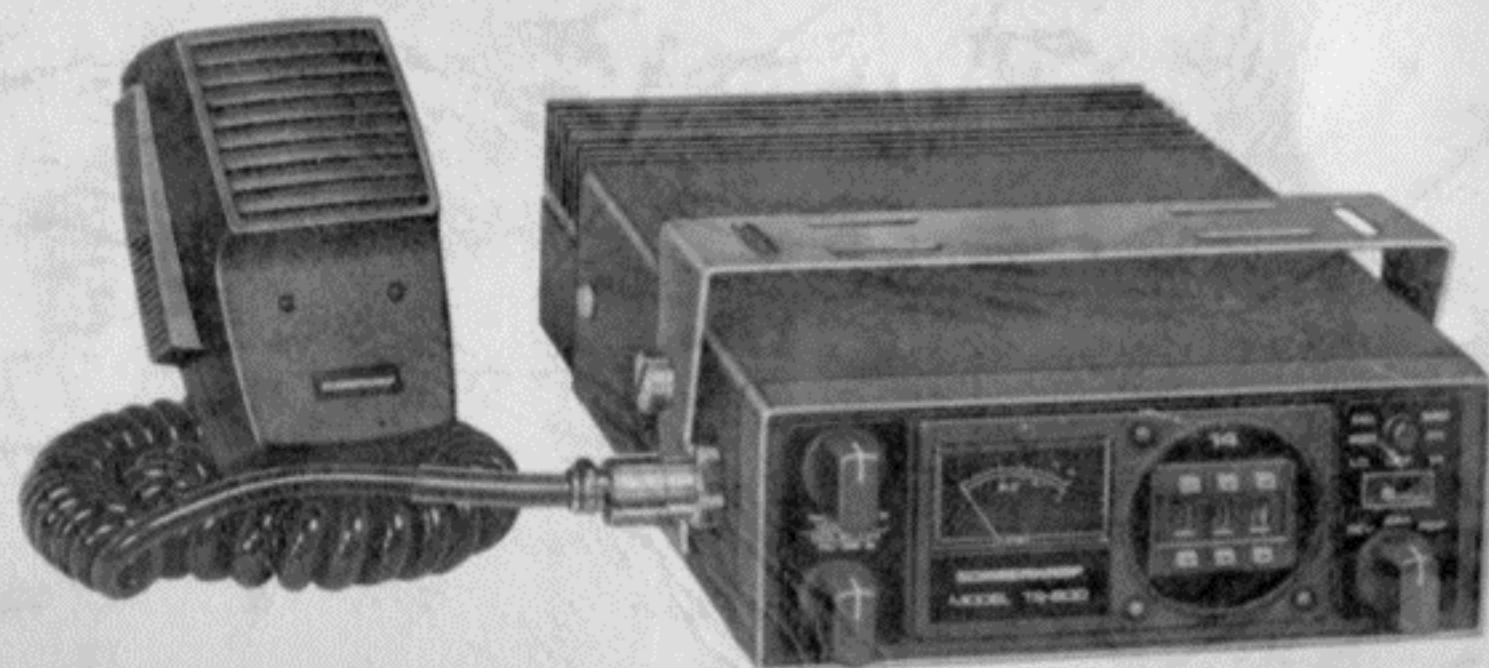


SOMMERKAMP

MODEL TS-800



SOMMERKAMP ELECTRONIC SAS

CH-6903 LUGANO, P.O. BOX 176

SWITZERLAND

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INSTRUCTION MANUAL

SECTION I - SPECIFICATIONS

GENERAL :

- | | |
|-----------------------------|---|
| 1. Semiconductors | : 15 IC's, 38 Transistors, 7 FET's & 63 Diodes |
| 2. Frequency Range | : 140.000~149.9875MHz. in 12.5KHz step |
| 3. Frequency Control system | : Phase Locked Loop Synthesizer |
| 4. Modulation Type | : Frequency Modulation |
| 5. Frequency Stability | : 20ppm (2KHz) at 25°C |
| 6. Power Supply | : 11~16V DC, Negative Ground |
| 7. Current Drain | : Transmit: 12A at 13.8V
Receive: 500mA at 13.8V |
| 8. Antenna Impedance | : 50 ohm unbalanced |
| 9. Speaker | : Dynamic type 8 ohm |
| 10. Microphone | : Ceramic type 1K ohm |
| 11. Size | : 61 × 156 × 290mm |

TRANSMITTER:

- | | |
|-------------------------------|---|
| 1. RF Output Power | : Abt. 50W at 13.8V in HI position
Abt. 5W at 13.8V in LO position |
| 2. Spurious & Harmonic Output | : Less than -60dB (below carrier) |
| 3. Deviation | : ±5KHz max. |

RECEIVER:

- | | |
|---------------------------|---------------------------------------|
| 1. Frequency Scheme | : Dual Conversion PLL Superheterodyne |
| 2. Sensitivity | : 1µV for 25dB |
| 3. Spurious Response | : Less than -60dB |
| 4. Selectivity | : Bandwidth 6dB down at ±7.5KHz |
| 5. Audio Output Power | : 2W at 8 ohm at less than 10% THD |
| 6. Intermediate Frequency | : 1st IF: 17.09MHz
2nd IF: 455KHz |

ACCESSORIES:

An individual packing contains the following accessories beside the TS-800:

- | | |
|----------------------------|---------|
| 1) Car Mounting Bracket | 1 pce. |
| 2) Mounting Screw (large) | 4 pcs. |
| 3) Mounting Screw (middle) | 4 pcs. |
| 4) Mounting Screw (small) | 2 pcs. |
| 5) Mounting Nut | 4 pcs. |
| 6) Various Washer | 10 pcs. |
| 7) Microphone | 1 pce. |

TABLE OF CONTENTS

I. SPECIFICATIONS	1
II. GENERAL DESCRIPTIONS	2
III. INSTALLATIONS	4
IV. CONTROLS & FUNCTIONS	7
V. OPERATIONS	11
VI. CIRCUIT DESCRIPTIONS	12
VII. MAINTENANCE & ALIGNMENTS	16
VIII. DIAGRAMS & LAYOUTS	19
IX. PARTS LIST	32

SECTION II - GENERAL DESCRIPTIONS

Your SOMMERKAMP TS-800 transceiver has been designed for continuous heavy duty mobile and base station application on FM (Frequency Modulation).

You can select 800 channels of frequency in 12.5KHz step between 140.000~149.9875 MHz. The biggest feature of this transceiver is that any ranges of frequency for 1,000KHz, 100KHz and 10KHz band can be selected instantly by pushing the Thumb Wheel Drum Switches. The TS-800 has many other special features, one of which is a tone squelch circuit. When the squelch control knob is pulled, the tone squelch circuit is on and a certain fixed signal between 65~95Hz is transmitted together with the normal TX carrier when PTT bar on the microphone or the tone call button on the front panel is pushed. In case the squelch control knob of the opposite transceiver is also pulled, the squelch circuit of the opposite party is opened only by this tone squelch signal, which enables your set not to be activated by any other signals except the tone squelch signal.

The call lamp is always lighted up when the transceiver receives the signals including the tone squelch signal. The tone squelch signal is closely related to the answer back function. When the volume control knob is pulled, the answer back circuit is activated and the answer back signal is sent back to the opposite party in response to the incoming tone squelch signal, and the tone call lamp of the opposite party will also be lighted up.

The TS-800 has the frequency shift of Simplex, Repeater and or Reverse mode, on which you can communicate with your opposite party both through a repeater relay station and or directly. Normal communication will be made on Simplex mode. In Repeater position, 600KHz is increased in transmitting frequency and in Reverse in receiving frequency. If your transceiver is set to the repeater position, you can communicate with your opposite party either on the simplex mode through a repeater relay station or on the reverse mode directly without relaying through a repeater station.

The repeater/reverse frequency shift can also be programmed to your desire from 100KHz to 9.9MHz in 100KHz step by installing and setting 2 dip switches as described in SECTION IV. The other important feature is that you can operate this transceiver with the supplied remote control microphone by which you can control volume, squelch and tone calls etc. There are two tone call buttons on the microphone, the left one F1 and the right F2. F1 sends 1,750Hz tone signal and F2 1,800Hz. You can alter the frequency of these tone calls to 941Hz and 1,209Hz respectively by adjusting the small slide switch of SW6 and SW7 on the PLL printed board. When the tone call button on the front panel of the transceiver is pushed, the double tones of F1 and F2 are transmitted simultaneously.

The Telephone Interconnect SOMMERKAMP TS-851 can also be connected to this transceiver to enjoy the Cityplex Autopatch. For connecting to TS-851, the slide switch SW1 on the rear panel of the transceiver should be switched to the lower position.

The receiver section is designed to receive FM signals in the 140.000 ~ 149.9875 MHz band. The unique combination of low noise field effect transistors, double conversion, a combination of mechanical, ceramic, crystal and L C filters, integrated limiting amplifier and discriminator and a hi-fi quality speaker amplifier will provide exceptional reception quality in this fine piece of equipment.

In addition the above combination of the latest technology provides you with a sensitivity and unwanted signal rejection and noise suppression available previously only in space and military communication equipment. The power supply of the receiver RF, IF and the second oscillator mixer section is stabilized by an extremely sharp cut-off zener diode in conjunction with a series regulator to obtain the high sensitivity and unwanted signal rejection. The efficient series gate noise limiter, which virtually cuts off the audio output during ignition noise pulses is defeatable to make even the weakest signal audible which otherwise would be cut off by the threshold level of ANL switching diode.

The noise squelch sensitivity is achieved by using a separate noise amplifier detector and switching circuit with carefully balanced hysteresis. On the other hand, the tone squelch is achieved by using a high selective integrated circuit which activates the switching circuit and selects the tone squelch signal.

The transformerless Hi-Fi quality audio amplifier will drive any load between 8 ohm and indefinite such as internal speaker or external speaker microphone or headset combinations having the above impedances. An automatic tuning circuit will automatically tune to the best reception on the entire band. The meter indicates the field strength during reception of a signal.

The transmitter section is designed to transmit on FM also in the 140.000 ~ 149.9875 MHz band. The output signal of the PLL unit is 122.91 ~ 132.8975 MHz which is mixed with the 17.09 MHz IF and the resulting signal is amplified in the pre and power amplifier of the transmitter section. The output of the final power amplifier is fed via a matching network, low pass filter and antenna switch to the antenna jack. Between the low pass filter and the antenna jack an SWR bridge detects the standing wave ratio on the antenna system. In case the SWR is too high, it switches off the transmitter to protect the power amplifier and then the SWR lamp beneath the thumb wheel switch on the front panel will light up.

The input is designed for 1,000 ohm ceramic, 500 ohm dynamic microphone or 32 ohm speaker microphone combination.

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Beware that the actual frequency indication on the thumb wheel switches in the possible range in the preset 600KHz offset is as follows:

SIMPLEX MODE	{ TX: 140.000 ~ 149.9875 MHz RX: 140.000 ~ 149.9875 MHz
REPEATER MODE	{ TX: 140.000 ~ 149.9875 MHz RX: 140.000 ~ 149.3875 MHz
REVERSE MODE	{ TX: 140.000 ~ 149.3875 MHz RX: 140.000 ~ 149.9875 MHz

SECTION III - INSTALLATIONS

UNPACKING :

Carefully remove your transceiver from the packing carton and examine it for signs of shipping damage. It is recommended you keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary, they come in handy. Accessory hardware, screws, etc. are packed with the transceiver. Make sure you have not overlooked anything.

LOCATION :

The transceiver should be mounted where there is adequate space around the heatsink fins to allow free air circulation.

Mounting bracket and screws are supplied with the transceiver. For electrical connection, first make sure if the transceiver is turned off.

POWER REQUIREMENT :

The transceiver is supplied ready to operate from any regulated 13.8 VDC, 12 ampere negative ground source. An automobile, 12 volt negative ground system is usually more than adequate. Some note must be taken, however, to the condition of the vehicle's electrical system. Items such as low battery, worn generator/alternator, poor voltage regulator, etc. will impair operation of your transceiver as well as the vehicle. High noise generation or low voltage delivery can be traced to these deficiencies. If an AC power supply is used with your transceiver, make certain it is adequately regulated for both voltage and current. Low voltage while under load will not produce satisfactory results from your transceiver. Receiver gain and transmitter output will be greatly impaired.

CAUTION: Excessive Voltage (above 16VDC) will cause damage to your transceiver. Be sure to check the source voltage before connecting the power cord.

Attached with your transceiver is a DC power cable. The Red Wire is positive (+), the Black, negative (-). If your mobile installation permits, it is best to connect these directly to the battery terminals. This arrangement eliminates random noise and transient spient spikes sometimes found springing from automotive accessory wiring. If such an arrangement is not possible, then any convenient B + lead in the interior of the vehicle and the negative frame can be utilized. Your transceiver provides an internal DC filter that will take out the large amount of transient difficulties anyway. Remember, the unit operates on a negative ground system only-it cannot be used in a positive ground automobile.

ANTENNA REQUIREMENT :

This transceiver can be operated with any standard 50 ohm ground-plane, vertical, mobile whip, long wire or other adequate antennas. A standard SO-239 type connector is provided on the back panel for use with popular PL-259 antenna plug. A ground-plane type will provide greater coverage, and since it is essentially non-directional, it is ideal in base station to mobile operation.

From base station to base station, or point to point operation, a directional beam will give greater distance even under the adverse conditions.

A vertical whip antenna is best suited for mobile use. A non-directional antenna must be used for best result in any case. The base loaded whip antenna will normally provide effective communication. For greater range and more reliable operation, a full quarter wave whip may be used. Either of these antennas use the metal car body as a ground-plane, and the shield of the base as well as the metal case of the transceiver should be grounded.

Do not become alarmed if your transceiver fails to transmit at times during the antenna tune up procedure. Remember, your transceiver has a built-in Automatic Protection Circuit (APC) that will disable the transmitter if excessive VSWR, a shorted coaxial line or connector, or other antenna deficiency is present. A quick check on a good 50 ohm dummy load will show the transceiver to be working. The difficulty will lie with the antenna or its transmission line.

Pay careful attention to using a suitable wide range antenna covering 10MHz range, otherwise the SWR becomes very bad on some frequencies.

MICROPHONE :

A high quality special microphone is supplied with the transceiver. Merely plug it into the proper receptacle on the left side of the cabinet.

The microphone supplied has the following functions:

1. Ceramic type microphone
2. Extension speaker
3. Volume control
4. Squelch control with on/off
5. Tone call button F1 (1,750Hz) and F2 (1,800Hz)
6. Main speaker and microphone speaker switch

To transmit simply press the PTT bar on the microphone and release it for reception. The microphone has an auxiliary volume control which is an extension of the regular front panel receiver volume control. It offers great operating convenience by giving you instant volume adjustment right at your fingertips even while you are driving. As this is an extension control, the regular front panel volume control should be advanced in order. The same applies to the extension squelch control on the microphone, that means the regular front panel squelch control should be fully advanced before using the squelch on the microphone. On the other hand, the squelch on the microphone should always be turned off when you use the front panel squelch control.

