



MULTI-8

144MHz-FM
10WATTS
23CHANNELS+EXT. VFO

OWNER'S MANUAL

FUKUYAMA

electronics



MULTI-8 DX

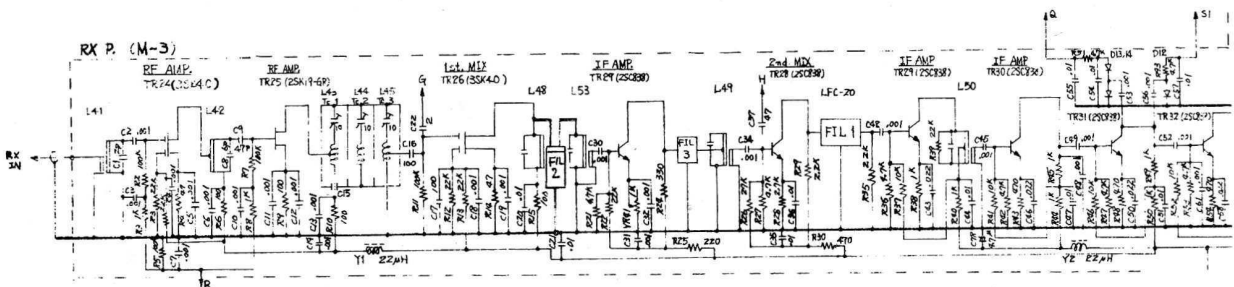
MULTI-8DX has all features of MULTI-8 and better receiving sensitivity and super selectivity than MULTI-8 in view of currently highly densed communication.

SUPER SENSITIVITY

In RF stage, 2 ICs are adopted to develop sensitivity and to cut noise considerably. In Limiter, Hybrid circuit in stead of IC is adopted to attain a good limiter performance, and thus suppress noise for a clear communication by a weak signal.

SUPER SELECTIVITY

Herical Resonator in RF stage and MOS Dual Gate FET in Mixer stage are adopted for extremely better performances for 2 signal characteristics by about 30db (i.e. 80db), Quieting Sensitivity of S/N, and Cross Modulation than MULTI-8, and accordingly MULTI-8DX can sharply cut a signal of adjacent channel and MULTI-8DX encounters a very little interference, for which a miniature crystal filter and a ceramic filter in the 1st IF and a ceramic filter also in the 2nd IF stage are adopted. With the mode switch to "LOCAL", AGC (automatic gain control) is applied to the RF stage to prevent overload.



IMPROVEMENT FOR NARROWER CHANNEL SEPARATION

In the highly densed communication now, a narrower channel separation is being used, and therefore radio amateurs are increasingly being felt annoyed with interference. MULTI-8DX can be improved for narrower channel by changing the ceramic filter in the 2nd IF stage to that of narrower band (LE-D15).

MULTI-8
144MHZ BAND FM TRANSCEIVER
FOR AMATEUR AC/DC TYPE

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MULTI 8
144Mhz BAND FM TRANSCEIVER
FOR AMATEUR AC/DC TYPE

1-1 GENERAL INFORMATION

** Specification

* General

Frequency: 144.00 - 146MHz band FM amateur
Number of channel: 23 channels without crystal
+ External VFO jack
Power Supply: AC100V $\pm 15\%$ 50/60Hz (AC117V to 240V in
DC 13.5V $\pm 15\%$ special order)
Power Consumption: Transmit: 2.3A with 10W output
Receive: 0.5A
Semiconductors: 1 IC, 3 FET, 1 SCR, 32 TR, 29 DIODES
Microphone: Dynamic microphone 600 ohms
Dimension: W179 x H75 x D247 mm
Weight: approx. 4kg

* Transmit

Wave Form: F3
Output Impedance: 50 - 75 ohms
Modulation System: Vector Phase Modulation
RF Output Power: 10W/3W/1W
Multiplication: 12 times
Spurious: better than -60db
Frequency Deviation: Max. 12KHz
Microphone: Dynamic type press-to-talk microphone, and
VOX system

* Receiver

Receiving System: Double conversion super heterodyne system
Sensitivity: 1uv, more than S/N30db (7.5KHz deviation
at 1KHz)
Intermediate Frequency: 1st: 10.7MHz, 2nd : 455KHz
Selectivity: ± 10 KHz -6db
 ± 19 KHz -50db
Spurious: under -70db
Audio output: 1.5W (at 10% distortion)

1-2 ** Features of "MULTI 8"

