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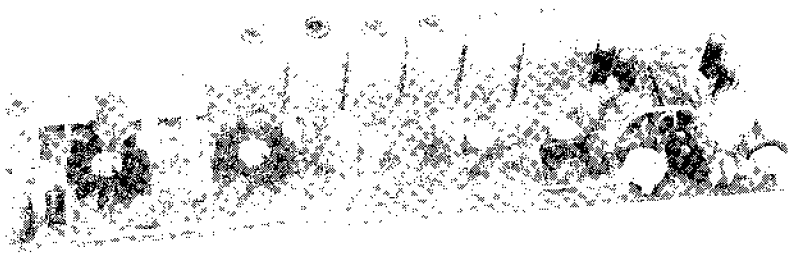
TX432 TRANSMITTER KIT



MEASURES ONLY 2" X 7.5" X 1"

A one watt exciter using five 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 PA432/10 amplifier for a 10 watt station. Some of the features are:

- Nominal output 1 watt
- Deviation adjustable to ±10 KHz
- IC audio with clipping and active filter
- All spurious outputs down 30db or more
- Temperature compensation crystal trimmer
- Zener regulated oscillator
- Uses readily available 18 MHz crystals
- 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 10 watt amplifier to full output

PRICE $1.00

Vhf engineering
DIVISION OF BROWNIAN ELECTRONICS CORP.
320 WATER ST. BINGHAMTON, N.Y. 13901 / Phone 607-723-9574

CIRCUIT DESCRIPTION

The exciter uses five 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 milliampere and its input impedance is about 600 ohms. A preemphasis network (R25-C45) 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-14 and R-15 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-13 controls the amount of audio applied to the varicap, thereby controlling the deviation of the carrier. The 5.6V Zener diode (D1) regulates the bias of Q1 and varicap D2. This assures oscillator stability and linear operation.

The crystal oscillates at 18 MHz in its fundamental mode. The collector circuit of Q1 is tuned to the 3rd harmonic by C-23 and L-1. Q2, Q3 and Q4 are frequency doublers which develope about 200 milliwatts at 432 MHz. Q5 is operated as a straight through class C amplifier developing about one watt output.

LIMITED WARRANTY

All parts 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. Factory wired units are fully warranted for 90 days from shipping date. The liability of VHF Engineering under warranty is limited to repair, adjusted or replacement of units proven to be defective. No further warranty is expressed or implied. Units modified or obviously misused will not be covered by the warranty.

Thank you for purchasing this VHF Engineering kit. We hope you will get as much pleasure and satisfaction out of building and using this unit as we have from designing it for you. Please read all of the enclosed material carefully. Unlike kits which are produced for the general public, this kit was designed for the ham who has some home-brew experience and technical knowledge. If you encounter problems in alignment or testing, don't hesitate to obtain assistance from a competent fellow ham near you or here at VHF Engineering.

Bob Brown W2EDN

Will Kupfrian W2BVA

The construction techniques and procedures in this manual are very important to the proper and easy building of VHF Engineering kits. If your previous experience has been with unminiaturized equipment the following information should prove invaluable. To build miniaturized equipment using P.C. boards requires extra patience and care, normal dexterity, and the proper tools for the job.

GENERAL NOTES

A. A good soldering job is essential to the satisfactory performance of this unit. Soldering to etched circuit boards is easier than conventional point to point wiring when it is done correctly.

Use rosin core solder only (1/16" or smaller is easiest to work with). Acid core solder or paste fluxes will cause corrosion and void all warranties. Use a clean, freshly tinned soldering iron of about 30-35 watts. (A controlled temperature type is preferred). A small tip will greatly reduce bridging and similar problems.

When soldering a part to the P.C. board, the solder must completely surround the wire lead where it comes through the board. Do not apply excessive solder, but do not hesitate to apply sufficient heat to assure a smooth flow of solder all around the lead and onto the board. Do not worry about overheating semiconductors. It is likely that P.C. board lands will be lifted long before a semiconductor device is damaged.

B. Leads on resistors, capacitors, transistors etc. are often longer than required. These leads should be trimmed as short as possible unless specific directions to the contrary are given in the instructions.

