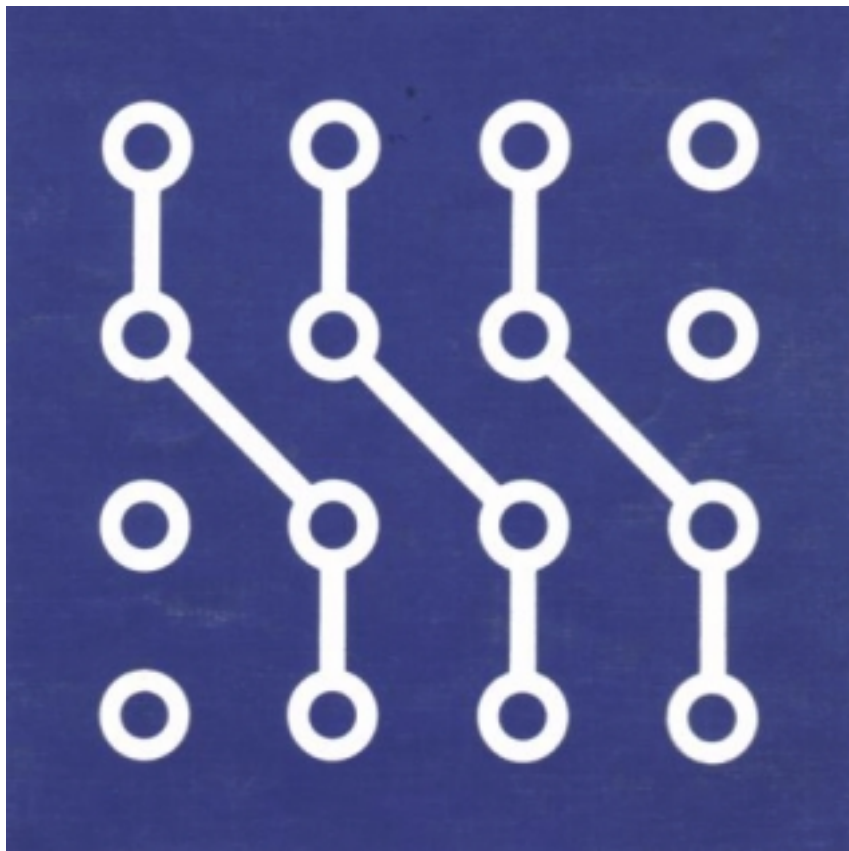


INSTRUCTION MANUAL



MODEL 2020



uniden

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COMMUNICATION SSB TRANSCEIVER MODEL 2020

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SECTION I INTRODUCTION



Photo. 1 The **uniden** 2020

1-1 General Description

UNIDEN's Model 2020 is an entirely new, self-contained amateur transceiver providing 80 through 10 meter amateur band coverage. The transceiver is capable of operating SSB, CW (180W DC INPUT) and AM (90W) respectively. Both its advanced technology and built-in features are designed to fulfil the needs of amateur radio operators world-wide.

1-2 Features

The 2020 has most capabilities desired for amateur operation in HF amateur bands with the ability to accept various accessories.

Being a desk-top transceiver, it is also convenient for mobile operation, with a built-in DC-DC converter and a fixed two-channel crystal oscillator circuit.

You can choose either Push-To-Talk or Voice-Controlled SSB/CW Break-In operation depending on the circumstances.

Main features include;

1) It's self-contained

The 2020 is equipped with a AC/DC power supply, a CW filter, a noise blanker, a marker oscillator and a blower. It also has the WWV and the Citizen Band (Reception only).

For operation, it requires an antenna and an AC or 12V DC power source.

2) Hybrid Dial Presentation (Read-out)

It is equipped with an original digital and analog combination dial reading. Over 100 kHz is a digital display by LEDs and below 100 kHz is shown by the drum dial mechanism.

3) Rugged Final Tubes

For a RF power amplifier, a pair of 6146Bs are used to provide dependable and stable RF output. The 2020 includes an amplifying ALC circuit and the screen voltages of the final tubes are stabilized by zenor diodes.

4) Cross modulation/Image Rejection Capabilities

The receiver is a pre-mixed type single conversion superheterodyne adopting PLL oscillator circuit. It has excellent cross modulation and image rejection features and signal to noise response. Crystal filters are used for USB, LSB and CW.

5) Independent RF circuit

Transmitting and receiving RF circuits are electrically separated providing precise tuning for transmission and reception on every band.



Photo. 2 The dial reading

6) Dual R.I.T. control

There is also UNIDEN's own dual receiver-incremental-tuning circuit. Without changing transmitting frequency, it is possible to change receiving frequencies for ± 5 kHz at the wide position, and for ± 1 kHz at the narrow position of R.I.T. control. Especially this narrow R.I.T. is effective as a CW and SSB clarifier.

7) Crystal controlled operation

Function switch's position A and B provides crystal control of the transceiver. By inserting proper crystals in channel A and B (PC-085), you can choose two fixed frequencies determined by the band and segment switch combination.

1-3 Specifications

Frequency Ranges:

Bands (meters)	Frequency (MHz)
80	3.5 — 4.0
40	7.0 — 7.5
20	14.0 — 14.5
15	21.0 — 21.5
10 (A)	28.0 — 28.5
10 (B)	28.5 — 29.0
10 (C)	29.0 — 29.5
10 (D)	29.5 — 30.0
11	27.0 — 27.5 Receive only
WWV	15.0

Mode of Operation;	LSB, USB, CW and AM
Input Power;	180 Watts DC INPUT SSB & CW 90 Watts DC INPUT AM
Carrier Suppression;	50 dB
Sideband Suppression;	50 dB at 1,000 Hz
Spurious Radiation;	Down 40 dB or more
Distortion;	Down 35 dB or more
Microphone impedance;	High
Modulation Method;	Balanced modulation (SSB) Low Power modulation (AM)
Transmitter Frequency Response;	300 to 2,700 Hz (down 6 dB)
Frequency Stability;	Less than 300 Hz drift in starting Less than 100 Hz drift or less after 30 minutes of warm up
Antenna Output Impedance;	50 – 75 ohms unbalanced
Receiver Sensitivity;	0.3 μ V S/N 10 dB (at 14 MHz) SSB/CW 1 μ V S/N 10 dB (at 14MHz) AM

Image Interference Ratio;

-50 dB and more (at 14 MHz)

IF interference ratio;

same as above

Receiver selectivity;

SSB/AM
2.4 kHz at -6 dB and
4.0 kHz at -60 dB
CW
600 Hz at -6 dB and
1.5 kHz at -60 dB

Audio Output;

2.5 Watts or more (10% distortion at 4 ohms load)

Audio Output Impedance;

4 ohms

Power Source;

100/110/117/200/220/234
Volts AC 50/60 Hz
13.8 \pm 10% DC

Power Consumption;

AC: 350 VA at the maximum final input
DC: 22A at the maximum final input. 7 A in receiving with final tubes heater "on" and 2A with heater "off"

Dimensions;

14-3/4" wide (350mm)
6-1/2" high (165mm)
13-1/4" deep (333mm)

Weight;

Approx. 39.6 Lbs. (18kg)

Tubes and semiconductors;

Tubes 6146B 2
12BY7A 1
Transistors 52
FETs 16
ICs 18
Diodes 154

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SECTION II INSTALLATION

2-1 Unpacking

Please carefully remove the transceiver from package and examine for visible defects. Check all controls for normal operation and check for internal damage, loose parts, etc.

CAUTION

Carefully check the cooling fan for free rotation. Damage to the cover can prevent rotation and cause "burn-out" of the motor and overheating of the transceiver – "WHO NEEDS A FIRE"!

Next, please check following standard accessories are in the package together with a transceiver.

Handy Microphone (dynamic type, 50k ohms of impedance, with curl-cord and 4P plug) – 1

AC Supply Cable (2 meters length, with multi-plug and AC connector) – 1

DC Supply Cable (3 meters length, with multi-plug, and inline fuse holder) – 1

Microphone Plug (4P) – 1

Headphone Plug (2p) – 1

Pin Plug (RCA type for external receiver antenna, and transverter connection) – 2 (see note 1)

Pin Plug (for phone patch connection, external speaker, Key, PTT and Anti-trip inputs) – 6

Coaxial Connector – 1

Spare Fuse 5 A (for AC), 3 A (for over 200 V) – 2
30 A (for DC) – 2

Accessory Plug (4P) – 1

Extra mounts and screws (set) – 2 (see note 2)

Screw Driver (1.5mm/2.0mm ϕ) – 2

note 1 – RCA type pin plugs are used for RF circuit

note 2 – Extra mounts are to change the viewing angle of front panel in order to obtain the desirable operating position.

2-2 Initial Connections

Several receptacles are on both front and rear panels of the transceiver. Let's explain briefly about each connection before going into actual settings.

2-2-1 Front Panel Connections

1 PHONES: Connect headphone for private listening. Impedance of 4 to 16 ohms desirable.

CAUTION

Insert the headphone plug wholly into the Jack. Otherwise the attenuator, which provide proper headphone output, may not work and the headphone produces un-attenuated audio (too loud).

2 MIC: Connect microphone here. If you use another microphone instead of the attached one, use 4P accessory plug and wire it as shown on the drawing. The microphone input is designed for a high impedance, and you must use a microphone with a built-in PTT switch for push-to-talk operation.

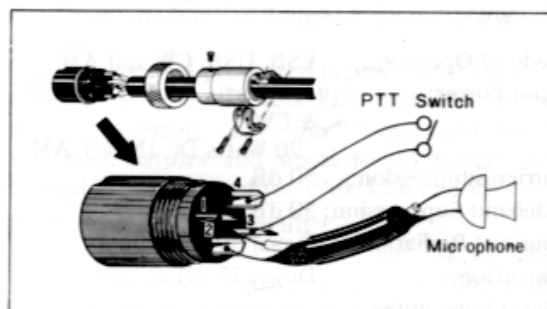


Fig. 1 Microphone plug connections

2-2-2 Rear Panel Connections

1 POWER: AC or DC power supply receptacle. Use the appropriate cable depending on the power source you choose. The transceiver is normally supplied for the nominal home current operation. (See page 30 for rewiring)

2 ANTENNA: Coaxial connection for antenna. Use M type coax. connector attached.

3 GROUND: Ground connection. To prevent RF troubles and for the safety of operators, use the best possible earth line.

4 KEY: Key jack for CW operation. As the keying is done by shorting the blocking bias of -50 volts, be sure to choose appropriate key especially when you use an electronic keyer.

CAUTION

Please be careful! There is -50 volts output at this terminal.

By going through 1 to 4 connections, you can operate all modes for a complete single unit installation of the model 2020.

5 PTT: Using this terminal, you can control the transceiver by a remote switch. It is convenient when you use a microphone without a built-in PTT switch, or a foot switch in CW mode operation.

6 EXT. VFO Connections for Remote VFO Model 8010. Cord and plug come with a VFO.

7 EXT. SP: Connections for external speaker Model 8120. Audio output of 4 ohms is provided at this terminal. Use attached pin plug when you connect other than 8120.

CAUTION

Please be sure of a short circuit of the speaker terminal to prevent audio IC defect.

8 ACCESSORY: This terminal provides ON and OFF of other equipments in accordance with the 2020. ALC connection is for the feed back of ALC voltage from a linear amplifier or a transverter.

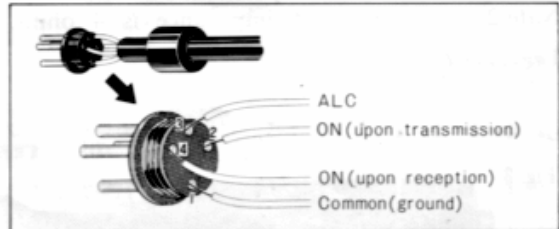


Fig. 2 Accessory plug connections

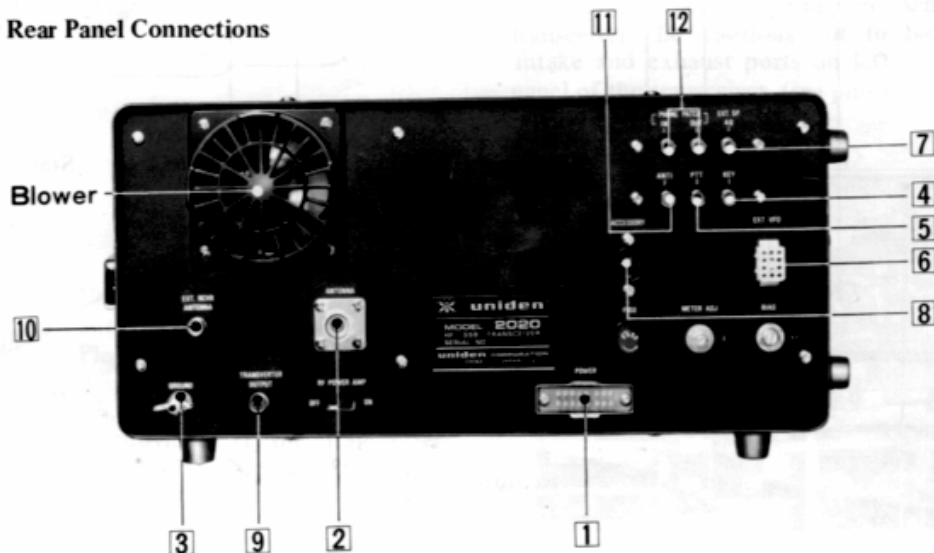
9 TRANSVERTER OUTPUT: Connections for a transverter. Signal frequency output from the driver stage may be obtained at this terminal.

10 EXT. RCVR ANTENNA: When you use an external receiver along with this transceiver, connect the receiver antenna to this jack.

11 ANTI: Anti-trip input from the additional receiver. Anti-trip input is obtained from a speaker voice coil.

12 PHONE PATCH: Connections for phone patch input and output. Input impedance is approx. 50K ohms and output impedance is 4 ohms.