By the speaker switch found on the back of the microphone, you can select the speaker being used, whether the main speaker of the set or the one installed in the microphone cabinet.

The tone call buttons on the microphone transmit 1,750Hz tone signal by pushing the F1 button and 1,800Hz by the F2. Even though you push both buttons simultaneously, the double tone call signal will not be transmitted, but only 1,750Hz signal. The double tone call signal is transmitted only by pushing the call lamp button on the front panel of the transceiver.

Important Hint :

Should you want to use a different type of microphone such as dynamic, telephone handset etc., just solder a 0.1 μ F capacitor across the microphone output.

SECTION IV-CONTROLS & FUNCTIONS

POWER ON-OFF SWITCH :

You can turn on the transceiver by snapping the toggle switch either to the left (HI Power) or right (LO Power) position, and off by switching it back to the center position. In HI power position, the RF output will be about 50W and in LO about 5W.

VOLUME/ANSWER BACK :

The receiver volume is increased as this knob is turned clockwise. To pull it, the answer back circuit will be activated and the answer back signal will be transmitted for about one second in response to the incoming tone squelch signal from your opposite party, and thus your partner can realize whether your set is switched on or off even though you are away from the transceiver.

Note, however, that this knob should be pushed again when you come back to the transceiver and start communication.

SQUELCH/TONE SQUELCH :

The squelch control is used to eliminate the background noise when there is no signal present to overcome the noise. To adjust the squelch control, select a frequency where is no signal. Turn the volume control up to the normal listening level, and rotate the squelch control clockwise until the background noise just disappears.

To pull this knob, the tone squelch signal is modulated and transmitted together with the TX carrier, tone call and/or answer back signal. When you use this function, you should fit the tone squelch frequency to that of your opposite party. This adjustment can be made by VR15, and the frequency error should always be within 3Hz between 65~95Hz. Since only the tone squelch opens the squelch circuit with the knob pulled, your transceiver will be mute until signals are received with the tone squelch signal.

S/RF METER :

In the receive mode, it reads the level of the incoming signals, and in the transmit mode, it indicates the relative power output.

The meter lamp also functions as an Out of Range indicator. The lamp goes off and the transceiver does not function when the thumb wheel indicates over 149.3875 MHz on receive mode in Repeater position and on transmit mode in Reverse position. However the lamp and the function will recover when the frequency returns within the functionable range on each mode and in each position.

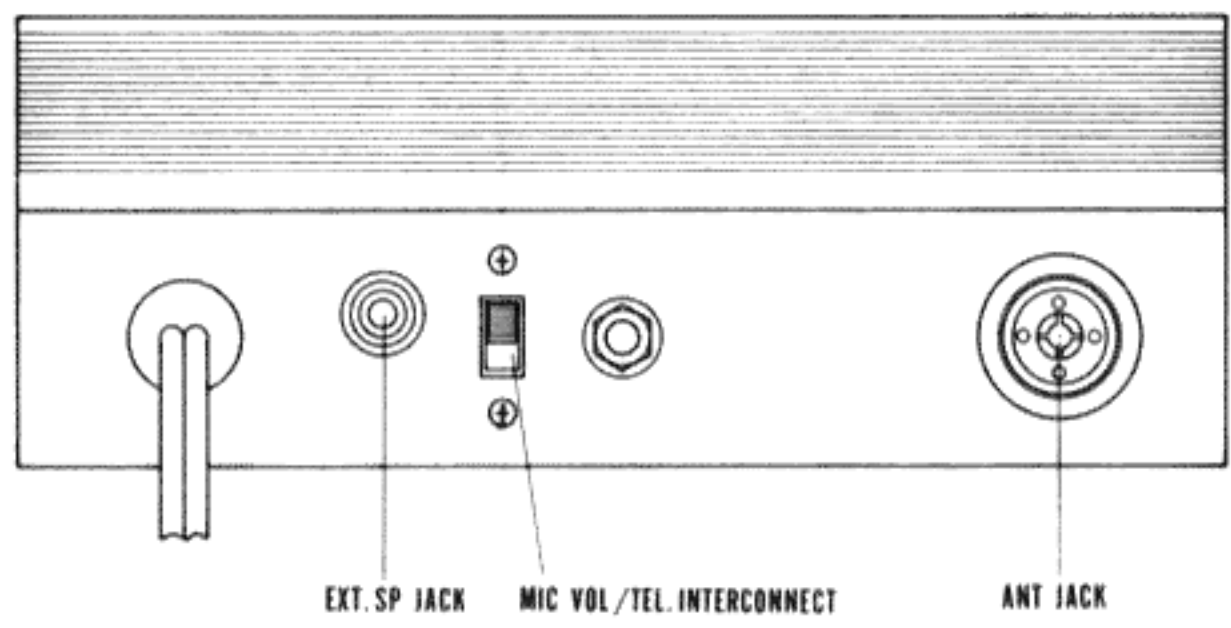
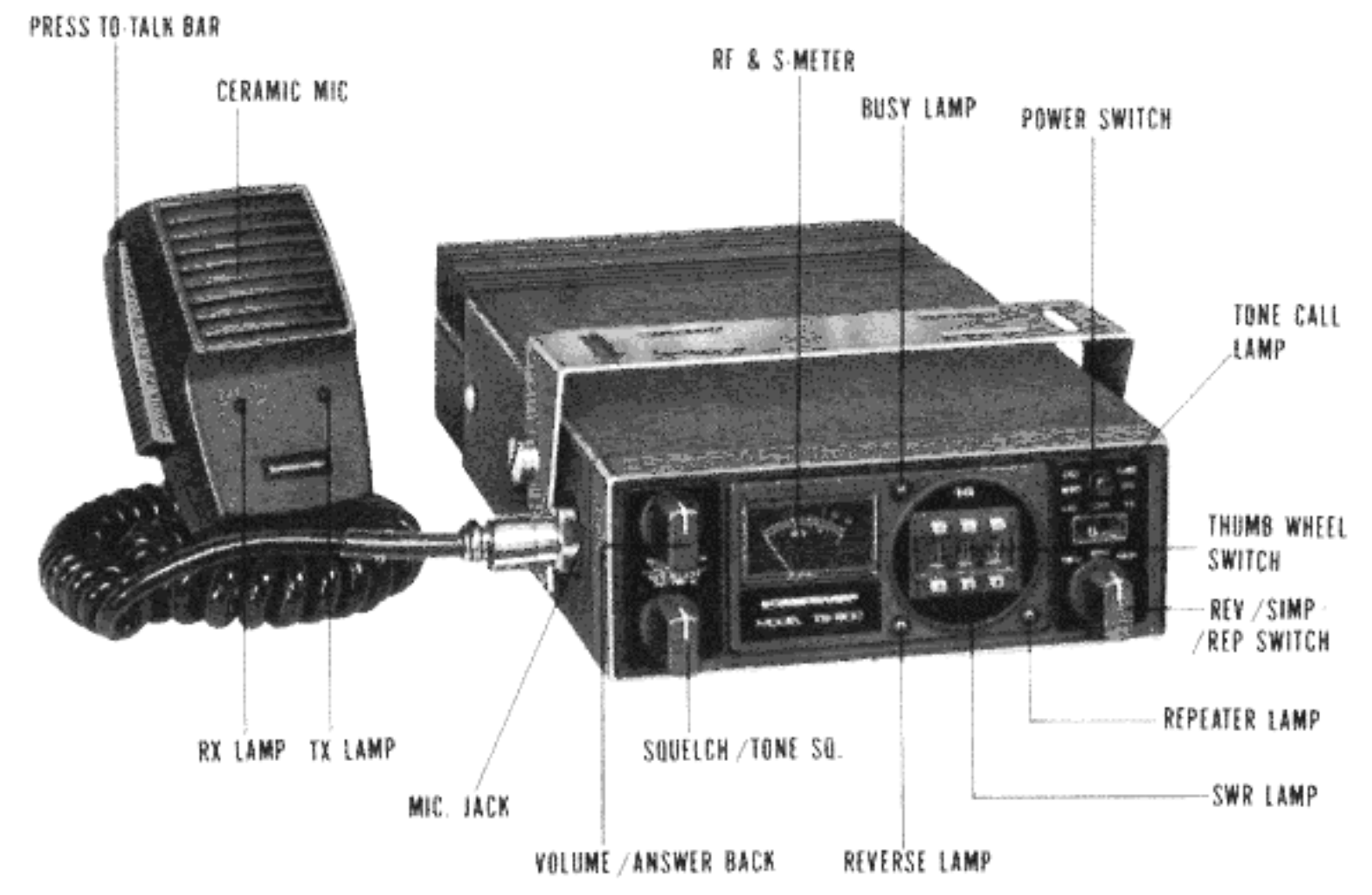
THUMB WHEEL SWITCH (FREQUENCY SELECTOR) :

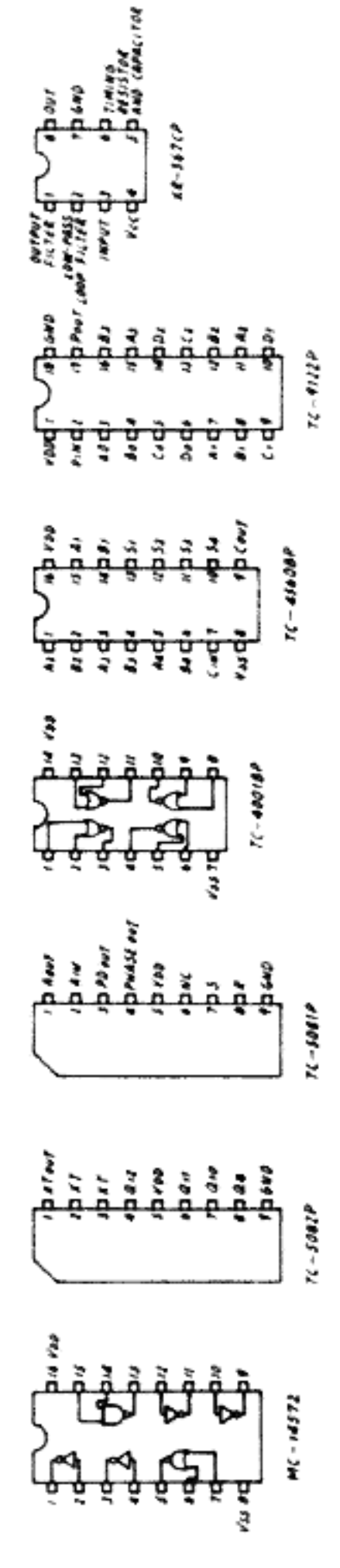
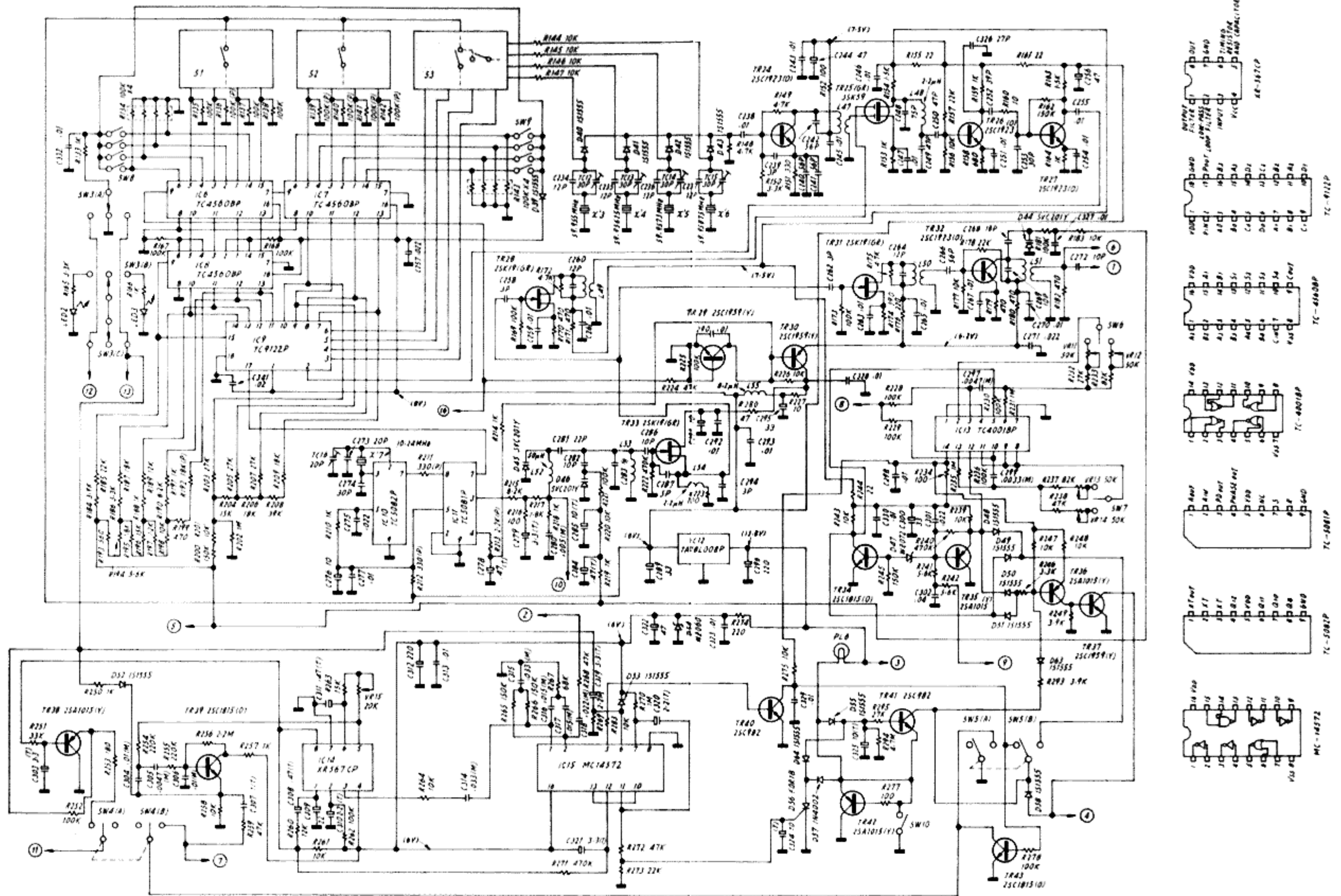
This is a unique frequency selector by which you can easily select any range of frequency only by pushing the drums which you want to select. There are three display windows indicating 1,000KHz, 100KHz and 10KHz ranges. The figure of 14 above the thumb wheel windows means the fixed range of 100MHz and 10MHz.

