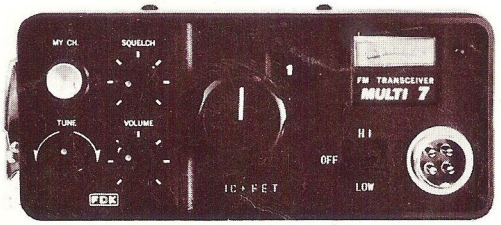
FDK

INSTRUCTION MANUAL

FUKUYAMA ELECTRONICS CO., LTD



MULTI-7

FM 2M
10W/1W
FIXED 23 CHANNELS
MY CHANNEL 1.

Thank you for your having purchas
Although the set was produced u
you are requested to take it at onc
have purchased or directly to our
any breakage or trouble in the co
be glad to repair or make any
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Please advise us the number of t
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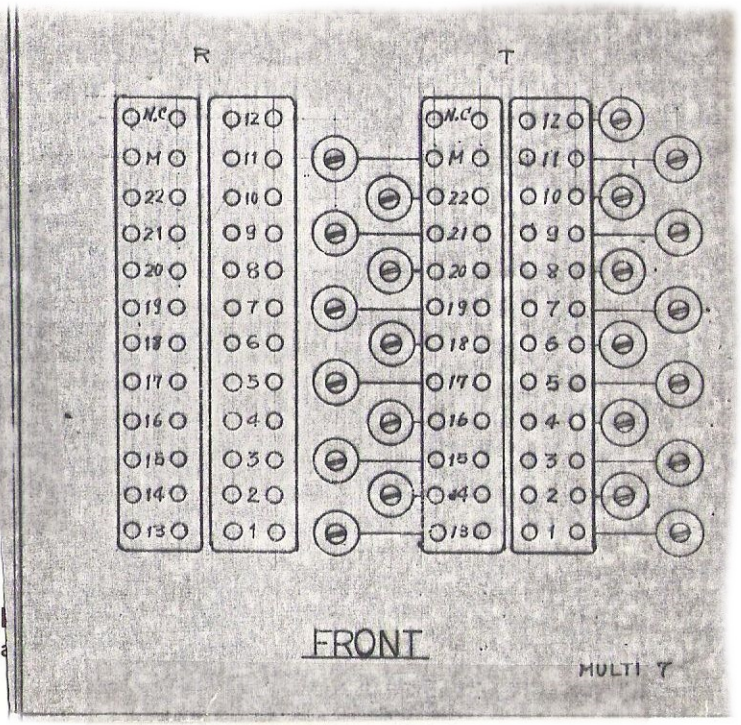
Service Dept.

FUKUYAMA ELECT
4-14-15, Fuji-machi, Hoya



SPECIAL FEATURES

■ **"My Channel" Function for Quick QSY.**

The model has 24 channels, namely 22 channels plus one "My Channel" and VFO one. "My Channel" is the function available easy QSY to your private channel like a club one.

■ **Fine Tuning Knob for Receiving**

It tunes and varies receive frequency and is strong effectively for noise interference owing to frequency slide.

■ **Center Meter (Discriminator Meter).**

The meter is switchable to S meter and Center meter. When it is on "Freq." position, namely as the center meter, you can watch an counter station's freq. slide. So, it can be used conveniently together with "Tune" function.

■ **Built in A. F. B. (Audio Feed Back) Squelch Circuit.**

We F. D. K. developed the particular AFB sq. circuit. Compared with the usual noise-amp. squelch, the AFB one can work stably, which does not break owing to some change by counter station's modulation, etc., since audio signal is returned. The two-step noise amplifiers are employed and squelch points is settled smoothly. Besides, it works even if it is against weaker signals.

■ **Output Power Selection of 10W (HI) and 1W (LOW).**

By switching the Output Power Selector, you can select a suitable output power from 10 or 1 Watt, seeing distance or situation between you and a counter station. You do not interrupt or interfere against any other stations on QSO at a selected output power.

■ **Helical Resonator and Crystal Filter.**

The helical resonator is used for RF stage of receiver circuit and the crystal filter is adopted to 1st IF stage with a ceramic filter. So, Multi 7 has the superior characteristics of band and cross-modulation.

■ **Changeable Speaker Position.**

According to mounting space or situation, you can change and replace the position of speaker from the bottom to the top of the set so as to listen clearly.

■ **Transmitting Indicator.**

The red lamp is put on when transmitting. You can watch mis-operation, etc.

■ **Accessory Terminal.**

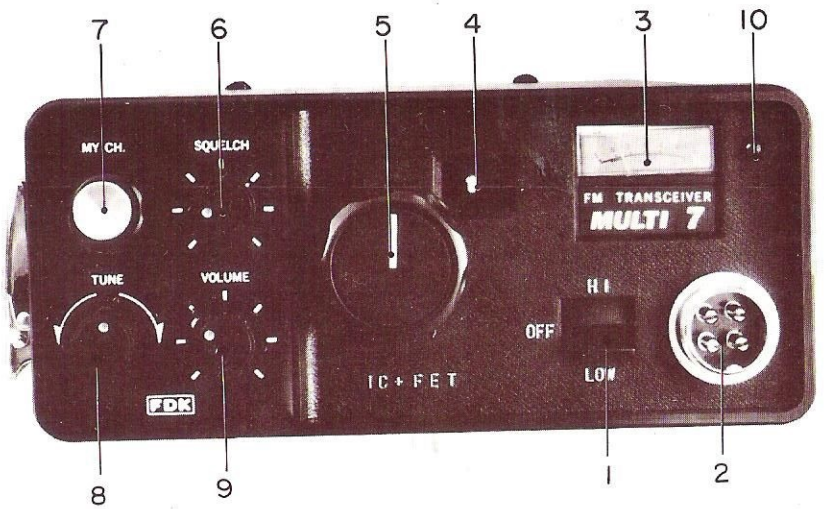
The 9-pin terminal is reserved at rear of the set. It is adaptable to VFO connection, stand-by function, external microphone, ext. discriminator meter and etc.