Photo. 3 Rear Panel Connections



2-3 Electrical Connection

2-3-1 Installation with Accessories I

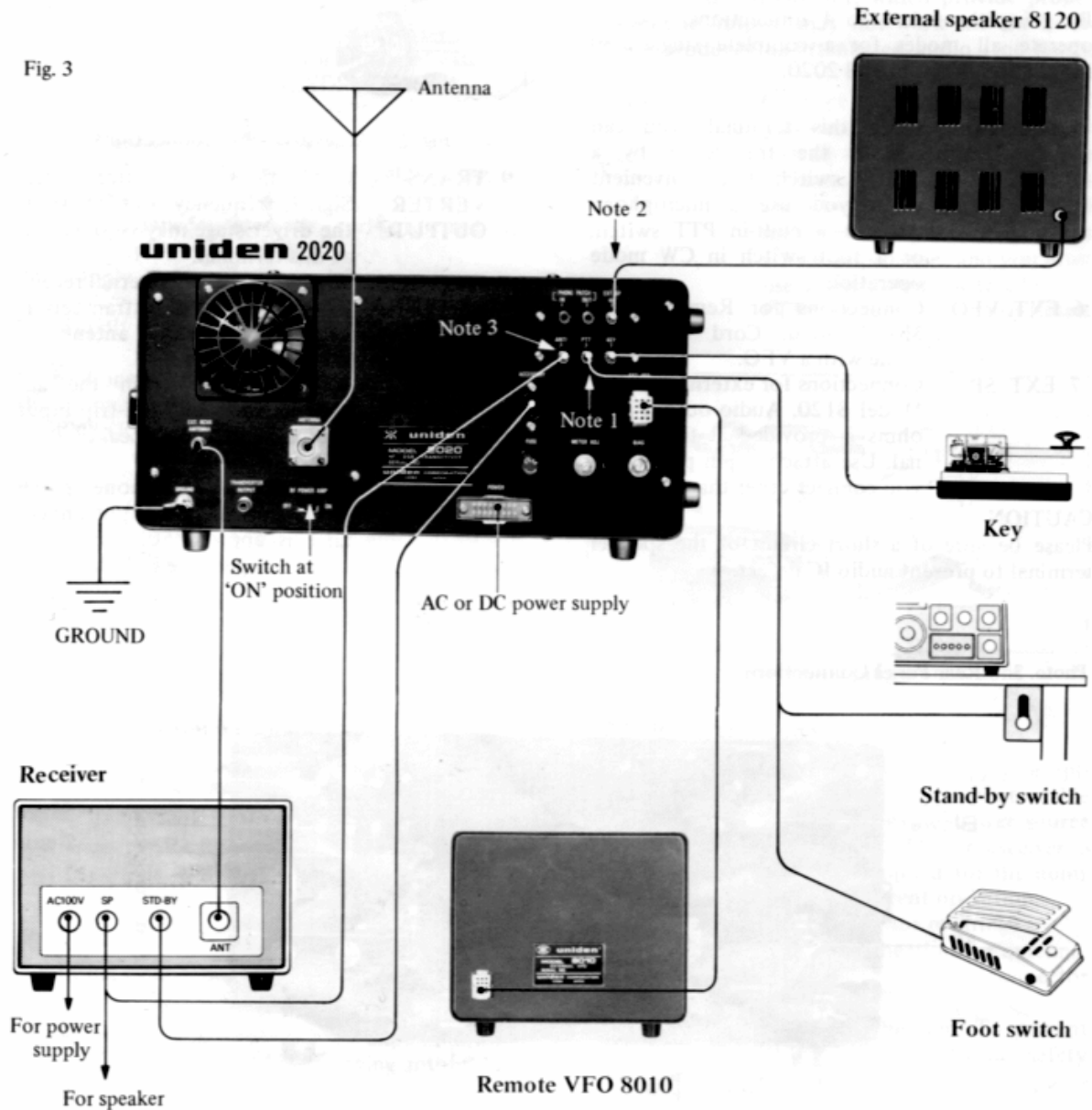
(Remote VFO 8010/External Speaker 8120 and an additional receiver connections)

- Note 1:** Be activated only when MANU/VOX/PTT switch on the front panel is positioned at PTT.
- Note 2:** Output impedance is 4 ohms.

When the external speaker is connected, the built-in speaker is automatically shut off.

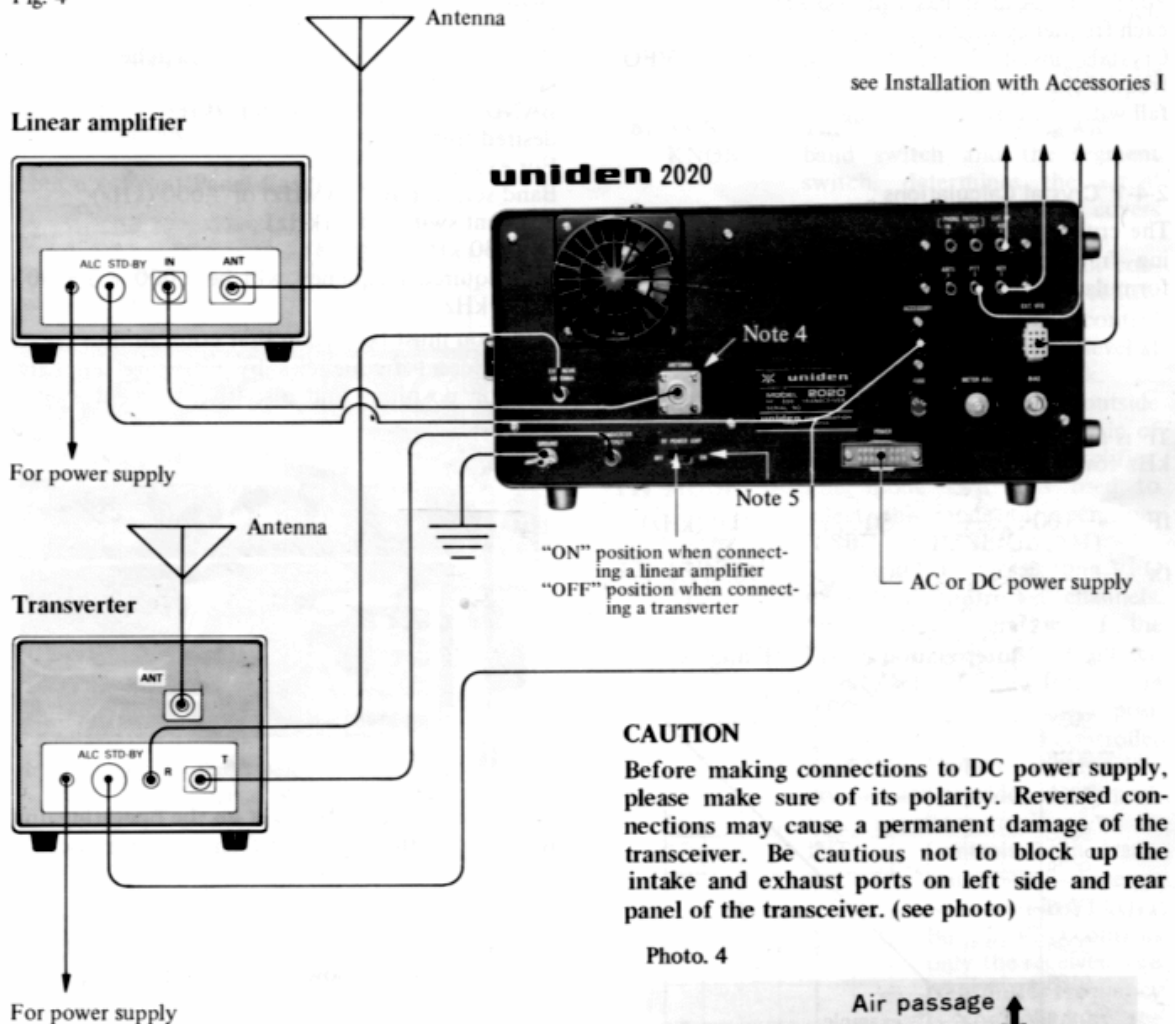
- Note 3:** Anti-trip input is obtained from a speaker voice coil of the additional receiver.

Fig. 3



2-3-2 Installation with Accessories II
(Linear Amplifier or Transverter connections)

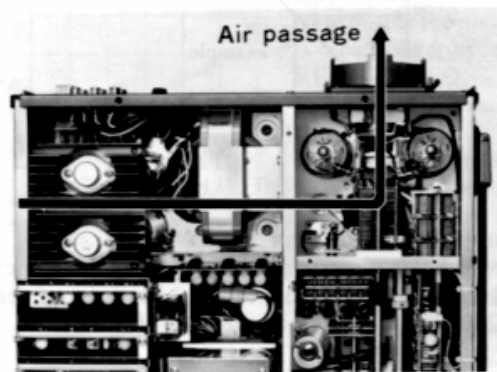
Fig. 4



CAUTION

Before making connections to DC power supply, please make sure of its polarity. Reversed connections may cause a permanent damage of the transceiver. Be cautious not to block up the intake and exhaust ports on left side and rear panel of the transceiver. (see photo)

Photo. 4



- Note 4: For transverter operation, HF antenna should be disconnected.
- Note 5: Please cut off the RF Power Amp switch when you operate a transverter. Then the RF output is provided at the transverter jack, at the same time, the power tube heaters and the blower are disconnected.

2-4 Crystal Controlled Operation

The internal crystal oscillator of the 2020 accepts two crystals for channel A and B, and the Remote VFO 8010 accommodates ten crystals.

The VFO frequencies are between 9,138 kHz and 9038 kHz. And it has full 100 kHz coverage on each frequency segment.

Crystals installed are to replace those VFO frequencies, therefore all crystal frequencies must fall within this frequency range.

2-4-1 Crystal Calculations

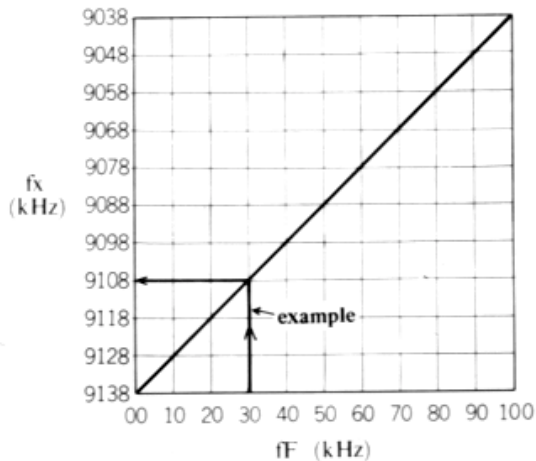
The crystal frequency (f_x) for any desired operating frequency is calculated by the following formula;

$$f_x = 9,138 - fF \text{ (kHz)}$$

fF is any desired operating frequency within 100 kHz coverage regardless of operating bands.

fF	→	00	50	100	(kHz)
		↓		↓		↓	
f_x	→	9138	9088	9038	

Fig. 5 Interrelation chart of fF and f_x



Example of calculation:

Provided you determine the operating frequency at 21,230 kHz, first look at 10 kHz order of this 21,230, and will find out the fF is 30 kHz.

Accordingly the f_x is;

$$f_x = 9138 - 30 = 9108 \text{ (kHz)}$$

2-4-2 Application of Crystal Controlled Operation

To operate at the frequency of 21,230, you must insert a crystal ($f_x = 9108$ kHz) to A or B socket of the operation unit. The band selector will be set at 21.0 (MHz) position, and the segment switch at 200 (kHz), then you can obtain 21,230 kHz.

By changing band and segment switches, you can create any fixed frequency.

$\text{BAND (MHz)} + \text{SEGMENT (kHz)} + fF = \text{any desired frequency}$

For example:

Band selector at 7.0 (MHz) or 7,000 (kHz)

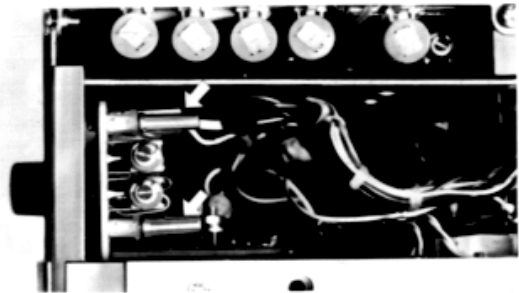
Segment switch at 0 (kHz)

fF at 30 kHz

the acquired frequency will be $7,000 + 0 + 30 = 7,030$ kHz

Now you must be certain that you can thus create 50 different frequencies by changing ten band selector positions and also five segment switch buttons.

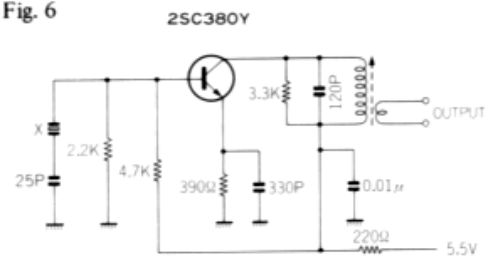
Photo. 5



The A and B crystal socket on the operating unit is located at the upper left-front of the transceiver cabinet.

In ordering fixed channel crystals, please note the oscillation circuit shown here for reference.

Fig. 6



SECTION III CONTROL FUNCTIONS

It is advised that you have a complete understanding of each control functions before going into actual operation.

3-1-1 Front Panel Controls

Functions of various front panel controls are described in this section.

