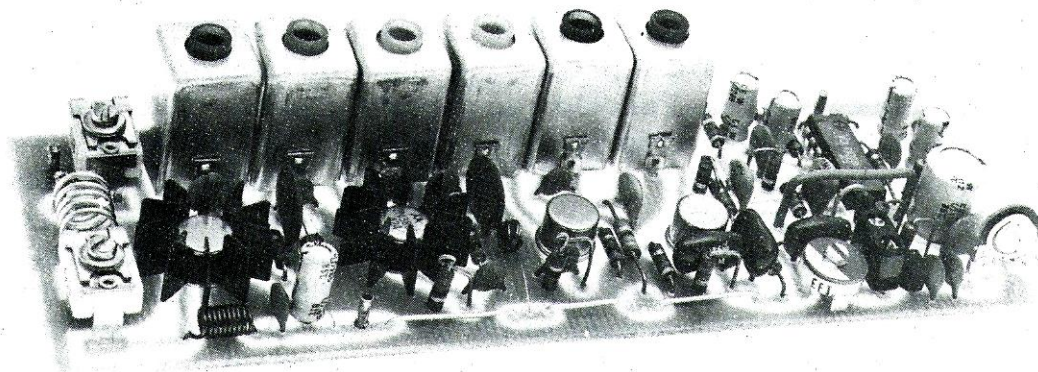


TX 144B and TX 220B TRANSMITTER KIT

5010602
REV.01
SEPT 1977

1687



MEASURES ONLY 2" X 6" X 1"

A one watt exciter using four RF transistors, two diodes, and one integrated circuit. The RF transistors are operating well below their ratings allowing long keying periods without damage. The exciter may be used alone as a transmitter or with our PA Series amplifiers for a 15 or 25 watt station. Some of the features are:

- Nominal output 1½ watts
- Deviation adjusted to 10KHz
- IC audio with clipping and active filter
- All spurious outputs down 30db or more
- Temperature compensation crystal trimmer
- Zener regulated oscillator
- Uses readily available 12 or 18 MHz crystals (18MHz for 220)
- All tuning coils prewound
- Predrilled and tinned G-10 Circuit board
- Easily built and tuned in one evening
- Multi-channel option available with addition of CD-2 crystal deck
- Will easily drive our 15 and 25 watt amplifiers to full output

Vhf engineering

DIVISION OF BROWNIAN ELECTRONICS CORP.

320 WATER ST. / BINGHAMTON, N.Y. 13901 / Phone 607-723-9574

CIRCUIT DESCRIPTION

The exciter uses four RF type transistors, two diodes, and one IC in the audio circuit. The RCA CA-3086 is actually five NPN transistors on one chip. Pin 3 is common to two transistors and must be at A.C. ground if they are used separately. Pin 12 is the base of the mike preamp. It is biased to about one milliamperere and its input impedance is about 600 ohms. A pre-emphasis network (R25-C41) provides proper matching for a high impedance microphone. The collector (pin 14) should run about six volts. The next two transistors are connected as diodes to limit the audio voltage to .6 volts peak to peak. The next amplifier (Pins 3-4-5) drives the active filter stage. Its collector should run about six volts. The current through R-18 and R-19 is very low and the base of the active filter should be a little under six volts. The emitter (Pin 7) should run .6 volts less than the base. The deviation control R-20 controls the amount of audio applied to the varicap, thereby controlling the deviation of the carrier. The 5.6 V Zener diode (D1) regulates the bias of Q1 and varicap D2. This assures oscillator stability and linear operation.

In the TX144 L1 is tuned to approximately 36 MHz. Therefore, the transmitter will accept either 12 MHz or 18 MHz crystals without retuning. L1 is tuned to the 55 MHz range in the TX220 and will function best if 18 MHz crystals are used. Q2 and Q3 are frequency doublers in both transmitters and the final transistor (Q4) operates straight through. All RF stages except the oscillator operate in class C with no collector current when the drive is removed.

LIMITED WARRANTY

Factory wired units are warranted for 90 days. The unit must be returned to the factory postpaid with a note describing difficulty and date of purchase; include a check to cover return postage. Our liability under warranty is limited to repair, adjustment or replacement of units proven to be defective. No further warranty is expressed or implied. Units modified or obviously mis-used will not be covered by the warranty.

