

# YAESU FTV-107R VHF/UHF TRANSVERTER



## GENERAL

The FTV-107R is an all-new transverter for the FT-107M series, capable of operation on the 50, 144, and 430 MHz bands. The basic unit comes equipped with all control circuitry, and the 430 MHz and either the 50 MHz or 144 MHz unit may be installed as options. Power input is 20 watts DC on all 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-107M. The operator may transmit on 145 MHz while listening on 29 MHz or 435 MHz, or transmit on 435 MHz while listening on 145 MHz.

The FTV-107R includes repeater split on all repeater bands within its operating range, for operation on the many SSB repeaters that are emerging. Fully solid state, the FTV-107R 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-107R. With proper care in operation, this equipment will provide many years of trouble-free operation.

## SPECIFICATIONS

### TRANSMITTER:

**Input frequency:**

28 MHz to 30 MHz

**Input level:**

0.22 volts (rms) max.

**Input impedance:**

50 ohms

**Power input:**

20 watts DC (SSB, CW, FSK)

5 watts DC (AM)

**Transmit frequency range:**

50 MHz to 54 MHz\*

144 MHz to 148 MHz\*

430 MHz to 440 MHz\*

**Output impedance:**

50 ohms

**Spurious radiation:**

Better than 60 dB down

### RECEIVER:

**Receiver frequency range:**

50 MHz to 54 MHz\*

144 MHz to 148 MHz\*

430 MHz to 440 MHz\*

**Antenna input impedance:**

50 ohms

**Sensitivity:**

0.25  $\mu$ V for S/N 10 dB (SSB, CW, FSK)\*\*

1.0  $\mu$ V for S/N 10 dB (AM)\*\*

**Output frequency range:**

28 MHz to 30 MHz

**Output impedance:**

50 ohms

### POWER SUPPLY:

**Current consumption:**

3.5 amps

### GENERAL:

**Size:**

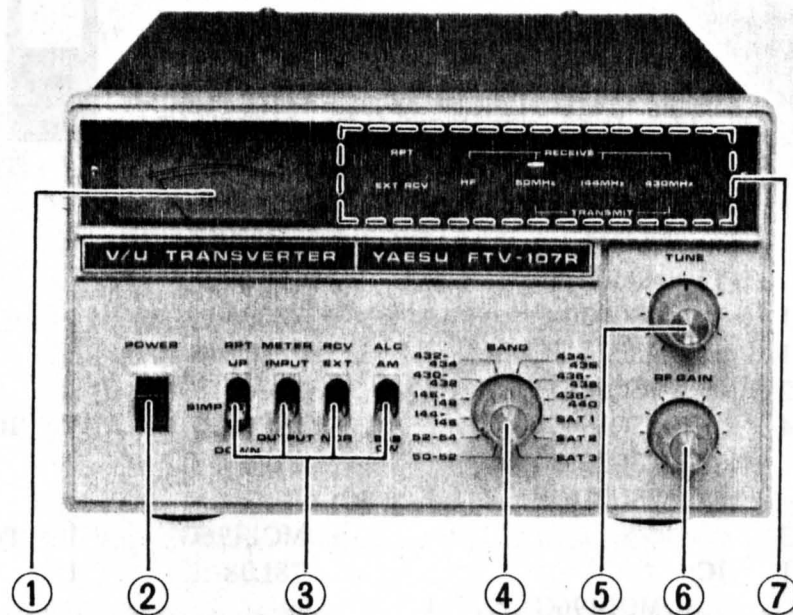
216 (W) x 129 (H) x 370 (D) mm

**Weight:**

4.5 kg. (with 2 units installed)

\*50, 144, 430 MHz units optional. 430 MHz and 50 MHz or 144 MHz units may be installed. 50 MHz and 144 MHz units may not be installed together in FTV-107R.

\*\*When used with FT-107M.



### (1) METER

According to the position of the METER switch, the front panel meter displays either the input or output relative power level.

### (2) POWER

This is the main power ON/OFF switch. When the switch is set to OFF, the HF antenna is automatically fed through to the transceiver.

### (3) FUNCTION SWITCHES

SHIFT—This switch selects UP or DOWN repeater shift, or simplex operation. See the “OPERATION” section for details.