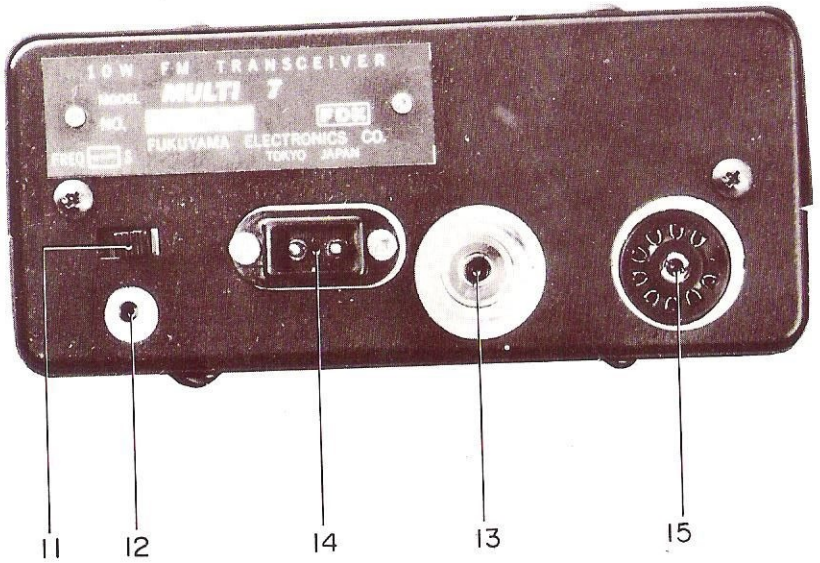
■ **Professional Circuit Design.**

- For modulation circuit of the transmitter, the IDC splatter filter was employed. It prevents over deviation and clears up interference against other stations. Also it can correspond to future "Narrow Band" modification easily.
- Planned the drastical decrease of spurious by low-pass filter adopted to antenna circuit.
- Used the perfect-shielded module system for driver and final circuits.
- The receiver circuit consists of 1-step RF, 2-step 1st IF, 6-step 2nd IF, and 2-step limitter.
- The FET were adopted to the RF and the 1st Mixer, and elevate two-signal characteristics.
- Used the helical resonator, crystal filter and ceramic filter effectively and they are workable to get high sensitivity and two-signal characteristics. You can modify Multi 7 to "Narrow" band type simply.
- Adopted the reliable speaker. Size: 92 m/m Output: 1-Watt. The speaker is housed in front-inclinated cabinet. This design contributes to get clear sound and makes a fine accoustic effect.

CONTENTS

NAME OF PARTS AND THEIR FUNCTION





1 Power ON/OFF and Output Power Selector.
OFF at center, Power at HI or LOW position.

2 Microphone Connector.

3 Meter
It works as a S meter, center meter and output power one. S meter works full-scale at approx. 20 dB input. Center meter shows 2 or 3 KHz at 1-scale range. Output power is indicated approx. 8 at 10 Watts and 50 ohms load. The meter is switched to S or Center by the selector at the rear of set.

4 Channel Indicator.
When power on, a channel is shown illuminated. But it is put off when you operate Multi 7 at "My Channel"

5 Channel Selector.

6 Squelch Control.
Tune clockwise and squelch is closed.

7 "My Channel" switch.
You can do QSY to your own channel preset by only one-touch to the switch. Try push it and automatically the channel is changed to the "My Channel", regardless of the channel selector position. When the above case is, the channel indicator illumination is put off. Again, push the knob and the original channel selector works. It is enough to install the particular freq. crystals you specify into the "M" positions for Tx and Rx crystals in the set.

8 Tune Knob.
It works to revise freq. slide. Set the knob at a position that you can listen most clearly. If the knob is tuned clockwise, receive frequency comes to higher. Other hand, the receive frequency comes to lower when the knob is tuned counter-clockwise.

9 Volume Control.
When you tune the knob clockwise, volume comes up.

10 Transmitting Indicator Lamp.
It puts on when transmitting, namely, you press the "Push-to-talk" button on the microphone.

11 Meter Function Switch.
Set the switch at "S" position, the meter works as a S meter. Other hand, when you set it at "Freq." position, it works as a Center meter.

12 Ext. Speaker Jack.
When you use an external speaker, connect with Multi 7 by accessory plug furnished.

13 Antenna Connector.
Use a M type plug. Its impedance is 50-ohm required.

14 Power Cord Connector.
Use the accessory one.

15 Accessory Terminal.
It is a 9-pin plug for the following purposes.

Terminal 1: VFO receive-input
2: Stand-by signal (When grounded it comes to transmit)
3: Microphone
4: Grounding
5: Positive Power Source (13.5 V)
6: Transmit Power Source
7: Receive Power Source
8: Discriminator Output
9: VFO transmit-input

ACCESSORIES

1. Dynamic Microphone, press-to-talk type with curled cord and 4-pin plug ..... 1 pc.
2. Microphone Hanger ..... 1 pc.
3. Bracket and Fixtures for car dash mounting ..... 1 set
4. 2m long DC power cord with fuse and fuse holder (red-positive, black-negative)
5. Fuse (3A) ..... 1 pc.
6. External Speaker Plug ..... 1 pc.
7. Accessory plug ..... 1 pc.

SPECIFICATIONS

General

Semiconductors:	27-Transistor, 2-FET, 1-IC, 1-SCR and 14-Diode
Freq. Coverage:	144.00 – 146.00 MHz
Channel Capacity:	23-channel plus one external VFO channel
Power Source:	DC 13.5 V (operating range: 11.0 – 15 V, negative ground)
Power Consumption:	2.3 A approximately at "HI" on transmit 1.2 A approx. at "LOW" 400 mA on receive
Dimensions:	134(W), 216(D), 58(H) (75 max.) mm
Weight:	Approx. 1.6 Kg

Transmitter

Emission:	50 ohms
Modulation:	Vector Composite Phase Modulation
Freq. Multiplication:	12 times
Freq. Deviation:	12 KHz max.
Spurious Radiation:	–60 dB or less
Output Power:	10W at "HI", 1W at "LOW"
Microphone:	600-ohm, dynamic, press-to-talk type.

Receiver

Emission:	F3
Receiver System:	Double Super-heterodyne
Intermediate Freq.:	1st – 10.7 MHz, 2nd – 455 KHz
Sensitivity:	S/N 30 dB or up at 1 μV input (at 7.5 KHz deviation with 1 KHz AF)
Selectivity:	10 KHz (–6 dB), 19 KHz (–50 dB)
Image Ratio:	60 dB or up
Spurious Sensitivity:	60 dB or up
1st Local Osc. Freq. Multiplication:	3 times
Audio output:	2 W (at 10% distortion, 8-ohm load)
Speaker:	92 mmϕ 8-ohm

METHOD OF INSTALLATION AND HOOK-UP OF VARIOUS PARTS

■ When Mounting on the Car

Safety first! Safe driving should be the matter of concern for all drivers and radio fans as well.

- **Installation Place.**

Mount the set at place not so as to disturb driver. Do not put the set at the following spaces.

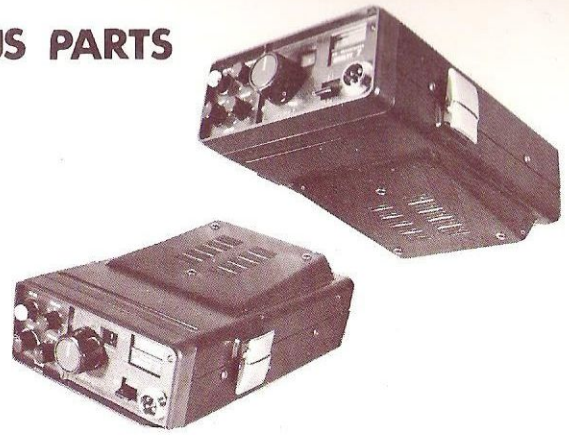
1. Humid 2. Direct rays of the sun, even if it is given through a glass window, etc. 3. Direct heated blowing from the air conditioner. 4. High Temperature.