- 1) AC/DC two way use
DC Power of a car or a marine battery (DC 13.5V) and AC power 100V can be selected only by changing the power jack and "MULTI 8" is designed in a compact size and is available with a carrying hanger optionally which can be fixed to the unit.
- 2) 23CH + Ext. VFO jack
A counter measure for a high density of communication is perfect. The channels available are 23 channels, which are the maximum among this types of rigs in market, and between 144.00 and 146.00MHz the frequency can be selected freely by VFO, which is optionally available.
- 3) VOX auto transmitter system
Not only the operation can be made by press-to-talk switch but also can be operated by a modern system of VOX auto transmitting system not by using fingers, i.e., when conversation starts "MULTI 8" automatically transmit and as soon as your voice finishes the "MULTI 8" automatically rests on receiving. Further your satisfaction can be obtained by adjusting the VOX system (gain control, time constant control, and anti trip control).
- 4) AFB squelch control
"MULTI 8" adopts AFB (Audio Feed Back) squelch circuit that feeds back noise signal, which has been developed by FDK. In comparison with the conventional squelch system that only controls a noise level, the merit of "MULTI 8" is that a break in communication due to an over-modulation of a counter station can be avoided, and by means of two staged noise amplifier a squelch control can be attained surprisingly smoothly and operates enough by a weak signal.
- 5) CALL tone
If you push the "CALL tone" switch, F2 signal will be received by your counter station, and therefore it will be not necessary for you to be nearby at all times to your rig. The CALL tone invites you. If tone sound is pre-determined you can identify who he is by the tone frequency. And telegraph operation is also possible by F2 wave.
- 6) multi S meter
This single meter has four functions, with peculiarity with diverse use:

MULTI 8

- A) for adjustment of transmitting frequency:
Put the function switch to CAL, and the transmitting oscillator and the receiving circuit as well operates, so that the tolerance of the transmitting frequency can be measured. The transmitting frequency can be corrected only by adjusting the oscillatory trimer, so that the meter deflection rests on the zero point. The arrangement involved for this adjustment can be carried out by only opening the upper cover without removing the whole cabinet.
- B) for adjustment of receiving frequency
Put the switch to FREQ and the meter can measure tolerance of the frequencies between a counter station and yours.
- C) S meter with 2 steps sensitivity
When the switch is adjusted to S1 or S2, the meter becomes as S meter for measuring the strength of signal. Being a meter with amp. with 2 steps, the switch may be selected to S1 or S2 depending on the strength of signal. Normally S1 may be recommended, and when the signal of the counter station is strong as in a case of base station the use of S2 will make you convenient to set a beam antenna to a required direction.
- D) for measurement of transmit power
At the position of S1 or S2 the meter automatically becomes as the power indicator.
- 7) 10W/3W/1W transmit power switch
The output power can be changed by a switch to 10W, 3W or 1W, and can be selected to a proper power depending on distance between the counter station, and a conscientious QSO is possible not affecting other stations/
- 8) BGM intermediate terminal for adjustment and experiment
On your right side cabinet, an intermediate terminal is attached, and the terminal can be used when to test other microphone or to use Remote Control Microphone (which will be sold separately in the near future) which makes your communication possible by a wireless system.
- § High class circuit design
MULTI 8 is composed of 1 IC, 3 FET, 1 SCR, 32 transistors and 29 diodes and is designed in pursuit for a super sensitivity and a super stability with the solid stated circuit.

*transmit circuit

The transmit circuit being an important part of transceiver has a circuit design aimed at a professional class, and its performance is the professional class.

Modulation circuit:

IDC splatter filter are adoted and thus avoid an over-modulation, so that an intereferece to other parties can be neglected.

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Driver and Final stage..... A perfectly shielded module system is adopted and an large heat radiation enough is left.

*Receive circuit

The First Mixer circuit..... The use of FET materializes a super sensitivity and a good simultaneous two signal characteristics
IF, AF amp., Power amp..... With the adoption of IC a super stability is materialized.

§ Final Stage Protection Circuit

When SWR (Standing Wave Ratio) increases owing to a misuse or a mis-connection of antenna, APC circuit (Automatic Power Control) with Scylister automatically acts and voids the breakdown of the expensive transistors.

§ Easy Channel Mounting and Frequency Adjustment

Without removing the cabinet, this can be made easily by opening an upper cover.