The parts in kits built according to our instructions carry the original manufacturers' warranty. Defective parts must be returned for credit. Units built from kits may be returned to the factory for repair and alignment for a nominal charge, plus parts and shipping.

IMPORTANT NOTE:

At VHF Frequencies, short leads are necessary to eliminate stray inductances. Therefore, all transistors must be flush with the board. Sockets should not be used. All bypass capacitors must be flush with the board. If the disc capacitor coating prevents flush mounting, the coating on the leads must be removed. This is easily done by pinching the coating on the lead with a pair of needle nose pliers.

Substitute transistors (HEP, SK, and ECG series) may not perform to our specifications.

1. a) Mount IC-1. Be sure that it is oriented correctly.
 b) Mount Q1, Q2, Q3 and Q4 as shown on the layout drawing.
2. Mount the resistors as shown on the parts layout. R2, R18, R19, R22, R23 and R25 are mounted on end. R5 and R7 must be mounted on end with the upper lead connected to the emitters of Q2 and Q3 respectively. These leads will serve at test points during tune up.
3. Mount the capacitors as shown on the layout. Be careful to observe the polarity of electrolytic capacitors.
4. Mount D1, D2. The diodes are polarized as shown on the layout. The band indicates cathode.
5. RFC1 and RFC2 are ferrite beads with 3 turns of #30 Wire looped through the center hole. Mount these as shown being careful to scrape the #30 wire to assure a clean solder connection. Wind L -7 and L -8 as indicated in parts list and mount as shown.
6. Install the 4 jumper wires as shown. The wire next to the IC should be insulated hookup wire. The others may be bare tinned type.
7. Insert the keystone pins, crystal socket, and coil shields. Solder all connections and check carefully for bridges, cold joints, etc.
 Install the heat sink on Q3 and Q4.

CRYSTAL INFORMATION

TX144: HC25/u holders
 ground parallel at 20pf
 18 MHz fundamental freq. = $\frac{\text{output freq.}}{8}$
 12 MHz fundamental freq. = $\frac{\text{output freq.}}{12}$

TX220: HC25/u holders
 ground parallel at 20pf
 18 MHz fundamental freq. = $\frac{\text{output freq.}}{12}$

TUNING

The exciter can be tuned using a voltmeter. Install a crystal and connect a load to the output terminals. A #12 light bulb will plug into the output pins and glow brightly on one watt output. Of course, a dummy load and watt meter can be used if available.

Clip the negative VTVM lead to ground and the positive lead to the top of R5. Apply 12VDC to the exciter and tune L2 and then L1 for maximum indication (.2-.5VDC). Move the positive voltmeter lead to the top of R7 - apply power tune L4 and then L3 for maximum (.5-1.6 VDC). At this point some RF output should be present. Tune L6 and then L5 for maximum power output.

Tune C24 and C25 for maximum output. Since some interaction will occur, the tuning procedure should then be repeated until maximum output is obtained.

The deviation control (R20) can be adjusted on the air for best sounding audio.

MULTI-CHANNEL OPERATION

The TX Series of transmitters may be multi-channelled by adding a suitable switching arrangement. The VHF ENGINEERING CD-2 crystal deck is ideally suited to this application. Each crystal will require a separate series netting capacitor. Connect the common terminal of the switch to the junction of D2 and R23. Connect the common terminal of the netting capacitors directly to the base of Q1. Do not use leads longer than 3" for these connections. The trimmer and C-39 on the TX module may be removed.

MOUNTING

The board can be mounted on a chassis or metal plate with 4-40 screws and 1/4 inch spacers. A better method is to solder two brass angle rails 1/4X1/2X6 inches long to the ground foil along the edges of the board. The transmitter may also be mounted in a box fabricated from sheet copper, brass, tin or double sided circuit board. The inside dimensions of the box should be 2" X 6" by at least 2" high. The bottom of the board should be about 1/2 inch from the edge of the sides. A box with the inside dimensions 4" X 6" will accomodate both the transmitter and power amplifier.

MICROPHONE

A medium to high impedance (2000 ohms nominal) dynamic or ceramic mike is preferred.

