

**INSTRUCTION
MANUAL
FTV-901R**

YAESU MUSEN CO , LTD.

TOKYO JAPAN.

FTV-901R

VHF/UHF TRANSVERTER



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	VP07BL	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:

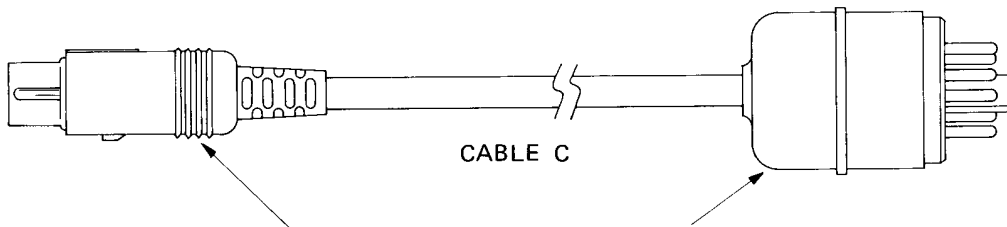
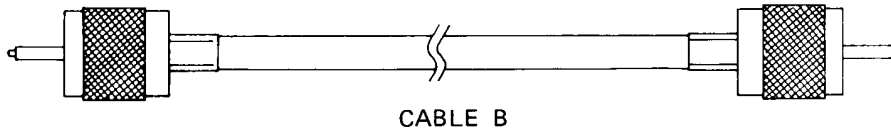
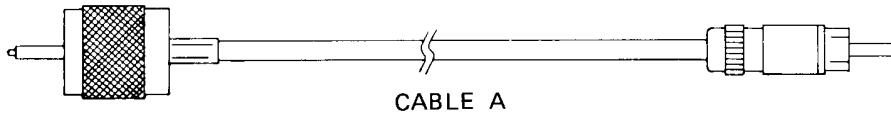
1S188FM	6
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Silicon Diodes:

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

ACCESSORIES:

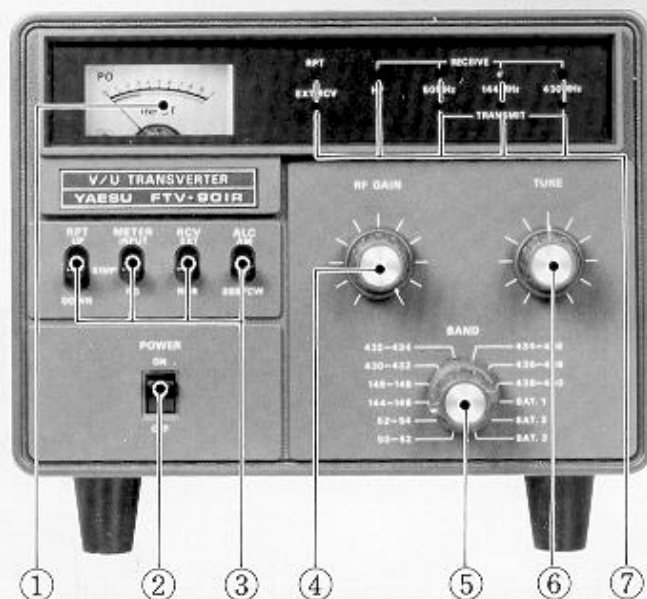
- Cable A 1 pc. RCA plug 1 pc.
- Cable B 1 pc. Spare fuse 1 pc.
- Cable C 1 pc.



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	WHITE/RED	9
7	RX:GND	WHITE/GREEN	10
GROUND SHELL	EARTH	BLACK	8

Cable C Connections

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.

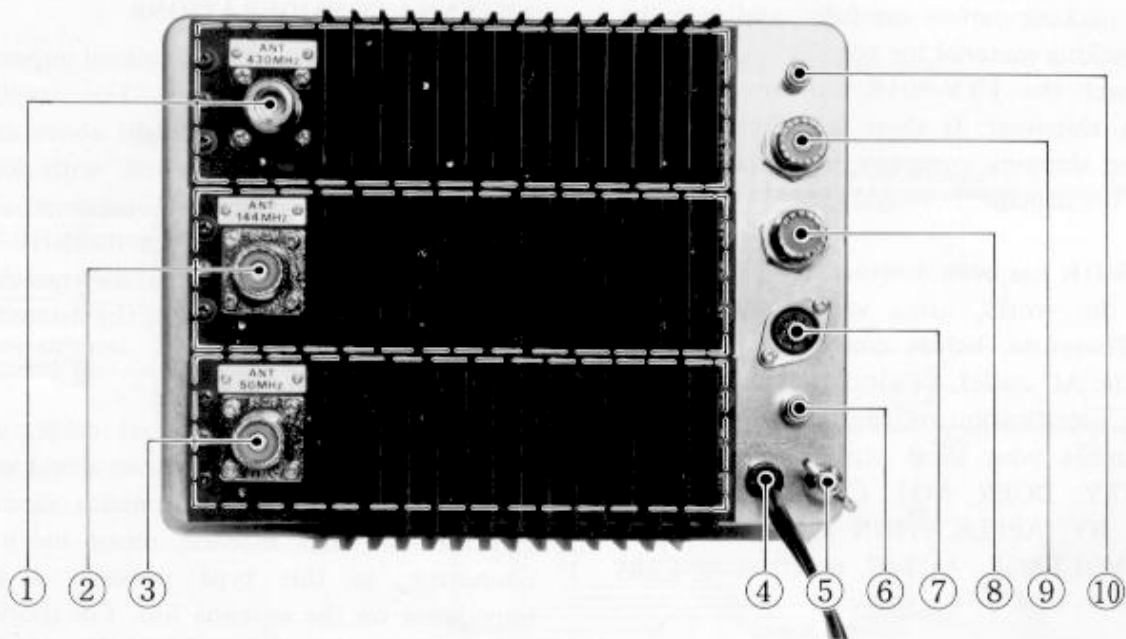
(6) TUNE

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.

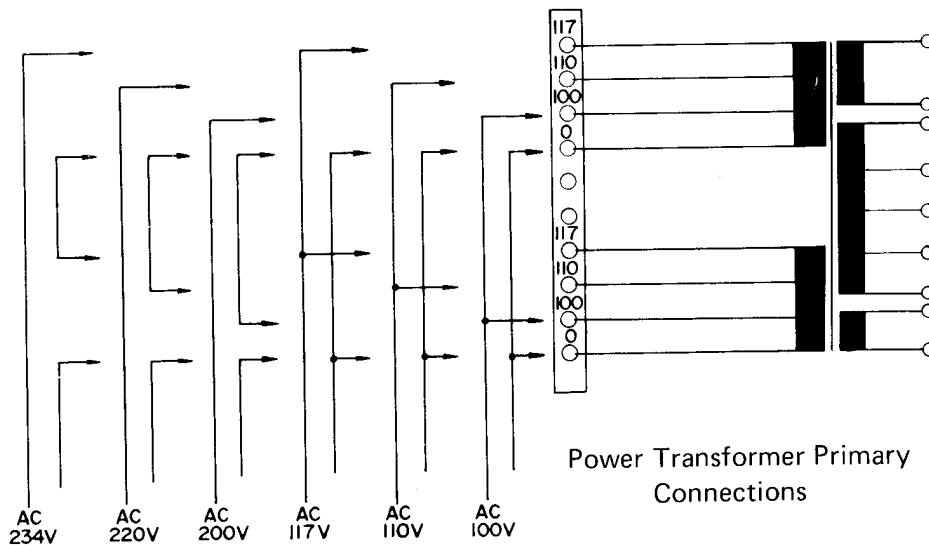
The transverter should be connected to a good earth ground.

