

TRANSVERTER

INSTRUCTION MANUAL

FTV-901R

SCHEMATEEK

Beh. T. Hultermans

Postbus 4228

5604 EE Eindhoven

YAESU MUSEN CO , LTD.

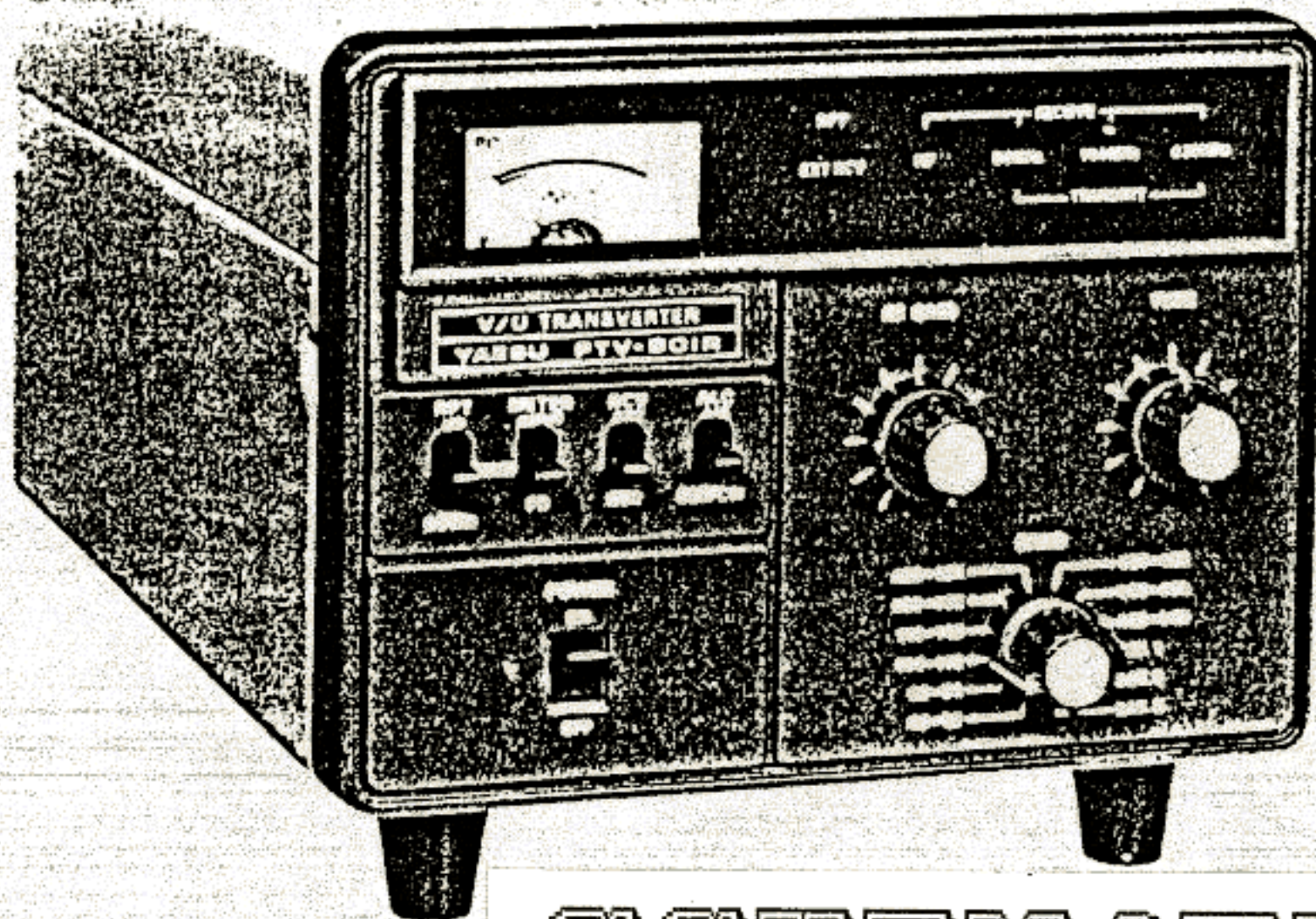
TOKYO JAPAN.

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FTV-901R

VHF/UHF TRANSVERTER



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GENERAL

The FTV-901R is an all-new transverter for the FT-901DM and FT-101ZD series, capable of operation on the 50, 144, and 430 MHz bands. The basic unit comes equipped with 144 MHz capability, and the 50 and 430 MHz band modules may be added as options. Power input is 20 watts on all three bands.

For satellite operators, three satellite bands are provided, allowing full duplex operation through the transverter, using an external receiver in addition to the FT-901DM. The operator can transmit on 145 MHz while listening on 29 MHz or 435 MHz, or transmit on 435 MHz while listening on 145 MHz.

The FTV-901R also includes repeater split for 50 and 144 MHz, allowing full use of the FM capability of the FT-901DM. Fully solid state, the FTV-901R includes protection for the final amplifier transistors against damage caused by high SWR. Spurious radiation is at least 60 dB down.

The owner is urged to read this manual in its entirety, so as to become better acquainted with the exciting new FTV-901R. With proper care in operation, this equipment should provide many years of trouble-free operation.

SPECIFICATIONS

Frequency range:

- 50–54 MHz (option)
- 144–148 MHz
- 430–440 MHz (option)

Mode:

- SSB, CW, AM, FM

Input impedance:

- 50–75 ohms

IF output frequency:

- 28–30 MHz

RF power output:

- 10 watts @ 50% duty cycle

Drive requirements:

- 3 V RMS at 28–30 MHz

Receiver spurious responses:

- Image rejection better than 50 dB.
- Internal spurious signals below 1 μ V equivalent to antenna input.

Size:

- 210(W) x 157(H) x 352(D) mm

Weight:

- 10 kg

SEMICONDUCTOR COMPLEMENT

FET:

3SK51-03	6	3SK59Y	1
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Schottky Barrier Diodes:

1SS43	4
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Silicon Transistors:

2SC730	2	2SC2053	2
2SC784R	6	2SC2166	1
2SC1424	5	2SC2369	2
2SC1426	2	2SC235D	1
2SC1815Y	11	MJE3055	1
2SC1945D	1		

Zener Diode:

WZ110	1
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Varactor Diodes:

1S2209	12
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Power Modules:

VP20BL	1	UP07BL	1
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Integrated Circuits:

MC1496G	2	μ PC14308	1
78L08	3	TA7089M	1

Light Emitting Diodes:

GD4-203SRD	9
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Germanium Diodes:

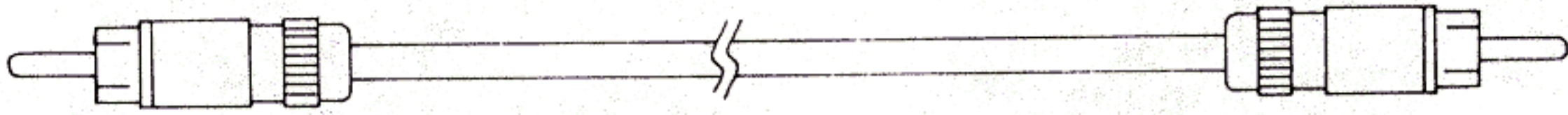
1S188FM	6
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Silicon Diodes:

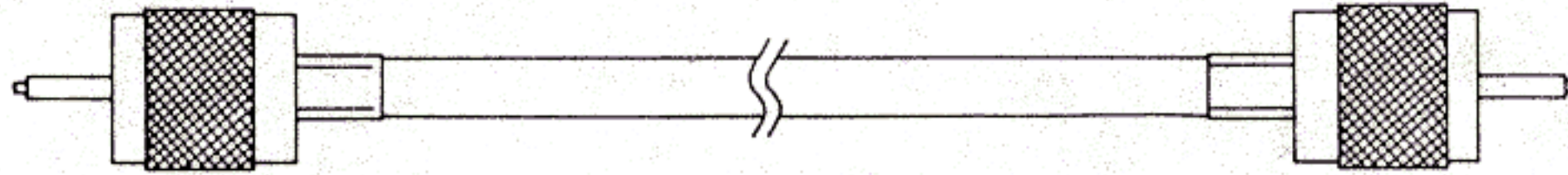
1S1555	46	10D1	13
MC301	2	S4VB	1
1SS53	22		

ACCESSORIES:

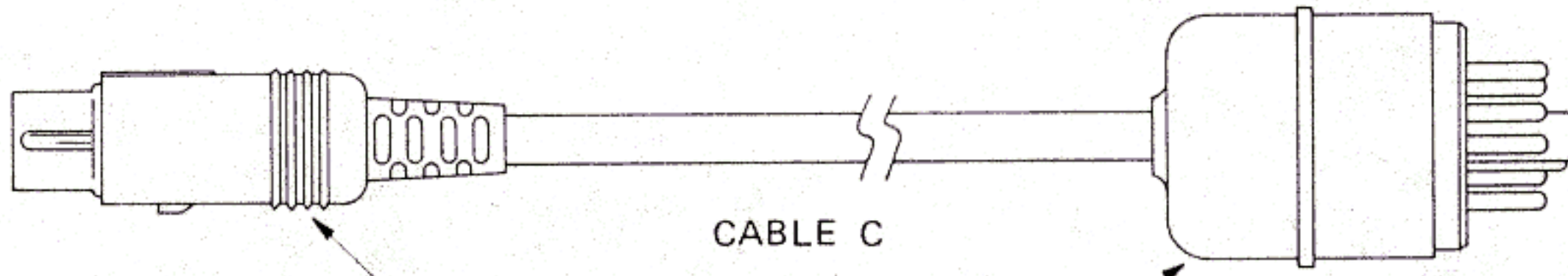
- | | | | |
|---------|-------|------------|-------|
| Cable A | 1 pc. | RCA plug | 1 pc. |
| Cable B | 1 pc. | Spare fuse | 1 pc. |
| Cable C | 1 pc. | | |
| Cable D | 1 pc. | | |



CABLE A



CABLE B

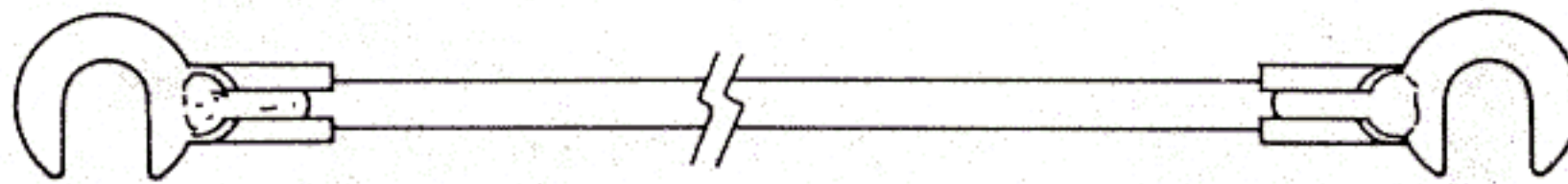


CABLE C

PIN No.		COLOR	PIN No.
1	HEATER1	WHITE	1
2	HEATER2	BLUE	2
3	No. C		
4	HEATER1'		1
5	HEATER2'		2
6	TX:GND	RED	9
7	RX:GND	GREEN	10
GROUND SHELL	EARTH	BLACK	8

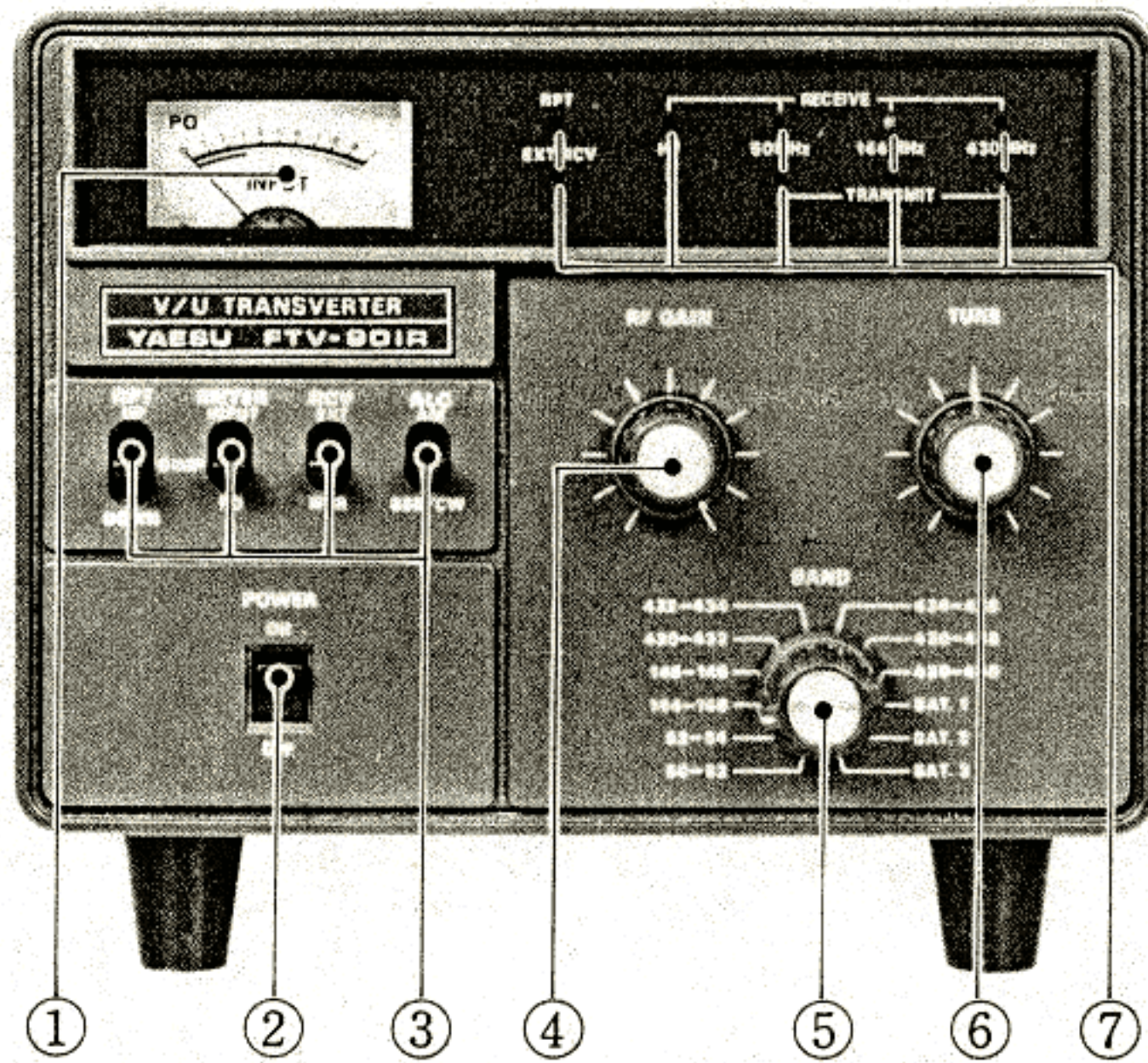
Cable C Connections

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CABLE D

FRONT PANEL CONTROLS AND SWITCHES



(1) METER

Depending on the position of the METER switch, the meter displays the drive level or the relative output level of the transmitter.

(2) POWER

This is the main ON/OFF switch for the transverter.

(3) FUNCTION SWITCHES

SHIFT (UP/SIMP/DOWN)

For 144 MHz, this switch selects ± 600 kHz repeater shift, or simplex operation. When the optional 50 MHz unit is installed, this switch selects ± 1 MHz split, or simplex operation.

METER

When set to the input position, the METER selects indication of the input level for meter display. In the PO position, relative power output is displayed.

RCV

In the NOR position, both transmit and receive functions are accomplished by the FT-901DM or other transceiver. When set to the EXT position, reception is accomplished on an external receiver. This is normally used only for satellite operation.

ALC

This switch selects the ALC threshold level. For FM operation, use the SSB/CW position.

(4) RF GAIN

This control sets the receiver RF gain level for 50 and 144 MHz operation. This control is not used for 430 MHz.

(5) BAND

For 50 and 144 MHz, two bandswitch positions are used. For 430 MHz, 5 bandswitch positions are assigned. Each bandswitch position tracks 500 kHz, the tuning range of the FT-901DM.

The SAT. 1 position is for OSCAR Mode A: 144 MHz transmit, 28 MHz receive. The SAT. 2 position is for OSCAR Mode B: 430 MHz transmit, 144 MHz receive. The SAT. 3 position is for OSCAR Mode J: 144 MHz transmit, 430 MHz receive.

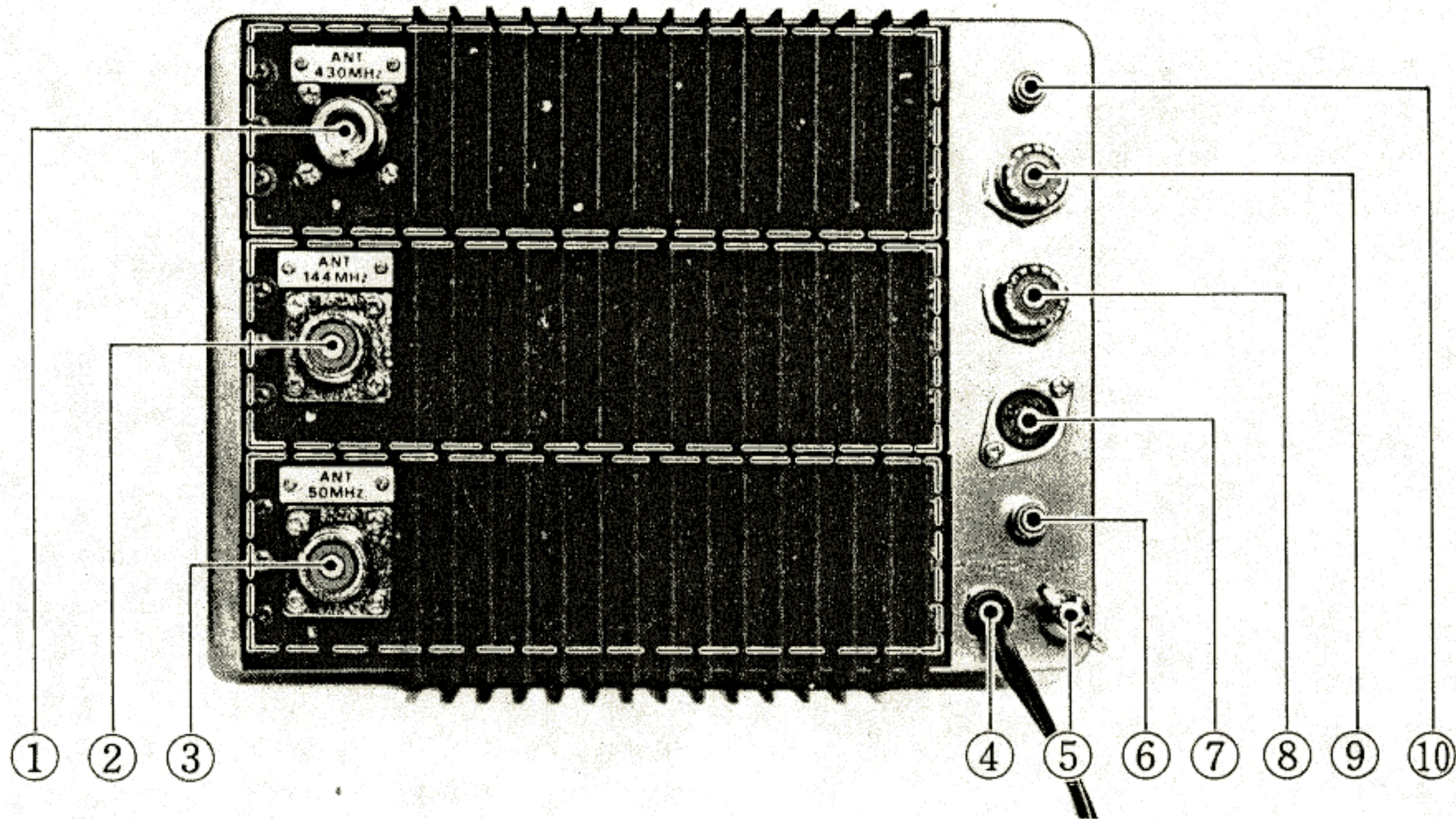
(6) TUNE

This control peaks the transmitter section of the transverter, on the 50 and 144 MHz bands. This control is not used for 430 MHz.

