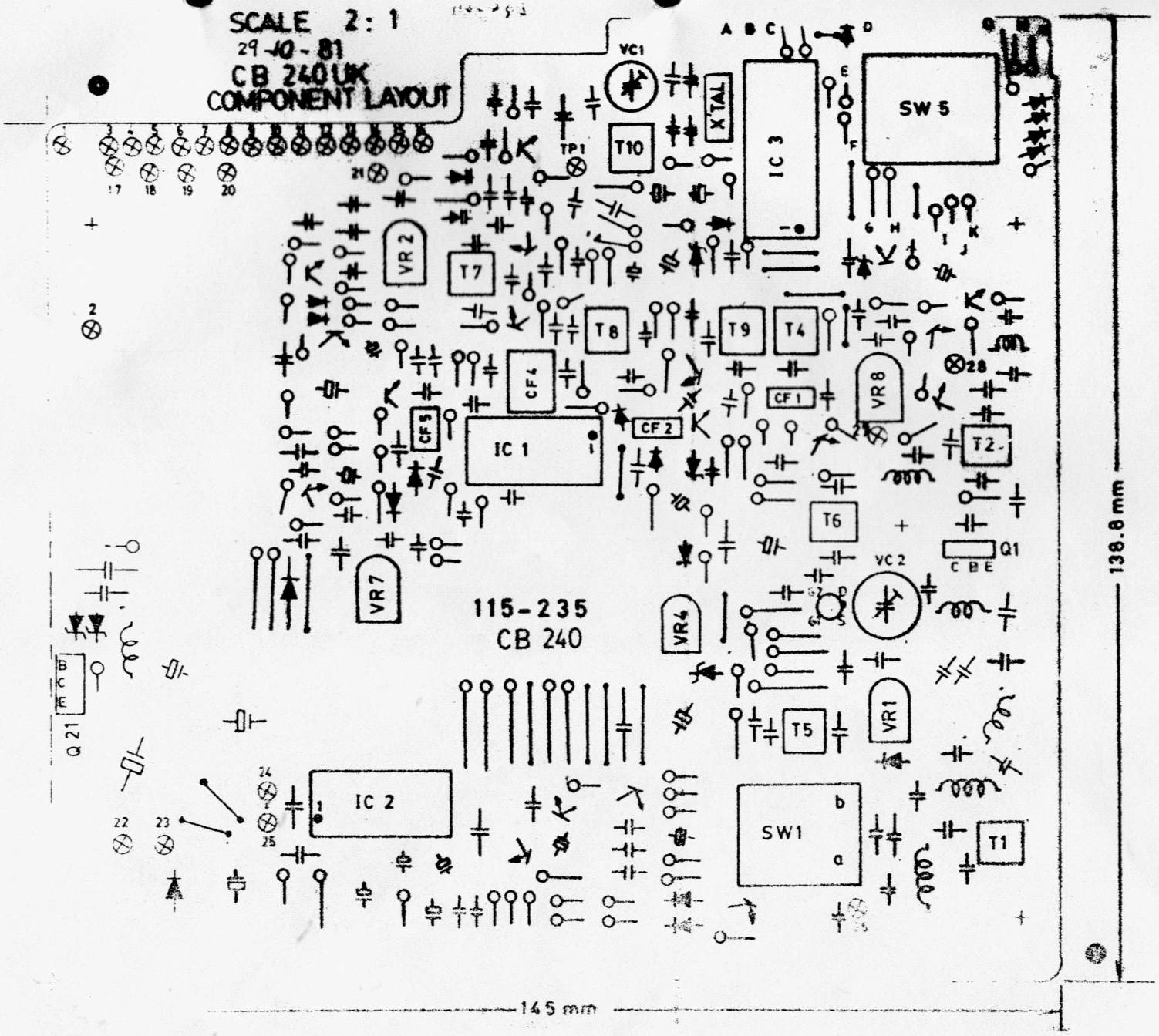
(REVISION C)

SCALE 2 : 1

2 -11-81

CB 240UK
DSPCB




SCALE 2:1
29-10-81
CB 240 UK
COMPONENT LAYOUT
115-235
CB 240
VC1
XTAL
IC 3
SW 5
TP1
T10
VR 2
T7
T8
T9
T4
CF4
CF1
VR8
CF 2
CF3
IC 1
T2
T6
Q1
C B E
VC 2
VR7
VR4
VR1
T5
Q 21
IC 2
SW1
T1
138.8 mm
145 mm