NETTING

The frequency netting trimmer (C-39) will vary the carrier frequency about 10 Khz either side of the center frequency. This should be adjusted with the aid of a frequency standard or counter. If neither is available, it may be set on the air with the help of someone with an accurate receiver. FM requires you to be within a few hundred Hertz of the correct frequency.

ANTENNA

The transmitter will match any antenna impedance from 40-75 ohm.

LINE INPUT

High level audio input requiring approximately 1 volt peak-to-peak. Used for repeater, autopatch, etc.

(5010602)

TX144B/TX220B
(Kit 7010010)
(Wired 7010011)

R1	4.7K	(2020290)	C8	.001	(2010370)	C40	33pf SM	(2010171)
R2	270	(2020150)	C9	22pf	(2010120)	C41	.01	(2010410)
R3	47	(2020080)	C10	2.2pf	(2010030)			
R4	1K	(2020230)	C11	.1	(2010440)	Q1	2N2193	(1030011)
R5	10	(2020030)	C12	.001	(2010370)		2N3866	(1030030)*
R6	1K	(2020230)	C13	30pf	(2010160)	Q2	2N2193	(1030011)
R7	10	(2020030)		47pf	(2010190)*		2N3866	(1030030)*
R8	47	(2020080)	C14	120pf	(2010260)	Q3	2N3866	(1030030)
	120	(2020120)*		47pf	(2010190)*	Q4	2N3553	(1030010)
R9	100	(2020100)	C15	.001	(2010370)		2N5913	(1020130)*
R10	470K	(2020440)	C16	10pf	(2010070)	IC1	LM or CA3086	(1050100)
R11	4.7K	(2020290)		5pf	(2010050)*	D1	5.6V Zener	(1050050)
R12	1.2K	(2020250)	C17	3.3pf	(2010040)	D2	MV2112 or Equiv.	(1010029)
R13	1.2K	(2020250)	C18	.001	(2010370)	L1	Brown (2030030)	(2030020)*
R14	4.7K	(2020290)	C19	.1	(2010440)	L2	"	White
R15	27K	(2020370)	C20	4.7MFD 16V	(2010490)	L3	Yellow (2030040)	Red
R16	4.7K	(2020290)	C21	.001	(2010370)	L4	"	"
R17	1K	(2020230)	C22	12pf	(2010080)	L5	Red (2030070)	Blue
R18	4.7K	(2020290)		15pf	(2010090)*	L6	"	"
R19	4.7K	(2020290)	C23	47pf	(2010190)	L7	10 T #24 1/8" D Enamel	(3030290)
R20	5K Pot	(2020520)	C24	ARCO 403	(2010690)	L8	6 T #20 Silver Plt. 1/4" D	(3030170)
R21	330	(2020170)	C25	ARCO 403	(2010690)		4 T #20 Silver Plt. 1/4" D	(3030170)*
R22	47K	(2020390)	C26	100MFD 16V	(2010540)	RFC 1, 2	3 T #30 Wire	(3030360)
R23	10K	(2020330)	C27	4.7MFD 16V	(2010490)		looped thru Ferrite Bead	(3050220)
R24	2.2K	(2020260)	C28	.001	(2010370)	2	Rails	(3050080)
R25	22K	(2020360)	C29	4.7MFD 16V	(2010490)	6	Keystone Pins	(4060130)
			C30	4.7MFD 16V	(2010490)	1	Crystal Socket	(4080050)
C1	220pf SM	(2010300)	C31	.01	(2010410)	2	Heat Sinks	(4020050)
C2	220pf SM	(2010300)	C32	4.7MFD 16V	(2010490)	6	Coil Shields	(2030090)
C3	27pf	(2010150)	C33	.01	(2010410)	1	PC Board	(4040080)
C4	2.2pf	(2010030)	C34	.01	(2010410)	1	Instruction Manual	(5010602)
C5	.01	(2010410)	C35	.005	(2010390)			
C6	33pf	(2010180)	C36	.02	(2010430)			
	47pf	(2010190)*	C37	.001	(2010370)			
C7	150pf	(2010270)	C38	.001	(2010370)			
	100pf	(2010250)*	C39	20pf var.	(2010650)			