Photo. 6 Front Panel Controls



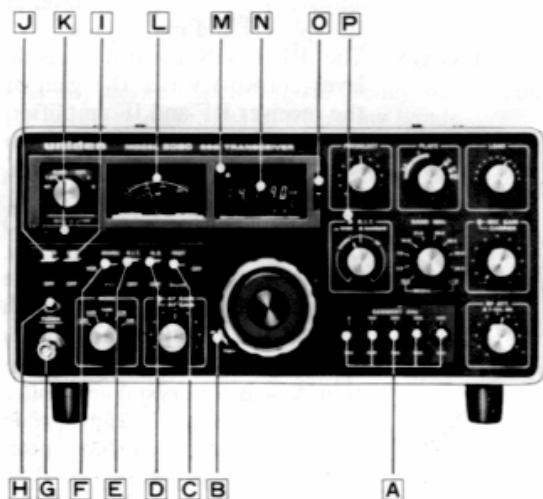
- 1) **BAND MHz:** Band selector switch. Red color coded figures of 3.5/28.5 29.5 correspond to the red figures of the segment switch buttons.
- 2) **PLATE:** Tunes plate circuit of the power amplifier.
- 3) **LOAD:** Tunes the output circuit of the pi network to match the antenna impedance.
- 4) **MIC GAIN:** Varies the audio level from the microphone.
- 5) **CARRIER:** This control varies the amount of carrier in the CW, AM and TUNE modes of operation.
- 6) **RF ATT.:** RF attenuator control. This control is to adjust the incoming signal to minimize interference which may be caused by extremely strong local signals.
- 7) **F. CAL. ON:** The dial calibration oscillator is activated by pulling out the

- 8) **TUNING KNOB:** The tuning knob, along with the band switch and the segment switch, determines the actual frequency of operation. It covers full 100 kHz at a 4:1 ratio.
- 9) **AF GAIN:** The AF gain and RF gain controls are mounted on concentric shafts. The AF gain control adjusts the audio output level at the speaker and phone jack.
- 10) **RF GAIN:** The RF GAIN control (outside lever control) varies the gain of the receiver RF and IF amplifier.
- 11) **MODE:** The mode switch is used to select the mode of operation. (LSB/USB/TUNE/CW/AM)
- 12) **FUNCTION:** This switch is for selecting VFO or crystal controlled channels. Single unit operation of the transceiver requires the switch set at INT. position for built-in VFO control. May select position A or B for crystal controlled operation when appropriate crystals are provided. Each position's functions are:
 - INT. Controls both transmitter and receiver with built-in VFO
 - T. EXT. Built-in VFO controls only the receiver. The transmitter frequency is controlled by the REMOTE VFO.
 - R. EXT. Reverse function of the above.
 - EXT. Both transmitter and receiver frequencies are controlled by the REMOTE VFO.
 - A/B Provides crystal control of the transceiver.
- 13) **PRE-SELECT:** This control pretunes the signal circuits for both transmitter and

- 14) **R.I.T. : (Receiver Incremental Tuning)** receiver except the transmitter final RF circuits tunings. This control varies the Receiver frequency disregarding the transmitting frequency. At the normal (WIDE) position you can change the frequency 5 kHz to either side of the transmitting frequency. At the PULL position (NARROW) it changes the frequency 1 kHz to either side for fine tuning.

3-1-2 Front Panel Switches and Others

Photo. 7 Front Panel Switches and Others



- A) SEGMENT kHz:** These push buttons enables select every 100 kHz by five steps at each band. The figure 0 indicates the frequency coverage between 0 and 100 kHz, 100 indicates 100 to 200 kHz and so on.
- B) TIGHT:** This lever tightens the tuning knob rotation as desired. Especially valuable in mobile operation.
- C) FAST-OFF-SLOW:** Selector of AGC time constants. Normally, SLOW position for SSB and FAST position for CW and AM reception.

- D) N.B.-OFF:** In upper position, the noise blander is activated and works effectively to eliminate noise pulses.
- E) R.I.T.-OFF:** When the switch is turned on, the LED (B) is lit and indicates that the R.I.T. circuit is working. The R.I.T. is usable only when the function switch is set at INT./T.EXT./A/B positions.
- F) MANU-VOX-PTT:** This switch selects desired transmitter mode for both microphone and key operation.

MANU: Actuates transmitter and must be returned to PTT position for normal receiver operation.

VOX: For voice controlled transmission of SSB & AM or CW break-in operation. The transmitter is actuated by simply speaking into the microphone. For break-in CW, when the key is depressed, it actuates the transmitter likewise. The receiver recovers either when the operator stop speaking or key is released.

PTT: Turns transmitter 'ON' when microphone PTT switch, or an external switch connected to the PTT terminal in the rear, is depressed.

- G) MIC:** Microphone jack. Four pin connector is used for microphone input, and push-to-talk relay actuation.
- H) PHONE:** Headphone jack for private listening.
- I) HTR-OFF:** This switch turns on the transmitter tube heaters. After a 30 second warm-up, the transmitter is ready for operation. Cut the switch off for long period of reception, or when operation from a battery source in order to save excessive battery drain.
- J) PWR-OFF:** Main switch turns transceiver 'ON' for both AC and DC operation.

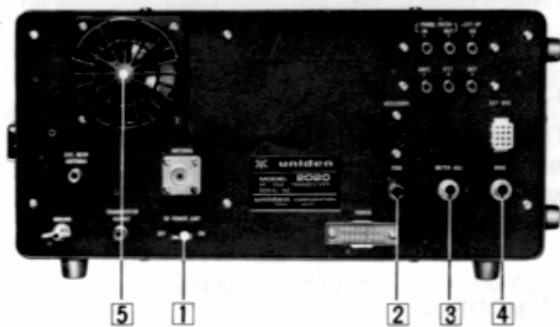
- K) **ALC-IK-PWR:** Selects the meter mode to read PA cathode current (IK), relative power output (PWR), or ALC feedback voltage.
- L) **METER:** The meter indicates S, regardless of modes in receiving. In transmitting, it indicates ALC/IK/PWR as a mode is selected. The green triangle spot on the meter scale shows the position of idling current in SSB transmission. (Red ▲ is for 10W model) (see note)
- M) **LED (A):** This LED when lit, indicates the internal VFO is in action.
- N) **DIAL SCALE:** It consists of digital display of LEDs above 100 kHz and analog display of drum dial under 100 kHz. The digital display is automatically switched by selecting BAND and SEGMENT switches. You may read to 1 kHz order on the drum scale.
- O) **DIAL SET:** The dial set is used to calibrate the main tuning dial. By using the internal marker oscillator as a frequency standard, slide the dial pointer to the correct position.
- P) **LED (B):** This LED, when lit, indicates that the R.I.T. circuit is actuated.

note: S-Meter Reading

The S-Meter is set to read S-9 with an input of 34 dBμ. Over S-9 reading is marked at every 10 dB., and within S-9 level, it is marked at every 4 dB.

3-1-3 Rear Panel Controls and Others

Photo. 8 Rear Panel Controls and Others



- 1) **RF POWER AMP. ON-OFF:** Turn the switch to OFF position to provide the RF output at the transverter output terminal, and cut off heaters of final power tubes and the blower circuit. (see note 5 on page 7)
- 2) **FUSE:** Fuse holder requires 5 amp fuse for AC operation.
- 3) **METER ADJ.:** Meter sensitivity adjustment for relative power output indication.
- 4) **BIAS:** This control is to adjust the final amplifier bias to insure linearity and normal operating plate dissipation for the final tubes. Please set it at the position when the idling current reading on SSB transmission marks ▲ (green triangle) point on the IK meter.

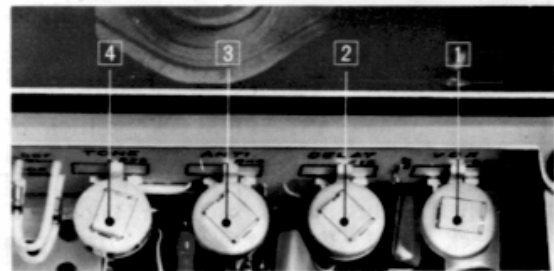
For the rest of terminal functions and connections, Please refer to the 2-3 Electrical Connections.

3-2 Internal Level Settings

The transceiver has been carefully aligned and tested at the factory before shipping, and requires almost no realignment. However, you may adjust controls for VOX operation and CW tone oscillator.

- 1) **VOX:** Speak into the microphone normally, adjust VOX control to activate VOX relay.
- 2) **DELAY:** Adjust the DELAY control for suitable release time.

Photo. 9



Adjustment of VOX gain, side TONE volume, etc.

- 3) **ANTI:** Setting the AF GAIN at the normal listening level, set the ANTI-TRIP control to the minimum point that will prevent the speaker output from tripping the VOX.
- 4) **TONE:** CW sidetone level is adjusted by this TONE control.

SECTION IV OPERATION

4-1 Initial Control Settings

Before turning on the main power switch, please be sure to set controls and switches as follows;

- 1) HTR switch – OFF
- 2) MANU-VOX-PTT switch – PTT
- 3) AF GAIN control – full counterclockwise

Then turn the main switch (PWR) on to find out that main dial and meter are illuminated and the blower starts running.

- 4) Check the digital display shows exact readings by selecting the band and segment switches.
- 5) Turn the R.I.T. switch to the operating position and make sure the LED lights up.
- 6) Turn the FUNCTION switch, and confirm that the LED on the dial scale lights up at the INT. and T. EXT. positions.

4-2 Receiver Tuning

Let's receive 14.100 MHz – 14.200 MHz SSB signal for trial.

FUNCTION switch – INT. position
MODE switch – USB
RF GAIN control – full clockwise
FAST-OFF-SLOW switch – SLOW
PRESELECT control – at 12 o'clock position
BAND switch – 14.0
SEGMENT switch – push 100 button
RF ATT. – full clockwise

Then turn the AF control clockwise to obtain enough audio output. Tune the main dial to select any signals and check the followings;

- (1) Make sure if the R.I.T. control works normally at both WIDE and NARROW positions.
- (2) Find out the noise blanker is suppressing pulse type noise.
- (3) By changing FAST-OFF-SLOW position of AGC time constant, and see if it works as indicated.
- (4) Pull out the marker oscillator knob and check it make beats at every 25 kHz on the dial.

Follow the same procedure for every band and segment ranges.

4-3-1 Dial Calibration

To calibrate the Dial Readings;

Set R.I.T. switch OFF
RF ATT. control full counterclock-wise
MODE selector USB or LSB
F. CAL. ON pull out the knob

Select any band for calibration, and let the segment switch at any position.

The carrier frequency is set at 6187 kHz regardless modes used, the caribration made at SSB mode applies either CW or AM mode as well.

By turning the main dial tuning, you may notice "beat" signal at every 25 kHz. Zero beat it until there is no difference between USB and LSB modes. Then slide the dial needle to 00, 25, 75, or 100 on the dial scale.

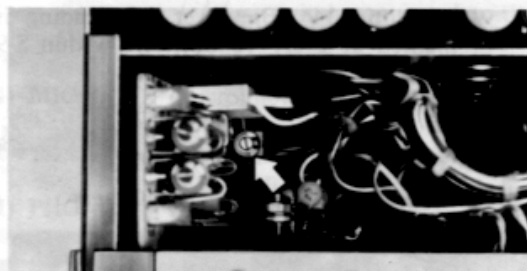
4-3-2 Marker Oscillator Adjustment

The transceiver provides the standard WWV signal reception. By adjusting the built-in calibrator against this WWV signal, you can make accurate frequency calibration.

- (1) Take off eleven screws on the top cover of the equipment. And you will find a trimming capacitor near the fixed frequency control unit located at the upper left-front of the cabinet.
- (2) Turn the mode switch to AM position.
- (3) Change the band selector to WWV position and receive WWV signals.

After those preparations, set the marker oscillator to work by pulling out the knob and you may hear the beats of WWV and the built-in calibrator. Use plastic screw driver for precise adjustment of marker frequency to zero-beat the WWV signals.

Photo. 10 Trimmer capacitor for adjusting marker oscillator.



4-4 Basic Transmitter Tune Up

The following settings of switches and controls must be ready prior to selection of desired operating modes. Let's make 14.1 – 14.2 MHz transmission for trial.

HTR switch HTR (on)
ALC-IK-PWR switch ALC
MODE switch TUNE

PLATE control approx. at 14
 LOAD full counterclock-
 wise
 MIC GAIN & CARRIER.. full counterclock-
 wise

4-4-1 Tuning Procedure

1. Set the MANU-VOX-PTT switch at MANU. position and let the transmitter work.
2. Turn CARRIER control clockwise until the meter needle marks maximum ALC reading within ALC zone.
3. Also readjust PRESELECT control so as that the meter needle marks the maximum ALC reading.
4. Again, set the CARRIER CONTROL within ALC limit.
5. Set the meter switch (ALC-IK-PWR) to PWR position and tune PLATE and LOAD controls for the maximum relative power output.

CAUTION

Above 1 to 5 process must be taken place within 30 seconds at a time.

6. Make sure that the IK (power tubes cathode current) reading shows somewhere around 240 – 250 mA on the meter after all tuning procedure.

When choosing another segment of frequencies, the same procedure must be followed throughly. Most important is the PRESELECT tuning.

CAUTION

Segment switches must be pushed one at a time, otherwise the frequency reading on dial has nothing to do with the actual frequency.

4-4-2 SSB Operation

In general SSB communication, LSB mode is applied for the operation under 10 MHz and USB mode above it.

- (1) Select USB position on mode switch
- (2) Choose PTT position on MANU.-VOX-PTT switch
- (3) Transmission is made when you push a microphone PTT switch.
- (4) By speaking into the microphone, turn the MIC GAIN control clockwise until the meter shows maximum ALC reading within the GREEN ALC zone of the meter.
- (5) Also check that the final tube current is at the idling position (green triangle spot) when there is no microphone input. (see note)

note: When the meter indicates different reading, readjust the idling current by BIAS control on the rear panel.

4-4-3 CW Operation

Change the MODE switch to CW position, and set the MANU.-VOX-PTT to MANU. position, then you can operate CW by depressing the key.

When using PTT, push down the microphone PTT switch or the remote switch connected to the PTT terminal on the rear panel.

You can monitor your own keying by the built-in sidetone and the volume is adjustable as is described in 3-2.

Carrier control must be remained at the same position as the tuning procedure. (4-4-1)

4-4-4 AM Operation

Change the MODE switch to AM position and set the meter switch to IK. Let the transmitter work, and adjust the CARRIER control so that the IK reading shows between 110 – 120 mA.

MIC GAIN is set at the point where the IK reading increases a little bit when talking into a microphone.

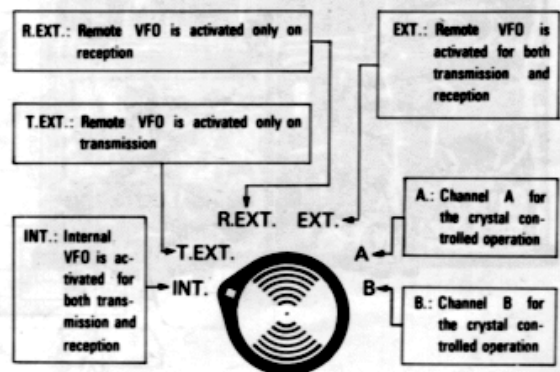
4-4-5 Operating with REMOTE VFO

When you use a remote VFO, the operating function is selected as is shown in fig. below.