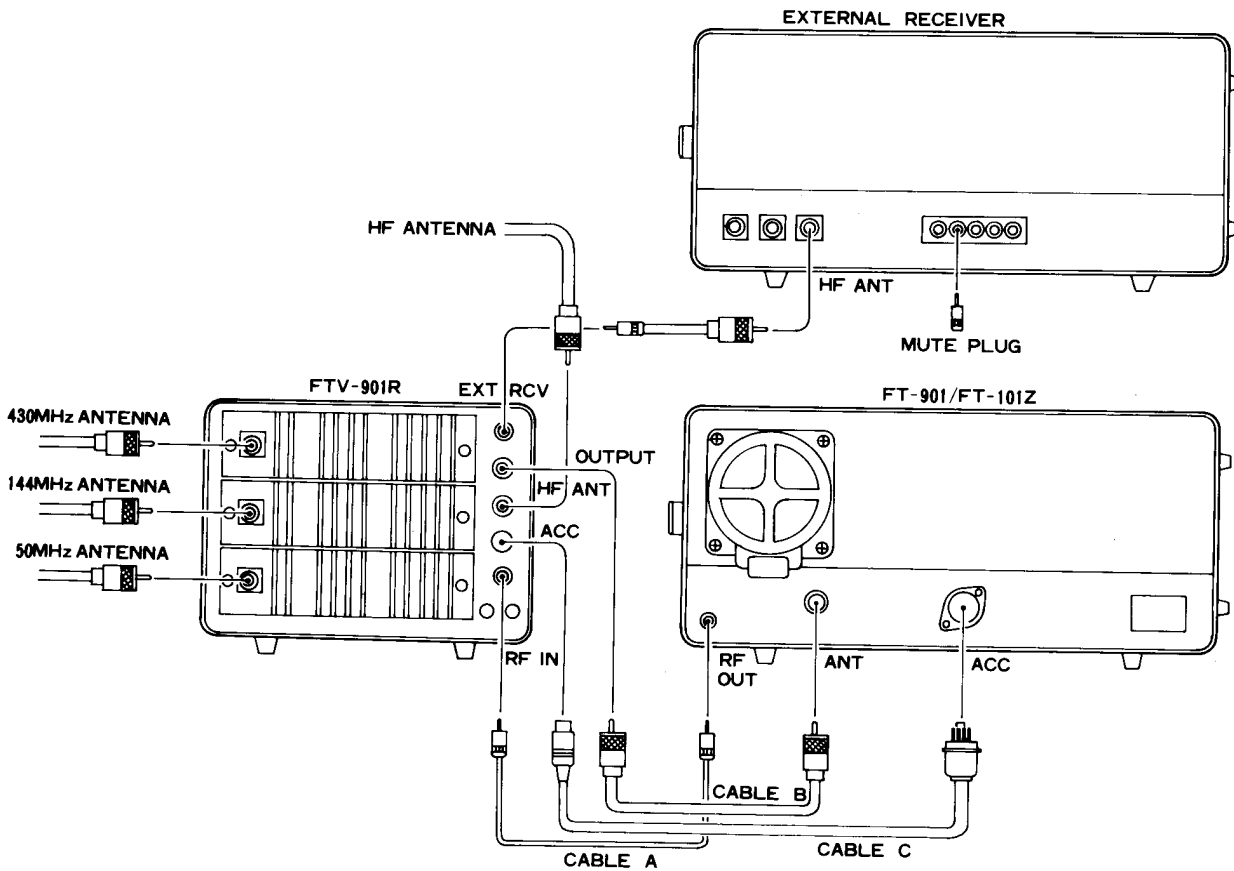
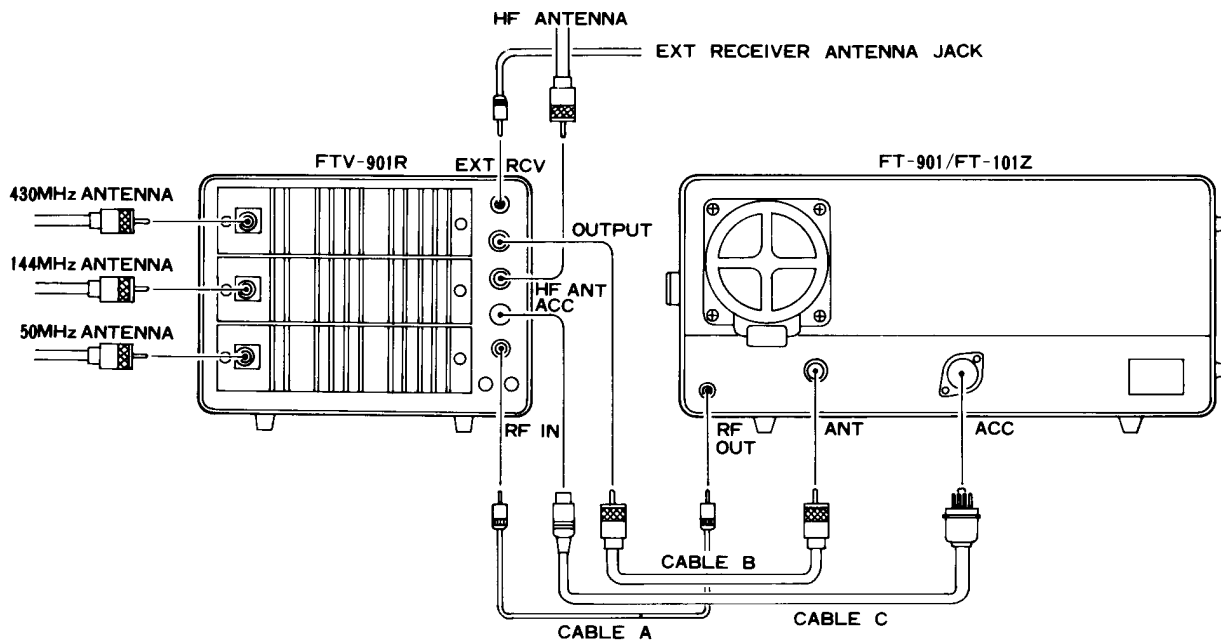
Please refer to the drawings for details of correct interconnections between the FTV-901R and the FT-901DM/FT-101ZD and an external receiver, such as the FR-101D.

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

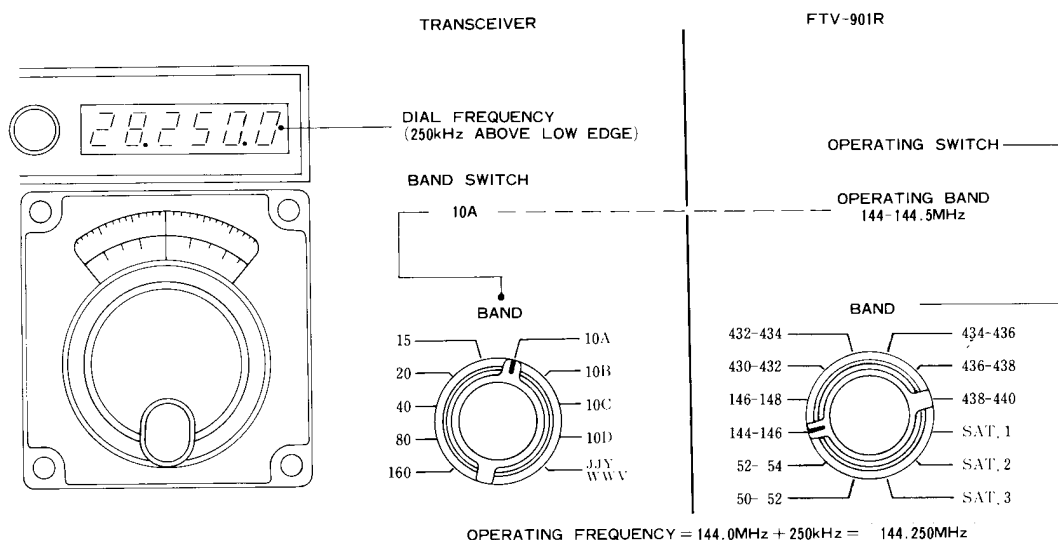
Before connecting the FTV-901R to the power source, confirm that the AC power specification is correct for the supply voltage used, and that a fuse of the proper rating is installed. Check all switches for normal operation. Recheck the interconnections between the HF equipment and the transverter.

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	
		28.0-28.5	28.5-29.0	29.0-29.5	29.5-30.0	
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				29.0-29.5		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.

SATELLITE OPERATION

Operation on the amateur satellites is possible, using an external receiver in addition to the FT-901DM transceiver. The FT-901DM transceiver 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.

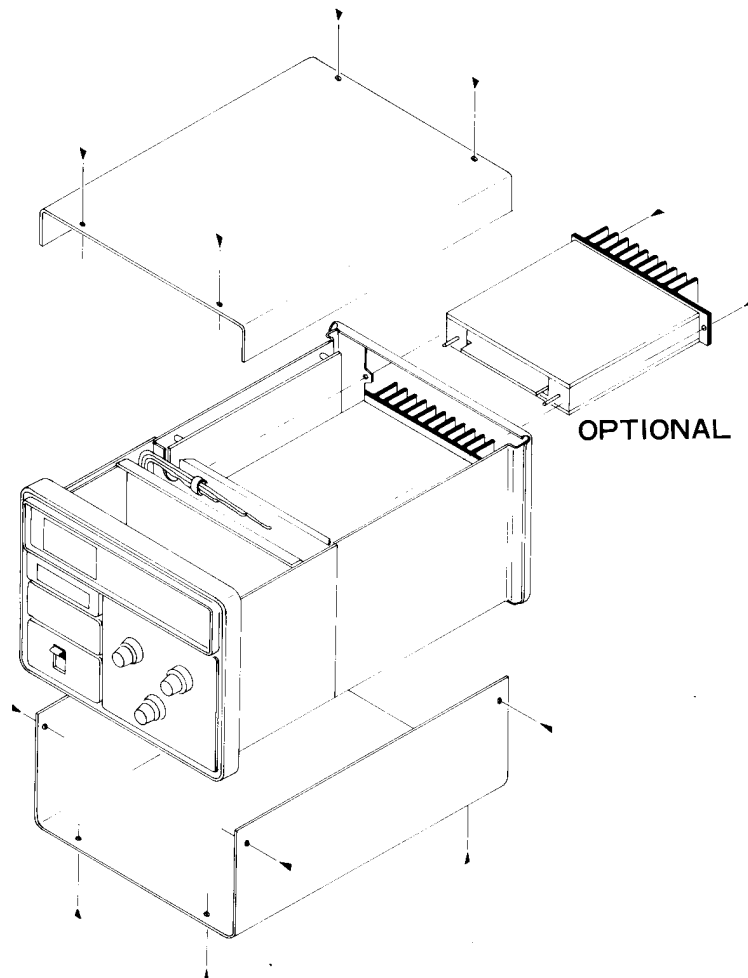
AUXILIARY REPEATER SPLIT INSTALLATION

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..	"	"	"	"