METER—The METER switch selects indication of the relative input or output power level on the front panel meter.

RCV—This switch allows selection of receive operation using the FT-107M transceiver (NOR) or an external receiver (EXT) (for satellite work, etc.).

ALC—This switch selects the proper ALC action for the mode in use. For SSB and CW, use the lower position, and for AM use the upper position.

### (4) BAND

For six or two meter operation, two bands are provided. These allow 4 MHz of coverage in conjunction with the four 500 kHz ranges of the FT-107M 10 meter band. For 430 MHz operation,

5 bands are provided, allowing operation on 10 MHz of the band (430–440 MHz).

The SAT. 1 band is used for OSCAR Mode A, with TX on 145 MHz, and RX on 29 MHz. The SAT. 2 band is used for OSCAR Mode B, with TX on 435 MHz and RX on 145 MHz. The SAT. 3 band is for OSCAR Mode J, with TX on 145 MHz and RX on 435 MHz.

### (5) TUNE

For 50 or 144 MHz operation, this control peaks the transmit and receive circuits for maximum performance. On 430 MHz, the tuned circuits of the transverter are preset, and no tuning is required.

### (6) RF GAIN

For 50 or 144 MHz operation, this control varies the gain of the RF amplifier stage.

### (7) INDICATORS

These lamps indicate the band and mode of operation, in conjunction with the selection performed by the front panel switches.

# SEMICONDUCTORS

MAIN CHASSIS:	50MHz UNIT	144MHz UNIT	435MHz UNIT
<b>FET:</b>	<b>FET:</b>	<b>FET:</b>	<b>Transistor:</b>
3SK59Y 1	3SK51-03 3	3SK51-03 3	2SC784R 1
			2SC1424 5
<b>Transistor:</b>	<b>Transistor:</b>	<b>Transistor:</b>	2SC1426 1
2SA733 1	2SC730 1	2SC730 1	2SC1815Y 2
2SC380TMY 1	2SC784R 2	2SC784R 3	2SC2369 2
2SC945P 2	2SC1815Y 2	2SC1815Y 2	
2SC1815Y 4	2SC1945D 1	2SC2053 1	<b>IC:</b>
	2SC2053 1		78L08 1
<b>IC:</b>	2SC2166 1	<b>IC:</b>	
MC14016BP 3		MC1496G 1	<b>Power module:</b>
μPC14308 1	<b>IC:</b>	78L08 1	UP-07BL 1
	MC1496G 1		
<b>Germanium diode:</b>	78L08 1	<b>Power module:</b>	<b>Germanium diode:</b>
1S188FM 2		VP-20BL 1	1S188FM 4
	<b>Germanium diode:</b>		
<b>Silicon diode:</b>	1S188FM 1	<b>Germanium diode:</b>	<b>Silicon diode:</b>
10D1 10		1S188FM 1	1S1555 2
1S1555 18	<b>Silicon diode:</b>		M1301 3
	1S1556 12	<b>Silicon diode:</b>	1SS53 10
<b>Varistor diode:</b>	1SS53 4	1S1555 3	10D1 1
MV103 1	10D1 3	1SS53 11	
		10D1 1	<b>Schottky barrier diode:</b>
<b>Zener diode:</b>	<b>Varactor diode:</b>	<b>Varactor diode:</b>	1SS97 4
WZ090 1	1S2209 8	1S2209 4	
<b>LED:</b>			
LN224RP 9			

Specifications subject to change without notice.

## ACCESSORIES

The following accessories are included with your FTV-107R:

Cable "A"	1 pc.
Cable "B"	1 pc.
Cable "C"	1 pc.
Ground Cable "D"	1 pc.
RCA Plug	1 pc.
DC Fuse (5A)	2 pcs.
Extender Feet	2 pcs.
Extender Foot Pads	2 pcs.

## BOTTOM PANEL FEET

The feet on the bottom panel may be changed, if it is desired to change the viewing angle for the FTV-107R. In the accessory kit for your FTV-107R, there are two extender feet with mounting pads. These may be installed either in front or in back, according to the requirements of your station. Refer to Figure 1 for mounting details.