As a general rule all parts should be mounted as close to the board as possible. In the case of capacitors it may be necessary to scrape the body coating off of the leads to allow the bottom of the capacitor to rest on the board.

C. Inspect your work after each step and check off the steps as they are completed. You will find it helpful to check off capacitors, resistors, etc. on the parts list as they are installed. This will save you time and mistakes.

D. Check and double check the direction in which polarized components should be installed. In particular, take great care when inserting transistors, I.C.'s, electrolytic and tantalum capacitors etc. Remember the old carpenters rule "Measure twice and cut once"

PARTS IDENTIFICATION

In order to expedite delivery to you, we are occasionally forced to make minor substitutions of parts. For example; 4.7 MFD for 5 MFD; .022 MFD for .02 MFD. Such substitutions are carefully checked before they are approved and the parts supplied will function satisfactorily. These changes are usually self-evident and are mentioned here only to prevent confusion in checking the contents of your kit.

Each manufacturer seems to have his own method of marking for similar parts. In order to eliminate confusion about reading values marked on components, the following examples are presented.

DISC CERAMIC CAPACITORS - value and a tolerance letter printed on body. For example: 2.2C=2.2PF ± 1/4pf; 5D=5pf ± 1/2pf; 12J=12pf ± 5%; 680K=680pf ± 10%; 1000p=.001 Mfd; 104p=10000pf=.01 Mfd. Please note that the letters on capacitors do NOT denote a multiplier, they indicate tolerance only.

SILVER MICA (SM) CAPACITORS - value and tolerance are coded on the body of the device. For example: 220J03=22pf ± 5%; 330J03=33pf ± 5%; 221J03=220pf±5%; 331J03=330pf ±5%. Actual value may also be printed on the body. This should be self-evident.

ELECTROLYTIC AND TANTALUM CAPACITORS - the value is printed on the body of the device. There are several shapes and sizes the only odd one which we use is a tantalum which is shaped like a drop of water. BE SURE THAT YOU OBSERVE POLARITY MARKINGS.

RESISTORS - are color coded. Be very careful, when reading codes, not to confuse red and orange, brown and orange, violet and grey etc. When in doubt, check values with an ohmeter.

R.F. CHOKES - read color code as follows:

1. Start reading from wide silver band.
2. The next group of bands indicate significant figures.
3. When a gold band appears in the significant figure grouping it should be read as a decimal point.
4. Last band indicates tolerance: gold=5% silver=10% None=20%

Examples:
wide silver/ gold/ orange/ orange = .33 uhy20%
wide silver/ brown/ black/ black/ gold = 10 uhy 5%
wide silver/ blue/ grey/ brown/ gold = 680 uhy 5%
wide silver/ yellow/ gold/ purple/ silver = 4.7 uhy 10%

COIL WINDING: Follow our coil data exactly as given in the main part of this manual. When counting turns, be very careful to start with the first complete turn and not the second. For example: when a 3 1/2 turn coil is completed if you look at one side of the coil you will count 3 turns and looking at the other side you will count 4. Be very careful to wind all coils in the same direction.

IMPORTANT NOTE: ALL COMPONENTS MUST BE MOUNTED USING THE SHORTEST POSSIBLE LEAD LENGTHS. DO NOT USE SOCKETS OR STANDOFFS OF ANY KIND. SUBSTITUTE TRANSISTORS (HEP, SK SERIES, ECG) MAY NOT FUNCTION PROPERLY.

I. a) Mount IC1. Be sure that it is oriented correctly. Pin 1 may be indicated by a notch, deep indentation, or small dot on the device.

b) Mount Q1, Q2, Q3, Q4, and Q5 as shown on the layout drawing. Do not use sockets. The transistors must be mounted on the board with the shortest possible leads.

II. Mount the resistors as shown on the parts layout. R2, R5, R7, R10, R11, R14, R15, and R25 are mounted on end. R5 and R7 must be mounted on end with the upper lead connected to the emittors of Q2 and Q3 respectively. These leads will serve as test points during tune up.