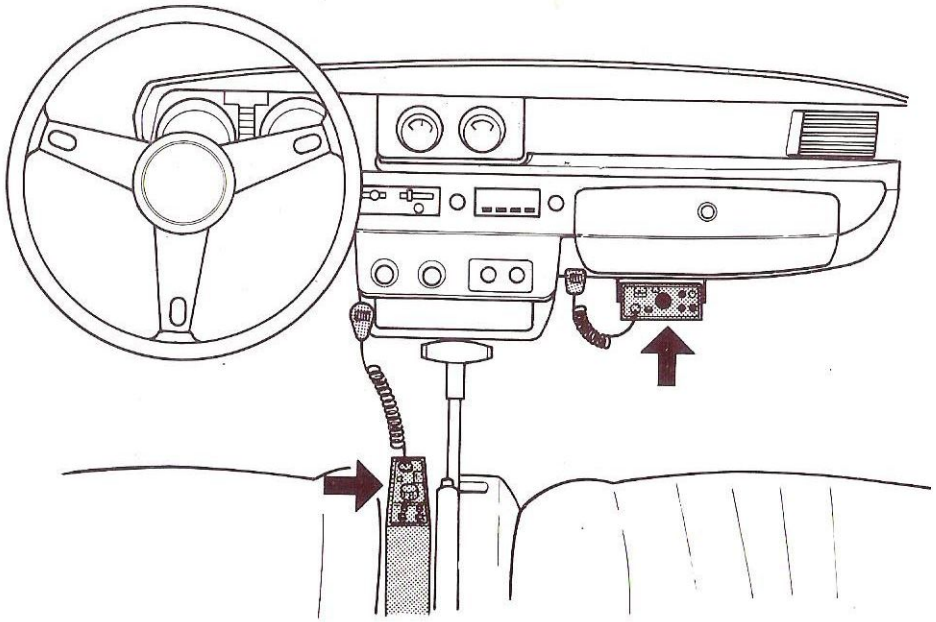
- **Setting.**

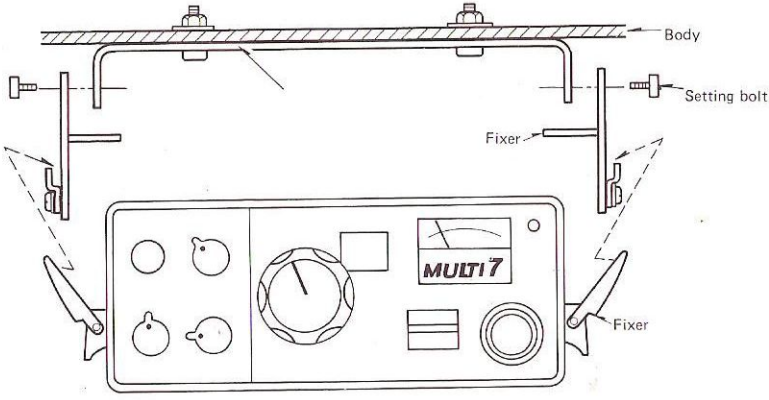
The Multi 7 has the negative ground. If you can has the one, fix the set directly with dash board mounting or so and connect the black colored lead-wire with body of car as a ground.

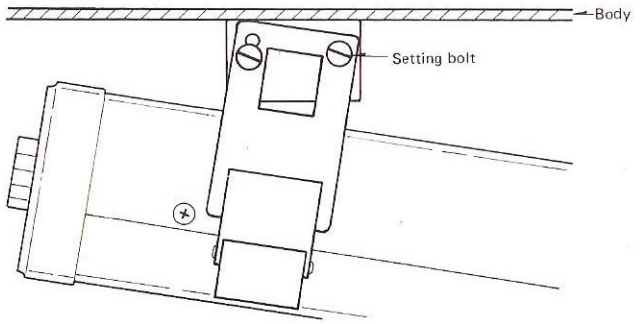
On the contrary, if it is a positive ground, the set has to be free from car body electrically by an insulation washer, etc. In case of this, join the red colored lead wire with car body as a ground. Further, connect also the outer core of antenna coaxial cable through a capacitor (0.001 μF).

Fix the transceiver using the brackets and screws furnished. Set the rig at desired angle. You can select it at two angles of the bracket screws' position. And clinch the fixtures attached to the transceiver. According to situation, try to exchange the speaker position on the top or at the bottom of the transceiver. When you put the set on car seat, it is convenient to fix the speaker on the top of the transceiver.





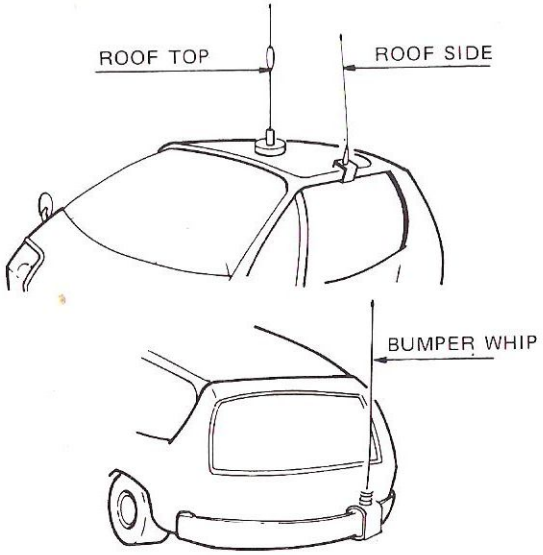




- **Antenna.**

The antenna output impedance is 50-ohm, so you can use any antenna of 50-ohm impedance. At mobile use, select antenna seeing type of a car and set it so as to bear up against wind pressure. Antenna give greatly influence to receive-sensitivity, power output and etc. So, pay attention to the antenna circuit from the ant. connector of the transceiver.

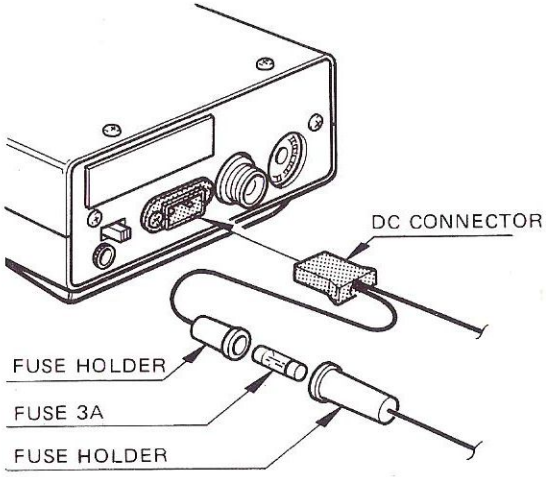
Use the 50-ohm coaxial cable. Please care for strain of the cable when it is drawn into a car. Keep a reasonable tension and do not be it loosened.