(7) INDICATOR LEDs

These light emitting diodes indicate which band is being used for transmit and receive, and also indicate repeater and external receiver operation.

REAR PANEL



(1) 430 MHz UNIT and ANTENNA JACK

When the optional 430 MHz unit is installed, the 430 MHz antenna should be connected here. An N-type connector is utilized, for improved UHF performance.

(2) 144 MHz UNIT and ANTENNA JACK

The 144 MHz unit is built in, and the 2 meter antenna should be installed here.

(3) 50 MHz UNIT and ANTENNA JACK

When the optional 50 MHz unit is installed, the 50 MHz antenna should be connected to this jack.

(4) POWER cord

This is the connection to the AC power line.

(5) GND

For best performance, and protection from dangerous electrical shock, a good earth ground should be connected here, using a short, heavy, braided cable.

(6) RF IN

This jack should be connected to the FT-901DM RF OUT jack, using the supplied Cable A. Do NOT connect this jack to the FT-901DM ANT jack.

(7) ACC

This jack should be connected to the FT-901DM ACC jack, using the supplied Cable C.

(8) HF ANT

The HF antenna should be connected to this jack.

(9) OUTPUT

This jack should be connected to the FT-901DM ANT jack, using the supplied cable B.

(10) EXT RCV

When an external receiver is used, its antenna jack should be connected to this terminal. The connection will be made when the FUNCTION switch is set to EXT RCV. (Connection cable not supplied)

INSTALLATION

Open the packing carton carefully, and save the box and packing material for possible use at a later date. Inspect the FTV-901R for any signs of damage in shipment. If there is visible damage, contact the shipping company immediately, and document the damage thoroughly.

The FTV-901R has been designed for use in many areas of the world, using various AC supply voltages. Therefore, before connecting the FTV-901R to the AC outlet, be absolutely certain that the power specification on the rear of the transverter matches your local supply voltage. **OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY APPLICATION OF IMPROPER SUPPLY VOLTAGE.** As well, never connect the power cord to a DC power source.

The transverter may be situated in any position without loss of performance. The only constraints regarding installation involve air circulation: the transverter should be located where there is free passage of air around the cabinet and heat sinks.

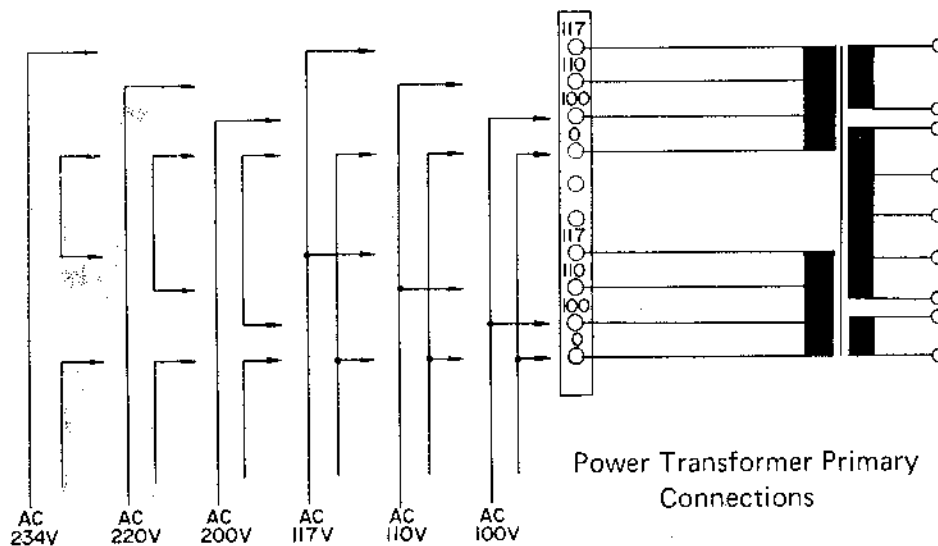
The transverter should be connected to a good earth ground.

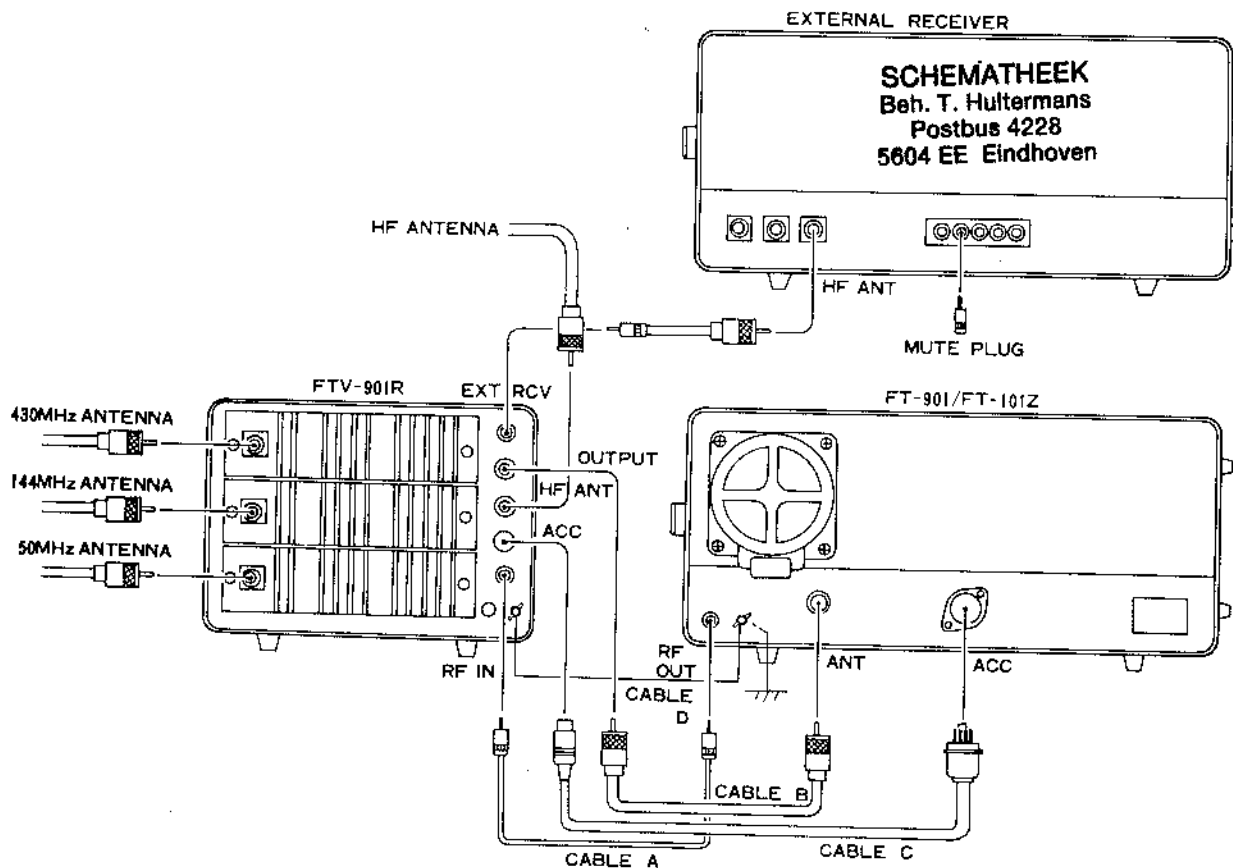
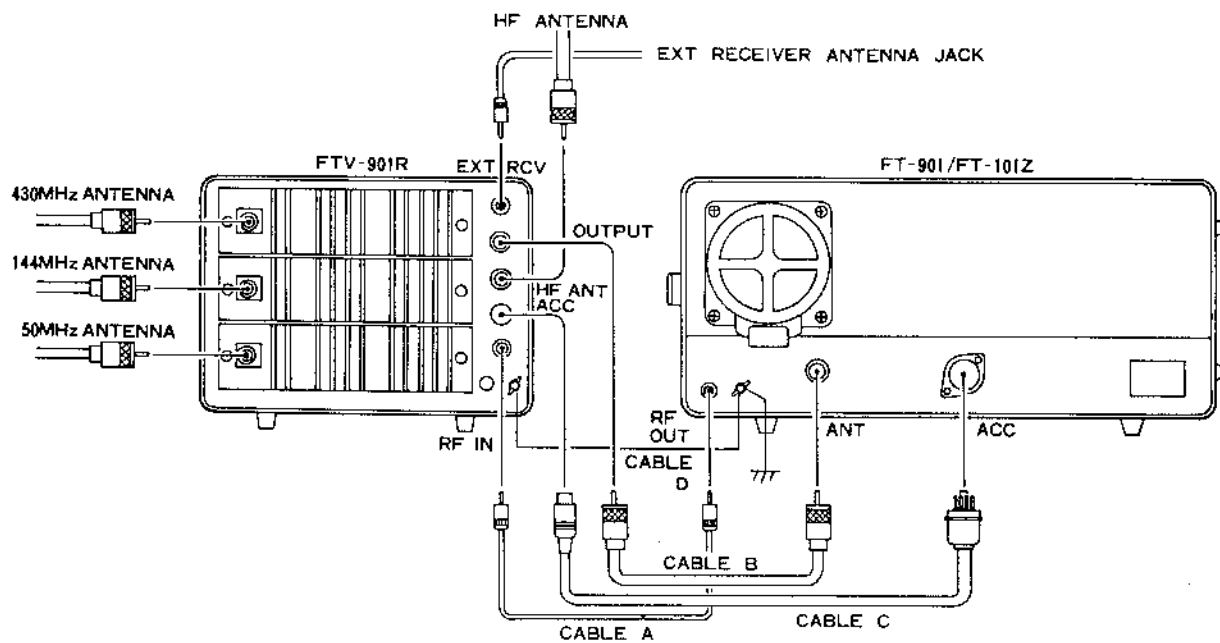
Please refer to the drawings for details of correct interconnections between the FTV-901R and the FT-901DM/FT-101ZD and an external receiver, such as the FR-101D.

ANTENNA CONSIDERATIONS

The antenna installation is of critical importance in VHF and UHF installations. For satellite and moonbounce applications, height above ground is not as critical as is the case with local FM installations. A minimum distance of 10 feet should be maintained between the VHF and HF antennas. In all installations, the antenna should be clear of surrounding objects, if the desired pattern is to be obtained.

Do not economize on coaxial cable, as some "bargain" cables have very poor shield coverage, and this may degrade performance significantly. For the 430 MHz antenna, please use a type N connector, as this type provides a constant impedance on the antenna line. For short coaxial runs, we recommend type RG8A/U coax. For very long runs, type RG-17A/U, aluminum-jacketed "foamflex" coax, or air-dielectric "heliac" cables may be used, owing to their very low losses. The SWR on the feedline should be kept below 2 : 1 at all times, to minimize feedline losses.





OPERATION

The tuning procedure for the FTV-901R transverter is not complicated. However, care should be exercised in tuning so as not to exceed the ratings of the transverter and HF transceiver. It is assumed that the proper interconnections have been performed, as described on page 7.

The following discussion is tailored to a fully-equipped FTV-901R, including the 50 and 430 MHz units. The reader should note that these are optional units on the standard FTV-901R. The word "option" will hereafter be omitted in the interest of brevity.

INITIAL CHECK

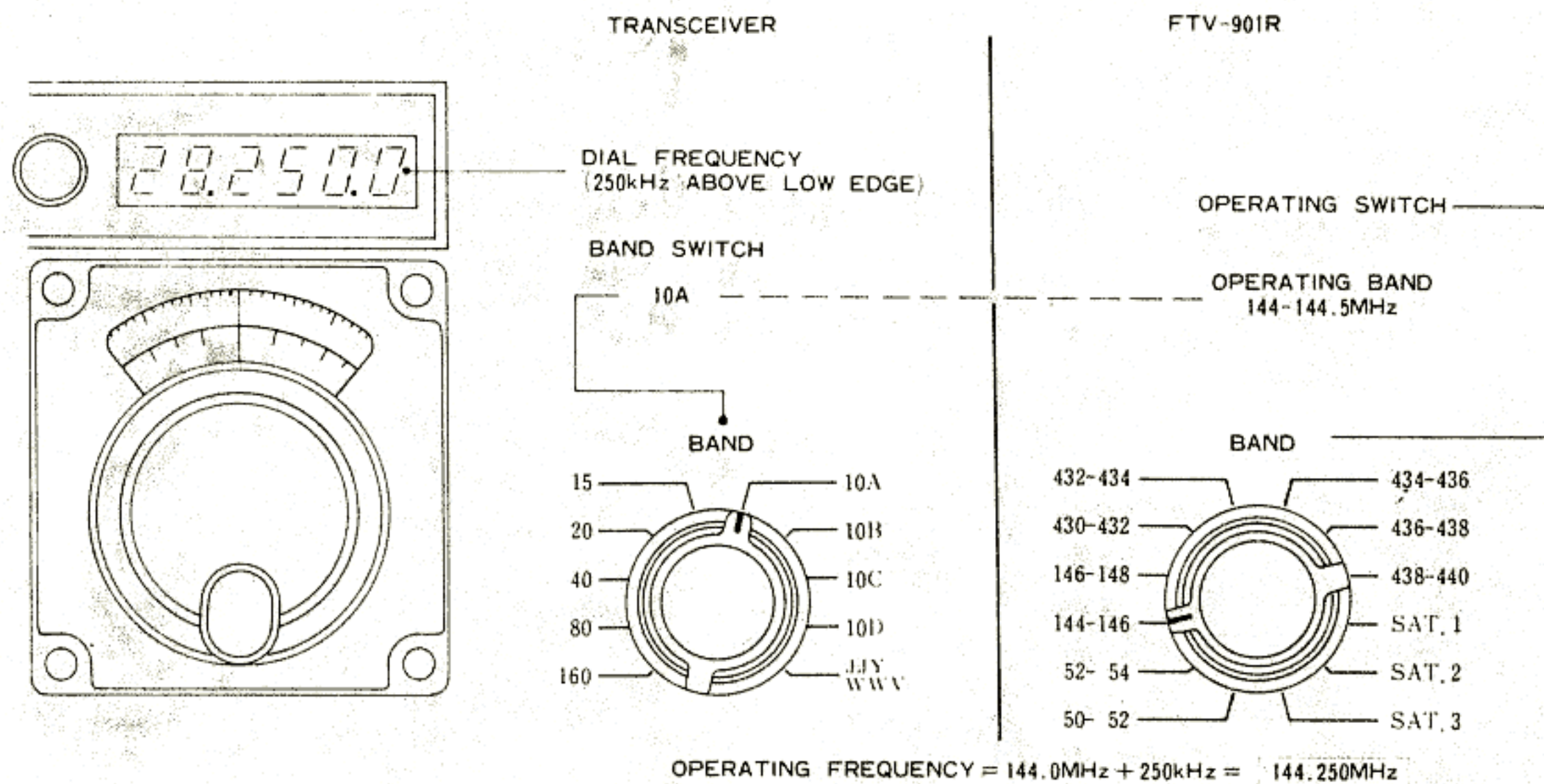
Before connecting the FTV-901R to the power source, confirm that the AC power specification is correct for the supply voltage used, and that a fuse of the proper rating is installed. Check all switches for normal operation. Recheck the interconnections between the HF equipment and the transverter.

FREQUENCY SELECTION

The operating frequency is determined by the position of the main tuning dial and bandswitch of the HF transceiver, as well as the position of the transverter band switch. Please refer to the frequency chart below.

FREQUENCY COVERAGE CHART

HF TRANSCEIVER BANDSWITCH		10A	10B	10C	10D	
FTV-901R BANDSWITCH	50-52	50.0-50.5	50.5-51.0	51.0-51.5	51.5-52.0	
	52-54	52.0-52.5	52.5-53.0	53.0-53.5	53.5-54.0	
	144-146	144.0-144.5	144.5-145.0	145.0-145.5	145.5-146.0	
	146-148	146.0-146.5	146.5-147.0	147.0-147.5	147.5-148.0	
	430-432	430.0-430.5	430.5-431.0	431.0-431.5	431.5-432.0	
	432-434	432.0-432.5	432.5-433.0	433.0-433.5	433.5-434.0	
	434-436	434.0-434.5	434.5-435.0	435.0-435.5	435.5-436.0	
	436-438	436.0-436.5	436.5-437.0	437.0-437.5	437.5-438.0	
	438-440	438.0-438.5	438.5-439.0	439.0-439.5	439.5-440.0	
	SAT. 1	TX	144.0-144.5	144.5-145.0	145.0-145.5	145.5-146.0
RX		28.0-28.5	28.5-29.0	29.0-29.5	29.5-30.0	USB
SAT. 2	TX	432.0-432.5	432.5-433.0	433.0-433.5	433.5-434.0	USB
	RX	144.0-144.5	144.5-145.0	145.0-145.5	145.5-146.0	LSB
SAT. 3	TX	144.0-144.5	144.5-145.0	145.0-145.5	145.5-146.0	USB
	RX	434.0-434.5	434.5-435.0	435.0-435.5	435.5-436.0	LSB



For example, with the FT-901DM bandswitch set to 10A, and the FTV-901R bandswitch set to 144-146, operation will take place on 144.0-144.5 MHz. By setting the FT-901DM main tuning dial to 28,250.0, operation will take place on 144,250 MHz. See the section on satellite operation for frequency determination on the SAT. bands.

NORMAL TUNE UP

- (1) Set the FTV-901R RPT switch to NOR, the METER switch to INPUT, the RCV switch to NOR, the ALC switch to SSB/CW, and the BAND switch to the desired band. The POWER switch should be OFF.
- (2) With the transverter off, peak the preselector on the FT-901DM against the marker signal. Be certain that the FT-901DM HEATER switch is ON.
- (3) Set the FTV-901R POWER switch to ON.
- (4) For 50 or 144 MHz tuning, set the FT-901DM CARR control fully counterclockwise. Push the TUNE button, and slowly advance the CARR control until the FTV-901R meter enters the green zone. Now switch the FTV-901R METER switch to PO, and rotate the TUNE control for a maximum meter reading.
- (5) For 430 MHz, there is no peaking procedure for the transverter. With the FT-901DM preselector peaked, the only adjustment that must be made is to set the drive level correctly.
- (6) For FM and CW operation, set the ALC switch to SSB/CW. The transceiver CARRIER control may be advanced to the point where the PO does not increase further.
- (7) For SSB operation, set the FT-901DM MIC GAIN level so that the FTV-901R INPUT level on the meter does not go past the green zone on the meter scale on voice peaks.
- (8) For AM operation, set the ALC switch to AM, and set the METER switch to PO. Advance the transceiver CARRIER control until the meter indicates .3 on the scale. Advance the transceiver MIC GAIN control until the PO meter just begins to move on voice peaks.
- (9) Advancement of any of the drive levels beyond the point stipulated in steps (6) through (8) will not increase the power output; component life may, however, be

shortened drastically if these input levels are exceeded.

- (10) For 6 and 2 meters, rotation of the FTV-901R RF GAIN control will provide adjustment of the gain of the receive converter section. For 430 MHz, this control has no effect, as the converter is always set for maximum gain.

REPEATER OPERATION

When using the FT-901DM transceiver, FM operation on repeaters on 6 and 2 meters is provided. For repeater split, set the RPT switch to the DOWN position for shift of -1 MHz on 6 meters, or -600 KHz for 2 meters. For a shift of +1 MHz or /600 kHz, set the RPT switch to UP.

For 70 cm operation, 1.6 MHz down shift can be provided on the 434.6-434.825 MHz European band, or 7.6 MHz down shift can be provided on the 438.6-439.05 MHz European band (note that only one shift capability can be installed in the FTV-901R. The 70 cm repeater shift crystal is an option, available from your Yaesu dealer. The 6 and 2 meter repeater crystals are included with all plug-in units for those bands.