The 1,000KHz and 100KHz ranges have 10 steps from 0 to 9, while the 10KHz range has only 8 figures in 12.5KHz interval, 00.0, 12.5, 25.0, 37.5, 50.0, 62.5, 75.0, 87.5. Another 2 steps in 10KHz range with no figure indication are blank.

The frequency increases as pushing the button marked + (plus) and decreases as pushing the - (minus) button.

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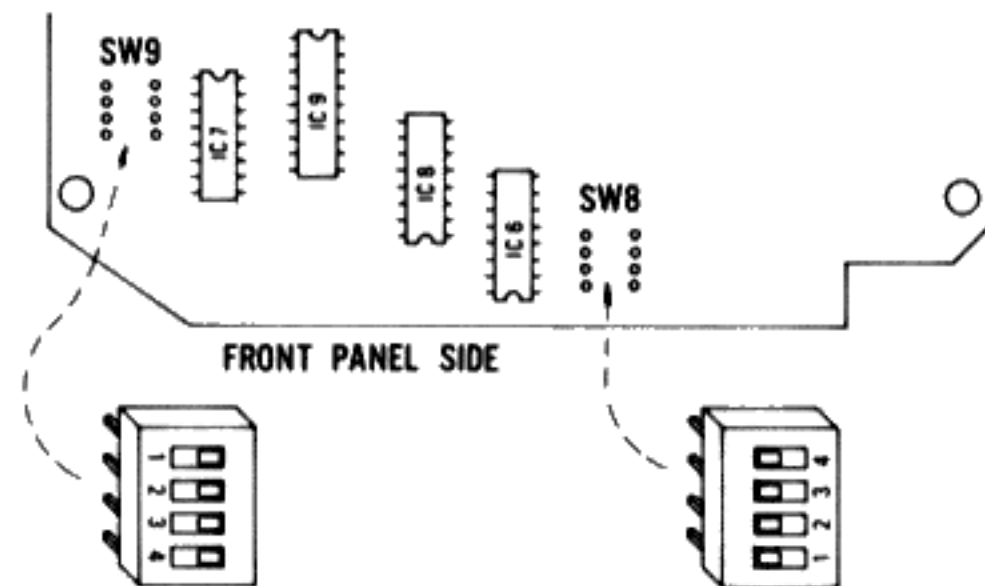


REVERSE/SIMPLEX/REPEATER SWITCH:

In Reverse and Repeater mode, the 600KHz frequency shift is set, while in Simplex mode the transmit and receive frequency stays same.

A frequency of 600KHz above the thumb wheel indication frequency is received in the repeater mode and is transmitted in the reverse mode.

However, you can program any frequency shift between 100KHz and 9.9MHz in 100 KHz step besides the 600KHz shift provided by installing two dip switches on the position of SW8 and SW9 as illustrated below:



The dip switch for 100KHz is installed on SW9 and 1MHz on SW8, and each dip switch constructs the following frequencies according to BCD code:

SW9		SW8	
No.	Freq.	No.	Freq.
1	100KHz	1	1MHz
2	200KHz	2	2MHz
3	400KHz	3	4MHz
4	800KHz	4	8MHz

You can program any figure of frequency shift combining the above figures. In case of programming 6.9MHz shift, for instance, move 2 for 2MHz and 3 for 4MHz on the dip switch SW8, and 1 for 100KHz and 4 for 800KHz on SW9. Thus $2\text{MHz} + 4\text{MHz} + 100\text{KHz} + 800\text{KHz} = 6.9\text{MHz}$.

Pay attention that a figure to be programmed on one dip switch is up to 9, i. e. up to 900KHz on SW9 and 9MHz on SW8 and that the shift program should be made so that communication can be performed within the range of 140.000 ~ 149.9875 MHz even in the Reverse or Repeater mode. That means if the programmed frequency shift is 9.9MHz, then actual coverage in which the set can be operated on Reverse or Repeater mode is 140.000 ~ 140.0875MHz. ($149.9875 - 9.9 = 140.0875$)

REVERSE LAMP (Red) :

In reverse mode, the lamp is on when the signal is transmitted and off when the set receives signals.

REPEATER LAMP (Green) :

In repeater mode the lamp is on when signals are received and off when the signal

BUSY LAMP (Green) :

This lamp is on and glittering according to the strength of the incoming signal when the set is in receive mode. You can notice the receiving signals by this lamp even when the set is mute due to the tone squelch effect or excess squelch.

SWR LAMP (Red) :

This is the small lamp located beneath the thumb wheel switches. The lamp is lit when the built-in automatic protection circuit disables the transmitter due to excessive VSWR (over 3:1), shorted coaxial line or connector, or other antenna deficiencies. If this lamp is on, switch the transceiver off and check the antenna or its transmission line. After the VSWR is adjusted within 1.5:1 or 2:1, switch the set on again. In order to keep the good antenna matching, you should use the special type of antenna covering the wide frequency range for 10MHz, and are also recommended to use an antenna coupler.

TONE CALL LAMP (Red) :

This lamp has the following functions:

1. Tone Squelch Lamp.

This lamp is on when the set receives the signals including the tone squelch signal.

2. Reset Lamp Switch.

The lamp lit by the incoming tone squelch signal is switched off by pushing this button.

3. Double Tone/Burst.

To push this button, the double tone call signals of F1 (1,750Hz) and F2 (1,800Hz) are transmitted simultaneously for about 2 seconds.

MICROPHONE JACK :

The 8-Pin microphone jack has the following internal connections:

- | | |
|------------------------------|---------------------------------------|
| 1. +13.8V for VOX etc. | 5. Internal Speaker |
| 2. Audio Output (Z8~10K ohm) | 6. Microphone Input (Z600~10K ohm) |
| 3. Ground | 7. Mic. Volume Squelch out for TS-851 |
| 4. Transmit/Receive Switch | 8. Mic. Squelch |

Always operate the transceiver with the microphone plug inserted in the mic. jack, or with the external connections illustrated on the next page.

ANTENNA JACK :

This jack found on the rear panel accepts the standard PL-259 coaxial connector. Most PL-259 connector will mate satisfactorily if care is taken to seat them properly. If you have difficulty, try a different make.

EXTERNAL SPEAKER JACK :

You may add any 8~16 ohm external speaker. Connecting an external speaker will automatically disconnect the internal speaker.

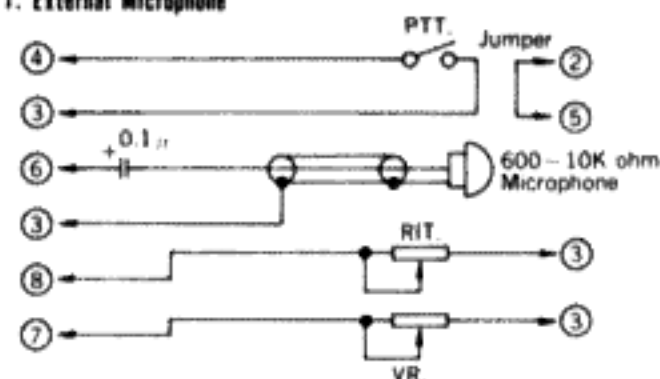
TELEPHONE INTERCONNECT/MIC VOLUME SWITCH :

This is the small slide switch found on the rear panel. When you connect the Telephone Interconnect Model TS-851 with this transceiver, switch it to the lower position to get the squelch output from the Pin 7 on the microphone jack.

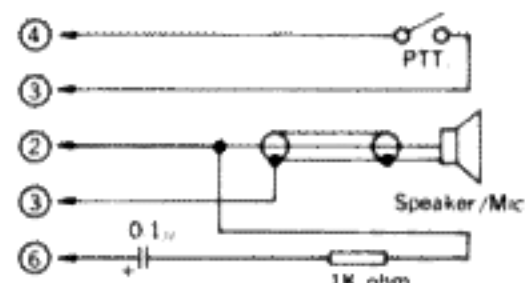
For normal communication, it should be back again to the upper position, otherwise no volume control on the microphone will be possible.

SECTION V - OPERATIONS

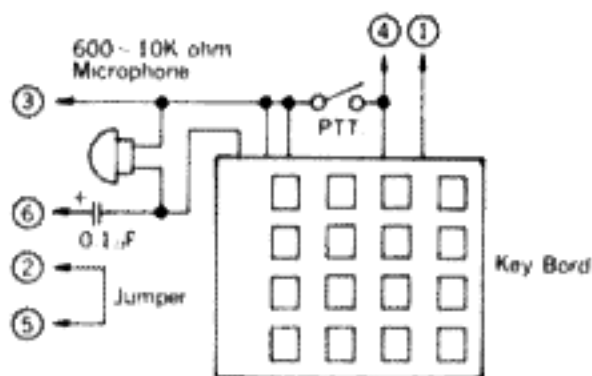
1. External Microphone



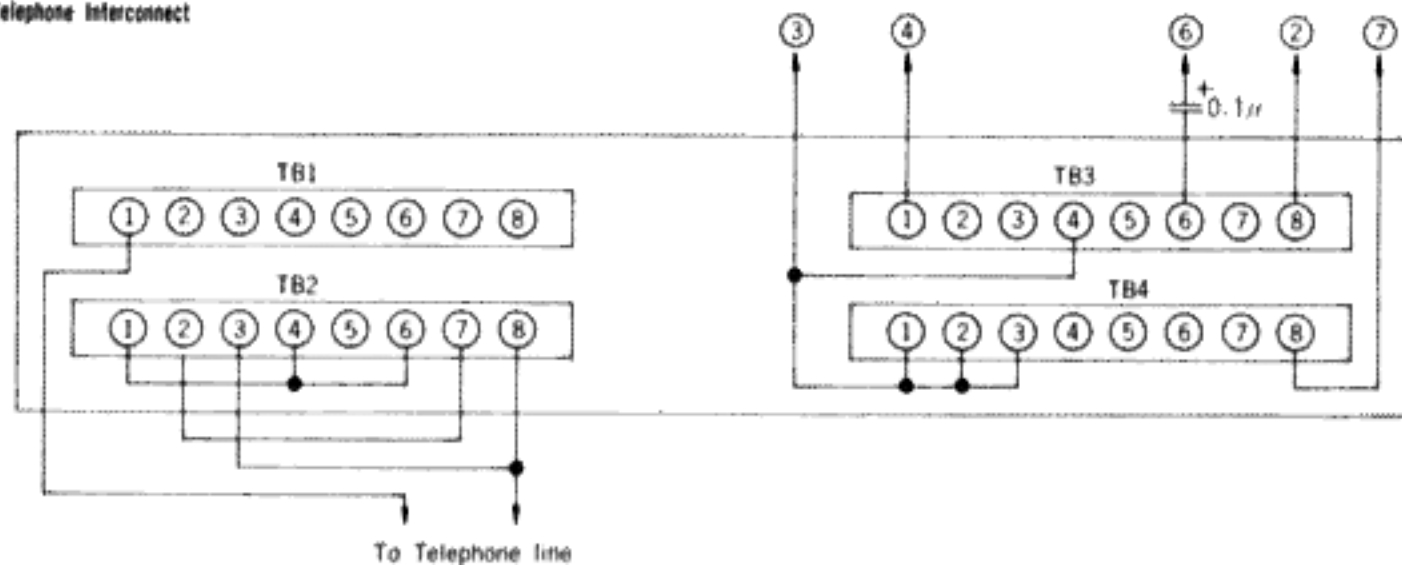
2. External Microphone Speaker with PTT.



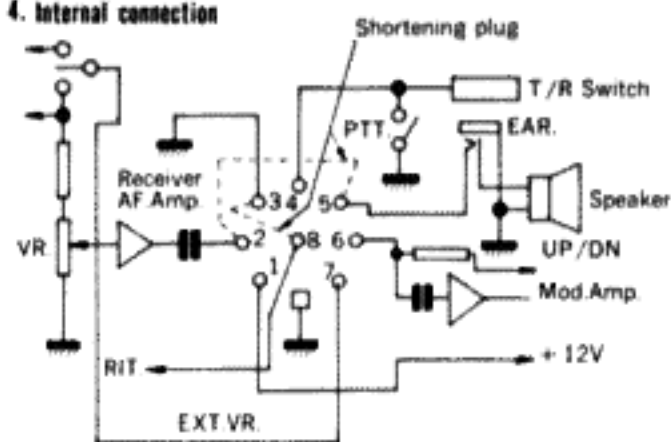
3. Telephone encoder Mic.



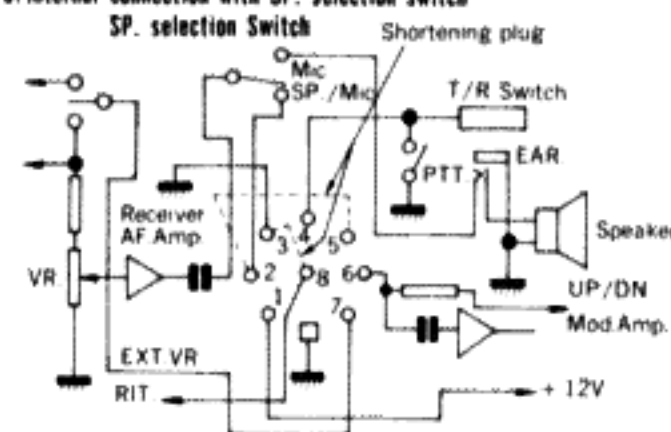
7. Telephone Interconnect



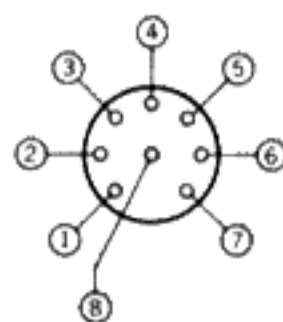
4. Internal connection



5. Internal connection with SP. selection switch



6. Connections number



INITIAL PREPARATIONS :

- Connect the microphone to the microphone jack.
- Connect an antenna to the antenna jack. Make sure the coax line is of the correct impedance (50 ohms) and is neither short nor open circuited.
- Make sure the power switch is in the OFF position. The RED cord should be connected to the positive side of the power source and the BLACK to the NEGATIVE side. In the event that these cords are improperly connected, the set will not function. No damage will be incurred since a protection circuit is provided for this purpose.
- Make sure if the supply voltage is adequate.
- Set the both volume and squelch control to the maximum counter-clockwise position.

OPERATION :

- Snap the power switch either to the left or to the right, and the meter and the frequency display shall illuminate.
- Tune to the desired frequency by operating the frequency selector on the front panel.

RECEPTION :

- Adjust the volume control to a comfortable listening level by turning it clockwise.
- With no signal present, turn the squelch control clockwise until the rushing noise just disappears. The set will now remain silent until an incoming signal is received, which opens the squelch. If the squelch is unstable due to the reception of weak or unstable stations, adjust the squelch control further until the proper threshold is obtained.
- The S-meter indicates the signal strength of the incoming stations.
- Set the squelch either on the front panel or on the microphone for best reception.