For example;

During operation with the function mode INT., you may listen to another frequencies other than the operating frequency on the band by simply switching the selector to R.EXT. position and working on the external VFO tuning. LEDs on the dial board indicate which VFO (internal or external) is working upon transmission or receiving.

Function switch providing selection of remote VFO or two crystal controlled oscillator. Fig. 7



SECTION V CIRCUIT DESCRIPTION

Electrical Line-up

The 2020 transceiver is basically composed of fifteen major units. And most of them are built into plug-in type modules. They are carefully constructed for easier access and service. The front panel is also detachable as is introduced in the picture. The block diagram is shown on the following page.

Local oscillator section has unique pre-mixed system using PLL program oscillator. And the block diagram of the local oscillator portion is described separately from the main diagram.

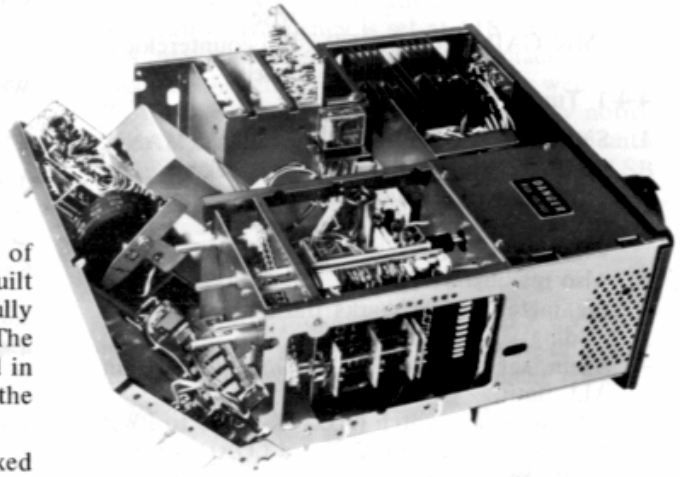


Photo. 11 The 2020 Construction

Photo. 12 Module Units Locations, Top View

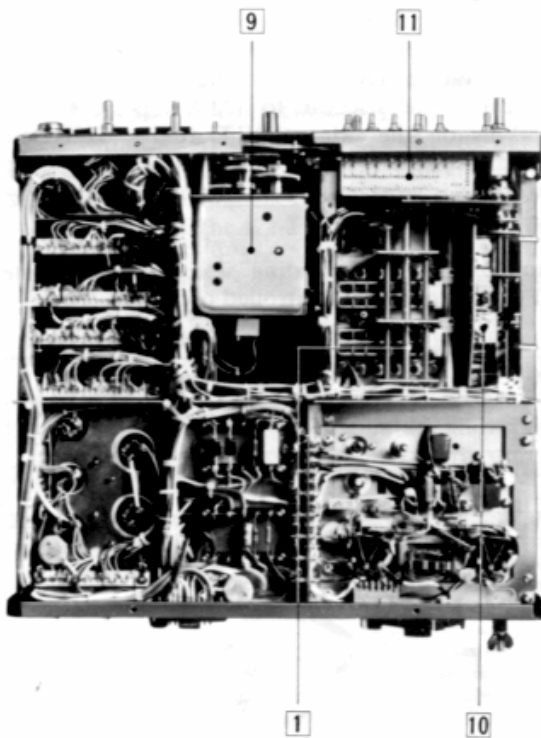


Photo. 13 Module Units Locations, Bottom View

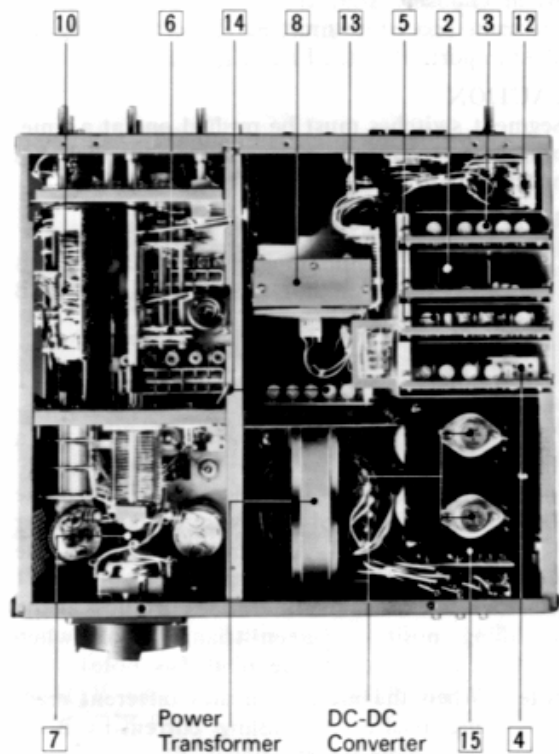
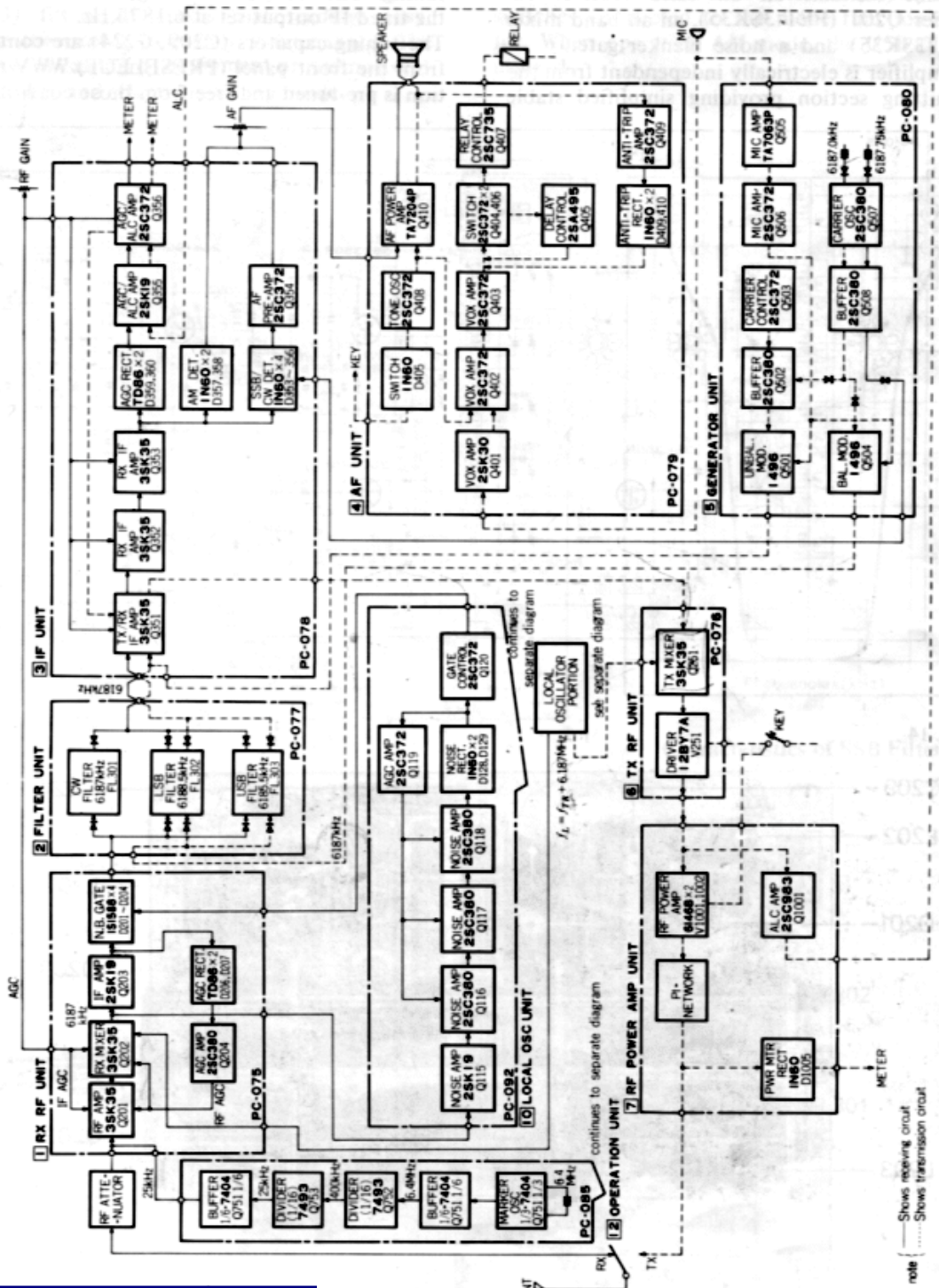


Fig. 8 Block Diagram of the 2020
(local oscillator section in page 25)



note { — Shows receiving circuit
..... Shows transmission circuit

* Features and specifications subject to change without notice.

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5-1 Receiver RF Unit (PC-075)

The unit contains an all band receiver RF amplifier Q201 (FET 3SK35), an all band mixer Q202 (3SK35) and a noise blanker gate. The amplifier is electrically independent from the transmitting section providing simplified stable

tuning. The receiver uses single conversion with the fixed IF output set at 6,187 kHz. The tuning capacitors (C209, C224) are controlled from the front panel (PRESELECT). WWV reception is pre-tuned and free from those controls.

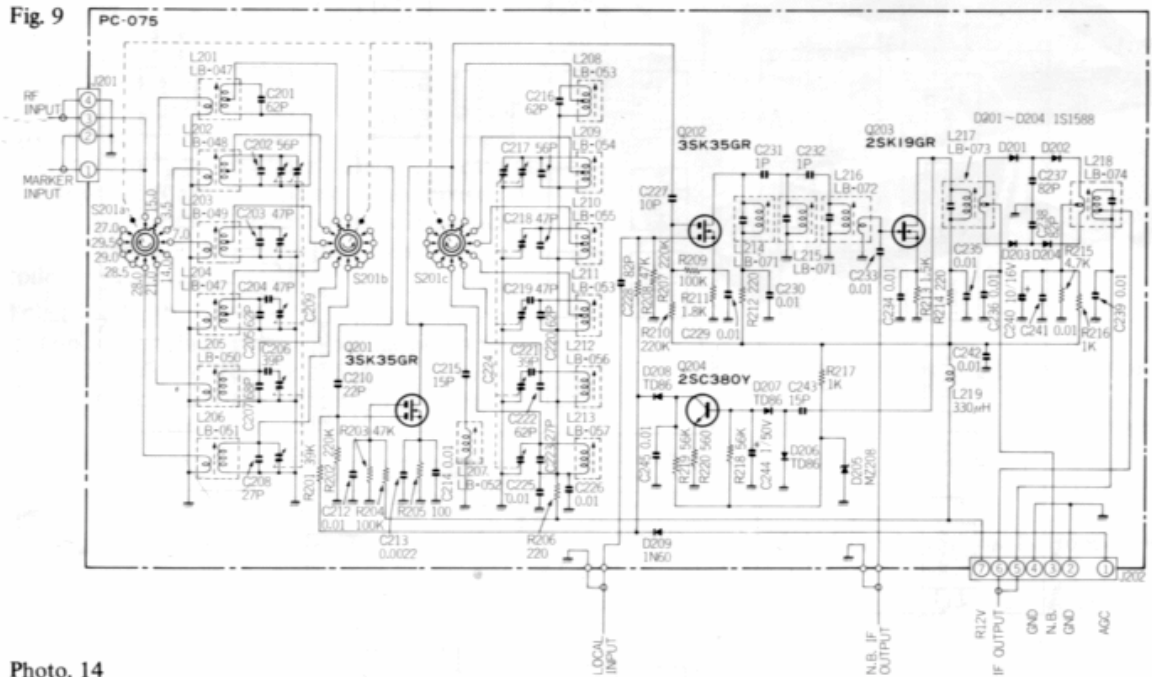
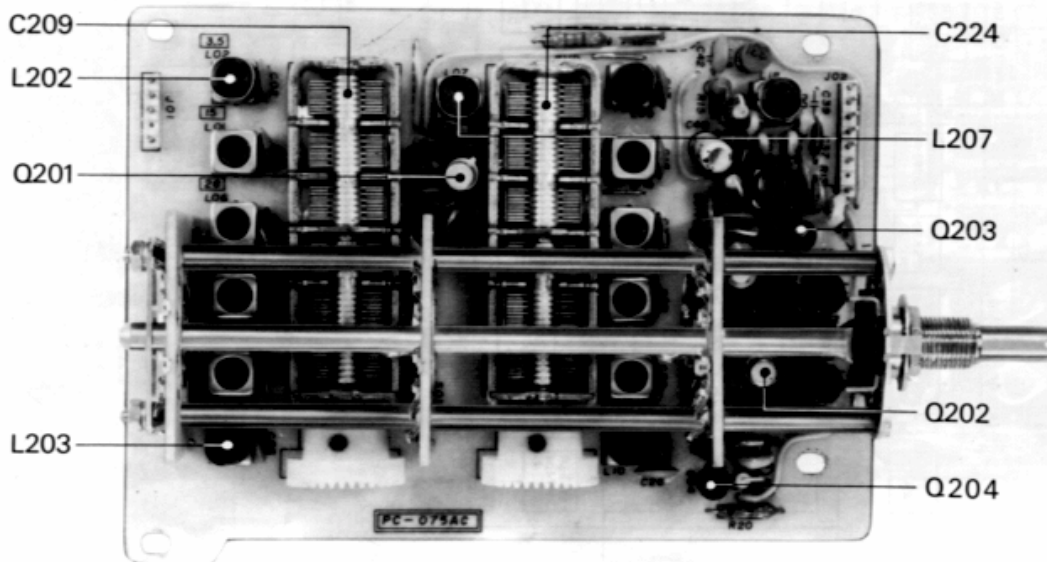


Photo. 14



note: All components numbers printed on circuit board exclude 100 order of parts numbers. Like L202 is indicated as L02

5-2 Filter Unit (PC-077)

The unit includes both LSB (FL302) and USB (FL303) filters. It makes dial readings easy, because the carrier frequency is unchanged. The CW filter is standard equipment providing excellent stability and selectivity in any mode.

Selection of filters is done automatically by diode switches connected to the mode function selector. When operating AM mode, the USB filter is utilized.