An example of antenna mounting

- **Power Cord Connection.**

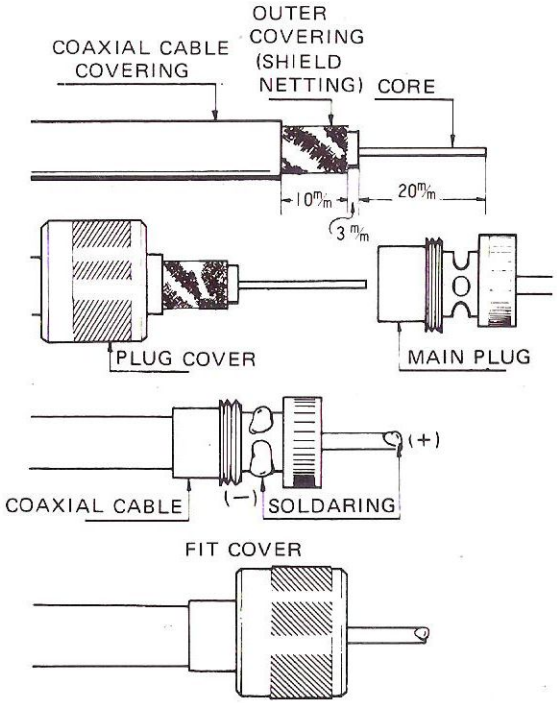
Use the accessory cord and confirm that the positive plug of the DC power cord connector of the set is for the red lead wire of the cord and another negative one is for the black one. Do not be the cords slackened, but keep a reasonable strain.



Power cord connection

Coaxial Cable and Fitting M-type Plug

(1) Cut off the covering of the coaxial cable 30 mm from the end.
(2) Pour soldar quickly on the outside cover (shield netting), and cut off about 20 mm from the end.
(3) Insert the coaxial cable into the cover of the M-type plug .
(4) Run the coaxial cable thru the main M-type plug.
(5) Soldar securely both ⊕ and ⊖ sides.
In so doing, be sure that the covering does not burn with the heat.
(6) Cut-off the remaining wire and soldar.
(7) Check the current flow by tester and confirm if there is no short circuit prior to use.



Soldering M-type plug

PRIOR TO USING

The Multi 7 was designed so as to keep safety with various protection circuits. But please read the following notices and confirm them to enjoy your ham life.

- Do not put on the power ON/OFF switch before connection with antenna and at short-circuit of ant. terminal. Or, the final stage transistor might be broken.
- Pay attention to the polarity of your car. Please refer to 6 page. Other hand, in case you operate Multi 7 as a base station, you should use the power source at 13.5 Volts and available to get 2.7 A or up at less than 10 mV ripple.
- When being the power ON/OFF switch put-on, do not connect or remove power cord.
- Employ 3A type fuse into the fuse holder belonged to DC power cord.
- The Multi 7 was designed to bear up against a long time transmitting, but try "Stand-by" sometimes on a longer transmitting by way of precaution.
- Do not touch or modify the interior parts except the cores and trimmers. All of them are adjusted or tuned perfectly.

OPERATION METHOD

- **Setting.**

Connect the power cord, antenna cord and microphone to the prescribed connectors. Care for the polarity of the power cord. The red one is for positive and the black one is for negative.

- **Power-On.**

Set the Power ON/OFF and HI-LOW switch at HI or LOW position. The switch is ON, and the meter and channel indicator are back-lighted. If they are not lighted, the channel is placed at "MY" channel.

- **Receiving.**

Set the channel selector at a channel which is installed crystals and no signal is receiving. Tune the volume control clockwise and the squelch control counter-clockwise, some noises will be gotten gradually.

Set the volume control at desired point. Turn the squelch control knob clock-wise, noise is diminished. The knob should be set at the position that no noise is heard.

After above tunings, you can start QSO on other channels desired. When you operate the transceiver with external speaker, earphone and headphone, use the ext. speaker jack with the accessory plug. Employ the external speaker of 4 to 8-ohm impedance.

- **Transmitting.**

On pushing the press-to-talk switch of the microphone, the relay works and begin transmitting. On the action, transmitting indicator lamp puts on. Seeing the situation, select the output power from 1 Watt (LOW) and 10 Watts (HI).

The Multi 7 is adjusted to show "8" on the meter scale at 10W, by a 50-ohm power meter. When the SWR of antenna is fine, the meter pointer indicates "8" or so. It is the standard of antenna SWR.

Try to check antenna circuit when casually any RF power is not transmitted. You can watch the case easily since the pointer of meter does not swing. This is due to working of protection circuit of final stage transistor reacted against SWR soared up when short circuit is happened on the antenna circuit or a lead wire was snapped.

When SWR is raised, The Automatic Power Control circuit, designed with the SCR, works to cut off the collector voltage of TR3 transistor of the transmitter unit automatically and protects the breakage of final stage transistors.

Care for not so as to operate at a blank channel. At the channel, of course, no radio wave is transmitted.

In case the meter pointer swings dull extremely at 10 Watts output, the antenna matching is not enough. When the set is operating as it is no matching, the final stage transistor might be broken or its life is shortened.

- **My Channel.**

You can select your own channel by push the button regardless of the channel selector position. My channel has the priority. It is enough to install crystals you desire into the "M" positions, which are reserved in the set. My channel is good for a frequent QSO channel, for example, your club channel, private or secret one and main channel.

- **Tune Knob.**

On receive, you can adjust some slide of a counter station's frequency by tuning the knob. Especially it is effective for mobile station use, because the set receives more noises if a frequency is deviated, compared with base station use.

- **Meter Function Switch.**

Generally it is used as a S meter. When you have it work to watch frequency slide, set the switch at "FREQ" position and it works as a Center meter. Further, it is convenient for installment of additional crystals or adjustment of frequency by "Tune" knob.

INSTALLING ADDITTIONAL CHANNELS

Loosen 6 screws on the upper cover of the set and remove it. There are the crystal sockets arranged four lines. Insert crystals confirming T (transmit) or R (receive) marked. The mark "M" is reserved for My channel.

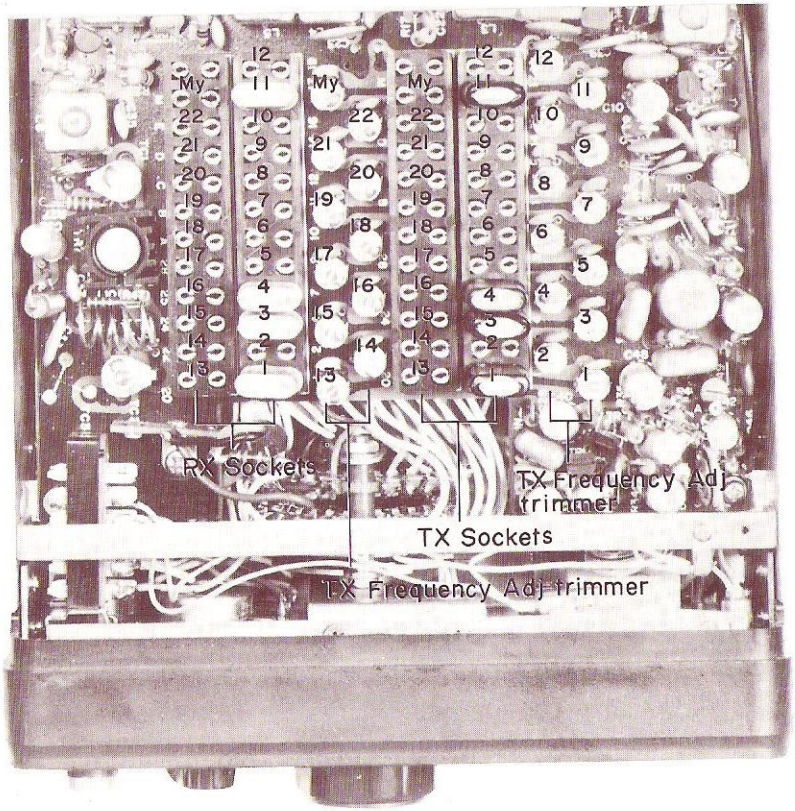
Regarding freq. adjustment, first set the meter function switch at "FREQ" position. Second, make short circuit by some wires No. 6 for transmit power source and No. 7 for receive power source of the accessory terminal's pins. Third, tune the trimmer capacitor along Tx crystals so as to be indicated 0 (zero) by the meter pointer. During the above adjustment, put the TUNE knob on the center position.