TRANSMISSION :

- Push the PTT bar on the microphone and hold it until you finish your speech. On transmission, the meter needle shall stay on the red point and shall provide an indication of relative power output.
- Hold the microphone about 10~15cm from your mouth and speak in a normal tone of voice. Shouting does not increase your communication range.
- To receive again, just release the PTT bar.

WARNING: The microphone plug should always be completely inserted and 100% firmly fixed into the microphone jack with the microphone nut attached. Failure of doing so will result in improper or wrong functions with the transceiver. Never operate the transceiver without an adequate antenna system or load. The antenna SWR should not exceed 2:1. Failure to follow this could result in damage to the output transistors.

RECEIVER:

The RF input signal from the antenna is fed through the low pass filter (L44,43, 42 & 41) to the band pass filter consisting of L1 & L2. While passing through L1 & L2, the signal is automatically tuned by D1 & D2(both 1SV50, varicap diode) to one of the frequencies between 140.000 and 149.9875MHz.

RF AMP:

The signal from the BPF(L1 & L2) is amplified by TR1(3SK59) and fed to the mixer circuit passing through the band pass filter (L3, 4 & 5). While passing L3,4 & 5, the signal is automatically tuned by D3, 4 & 5(all 1SV50) to one of the frequencies between 140.000 and 149.9875MHz.

1ST MIXER:

The signal from the BPF(L3, 4 & 5) is fed to the gate 1 of TR2(3SK59) of the mixer circuit, where the signal is mixed to produce the IF signal of 17.09MHz with the local oscillator signal of 122.91~132.8975MHz delivered to the gate 2 of TR2 from L51 of the PLL circuit. The 17.09MHz IF signal is filtered by L6, XF1 & L7 and fed to the pin 6 of IC1(TA7069) of the 2nd mixer circuit.

2ND MIXER:

The IF signal fed to IC1 is mixed to produce the 2nd IF signal of 455KHz with 17.545MHz of the crystal X1.

2ND IF LIMITER AMP:

The 2nd IF signal coming out from the pin 7 of IC1 is fed through CF1 to the pin 6 of IC2(TA7061 for 2nd IF Amp) for amplification. The signal from the pin 3 of IC2 is delivered to the two different directions, one to IC3(TA7073) and the other to TR5(2SC1923).

S-METER/BUSY LAMP:

One signal from IC2 is delivered to the base of TR5 for amplification and then detected by D8 & 9(both 1N60) to activate the S-meter(MI) for reception. At the same time the amplified signal coming out from the collector of TR5 is fed to the base of TR8(2SC982) for amplification and is detected by D14 & 15(both 1N60) to activate TR23(2SC1815) to light up the busy lamp(LED1).

2ND IF AMP:

The other signal from the pin 3 of IC2 is fed through L8 to the pin 4 of IC3(TA7073), where the signal is amplified and detected, and comes out from the pin 2 of IC3 resulting in the AF output signal. The AF output signal is divided and delivered as follows:

- (1) to the base of TR3(2SC1815 for AF Pri-Amp)
- (2) to the base of TR6(2SC1815 for Noise Amp)
- (3) to the pin 2 of IC15(MC14572) as the tone squelch signal

(1) AF PRI-AMP:

The AF signal fed to TR3 is amplified and then fed through the AF volume(VR1)

is finally delivered to the speaker through the mic jack.

(2) NOISE SQUELCH:

The AF signal is fed through L10 & 11 and the squelch potentiometer (VR4) to TR6 for amplification. This signal is also amplified by TR7(2SC1815) and detected by D10 & 12(both 1N60) and then fed to TR4(2SC1815 for Squelch Switching) which switches TR3 on and off.

(3) TONE SQUELCH:

The AF signal fed to IC15 is amplified and comes out from the pin 1 of IC15. The amplified signal is then fed to the pin 3 of IC14(XR567 for Tone Decoder) to select the fixed tone squelch frequency between 65~95Hz and it switches the pin 8 of IC14 on and off. The voltage from the pin 8 of IC14 also switches TR38 on and off and the signal from TR38(2SA1015 for Tone Squelch Switching) is fed via SW4 to TR4 which also switches TR3 on and off.

On the other hand, the signal fed to the pin 2 of IC15 passes through the inverter circuit and comes out from the pin 11 of IC15 from where the signal is delivered to the following two directions, one of which switches D56(SCR, FOR1B) on and off to light up the tone call lamp(PL6). The other signal is fed again to the pin 7 of the same IC of which output power signal comes out from the pin 5 passing through the gate circuit of IC15 and activates TR40(2SC982 for Answer Back Switching).

TRANSMITTER:**TRANSMITTING CIRCUIT:**

The signal of the crystal X2(17.09MHz) is oscillated by TR13(2SC1923 for Local Osc) and fed through the low pass filter(L12) to the gate 1 of TR14(3SK59 for Mixer). In TR14 the signal is mixed to produce 140.000~149.9875MHz with the local oscillator signal of 122.91~132.8975MHz delivered to the gate 2 of TR14 via L51 of the PLL circuit. The mixed signal is fed through the band pass filter(L13, 14 & 15) to the base of TR15(2SC387 for 144MHz Amp).

While passing L13, 14 & 15, the signal is automatically tuned by D21, 22 & 23(all SVC201) to one of the frequencies between 140.000~149.9875MHz. Then the signal is amplified by TR15 and fed through BPF(L16 & 17) to the base of TR16(2SC387 for 144MHz Amp) while being automatically tuned by D24 & 25(both SVC201) to one of the frequencies between 140.000~149.9875MHz. The signal is also amplified by TR16 and fed through the BPF(L18 & 19) to the base of TR17(2SC387 for Pri-Buffer) while being automatically tuned by D26 & 27(both SVC201) to one of the frequencies between 140.000~149.9875MHz.

Further the signal is amplified by TR17 and fed through the low pass filter(L20) to TR18(2SC1970 for Buffer) while being automatically tuned by D28(1SV50) to one of the frequencies between 140.000~149.9875MHz. Then the signal is amplified by TR18 and fed through the tuning circuit of TC2 & L22 to TR19(2SC1971 for Pri-Drive) for amplification. The signal from TR19 is fed through the tuning circuit of L24, TC3, TC4 & L25 to the base of TR20(2SC1729 for Drive). The signal amplified by TR20 is fed to TR22(2SC2630 for RF Power Amp) passing through the tuning circuit of L28, TC5 & TC6, the LPF(L29 & 46) and the tuning circuit of TC8, TC9 & L33. The signal amplified by TR22 is finally delivered to the antenna through the tuning circuit of L37 & TC10, the antenna switching diodes D30~35(all M1402) and the LPF of L41~44.

LOW POWER/ALC CIRCUIT:

The RF output power signal is picked up by C218 while passing the LPF(L41~44) and detected by D36(1N60). The detector diode(D36) activates TR45(2SC1815) and TR44(2SD880) to control the voltage of the power supply to function the ALC. On the other hand, the RF output power signal detected by D36 operates the TX Power meter(M1) to indicate the strength of the output power.

SWR:

The reflexed signal picked up by the pick-up coil is detected by D37(1N60) to activate D38(SCR, FOR1B) and then lights up the SWR lamp(PL5). The current from D38 ceases the function of TR10(2SC496) to switch off the current of the power supply for TR11, 12 etc.

AF MODULATION CIRCUIT:

The speech signal from the microphone is fed to the pin 6 of IC5(TA7061 for AF Limiter Amp) and comes out from the pin 3 after being amplified. The signal is then fed through the LPF(L31 & 32) to the VCO circuit, where the signal is frequency-modulated. This signal is finally delivered via L51 to the mixer transistor TR14 for mixture with 17.09MHz of the TX local oscillator.

TONE SQUELCH MODULATION:

The tone squelch signal adjusted by VR15 to a certain frequency between 65~95Hz is decoded by IC14(XR567 for Tone Decoder). This signal comes out from the pin 4 of IC14 and impedance-converted by TR39(2SC1815). The signal from TR39 is fed via SW4 to the LPF(L31 & 32) of the AF amp. circuit, where the signal is joined to the signal from the AF modulation circuit and then delivered to the VCO circuit of the PLL circuit.

TONE CALL MODULATION:

To push a push button on the microphone, TR34(2SC1815) and TR35(2SA1015) are activated and thus the oscillator circuit of IC13(TC4001) produces the tone call signal of 1,750 or 1,800Hz. The 1,750Hz signal comes out from the pin 3 and the 1,800Hz from the pin 10 of IC13, and each signal is fed to the base of TR21(2SA562) for amplification. The amplified signal comes out from the collector of TR21 and is delivered to the two different directions. One is sent to the speaker as the monitor signal and the other is sent to the pin 6 of IC5(TA7061) for modulation. Hereafter the modulated signal follows the same route as the AF modulation circuit. When TR34 and TR35 are activated by pushing the call button(SW8) on the front of the transceiver, the switching transistors of TR36(2SA1015) and TR37(2SC1959) are switched on to transmit the double tone call signal even without pushing the PTT bar on the microphone.

REST/DOUBLE TONE/BURST SWITCH:

A) REST SWITCH:

When the transceiver receives a tone squelch signal, D56(FOR1B) is switched on and the tone call lamp(PL6) is turned on. Pushing the rest button(SW8), TR42(2SA1015) activates and switches D56 off and the tone call lamp is turned off.

B) DOUBLE TONE/BURST SWITCH:

To push the tone call button(SW8), TR41(2SC982) is switched on and the voltage from TR41 activates D48 & 49(both 1S1555). These diodes activate the oscillator circuit of IC13(TC4001) to produce the double tone call signal of 1,750 and 1,800Hz. This signal is transmitted through the same route as the tone call

PLL & SUBSIDIARY CIRCUITS:

PLL:

The base oscillator of IC10(TC5082 for Divider) oscillates the crystal X7(10.24MHz) and divides the frequency into 1/1,024 resulting in the 10KHz signal which is fed to the pin 8 of IC11(TC5081 for Phase Comparator).

LOCAL OSCILLATOR:

TR24(2SC1923) oscillates the 4 crystals of X3(59.955MHz), X4(59.95625MHz), X5(59.9575MHz) & X6(59.95875MHz) to set up the frequencies of 10KHz band. These crystals are selected by the Thumb Wheel Switches as follows:

00.0 & 50.0	X3
12.5 & 62.5	X4
25.0 & 75.0	X5
37.5 & 87.5	X6

The above frequencies oscillated by TR 24 are fed to the gate 1 of TR25(3SK59) in which these frequencies are mixed with other ones(122.91~132.8975MHz) delivered to the gate 2 of TR25 from TR28(2SK19 for VCO Amp) resulting in the signal in 3~13MHz. The mixed signal is amplified by TR26(2SC1923) and TR27(2SC1923), and fed to the pin 2 of IC9(TC9122 for Programable Divider) where the signal is divided into the 10KHz range according to the division ratio set up by the thumb wheel switches and the adder circuit. The signal comes out from the pin 17 of IC9 and is fed to the pin 7 of IC11(TC5081 for Phase Comparator) where the signal is phase-comparated and comes out from the pin 3 of IC11. Then the signal passes through the passive filter circuit (R216, C279 etc.) and controls D45(SVC201) of the VCO circuit consisted of TR33(2SK19 for VCO) etc. to activate the VCO circuit. D46(SVC201) supports the function of D45 according to the frequency of 122.91~132.8975MHz which is oscillated by TR33 and is divided into 2. One signal is fed to the gate of TR28(2SK19) for amplification and delivered via L49 to the gate 2 of TR25(3SK59) as mentioned above. The other signal is fed to the gate of TR31(2SK19) for amplification and is fed through L50 to the base of TR32(2SC1923) for further amplification. The amplified VCO signal is delivered via L51 to TR2(3SK59 for Mixer of RX) and TR14(3SK59 for Mixer of TX) as described in the Receiver and Transmitter sections. This signal is automatically tuned by D44(SVC201) to one of the frequencies between 122.91~132.8975MHz while passing through L51.

THUMB WHEEL:

The thumb wheel switches set up the desired frequencies by activating IC9(TC9122 for Programable Divider). The thumb wheel SW1 controls the figure of 1MHz, SW2 for 100MHz and SW3 for 10KHz.

However on Repeater/Reverse mode, it is possible to shift a different frequency such as 600KHz or any other frequency from 100KHz up to 9.9MHz which can be adjusted by dip switches which later optionally are installed on the PC board. In this case, SW1 activates IC9 through IC6(TC4560) and SW2 through IC7(TC4560). In order to set up the division ratio of the PLL circuit, IC8(TC4560) is used in the 1MHz step and it programs IC9 to start from 3MHz.

AUTOMATIC TUNING CIRCUIT:

A combination circuit of resistors (R184~209) changes the output power of IC7 & 8 (both TC4560 for Adder) to produce automatic tuning voltage for each positions of

UNLOCK MONITOR CIRCUIT :

This circuit is designed to activate TR29 and TR30 (both 2SC1959) to stop the local oscillation circuit to cease transmit and receive.

The unlock monitor circuit will work when the PLL circuit disables to function properly due to any reasons such as misprogramming of the repeater/reverse frequency shift or any other difficulties.

SECTION VI - MAINTENANCE AND ALIGNMENTS

This transceiver has been carefully aligned and tested at the factory prior to shipment. The reliability of the solid devices used in this transceiver should provide years of trouble-free services if the set is not abused and the proper routine maintenance is carried out. This manual describes the adjusting sequence and procedures of this equipment.

Please do not attempt to adjust the unit without using the proper measuring instruments listed in this manual.

RECEIVER ADJUSTMENT

1. MEASURING INSTRUMENTS :

- DC Power Supply 13.8V
- Signal Generator
- Voltmeter
- Oscilloscope

2. SENSITIVITY ADJUSTMENT :

Frequency Figure : 145.000MHz.
Modulation : 1KHz.
Deviation : 3KHz.

A) Sensitivity Adjustment :

- Connect a voltmeter and an oscilloscope in parallel to a speaker with 8 ohm audio output. Then connect a signal generator to the antenna jack of the equipment and set the output of the SG to about 0.02V.
- Adjust L1~9 for maximum reading on the voltmeter. At the same time, confirm on the oscilloscope whether the wave figure shows the sine curve.
- Set the output of the SG to $1\mu\text{V}$ and repeat the same adjustment as above.

B) Squelch Sensitivity Adjustment :

Set the output of the SG to $2\mu\text{V}$ and turn the squelch control fully clockwise. Adjust VR3 in the vicinity of the threshold so that the background noise just appears.

C) RX Meter Adjustment :

Set the output of the SG to $100\mu\text{V}$ and adjust VR2 so that the meter needle indicates around 9.