SATELLITE OPERATION

Operation on the amateur satellites is possible, using an external receiver in addition to the FT-901DM transceiver. The FT-901DM provides the transmit signal, while the external receiver monitors the downlink, on full duplex.

For OSCAR Mode A, transmission takes place on 145.850-145.950 MHz, with reception on 29.400-29.500 MHz. Set the FTV-901R band switch to the SAT. 1 position. Set the FT-901DM band switch to 10D, and tune to 29.850-29.950 MHz. Set the external receiver for reception on 29.400-29.500 MHz.

For OSCAR Mode B, the uplink is 432.125-43.175 MHz, and the downlink is 145.975-145.925 MHz. Set the FTV-901R band switch to the SAT. 2 position. Set the FT-901DM band switch to 10A, and tune to 28.125-28.175 MHz. Set the external receiver for reception on 29.925 MHz. The OSCAR 7 Mode B transponder inverts signals, so an upper sideband signal on the uplink becomes a lower sideband signal on the

downlink. Set the mode switches on the FT-901DM and the external receiver appropriately.

For OSCAR Mode J, the uplink is 145.900–146.000 MHz, while the downlink is 435.100–435.200 MHz. Set the FTV-901R band switch to the SAT. 3 position. Set the FT-901DM band switch, to 10D and tune to 29.900–29.999 MHz.

Set the external receiver for reception on 29.6–29.7 MHz. The OSCAR 8 Mode J transponder also inverts signals.

Please note that, because of Doppler effect and other reasons, the frequency translation may not be precisely linear, as might be inferred from the above discussion. Some precise zeroing using the external receiver may be necessary.

Note: When using the FTV-901R on OSCAR Mode J, along with an FT-101 or FR-101 external receiver, a fairly loud spurious signal may be noted at 29.150 MHz on the external receiver (29.150 MHz receive). This is because the fourth harmonic of the local oscillator (35.02 MHz for band 10C), plus the VFO frequency (5.87 MHz), is precisely the transmitting frequency required (145.950 MHz). We recommend that the local crystal frequency be changed to 35.12 MHz.

We regret this inconvenience to you, but the FT-101 and FR-101 series was produced long before OSCAR 8 was conceived. There should be no problem at all when using the FT-901 series or FT-101ZD, etc.

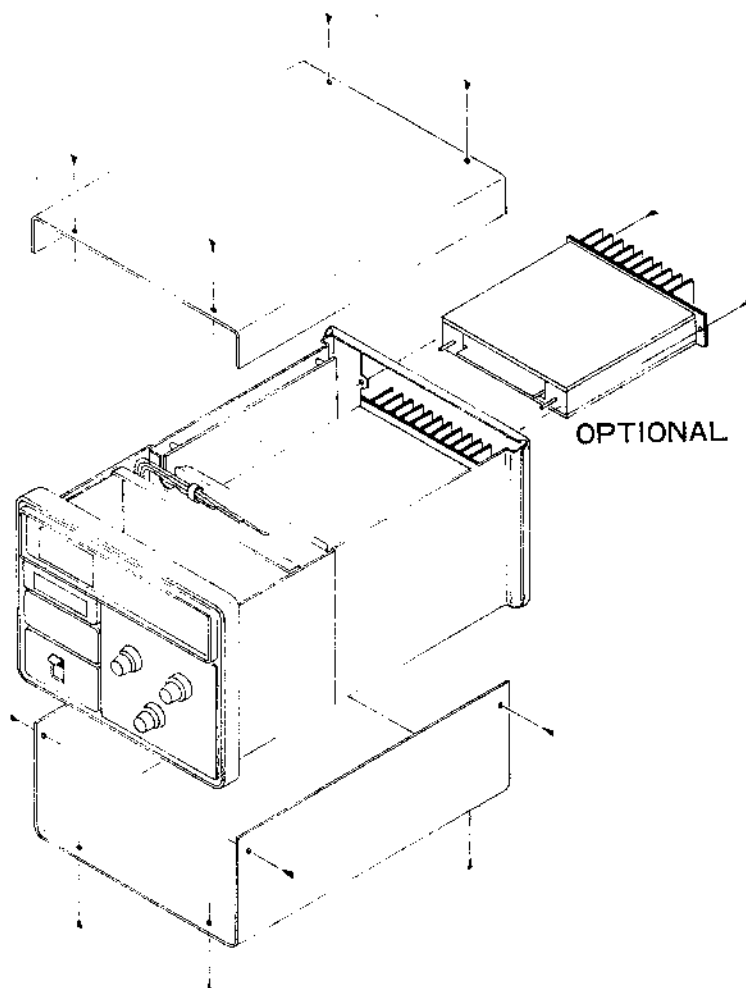
AUXILIARY REPEATER SPLIT INSTALLATION

Should your locality use a repeater split of other than 1 MHz or 600 kHz for six and two meters, respectively, the correct split can be installed by obtaining an optional crystal (see your Yaesu dealer).

Connect a frequency counter to the cathode of D₂₁₂ (6 meters) or D₆₀₇ (2 meters). Adjust the trimmer capacitors shown in the chart below for the correct frequency.

INSTALLATION OF OPTIONAL MODULES

1. Remove the top and/or bottom cover of the transverter, to allow precise insertion of the unit to be installed.
2. Carefully slide the module into the correct position. Do not force the connection.
3. Replace the cabinet covers. Installation is now complete. The module has been carefully aligned at the factory.



CRYSTAL DATA FTV-901R

FUNCTION	HOLDER	RANGE (MHz)	MODE	LOAD C	EFFECTIVE RESISTANCE	DRIVE LEVEL	
50 MHz	X ₂₀₁	HC-18/U	22.0	Fundamental	19 pF	15 Ω	2 mW
	X ₂₀₂	"	24.0	"	"	"	"
	X ₂₀₃	HC-25/U	23.0	"	"	"	"
	X ₂₀₅	"	21.0	"	"	"	"
144 MHz	X ₆₀₁	HC-18/U	38.666..	3rd overtone	15 pF	25 Ω	"
	X ₆₀₂	"	39.333..	"	"	"	"
	X ₆₀₃	HC-25/U	38.866..	"	"	"	"
	X ₆₀₄	"	39.533..	"	"	"	"
	X ₆₀₅	"	38.466..	"	"	"	"
	X ₆₀₆	"	39.133..	"	"	"	"
430 MHz	X ₁₆₀₁	HC-18/U	67.000	"	23.5 pF	40 Ω	0.5 mW
	X ₁₆₀₂	"	67.333..	"	"	"	"
	X ₁₆₀₃	"	67.666..	"	"	"	"
	X ₁₆₀₄	"	68.000	"	"	"	"
	X ₁₆₀₅	"	68.333..	"	"	"	"

BAND	50MHz			
RANGE	50-52	52-54	50-52 (1MHz DOWN)	52-54 (1MHz DOWN)
LOCAL FREQUENCY	22MHz (x1)	24MHz (x1)	23MHz (x1)	21MHz (x1)
OSC. FREQUENCY	22MHz *	24MHz *	23MHz *	21MHz *

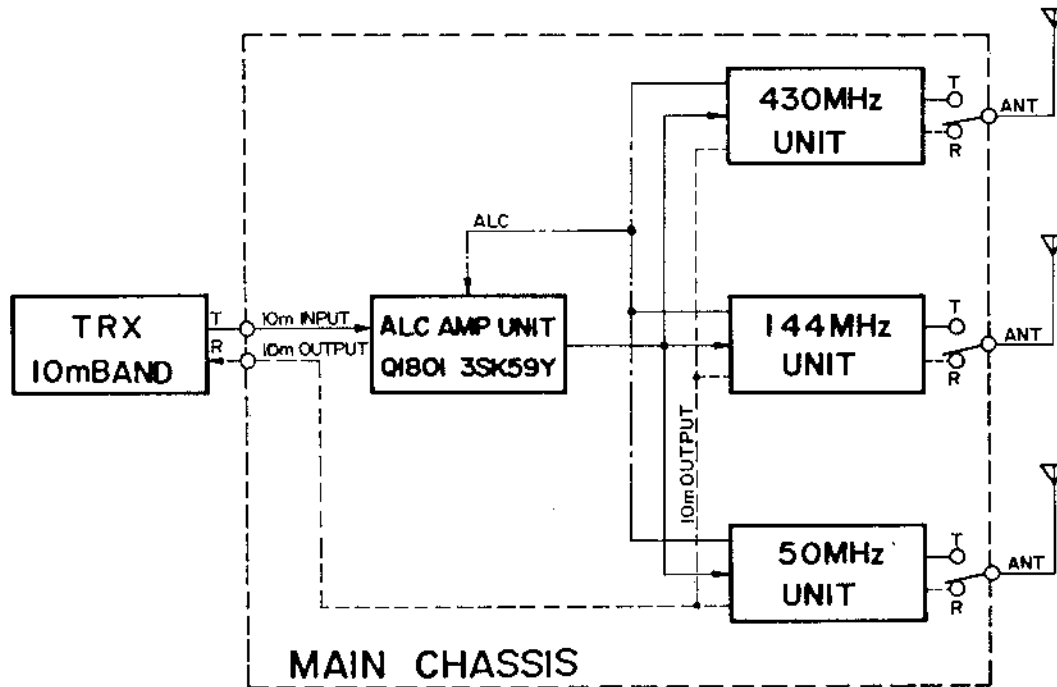
BAND	144MHz					
RANGE	144-146	146-148	144-146 (600kHz UP)	144-146 (600kHz DOWN)	146-148 (600kHz UP)	146-148 (600kHz DOWN)
LOCAL FREQUENCY	116MHz (x3)	118MHz (x3)	116.6MHz (x3)	115.4MHz (x3)	118.6MHz (x3)	117.4MHz (x3)
OSC. FREQUENCY	38.666...MHz ▲	39.333...MHz ▲	38.866...MHz ▲	38.466...MHz ▲	39.533...MHz ▲	39.133...MHz ▲

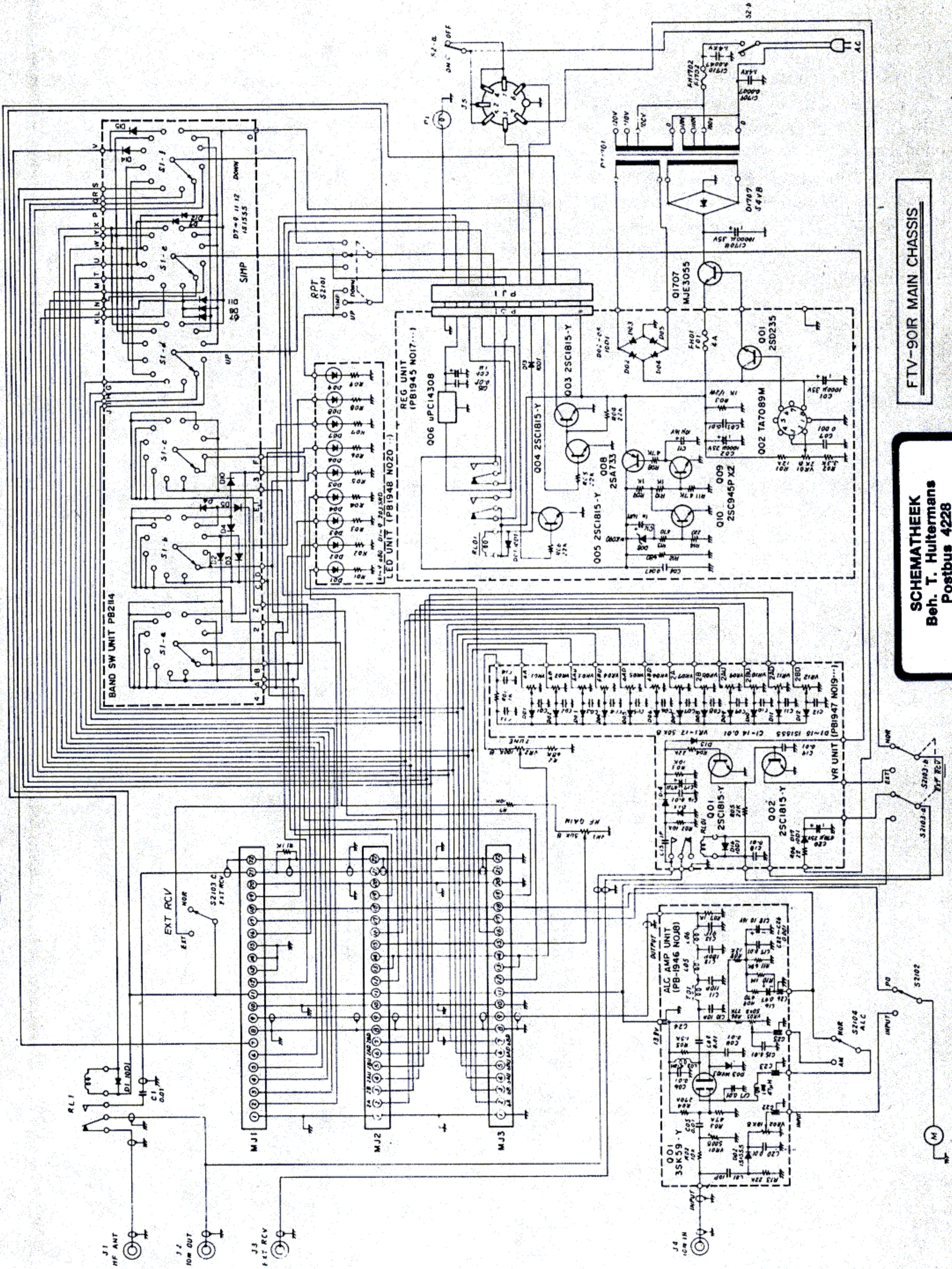
BAND	430MHz						
RANGE	430-432	432-434	434-436	436-438	438-440	434-436 (1.6MHz DOWN)	438-440 (7.6MHz DOWN)
LOCAL FREQUENCY	402MHz (x3x2)	404MHz (x3x2)	406MHz (x3x2)	408MHz (x3x2)	410MHz (x3x2)	404.4MHz (x3x2)	402.4MHz (x3x2)
OSC. FREQUENCY	67.000MHz ▲	67.333...MHz▲	67.666...MHz▲	68.000MHz ▲	68.333...MHz▲	67.400MHz ▲	67.066...MHz▲

- * FUNDAMENTAL
- ▲ THIRD OVERTONE

CIRCUIT DESCRIPTION

The circuit description to follow should help you understand the operation of the FTV-901R transverter. Follow the block diagrams while reading this discussion, and refer to the schematic diagram for specific details.





FTV-90IR MAIN CHASSIS

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50 MHz UNIT

The 50 MHz signal from the antenna is fed through a low-pass filter, consisting of C₃₂₃, C₃₂₄, L₃₁₂, and L₃₁₃, to RL₃₀₁. On receive, the signal is amplified by Q₂₀₅ (3SK51) and fed through a selective bandpass filter, which is tuned to the operating frequency by varactor diodes D₂₁₀ and D₂₁₁ (1S2209). The second gate of Q₂₀₅ is connected through a large resistor to the front panel RF GAIN control, allowing variation in the gain of the RF amplifier.

The signal is then fed to the mixer, Q₂₀₆ (3SK51), where the 50–54 MHz signal is mixed with a local signal of 22 or 24 MHz, producing an IF signal of 28–30 MHz which is fed through a diode switch to the 10 M OUTPUT jack.

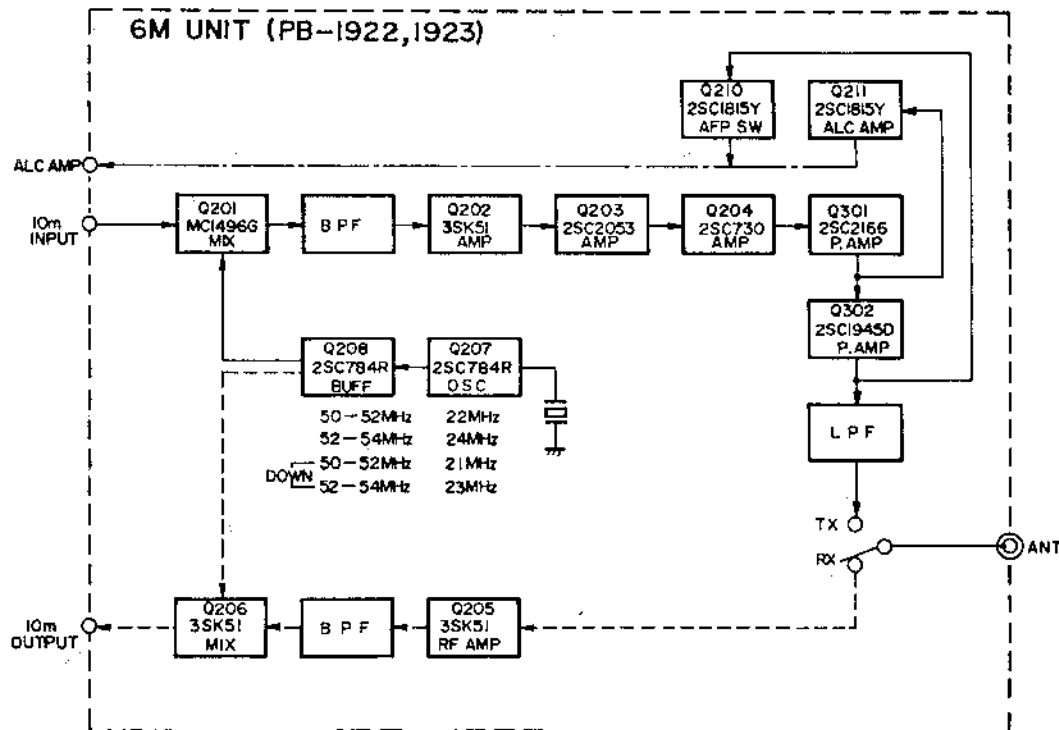
The local signal is generated by crystal oscillator Q₂₀₇ (2SC784R), and amplified by Q₂₀₈ (2SC784R). For repeater operation, the local signal is shifted up or down 1 MHz, according to the position of the front panel RPT switch.

For transmission, the 28–30 MHz output signal from the transceiver is fed to the balanced mixer,

Q₂₀₁ (MC1496G), where it is mixed with the local signal delivered from Q₂₀₈. The 50–54 MHz signal is then passed through a selective bandpass filter, which effectively eliminates spurious signals. The signal is then amplified by the amplifier chain, consisting of Q₂₀₂ (3SK51), Q₂₀₃ (2SC2053), Q₂₀₄ (2SC730), Q₃₀₁ (2SC2166), and Q₃₀₂ (2SC1945D). The output signal of approximately 10 watts is then fed, via a low pass filter, to the ANT jack.

A portion of the output from Q₃₀₁ is detected by D₃₀₃ and D₃₀₄ (1S1555), and the resulting DC voltage is amplified by Q₂₁₁ (2SC1815Y) for ALC purposes. A portion of the output from L₃₁₁ is detected by D₃₀₆ and fed to the base of Q₂₁₁, controlling the bias of Q₂₁₁ and Q₃₀₂. Q₂₁₀ (2SC1815Y) works as a switch for the automatic final protection circuit, which will reduce the gain of the amplifier transistors in case of high SWR. A further portion of the output is detected by D₃₀₅ (1S1555) and fed to the meter, for an indication of relative power output.

Q₃₀₉ (78L08) regulates the supply voltage at 8 volts for the transistors.



144 MHz UNIT

The incoming 144 MHz signal is fed through a low-pass filter, consisting of L₇₀₈, C₇₁₆, and C₇₁₇ to RL₇₀₁. On receive, the signal is amplified by Q₆₀₅ (3SK51). The output from Q₆₀₅ is fed through a 4-stage bandpass filter. Gate 2 of the RF amplifier is connected through a large resistor to the front panel RF GAIN control.

The signal is then fed to the mixer, Q₆₀₆ (3SK51), where the incoming signal is heterodyned with a local signal of 116 or 118 MHz, producing an IF signal of 28–30 MHz which is fed through a diode switch to the 10 M OUTPUT jack.