III. a) Mount the disc capacitors as shown on the parts layout. It may be necessary to scrape the coating from the leads to allow the body of the devices to rest on the surface of the board.

b) Mount electrolytic capacitors C28, C38, C39, C41, C47, and C44. Observe the polarity shown on the parts layout.

c) Mount C-47 on the foil side of the board in the position shown. Be very careful to avoid shorting lands with this device. Solder both sides of the case to the ground land and the small tab to the base of Q5.

d) Mount D1, D2 and L1-L6. The diodes are polarized as shown on the layout. Wind L7 through L11 and mount as shown.

e) *RFC1, RFC2, and RFC3 are ferrite beads with three turns of* #30 wire looped through the center hole. Mount these as shown. Scrape and tin the #30 wire to assure a clean solder connection.

f) Install the five jumper wires as shown.

IV. a) Insert the keystone pins, crystal socket, and coil shields. Solder all connections and check carefully for bridges, cold joints, etc. The coil shields must be soldered before tuning is attempted.

b) Install the heat sinks on Q4 and Q5.

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 1/4 X 1/2 X 8 inches long to the ground foil along the edges of the boar 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 8" 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 5" X 8" will accomodate both the transmitter and power amplifier.

MICROPHONE

A medium to high impedence dynamic or ceramic mike is preferred.

NETTING

The frequency netting trimmer (C-30) 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.

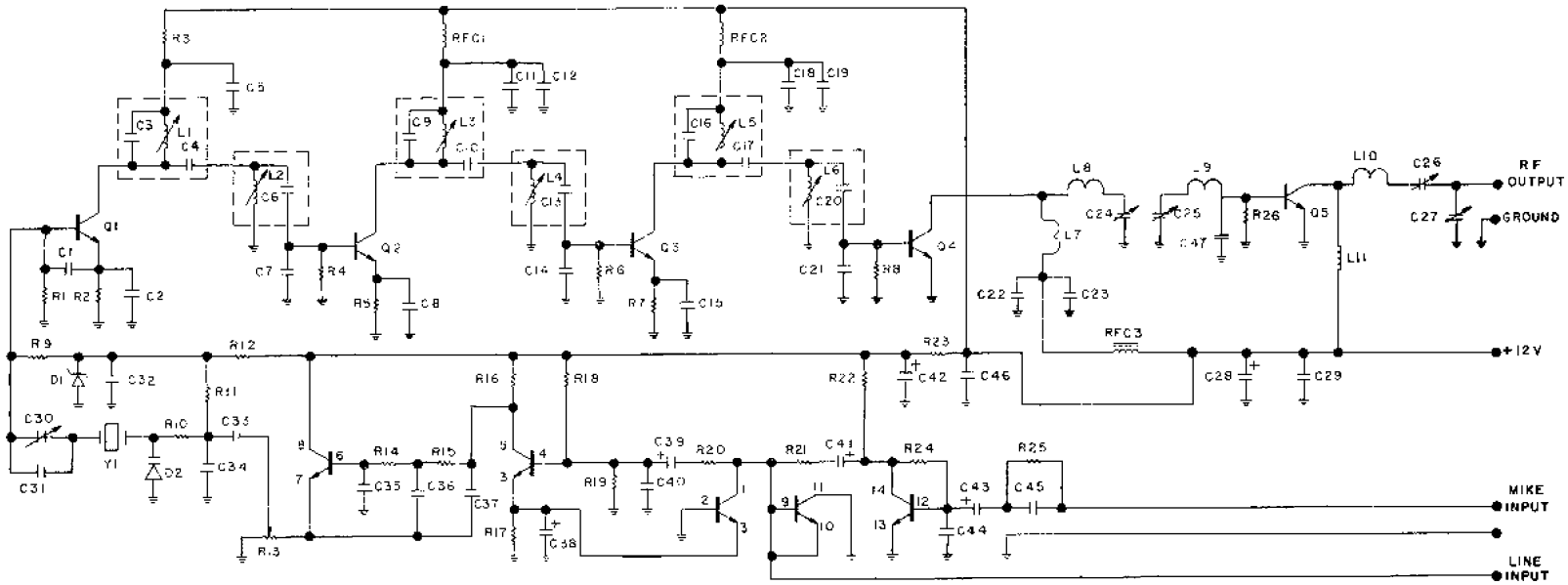
CRYSTAL INFORMATION

HC25/u Holders
Ground Parallel at 20pf

$$\text{18 MHz fundamental freq.} = \frac{\text{output freq.}}{24}$$

MULTI-CHANNEL OPERATION

The TX Series of transmitters may be muti-channeled 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 R19. 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 C31 on the TX module may be removed.