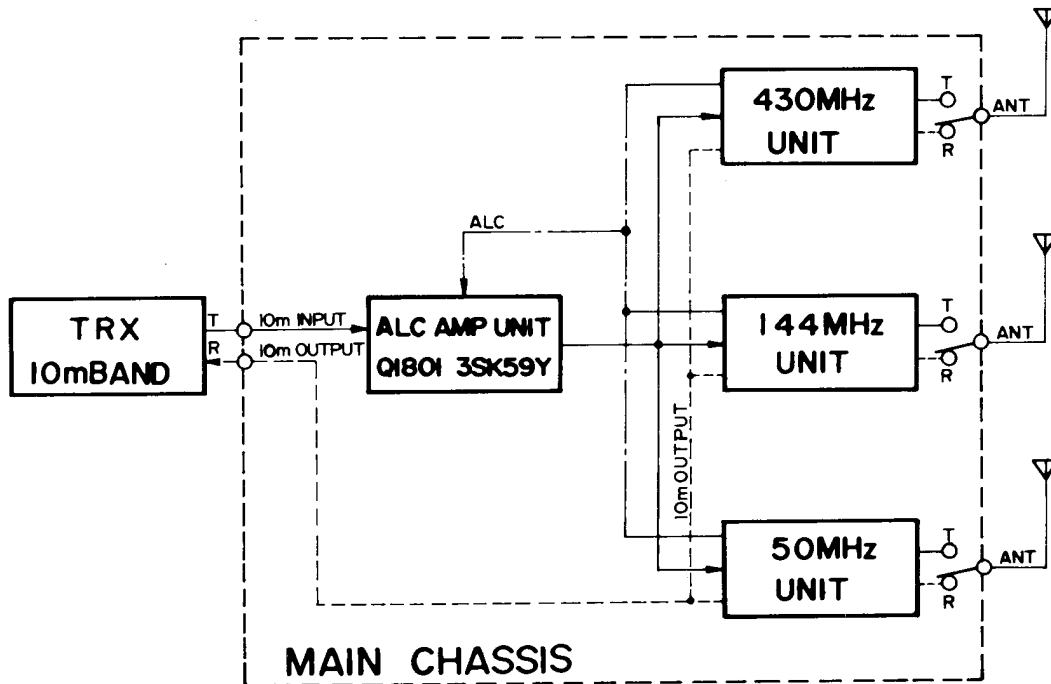
BAND	50MHz		144MHz	
RANGE	50-52	52-54	144-146	146-148
LOCAL FREQUENCY	22MHz(×1)	24MHz(×1)	116MHz(×3)	118MHz(×3)
OSC. FREQUENCY	22MHz ☆	24MHz ☆	38.666..MHz ▲	39.333..MHz ▲

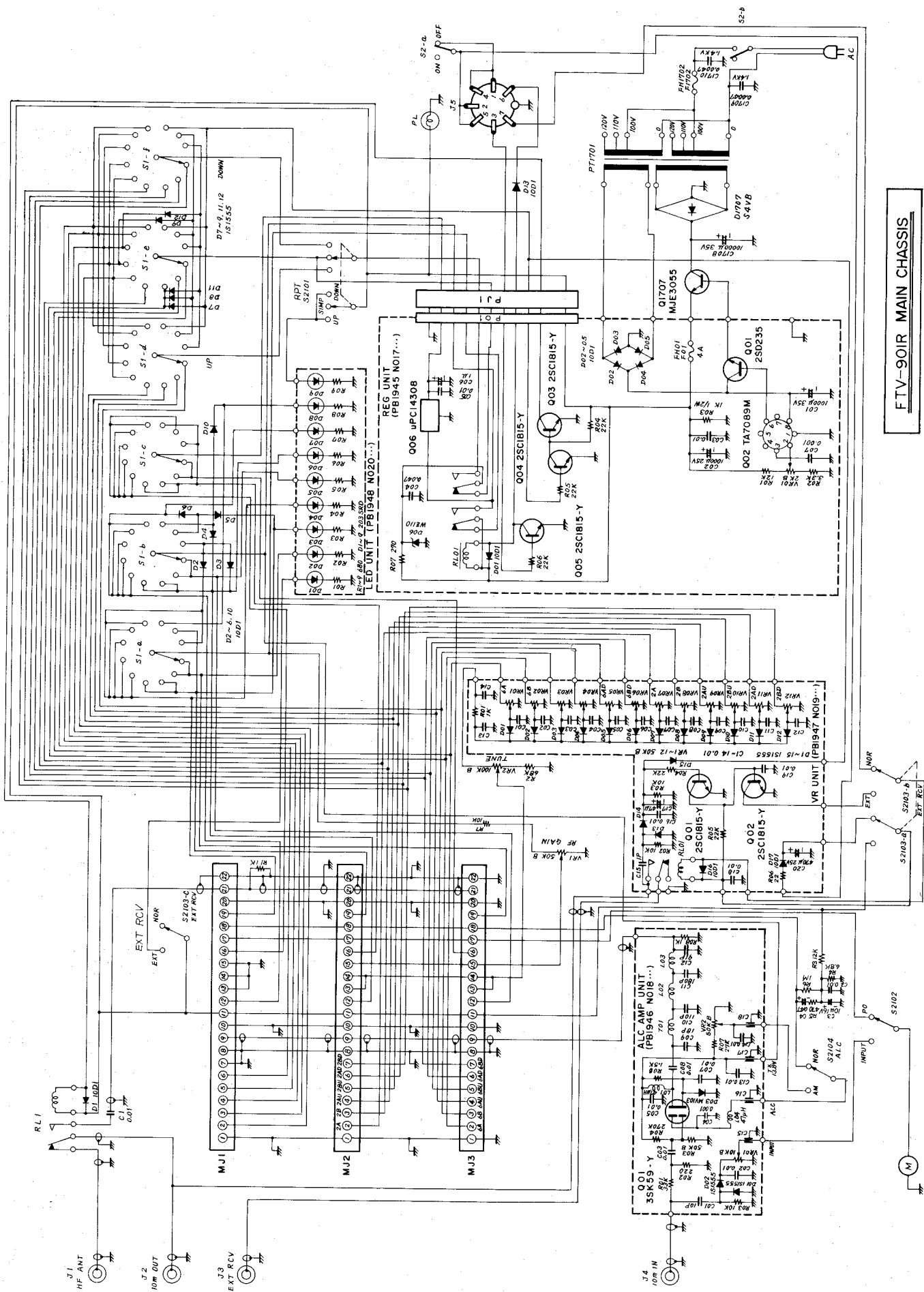
☆ FUNDAMENTAL
▲ THIRD OVERTONE

BAND	430MHz				
RANGE	430-432	432-434	434-436	436-438	438-440
LOCAL FREQUENCY	402MHz (×3×2)	404MHz (×3×2)	406MHz (×3×2)	408MHz (×3×2)	410MHz (×3×2)
OSC. FREQUENCY	67.000 MHz ▲	67.333..MHz ▲	67.666..MHz ▲	68.000 MHz ▲	68.333..MHz ▲

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-901R MAIN CHASSIS

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.

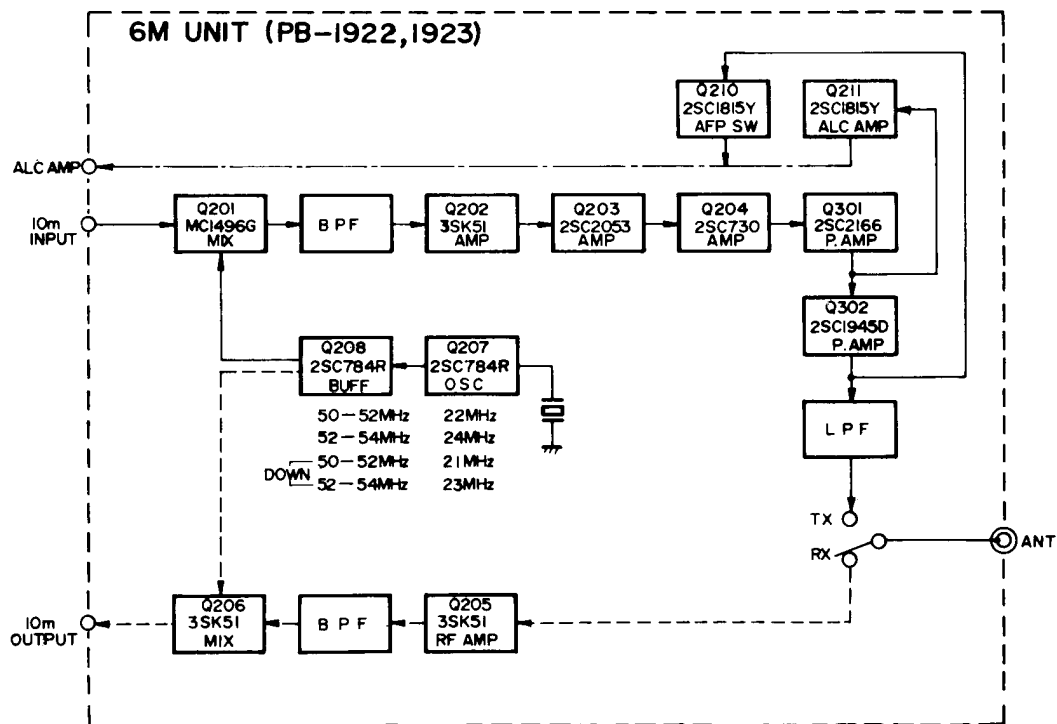
The local signal is generated by crystal oscillator Q₂₀₇ (2SC784R), and amplified by Q₂₀₈ (2SC784R). For repeater operation, the local signal is shifted up or down 1 MHz, according to the position of the front panel RPT switch.