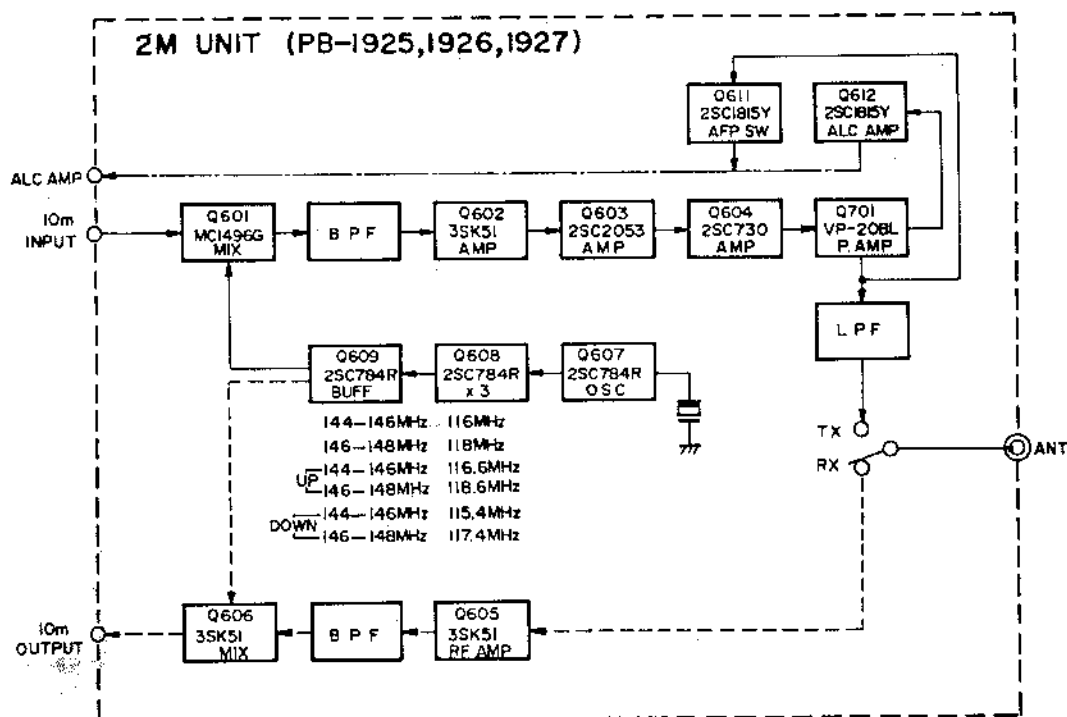
The local signal is generated at 38.666 MHz by Q₆₀₇ (2SC784R), then delivered to tripler Q₆₀₈ (2SC784R), then delivered through buffer Q₆₀₉ (2SC784R) to gate 2 of Q₆₀₆. For repeater operation, the local signal is shifted up or down 600 kHz, depending on the position of the front panel RPT switch.

For transmission, the 28–30 MHz input signal is fed to Q₆₀₁ (MC1496G), where it is mixed with the local signal delivered from Q₆₀₉. The 144–148 MHz signal is then fed through a selective

bandpass filter, which is tuned to the operating frequency by varactor diodes D₆₀₂, D₆₀₃, and D₆₀₄ (1S2209), thus effectively eliminating spurious responses. The signal is then amplified by the amplifier chain, consisting of Q₆₀₂ (3SK51), Q₆₀₃ (2SC2053), and Q₆₀₄ (2SC730), and delivered to the final amplifier, Q₇₀₁ (VP-20BL).

A portion of the output signal at the power module is amplified by Q₆₁₂ (2SC1815Y) for ALC purposes. A portion of the output signal is also fed to Q₆₁₁ (2SC1815Y), which acts as a switch for the AFP circuit, which will protect Q₇₀₁ from damage caused by high SWR. A further portion of the output is detected by D₇₀₂ (1S1555) and fed to the meter, for an indication of relative power output.

The supply voltage is regulated at 8 volts by Q₅₁₀ (78L08).



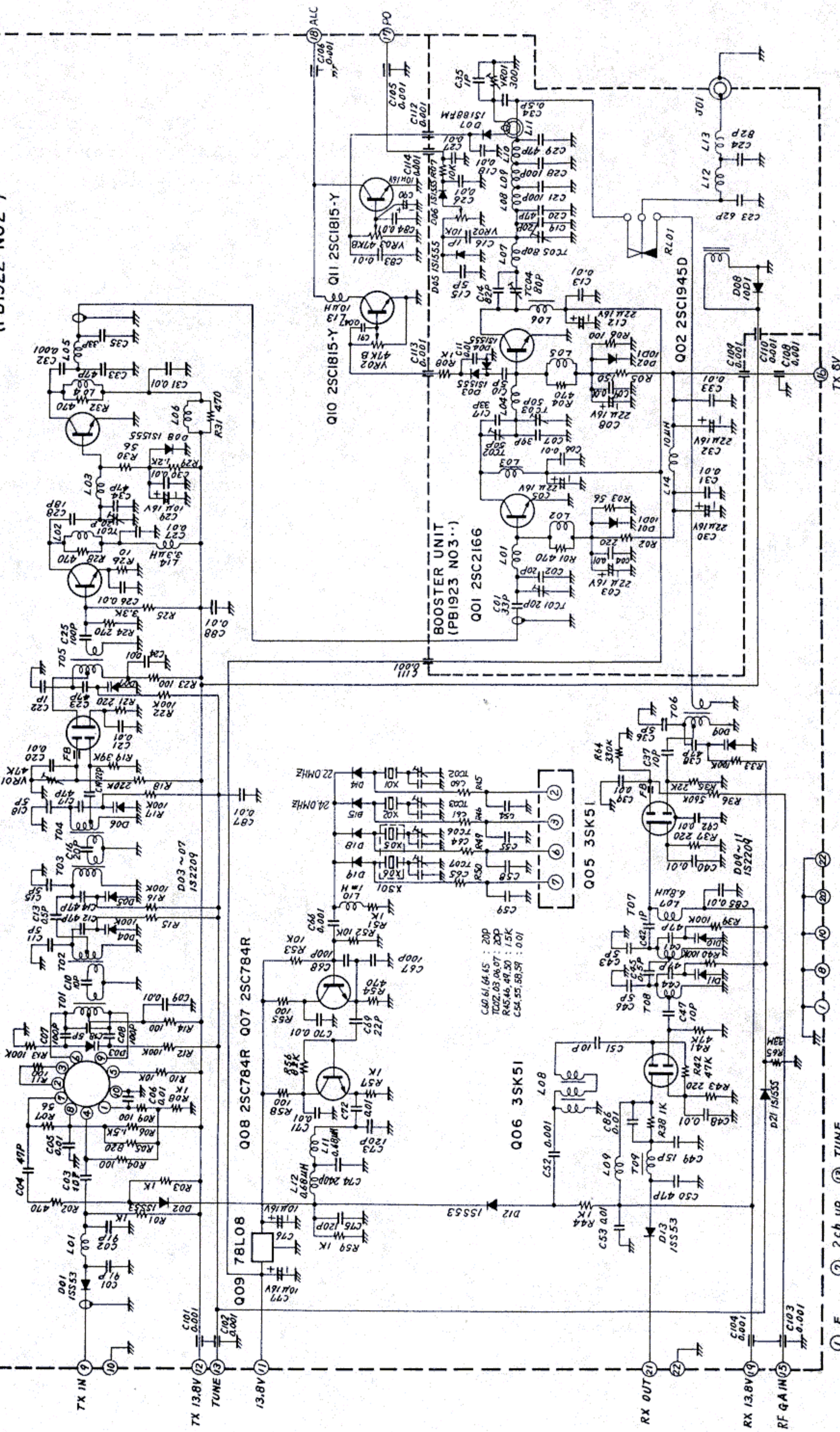
CONVERTER UNIT
(PB1922 NO2..)

Q04 2SC730

Q03 2SC2053

Q02 3SK51

Q01 MC1496G



6M UNIT CIRCUIT DIAGRAM

SCHEMATHEEK
Beh. T. Huitermans
Postbus 4228
5604 EE Eindhoven

- ① E
- ② 1ch
- ③ 2ch
- ④ NC
- ⑤ NC
- ⑥ 1ch up
- ⑦ 2ch up
- ⑧ E
- ⑨ TX IN
- ⑩ E
- ⑪ 13.8V
- ⑫ TX13.8V
- ⑬ TUNE
- ⑭ NC
- ⑮ GAIN
- ⑯ TX 8V
- ⑰ P0
- ⑱ ALC
- ⑲ RX 13.8V
- ⑳ E
- ㉑ RX OUT
- ㉒ E

CONVERTER UNIT
(PBI925 NO6..)

Q02 3SK51 Q03 2SC2053 Q04 2SC730

Q01 MC1496G

Q05 3SK51

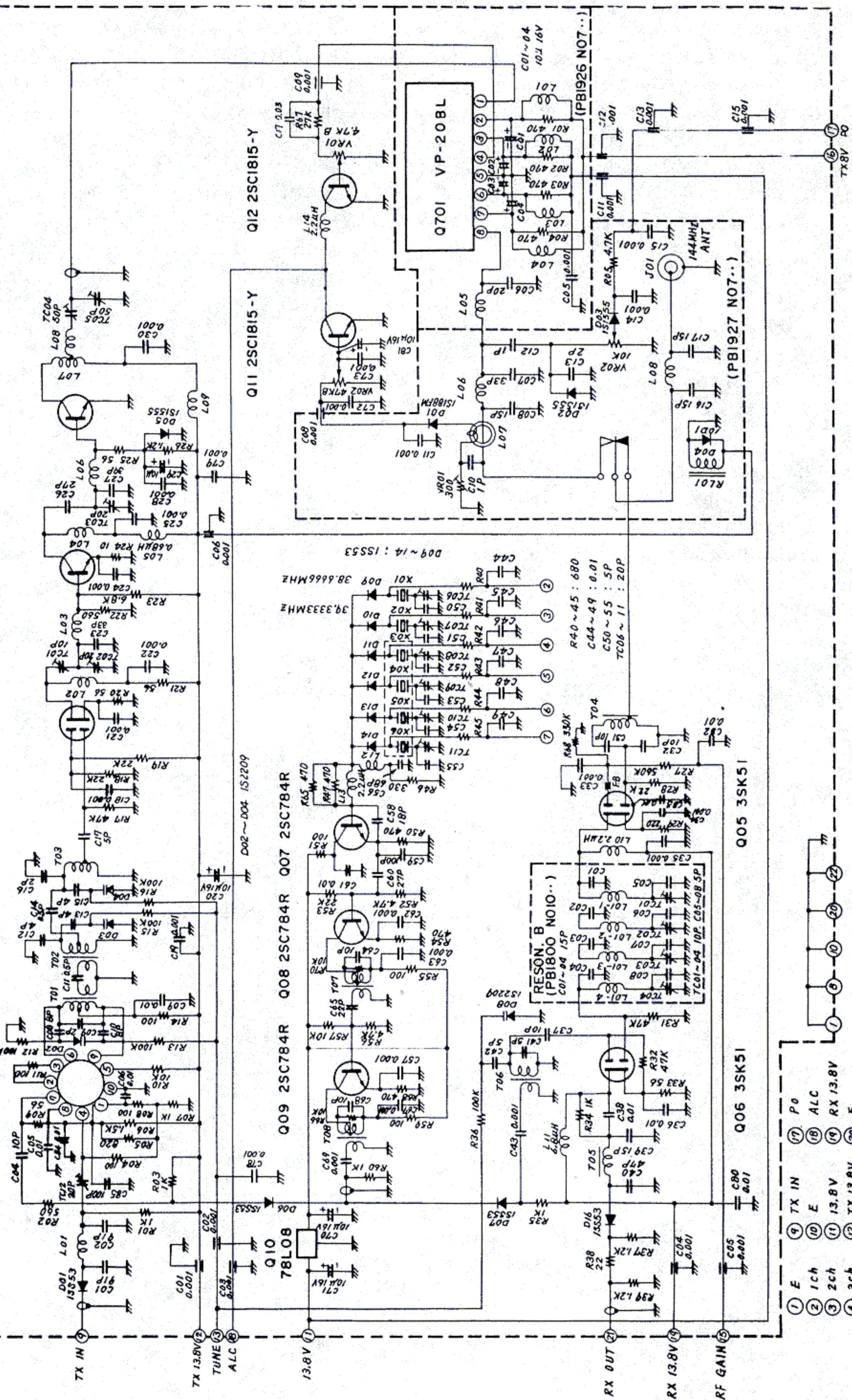
Q06 3SK51

Q07 2SC784R

Q08 2SC784R

Q09 2SC784R

Q10 78L08



2M UNIT CIRCUIT DIAGRAM

SCHEMATHEEK
Beh. T. Huitermans
Postbus 4228
5604 EE Eindhoven

- | | | | | | |
|---|-----|----|----------|----|----------|
| 1 | E | 9 | TX IN | 17 | P0 |
| 2 | 1ch | 10 | E | 18 | ALC |
| 3 | 2ch | 11 | 13.8V | 19 | RX 13.8V |
| 4 | 3ch | 12 | TX 13.8V | 20 | E |
| 5 | 4ch | 13 | TUNE | 21 | RX OUT |
| 6 | 5ch | 14 | NC | 22 | E |
| 7 | 6ch | 15 | GAIN | | |
| 8 | E | 16 | TX 8V | | |

430 MHz UNIT

The incoming signal is fed through RL₁₃₀₁ to the two stage RF amplifier, consisting of Q₁₂₀₁ and Q₁₂₀₂ (2SC2369), and then passed through a selective filter to the doubly balanced diode mixer, D₁₅₀₃-D₁₅₀₆ (1SS43) where the incoming signal is mixed with a 402-410 MHz local signal, producing a 28-30 MHz output signal which is fed to the 10 M OUTPUT jack.

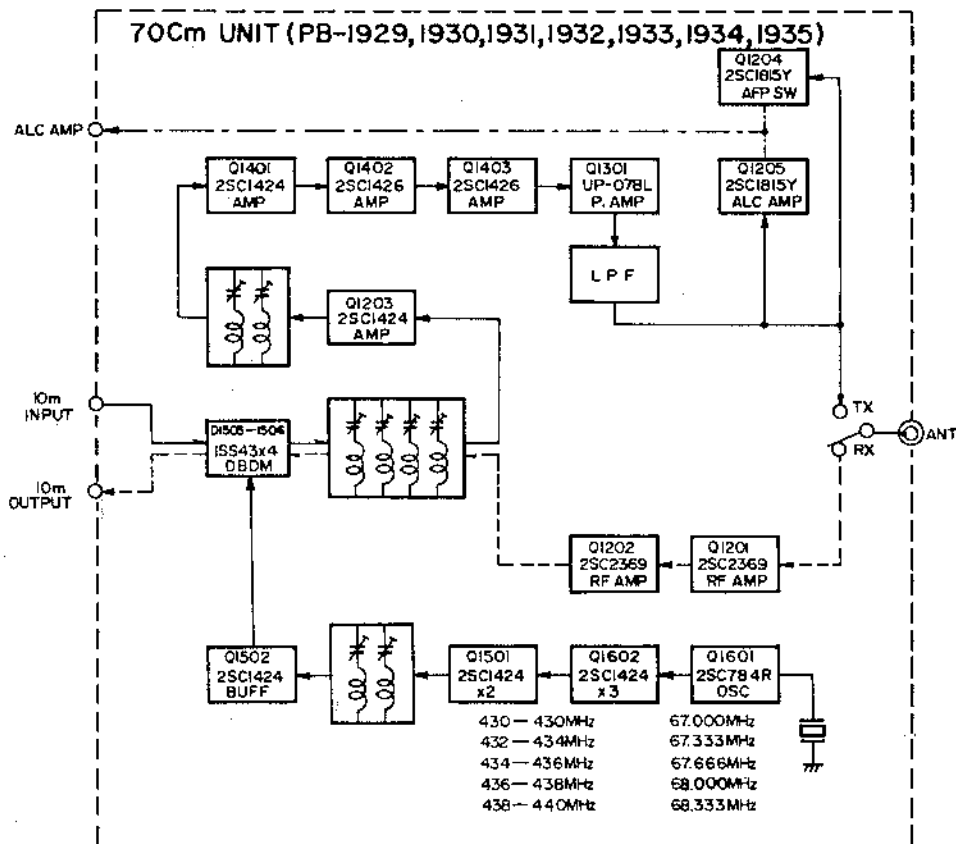
The local signal is generated at 67-68 MHz by oscillator Q₁₆₀₁ (2SC784R), then multiplied by Q₁₆₀₂ and Q₁₅₀₁ (2SC1424). The local signal at 402-410 MHz is then passed through a selective filter to buffer Q₁₅₀₂ (2SC1424), for delivery to the mixer.

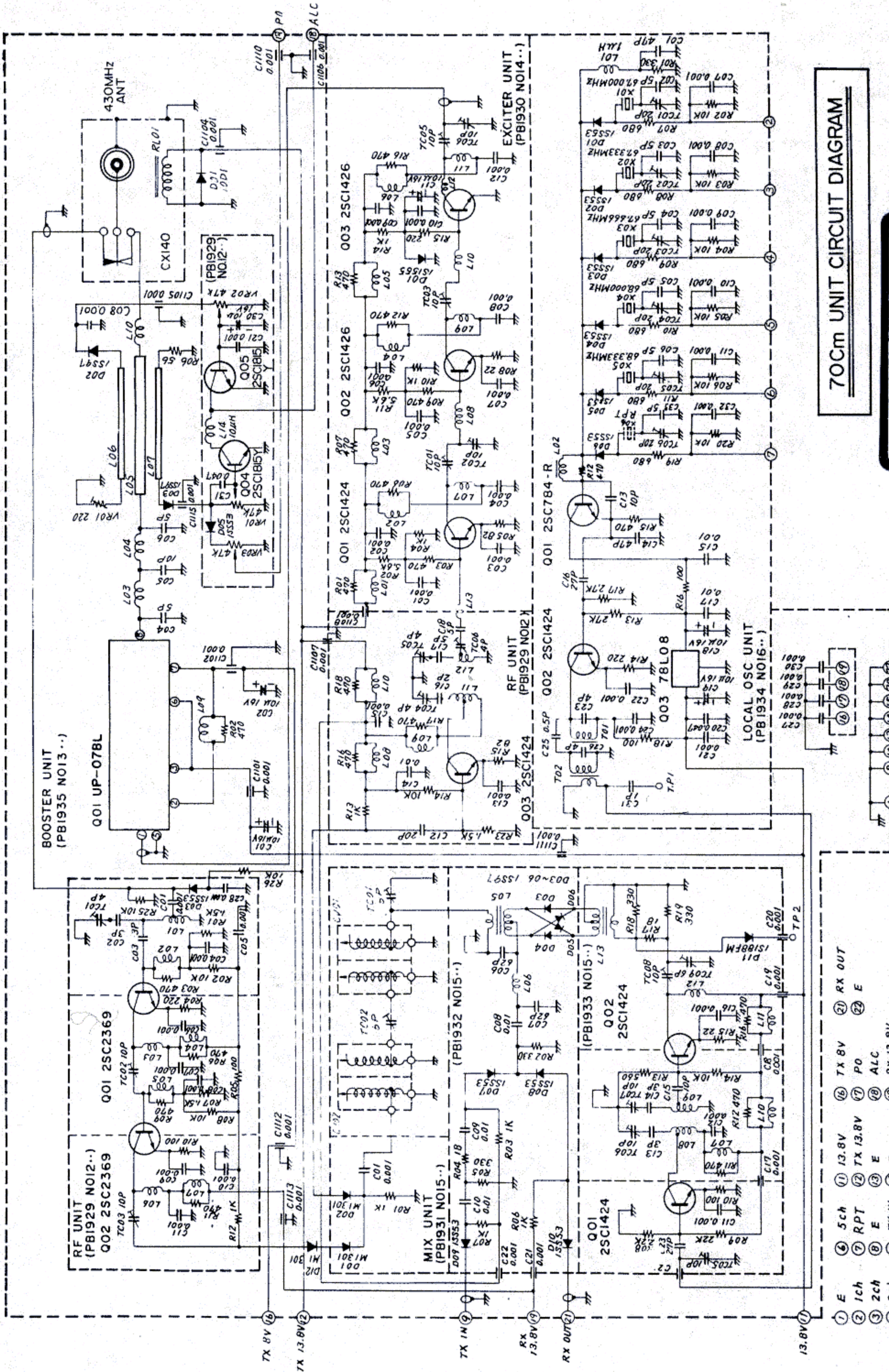
For transmission, the output from the transceiver is delivered to the diode ring mixer, where it is heterodyned with the local oscillator signal, resulting in a signal of 430-440 MHz. The signal is then fed through a selective filter, which effectively eliminates spurious responses. The signal is then amplified by Q₁₂₀₃ (2SC1424), fed through another selective filter, then amplified by the amplifier chain, consisting of Q₁₄₀₁ (2SC1424),

Q₁₄₀₂ (2SC1426), Q₁₄₀₃ (2SC1426), and final amplifier Q₁₃₀₁ (UP-07BL). The output signal from Q₁₃₀₁ is fed through a stripline filter, via RL₁₃₀₁, to the ANT jack.