The crystals are the HC-25 type and the following are their frequency formulas.

Transmit: Crystal Frequency = F x ~~1/3~~ 1/12 MHz

Receive: Crystal Frequency = (F-10.7) x 1/3 MHz

Please use the crystals made specially for the Multi 7. Crystals vary their oscillation intensity delicately due to their internal resistance, C.I. and etc., and they happen drastical decrease of sensitivity, freq. slide and etc.



EXPLANATION OF THE CIRCUIT

Please refer to the block diagram drawn on the later pages.

- **Receiver Circuit.**

The receiver circuit is the crystal-controlled double superheterodyne. The 1st IF is 10.7 MHz and the 2nd IF is 455 KHz.

The input signal from antenna is amplified by RF amp., which consists of 2-step FET (2SK19), through antenna relay. It is the helical resonator that is a tuning circuit between RF amplifier and the next stage. The resonator is a good characteristic band-pass filter which is 3-step coupled high "Q" factor tuning circuit by a slit applied to cavity resonance.

It is available to get 2 MHz of band width by the resonator. The frequency side is clear and it is planned to level up two-signal characteristics and 1st image ratio. Further, you can have enough gain and high sensitivity, because the two-stage RF amplifier was adopted.

The signal passed the resonator is forwarded to the 1st mixer which was used FET (3SK39). And it comes to the 1st IF signal of 10.7 MHz mixed with the 1st Local Oscillator.

The first local oscillator is the circuit that oscillates 15 MHz band (14.811 – 15.033 MHz) by a Pierce circuit, which consists of 2SC838, connected between the base and the collector. After picked up the 3rd tuned frequency of 45 MHz band (44.433 – 45.100 MHz) factor by the L37 tuning circuit, a signal is multiplied by 3 times at TR33 (2SC1047) and is forwarded to the 1st mixer as a 1st local osc. signal of 135 MHz band (133.3 – 135.3 MHz) which is 10.7 MHz lower, according to each signal frequency.

The 10.7 MHz 1st IF signal of the 1st mixer output is amplified at the 1st IF amplifier through the crystal filter and the ceramic one. By combination of the two filters, it is very much effective to have good image ratio, two-signal image characteristics and to avoid interference by adjacent channels. Besides, it has the distinct side line over 15 KHz of frequency. A signal is amplified by TR24 after passed the filter, so there is no attenuation by filter and can get sensitivity fully.

At the 2nd mixer (TR25), the signals 11.155 and 10.7 MHz, which were oscillated by the 2nd local osc. (TR34), are mixed and come to a signal of 455 KHz 2nd IF signal.

The 2nd local osc. can vary oscillation freq. by variation of applied voltage at the vari-cap. diode which is located between the crystal oscillator and the grounding. This variation can be made by "Tune" knob on the front panel of the set.

Through the ceramic filter, the 2nd IF signal is amplified and amplitude-limitted at the IF amp. TR26, 27, 28, 29, 30, 31 and the limitter D2, 3, 4 and 5, and is forwarded to the discriminator. At the 2nd IF stage, designed to employ 6-stage transistor amplifier, substituted for integrated circuit one, to get full amplification and perfect limitter characteristics.

AF signal is multi-tuned by the discriminator which consists of the two diodes (OA90) D6 and 7. And, after amplification by TR38 AF amp. and passed VR201 volume adjuster, it is amplified by AF power amp. IC (TA7092) and is forwarded to the speaker.

A.F.B. (Audio Feed Back) Squelch Circuit.

The AFB squelch is our own developed circuit. The usual noise amp. type squelch control system often breaks voice when the counter station's modulation changes. It is the same as the case that signal varies by fading, etc. This is caused by variation of noise level accompanied signal change and squelch level is shifted. On the contrary, if variation of squelch-level is lessened and a rated level is kept, over-modulation and voice-break by fading are vanished. It is the AFB squelch that was realized the above theory.

The noise factor picked from the 2nd IF (455 KHz) is amplified by the TR35 and 36 2-stage noise amp, through VR202 for squelch threshold level tuning. As signal amplified is forwarded to the base of TR38 AF amp. after rectification by D8 and 9, and the signal erases mutually with the AF signal demodulated by the discriminator. Namely, if it is settled the VR202, at the point that noise is wiped out, by the squelch knob, no signal is forwarded to TR38, but, if noise factor is lessened by input of receive signal, rectification signal level of the noise amp. is down and a signal is sent to the TR38. The signal is output from the speaker.

Further, by the TR37 amp., the AFB squelch amplified the AF signals demodulated by the discriminator and applies the signal to the base of TR38 after rectification of it. This signal has the reverse polarity to the signal from the noise amp. and a signal from the AFB amp. also grow larger if AF signal does.

The AFB squelch erases the enlargement of rectification output from noise amp. accompanied the increase of noise level and keeps always a rated and stable squelch level.

Transmitter Circuit.

The oscillation is made by the non-tuned circuit which was used TR1 transistor connected with the crystal oscillator selected by channel selector circuit and connected between the base and grounding. The oscillation frequency is 12 MHz band (12.000 – 12.166 MHz). This osc. output is made of vector composite phase modulation with a signal from modulation amp., at TR2.

The modulation AF amp. consists of the two-stage AF amp., IDC. Miller circuit and splatter filter. A signal through microphone is amplified by the TR8 and 9 AF amp. and is forwarded to the D1 and 2 IDC circuit. The circuit clips a given level signal not so as to excess the maximum freq. deviation when the modulation level is soared up in a moment. IDC output is integrated at TR10 through VR1 tuning semi-fixed resistor and is applied to the base of TR2 modulator through the splatter filter.

Modulated signal is multiplied three times at TR3, 2 times at TR4 and 2-times at TR5, and it comes to 144 MHz band. Further, it is forwarded to TR7 pre-drive amp. through TR6 buffer. It is amplified approximately 0.5W at TR7 and is sent to the booster unit.

The booster unit is assembled with the driver stage TR11 (2SC320) and power amplifier TR12 (2SC1190). The above 0.5W signal is amplified to 1.5W or so at TR11.

At the final transistor TR12, it is available to gain 10 Watts or up by 1.5-Watt input. The TC7 and 8 are the trimmer capacitors for impedance matching.