Fig. 10

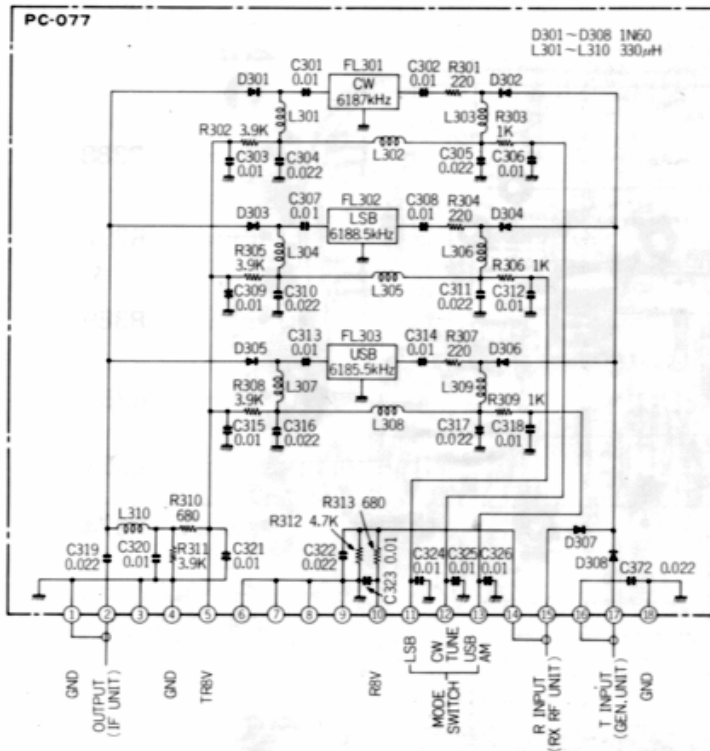
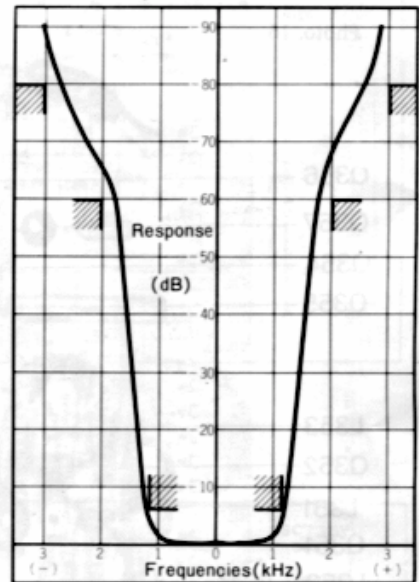
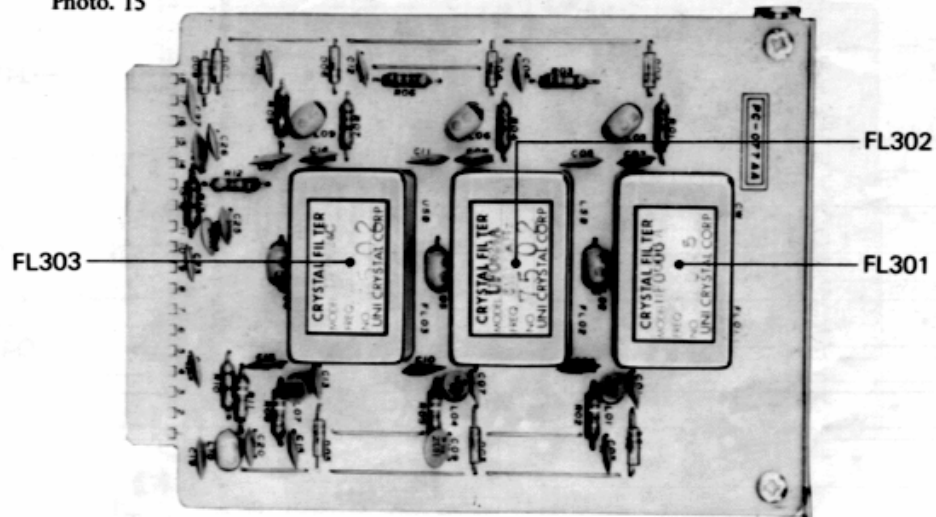


Fig. 11



Characteristics of SSB Filters

Photo. 15



5-3 IF Unit (PC-078)

The unit includes IF amplifier circuit for both reception and transmit, independent receiver IF amplifier circuit, a SSB/CW/AM regenerator and an AGC/ALC amplifier. To adjust SSB/CW and AM audio output level, AF pre-amplifier (Q354) is also provided. IF amplifier circuit uses FETs to assure linear amplification and good AGC/ALC effect.

5-4 AF Unit (PC-079)

There are an AF amplifier circuit, a tone oscillator for CW monitoring, a voice control amplifier and switching circuit and an antitrip circuit. The AF amplifier uses SEPP-OTL circuit for adequate audio output and good tonel quality.

Photo. 16

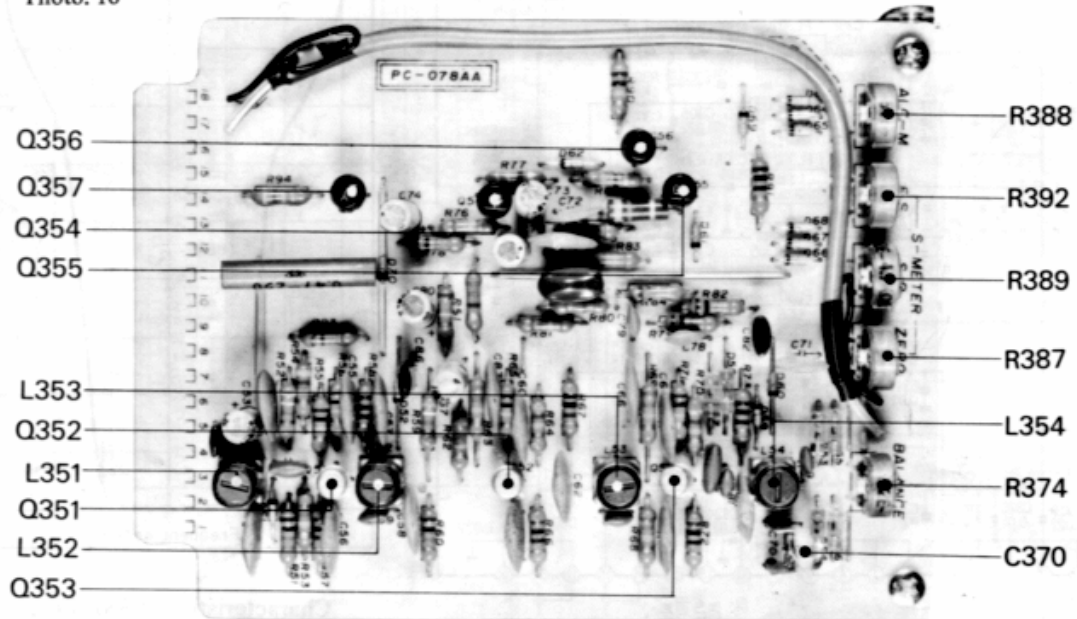


Photo. 17

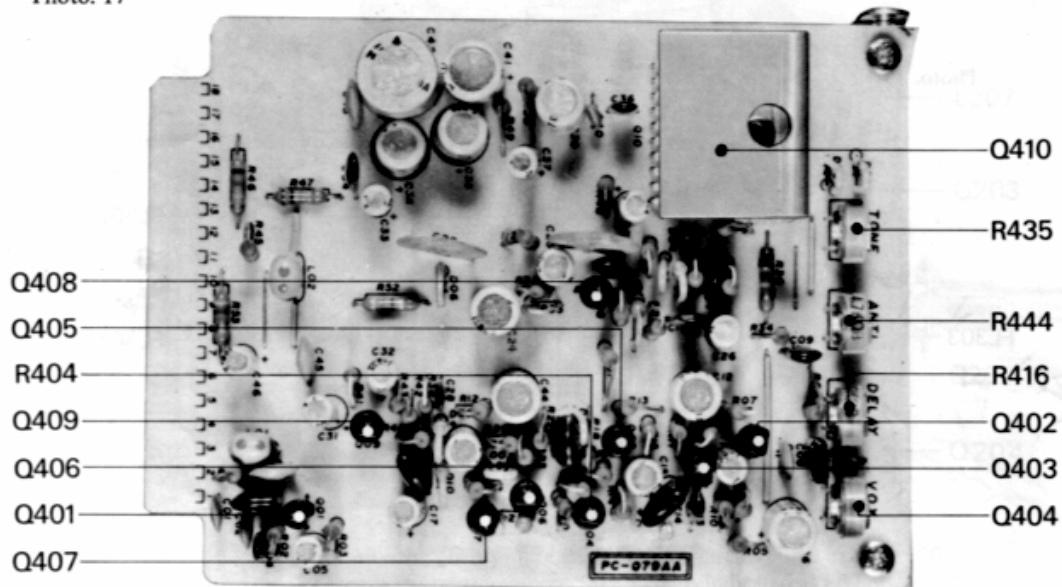


Fig. 12

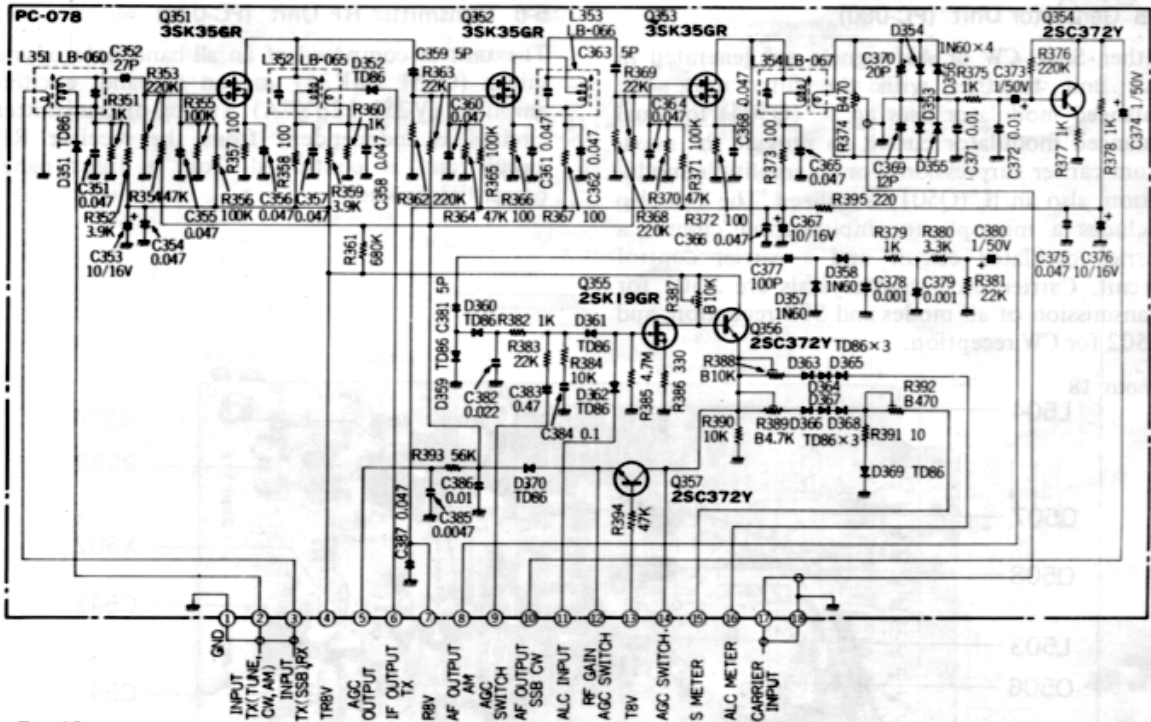
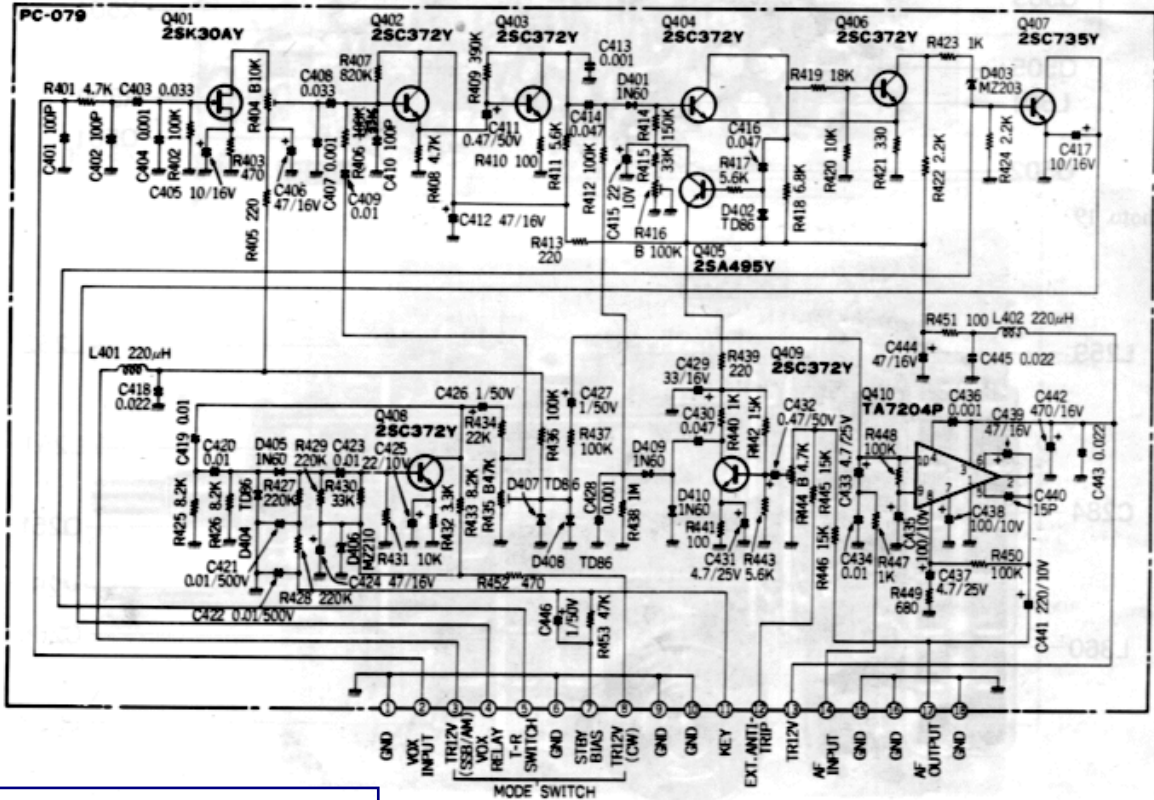


Fig. 13



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5-5 Generator Unit (PC-080)

Either SSB, CW or AM signals are generated in this unit together with the filter unit. The balanced modulator uses an IC (Q504) for dual balanced modulator circuit to provide the maximum carrier suppression. For an amplitude modulation, also an IC (Q501) is utilized. The unit also includes a microphone amplification circuit, a carrier oscillator circuit and a carrier control circuit. Carrier oscillation crystals are X501 for transmission of all modes and SSB reception, and X502 for CW reception.