A portion of the output from L₁₃₀₆ is detected by D₁₃₀₂ (1S188FM) and fed to the base of Q₁₂₀₅ (2SC1815Y), for control of the bias applied to Q₁₃₀₁. Q₁₂₀₄ (2SC1815Y) acts as a switch for the automatic final protection circuit. A further portion of the output signal is rectified by D₁₃₀₃ (1S188FM) and fed to the meter, providing indication of relative power output.

The supply voltage is regulated at 8 volts by Q₁₆₀₃ (78L08).





70cm UNIT CIRCUIT DIAGRAM

SCHEMATHEEK
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 Postbus 4228
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ALC CIRCUIT

The 28 MHz input signal from the transceiver is fed to the ALC AMP unit, where it is amplified by Q₁₈₀₁ (3SK59Y). Gate 1 receives the RF signal, while gate 2 is connected to the ALC voltage supplied from the various modules. The ALC voltage is used to control the gain of Q₁₈₀₁. In the AM mode, the ALC level is fixed, and no connection is made to the modules for the individual bands.

A portion of the input signal is detected by D₁₈₀₁ and D₁₈₀₂ (1S1555), for an indication of the input level on the meter.

SWITCHING CIRCUITS

(1) POWER switch OFF

Heater voltage from the transceiver appears at the ACC connector, when proper connections are made to the FTV-901R. When the transceiver heater switch is ON, and the FTV-901R power switch is OFF, RL₁ is set to OFF, and the 10 m OUT jack is connected to the HF ANT jack, permitting normal HF operation. After the transverter is turned off, a warmup time of approximately 1 minute is required to allow the transceiver tubes to reach operating temperature.

(2) POWER switch ON

When the FTV-901R is turned on, voltage is applied to relay driver Q₁₇₀₃ (2SC1815Y) turning it on. With the conduction of Q₁₇₀₃, RL₁ is

activated, connecting the 10 meter output to the various units of the transverter, according to the position of the bandswitch. When the heater switch is on, and the FTV-901R is not in use, RL₁₉₀₁ switches the external receiver to the HF antenna on receive.

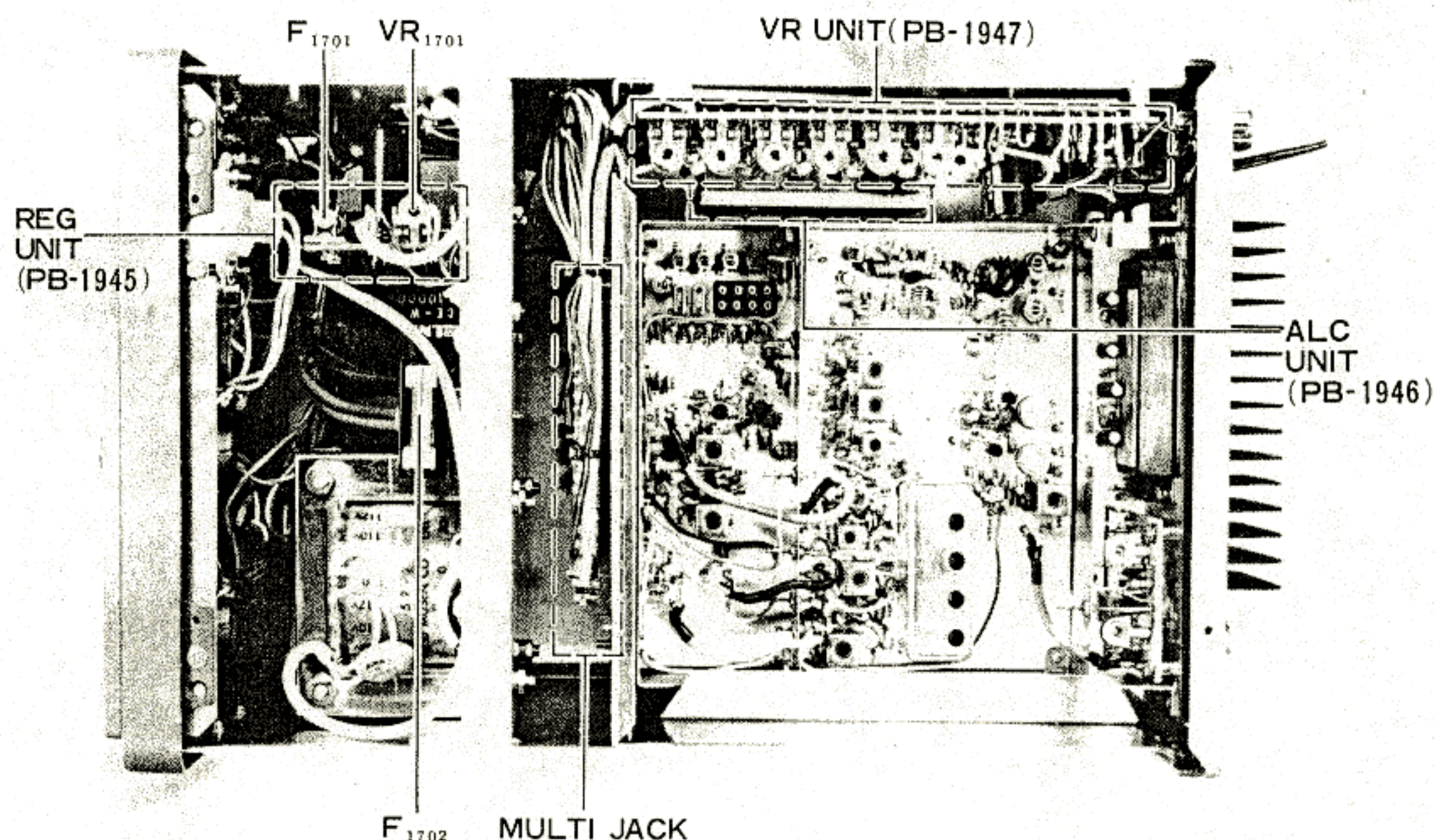
When the heater switch is turned off, Q₁₉₀₂ (2SC1815Y) is switched on, switching the EXT RCV jack to be in parallel with the HF ANT jack, allowing monitoring on the external receiver. If the external receiver is not normally used for monitoring, the heater switch should always be left on.

POWER SUPPLY

The AC voltage from the power transformer is rectified by bridge rectifier, and stabilized at 13.8 volts by Q₁₇₀₇ (MJE3055), Q₁₇₀₁ (2SD235), and Q₁₇₀₂ (TA7089M). This voltage is used for the LED UNIT, pilot lamps, and the three converter units.

D₁₇₀₆ (WZ110) provides 11 volts for the local oscillator diode switch circuits, while Q₁₇₀₆ (μ PC14308) regulates the 13.8 volt line from RL₁₇₀₁ for the low voltage circuits.

On the VR UNIT, diode switches D₁₉₀₁–D₁₉₁₂ (1S1555) select voltage regulating potentiometers VR₁₉₀₁–VR₁₉₁₂, for tuning the varactor-diode-tuned circuits in the various units.



MAINTENANCE AND ALIGNMENT

The FTV-901R has been carefully aligned and tested at the factory prior to shipment. With normal use, if the unit is not abused, the FTV-901R will provide many years of trouble-free operation.

Sudden difficulties are usually the result of parts failures, rather than alignment problems. Therefore, alignment should not be undertaken unless the operation of the transverter is completely understood, the fault has been thoroughly diagnosed, and the trouble has been definitely traced to misalignment rather than part failure. Attempts to align this equipment by other than an experienced technician are discouraged.

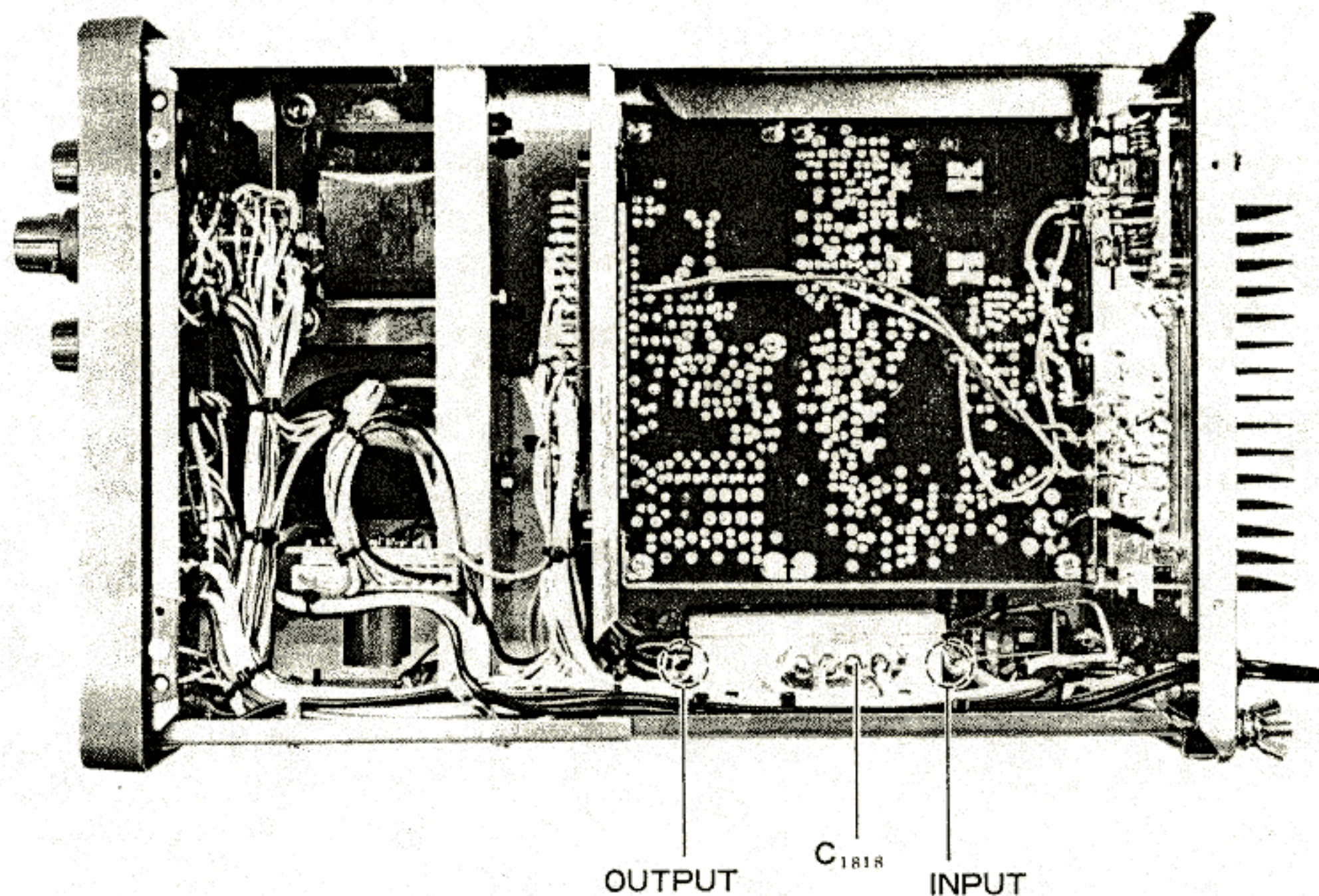
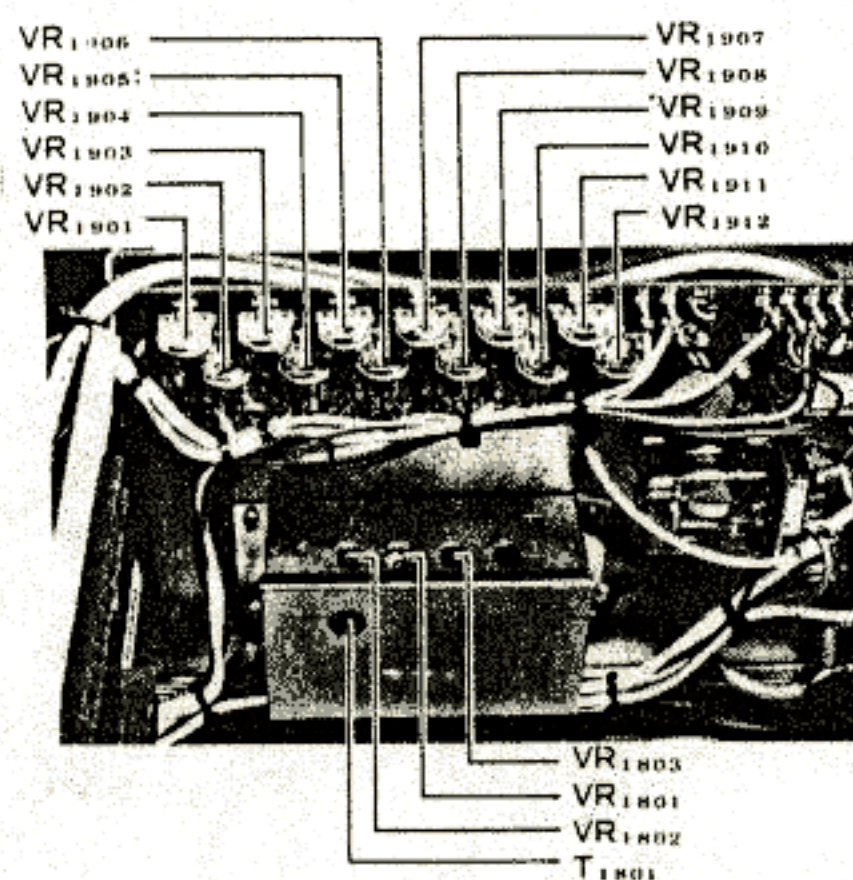
For alignment purposes, a VTVM with RF probe good to 450 MHz is required. Also, a signal generator good to 450 MHz, and a frequency counter good to 250 MHz are required. A dummy load and wattmeter good to 450 MHz are also required.

REG UNIT (PB-1975)

Connect a DC voltmeter to pin 11 of multijack MJ1, 2, or 3. Adjust VR₁₇₀₁ for a reading of 13.8 volts.

ALC AMP UNIT (PB-1946)

- (1) Set the HF transceiver to 29 MHz, CW mode.
- (2) Connect the RF probe of the VTVM to the input of the ALC AMP unit, and adjust the HF transceiver DRIVE or CARRIER control for an output of 3 volts RMS while transmitting.
- (3) Connect the DC voltmeter between the hot lead and case of C₁₈₁₈. Set the ALC meter to AM. Adjust VR₁₈₀₂ for a reading of 5 volts on the voltmeter.
- (4) Connect the RF probe of the VTVM to the output of the ALC AMP unit. Adjust T₁₈₀₁ for a maximum VTVM indication. Adjust VR₁₈₀₃ for a maximum VTVM indication (0.7 volts nom.).
- (5) Set the FTV-901R meter switch to INPUT. Adjust VR₁₈₀₁ for a reading of .2 on the meter.



50 MHz UNIT

Please remove the 144 and 430 MHz units, if installed, to allow access to test points on the 50 MHz module.

1. Local oscillator circuit

- (1) Connect the DC voltmeter to pin 2 of the edge connector for the 50 MHz unit. Confirm that 11 volts is present, with the BAND switch set to 50–52 MHz. Switch to 52–54 MHz, and check for 11 volts at pin 3 of the edge connector.
- (2) Connect the RF probe of the VTVM to the LOCAL OUT terminal. Confirm that the unit is oscillating.
- (3) Connect a frequency counter to the LOCAL OUT terminal. Set the BAND switch to 50–52 MHz, set the RPT switch to SIMP, and adjust T₂₀₂ for a reading of exactly 22.0 MHz. Switch to 52–54 MHz, and adjust TC₂₀₃ for a reading of 24.0 MHz.

2. Receiver section

- (1) Set the HF transceiver to 29 MHz, and peak the preselector against the marker signal for maximum sensitivity.
- (2) Connect the DC voltmeter to pin 19 of the edge connector, set the BAND switch to 50–52 MHz, then 52–54 MHz, and confirm that 13.8 volts is present.
- (3) Connect the DC voltmeter to pin 15 of the edge connector, and rotate the FTV-901R RF GAIN control fully counterclockwise. The voltmeter reading should be 0 volts. In the fully clockwise position, it should be 13.8 volts. After confirming these voltages, please leave the level at maximum gain.
- (4) Connect the DC voltmeter to pin 14 of the edge connector, and set the FTV-901R TUNE control to the center position (12 o'clock). With the BAND switch in the 50–52 MHz position, adjust VR₁₉₀₁ for a reading of 4 volts.
- (5) Connect a signal generator to the 50 MHz ANT jack, and set the FTV-901R BAND switch to 50–52 MHz. Set the signal generator to 51 MHz, and tune the receiver to its output. Peak VR₁₉₀₂, T₂₀₆, T₂₀₇, T₂₀₈, and T₂₀₉ for a maximum reading on the HF transceiver S-meter. Reduce the signal generator output,

if necessary, to secure easy viewing of the peak point. Switch to the 52–54 MHz band, set the signal generator output to 53 MHz, and repeak these transformers again while tuned to the generator frequency. Then recheck the results at 51 MHz.

3. Transmitter section

- (1) Connect a dummy load/wattmeter to the 50 MHz ANT jack. Set VR₂₀₂ and VR₂₀₃ fully counterclockwise. Set the HF transceiver DRIVE or CARRIER control to the center its range (12 o'clock). Set the BAND switch to 50–52 MHz.
- (2) Connect the RF probe of the VTVM to the collector of Q₂₀₃. While transmitting, peak T₂₀₁, T₂₀₂, T₂₀₃, T₂₀₄, and T₂₀₅ for a maximum reading on the VTVM (0.4 volts RMS nom.).
- (3) Connect the RF probe to terminal A on the 50 MHz unit. Peak TC₂₀₁ and L₂₀₅ for a maximum reading on the VTVM (4 volts RMS nom.).
- (4) While transmitting, peak TC₂₀₁, TC₂₀₂, TC₂₀₃, TC₂₀₄, and TC₂₀₅ for a maximum power output indication on the wattmeter.
- (5) Repeat steps (2) through (4) on the 52–54 MHz band. Then recheck the results at 50–52 MHz.
- (6) Set the FTV-901R meter switch to the PO position, and set the transceiver DRIVE or CARRIER control for an output of 12 watts from the transverter. Set VR₃₀₂ for a reading of .8 on the FTV-901R meter.
- (7) Beginning at zero drive, gradually increase the transceiver DRIVE or CARRIER control until the output from the transverter does not increase more. Do not exceed this level.
- (8) Rotate VR₂₀₂ slowly clockwise, until an output of 12 watts is secured across the 50–54 MHz range.
- (9) Set VR₂₀₃ fully clockwise.
- (10) While transmitting, rotate VR₃₀₁ to secure maximum power output on the wattmeter.
- (11) Now rotate VR₂₀₃ fully counterclockwise. While transmitting, rotate VR₂₀₃ slowly clockwise, until the power output just begins to fall off. Do not go past the threshold point.

(12) Remove the dummy load from the antenna jack. While transmitting, confirm that the PO indication is .2 with no load applied. If not, check the AFP circuit for malfunctioning part.