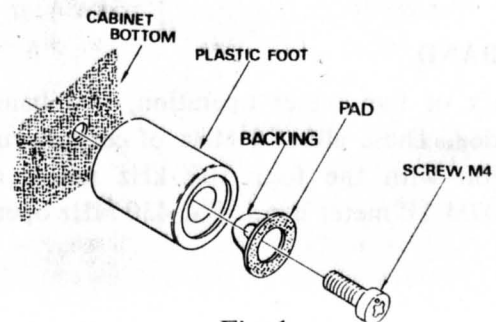
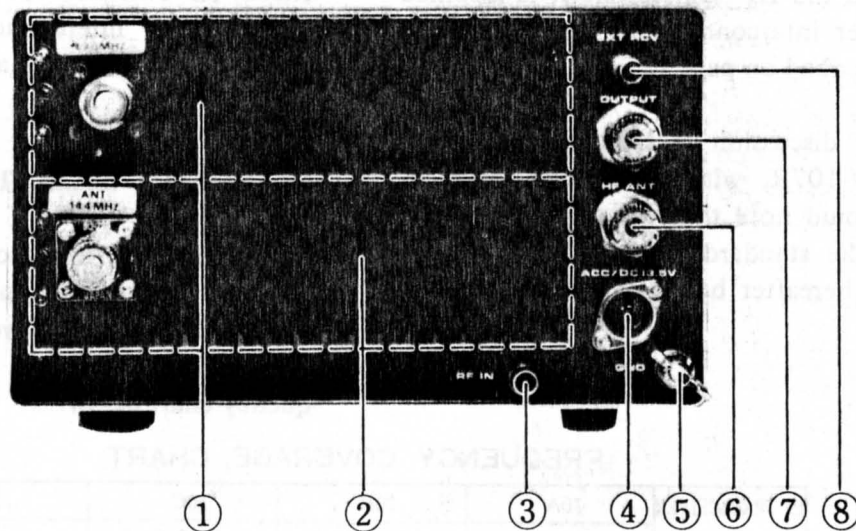


Fig. 1

## REAR APRON



### (1) 430 MHz UNIT (OPTION)

When the optional 430 MHz unit is obtained, it must be installed in the upper rack of the FTV-107R.

### (2) 50/144 MHz UNIT (OPTION)

The bottom rack is for installation of either the 50 MHz Unit or the 144 MHz Unit. The 50 MHz Unit and the 144 MHz Unit cannot both be installed in the same FTV-107R.

### (3) RF IN

This RCA jack is for connection to the FT-107R RF OUT jack. Use the supplied "Cable A" for this connection.

### (4) ACC/DC 13.5V

This jack is for connection to the FT-107M ACC 2 jack. Use the supplied "Cable C" for this connection.

### (5) GND

Connect a good earth ground to this terminal, using a heavy braided cable for connection to the station ground buss.

### (6) HF ANT

Connect your HF antenna to this jack. When using a linear amplifier for the HF bands, connect a coaxial cable between this jack and the amplifier RF input jack. The switching circuitry is not

designed to handle the high power output from an amplifier.

### (7) OUTPUT

This jack should be connected to the FT-107M ANT jack. When the transverter is turned off, the transceiver output will be fed through to the HF antenna.

### (8) EXT RCV

This RCA jack is for connection to the antenna connector of an external receiver. When the RCV switch is set to EXT, the 28–30 MHz output from the receive converters will be fed through to the external receiver, allowing full duplex operation for satellite work.

The tuning procedure for the FTV-107R is not complicated. However, care should be observed in operation, so as not to exceed the ratings of the transverter and the 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-107R, with both units installed. The reader should note that the plug-in units are optional on the standard FTV-107R. The word "option" will hereafter be omitted in the interest of brevity.