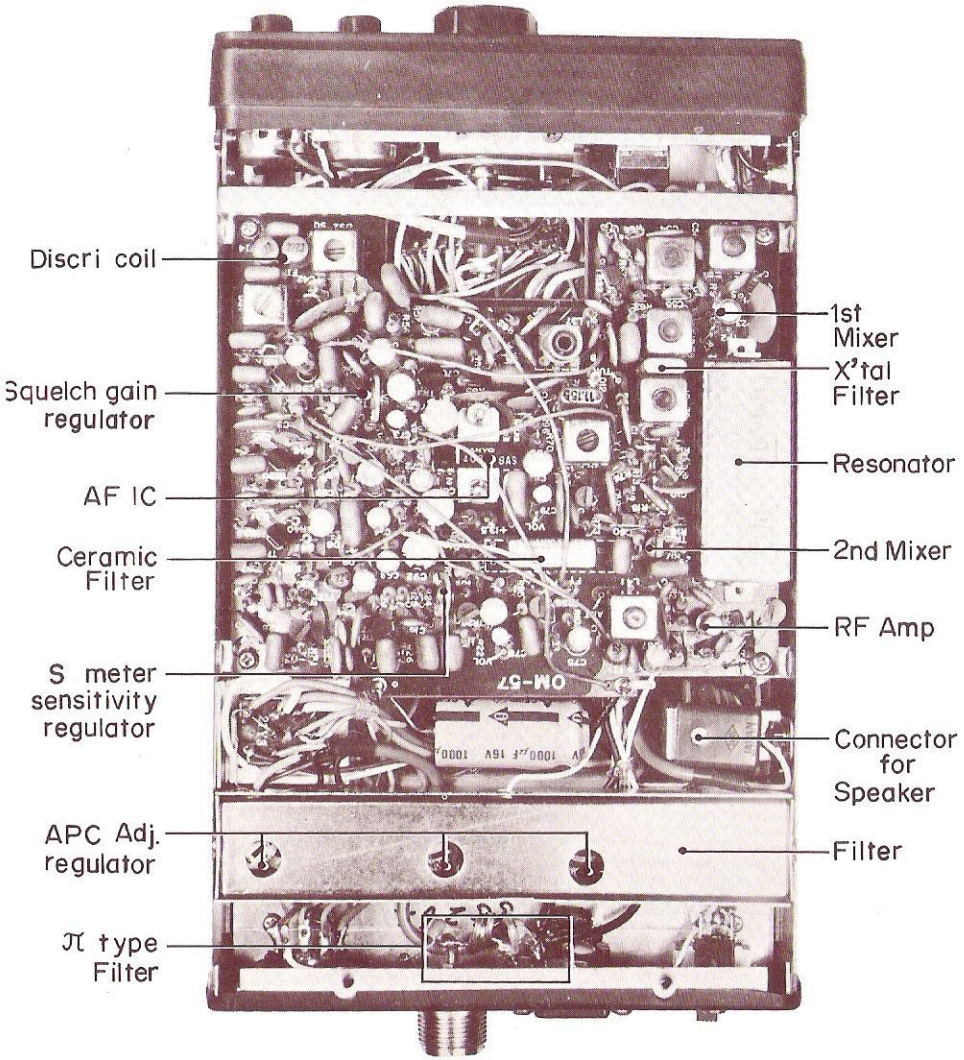
When the output power selector is set at "LOW" position, the power source voltage of TR7, 11 and 12 is lowered by the R201 voltage drop resistor, and output power is reduced to 1 Watt or less.

The signal power-amplified at the booster unit is forwarded to the filter unit and passes the two-stage low-pass filter. Further, it is sent out to the antenna as 10 Watts output from the antenna connector through the antenna change-over switch. In the filter unit, D301 detecting circuit that selects transmit RF level meter and D302 detecting circuit as a final transistor protective circuit are assembled.

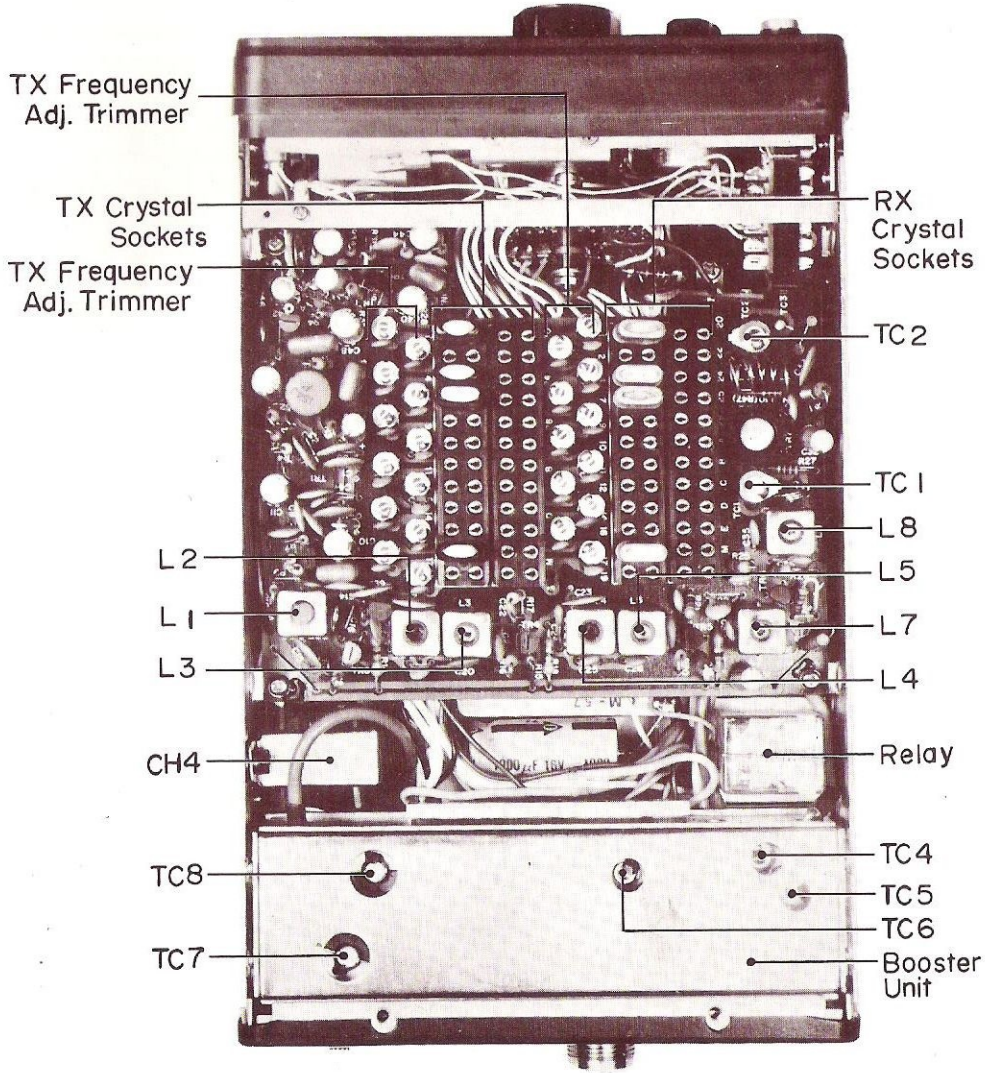
The protective circuit (APC circuit) detects reflected wave when SWR soared up and applied direct current signal detected by the diode to the gate of the SCR 1. Further, it drops the collector voltage of TR3 through SCR1 so that a signal does not go to the latter half stage.