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 positive lead to the top of R-5. Apply 12VDC to the exciter and tune L-2 and then L-1 for maximum indication (.15-.3 VDC). Move the positive voltmeter lead to top of R-7 and tune L-4 and then L-3 for maximum (1-1.5 VDC). Connect the positive lead of the voltmeter to ground and the negative lead to the base of Q4 through a 10K resistor. Adjust L-6 and then L-5 for maximum indication (.25-.5 VDC). Move the negative lead with the 10K resistor to the base of Q5 and adjust C-24 and C-25 for maximum indication (.02-.05 VDC). Adjust C-26 and C-27 for maximum output.

Since some interaction will occur, the tuning procedure should be repeated until maximum output is obtained.

Typically, the output should be bwtween .8 and 1.2 watts, and draw about 300-350 mils. at 12.8 VDC.

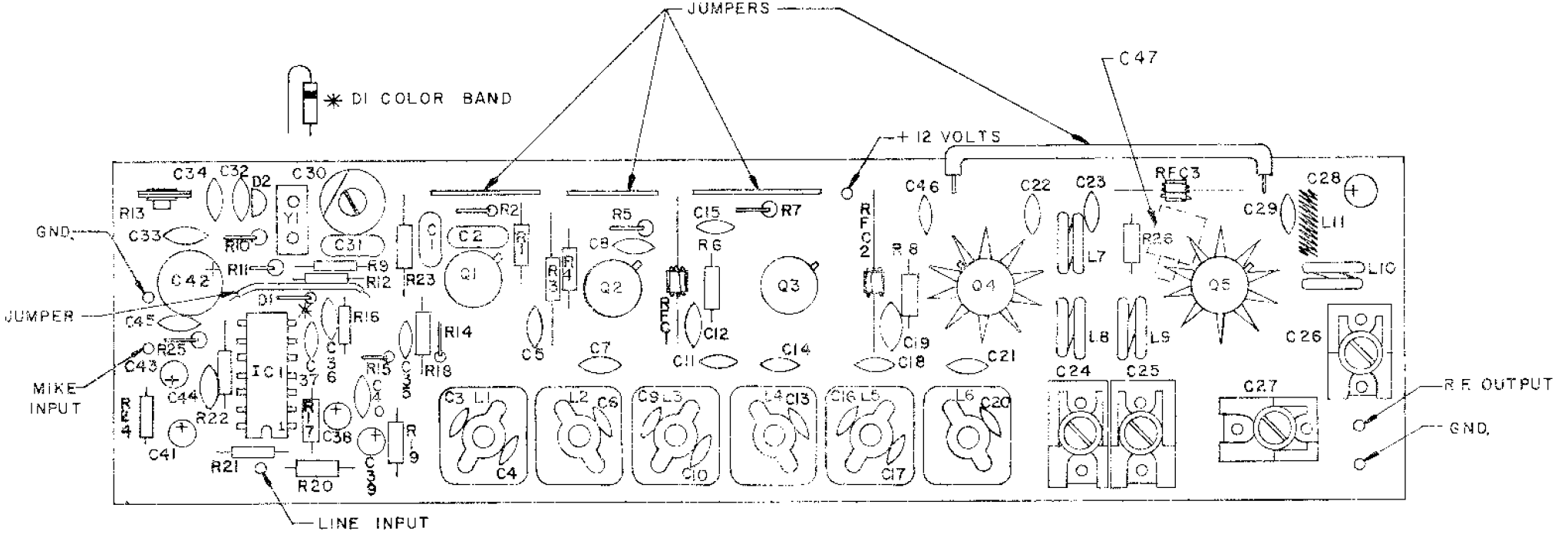
The netting trimmer (C-30) should be adjusted with the aid of a frequency counter.

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

If the counter available cannot read to 500 MHz, a reading may be taken from one of the lower frequency stages and the reading multiplied to determine the actual output frequency. The trimmer may also be adjusted on the air with the help of someone with an accurate receiver.