**INITIAL CHECK**

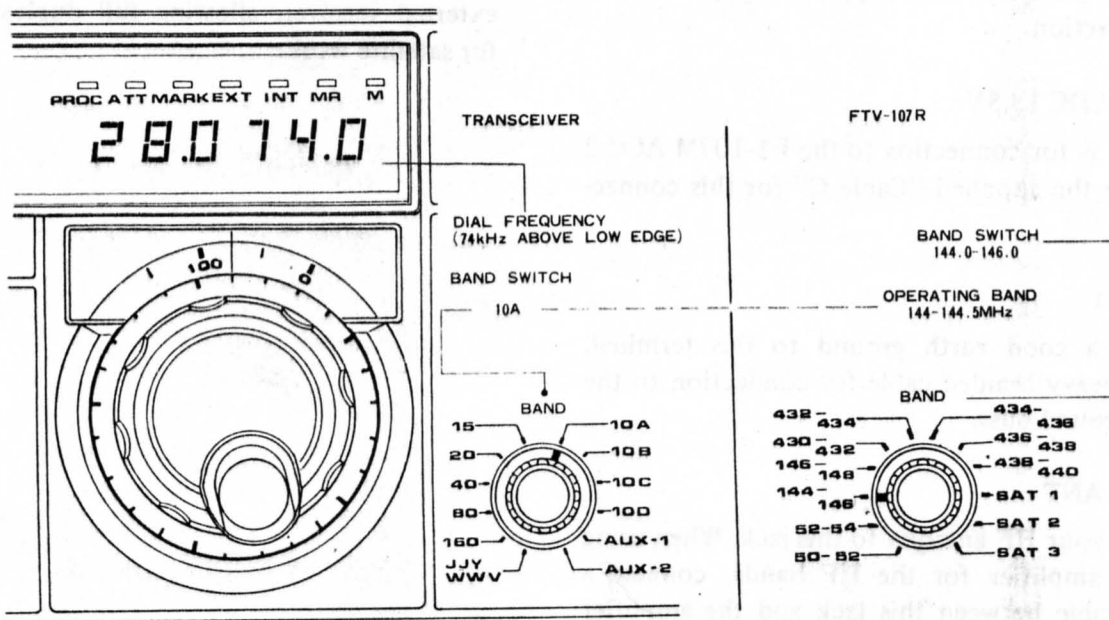
Before turning the FTV-107R and FT-107M on, check all switches for normal, smooth action. Recheck the interconnections between the HF equipment, the antenna system, and the transverter.

**FREQUENCY SELECTION**

The operating frequency is determined by the position of the main tuning dial and bandswitch of the transceiver, as well as the position of the transverter bandswitch. 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-107R 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	USB
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	



OPERATING FREQUENCY = 144.0MHz + 074kHz = 144.074MHz

For example, with the FT-107M bandswitch set to 10A, and the FTV-107R bandswitch set to 144–146, operation will take place on 144.0–144.5 MHz. By setting the FT-107M main tuning dial to 28.250 MHz, operation will take place on 144.250 MHz. See the section on satellite operation for frequency determination on the satellite bands.

### NORMAL TUNE UP

- (1) Set the FTV-107R SHIFT switch to SIMP, the RCV switch to NOR, the METER switch to INPUT, the ALC switch to SSB/CW, and the BAND switch to the desired band. Set up the FT-107M for operation on the section of the 10 meter band appropriate for the VHF or UHF frequency to be worked.
- (2) Set the FTV-107R POWER switch to ON.
- (3) Set the transceiver DRIVE control fully counterclockwise, and close the PTT switch. For 50 or 144 MHz operation, apply a key-down signal, and advance the transceiver DRIVE control until the input meter needle reaches the right-hand side of the input scale (the input scale is the lowermost range on the meter). Now set the FTV-107R METER switch to OUTPUT, and rotate the TUNE control for maximum power output as indicated on the transverter meter.
- (4) For 430 MHz operation, there is no peaking procedure for the transverter. The only adjustment that must be made is to set the input level to the transverter. As with 50 or 144 MHz operation, the drive level should be adjusted so that the meter needle rests within the input scale on the meter.
- (5) For CW operation, set the ALC switch to SSB/CW. Do not advance the DRIVE control of the FT-107M so that the input meter needle goes beyond the input scale on the meter.
- (6) For SSB operation, adjust the FT-107M MIC GAIN so that the meter needle stays within the input meter scale on voice peaks.
- (7) For AM operation, set the ALC switch to AM. Set the METER switch to OUTPUT, and

advance the FT-107M DRIVE control until the meter needle reaches 3 on the output scale. Now advance the transceiver MIC GAIN control until the output meter just begins to move on voice peaks.

- (8) Advancement of the drive level beyond that stated above will not increase the power output. However, component life will be shortened drastically if these input levels are exceeded.
- (9) For 50 or 144 MHz operation, rotation of the FTV-107R RF GAIN control will provide adjustment of the receive converter gain level. For 430 MHz operation, this control has no effect, as the converter is always set for maximum gain.