§ Effective Lightings Easy to Look on

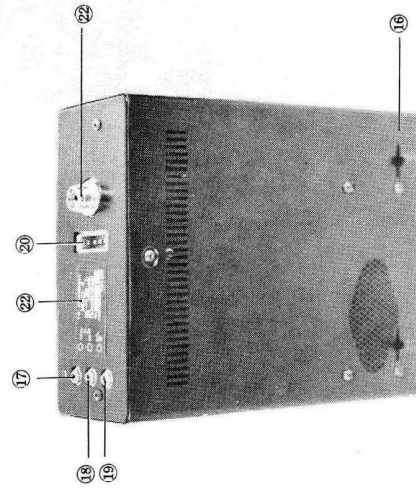
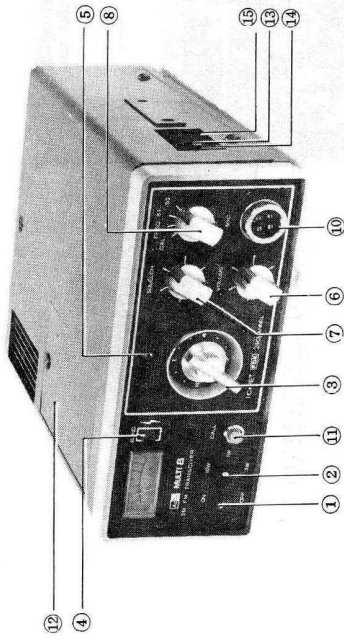
The number of channel floats out by ligh from the black window. On the channel indication and S-meter highly realiable lamp for cars is used, and does not blown out by frequently repeated operation. And at night the effective lightings are possible with safe.

§ In order to make a good use of the maneuverability of AC/DC, it is made easy to fix this unit on the mounting ware, and for convenience when you carry it a hanger may be adapted.

§ Operable Ambient Temperature Range

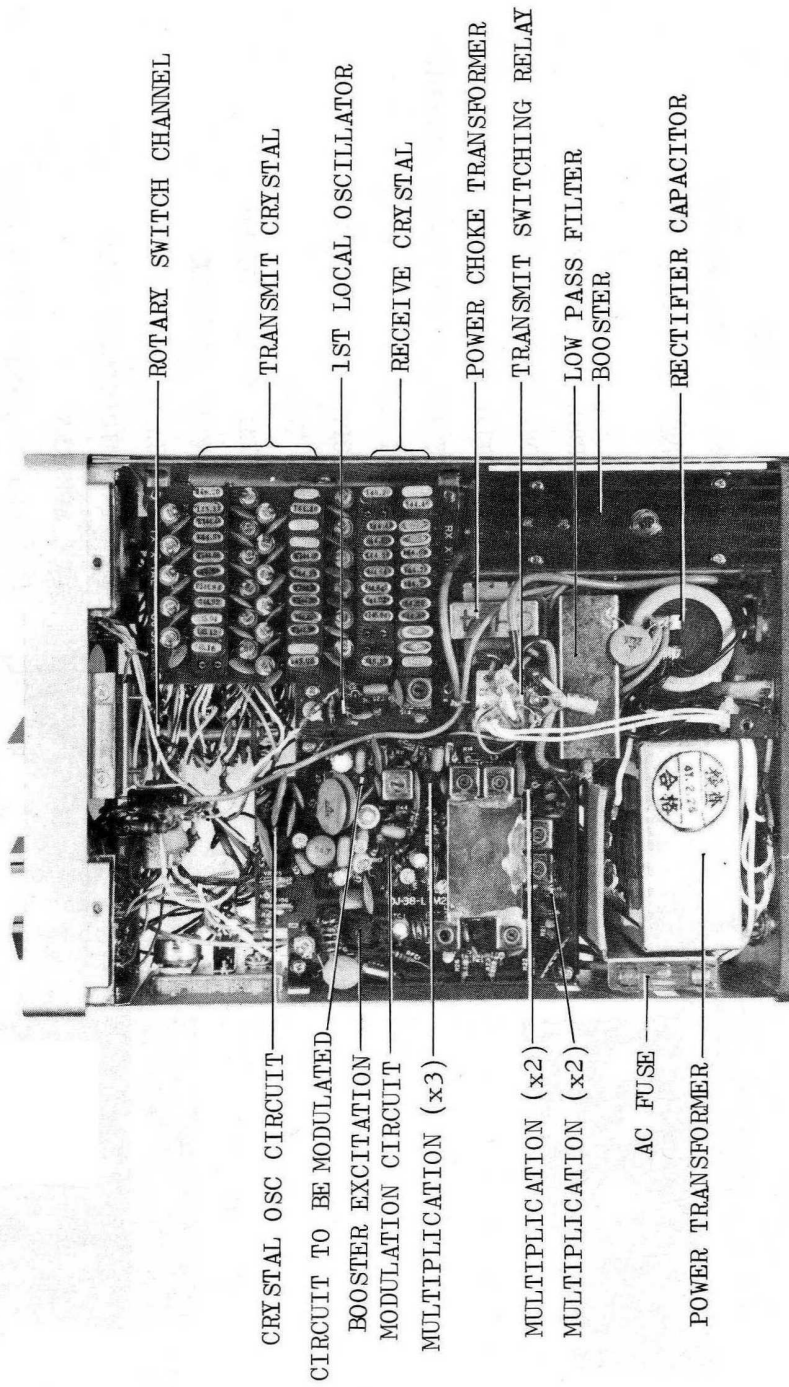
"MULTI-8" stands good enough for an operation in an extremely severe whether condition ranging from -20°C to $+60^{\circ}\text{C}$.