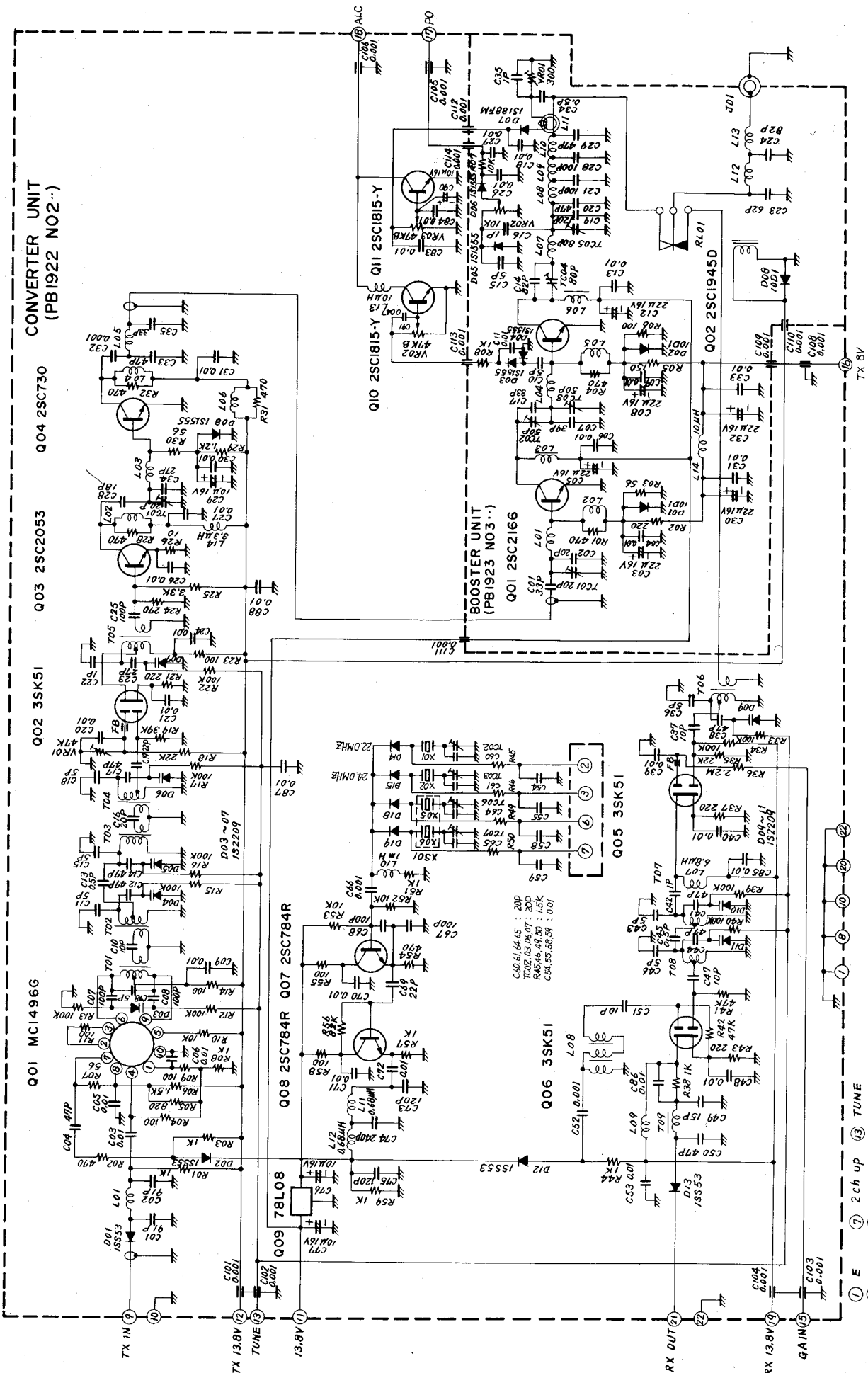
For transmission, the 28–30 MHz output signal from the transceiver is fed to the balanced mixer,

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.





6M UNIT CIRCUIT DIAGRAM

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

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.

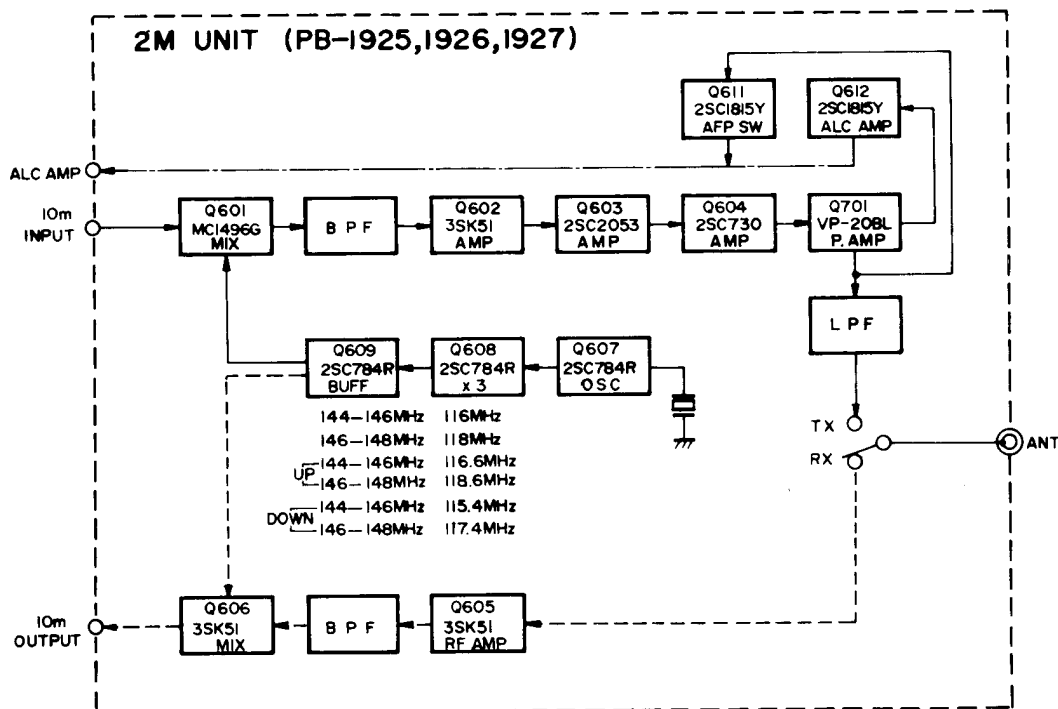
The local signal is generated at 38.666 MHz by Q₆₀₇ (2SC784R), then delivered to tripler Q₆₀₈ (2SC784R), then delivered through buffer Q₆₀₉ (2SC784R) to gate 2 of Q₆₀₆. For repeater operation, the local signal is shifted up or down 600 kHz, depending on the position of the front panel RPT switch.

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
(PBI925 NO6..)