### REPEATER OPERATION

For operation on SSB repeaters, standard repeater shifts are provided on the FTV-107R. Alternatively, when using a transceiver equipped for FM operation, FM repeater operation is possible. Note that the FT-901DM transceiver may not be used directly with the FTV-107M, because the RF OUT jack on the FT-901DM is connected to the control grid of the final amplifier tubes, thus presenting a high impedance at the RF OUT jack. The FTV-107R requires a 50 ohm input from the transceiver.

For 50 MHz, repeater splits of  $\pm 1$  MHz are provided, while on 144 MHz, splits of 600 kHz are provided. For 70 cm, 1.6 MHz down shift will occur 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-107R). The 70 cm repeater shift crystal is an option, available from your Yaesu dealer. The 6 and 2 meter 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-107M transceiver. The FT-107M 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-107R BAND switch to the SAT. 1 position, and set the FT-107M BAND switch to 10D. Tune the transceiver between 29.850 and 28.950 MHz for uplink transmission, and tune the external receiver to 29.4–29.5 MHz for downlink monitoring.

For OSCAR Mode B, the uplink is 432.125–432.175 MHz, and the downlink is 145.975–145.925 MHz. Set the FTV-107R BAND switch to SAT. 2, and set the FT-107M BAND switch to 10A. Tune the transceiver to 28.125–28.175 for uplink transmission, and set the external receiver to 29.975–29.925 MHz for downlink monitoring. 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-107M and the external receiver appropriately.

For OSCAR Mode J operation, the uplink is 145.900–146.000 MHz, while the downlink is 435.100–435.200 MHz. Set the FTV-107R BAND switch to SAT. 3, and set the FT-107M BAND switch to 10D. Tune the FT-107M between 29.900 and 29.999 MHz for uplink transmission, and tune the external receiver between 29.6 and 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. The full duplex feature of the FTV-107R makes this a simple matter.

**Note:** When using an FT-101B/E/F or FR-101 as an external receiver for Mode J operation, a fairly loud spurious signal may be noted at 29.150 MHz on the external receiver. 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 oscillator crystal for this band be changed to 35.12 MHz.

We regret this inconvenience to you. However, the FT-101 and FR-101 series were produced long before OSCAR 8 was conceived. There should be no problem at all when using the FT-901, FT-101Z, or FT-107 series of equipment.

#### **AUXILIARY REPEATER SPLIT INFORMATION**

Should you require a repeater split other than the standard ones included with your FTV-107R, you may install an optional crystal to cover the desired split. See your Yaesu dealer for details.

To align the split frequency, set the RPT split to DWN, and couple a frequency counter lightly to the transmission line (a one-turn loop is usually sufficient). Close the PTT switch, and adjust the trimmer capacitor for the crystal for exactly the correct transmit frequency. Alternatively, the frequency counter may be connected to the LOCAL OUT terminal of the board under test, and the local oscillator frequency may then be read on the counter. The local oscillator chart shown on page 11 will show you how to calculate the frequency.



# CRYSTAL DATA : FTV-107R

FUNCTION		HOLDER	RANGE (MHz)	MODE	LOAD C	EFFECTIVE RESISTANCE	DRIVE LEVEL
50 MHz	X <sub>201</sub>	HC-18/U	22.0	Fundamental	19 pF	15 Ω	2 mW
	X <sub>202</sub>	"	24.0	"	"	"	"
	X <sub>203</sub>	HC-25/U	23.0	"	"	"	"
	X <sub>205</sub>	"	21.0	"	"	"	"
144 MHz	X <sub>601</sub>	HC-18/U	38.666..	3rd overtone	15 pF	25 Ω	"
	X <sub>602</sub>	"	39.333..	"	"	"	"
	X <sub>603</sub>	HC-25/U	38.866..	"	"	"	"
	X <sub>604</sub>	"	39.533..	"	"	"	"
	X <sub>605</sub>	"	38.466..	"	"	"	"
	X <sub>606</sub>	"	39.133..	"	"	"	"
430 MHz	X <sub>1601</sub>	HC-25/U	67.000	"	23.5 pF	40 Ω	0.5 mW
	X <sub>1602</sub>	"	67.333..	"	"	"	"
	X <sub>1603</sub>	"	67.666..	"	"	"	"
	X <sub>1604</sub>	"	68.000	"	"	"	"
	X <sub>1605</sub>	"	68.333..	"	"	"	"
	X <sub>1606</sub> (1.6MHz DOWN)	"	67.400	"	"	"	"
	X <sub>1606</sub> (7.6MHz DOWN)	"	67.066..	"	"	"	"