The π type filter is put between the antenna relay and ant. connector, and it supresses spurious as 3 times harmonic wave by diode detection.

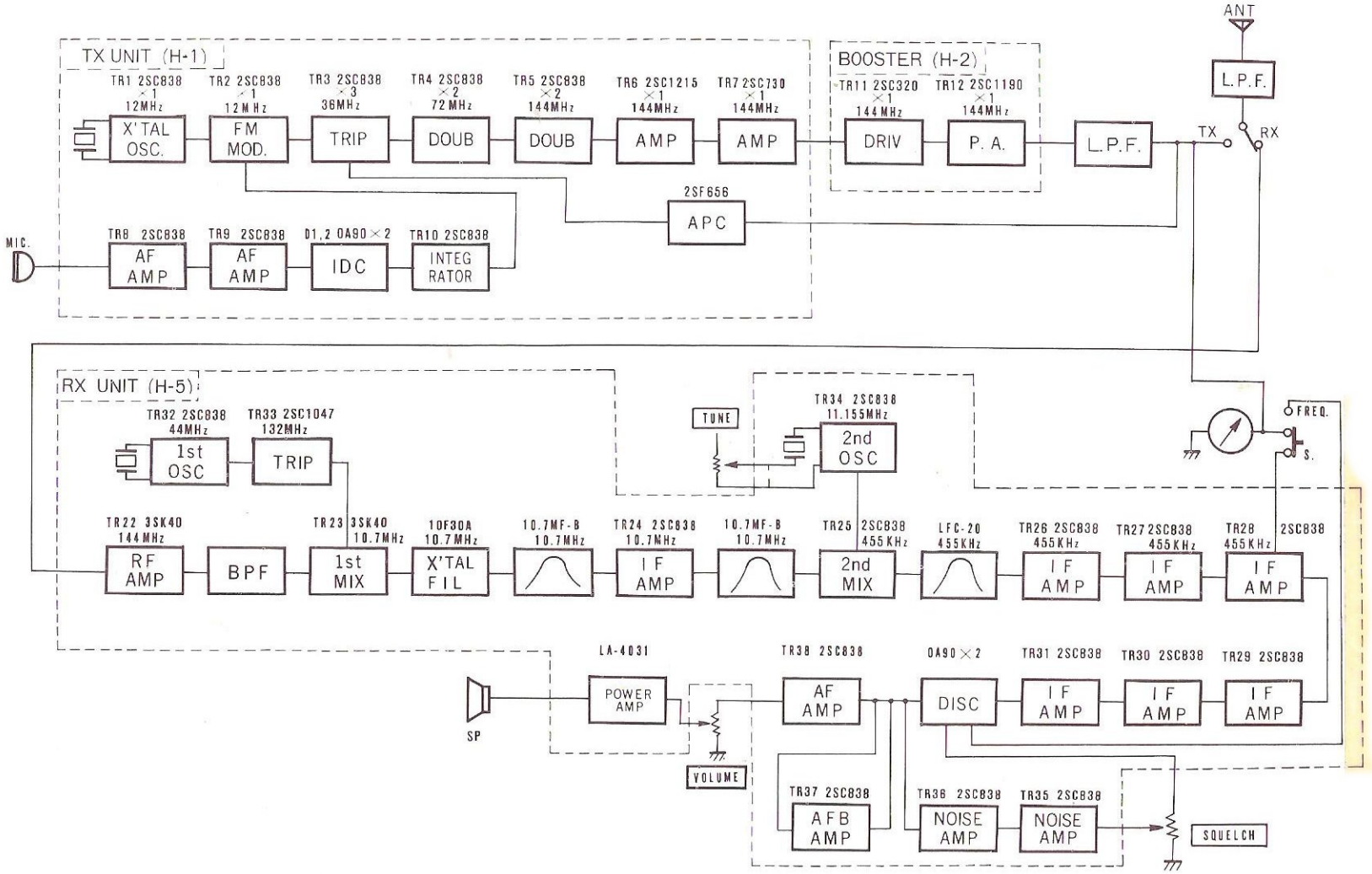
ARRANGEMENT OF VARIOUS PARTS



ARRANGEMENT OF VARIOUS PARTS



BLOCK DIAGRAM



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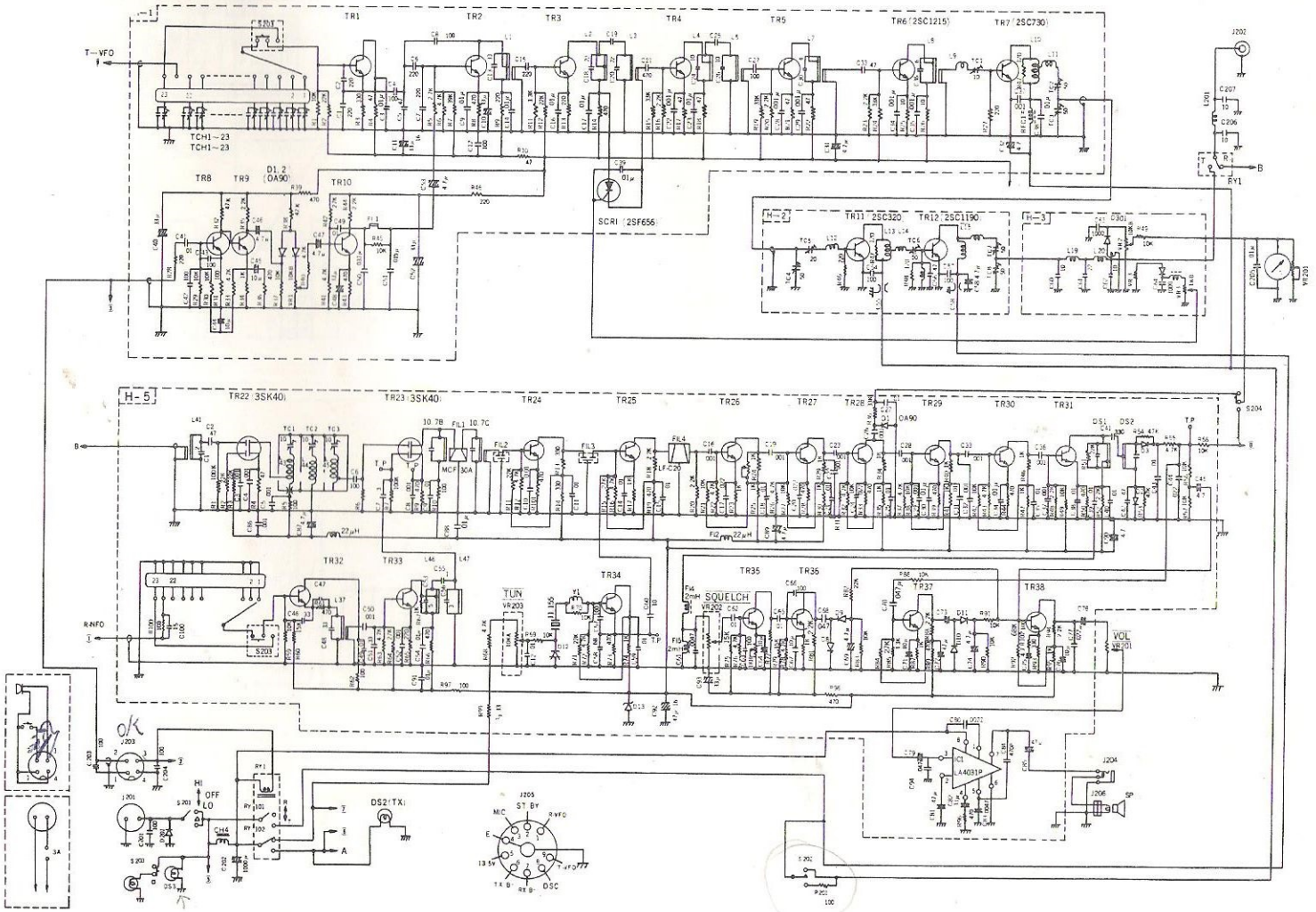