Photo. 18

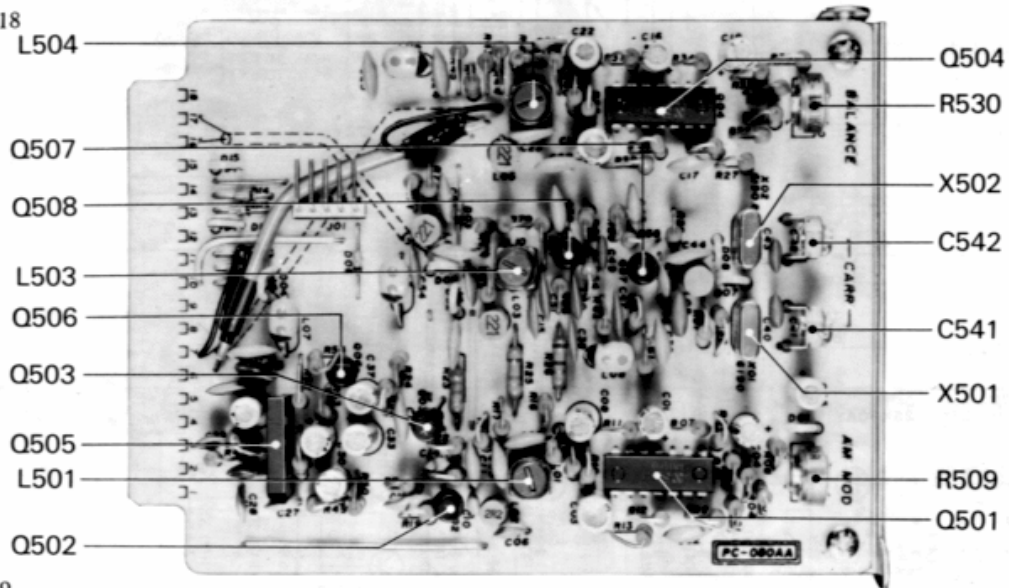
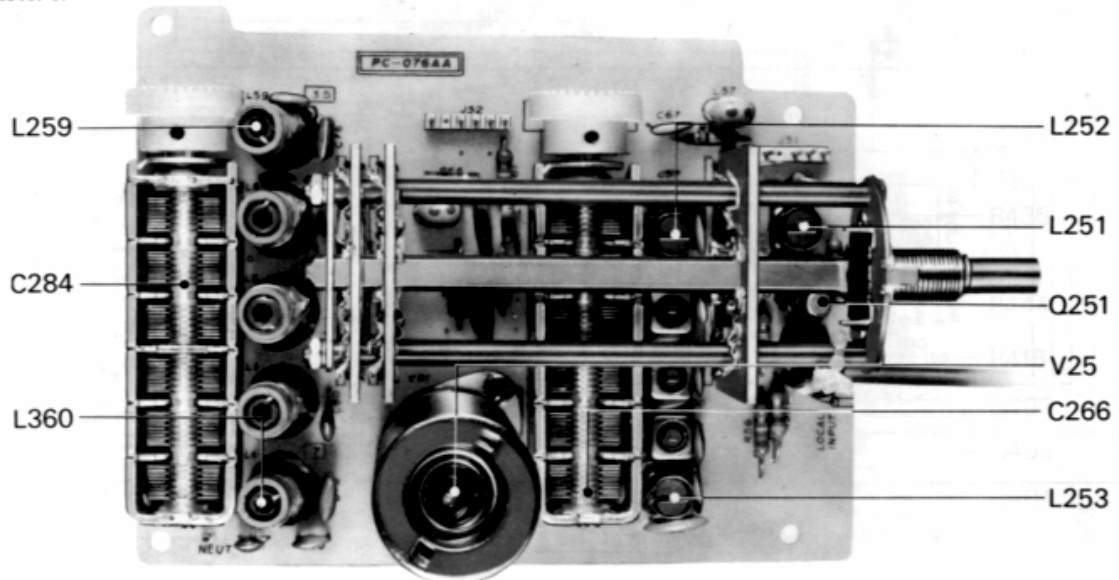


Photo. 19



5-6 Transmitter RF Unit (PC-076)

The unit is composed of an all-band heterodyne mixer (Q251 3SK35) and an all-band exciter-amplifier (V251 12BY7A). Tuning of transmitter circuits is independent from the receiver RF circuit and is controlled from a front panel preset tuning knob.

Fig. 14

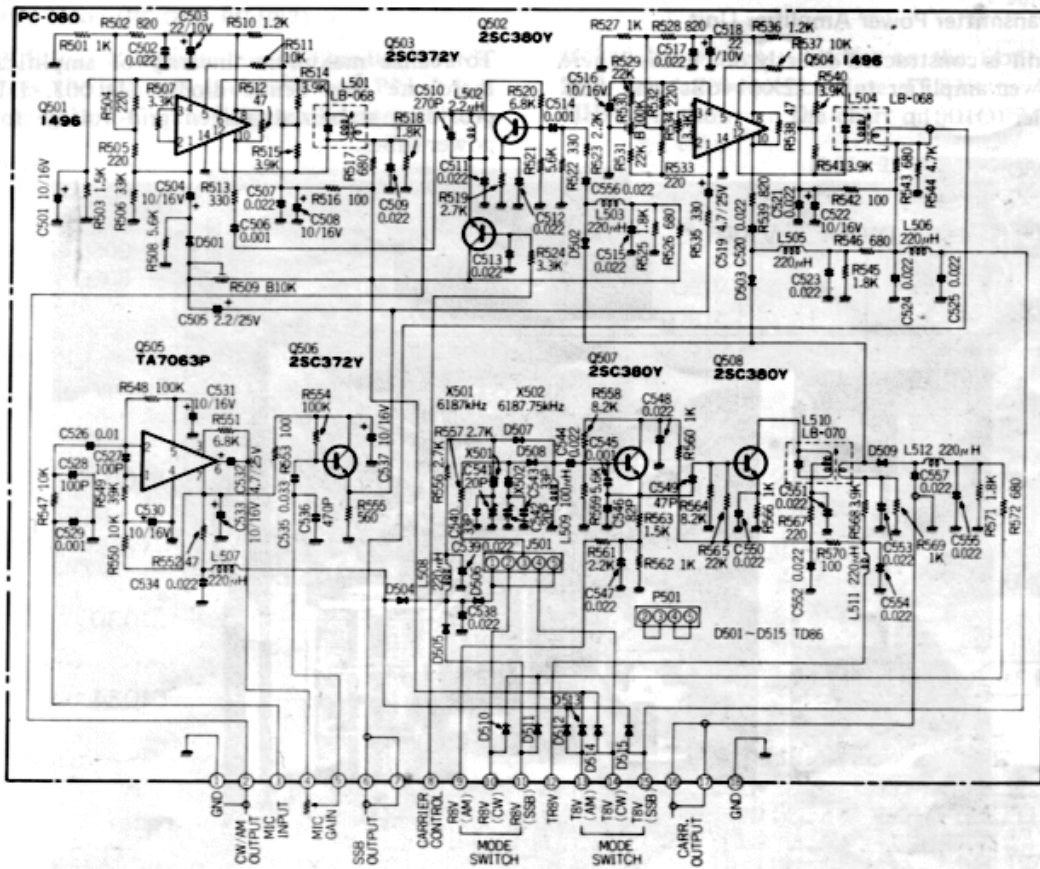
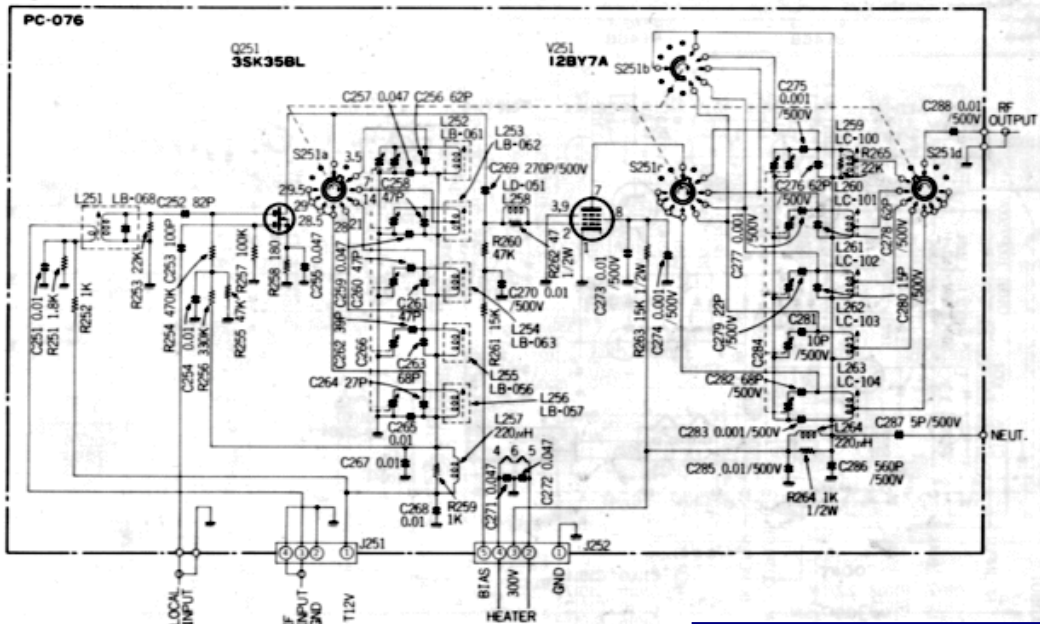


Fig. 15



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5-7 Transmitter Power Amplifier Unit

This unit is constructed directly on chassis. There are power amplifier tubes (2X6146Bs) and ALC amplifier (Q1001).

To realize maximum linearity of amplification, there are two zenor diodes (D1003, D1004) providing stabilized, screen grid voltage for the power tubes.

Photo. 20

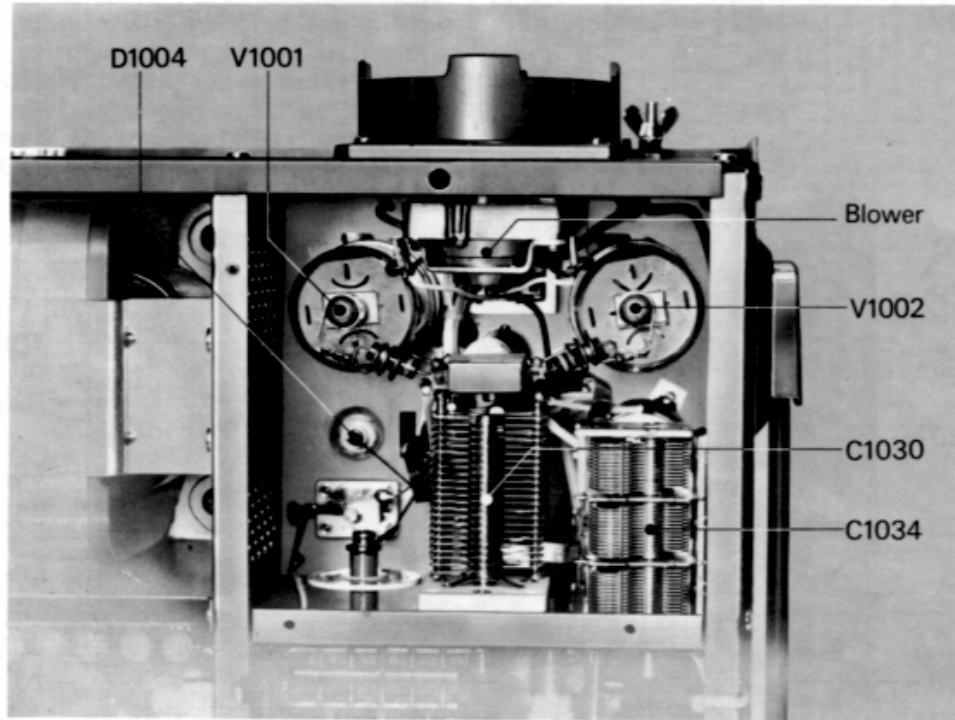
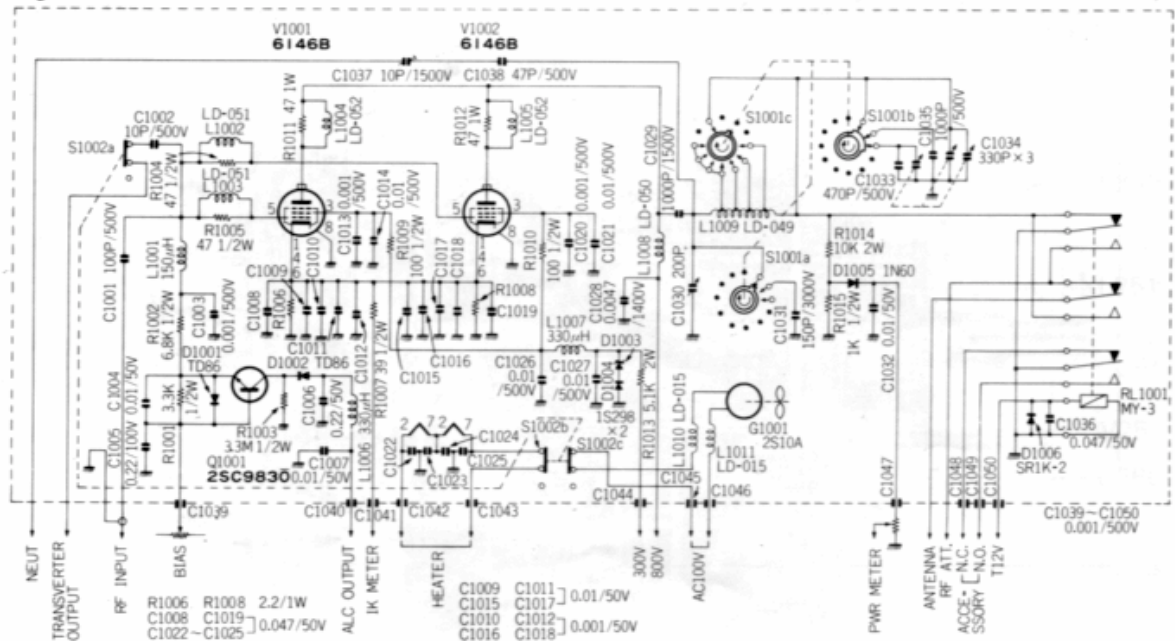


Fig. 16



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5-8 PLL Unit (PC-086, PC-087)

The PLL unit is separated on two module boards. PLL-1 is the main PLL circuits and PLL-2 is a program selector unit. Program selector is controlled by segment switches on the front panel. PLL output frequencies are 15.838 to 15.338 MHz as is shown in the chart on page 27.

controlled by segment switches on the front panel. PLL output frequencies are 15.838 to 15.338 MHz as is shown in the chart on page 27.