Q04 2SC730

Q03 2SC2053

Q02 3SK51

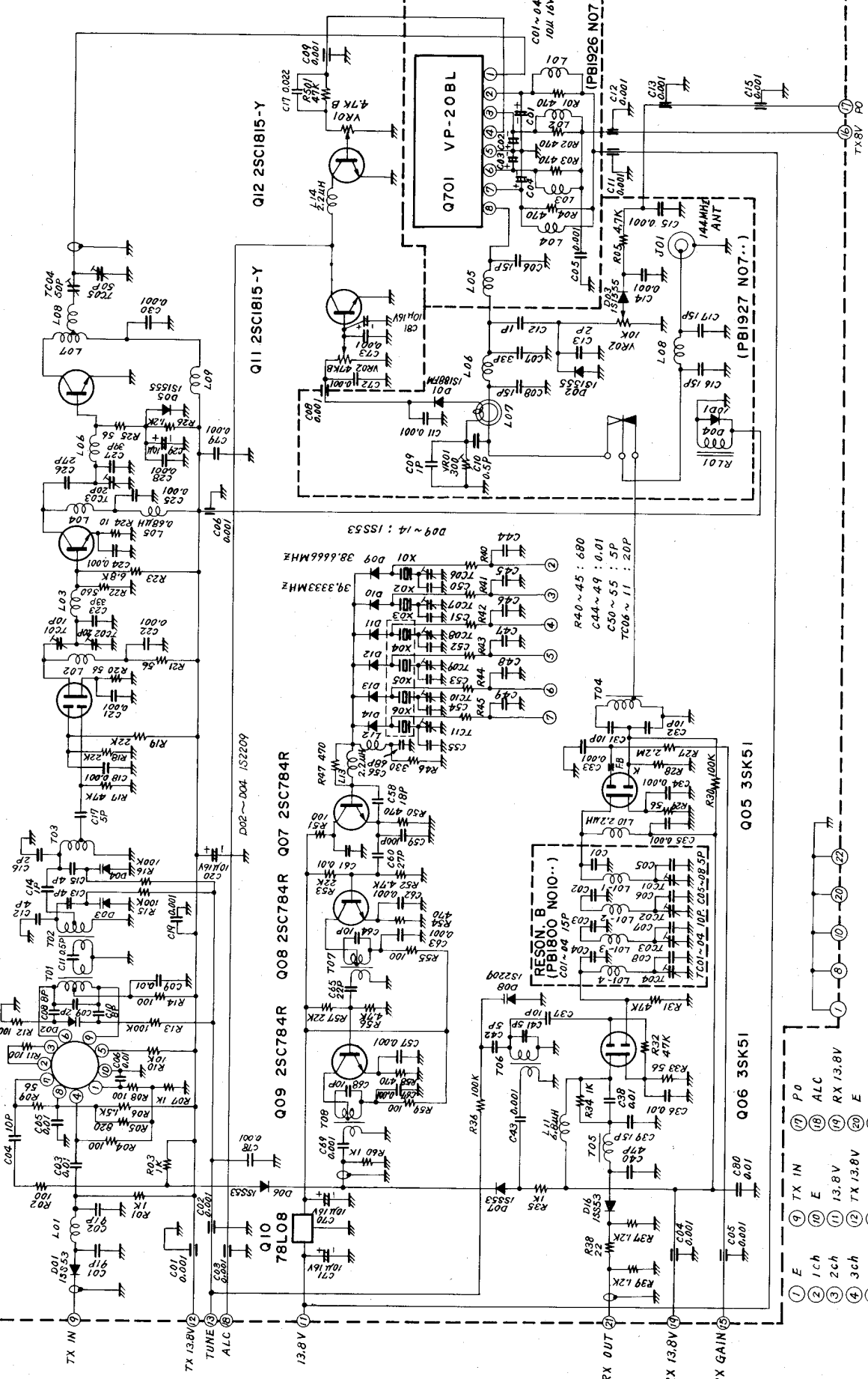
Q01 MC1496G

Q09 2SC784R

Q08 2SC784R

Q07 2SC784R

Q10 78L08



2M UNIT CIRCUIT DIAGRAM

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

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.

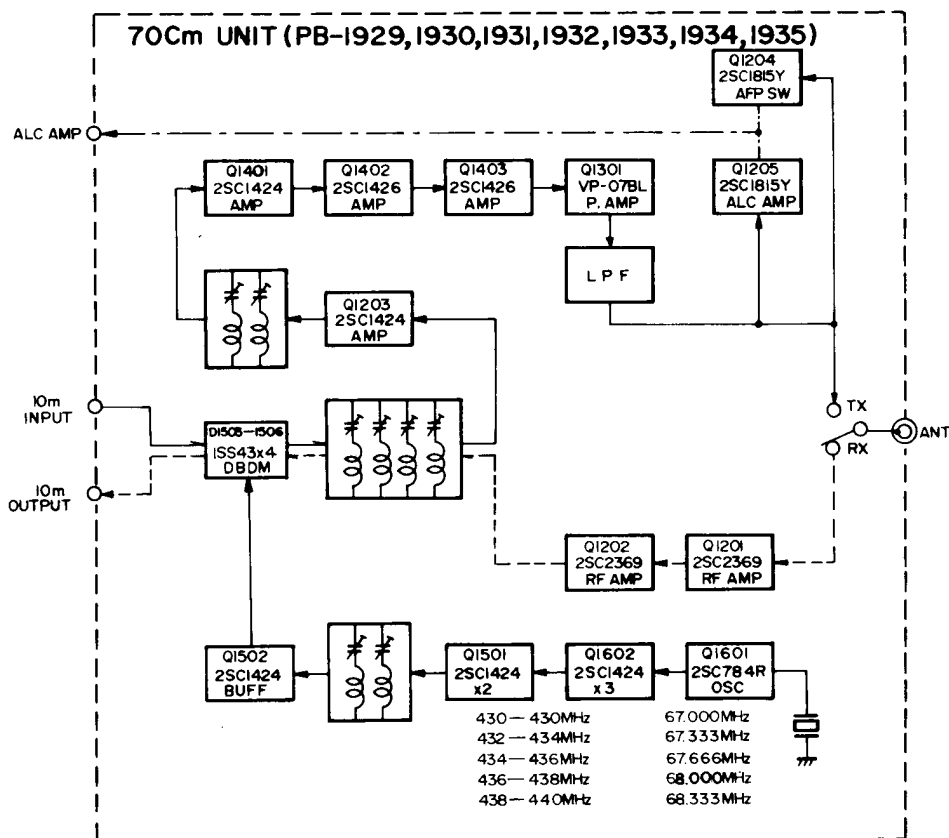
The local signal is generated at 67-68 MHz by oscillator Q₁₆₀₁ (2SC784R), then multiplied by Q₁₆₀₂ and Q₁₅₀₁ (2SC1424). The local signal at 402-410 MHz is then passed through a selective filter to buffer Q₁₅₀₂ (2SC1424), for delivery to the mixer.

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 (VP-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).



ALC CIRCUIT

The 28 MHz input signal from the transceiver is fed to the ALC AMP unit, where it is amplified by Q_{1801} (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 Q_{1801} . 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 D_{1801} and D_{1802} (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, RL_1 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 Q_{1703} (2SC1815Y) turning it on. With the conduction of Q_{1703} , RL_1 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, RL_{1901} switches the external receiver to the HF antenna on receive.

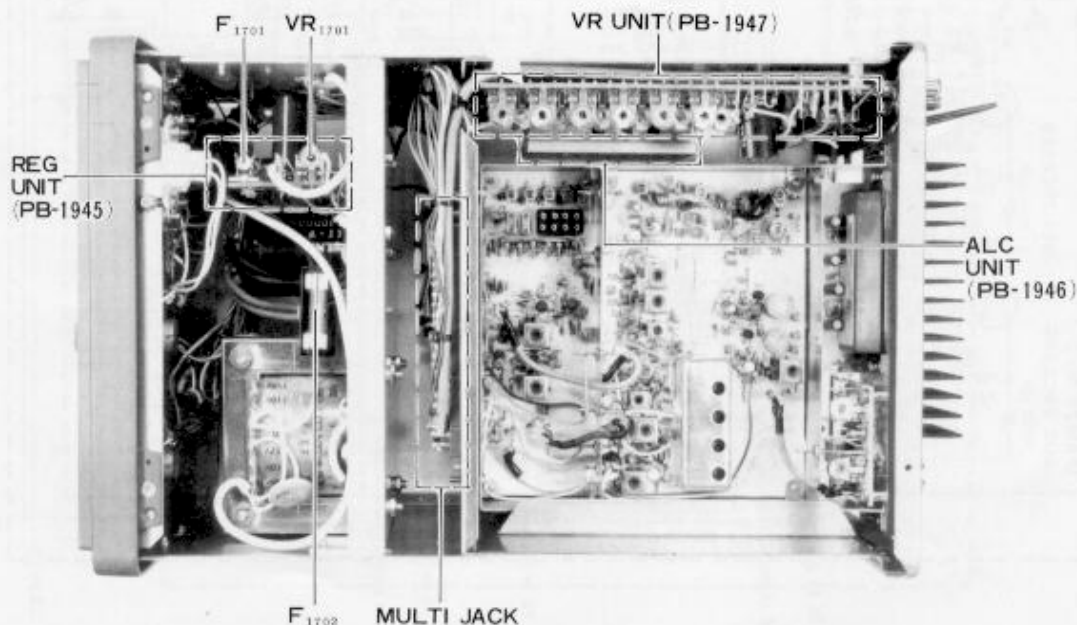
When the heater switch is turned off, Q_{1902} (2SC1815Y) is switched on, switching the EXT RCV jack to be in parallel with the HF ANT jack, allowing monitoring on the external receiver. If the external receiver is not normally used for monitoring, the heater switch should always be left on.

POWER SUPPLY

The AC voltage from the power transformer is rectified by bridge rectifier, and stabilized at 13.8 volts by Q_{1707} (MJE3055), Q_{1701} (2SD235), and Q_{1702} (TA7089M). This voltage is used for the LED UNIT, pilot lamps, and the three converter units.

D_{1706} (WZ110) provides 11 volts for the local oscillator diode switch circuits, while Q_{1706} (μ PC14308) regulates the 13.8 volt line from RL_{1701} for the low voltage circuits.

On the VR UNIT, diode switches D_{1901} – D_{1912} (1S1555) select voltage regulating potentiometers VR_{1901} – VR_{1912} , 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 FT-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.