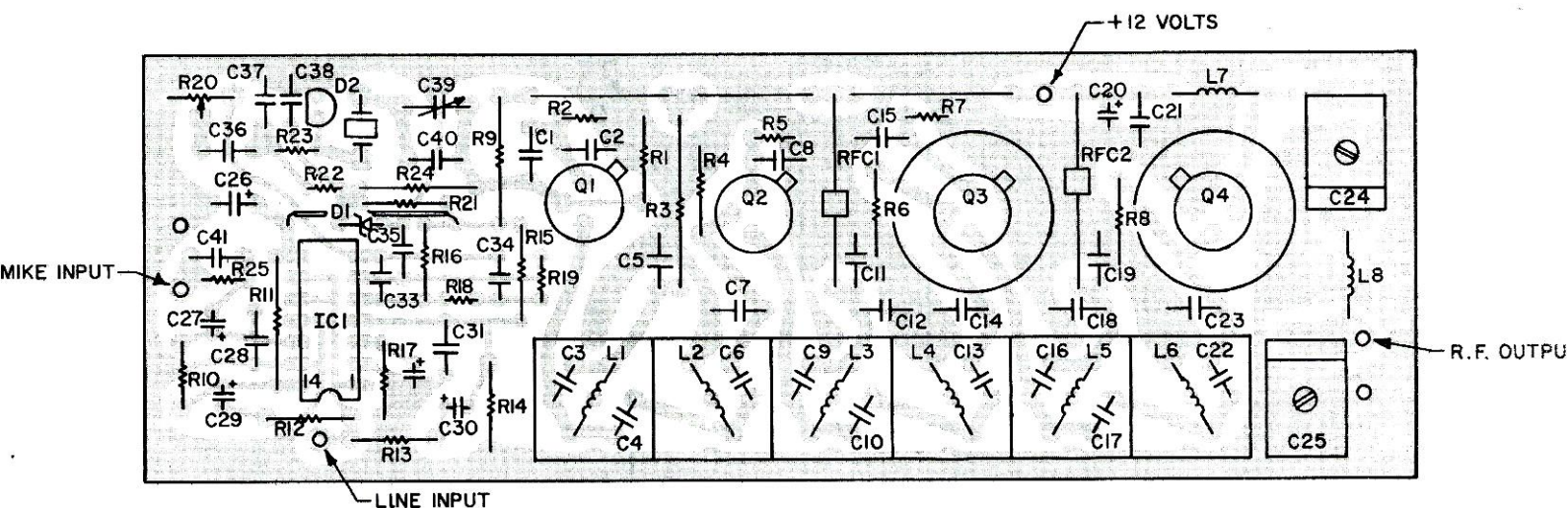
* USED ON 220 MHz ONLY

TX144HS HIGH BAND MODIFICATION KIT

These changes allow the amateur version of the VHF Engineering TX144 to tune the 150-170 MHz commercial band.

	<u>WAS</u>	<u>IS NOW</u>	<u>PART NO.</u>
R5, R7	10 ohm $\frac{1}{4}$ W	33 ohm $\frac{1}{4}$ W	P202-0070
C9	22pf	15pf	P201-0090
C6	33pf	22pf	P201-0120
C3	27pf	22pf	P201-0120
C16	10pf	5pf	P201-0050
C22	12pf	10pf	P201-0070
C40	33pf SM	22pf SM	P201-0140

These parts comprise the VHF Engineering TX144HS Modification Kit.