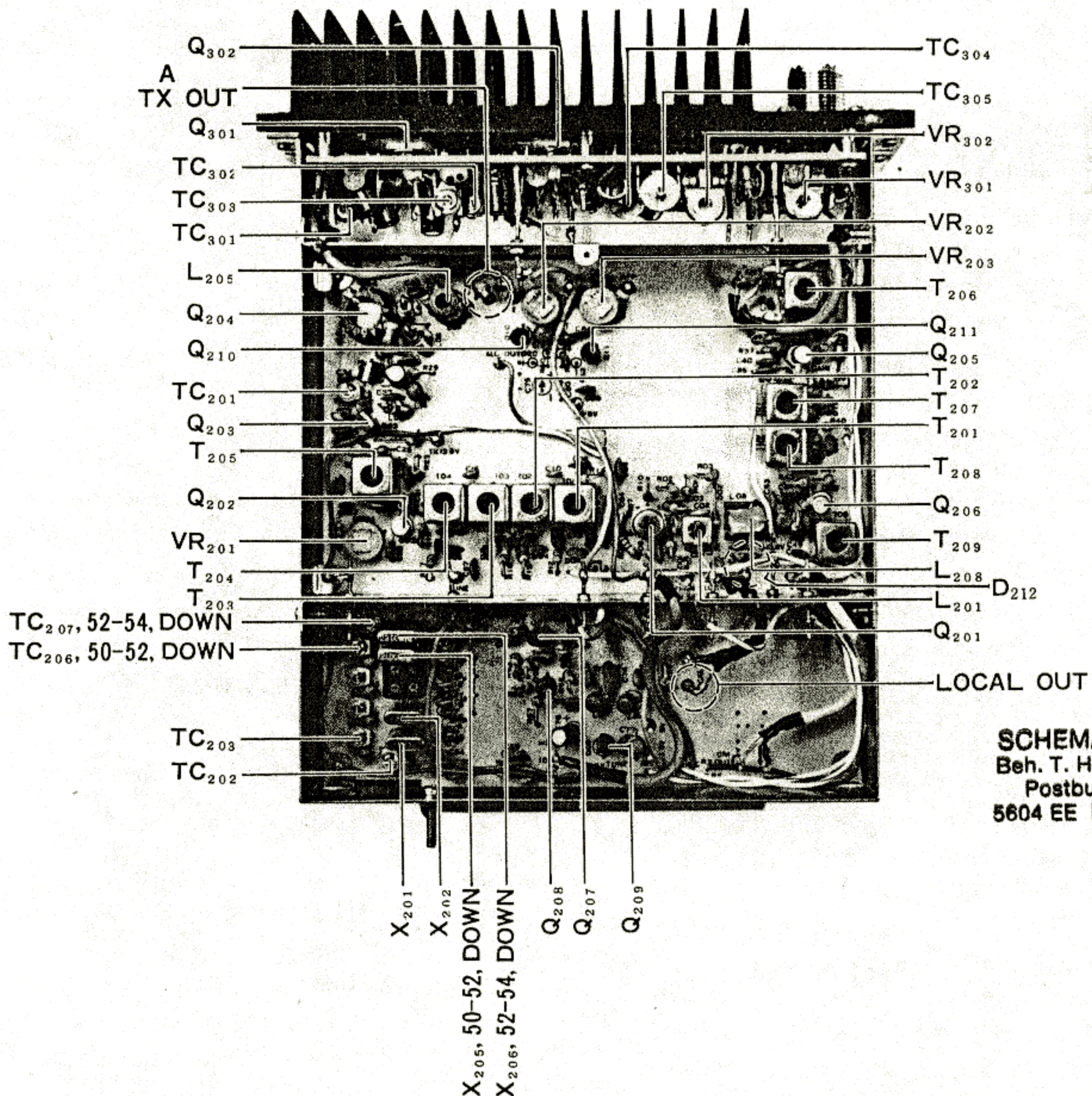
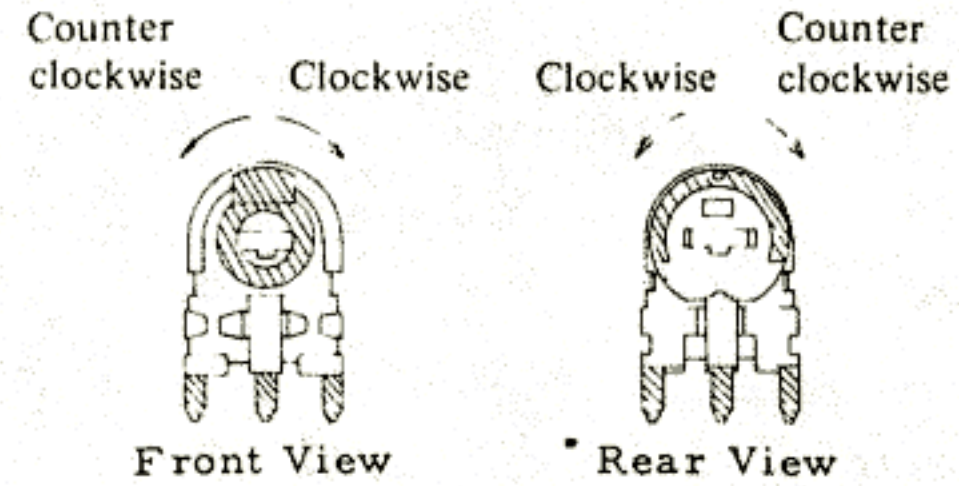
(13) Connect the RF probe of the VTVM to the LOCAL OUT terminal. Set the BAND switch to 50-52 MHz, then switch the repeater switch to UP and DOWN. Confirm that oscillation is taking place. Repeat on 52-54 MHz.

(14) Connect the frequency counter to the LOCAL OUT terminal. Adjust TC₂₀₄ - TC₂₀₆ as shown in the chart below.

BAND SWITCH	RPT SWITCH	ADJUST	FREQUENCY
50-52	DOWN	TC ₂₀₆	21.0MHz
52-54	DOWN	TC ₂₀₇	23.0MHz

(15) Set the TUNE control to the center of its range. Adjust the potentiometers for maximum power output while transmitting into the dummy load, as shown in the chart below.

BAND SWITCH	RPT SWITCH	ADJUST	RESULT
50-52	DOWN	VR ₂₂₀₅	MAXIMUM
52-54	DOWN	VR ₂₂₀₆	OUTPUT



144 MHz UNIT

Please remove the 50 and 430 MHz units, if installed, to allow access to test points on the 144 MHz module.

1. Local oscillator circuit

- (1) Connect the DC voltmeter to pin 2 of the edge connector for the 144 MHz unit. Confirm that 11 volts is present, with the BAND switch set to 144–146 MHz. Switch to 146–148 MHz, and check for 11 volts at pin 3 of the edge connector.
- (2) Connect the RF probe of the VTVM to the LOCAL OUT terminal. Confirm that the unit is oscillating.
- (3) Connect a frequency counter to the LOCAL OUT terminal. Set the BAND switch to 144–146 MHz, set the RPT switch to SIMP, and adjust TC₆₀₆ for a reading of exactly 116.0 MHz. Switch to 146–148 MHz, and adjust TC₆₀₇ for a reading of 118.0 MHz.

2. Receiver section

- (1) Set the HF transceiver to 29 MHz, and peak the preselector against the marker signal for maximum sensitivity.
- (2) Connect the DC voltmeter to pin 19 of the edge connector, set the BAND switch to 144–146 MHz, the 146–148 MHz, and confirm that 13.8 volts is present.
- (3) Connect the DC voltmeter to pin 15 of the edge connector, and rotate the FTV-901R RF GAIN control fully counterclockwise. The voltmeter reading should be 0 volts. In the fully clockwise position, it should be 13.8 volts. After confirming these voltages, please leave the level at maximum gain.
- (4) Connect the DC voltmeter to pin 14 of the edge connector, and set the FTV-901R TUNE control to the center position (12 o'clock). With the BAND switch in the 144–146 MHz position, adjust VR₁₉₀₇ for a reading of 4 volts. Switch to 146–148 MHz, and adjust VR₁₉₀₈ for a reading of 4 volts.
- (5) Connect a signal generator to the 144 MHz ANT jack, and set the FTV-901R BAND switch to 144–146 MHz. Set the signal generator to 145 MHz, and tune the receiver to its output. Peak TC₁₀₀₁–TC₁₀₀₄, T₆₀₄–TC₆₀₈ for a maximum reading on the HF transceiver S-meter. Reduce the signal

generator output, if necessary, to secure easy viewing of the peak point. Switch to the 140–148 MHz band, set the signal generator output to 147 MHz, and repeak these transformers again while tuned to the generator frequency. Then recheck the results at 145 MHz.

3. Transmitter section.

- (1) Connect a dummy load/wattmeter to the 144 MHz ANT jack. Set VR₆₀₁ and VR₆₀₂ fully counterclockwise. Set the HF transceiver DRIVE or CARRIER control to the center of its range (12 o'clock). Set the BAND switch to 144–146 MHz.
- (2) Connect the RF probe of the VTVM to the collector of Q₆₀₃. While transmitting, peak T₆₀₁–T₆₀₃, TC₆₀₁, and TC₆₀₂ for a maximum reading on the VTVM (0.9 volts RMS nom.).
- (3) Connect the RF probe to terminal A on the 144 MHz unit. Peak TC₆₀₄ and TC₆₀₅ for a maximum reading on the VTVM (2.5 volts RMS nom.).
- (4) Repeat steps (2) and (3) on the 146–148 MHz band. Then recheck the results at 144–146 MHz.
- (5) Set the FTV-901R meter switch to the PO position, and set the transceiver DRIVE or CARRIER control for an output of 12 watts from the transverter. Set VR₇₀₂ for a reading of .8 on the FTV-901R meter.
- (6) Beginning at zero drive, gradually increase the transceiver DRIVE or CARRIER control until the output from the transverter does not increase more. Do not exceed this level.
- (7) Rotate VR₆₀₁ slowly clockwise, until an output of 12 watts is secured across the 144–148 MHz range.
- (8) Rotate VR₆₀₂ fully clockwise.
- (9) While transmitting, rotate VR₇₀₁ to secure maximum power output on the wattmeter.
- (10) Now rotate VR₆₀₂ fully counterclockwise. While transmitting, slowly rotate VR₆₀₂ clockwise, until the power output just begins to fall off. Do not go past the threshold point.
- (11) Remove the dummy load from the antenna jack. While transmitting, confirm that the PO indication is .2 with no load applied. If not, check the AFP circuit for malfunctioning parts.

(12) Connect the RF probe of the VTVM to the LOCAL OUT terminal. Set the BAND switch to 144–146 MHz, then switch the repeater switch to UP and DOWN. Confirm that oscillation is taking place. Repeat on 146–148 MHz.

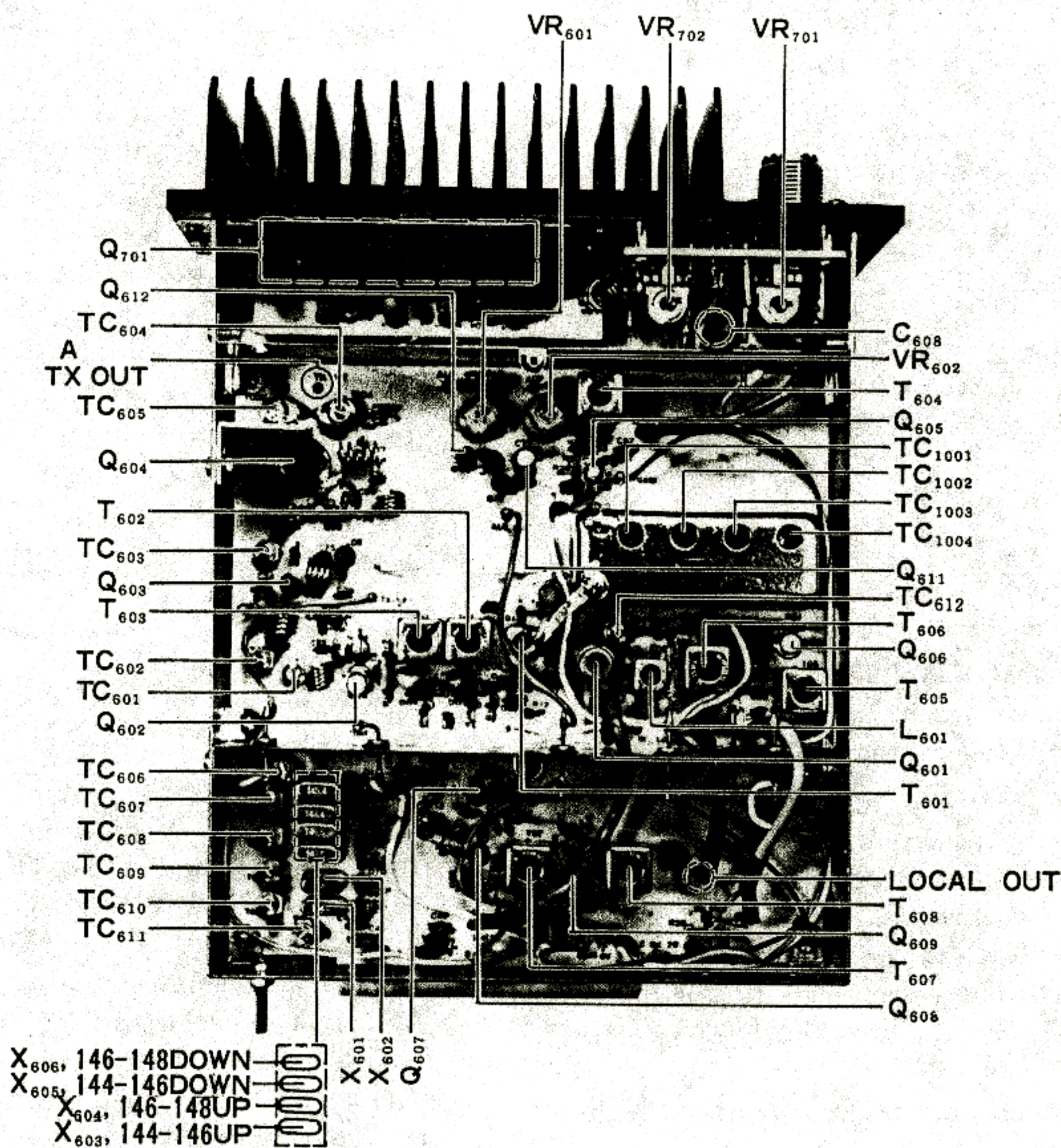
(13) Connect the frequency counter to the LOCAL OUT terminal. Adjust TC₆₀₈–TC₆₁₁ as shown in the chart below.

BAND SWITCH	RPT SWITCH	ADJUST	FREQUENCY
144–146	UP	TC ₆₀₈	116.6MHz
	DOWN	TC ₆₁₀	115.4MHz
146–148	UP	TC ₆₀₉	118.6MHz
	DOWN	TC ₆₁₁	117.4MHz

(14) Set the TUNE control to the center of its range. Adjust the potentiometers for maximum power output while transmitting into the dummy load, as shown in the chart below.

BAND SWITCH	RPT SWITCH	ADJUST	RESULT
144–146	UP	VR ₂₂₀₉	MAXIMUM OUTPUT
	DOWN	VR ₂₂₁₁	
146–148	UP	VR ₂₂₁₀	
	DOWN	VR ₂₂₁₂	

(15) Adjust T₆₀₇ and T₆₀₈ for identical power output with the RPT switch in the UP and DOWN positions.



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430 MHz UNIT

Please remove the 50 and 144 MHz units, if installed, to allow access to test points on the 430 MHz unit.

1. Local oscillator circuit

- (1) Connect a DC voltmeter to pin 2 of the edge connector for the 430 MHz unit. Set the BAND switch to 430-432, and confirm that 11 volts is present. In turn, check pins 3, 4, 5, and 6 for 11 volts, while switched to the 432-434, 434-436, 436-438, and 438-440 MHz bands, respectively.
- (2) Connect the RF probe of the VTVM to TP₁, and adjust L₁₆₀₂, T₁₆₀₁, and T₁₆₀₂ for maximum indication on the VTVM.
- (3) Connect the frequency counter to TP₁. Refer to the chart below, and adjust TC₁₆₀₁-TC₁₆₀₅ for local output readings as shown for the various positions of the BAND switch.

BAND	TRIMMER	FREQ.
430-432	TC ₁₆₀₁	201 MHz
432-434	TC ₁₆₀₂	202 MHz
434-436	TC ₁₆₀₃	203 MHz
436-438	TC ₁₆₀₄	204 MHz
438-440	TC ₁₆₀₅	205 MHz

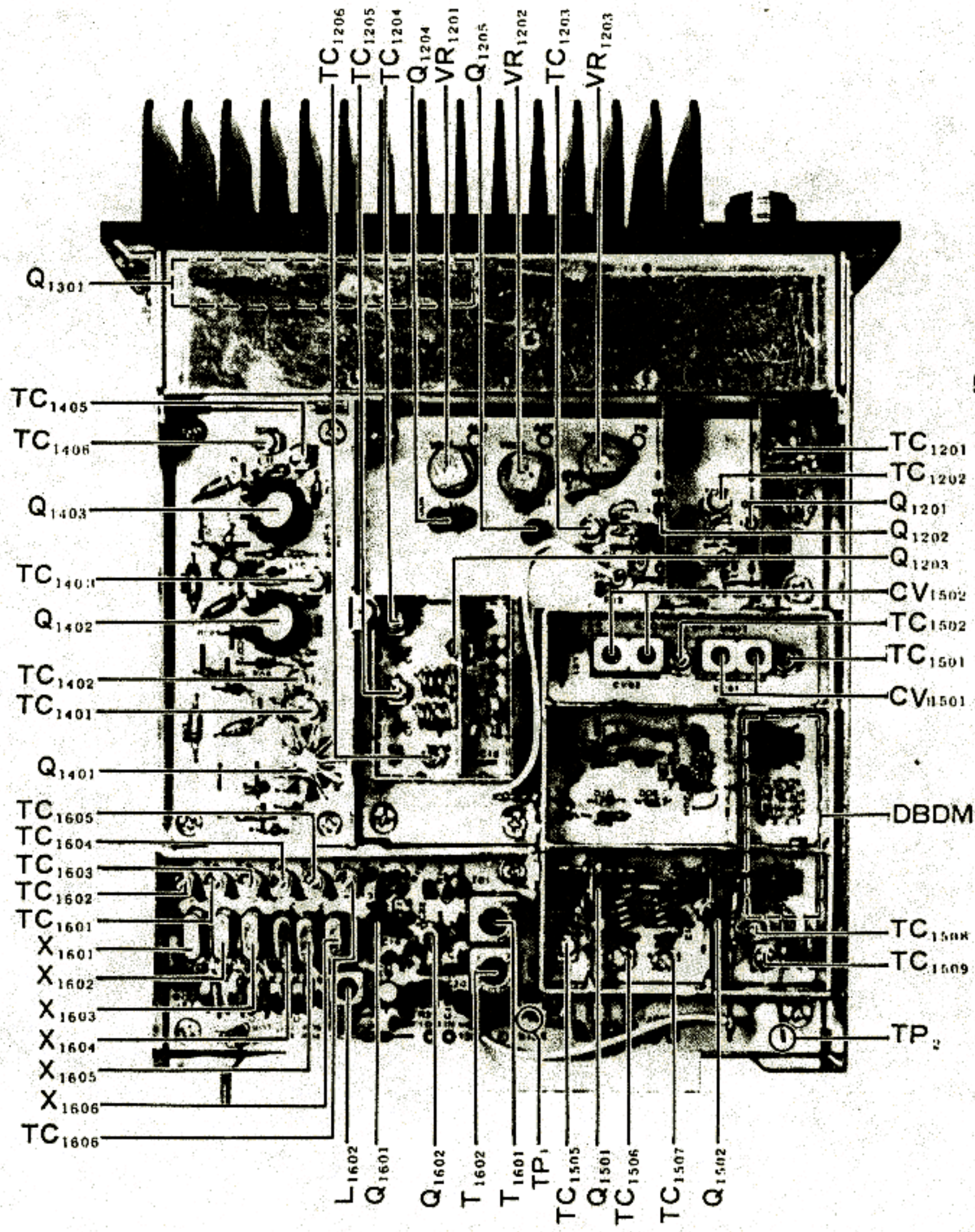
- (4) Connect the DC voltmeter to TP₂, and adjust TC₁₅₀₅-TC₁₅₀₉ for maximum indication on the voltmeter (1 volt nom.).