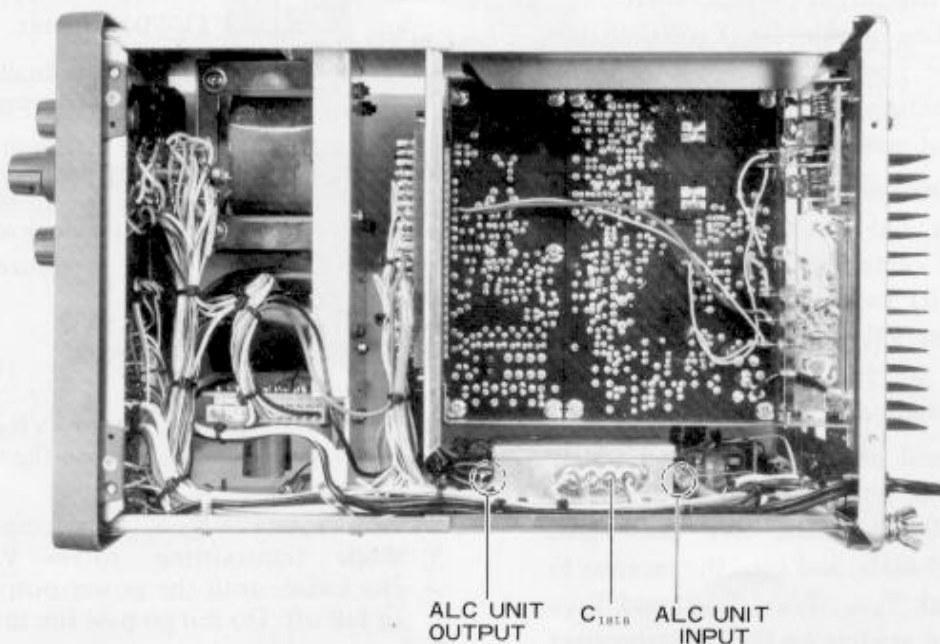
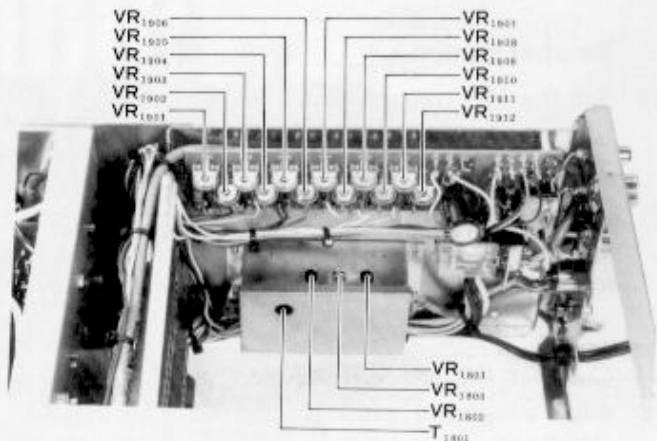
For alignment purposes, a VTVM with RF probe good to 450 MHz is required. Also, a signal generator good to 450 MHz, and a frequency counter good to 250 MHz are required. A dummy load and wattmeter good to 450 MHz are also required.

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. Switch to 52–54 MHz, and adjust VR₁₉₀₂ 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 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

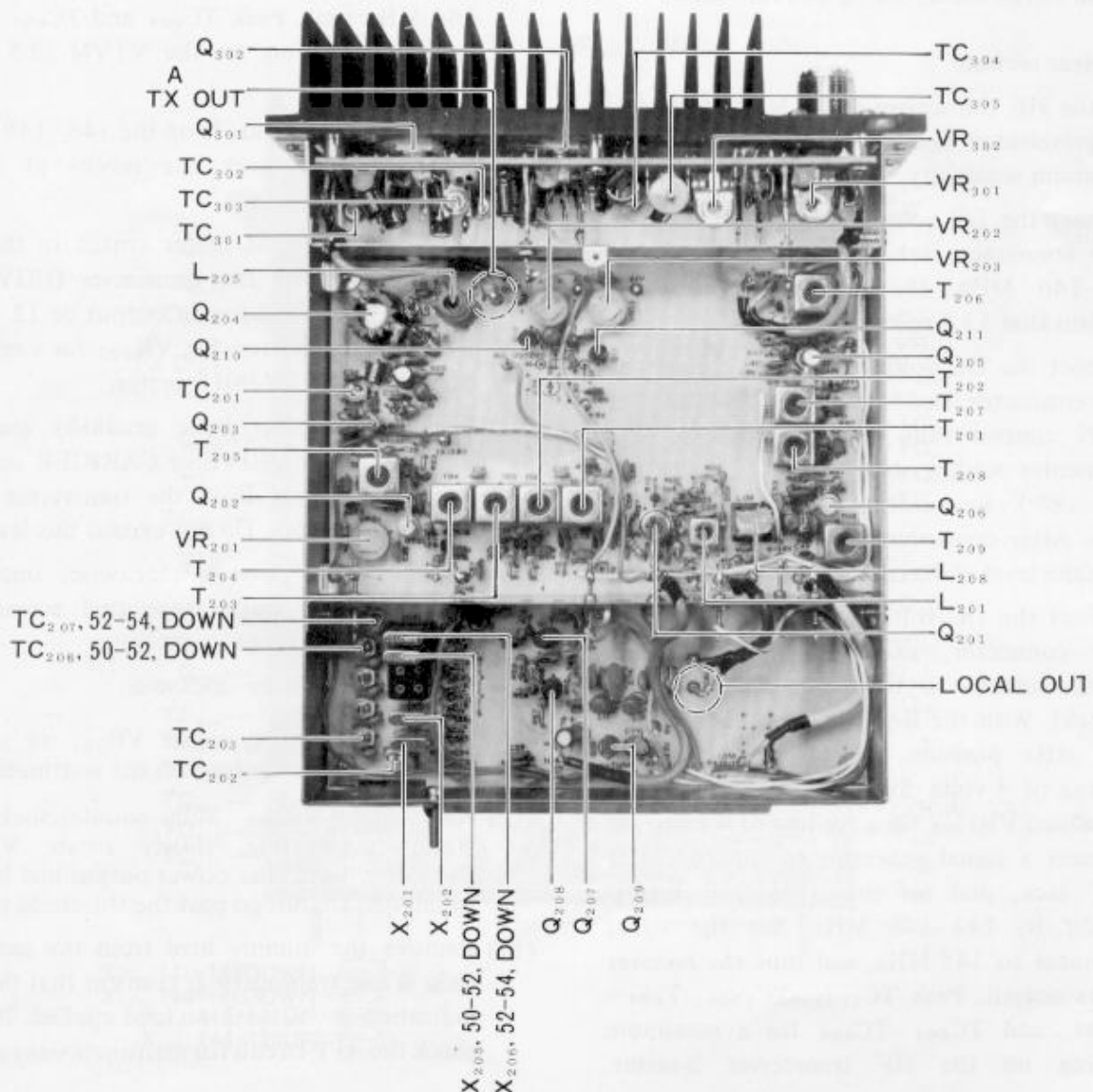
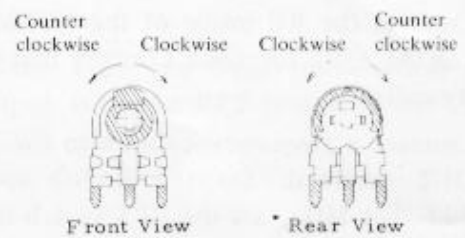
- (1) Connect a dummy load/wattmeter to the 50 MHz ANT jack. Set VR₂₀₂ and VR₂₀₃ fully counterclockwise. Set the HF transceiver DRIVE or CARRIER control to the center of its range (12 o'clock). Set the BAND switch to 50–52 MHz.
- (2) Connect the RF probe of the VTVM to the collector of Q₂₀₃. While transmitting, 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 ₁₀₀₅	MAXIMUM
52-54	DOWN	VR ₁₀₀₆	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–TC₆₀₆, and TC₆₀₁–TC₆₀₄ 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.

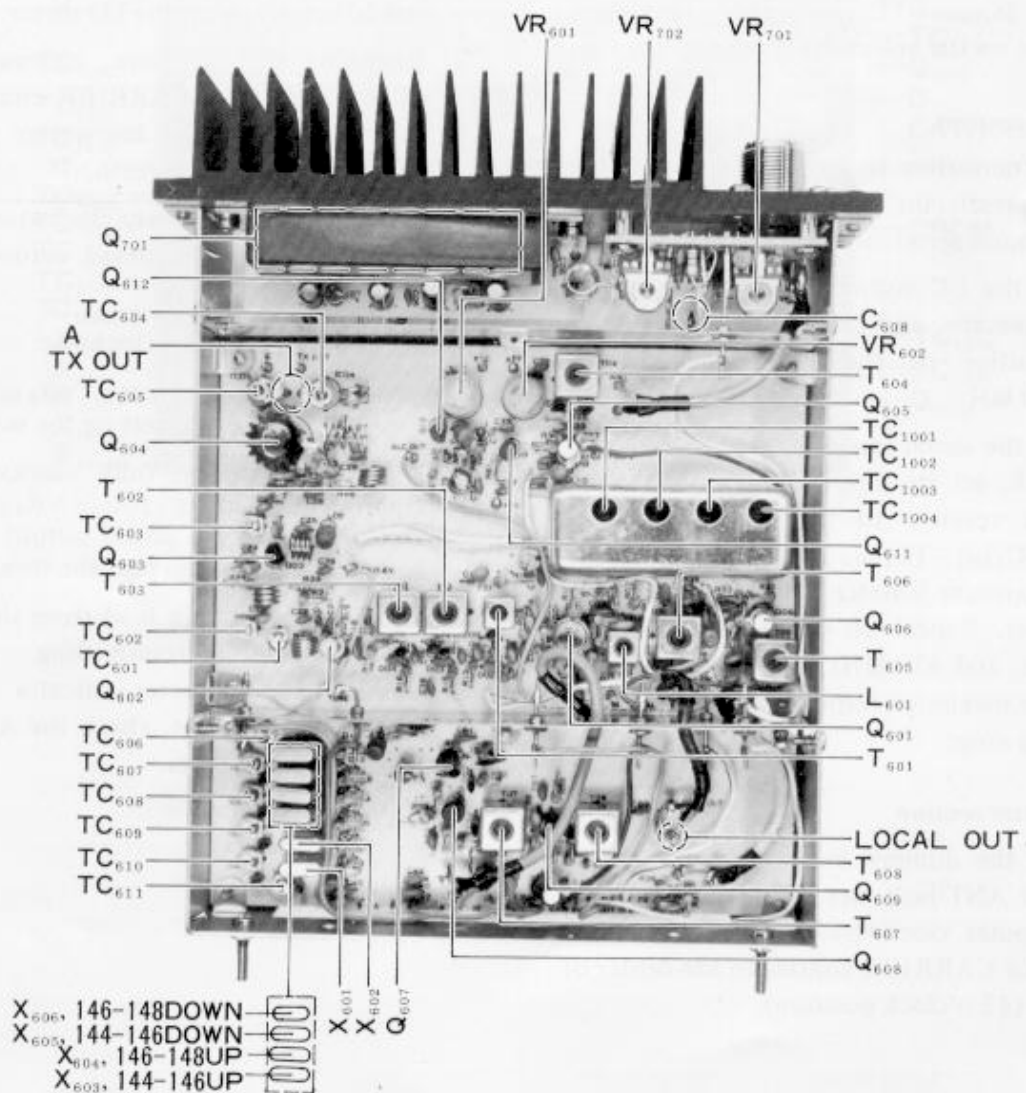
(13) Connect the frequency counter to the LOCAL OUT terminal. Adjust TC₆₀₈-TC₆₁₁ as shown in the chart below.