● EXTERIOR VIEW

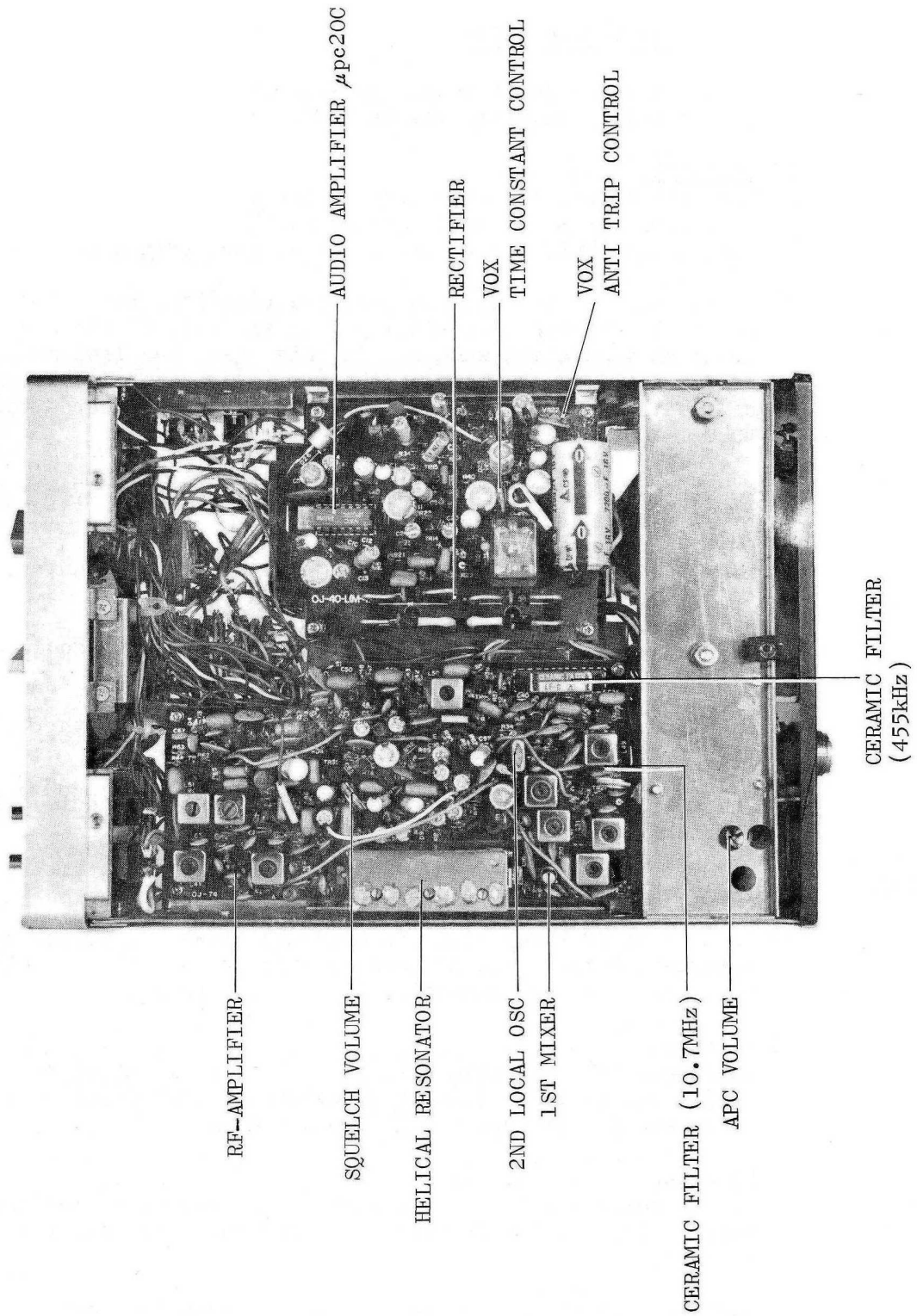


- ① POWER SWITCH
- ② POWER SELECTOR SWITCH
- ③ ④ CHANNEL SELECTOR
- ⑤ CHANNEL INDICATOR
- ⑥ VOLUME CONTROL KNOB
- ⑦ SQUELCH KNOB
- ⑧ FUNCTION SWITCH (METER SELECTOR)
- ⑨ MULTI METER
- ⑩ MICROPHONE CONNECTOR
- ⑪ CALL TONE
- ⑫ CRYSTAL SOCKET COVER
- ⑬ VOX-NORM SELECTOR
- ⑭ VOX GAIN
- ⑮ BGM MICROPHONE JACK
- ⑯ SPEAKER
- ⑰ VFO TRANSMIT INPUT JACK
- ⑱ VFO RECEIVE INPUT JACK
- ⑲ EXTERNAL SPEAKER JACK
- ⑳ POWER CONNECTOR (AC, DC, COMMAN USE)
- ㉑ ANTENNA CONNECTOR
- ㉒ IDENTIFICATION PLATE

● INTERNAL VIEW AND SECTION POSITION



● INTERNAL VIEW AND SECTION POSITION



INSTRUCTION MANUAL

2-1 Pre-cautions before using

- 1) Do not put the power switch ON without connecting antenna.
(The final transistors may be broken down.)
- 2) POLARITY
 - A) For mobile use, pay attention to the polarity of the power of your car. If your car is ground earth there is no problem. Just mount "MULTI-8" by using the hanger. (Black lead (-))
 - B) If the body of the car has positive polarity, the "MULTI-8" should be floated electrically from the body of the car by using an insulation washer. In this case, Red lead should be connected to the body of the car (+), and the outer shield of the coaxial cable should be ground through a capacitor (0.001 - 0.005uF).
- 3) Do not connect nor disconnect the power leads with power switch ON.
- 4) Ascertain that the channel Selector has crystal mounted, and do not operate the transceiver without crystals.
- 5) Power fuse for DC which is inserted in the cable should be 3A and for AC 1A.
- 6) When the moving carrying hanger is used, fix it with two screws tightly and do not shake violently.
- 7) The mobile power cords should necessarily be connected with the terminals at the battery of car.

2-2

OPERATION METHODS

- 1) In case of DC power with the attached Red-Black cords, and with Alternate Current the AC cords should be used by connecting into the 5P square connector (20) at the rear side.
- 2) Antenna
Impedance is applicable with 50 - 75 ohms by the coaxial connector (21). The cable 5C2V under 20 meters or 7C2V under 20 meters is recommended, and use a high quality one.
- 3) Receiver
If the power supply and the antenna are ready, put on the power switch (1), and the channel indicator and multi meter will be lighted.

SQUELCH control is designed to reduce excessive noise (such as high line interference, ignition noise, etc.). This control must be set when only noise, no signal is heard. When only noise is present, turn the squelch control counterclockwise until the noise is blanked out.