TRANSMITTER ADJUSTMENT

1. MEASURING INSTRUMENTS :

- AF Signal Generator
- DC Power Supply 13.8V
- Wattmeter
- Frequency Counter

2. POWER ADJUSTMENT :

TX Frequency : 145.000MHz.

Connect a frequency counter and a wattmeter to the antenna jack of the set and keep them always connected all through the adjustments.

A) HI-Power Adjustment :

- Adjust L13~20 and TC2~6 & 8~11 for maximum reading on the wattmeter.
- Then change the frequency to the highest end (149.9875MHz) and the lowest (140.000MHz). If there are point where the output power is below 40W, adjust TC8~11 again to get 40~65W in all entire frequency range.

B) LO-Power Adjustment :

Set the TX frequency to 145.000MHz and switch to the LO power position. And adjust VR9 so that the output power shows about 5W.

3. RF POWER METER ADJUSTMENT :

Set the TX frequency to 145.000MHz and switch to the HI power position, and adjust VR16 so that the S/RF Meter indicates 20dB.

4. PROTECTION CIRCUIT ADJUSTMENT :

- Connect a SWR meter between the antenna jack and the antenna.
- Switch the transceiver on and adjust VR10 so that the SWR lamp just lights up when SWR is 3:1.

5. MODULATION ADJUSTMENT :

A) Mic Modulation Adjustment :

- Connect an AF Generator to the mic input and also connect an FM Linear Detector to the antenna jack together with a frequency counter and a wattmeter. Set the frequency of the AF Generator to 2KHz and its output to 0.01V.
- Adjust VR7 to fit the deviation on the FM Linear Detector to 4KHz. A mic sensitivity difference can be adjusted by VR6.

B) Tone SQ Modulation Capacity Adjustment :

Pull the squelch control knob and adjust VR8 so that the deviation on the FM Linear Detector indicates 1KHz.

6. TONE SQUELCH FREQUENCY ADJUSTMENT :

- Connect a frequency counter to the emitter of TR39.
- Adjust VR15 so that the frequency counter indicates your desired frequency between 65~95Hz.

7. TONE CALL ADJUSTMENT :

- Connect the frequency counter to the secondary position of L31.
- Switch the small slide switch (SW6) to the rear panel direction, and adjust VR11 so that the frequency counter indicates 1,750Hz.
If you wish to make the 941Hz tone call, just switch SW6 to the other direction and adjust VR12 so that the frequency counter shows 941Hz.
- Then set the other small slide switch (SW7) to the left position seeing from the front panel side and adjust VR14 to make 1,800Hz on the frequency counter. In case of making the 1,209Hz tone call, set SW7 to the right position and adjust VR13 to show 1,209Hz on the frequency counter.

8. TX FREQUENCY ADJUSTMENT:

It is always premised that the PLL and the Local Oscillator circuit are properly adjusted. The TX frequency is an addition of the crystal X2 (17.09MHz) and the local oscillator frequency. And thus the deviation on the TX frequency can be adjusted by TC1. Couple a capacitor of the smallest possible capacitance on the probe and apply to the gate 1 of TR14 and read 17.09MHz on the frequency counter by adjusting TC1.

PLL ADJUSTMENT

1. MEASURING INSTRUMENTS:

- Frequency Counter
- Oscilloscope
- DC Power Supply 13.8V

2. LOCAL OSCILLATOR ADJUSTMENT:

- The adjustment of the crystals for the 8 steps in the 10KHz band is made as follows:

X3 for 00.0 & 50.0KHz: Adjust TC12 and read 59.955MHz
X4 for 12.5 & 62.5KHz: Adjust TC13 and read 59.95625MHz
X5 for 25.0 & 75.0KHz: Adjust TC14 and read 59.9575MHz
X6 for 37.5 & 87.5KHz: Adjust TC15 and read 59.95875MHz

Couple a capacitor of the smallest possible capacitance on the probe and apply to the gate 1 of TR25, and read the above frequency on the frequency counter. In case the above frequency is not readable, then adjust L47 so that the wave on the oscilloscope shows the maximum amplitude.

- The adjustment of the crystal X7 for PLL Base Oscillator is made by TC16. Apply the probe coupling a capacitor of the smallest possible capacitance to the pin 1 of IC10 and read on the frequency counter 10.24MHz by adjusting TC16.

3. PLL LOCK ADJUSTMENT:

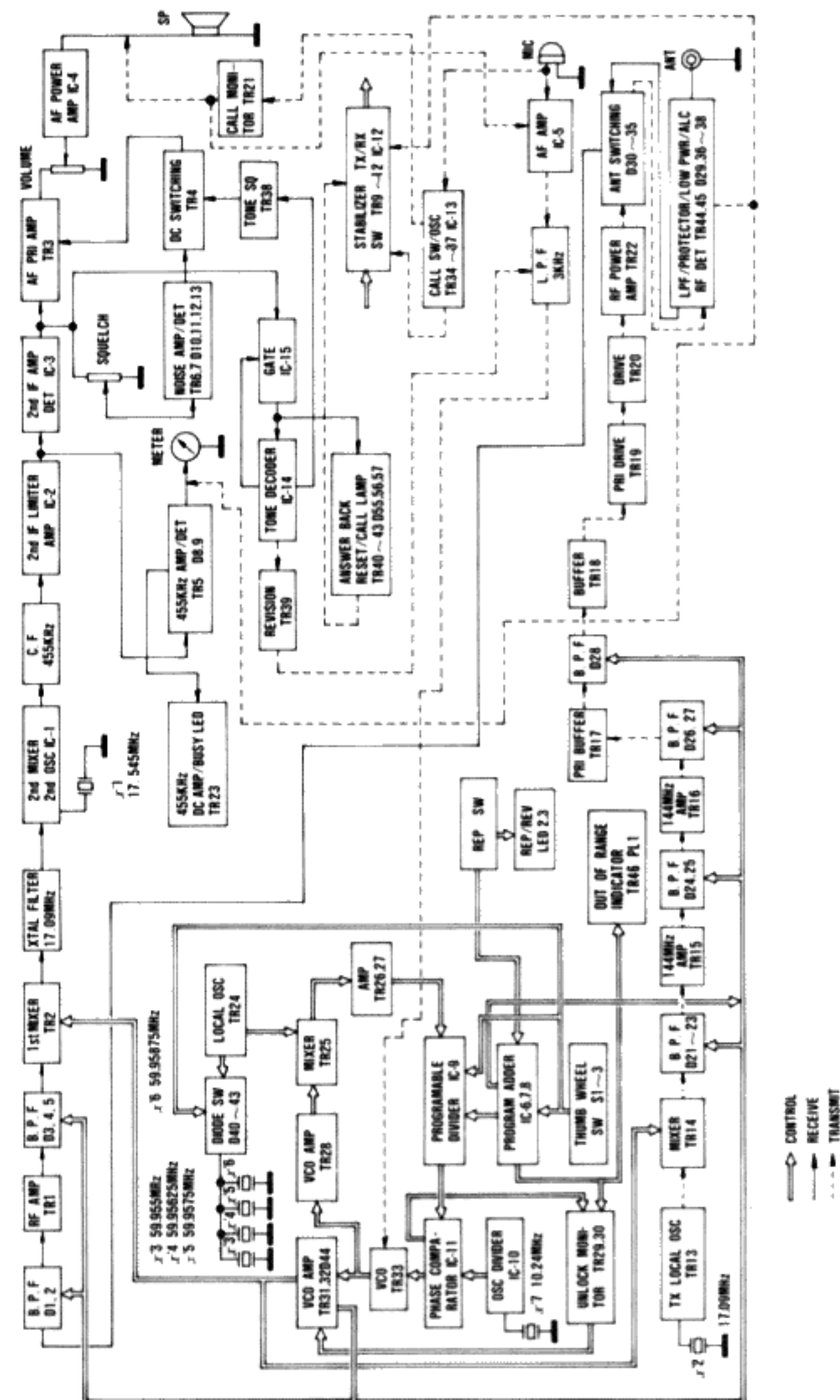
PLL Lock is achieved only after the crystals X3~7 are properly adjusted. Connect the frequency counter and the oscilloscope with the capacity up to 200MHz, and set the thumb wheel to 149.9875MHz.

- Apply the probe coupling a capacitor of the smallest possible capacitance to the gate 2 of TR25. Rotate the center core of L53 fully counterclockwise and then turn it slowly clockwise again until the frequency counter indicates 132.8975MHz.
- From that position, rotate L53 about 45 degrees further clockwise and confirm that 132.8975MHz is still on the frequency counter.
- Then set the thumb wheel to 140.000MHz. Adjust L49 so that the wave on the oscilloscope shows the maximum amplitude, and confirm that 122.91MHz is indicated on the frequency counter. Now all frequency is locked consequently.

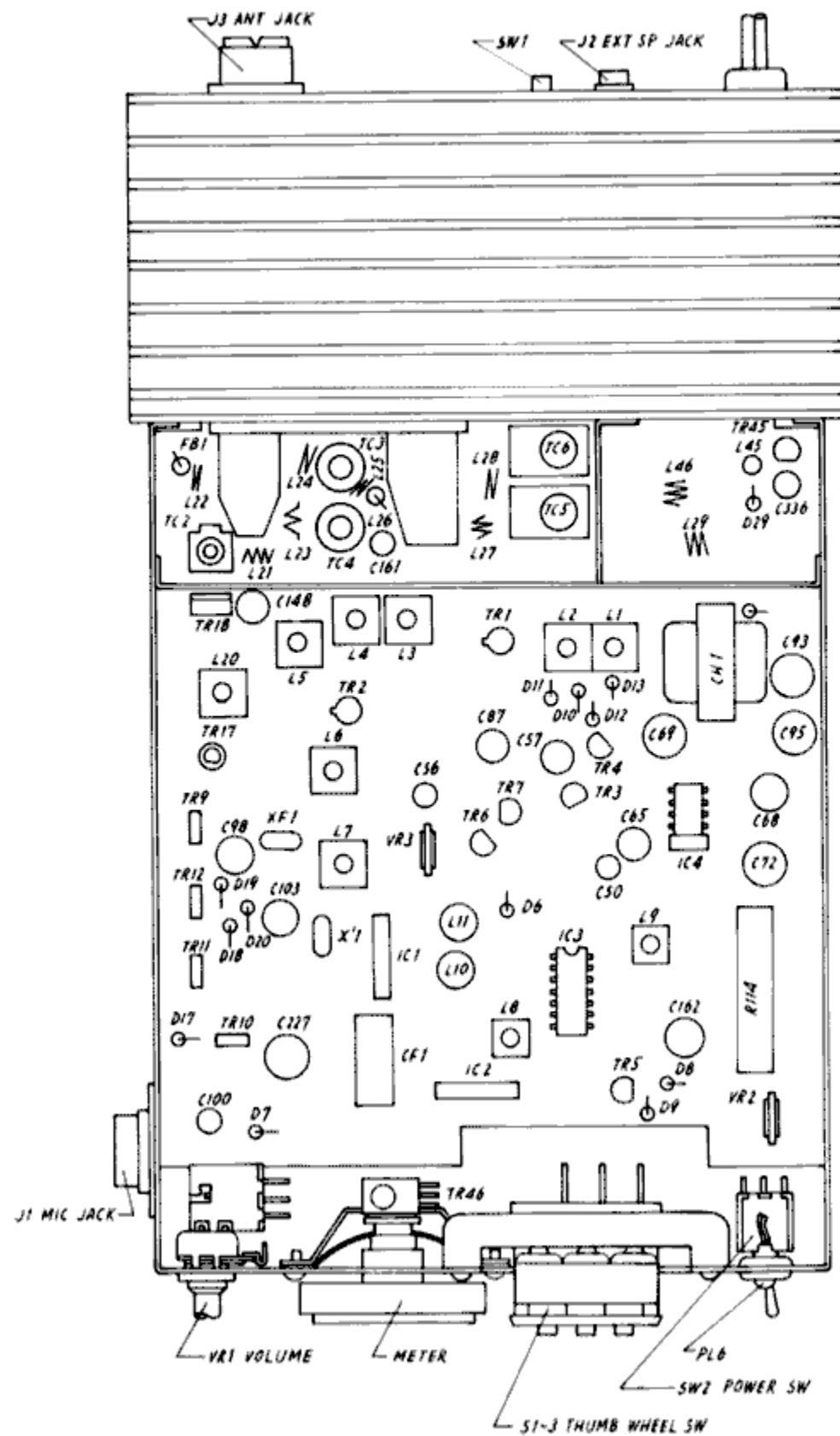
4. LOCAL OSCILLATOR ADJUSTMENT:

Set the thumb wheel to 145.000MHz and connect the oscilloscope to the secondary position of L51. After the PLL Lock adjustment is completed, adjust L50~51 so that the amplitude of the wave on the oscilloscope shows maximum value.