2. Receiver section

- (1) Set the transceiver to 29 MHz, and peak the receiver preselector against the marker signal for maximum sensitivity.
- (2) Connect the DC voltmeter to pin 19 of the edge connector, and check for 13.8 volts at each position of the BAND switch over 430-440 MHz.
- (3) Connect the signal generator to the 430 MHz ANT jack, set its output to 431 MHz, and tune the receiver to the generator signal. Adjust TC₁₂₀₁-TC₁₂₀₃ and TC₁₅₀₁-TC₁₅₀₄ for a maximum S-meter indication on the HF transceiver. Repeat on 433 MHz, 435 MHz, 437 MHz, and 439 MHz. Recheck the results to ensure maximum response across the entire operating range.

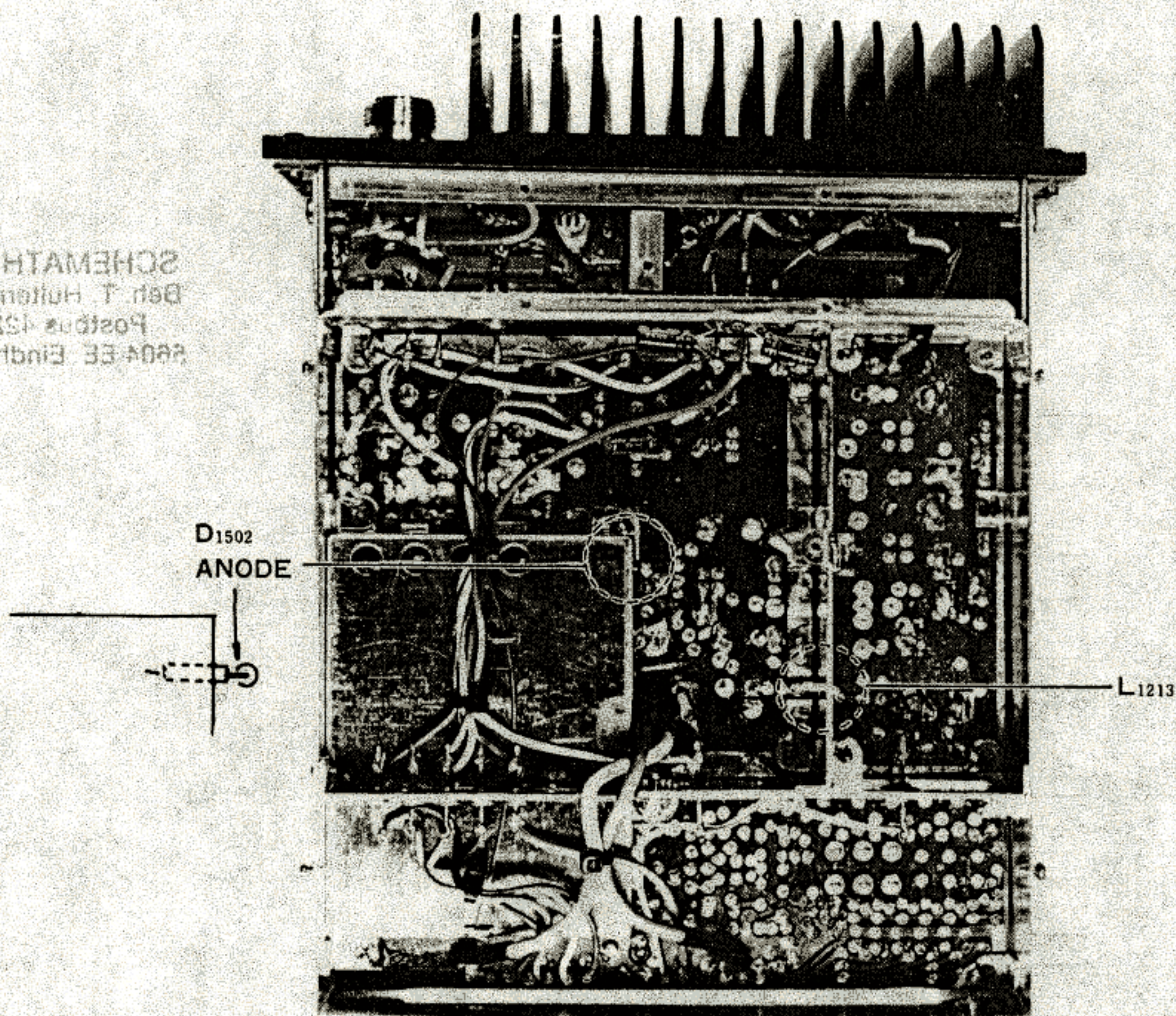
3. Transmitter section

- (1) Connect the dummy load/wattmeter to the 430 MHz ANT jack. Set VR₁₂₀₁ and VR₁₂₀₂ fully counter clockwise. Set the transceiver DRIVE or CARRIER control to the center of its range (12 o'clock position).
- (2) Connect the RF probe of the VTVM to the cathode of D₁₅₀₂. Peak TC₁₅₀₁-TC₁₅₀₄ for a maximum indication on the VTVM while transmitting.
- (3) Connect the RF probe of the VTVM to the hot side of L₁₂₁₃. Peak TC₁₂₀₃-TC₁₂₀₆ for a maximum indication on the VTVM.
- (4) Connect the RF probe of the VTVM to terminal A on the 430 MHz unit. Peak TC₁₄₀₁-TC₁₄₀₆ for a maximum indication on the VTVM.
- (5) Confirm the results in steps (2) through (4) on the wattmeter.
- (6) Repeat the points in steps (2) through (5) on each position of the BAND switch, then recheck the results to ensure maximum performance over the entire range 430-440 MHz.
- (7) Set the meter switch to PO. Set the transceiver DRIVE or CARRIER control for an output of 12 watts. Adjust VR₁₂₀₃ for an indication of .8 on the PO meter.
- (8) Beginning at zero drive, increase the level of the DRIVE or CARRIER control on the transceiver until the transverter power output does not increase further.
- (9) Advance VR₁₂₀₁ slowly clockwise until equal power output is achieved across the 430-440 MHz range.
- (10) Rotate VR₁₂₀₂ fully clockwise.
- (11) While transmitting, rotate VR₁₃₀₁ to secure maximum power output on the wattmeter.
- (12) Now rotate VR₁₂₀₂ fully clockwise. While transmitting, slowly rotate VR₁₂₀₂ counter-clockwise, until the power output just begins to fall off. Do not go past the threshold point.
- (13) Remove the dummy load from the 430 MHz ANT jack. While transmitting, check to be sure that the PO meter indicates .2 with no load applied. If not, check the AFP unit for malfunctioning parts.



SCHEMATHEEK
 Beh. T. Hultermans
 Postbus 4228
 5604 EE Eindhoven

SCHEMATHEEK
Der T. Hulsmans
Postbus 1328
3804 EE Eindhoven



FTV-901R PARTS LIST

MAIN CHASSIS						MULTI JACK	
Symbol No.	Parts No.	Description	MJ1-3	P4090004	121S-22B-105A		
		DIODE					
D1-6, 10,	G2090001	Silicon Diode 10D1					
D7-9, 11, 12	G2015550	" " 1S1555					
						PLUG	
			P1 (with wire)	T9201170A	5065-112		
		RESISTOR					
R1	J10246102	Composition " GK 1 kΩ					
R2	J01245683	" " " TJ 68 kΩ					
						50 MHz UNIT	
			Symbol No.	Parts No.	Description		
					***** MAIN CHASSIS *****		
			C101-106, 108-114	K21170002	Ceramic Feed Thru ECK-Y1H102WE		
		POTENTIOMETER					
VR1	J60800048	VM10A50KΩB 50 kΩB			***** 50 MHz CONVERTER MAIN BOARD *****		
VR2	J60800047	VM10A100KΩB 100 kΩB	PH-1922	F0001922	Printed Circuit Board		
				C0019220	PCB with Components		
		CAPACITOR					
C1, 2	K13170103	Ceramic Disc 50 WV 0.01 μF				IC, FET, TRANSISTOR	
			Q201	G1090061	IC	MC1496G	
			Q209	G1090123	"	78L08	
			Q202, 205, 206	G4800510C	FET	3SK51	
			Q203	G33020530	Transistor	2SC2053	
			Q204	G3307300	"	2SC730	
			Q207, 208	G3307840R	"	2SC784R	
M1	M0090008	200 μA	Q210, 211	G3318150Y	"	2SC1815Y	
		RELAY				DIODE	
RL1	M1090002	MX-2P 12 V	D201, 202 212, 213	G2090027	Silicon	1SS53	
			D208, 214- 219, 221	G2015550	"	1S1555	
		RELAY SOCKET	D203-207, 209-211	G2022090	Varactor	1S2209	
RLS1	M1490001	PX-08-1					
		SWITCH				CRYSTAL	
S1	N0190033	SRN606 CN	X201	H0101330	HC-18/U	22.0 MHz	
S2	N7090005	WD-9223	X202	H0101340	"	24.0 MHz	
			X203	H0101360	"	23.0 MHz	
			X205	H0101350	"	21.0 MHz	
		RECEPTACLE					
J1, 3	P1090028	MBR-06B					
J2, 4	P1090025	STR-0L				CRYSTAL SOCKET	
J5	P1090034	D7-701B00	XS201	P3090029	S-14-4P		

		RESISTOR	C273, 275	K00175121	Ceramic Disc 50WV SL 120 pF
R226	J00245100	Carbon Film 1/4 VJ 10 Ω	C274	K00179020	" " " " 240 pF
R207, 230	J00245560	" " " " 56 Ω	C232,252,266	K12171102	" " " " 0.001 μF
R204,209,211, 214,223,255, 258	J00245101	" " " " 100 Ω	C205,206,209, 220,221,224, 226,227,230, 231,239,240, 248, 253-259, 270-272, 283-288, 292	K14170103	" " " " 0.01 μF
R221,237,243	J00245221	" " " " 220 Ω	C291	K50177473	Mylar 50WV 0.047 μF
R224	J00245271	" " " " 270 Ω	C229,276,277, 290	K40120106	Electrolytic 16WV 10 μF
R202, 254	J00245471	" " " " 470 Ω			
R205	J01245821	" " " TJ 820 Ω			
R201,203,208, 238,244,251, 257,259	J01245102	" " " VJ 1 kΩ			
R229	J00245122	" " " " 1.2 kΩ			
R206, 245- 250	J00245152	" " " " 1.5 kΩ			
R225	J00245332	" " " " 3.3 kΩ			
R210,252,253	J00245103	" " " " 10 kΩ			TRIMMER CAPACITOR
R235	J00245223	" " " " 22 kΩ	TC201-207	K91000029	ECV1ZW 20 x 53N 20 pF
R219	J00245393	" " " " 39 kΩ			
R241, 242	J00245473	" " " " 47 kΩ			
R256	J00245823	" " " " 82 kΩ			
R212,213,215 -217, 220, 234,239,240	J01245104	" " " " 100 kΩ			TRANSFORMER
R222, 233	J01245104	" " " TJ 100 kΩ	T201-208	L0020408	
R218	J00245224	" " " VJ 220 kΩ	T209	L0020166	R12-4180,
R264	J01245334	" " " TJ 330 kΩ			
R236	J00245564	" " " VJ 560 kΩ			
R265	J00245335	" " " " 3.3 MΩ			INDUCTOR
			L211, 212	L1190004	Micro Inductor FL-4H 0.68 μH
			L214	L1190009	" " " " 3.3 μH
		POTENTIOMETER	L207, 209	L1190013	" " " " 6.8 μH
VR201-203	J51723473	SR19RS 47 kΩB	L213	L1190014	" " " " 10 μH
			L210	L1190017	" " FL-5H 1 mH
			L208	L0020209	
			L202,204,206	L1020324	
		CAPACITOR	L203	L0020416A	
C213, 245	K00179001	Ceramic Disc 50WV SL 0.5 pF	L201	L0020535	
C222, 242	K02279001	" " " CH 1 pF	L205	L0190003	IFT-51S10-H3
C211,215,218, 236,243,246, 278	K02172050	" " " " 5 pF			
C203, 210	K00173100	" " " SL 10 pF			FERRITE BEADS
C237,247,251	K02173100	" " " CH 10 pF		L9190001	Ri 3 x 3-1
C249	K02173150	" " " " 15 pF			
C228	K00175180	" " " SL 18 pF			
C216	K00175220	" " " " 20 pF		Q5000025	Wrapping Terminal A
C219	K00175220	" " " " 22 pF			
C260-265, 269	K02179009	" " " CH 22 pF			
					HEAT SINK
C235	31829330	" " " SL 33 pF		R5047915B	T0-5, L = 15 mm
C204,233,234	K00175470	" " " " 47 pF			
C212,214,217, 250	K02175470	" " " CH 47 pF			
C238,241,244	K06175470	" " " UJ 47 pF			
C201, 202	K00179013	" " " SL 91 pF	PB-1923	F0001923A	Printed Circuit Board
C225	K00175101	" " " " 100 pF		C0019230A	PCB with Components
C207,208,267, 268	K02175101	" " " CH 100 pF			

		TRANSISTOR		L311	L0020584	#220584
Q301	G3321660	Transistor	2SC2166			
Q302	G3319450D	"	2SC1945D			
						TRIMMER CAPACITOR
				TC301	K91000020	ECV-1ZW 20 x 40N 20 pF
		DIODE		TC302, 303	K91000023	ECV-1ZW 50 x 40N 50 pF
D301,302,308	G2090001	Silicon	10D1	TC304, 305	K91000058	2222-808-61809 80 pF
D307	G2001880F	Germanium	1S188FM			
D303-306	G2015550	Silicon	1S1555			
						RELAY
				RL301	M1190006	FBR-221D012
		RESISTOR				
R303	J10276560	Carbon Composition 1/2 GK	56 Ω			
R306	J10276101	" " " "	100 Ω			
R305	J10276151	" " " "	150 Ω			CONNECTOR
R302	J10276221	" " " "	220 Ω	J301	P1090026	SO-239
R301, 304 (L302, 305)	J10276471	" " " "	470 Ω			
R308	J10245102	Carbon Film 1/4 TJ	1 kΩ		Q5000025	Wrapping Terminal A
R307	J00245103	" " " VJ	10 kΩ			
					R4050740	Booster Heat Sink
		POTENTIOMETER				
VR301	J50702301	EVL-SOAA00B32	300 ΩB			
VR302	J50702103	EVL-SOAA00B14	10 kΩB			
				144 MHz UNIT		
				Symbol No.	Parts No.	Description
		CAPACITOR		***** MAIN CHASSIS *****		
C334	K00179001	Ceramic Disc 50WV SL	0.5 pF	C501-506,	K21170002	Ceramic Feed Thru ECK-Y1H102WE
C316, 335	K00172010	" " " "	1 pF	508, 509,		
C310, 315	K00172050	" " " "	5 pF	511-513,		
C302	K00179005	" " " "	20 pF	515		
C301, 317	K00175330	" " " "	33 pF	C517	K50177223	Mylar 50WV 0.022 μF
C307	K00175390	" " " "	39 pF			
C320	K00175470	" " " "	47 pF			
C323, 329	K00179011	" " " "	62 pF			
C314, 324	K00175820	" " " "	82 pF			
C321, 328	K00175101	" " " "	100 pF			
C319	K00175121	" " " "	120 pF			
C304,306,309, 311,313,318, 326,327,331, 333	K14170103	" " " "	0.01 μF			
				***** 144 MHz CONVERTER MAIN BOARD *****		
C303,305,308, 312,330,332	K40120226	Electrolytic 16WV TW	22 μF	PB-1925A	F0001925A	Printed Circuit Board
					C0019250A	PCB with Components
						IC, FET, TRANSISTOR
		INDUCTOR		Q601	G1090061	IC MC-1496G
L314	L1190003	Micro Inductor	10 μH	Q610	G1090123	" NJM78L08
L304, 313	L0020196		#	Q602,605,606	G4800510C	FET 3SK51
L302, 305	L0020324		#	Q604	G3307300	Transistor 2SC730
L301	L0020527		#	Q607-609	G3307840R	" 2SC784R
L303, 306	L0020528		#	Q611, 612	G3318150Y	" 2SC1815Y
L307	L0020529		#	Q603	G3320530	" 2SC2053
L308-310, 312	L0020530		#			

		DIODE				CAPACITOR					
D601,606,607, 609-614,616	G2090027	Silicon		ISS53	C614	K00179001	Ceramic Disc	50WV	SL	0.5 pF	
					C609	K02179001	"	"	CH	2 pF	
D605	G2Q15550	"		IS1555	C612, 616	K02172020	"	"	"	4 pF	
D602-604,608	G2022090	Varactor		IS2209	C613, 615	K06172040	"	"	UJ	4 pF	
					C611, 617	K00172050	"	"	SL	5 pF	
					C641,650-655	K02172050	"	"	CH	5 pF	
					C642	K06172050	"	"	UJ	5 pF	
					C608, 610	K06173080	"	"	"	8 pF	
		CRYSTAL			C604, 637	K00173100	"	"	SL	10 pF	
X601	H0101380	HC-18/U		38.6666 MHz	C631,632,664, 668	K02173100	"	"	CH	10 pF	
X602	H0101390	"		39.3333 MHz							
X603	H0101405	HC-25/U		38.8666 MHz	C639	K00175150	"	"	SL	15 pF	
X604	H0101420	"		39.5333 MHz	C658	K02175180	"	"	CH	18 pF	
X605	H0101410	"		38.4666 MHz	C665	K00175220	"	"	SL	22 pF	
X606	H0101430	"		39.1333 MHz	C626	K00175270	"	"	"	27 pF	
					C660	K02179011	"	"	CH	27 pF	
					C623	K00175330	"	"	SL	33 pF	
					C627	K00175390	"	"	"	39 pF	
		CRYSTAL SOCKET			C640	K00175470	"	"	"	47 pF	
XS601	P3090029	S-19-4P			C656	K02175680	"	"	CH	68 pF	
					C601, 602	K00179013	"	"	SL	91 pF	
					C685	K00175101	"	"	"	100 pF	
		RESISTOR			C659	K02175101	"	"	CH	100 pF	
R624	J00245100	Carbon Film	1/4	VJ 10 Ω	C607,618,619, 621,622,624, 625,628,630, 633-635,643, 657,662,663, 667,669,672, 673,678,679	K12171102				0.001 μF	
R638	J00245220	"	"	22 Ω							
R609,620,621, 633	J00245560	"	"	56 Ω							
R625	J00245680	"	"	68 Ω							
R604,608,611, 614,651,655, 659	J00245101	"	"	100 Ω							
R629	J00245221	"	"	220 Ω	C605,606,636, 638,644-649, 661,680, 682-684		K13170103				0.01 μF
R646	J00245331	"	"	330 Ω							
R665	J01245471	"	"	TJ 470 Ω							
R650,654,658	J00245471	"	"	VJ 470 Ω							
R602, 622	J00245561	"	"	560 Ω	C620,629,670, 671,681			K40120106	Electrolytic	16WV	TW
R640-645	J00245681	"	"	680 Ω							
R605	J01245821	"	"	TJ 820 Ω							
R601,603,607, 634,635,660	J00245102	"	"	VJ 1 kΩ							
R626,637,639	J00245122	"	"	1.2 kΩ							
R606	J00245152	"	"	1.5 kΩ	TC601	K91000028	ECV-1ZW	10 x 53N		10 pF	
R652, 656	J00245472	"	"	4.7 kΩ	TC602, 603, 606-612	K91000029	ECV-1ZW	20 x 53N		20 pF	
R623	J01245682	"	"	TJ 6.8 kΩ							
R610,657,666	J00245103	"	"	VJ 10 kΩ	TC604, 605	K91000016	ECV-1ZW	50 x 32N		50 pF	
R618,619,628, 653	J00245223	"	"	22 kΩ							
R647 (L613)	J10276471	Composition	1/2	GK 470 Ω							
R667	J00245273	"	Film	1/4 VJ 27 kΩ							
R617,631,632	J00245473	"	"	47 kΩ	L605	L1190004	Micro Inductor	FL-4H R68M	0.68 H		
R612,613,615, 616,630,636	J00245104	"	"	100 kΩ	L610,612,614	L1190008	"	"	2R2M	2.2 H	
					L611	L1190013	"	"	6R8M	6.8 H	
R668	J00245334	"	"	330 kΩ	L606, 608	L0020193	"	"	"		
R662	J00245564	"	"	560 kΩ	L602	L0020195	"	"	"		
					L603,604,609	L0020196	"	"	"		
		POTENTIOMETER			L613	L0020206	"	"	"		
VR601	J51723472	SR19RS		4.7 kΩB	L607	L0020380	"	"	"		
VR602	J51723473	SR19RS		47 kΩB	L601	L0020535	"	"	"		