CHANNEL should be set by CHANNEL SELECTOR (3) and (4).

EXTERNAL SPEAKER may be connected to the jack on the rear side.

METER is normally used at (S1) position.

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4) TRANSMITTER

Connect the microphone to the mic-connector (10), and put the switch (13) to (NORM), and if you push the microphone switch the relay acts and RF power comes out. At this case multi meter becomes as output power meter at a position of (S1) or (S2). In case RF power does not come out, (no deflection of the meter is observed.) inspect the antenna system. This will be due to a fact that a final stage transistor Automatic Protection Circuit (APC) operated with the increase in SWR by the antenna short circuited or disconnected.

Automatic Protection Circuit avoids the breaking down the final transistor by automatically cutting the collector voltage of TR2 in M-2 unit. And at the channel where crystal is not mounted the RF power will not be radiated.

5) VOX operation

When communication is to be done by VOX system without using the push switch on the microphone, put the switch (13) to (VOX).

The level of switching Transmit and Receive can be adjusted by VOX GAIN (14) depending on the loudness of your voice and ambient circumstance. At the counter clockwised postion, the system operates by a louder voice, and clockwised postion a weaker voice.

The Time Constant for switching can be adjusted by a variable resistor VR-21 in M-4 unit.

ANTI TRIP circuit (which avoids that VOX operates by a sound through the speaker when receiving) can be controlled by a variable resistor VR-22 on M-4 unit, and your desired level can be attained.

6) CALL TONE

The CALL TONE is adopted so that your QSO may be made with more enjoyment. If the "CALL" button on the front panel is pushed, a signal automatically is oscillated and give your counter station a contrinued calling signal. An excessively loud sound from the speaker overruns the Anti Trip Circuit and may put the transceiver on transmitting, therefore it is suggested that the volume control is adjusted at a properly low level.

7) multi meter

The multi meter (9) has four functions with one meter and can be selected depending on a purpose of your use.

S-Meter

If you use the meter as S-meter on receiving, set the swithc either (S1) or (S2). With (S1) about 30dB in full scale input, and with (S2) about 70db signal.