In some cases, after completion of tuning as described here, spurious signals may be present along with the transmitter carrier. A tunable receiver, wavemeter, or other instrument should be used to check for the possible presence of spurious signals. The tunable receiver or wavemeter should be tuned over the range of (Carrier frequency -20MHz) to (Carrier frequency +20MHz) while the transmitter is operating into a dummy load. If a spurious signal is found, the oscillator and multiplier stages should be retuned slightly to reduce or eliminate the spurious signal.

As an option, VHF Engineering will align and tune your transmitter to frequency for a flat rate of $6.00. This does not include the replacement of parts damaged during assembly.



C1	220pf SM	(2010810)	C35	.01	(2010410)	R21	1.2K	(2020250)
C2	220pf SM	(2010810)	C36	.005	(2010350)	R22	4.7K	(2020290)
C3	3pf	(2010130)	C37	.01	(2010410)	R23	47	(2020080)
C4	2.2pf	(2010050)	C38	4.7MFD 16V	(2010480)	R24	176K	(2020440)
C5	.01	(2010410)	C39	4.7MFD 16V	(2010480)	R25	22K	(2020360)
C6	47pf	(2010190)	C40	.01	(2010410)	R26	8K	(2020670)
C7	200pf	(2010230)	C41	4.7MFD 16V	(2010480)			
C8	.001	(2010370)	C42	100 MFD 16V	(2010640)	Q1	2N3565	(1030020)
C9	22pf	(2010120)	C43	4.7MFD 16V	(2010480)	Q2	2N3866	(1030030)
C10	2.2pf	(2010030)	C44	.001	(2010370)	Q3	2N3866	(1030030)
C11	.001	(2010370)	C45	.01	(2010410)	Q4	2N3866	(1030030)
C12	.1	(2010440)	C46	.001	(2010370)	Q5	2N5913	(1020130)
C13	47pf	(2010190)	C47	22pf Unscaled Mica				
C14	47pf	(2010190)		Jumper Board*	(2010120.	D1	5.6V Zener	(1010050)
C15	.001	(2010370)				D2	1N 2112	(1010020)
C16	5pf	(2010050)	R1	4.7K	(2020290)			
C17	2.2pf	(2010030)	R2	270	(2020150)	IC1	CA3086	(1050100)
C18	.001	(2010370)	R3	47	(2020080)			
C19	.1	(2010440)	R4	1K	(2020230)	L1	White Coil	(2030020)
C20	22pf	(2010080)	R5	10	(2020030)	L2	White Coil	(2030020)
C21	47pf	(2010190)	R6	1K	(2020240)	L3	Red Coil	(2030070)
C22	.001	(2010370)	R7	10	(2020030)	L4	Red Coil	(2030070)
C23	.1	(2010440)	R8	1K	(2020240)	L5	Blue Coil	(2030010)
C24	ARCO 400	(2010680)	R9	2.2K	(2020260)	L6	Blue Coil	(2030010)
C25	ARCO 100	(2010650)	R10	10K	(2020340)	L7	3T #24 Silver Pl. .3" I.D	(3030080)
C26	ARCO 400	(2010680)	R11	47K	(2020390)	L8	3T #24 Silver Pl. .3" I.D	(3030080)
C27	ARCO 400	(2010680)	R12	33K	(2020370)	L9	3T #24 Silver Pl. .3" I.D	(3030080)
C28	4.7MFD 16V	(2010490)	R13	5K pot	(2020520)	L10	3T #24 Silver Pl. .3" I.D	(3030080)
C29	.001	(2010370)	R14	4.7K	(2020286)	L11	10T #22 1/8" Dia.	(3030271)
C30	22pf Var.	(2010660)	R15	4.7K	(2020286)			
C31	38 pf SM	(2010710)	R16	4.7K	(2020286)	RFC1-3	47 #30 through F.B.	(3030360)
C32	.001	(2010370)	R17	5K	(2020456)			
C33	.022	(2010430)	R18	270	(2020270)	3	Ferrite Beads	(3050220)
C34	.001	(2010370)	R19	4.7K	(2020286)	6	Keystone Pins	(4060130)
			R20	1.2K	(2020250)	2	Heat Sinks	(4020050)
						1	Crystal Socket	(4080050)
						6	Grid Sockets	(2080060)
						1	PC Board	(4040101)
						1	Instruction Manual	(4010600)