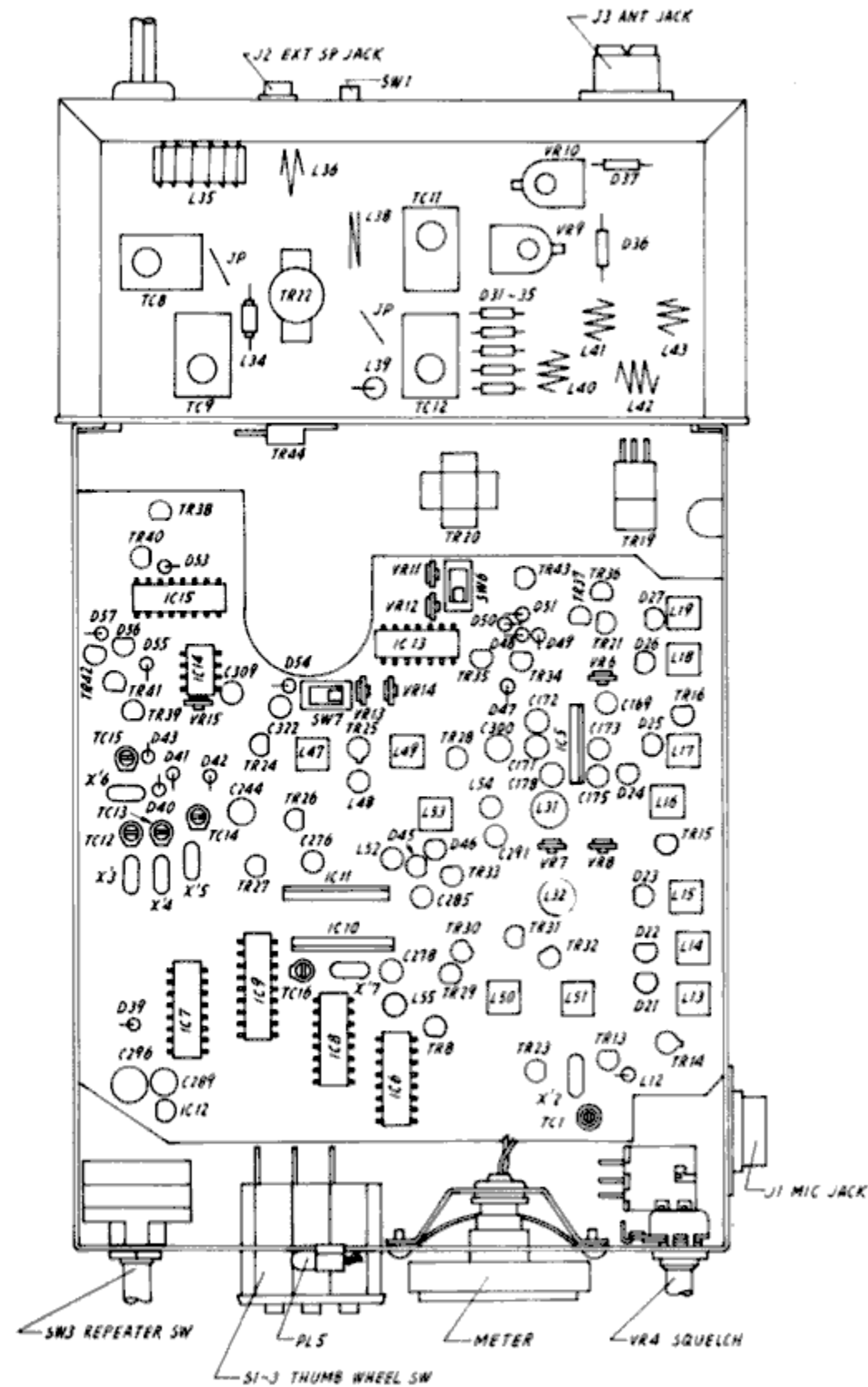
BLOCK DIAGRAM



COMPLETE PARTS LAYOUT

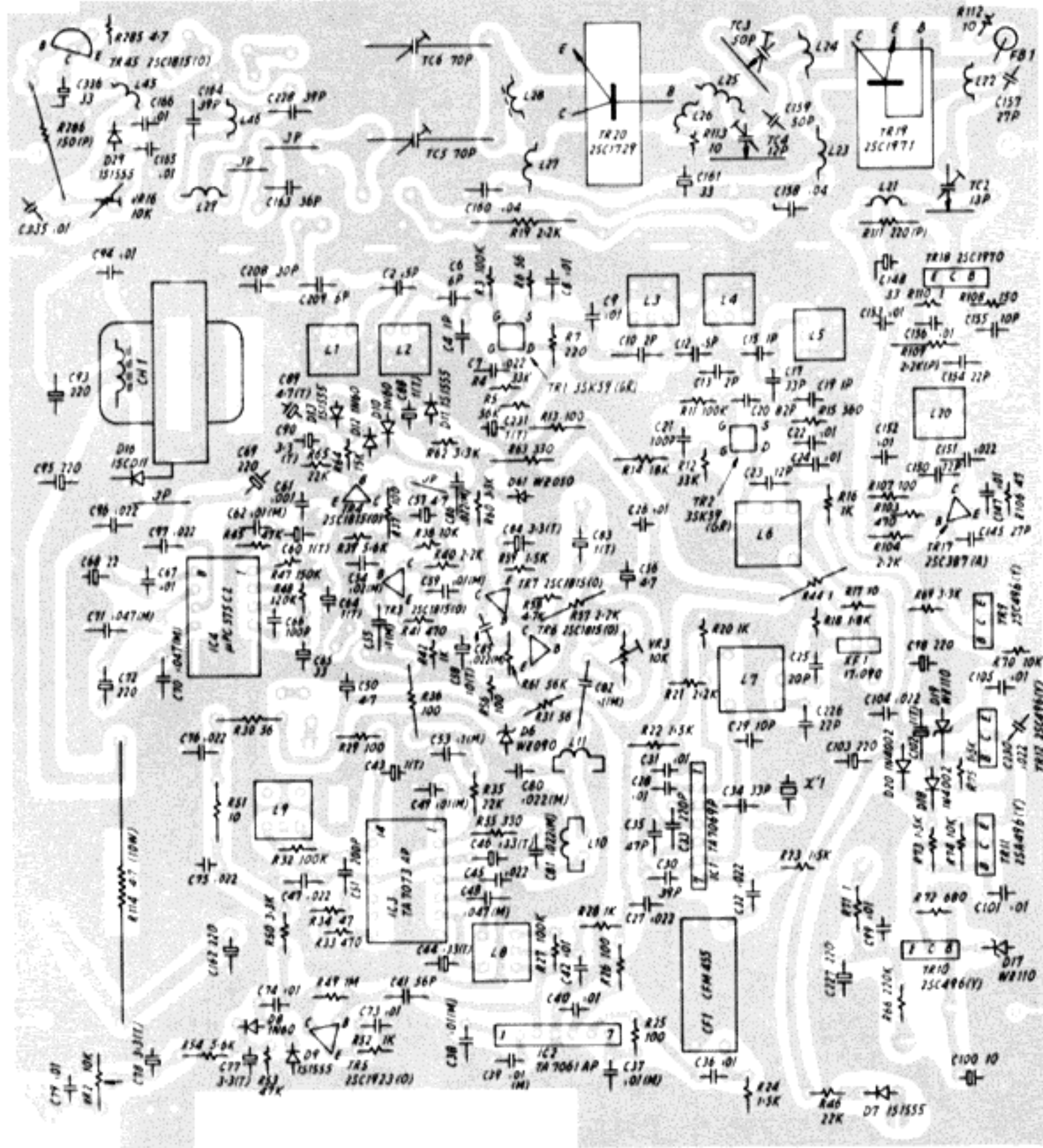


COMPLETE PARTS LAYOUT



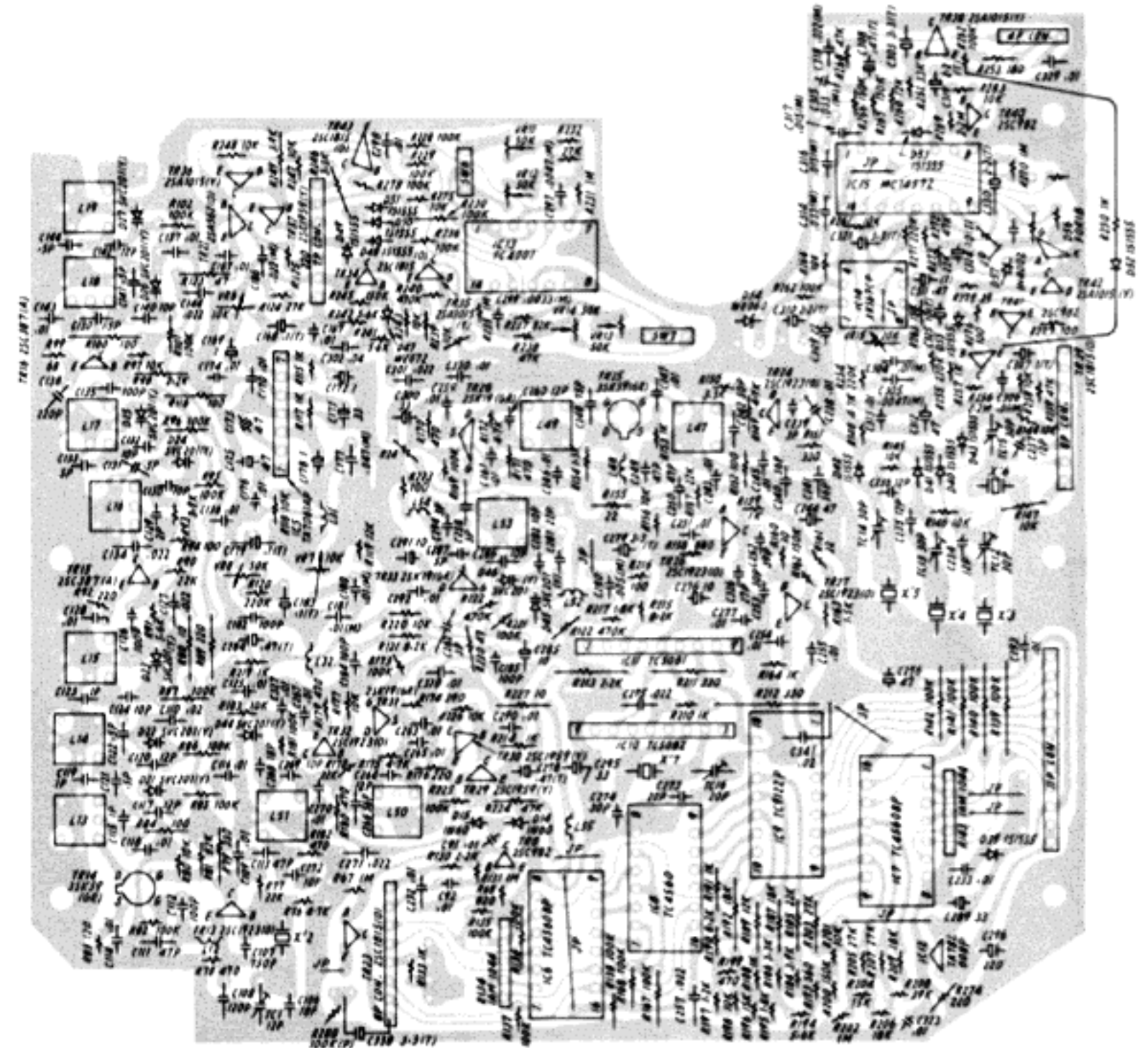
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PRINTED CIRCUIT BOARD PARTS LAYOUT (MAIN)



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PRINTED CIRCUIT BOARD PARTS LAYOUT (SUB)



VOLTAGE CHART

TESTER DC: 20kΩ V AC: 30MHz Scope

TR No.	TR	BASE	EMITTER	COLLECTOR	POSITION
TR34	Z5C1815 (O)	6.6V	0V	7.5V	RX
TR35	Z5A1015 (Y)	0.2V	0V	7.3V	RX
TR36	Z5A1015 (Y)	7.5V	7.5V	0V	RX
TR37	Z5C1969 (Y)	0V	0V	13.8V	RX
TR38	Z5A1015 (Y)	5.1V	5.7V	0V	RX
TR39	Z5C1015 (O)	1.5V	0.7V	5.0V	TX
TR40	Z5C982	0V	0V	6.9V	RX
TR41	Z5C982	13.8V	13.6V	13.8V	RX
TR42	Z5A1015 (Y)	13.8V	13.8V	0V	RX
TR43	Z5C1815 (O)	0.6V	0V	0V	RX
TR44	Z5C0880 (Y)	4.1V	3.4V	10.8V	TX, LO, PWR
TR45	Z5C1815 (O)	0.6V	0.05V	4.0V	TX, LO, PWR

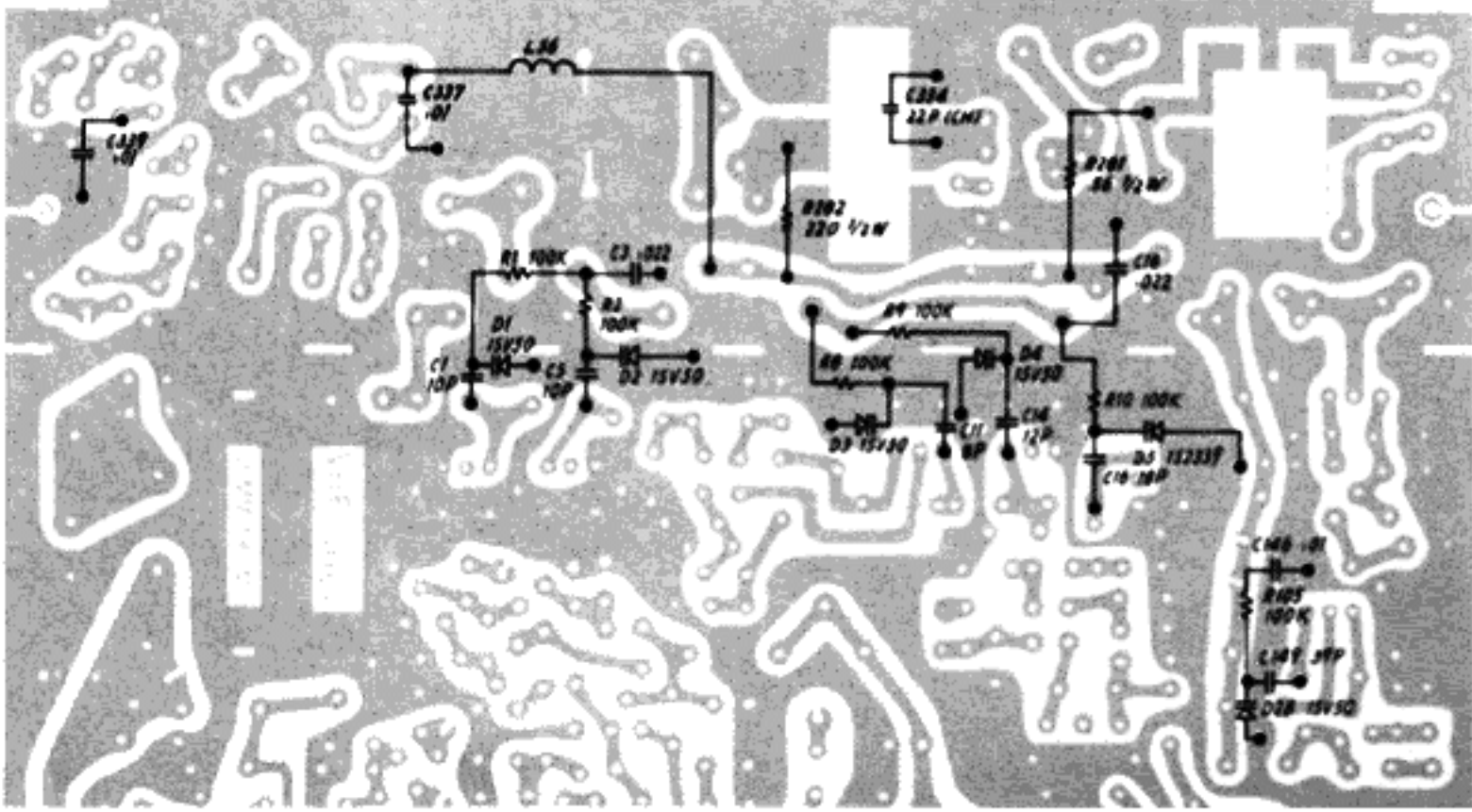
TR No.	MOS FET	GATE 1	GATE 2	DRAIN	SOURCE	POSITION
TR1	3SK59 (GR)	-	3.6V	8.5V	0.3V	RX
TR2	3SK59 (GR)	-	3.8V (110mVp-p)	9.4V	0.04V	RX
TR14	3SK59 (GR)	280mVp-p	0.3V (140mVp-p) @ 10.7V (240mVp-p)	9.4V	3.1V	TX