Power Meter

On transmitting, at the postion of (S1) or (S2) the meter indicates the transmitting output power, at which time the meter sensitivity is the same for either position.

MULTI-8

ADJUSTMENT OF FREQUENCY

When you use the meter as the center meter, that is, when to measure the difference between the frequency of your receiving crystal and that of transmitting of your counter-station, put the meter to (FREQ). The meter may depart from the center (zero point) in some extent but this not out of order. If the meter deflects to plus direction, the frequency of your counter station is higher than that of your "MULTI-8".

CAL

At "CAL" position, the transmitting oscillator and the receiving circuit simultaneously operate. Therefore, without using a measuring equipment, the difference of the oscillatory frequency can be measured, in this case, disconet the microphone.

8) EXTERNAL MICROPHONE JACK

The external microphone jack is the terminal applied applied after IDC of the mic-amplifier. The input sensitivity is lower than the terminal on the front panel and its level is -6dBm 70% modulation. This jack may be used for experiment and study of a microphone and a modulation circuit. And a remote control of wireless microphone in future is also applicable to this jack.

9) ADDITION OF CHANNEL

"MULTI-8" is supplied without crystals. The addition of channels is done by opening the small upper cover (12) and mounting crystals on the crystal sockets four line. Mount the crystal T and R not to mistakenly mount them. After mounting the crystals, put the function switch "CAL" and adjust the trimer positioned by the crystals, so that the meter indicates zero.

The crystals are HC-25/U type and the frequencies are as follows:

$$\text{Transmit..... crystal frequency} = \frac{F}{12} \text{ (MHz)}$$

$$\text{Receivve..... crystal frequency} = \frac{F - 10.7}{3} \text{ (MHz)}$$

2-3

TRANSMIT SECTION

Oscillation, being free from adjustment, oscillates 12MHz, and is modulated by Vector Synthesis by audio output. The signal is multiplied by 3 x 2 x 2 and becomes 144MHz at TR5 in M-2 unit, and is amplified by TR6 and TR7 to obtain 0.7 watt, and is amplified by JR8 and JR9 in M-5 unit to obtain more than 10 watt aerial power.

Low pass filter is adopted to decrease harmonics and spurious near by.

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Modulation amplifier is composed of 2 stage AF amplifier, IDC, Integral amplifier and Splatter filter.

VOX circuit uses 3 stages AF amplifier, one stage DC amplifier, which enable to control easily the gain, the time constant and the anti-trip controls.

2-4

RECEIVE SECTION

"MULTI-8" is composed of RF stages, IF 2 stages, and IC amplifier in double conversion super heterodyne system. The RF section adopts a peculiar coupling system of Static Coupler to couple a dual resonance coil and a resonance capacitor. Therefore the best performance is attained for mobile and base use as well. Therefore Quality figure of RF circuit and band width are shown for mobile and base use at the best performance.

On the second Intermediate frequency, amplifier section, two staged voil resonance type is adopted to decrease a distortion of wave and to improve the limiter characteristics. In this stage, IC is adopted to develop the characteristics further. The First oscillation is multiplied by 3 times by means of over-tone of 44 - 45MHz and is applied to the first mixer, and the second oscillation is left for free adjustment, and has output of 1.5 watt by OTL.

In AF circuit, IC is used to increase performance and Squelch circuit adopting noise amplifier of 2 stages and AFB circuit.

2-5

TROUBLE, CAUSES AND ADJUSTMENT

1) RECEIVER

- i) Sensitivity aggravation..... (A) short circuited or disconnected coaxial cable
(B) breakdown of TR24 (M-3) at the first RF section
- ii) Frequency shifting.....
 - entirely all channels ... shifted shifting of the discriminator coil F9 (M-3). (Adjust it so that the meter rests on zero by receiving an accurate frequency.)
 - a certain channel shifted.. variation of 1st oscillator
- iii) No sound
 - (A) disconnection of wiring, and deterioration of contact on the earphone jack
 - (B) breaking down at IC 2 (M-4) of audio amplifier
- iiii) Squelch not operating
 - deterioration of the noise amplifier, or disconnection of wiring and the layer short circuited on Y3, Y4 (M-3)