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 ☆

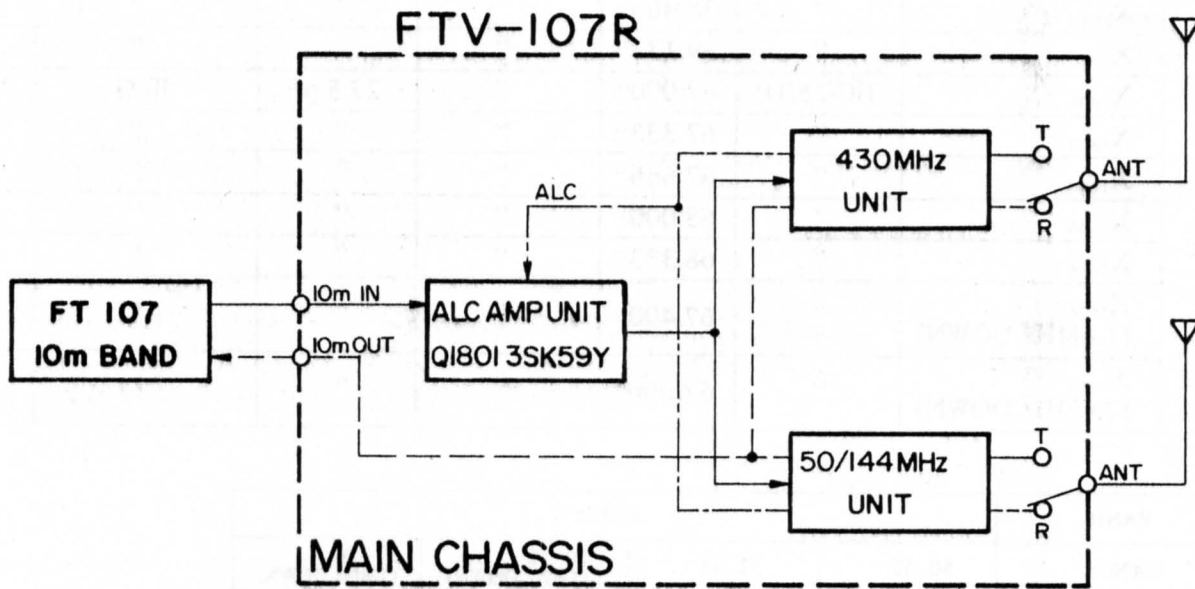
BAND	144MHz					
RANGE	144-146	146-148	144-146 (600kHz UP)	144-146 (600kHz DOWN)	146-148 (600kHz UP)	146-148 (600kHz DOWN)
LOCAL FREQUENCY	116MHz (x3)	118MHz (x3)	116.6MHz (x3)	115.4MHz (x3)	118.6MHz (x3)	117.4MHz (x3)
OSC. FREQUENCY	38.666...MHz ▲	39.333...MHz ▲	38.866...MHz ▲	38.466...MHz ▲	39.533...MHz ▲	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-107R transverter. Follow the block diagrams while reading this discussion, and refer to the schematic diagram for specific details.



## 144 MHz UNIT

The incoming 144 MHz signal is fed through a low-pass filter, consisting of L<sub>708</sub>, C<sub>716</sub>, and C<sub>717</sub>, to RL<sub>701</sub>. On receive, the signal is amplified by Q<sub>605</sub> (3SK51). The output from Q<sub>605</sub> 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, Q<sub>606</sub> (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.