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 ₁₀₀₉	MAXIMUM OUTPUT
	DOWN	VR ₁₀₁₁	
146-148	UP	VR ₁₀₁₀	MAXIMUM OUTPUT
	DOWN	VR ₁₀₁₂	

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



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

2. Receiver section

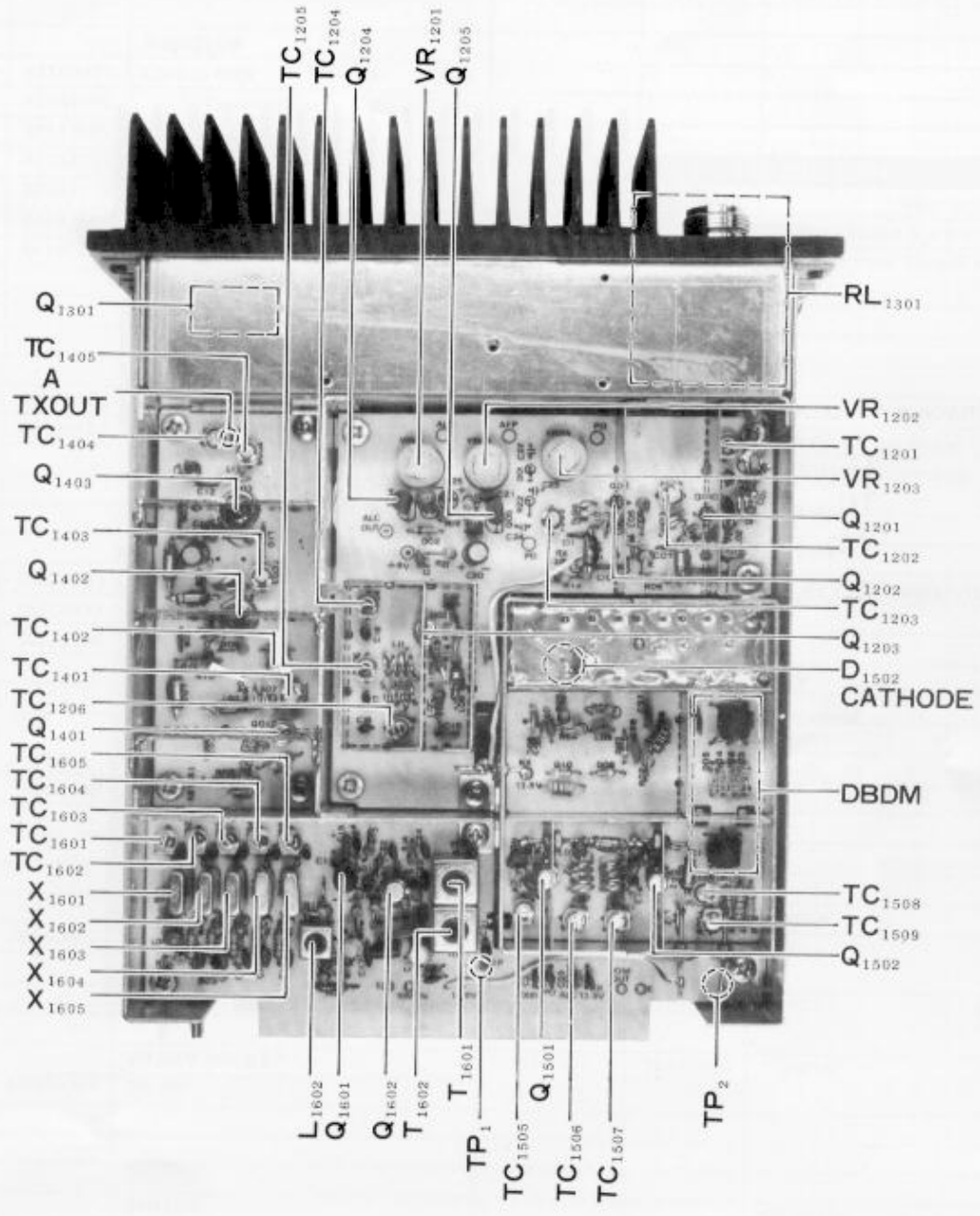
- (1) Set the transceiver to 29 MHz, and peak the receiver preselector against the marker signal for maximum sensitivity.
- (2) Connect the DC voltmeter to pin 19 of the edge connector, and check for 13.8 volts at each position of the BAND switch over 430–440 MHz.
- (3) Connect the signal generator to 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.

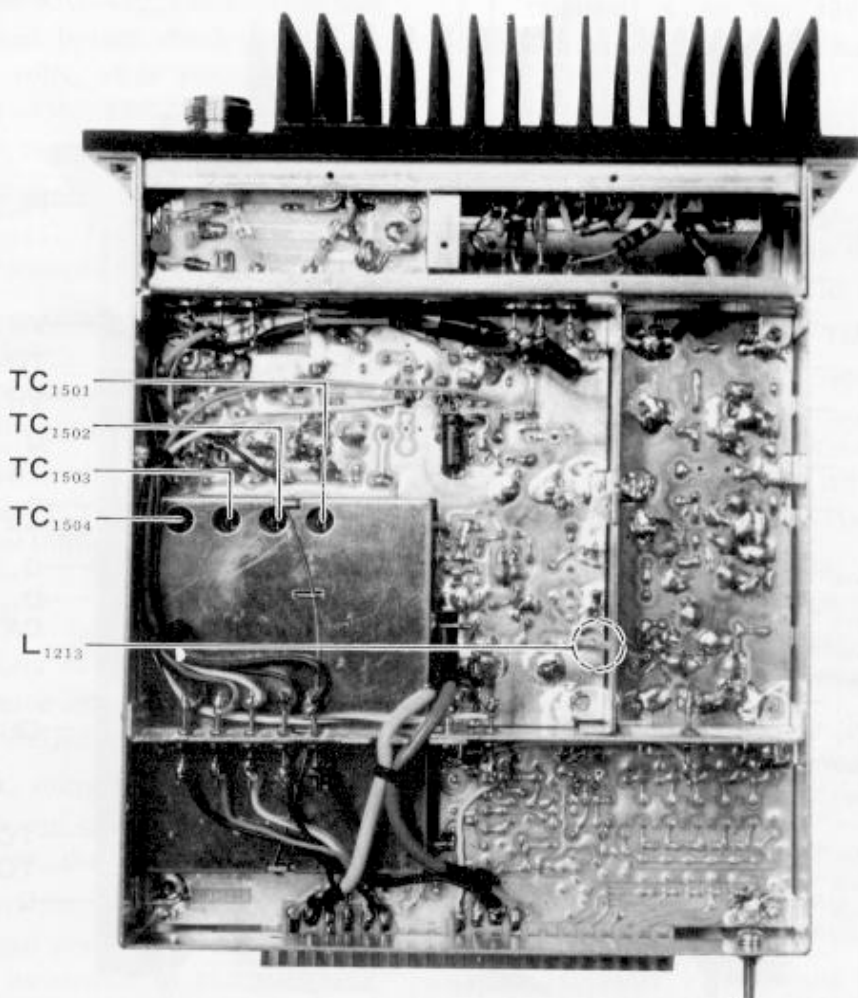
3. Transmitter section

- (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.