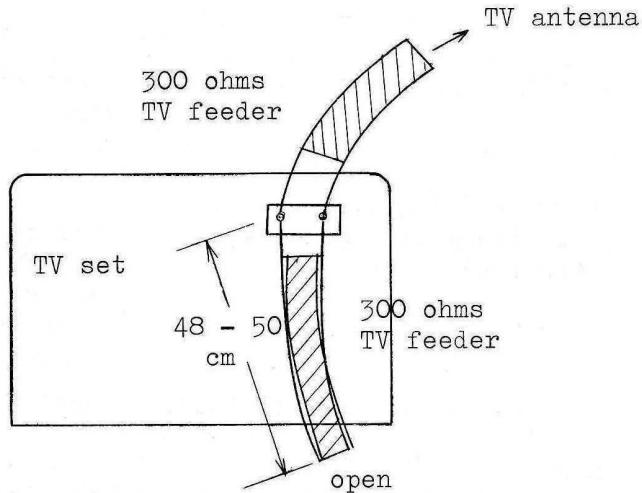
MULTI-8

2) TRANSMIT

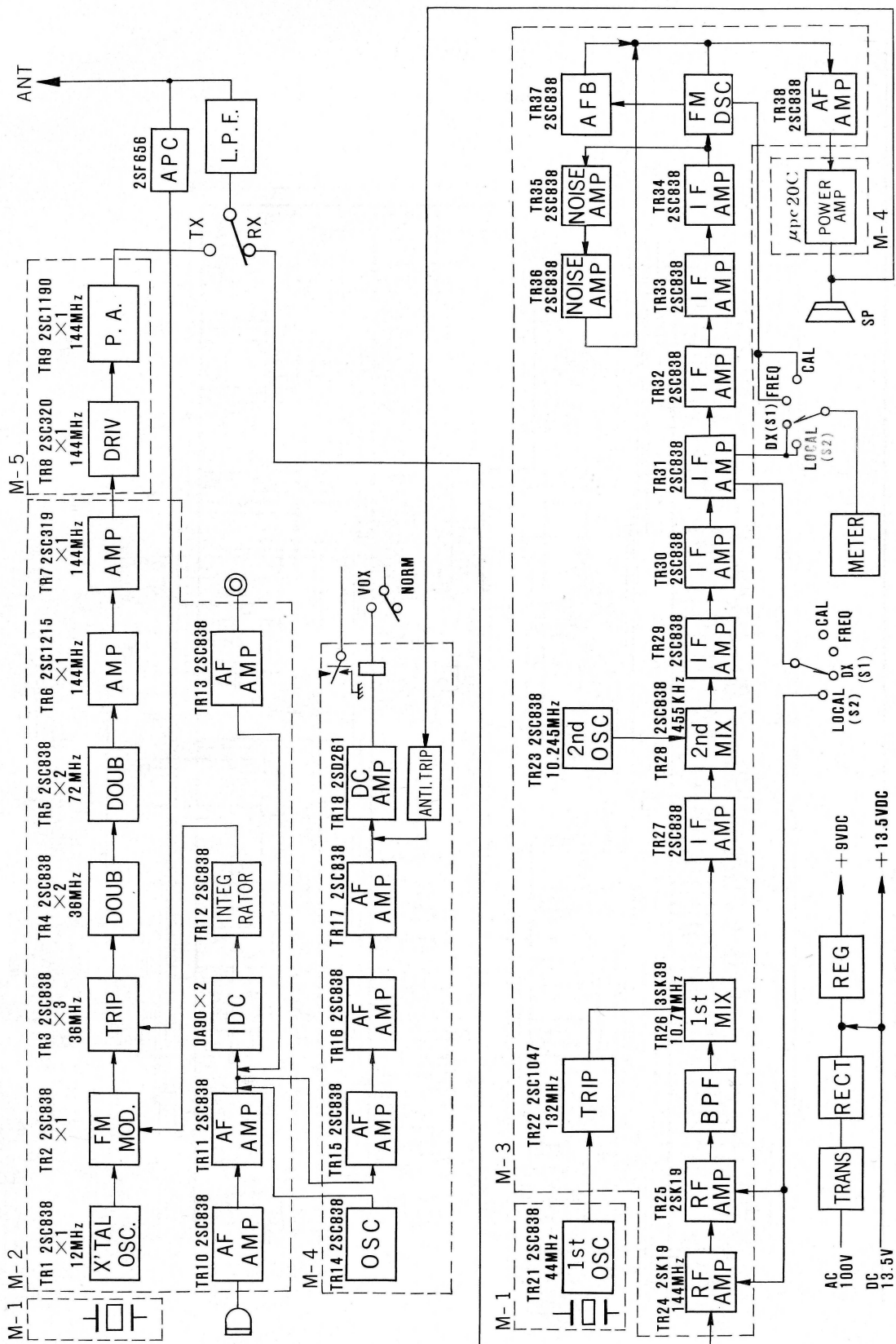
- i) Output power decreased much.....
Disconnection of wiring, or disconnected or short circuited coaxial cable, or shifting of resonance frequency due to use of years
- ii) Frequency shifting.....
Adjust the trimer by the crystals.
Firstly, put the meter on "CAL", and adjust the trimer so that the meter indicate zero.
- iii) No modulation.....
Disconnection or short circuit at the microphone wiring system.
Aggravation of contact at the connector, or deterioration of a transistor for the microphone amplifier.