TR No.	FET	GATE	DRAIN	SOURCE	POSITION
TR28	Z5K19 (GR)	-	6.8V	0.7V	
TR31	Z5K19 (GR)	-	5.5V	1.2V	
TR33	Z5K19 (GR)	-	7.5V	0.8V	

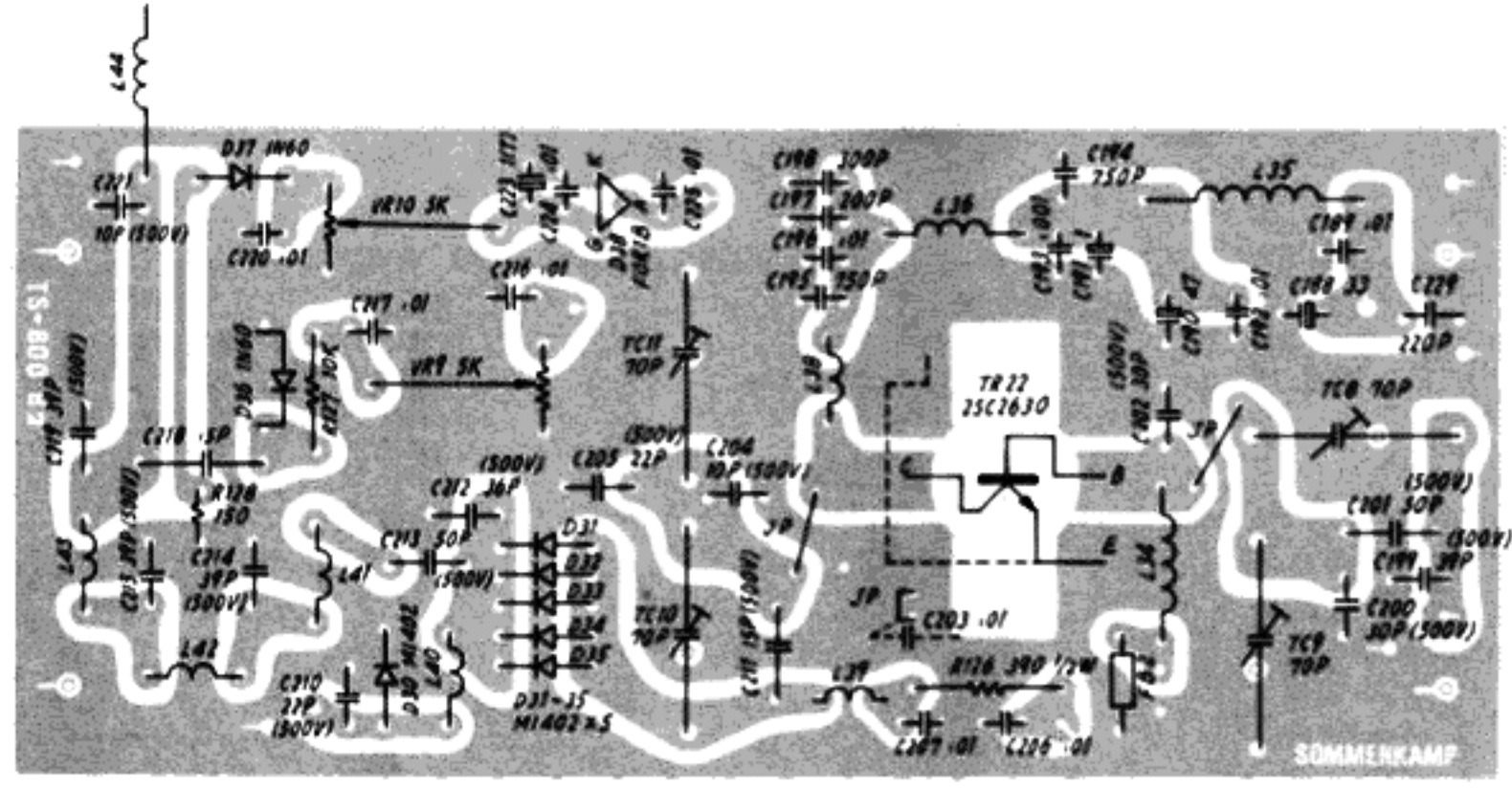
TR No.	TR	BASE	EMITTER	COLLECTOR	POSITION
TR3	Z5C1815 (O)	1.8V	1.1V	3.4V	RX
TR4	Z5C1815 (O)	-	0V	1.8V	RX
TR5	Z5C1923 (O)	1.1V	0.4V	7.5V	RX
TR6	Z5C1815 (O)	1.1V	0.4V	1.9V	RX
TR7	Z5C1815 (O)	1.9V	1.3V	2.2V	RX
TR9	Z5C496 (Y)	0.7V	0V	10.4V	TX
TR10	Z5C496 (Y)	11.3V	10.5V	12.8V	TX
TR11	Z5A496 (Y)	12.1V	12.8V	12.9V	TX
TR12	Z5C496 (Y)	11.0V	10.4V	12.9V	RX
TR13	Z5C1923 (O)	1.6V	0.9V	9.6V	TX
TR15	Z5C387 (A)	1.9V (90mVp-p)	1.1V	9.9V (200mVp-p)	TX
TR16	Z5C387 (A)	1.6V (100mVp-p)	0.8V	9.2V (500mVp-p)	TX
TR17	Z5C387 (A)	1.8V (240mVp-p)	1.1V	8.1V (900mVp-p)	TX
TR18	Z5C1970	0.4V (500mVp-p)	0.1V	10.5V (2.8Vp-p)	TX
TR19	Z5C1971	1000mVp-p	0V	13.8V	TX
TR20	Z5C1729	-	0V	13.8V	TX
TR21	Z5A562 (O)	9.5V	10.1V	1.3V	TX
TR22	Z5C2630	-	0V	13.8V	TX
TR23	Z5C1815 (O)	0.4V	0V	8.9V	RX
TR24	Z5C1923 (O)	2.7V	2.0V	6.9V	
TR26	Z5C1923 (O)	2.2V	1.5V	5.4V (100mVp-p)	
TR27	Z5C1923 (O)	2.5V	1.5V	5.1V (560mVp-p)	
TR29	Z5C1969 (Y)	0V	0V	7.7V	
TR30	Z5C1969 (Y)	7.0V	6.4V	7.7V	
TR32	Z5C1923 (O)	1.5V	0.9V	5.1V (230mVp-p)	

IC NO	IC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
IC1	TA7069P	8.9V	3.2V	1.4V (300mVp-p)	0V	0.7V	3.2V	9.0V									
IC2	TA7061AP	2.0V	2.0V	7.5V	0V	9.6V	2.0V	2.0V									
IC3	TA7073AP	4.4V	3.7V	4.2V	2.1V	2.1V	2.1V	0V	2.1V		4.2V			7.5V			
IC4	μPC575C2	2.0V	13.8V	13.0V	8.2V	7.0V	13.8V	0V	2.0V								
IC5	TA7061AP	2.0V	2.1V	5.6V	0V	9.2V	2.0V	2.0V		0V							
IC10	TC5082P	-	2.3V	1.2V (400mVp-p)	-	5.0V	-	2.0V									
IC11	TC5081P	-	0V	-	-	6.7V	6.6V	-	2.5V								
IC12	TA78L008P	13.8V	7.8V	0V	0V	2.0V	5.1V	2.5V (400mVp-p)									
IC14	XP567CP	4.2V	4.0V	2.0V	5.1V	2.5V (400mVp-p)	2.5V (1.200mVp-p)	0V									

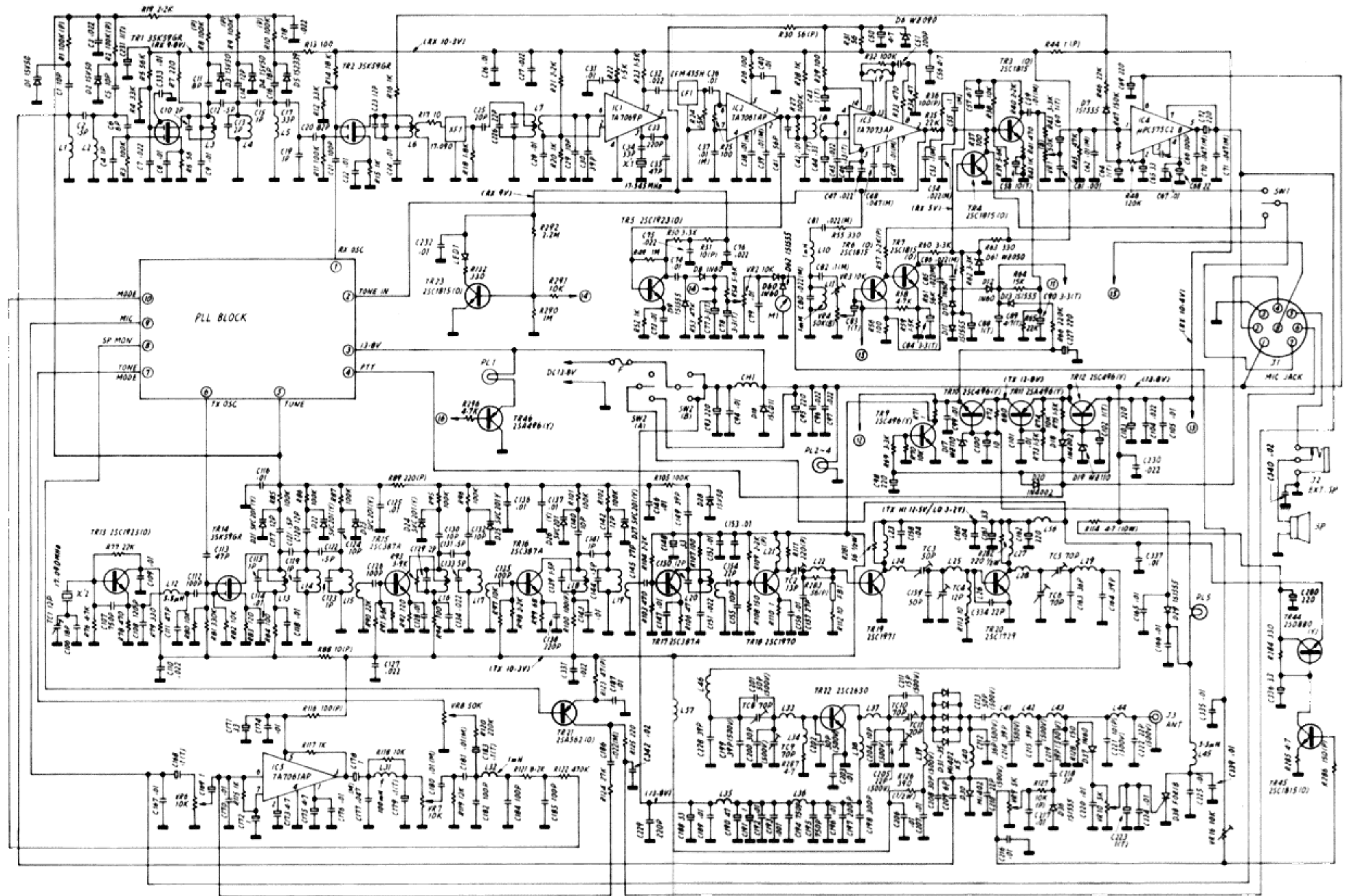
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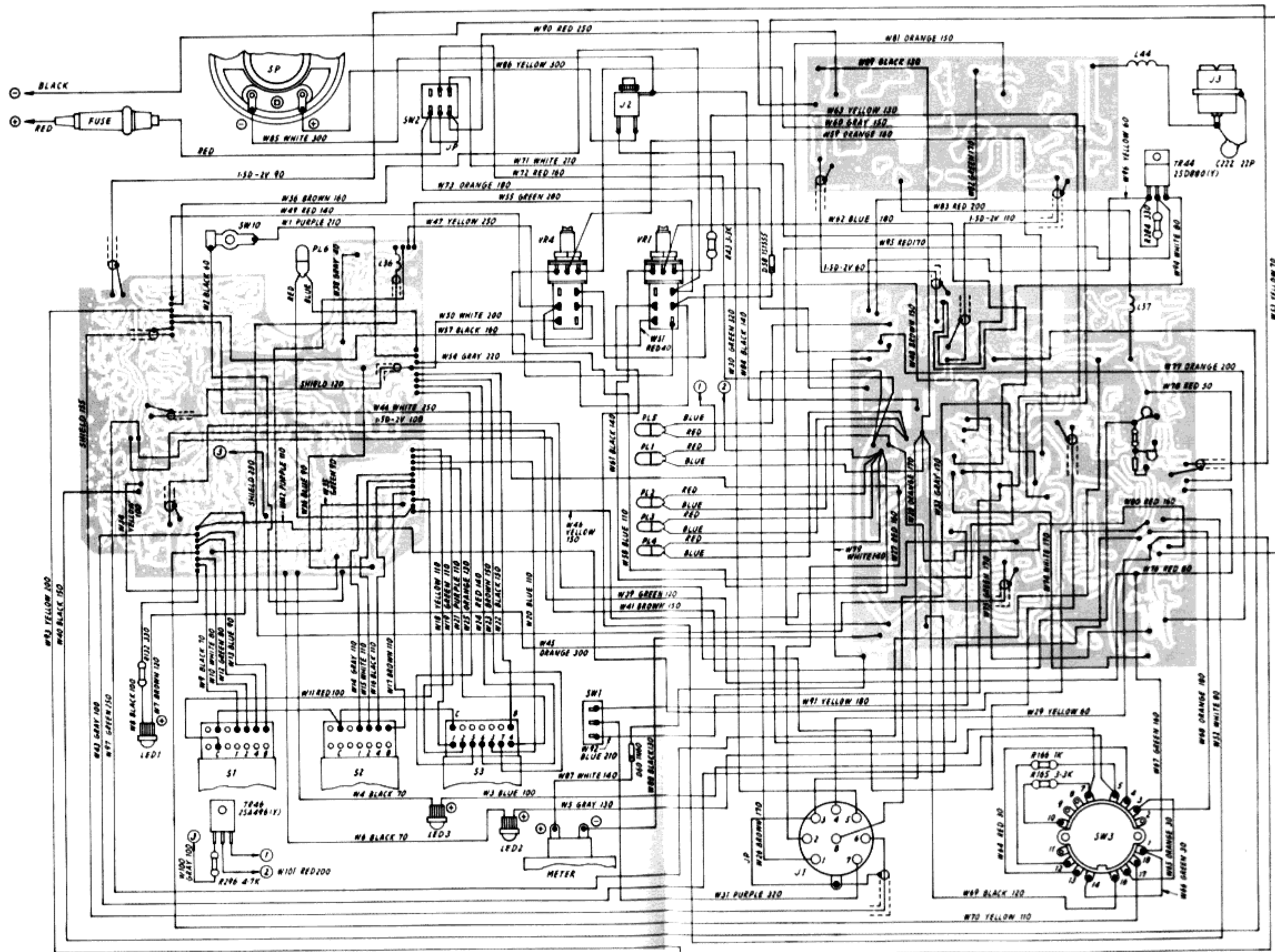