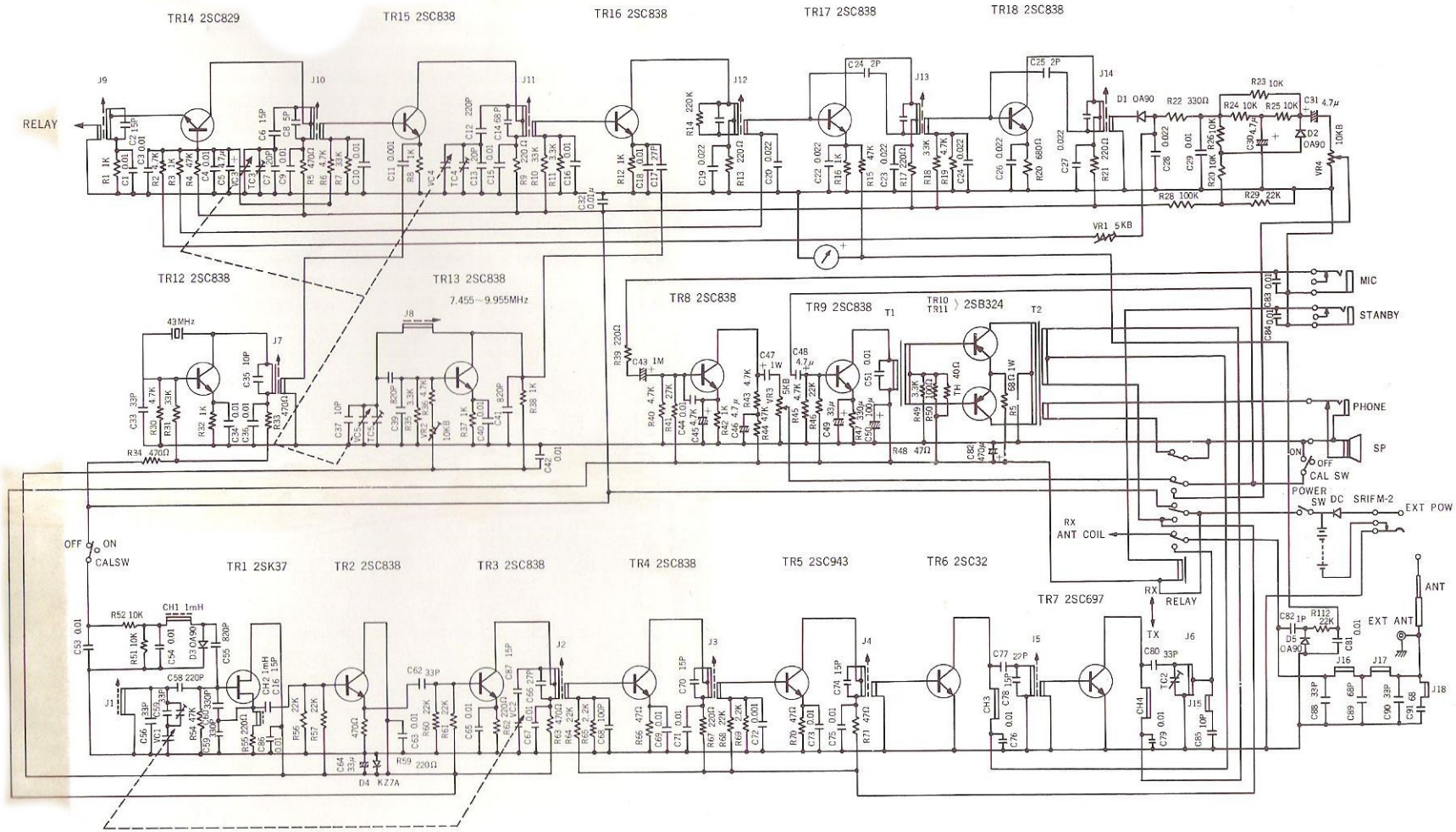


• NO MARKED TRANSISTORS ARE 2SC839.

* Schematic Diagram and Specifications are subject to change without prior notice.



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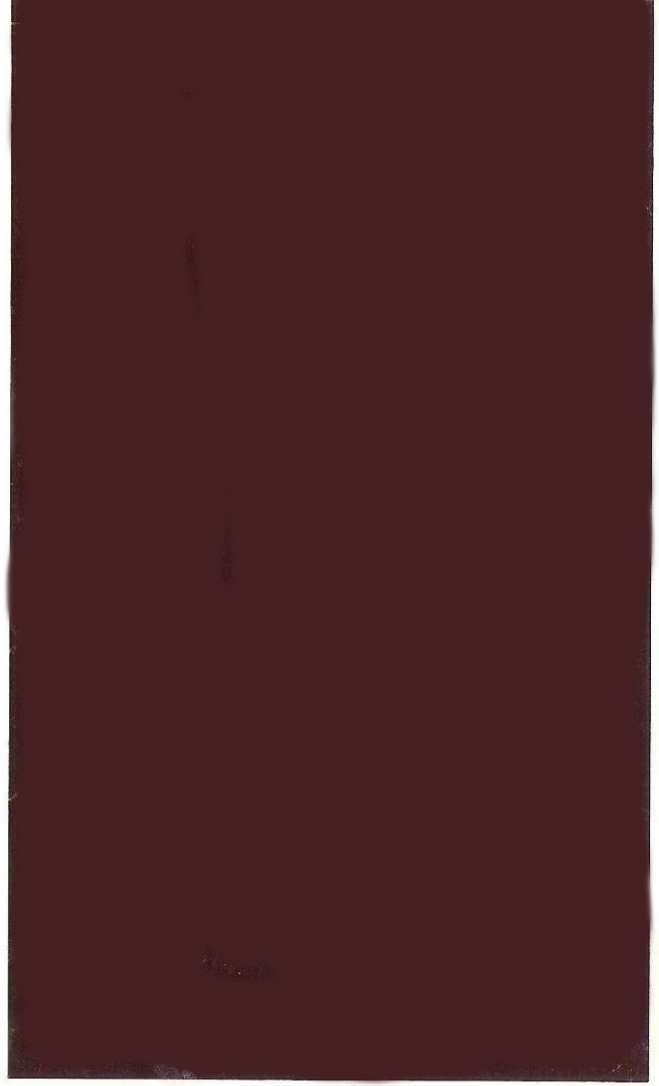

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