Photo. 21
PLL ①

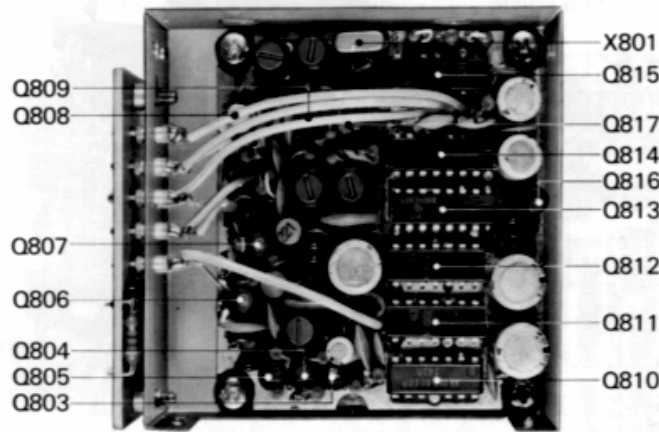
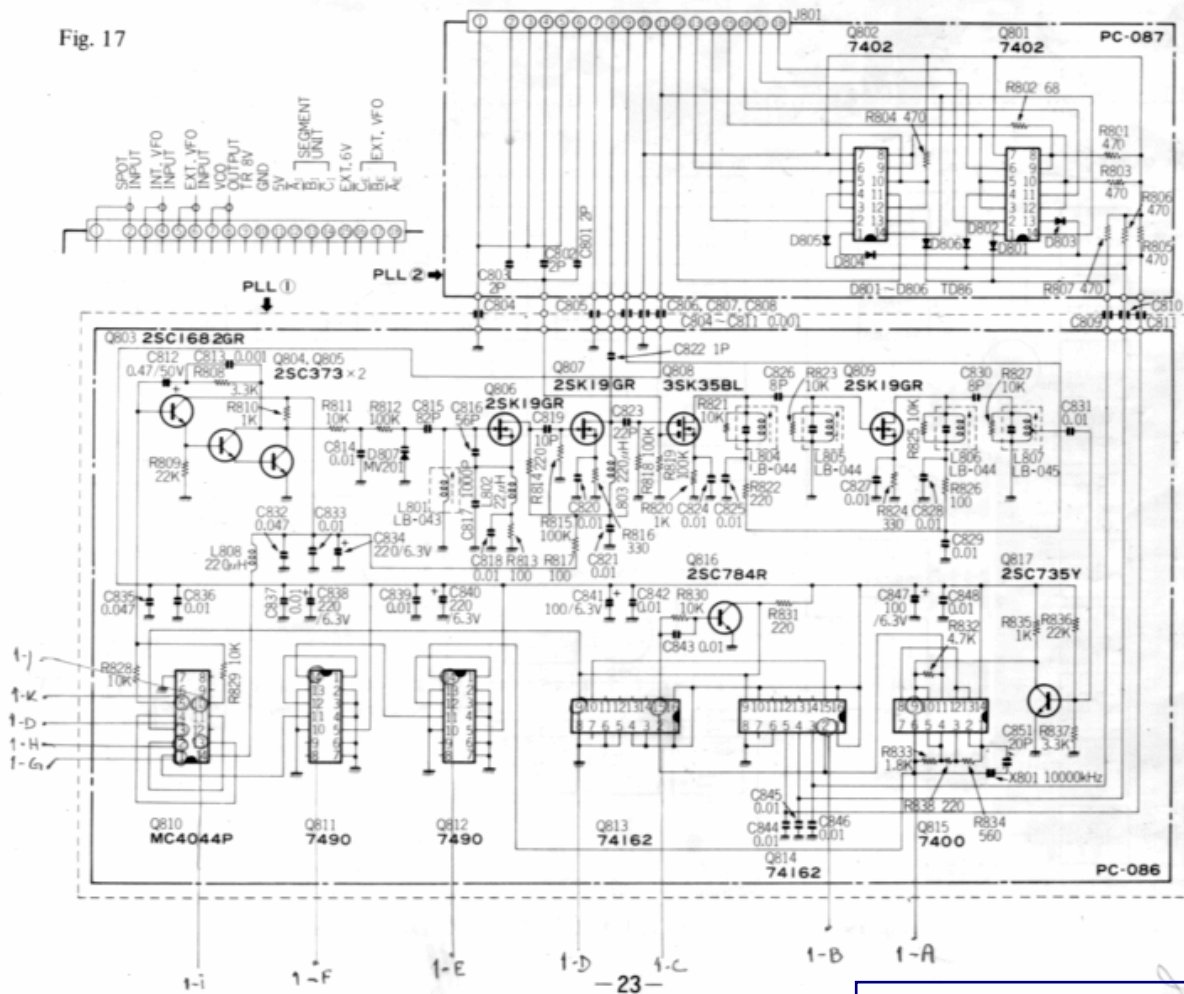


Photo. 22
PLL ②



Fig. 17



5-9 VFO Unit (PC-083, PC-084)

The VFO module is installed in the VFO chassis. The VFO designed to oscillate full 100 kHz from 9138 to 9038 kHz, thus providing drift-free stable signals. Moreover buffers (Q702 & Q703) help avoid load fluctuation effects.

Photo. 23

Fig. 18

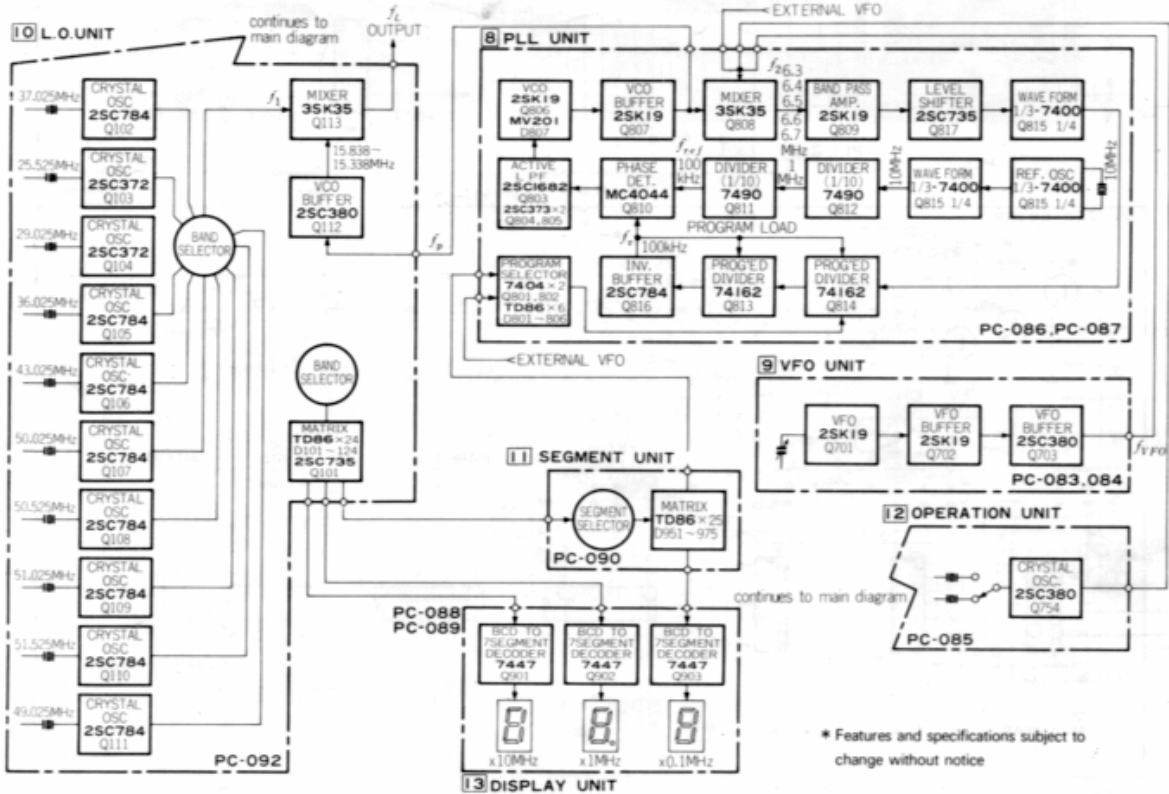
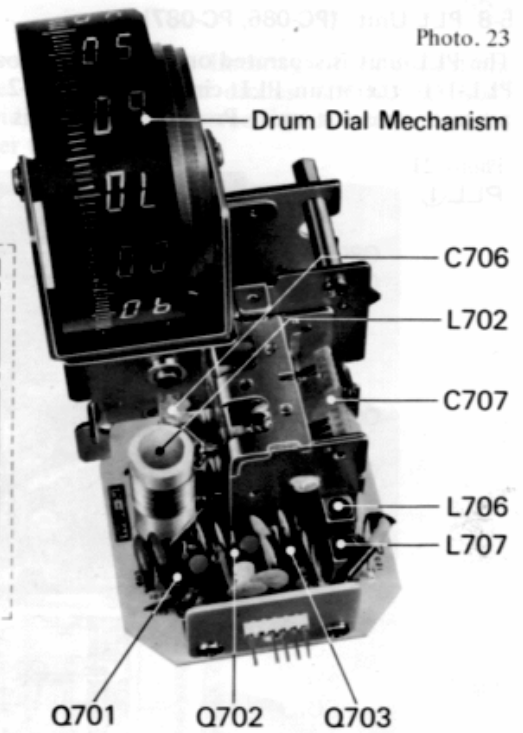
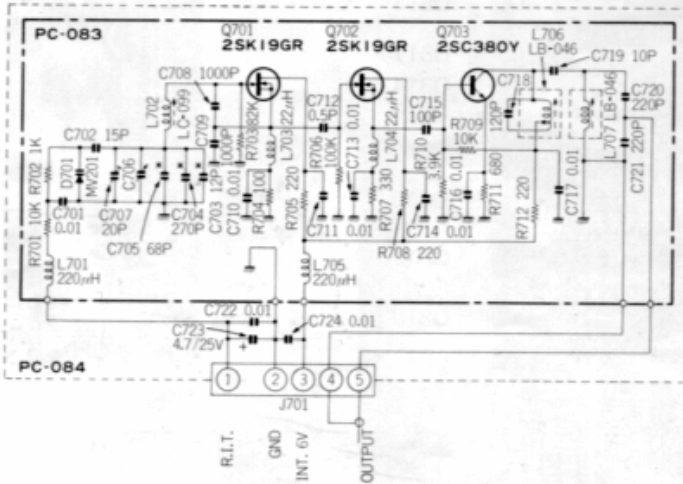


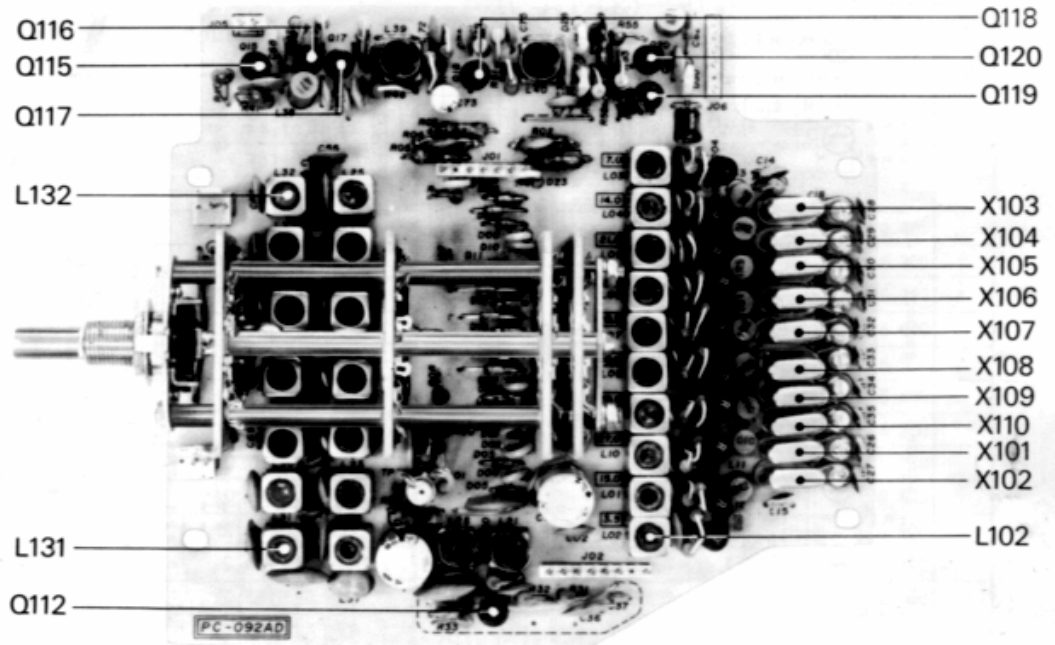
Fig. 19 LOCAL OSCILLATOR BLOCK DIAGRAM

5-10 Local Oscillator Unit (PC-092)

This unit includes local heterodyne oscillators for each band and an all-band mixer (Q-113) to pre-mix those local frequencies with fP from PLL oscillation circuits and also a noise blanker circuit. Crystal oscillator employ separate transis-

tors (Q102-Q111) to obtain equal output stabilities for each band and the use of dual-tuned circuit for the pre-mix output helps decrease unnecessary spurious radiation. Matrix circuit for digital display also comes with this unit.