BACK SIDE OF MAIN PCB (IMPORTANT PARTS)



CIRCUIT DIAGRAM





SECTION IX - PARTS LIST

DESIGNATION	PARTS NAME	PARTS NO.
D6	Zener Diode	WZ090
D17, 19	Zener Diode	WZ110
D38, 56	SCR	FOR 1B
LED2	LED	TLR-102KB
LED1, 2 3	LED	TLG-102KB
X'1	X'tal	17.545 MHZ
X'2	X'tal	17.090 MHZ
X'3	X'tal	59.955 MHZ
X'4	X'tal	59.95625 MHZ
X'5	X'tal	59.9575 MHZ
X'6	X'tal	59.95875 MHZ
X'7	X'tal	10.24 MHZ
XF-1	X'tal Filter	17.090 MHZ
CF-1	Ceramic Filter	CFM 455F
TC1	Trimmer 12PF	CV05 C120
TC2	Trimmer 13PF	CVB 10-41
TC4	Trimmer 12PF	CV03 B100
TC16	Trimmer 20PF	CV05 D2001
TC12~15	Trimmer 30PF	CV05 E3001
TC3	Trimmer 50PF	CV03 C500
TC5, 6, 8, 9, 10, 11	Trimmer 70PF	AL70C
VR9, 10	Semi Variable Resistor 5K ohm	FR-104C
VR6	Semi Variable Resistor 10K ohm	FR-083
VR3, 16	Semi Variable Resistor 10K ohm	FR-102B
VR2	Semi Variable Resistor 10K ohm	FRA-107D
VR15	Semi Variable Resistor 20K ohm	FR-081
VR8	Semi Variable Resistor 50K ohm	FR-083
VR7	Semi Variable Resistor 10K ohm	H0651A 10K
VR11, 12, 13, 14	Semi Variable Resistor 50K ohm	H0651 A50K
VR4	Variable Resistor (SQU) 50K ohm	VM-16E UER22 50KB
VR1	Variable Resistor (VOL) 50K ohm	VM-16E UER22 50KA
SW1	Slide Switch	SLS-C222 DPDT
SW2	Toggle Switch	8A 2021
SW3	Rotary Switch	SRN-1043N
S1, 2	Thumb Wheel Switch	A7BS-206-04-1
S3	Thumb Wheel Switch	A7BS-258-1
M1	Meter	510052
SP	Speaker	74EP01

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DESIGNATION	PARTS NAME	PARTS NO.
TR3, 4, 6, 7, 23, 34, 39, 43, 45	Transistor	2SC1815 (O)
TR5, 13, 24, 26, 27, 32	Transistor	2SC1923 (O)
TR20	Transistor	2SC1729
TR19	Transistor	2SC1971
TR18	Transistor	2SC1970
TR15, 16, 17	Transistor	2SC387 (A)
TR9, 10, 12	Transistor	2SC496 (Y)
TR11, 46	Transistor	2SA496 (Y)
TR8, 40, 41	Transistor	2SC982
TR29, 30, 37	Transistor	2SC1959 (Y)
TR35, 36, 38, 42	Transistor	2SA1015 (Y)
TR21	Transistor	2SA562 (O)
TR22	Transistor	2SC2630
TR44	Transistor	2SD880 (Y)
TR1, 2, 14, 25	FET	3SK59 (GR)
TR28, 31, 33	FET	2SK19 (6R)
IC1	Integrtd circuit	TA7069P
IC3	Integrtd circuit	TA7073AP
IC4	Integrated circuit	μPC575C2
IC2, 5	Integrated circuit	TA7061AP
IC12	Integrated circuit	TA78L008P
IC6, 7, 8	Integrated circuit	TC4560BP
IC9	Integrated circuit	TC9122P
IC11	Integrated circuit	TC5081P
IC10	Integrated circuit	TC5082P
IC13	Integrated circuit	MC14001B
IC15	Integrated circuit	MC14572UB
IC14	Integrated circuit	XR567CP
D7, 11, 13, 29, 39, 40, 41 42, 43, 48, 49, 50, 51	Silicon Diode	1S1555
52, 53, 55, 58, 36, 63, 64	Silicon Diode	1S1555
D18, 20, 57	Silicon Diode	1N4002
D16	Silicon Diode	15CD11
D8, 9, 10, 12, 37, 60	Germanium Diode	1N60
D1, 2, 3, 4, 28	Varicap Diode	1SV50
D21, 22, 23, 24, 25, 26 27, 44, 45, 46	Varicap Diode	SVC201 (Y)
D5	Varicap Diode	1S2339
D30, 31, 32, 33, 34, 35	RF. SW. Diode	MI 402
D54	Zener Diode	WZ060

DESIGNATION	PARTS NAME	PARTS NO.
J2	Ext. SP Jack	SJ-296
J3	ANT. Jack	MRM/INCH
SW6, 7	Slide Switch	A002-A
PL1 ~ 3	Thumb Wheel Switch Lamp	564841
PL4 ~ 6	Call Lamp/Meter Lamp/VSWR Indicator Lamp	564641
CH1	Power Choke Coil	E1-24
FB1	Ferrite Beads	T314-OP-3.5-3-IH
L1, 2, 4, 5	RX RF Tuning Coil	269-806
L3	RX RF Tuning Coil	269-809
L6, 7	RX IF Coil	424-001
L8	RX IF Coil	269-102
L9	RX FM DET Coil	269-101
L10, 11, 32	Noise Amp Filter Coil 3KHz L.P.F	7600-102
L12	TX Local OSC Coil	4H4R7K
L13, 14, 15, 16, 17	TX Mixing output Coil /144MHz Amp Coil	424-053
L18, 19	144 MHz Output Coil	424-052
L20	TX PRI Buffer output Coil	269-810
L29, 46	L.P.F Coil	269-905
L22, 23	TX Drive Input /RF Choke Coil	424-910
L24, 28, 38	TX Drive Tune /TX Final Tune Coil	269-907
L26	TX Drive Choke Coil	269-601
L27	TX Drive Choke Coil	424-909
L31	AF AMP Filter Coil	7600-104
L34	TX Final Choke Coil	005-902
L35	RFC Choke Coil	280-701
L36	RFC Choke Coil	424-908
L39	TX Final RF Choke Coil	010-909
L40, 41, 42, 43	TX Final RF Choke Coil L.P.F	269-904
L44	L.P.F Coil	299-901
L45	RF Choke Coil	005-903
L47, 49, 50, 51	PLL Local OSC /VCO AMP Coil	367-003
L48	PLL Mixing Output Coil	4H2R2M
L52	PLL VCO Coil	5H470K
L53	VCO RFC Choke Coil	424-852
L54	VCO RFC Choke Coil	4H2R2M
L55	RFC Choke Coil	4H8R2K
L25	TX Drive Input Coil	424-907
L21	TX Pri Drive Tune Coil	269-902
L56	RFC Choke Coil	010-907

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DESIGNATION	PARTS NAME	PARTS NO.
MP-631	Front Franme	564823
MP-632	Front Plate (R)	564836
MP-633	Front Plate (L)	564837
MP-634	Brand Plate	564831
MP-635	Back Plate	564832
MP-636	Dial Mask (A)	564826
MP-637	Dial Mask (B)	564825
MP-211	Meter Lamp Reflection Plate	484063
MP-638	Chassis Frame	562108
MP-639	Cabinet Cover (Upper)	553106
MP-640	Cabinet Cover (Lower)	553107
MP-641	Back Pannel	524428
MP-642	Chassis Frame Reinforcement	564830
MP-643	Lamp Holder	564829
MP-543	Mode SW Mounting Plate	534561
MP-457	Booster Chassis	523060
MP-462	Booster Chassis Cover	524421
MP-451	Heatsink (C)	524432
MP-5	Mounting Bracket for Speaker (A)	474038
MP-644	Mounting Bracket for Speaker (B)	564833
MP-107	Mounting Bracket	484085
MP-130	Screw for Mounting Bracket	484098
MP-110	Mounting Bracket for Meter	484064
MP-111	Call Switch Contact	484086
MP-112	Call Switch Spring	484087
MP-453	Shield Plate (C, D)	524430
MP-454	Shield Plate (E)	524431
MP-548	Microphone Hanger	484056
MP-605	Meter Fixing Plate Spacer	544661
MP-458	Heat Sink	523059
MP-19	Call Button	484057
MP-17	Knob for Volume/Squelch Control	474011
MP-645	SP Net	504308
MP-646	Shield Plate	563114

PARTS NUMBER REFERENCE
Schematic Diagram etc. vs Main PCB

*DIAGRAM ETC.: Parts numbers designated on the Schematic Diagram etc.
 *MAIN PCB : Parts numbers white silk printed on the surface of the Main Printed Circuit Board.

DIAGRAM etc.	MAIN PCB	DIAGRAM etc.	MAIN PCB	DIAGRAM etc.	MAIN PCB	DIAGRAM etc.	MAIN PCB	DIAGRAM etc.	MAIN PCB	DIAGRAM etc.	MAIN PCB
L 1	T 2	TR 20	TR 1	C 32	C 161	C 79	C 139	C 228	C 5	R 50	R 74
L 2	T 3	IC 1	IC 4	C 33	C 155	C 80	C 130	C 230	C 277	R 51	R 75
L 3	T 4	IC 2	IC 3	C 34	C 160	C 81	C 136	C 231	C 105	R 52	R 71
L 4	T 5	IC 3	IC 2	C 35	C 156	C 82	C 128			R 53	R 72
L 5	T 6	IC 4	IC 1	C 36	C 152	C 83	C 114			R 54	R 73
L 6	T 7			C 37	C 153	C 84	C 107	R 4	R 49	R 55	R 79
L 7	T 8	D 6	D 10	C 38	C 147	C 85	C 108	R 5	R 50	R 56	R 94
L 8	T 9	D 7	D 17	C 39	C 146	C 86	C 104	R 6	R 47	R 57	R 93
L 9	T 10	D 8	D 11	C 40	C 151	C 88	C 100	R 7	R 48	R 58	R 92
L 10	L 19	D 9	D 12	C 41	C 145	C 89	C 98	R 11	R 52	R 59	R 91
L 11	L 18	D 10	D 8	C 42	C 149	C 90	C 99	R 12	R 54	R 60	R 89
L 20	T 11	D 11	D 9	C 43	C 132	C 93	C 64	R 13	R 51	R 61	R 95
L 21	L 16	D 12	D 7	C 44	C 148	C 94	C 63	R 14	R 55	R 62	R 88
L 22	L 15	D 13	D 6	C 45	C 134	C 95	C 65	R 15	R 53	R 63	R 90
L 23	L 13	D 17	D 16	C 46	C 133	C 96	C 66	R 16	R 56	R 64	R 86
L 24	L 12	D 18	D 14	C 47	C 138	C 97	C 120	R 17	CF	R 65	R 85
L 25	L 10	D 19	D 13	C 48	C 135	C 98	C 283	R 18	R 59	R 66	R 82
L 26	L 11	D 20	D 15	C 49	C 131	C 99	C 94	R 19	R 5	R 67	R 44
L 27	L 9	D 29	D 2	C 50	C 127	C 100	C 90	R 20	R 61	R 68	R 43
L 28	L 8	D 61	C 106	C 51	C 137	C 101	C 279	R 21	R 62	R 69	R 45
L 29	L 5			C 53	C 129	C 102	C 278	R 22	R 63	R 70	R 41
L 46	L 4	C 2	C 69	C 54	C 110	C 103	C 92	R 23	R 64	R 71	R 40
CH 1	T 1	C 4	C 71	C 55	C 111	C 104	C 89	R 24	R 65	R 72	R 39
VR 2	VR 5	C 6	C 70	C 56	C 195	C 105	C 276	R 25	R 66	R 73	R 38
VR 3	VR 6	C 7	C 75	C 57	C 103	C 145	C 28	R 26	R 67	R 74	R 36
FB 1	L 14	C 8	C 72	C 58	C 107	C 147	C 27	R 27	R 69	R 75	R 35
TC 2	TC 5	C 9	C 73	C 59	C 107	C 148	C 87	R 28	R 68	R 103	R 34
TC 5	TC 2	C 10	C 74	C 60	C 116	C 150	C 26	R 29	R 68	R 104	R 33
TC 6	TC 1	C 12	C 76	C 61	C 102	C 151	C 25	R 30	R 82	R 106	R 32
XF 1	CF	C 13	C 73	C 62	C 115	C 152	C 91	R 31	R 84	R 107	R 31
		C 15	C 78	C 64	C 118	C 153	C 88	R 32	R 78	R 108	R 30
		C 17	C 79	C 65	C 119	C 154	C 24	R 33	R 76	R 109	R 29
TR 1	TR 10	C 19	C 81	C 66	C 117	C 155	C 22	R 34	R 77	R 110	R 28
TR 2	TR 11	C 20	C 82	C 67	C 121	C 156	C 23	R 35	R 80	R 111	R 27
TR 3	TR 14	C 21	C 85	C 68	C 122	C 157	C 20	R 36	R 83	R 112	R 26
TR 4	TR 13	C 22	C 83	C 69	C 101	C 158	C 19	R 37	R 97	R 113	R 25
TR 5	TR 12	C 23	C 86	C 70	C 125	C 159	C 18	R 38	R 99	R 114	R 24
TR 6	TR 16	C 24	C 84	C 71	C 123	C 160	C 15	R 39	R 99		R 23
TR 7	TR 15	C 25	C 84	C 72	C 124	C 161	C 16	R 40	R 96		R 22
TR 9	TR 17	C 26	C 80	C 73	C 144	C 163	C 8	R 41	R 100		R 21
TR 10	TR 20	C 27	C 150	C 74	C 142	C 164	C 6	R 42	R 101		R 20
TR 11	TR 18	C 28	C 157	C 75	C 141	C 165	C 11	R 43	R 102		R 19
TR 12	TR 19	C 29	C 159	C 76	C 141	C 166	C 67	R 44	R 102		R 18
TR 17	TR 4	C 30	C 159	C 77	C 143	C 208	C 68	R 45	R 103		R 17
TR 18	TR 3	C 31	C 154	C 78	C 140	C 226	R 60	R 46	R 104		R 16
TR 19	TR 2	C 31	C 158	C 78	C 140	C 227	C 93	R 47	R 104		R 15
								R 48	R 70		R 14
								R 49	R 70		R 13