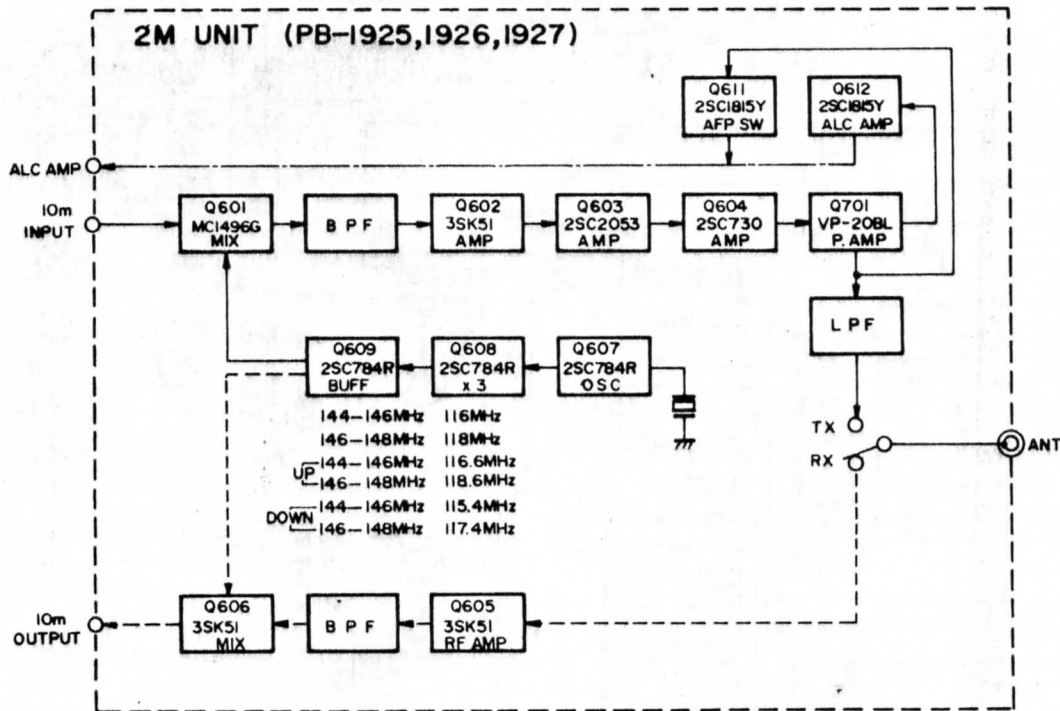
The local signal is generated at 38.666 MHz by Q<sub>607</sub> (2SC784R), then delivered to tripler Q<sub>608</sub> (2SC784R), then delivered through buffer Q<sub>609</sub> (2SC784R) to gate 2 of Q<sub>606</sub>. For repeater operation, the local signal is shifted up or down 600 kHz, depending on the position of the front panel RPT switch.

For transmission, the 28–30 MHz input signal is fed to Q<sub>601</sub> (MC1496G), where it is mixed with the local signal delivered from Q<sub>609</sub>. The 144–148 MHz signal is then fed through a selective

bandpass filter, which is tuned to the operating frequency by varactor diodes D<sub>602</sub>, D<sub>603</sub>, and D<sub>604</sub> (1S2209), thus effectively eliminating spurious responses. The signal is then amplified by the amplifier chain, consisting of Q<sub>602</sub> (3SK51), Q<sub>603</sub> (2SC2053), and Q<sub>604</sub> (2SC730), and delivered to the final amplifier, Q<sub>701</sub> (VP-20BL).

A portion of the output signal at the power module is amplified by Q<sub>612</sub> (2SC1815Y) for ALC purposes. A portion of the output signal is also fed to Q<sub>611</sub> (2SC1815Y), which acts as a switch for the AFP circuit, which will protect Q<sub>701</sub> from damage caused by high SWR. A further portion of the output is detected by D<sub>702</sub> (1S1555) and fed to the meter, for an indication of relative power output.

The supply voltage is regulated at 8 volts by Q<sub>510</sub> (78L08).