3) TVI

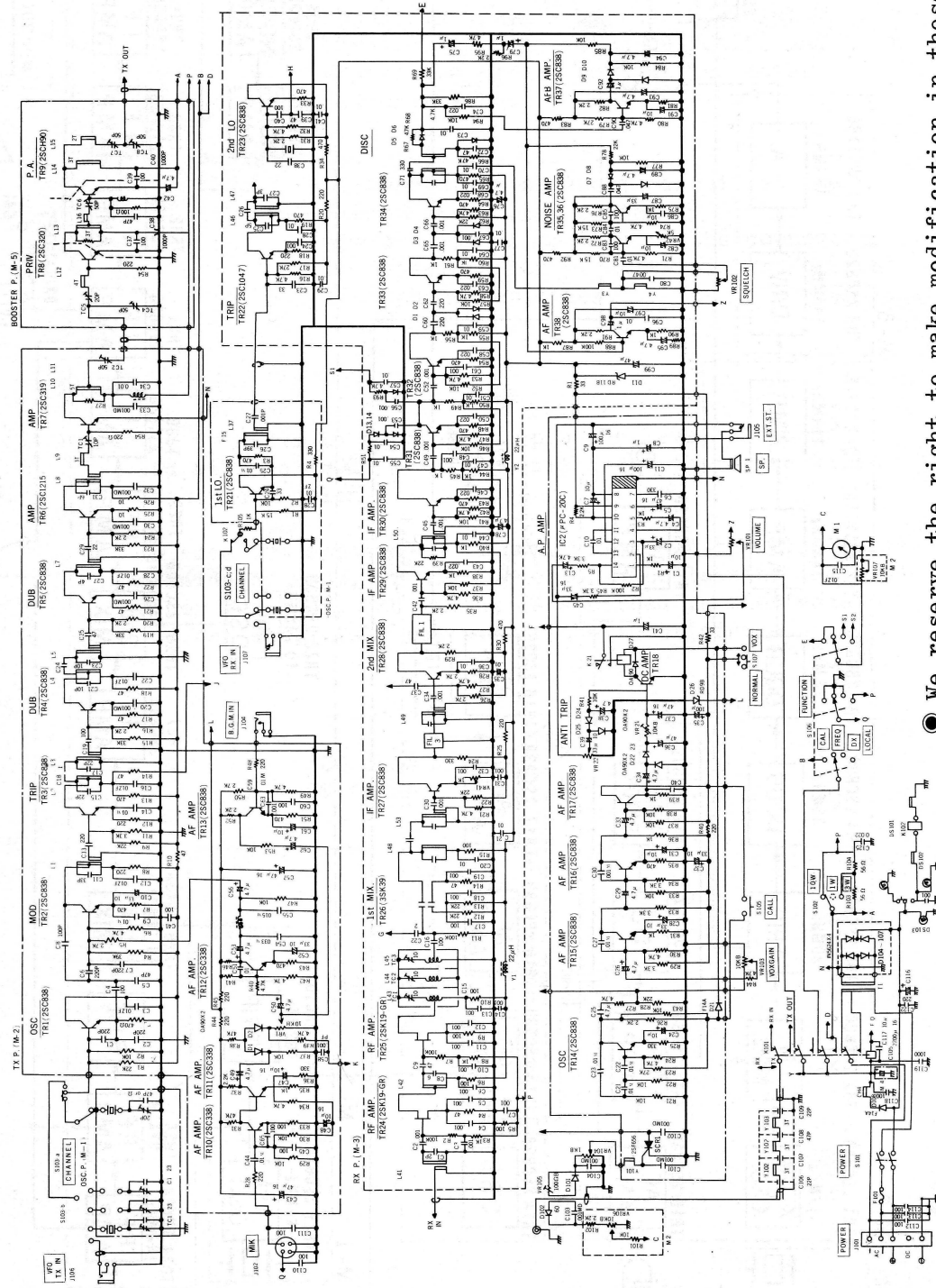
- i) The spurious is suppressed upto the level of -60db and will be -80db at a some distance, therefore will cause no problem.
- ii) In case TVI appears on TV set, bring out the TV antenna outside of room, or add feeder of 50cm leaving the other end open, and 144MHz is absorbed in the feeder and can completely get rid of the interference.



● BLOCK DIAGRAMS



SCHEMATIC DIAGRAMS



● We reserve the right to make modification in these models in accordance with technical developments.



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