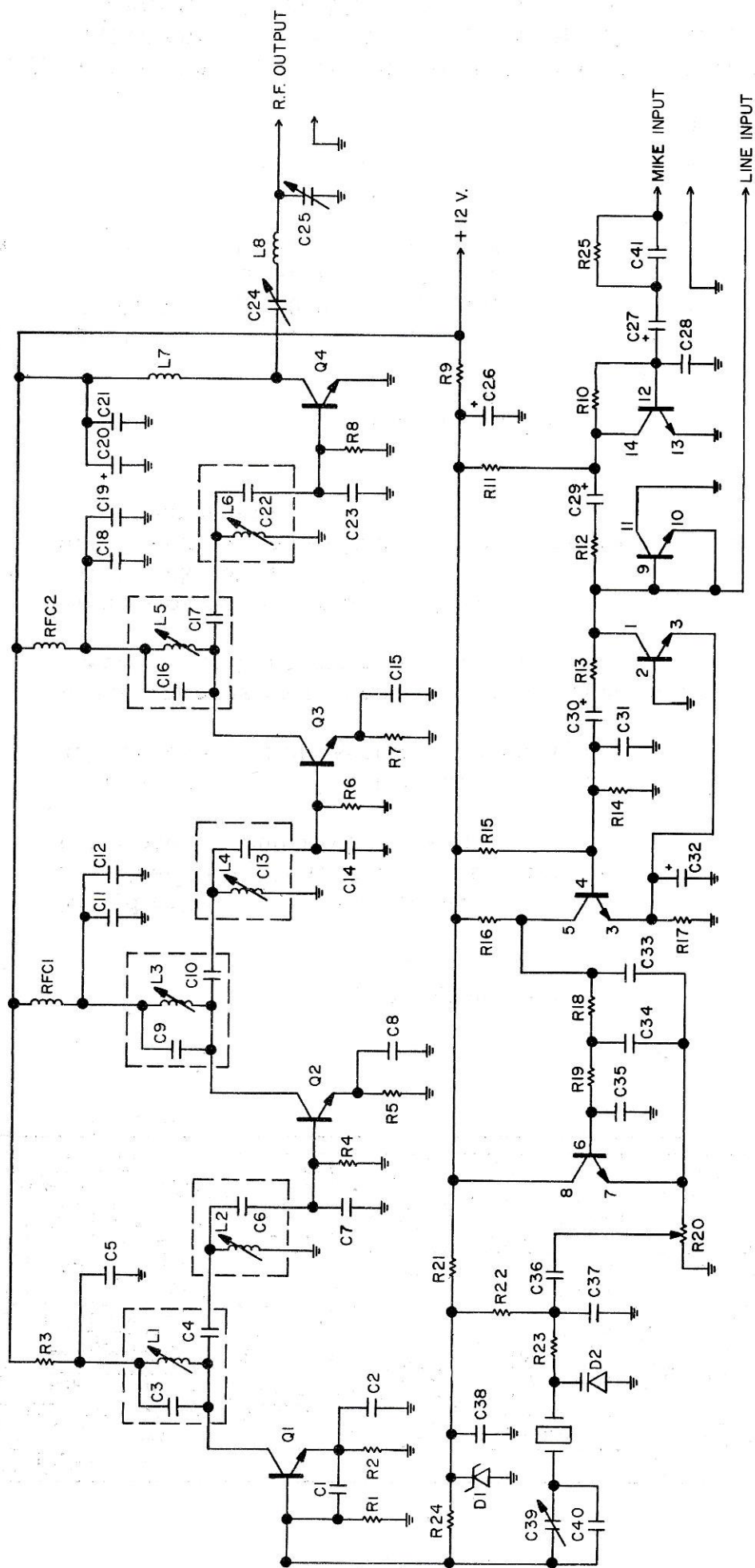
TROUBLESHOOTING

- 1) No indication on R-5 test point.
 - a.) Check D-1, Q-1, Q-2 and associated circuitry.
 - b.) Check or substitute crystal.
- 2) No indication on R-7 test point.
 - a.) Check Q-3 and associated circuitry.
- 3) If test voltages on R-5 and R-7 are correct, but no RF output, check Q-4 and associated circuitry.
- 4) Normal output but no modulation.
 - a.) Check voltages on IC-1
 - b.) Check IC-1 associated circuitry for open or misplaced components.

VOLTAGE CHART

				IC-1			
				Pin 1			
Q-1	E 3.0	B 3.5	C 12.5	2	0.3	9	0.5
Q-2	E 0.15	B -0.25	C 13.6	3	0	10	0.5
Q-3	E 0.5	B -0.8	C 13.6	4	0.9	11	0
Q-4	E 0	B 0.1	C 13.6	5	1.6	12	0.5
				6	6.3	13	0
				7	6.2	14	6.5
				8	5.5		
					11.2		

NOTE: ALL VOLTAGE MADE WITH 20,000 OHMS PER VOLT METER TO GROUND. VOLTAGES MAY VARY 10%. ALL VOLTAGES MEASURED WITH 13.6 SUPPLY VOLTAGE.



TX 144/220 B