RTY-015 PARTS LIST





		DIODE				CAPACITOR				
D601,606,607, 609-614,616	21090113	Silicon		1S553	C614	31829059	Ceramic Disc	50WV	SL	0.5 pF
					C609, 616	31820020	"	"	CH	2 pF
D605	21015550	"		1S1555	C612	31820040	"	"	"	4 pF
D602-604,608	21022090	Varactor		1S2209	C613, 615	31827040	"	"	UJ	4 pF
					C611, 617	31829050	"	"	SL	5 pF
					C641,650-655	31820050	"	"	CH	5 pF
					C642	31827050	"	"	UJ	5 pF
		CRYSTAL			C608, 610	31827080	"	"	"	8 pF
X601	71800144	HC-18/U		38.6666 MHz	C604, 637	31829100	"	"	SL	10 pF
X602	71800145	"		39.3333 MHz	C631,632,664, 668	31820100	"	"	CH	10 pF
X603	71500193	HC-25/U		38.8666 MHz						
X604	71500194	"		39.5333 MHz	C639	31829150	"	"	SL	15 pF
X605	71500195	"		38.4666 MHz	C658	31820180	"	"	CH	18 pF
X606	71500196	"		39.1333 MHz	C665	31829220	"	"	SL	22 pF
					C626	31829270	"	"	"	27 pF
					C660	31820270	"	"	CH	27 pF
					C623	31829330	"	"	SL	33 pF
		CRYSTAL SOCKET			C627	31829390	"	"	"	39 pF
XS601	69010013	S-14-4P			C640	31829470	"	"	"	47 pF
					C656	31820680	"	"	CH	68 pF
					C601, 602	31829910	"	"	SL	91 pF
					C685	31829101	"	"	"	100 pF
		RESISTOR			C659	31820101	"	"	CH	100 pF
R624	40143100	Carbon Film	1/4S	VJ 10 Ω	C607,618,619, 621,622,624, 625,628,630, 633-635,643, 657,662,663, 667,669,672, 673,678,679	30820102	"	"	"	0.001 μF
R638	40143220	"	"	" 22 Ω						
R609,620,621, 625,633	40143560	"	"	" 56 Ω						
R604,608,611, 614,651,655, 659	40143101	"	"	" 100 Ω						
R629	40143221	"	"	" 220 Ω	C605,606,636, 638,644-649, 661, 680, 682-684	30820103	"	"	"	0.01 μF
R647 (L613)	42124471	"	Composition	1/2 GK 470 Ω						
R665	41143471	"	Film	1/4S TJ 470 Ω						
R650,654,658	40143471	"	"	" VJ 470 Ω						
R602, 622	40143561	"	"	" 560 Ω	C620,629,670, 671,681	34220106	Electrolytic	16WV	TW	10 μF
R640-645	40143681	"	"	" 680 Ω						
R605	41143821	"	"	" TJ 820 Ω						
R601,603,607, 634,635,660	40143102	"	"	" VJ 1 kΩ						
R626,637,639	40143122	"	"	" 1.2 kΩ						
R606	40143152	"	"	" 1.5 kΩ	TC601	39000010	ECV-1ZW	10 x 53N		10 pF
R652, 656	40143472	"	"	" 4.7 kΩ	TC602, 603, 606-612	39000011	ECV-1ZW	20 x 53N		20 pF
R623	41143682	"	"	" TJ 6.8 kΩ						
R610, 666	40143104	"	"	" VJ 10 kΩ	TC604, 605	39000005	ECV-1ZW	50 x 32N		50 pF
R618,619,628, 653,657	40143223	"	"	" 22 kΩ						
R617,631,632	40143473	"	"	" 47 kΩ						
R612,613,615, 616,630,636	40143104	"	"	" 100 kΩ						
R627	40143225	"	"	" 2.2 MΩ	L605	53020038	Micro Inductor	FL-4H		0.68 μH
R646	40143331	"	"	" 330 Ω	L610,612,614	53020004	"	"	"	2.2 μH
					L611	53020006	"	"	"	6.8 μH
					L606, 608	55003090	"	"	"	#220193
					L602	55003092	"	"	"	#220195
		POTENTIOMETER			L603,604,609	55003093	"	"	"	#220196
VR601	49905472	SR19RS		4.7 kΩB	L613	55003120	"	"	"	#220206
VR602	49905473	SR19RS		47 kΩB	L607	55003294	"	"	"	#220380
					L601	5503371	"	"	"	#220535

		TRANSFORMER		C710, 712	31829010	Ceramic Disc	50WV	SL	1 pF
T604	54140910	R12-4091	#220105	C713	31829020	" "	" "	" "	2 pF
T602, 603, 606-608	54141020	R12-4102	#220111	C708,716,717	31829150	" "	" "	" "	15 pF
				C706	31829200	" "	" "	" "	20 pF
T605	54141800	R12-4180	#220166	C707	31829330	" "	" "	" "	33 pF
T601	55003378		#220536	C705,711,714, 715	30820102	" "	" "	" "	0.001 μ F
				C701-704	34220106	Electrolytic	16WV	TW	10 μ F
		HEAT SINK							
	95000004	TO-5, L = 15 mm							
						INDUCTOR			
				L707	55003380				#220069
				L701, 704	55003262				#220324
		FERRITE BEADS		L706, 708	55003306				#220430
	56000024	Ri 3 x 3-1		L702, 703					#220469
				L705					L0020654
	91100008	Wrapping Terminal C							
						RELAY			
				RL701	70000035	FBR-221D012			
***** 144 MHz BOOSTER BOARD *****									
PB-1926	60419260 019260AZ	Printed Circuit Board PCB with Components							
PB-1927	60419270 019270AZ	Printed Circuit Board PCB with Components				RECEPTACLE			
				J701	68000003	SO-239			
							91100008	Wrapping Terminal C	
		POWER MODULE							
Q701	78000002		VP-20BL						
***** RESONATOR BOARD *****									
				PB-1800	60418000 018000AZ	Printed Circuit Board PCB with Components			
D704	21090011	Silicon	10D1						
D701	21001880	Germanium	1S188FM						
D702, 703	21015550	Silicon	1S1555						
						CAPACITOR			
				C1005-1008	31820050	Ceramic Disc	50WV	CH	5 pF
				C1001-1004	31820150	" "	" "	" "	15 pF
		RESISTOR							
R705	40143472	Carbon Film	1/4S VJ 4.7 k Ω			TRIMMER CAPACITOR			
R706	40143473	" "	" " 47 k Ω	T1001-1004	39000010	ECV-1ZW 10x53N			10 pF
R701 (L702), 704 (L704)	42124471	Carbon Composition	1/2 GK 470 Ω			INDUCTOR			
R702 (L702), 703 (L703)	42144471	" "	1/4 " 470 Ω	L1001	55003381				#220252
							80044942	Resonator Case	
		POTENTIOMETER					91100008	Wrapping Terminal C	
VR701	49906301	EVL-SOAA00B32	300 Ω B						
VR702	49906103	EVL-SOAA00B14	10 k Ω B						
		CAPACITOR							
	31829059	Ceramic Disc	50WV SL 0.5 pF						

R1804	40143274	Carbon Film 1/4 VJ 270 kΩ			
					RESISTOR
		POTENTIOMETER	R1906	40143220	Carbon Film 1/4 VJ 22 Ω
VR1801	49906103	EVL-S0AA00B14 10 kΩB	R1901	40143102	" " " " 1 kΩ
VR1802, 1803	49906503	EVL-S0AA00B54 50 kΩB	R1902, 1903	40143103	" " " " 10 kΩ
			R1904, 1905	40143223	" " " " 22 kΩ
		CAPACITOR			
C1801, 1809	31829100	Ceramic Disc 50WV SL 10 pF			POTENTIOMETER
C1812	31829910	" " " " 91 pF	VR1901-1912	49906503	EVL-S0AA00B54 50 kΩB
C1810	31829111	" " " " 110 pF			
C1811	31829181	" " " " 180 pF			
C1815-1818	32821102	Ceramic Feed Thru ECK-Y1H102WE			
C1804	30830102	Ceramic Disc 50WV 0.001 μF			CAPACITOR
C1802, 1803, 1805, 1807, 1808, 1814	30820103	" " " 0.01 μF	C1915	31829010	Ceramic Disc 50WV SL 1 pF
			C1901-1914, 1916, 1918, 1919	30820103	" " " 0.01 μF
			C1917	34220476	Electrolytic 16WV TW 47 μF
			C1920	34320477	" 25WV TW 470 μF
		INDUCTOR			
L1801, 1804		Micro Inductor FL-5H 47 μH			
L1802, 1803	55003371	#220535			
					RELAY
			RL1901	70000031	FBR211D012
		TRANSFORMER			
T1801	52000047	R12-4434 #220180		91100008	Wrapping Terminal C
		HERMETIC SEAL			LED UNIT
	91001102	A-102	Symbol No.	Parts No.	Description
			PB-1948	60419480	Printed Circuit Board
				019480AZ	PCB with Components
	91100008	Wrapping Terminal C			
					LED
			Q2001-2009	20900140	GD4-203SRD
		VR UNIT			
Symbol No.	Parts No.	Description			
PB-1947	60419470	Printed Circuit Board			RESISTOR
	019470AZ	PCB with Components	R2001-2009	41143681	Carbon Film 1/4 TJ 680 Ω
		TRANSISTOR			
Q1901, 1902	22318154	2SC1815Y			
		DIODE			
D1901-1915	21015550	Silicon 1S1555			
D1916, 1917	21090011	" 10D1			