		TRANSFORMER	C710, 712	K00172010	Ceramic Disc	50WV	SL	1 pF	
T604	L0020105	R12-4091	C713	K00172020	"	"	"	2 pF	
T602, 603, 606-608	L0020111	R12-4102	C708, 716, 717	K00175150	"	"	"	15 pF	
			C706	K00179005	"	"	"	20 pF	
T605	L0020166	R12-4180	C707	K00175330	"	"	"	33 pF	
T601	L0020536		C705, 711, 714, 715	K12171102	"	"	"	0.001 μ F	
			C701-704	K40120106	Electrolytic	16WV	TW	10 μ F	
		HEAT SINK							
	R5047915B	TO-5, L = 20 mm							
					INDUCTOR				
			L707	L0020069					
			L701, 704	L1020324					
		FERRITE BEADS	L706, 708	L0020430					
	L9190001	Ri 3 x 3-I	L702, 703	L1020469					
			L705	L0020654					
	Q5000025	Wrapping Terminal A							
					RELAY				
			RL701	M1190006	FBR-221D012				
***** 144 MHz BOOSTER BOARD *****									
PB-1926	F0001926 C0019260	Printed Circuit Board PCB with Components							
PB-1927	F0001927 C0019270	Printed Circuit Board PCB with Components	J701	P1090026	RECEPTACLE SO-239				
				Q5000025	Wrapping Terminal A				
		POWER MODULE							
Q701	G1090216	VP-20BL							
***** RESONATOR BOARD *****									
			PB-1800	F0001800 C0018000	Printed Circuit Board PCB with Components				
		DIODE							
D704	G2090001	Silicon 10D1							
D701	G2001880F	Germanium 1S188FM							
D702, 703	G2015550	Silicon 1S1555							
					CAPACITOR				
			C1005-1008	K02172050	Ceramic Disc	50WV	CH	5 pF	
			C1001-1004	K02175150	"	"	"	15 pF	
		RESISTOR							
R705	J00245472	Carbon Film 1/4 VJ 4.7 k Ω			TRIMMER CAPACITOR				
			T1001-1004	K91000028	ECV-1ZW 10x53N			10 pF	
R701 (L702), 704 (L704)	J10276471	Carbon Composition 1/2 GK 470 Ω	L1001	L0020409	INDUCTOR				
R702 (L702), 703 (L703)	J10246471	" " 1/4 " 470 Ω							
				R0044940A	Resonator Case				
		POTENTIOMETER		Q5000011	Wrapping Terminal C				
VR701	J50702301	EVL-SOAA00B32 300 Ω B							
VR702	J50702103	EVL-SOAA00B14 10 k Ω B							
		CAPACITOR							

430 MHz UNIT			C1231	K50177473	Mylar	50WV	0.047 μ F
Symbol No.	Parts No.	Description	C1230	K40120106	Electrolytic	16WV	TW 10 μ F
***** MAIN CHASSIS *****							
C1101-1108, 1110-1115	K21170002	Ceramic Feed Thru ECK-Y1H102WE					
					TRIMMER CAPACITOR		
			TC1201, 1204 -1206	K91000059	ECV-1ZW 04 x 53N		4 pF
***** 430 MHz RF BOARD *****							
PB-1929	F0001929	Printed Circuit Board					
	C0019290	PCB with Components					
					INDUCTOR		
			L1214	L1190014	Micro Inductor FL-4H		10 μ H
		TRANSISTOR	L1202, 1204, 1205, 1207- 1210	L1020469			
Q1203	G3314240	Transistor 2SC1424					
Q1204, 1205	G3318150Y	" 2SC1815Y					
Q1201, 1202	G3323690	" 2SC2369	L1211, 1212	L0020471			
			L1203, 1206	L0020472			
			L1213	L0020474			
			L1201	L0020523			
		DIODE					
D1203	G2090027	Silicon 1SS53		Q5000011	Wrapping Terminal C		
D1201	G2015550	" 1S1555					
***** 430 MHz BOOSTER BOARD *****							
			PB-1935	F0001935A	Printed Circuit Board		
				C0019350A	PCB with Components		
		RESISTOR					
R1215	J00245820	Carbon Film 1/4 VJ 82 Ω					
R1205, 1210	J00245101	" " " " 100 Ω					
R1204	J00245221	" " " " 220 Ω			POWER MODULE		
R1203(L1202), 1206(L1204), 1209(L1205), 1211(L1207), 1216-1218 (L1208-1210)	J10246471	Carbon Composition 1/4 GK 470 Ω	Q1301	G1090217			UP-07BL
					DIODE		
R1212, 1213	J00245102	Carbon Film 1/4 VJ 1 k Ω	D1301	G2090001	Silicon 10D1		
R1201, 1207, 1223	J00245152	" " " " 1.5 k Ω	D1302-1304	G2001880F	Germanium 1S188FM		
R1202, 1208, 1214, 1225	J00245103	" " " " 10 k Ω					
					RESISTOR		
			R1301(L1308), 1302(L1309), 1304(L1301), 1305(L1302)	J10246471	Carbon composition 1/4 " 470 Ω		
		POTENTIOMETER					
VR1201-1203	J51723473	SR19RS 47 k Ω B					
		CAPACITOR					
C1202, 1203	K00172030	Ceramic Disc 50WV SL 3 pF			POTENTIOMETER		
C1216, 1218	K02172050	" " " " CH 5 pF	VR1301	J50702301	EVN-A00B32		300 Ω B
C1212	K02179008	" " " " 20 pF					
C1201, 1221, 1222, 1229	K12171102	" " " " 0.001 μ F					
C1204, 1211, 1213, 1215, 1228	K22170001	" HDC60E102M 0.001 μ F			CAPACITOR		
			C1304, 1309	K00172020	Ceramic Disc 50WV SL 2 pF		
			C1308	K12171102	" " " " 0.001 μ F		
C1214, 1226	K23140001	" Chip 25 V 0.01 μ F	C1301, 1302	K40120106	Electrolytic 16WV TW 10 μ F		

						CAPACITOR
			C1401-1410, 1412	K22170001	Ceramic HDC60E102M	0.001 μ F
			C1411	K40120106	Electrolytic 16WV TW	10 μ F
			TRIMMER CAPACITOR			
TC1301	K91000068	ECV1ZW 06 x 32	6 pF			
						TRIMMER CAPACITOR
			TC1401-1403, 1405, 1406	K91000028	ECV-1ZW 10 x 53N	10 pF
			INDUCTOR			
L1301, 1302, 1308, 1309	L1020469					
L1303, 1304	L0020525A					
						INDUCTOR
			L1401-1406	L1020469		
			L1407	L0020472		
						RELAY
RL1301	M1590001	CX-140N (with J1301)	L1409, 1411	L0020473		
			L1408, 1410	L0020522		
				R5047914B	Heat Sink	
			***** 430 MHz CONVERTER BOARD *****			
			PB-1931	F0001931	Printed Circuit Board	
				C0019310	PCB with Components	
			PB-1932	F0001932A	Printed Circuit Board	
				C0019320A	PCB with Components	
			***** 430 MHz EXCITER BOARD *****			
			PB-1933	F0001933	Printed Circuit Board	
PB-1930	F0001930A	Printed Circuit Board		C0019330	PCB with Components	
	C0019300A	PCB with Components				
						TRANSISTOR
			TRANSISTOR	Q1501, 1502	G3314240	Transistor 2SC1424
Q1401	G3314240	Transistor	2SC1424			
Q1402, 1403	G3314260	"	2SC1426			
						DIODE
			D1503-1506	G2090118	Schottky Barrier	1SS97
			D1507-1510	G2090027	Silicon	1SS53
D1401	G2015550	Silicon	1S1555	D1501, 1502, 1512	G2090033	MC-301
				D1511	G2001880F	Germanium 1S188FM
			RESISTOR			
R1408	J00245220	Carbon Film	1/4 VJ	22 Ω		RESISTOR
R1405	J00245820	" "	" "	82 Ω	R1504	J00245180
R1415	J00245221	" "	" "	220 Ω	R1517	J01245180
R1401(L1401), 1406(L1402), 1407(L1403), 1412(L1404), 1413(L1405), 1416(L1406)	J10246471	Carbon Composition	1/4 GK	470 Ω	R1515	J00245220
					R1510	J00245101
					R1518, 1519	J01245331
					R1502, 1505	J00245331
					R1511(L1507), 1512(L1510), 1516(L1511)	J10246471
R1409	J00245471	Carbon Film	1/4 VJ	470 Ω		
	J01245471	" "	" TJ	470 Ω	R1513	J00245561
R1404, 1410, 1414	J00245101	" "	" VJ	1 k Ω	R1501, 1506	J01245102
					R1503, 1507	J00245102
R1402, 1411	J01245562	" "	" TJ	5.6 k Ω	R1508	J00245222
					R1514	J01245103
					R1509	J01245223
						" " " " 2.2 k Ω
						" " " " 10 k Ω
						" " " " 22 k Ω

				CRYSTAL			
			X1601	H0101220	HC-18/U	67.000 MHz	
			X1602	H0101230	"	67.333 MHz	
		CAPACITOR	X1603	H0101240	"	67.666 MHz	
C1524, 1525	K00179001	Ceramic Disc 50WV SL	0.5 pF	X1604	H0102251	HC-25/U	68.000 MHz
C1526	K02172020	" " " CH	2 pF	X1605	H0102252	"	68.333 MHz
C1513, 1514	K02172030	" " " "	3 pF				
C1502-1505	K02173080	" " " "	8 pF				
C1515	K00173100	" " " SL	10 pF				
C1523	K00175270	" " " "	27 pF				
					RESISTOR		
C1506, 1507	K02179017	" " " CH	62 pF	R1616	J00245101	Carbon Film 1/4 VJ	100 Ω
C1511, 1512, 1516	K22170001	" HDC60E102M	0.001 μF	R1618	J01245101	" " " TJ	100 Ω
				R1614	J00245221	" " " VJ	220 Ω
C1517-1522	K21170002	" Feed Thru 50WV	0.001 μF	R1601	J00245331	" " " "	330 Ω
C1501	K12171102	" Disc 50WV	0.001 μF	R1612, 1615	J00245471	" " " "	470 Ω
C1508-1510	K13170103	" " "	0.01 μF	R1607-1611	J00245681	" " " TJ	680 Ω
				R1617	J00245272	" " " VJ	2.7 kΩ
				R1602, 1603, 1605, 1606	J00245103	" " " "	10 kΩ
		TRIMMER CAPACITOR		R1604	J01245103	" " " TJ	10 kΩ
TC1501-1504, 1509	K91000055	ECV-1ZW 06 x 53N	6 pF	R1613	J00245273	" " " VJ	27 kΩ
TC1505-1508	K91000028	ECV-1ZW 10 x 53N	10 pF				
					CAPACITOR		
				C1625	K00179001	Ceramic Disc 50WV SL	0.5 pF
		INDUCTOR		C1631	K02173010	" " " CH	1 pF
L1505, 1513	L0020720	FKMA070PB01-BR.		C1623, 1626	K02172040	" " " "	4 pF
L1507, 1510, 1511	L1020469			C1602-1606	K02172050	" " " "	5 pF
				C1613	K02173100	" " " "	10 pF
L1506	L0020470			C1616	K02179011	" " " "	27 pF
L1501-1504, 1508, 1509	L0020471			C1601, 1614	K02175470	" " " "	47 pF
L1512	L0020476			C1607-1611, 1621, 1622, 1624, 1627-1630	K12171102	" " " "	0.001 μF
				C1615, 1617	K14170103	" " " "	0.01 μF
		HERMETIC SEAL		C1620	K14170473	" " " "	0.047 μF
	Q4000001	A102		C1618, 1619	K40120106	Electrolytic 16WV TW	10 μF
***** 430 MHz LOCAL BOARD *****						TRIMMER CAPACITOR	
PB-1934B	F0001934B	Printed Circuit Board		TC1601-1605	K91000029	ECV-1ZW 20 x 53N	20 pF
	C0019340B	PCB with Components					
						INDUCTOR	
		IC, TRANSISTOR		L1601	L1190005	Micro Inductor FL-4H	1 μH
Q1603	G1090123	IC	78L08	L1602	L0020417	TM-80160	
Q1601	G3307840R	Transistor	2SC784R				
Q1602	G3314240	"	2SC1424				
						TRANSFORMER	
				T1601, 1602	L0020510	MB-80050	
		DIODE					
D1601-1605	G2090027	Silicon	1SS53		Q5000011	Wrapping Terminal C	

POWER SUPPLY UNIT						POTENTIOMETER	
Symbol No.	Parts No.	Description		VR1701	J50702202	EVL-S0AA00B23 2 kΩB	
***** MAIN CHASSIS *****							
TRANSISTOR				CAPACITOR			
Q1708	G3090003	MJE3055		C1707	K12171102	Ceramic Disc	50WV 0.001 μF
				C1703, 1705	K13170103	" " "	0.01 μF
				C1704	K14170473	" " "	0.047 μF
				C1706, 1712	K40170105	Electrolytic	25WV TW 1 μF
		DIODE		C1711	K40120106	"	16WV 10 μF
D1707	G2090031	Silicon Bridge	S4VB10	C1702	K40140108	"	25WV TW 1000 μF
				C1701	K40160108	"	35WV R 1000 μF
CAPACITOR				RELAY			
C1708	K43160002	Electrolytic	35WV TW 10000 μF	RL1701	M1190006	FBR221D012	
C1709, 1710	K12329002	Ceramic Disc	1.4 KV 0.0047 μF				
POWER TRANSFORMER				P1701	P0090074	5079-11A	
PT1701	L3030025					PLUG	
FUSE				FUSE			
F1702	Q0000003	(100-117 V)	2A	F1701	Q0000005	5A	
	Q0000002	(200-234 V)	1A			FUSE HOLDER	
FUSE HOLDER				FH1701	P2000003	F3265	
FH1702	P2000005	F3292					
					Q5000011	Wrapping Terminal C	
POWER SUPPLY BOARD							
PB-1945	F0001945B	Printed Circuit Board					
	C0019450B	PCB with Components					
				ALC AMP UNIT			
		Symbol No.	Parts No	Description			
IC, TRANSISTOR				PB-1946B	F0001946B	Printed Circuit Board	
Q1702	G1090036	IC	TA7089M		C0019460B	PCB with Components	
Q1706	G1090070	"	μPC14308				
Q1708	G3107330	Transistor	2SA733				
Q1709, 1710	G3309450	"	2SC945				
Q1703-1705	G3318150Y	"	2SC1815Y			FET	
Q1701	G34023500	"	2SD235-O	Q1801	G4800590Y	3SK59Y	
DIODE							
D1701-1705, 1713	G2090001	Silicon	10D1			DIODE	
D1708	G2090010	Zener	WZ090	D1801, 1802	G2015550	Silicon 1S1555	
				D1803	G2090005	Varistor MV103	
RESISTOR							
R1714	J00245221	Carbon film	¼ VJ 220 Ω				
R1713	J00245471	" "	" " 470 Ω			RESISTOR	
R1712	J10276561	" composition	½ GK 560 Ω	R1809	J00245471	Carbon Film	¼ VI 470 Ω
R1703	J10276102	" "	" " 1 kΩ	R1807	J00245102	" " "	" " 1 kΩ
R1709, 1710	J00245102	" film	¼ VJ 1 kΩ	R1805	J00245152	" " "	" " 1.5 kΩ
R1702	J00245332	" "	" " 3.3 kΩ	R1802, 1813	J00245103	" " "	" " 10 kΩ
R1708, 1711	J00245472	" "	" " 4.7 kΩ	R1808	J00245123	" " "	" " 12 kΩ
R1701	J00245123	" "	" " 12 kΩ	R1806	J00245273	" " "	" " 27 kΩ
R1704-1706	J00245223	" "	" " 22 kΩ	R1803	J00245473	" " "	" " 47 kΩ

R1804	J00245274	Carbon Film	1/4	VJ	270 kΩ				
									RESISTOR
		POTENTIOMETER				R1906	J00245220	Carbon Film	1/4 VJ 22 Ω
VR1801	J50702103	EVL-S0AA00B14	10 kΩB			R1901	J00245702	" "	" " 1 kΩ
VR1802, 1803	J50702503	EVL-S0AA00B54	50 kΩB			R1902, 1903	J00245103	" "	" " 10 kΩ
						R1904, 1905	J00245223	" "	" " 22 kΩ
		CAPACITOR							
C1801, 1810	K00173100	Ceramic Disc	50WV	SL	10 pF				POTENTIOMETER
C1813	K02179019	" "	" "	" "	91 pF	VR1901-1912	J50702503	EVL-S0AA00B54	50 kΩB
C1811	K02179020	" "	" "	" "	110 pF				
C1812	K02179023	" "	" "	" "	180 pF				
C1822-1826	K21170002	Ceramic Feed Thru	ECK-Y1H102WE						
	K14179001	Ceramic Disc	50WV		0.001 μF				CAPACITOR
C1805-1810, 1815, 1817, 1820	K14170103	" "	" "	" "	0.01 μF	C1915	K00172010	Ceramic Disc	50WV SL 1 pF
						C1901-1914, 1916, 1918, 1919	K13170103	" "	" " 0.01 μF
C1816	K70167474	Tantalum	35WV		0.47 μF				
C1818	K40120106	Electrolytic	16WV		10 μF	C1917	K40120476	Electrolytic	16WV TW 47 μF
						C1920	K40149007	"	25WV TW 470 μF
		INDUCTOR							
L1803, 1804	L1190029	Micro Inductor	FL-5H		47 μH				
L1805, 1806	L0020535								
									RELAY
						RL1901	M1190002	FBR211D012	
		TRANSFORMER							
T1801	L0020180	R12-4434	#220180				Q5000011	Wrapping Terminal C	
		HERMETIC SEAL							LED UNIT
	Q4000001	A-102				Symbol No.	Parts No.	Description	
						PB-1948	F0001948	Printed Circuit Board	
							C0019480	PCB with Components	
	Q5000011	Wrapping Terminal C							
									LED
						Q2001-2009	G2090060	GD4-203SRD	
		VR UNIT							
Symbol No.	Parts No.	Description							
PB-1947	F0001947	Printed Circuit Board							RESISTOR
	C0019470	PCB with Components				R2001-2009	J01245681	Carbon Film	1/4 T1 680 Ω
		TRANSISTOR							
Q1901, 1902	G3318150Y		2SC1815Y						
		DIODE							
D1901-1915	G2015550	Silicon	1S1555						
D1916, 1917	G2090001		10D1						

SW UNIT		
Symbol No.	Parts No.	Description
PB-1928	F0001928	Printed Circuit Board
	C0019280	PCB with Components
		SWITCH
S2101	N3090002	SLE-62301
S2102, 2104	N3090004	SLE-62251
S2103	N3090008	SLE-64251
ACCESSORIES		
Symbol No.	Parts No.	Description
	T9100071A	Connection Cable A
	T9100160A	" " B
	T9101160B	" " C
	T9100852	" " D
	P0090018	RCA Pin Plug STP-58
	Q0000005	Fuse 5A
	Q0000003	" 2A (100-117V)
	Q0000002	" 1A (200-234V)