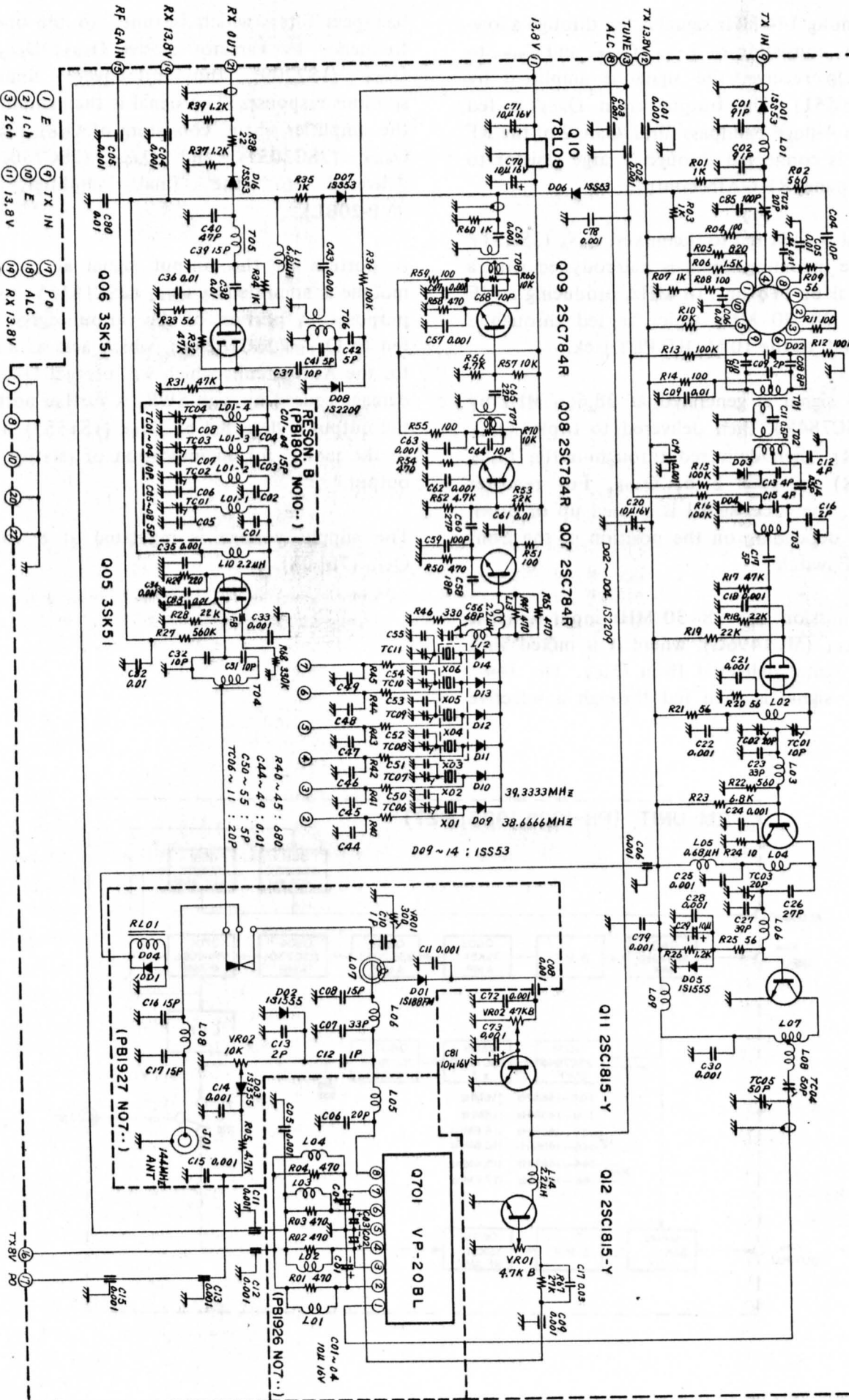
001 MC1496G

002 3SK51

003 2SC2053

004 2SC730

CONVERTER UNIT  
(PB1925 NO.6.)



- ① E
- ② 1.6H
- ③ 2c4
- ④ 3c4
- ⑤ 4c4
- ⑥ 5c4
- ⑦ 6c4
- ⑧ E
- ⑨ TX IN
- ⑩ E
- ⑪ 13.8V
- ⑫ TX 13.8V
- ⑬ RX 13.8V
- ⑭ RX 13.8V
- ⑮ E
- ⑯ RX OUT
- ⑰ E
- ⑱ TX IN
- ⑲ P0
- ⑳ ALC
- ㉑ RX 13.8V
- ㉒ E
- ㉓ RX OUT
- ㉔ E
- ㉕ TX GAIN
- ㉖ E
- ㉗ TX 8V

2M UNIT CIRCUIT DIAGRAM