Photo. 24



5-11-1 Segment Unit (PC-090)

Diode Matrix circuit to select the program of the PLL circuit and the digital display of 100 kHz order is featured on this unit.

Photo. 25

Fig. 20

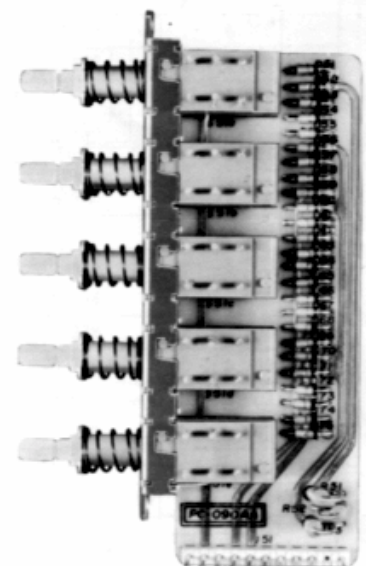
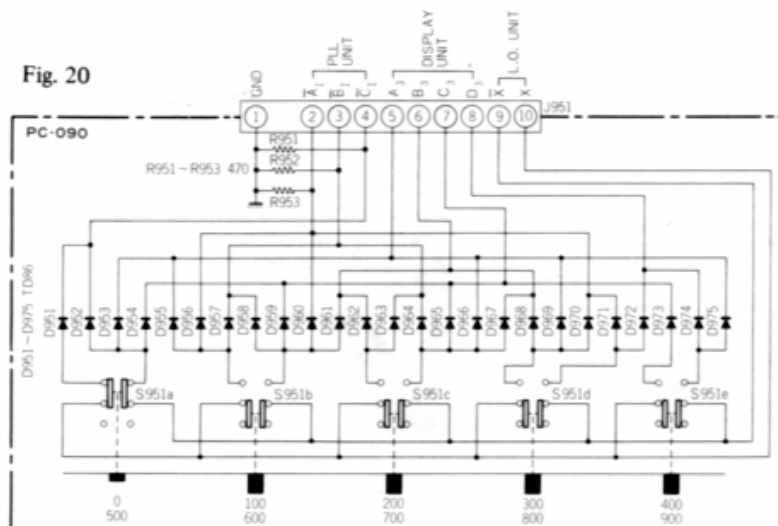


Fig. 22

5-11-2 Table of Frequency Interrelation

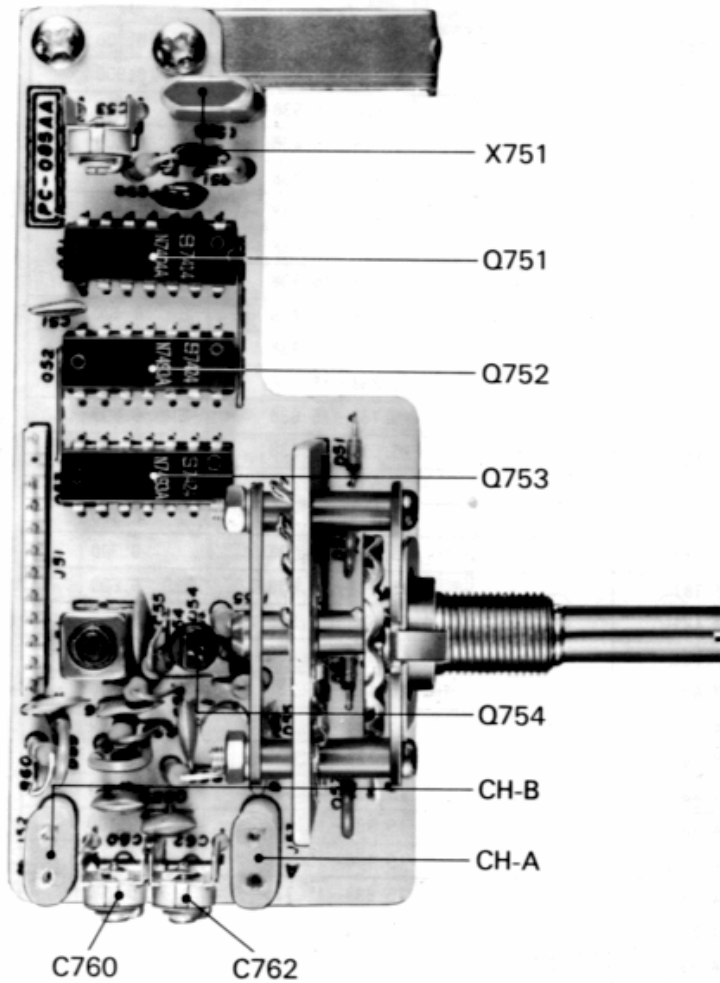
f_{TR} – Transmitting & receiving frequency
 f_i – Intermediate frequency
 f_L – Local oscillator frequency
 f_1 – Crystal oscillator frequency
 f_p – PLL output frequency
 f_2 – PLL heterodyne output frequency

BAND	f_{TR}	f_L	f_1	f_p	f_2
3.5	3.5– 3.6	9.687– 9.787	25.525	15.838– 15.738	6.700
	3.6– 3.7	9.787– 9.887		15.738– 15.638	6.600
	3.7– 3.8	9.887– 9.987		15.638– 15.538	6.500
	3.8– 3.9	9.987– 10.087		15.538– 15.438	6.400
	3.9– 4.0	10.087– 10.187		15.438– 15.338	6.300
7.0	7.0– 7.1	13.187– 13.287	29.025	15.838– 15.738	6.700
	7.1– 7.2	13.287– 13.387		15.738– 15.638	6.600
	7.2– 7.3	13.387– 13.487		15.638– 15.538	6.500
	7.3– 7.4	13.487– 13.587		15.538– 15.438	6.400
	7.4– 7.5	13.587– 13.687		15.438– 15.338	6.300
14.0	14.0– 14.1	20.187– 20.287	36.025	15.838– 15.738	6.700
	14.1– 14.2	20.287– 20.387		15.738– 15.638	6.600
	14.2– 14.3	20.387– 20.487		15.638– 15.538	6.500
	14.3– 14.4	20.487– 20.587		15.538– 15.438	6.400
	14.4– 14.5	20.587– 20.687		15.438– 15.338	6.300
21.0	21.0– 21.1	27.187– 27.287	43.025	15.838– 15.738	6.700
	21.1– 21.2	27.287– 27.387		15.738– 15.638	6.600
	21.2– 21.3	27.387– 27.487		15.638– 15.538	6.500
	21.3– 21.4	27.487– 27.587		15.538– 15.438	6.400
	21.4– 21.5	27.587– 27.687		15.438– 15.338	6.300
28.0	28.0– 28.1	34.187– 34.287	50.025	15.838– 15.738	6.700
	28.1– 28.2	34.287– 34.387		15.738– 15.638	6.600
	28.2– 28.3	34.387– 34.487		15.638– 15.538	6.500
	28.3– 28.4	34.487– 34.587		15.538– 15.438	6.400
	28.4– 28.5	34.587– 34.687		15.438– 15.338	6.300
28.5	28.5– 28.6	34.687– 34.787	50.525	15.838– 15.738	6.700
	28.6– 28.7	34.787– 34.887		15.738– 15.638	6.600
	28.7– 28.8	34.887– 34.987		15.638– 15.538	6.500
	28.8– 28.9	34.987– 35.087		15.538– 15.438	6.400
	28.9– 29.0	35.087– 35.187		15.438– 15.338	6.300
29.0	29.0– 29.1	35.187– 35.287	51.025	15.838– 15.738	6.700
	29.1– 29.2	35.287– 35.387		15.738– 15.638	6.600
	29.2– 29.3	35.387– 35.487		15.638– 15.538	6.500
	29.3– 29.4	35.487– 35.587		15.538– 15.438	6.400
	29.4– 29.5	35.587– 35.687		15.438– 15.338	6.300
29.5	29.5– 29.6	35.687– 35.787	51.525	15.838– 15.738	6.700
	29.6– 29.7	35.787– 35.887		15.738– 15.638	6.600

5-12 Operation Unit (PC-085)

This unit includes the Marker oscillator for dial calibration and crystal oscillator for the crystal controlled operation. Two crystals may be selected by a function switch on the front panel.

Photo. 26



5-13 Display Unit (PC-088, PC-089)

This unit consists of two printed circuit boards each containing a decoder circuit and a digital LED display (D902-D904) board. A VFO actuation indicator (D901) is also included.

Photo. 27

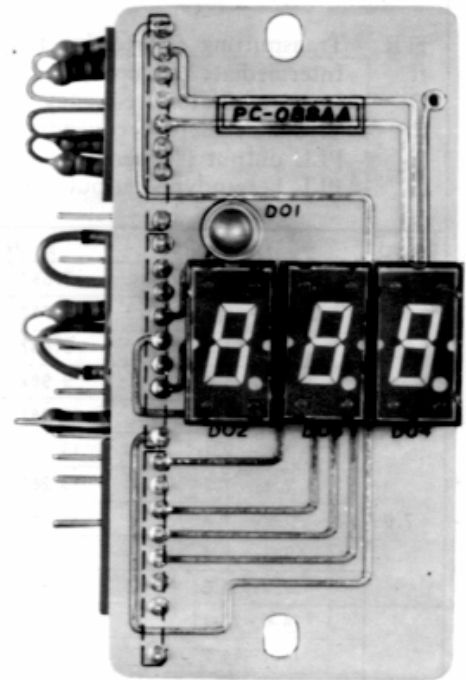


Photo. 28

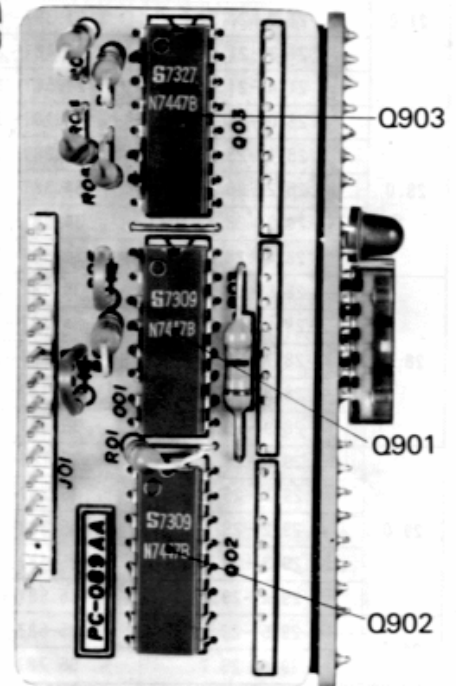


Fig. 23

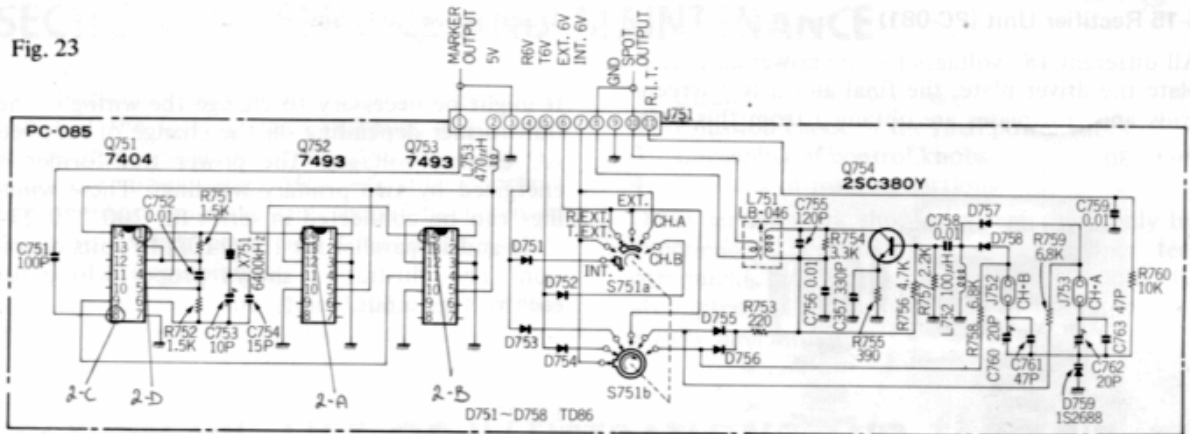
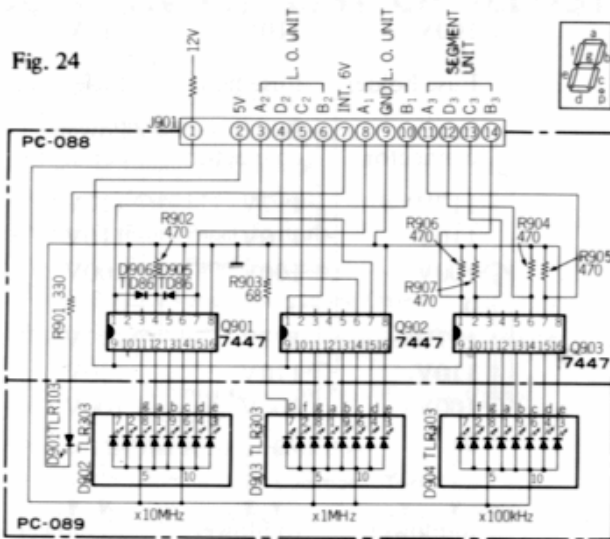


Fig. 24



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5-14 AVR Unit (PC-082)

This automatic voltage regulator unit supplies 5 volts DC for IC circuits, 8 volts DC for younger stage of the transceiver and 6 volts DC for the VFO circuit and also voltage control circuit of the R.I.T. control.

Photo. 29

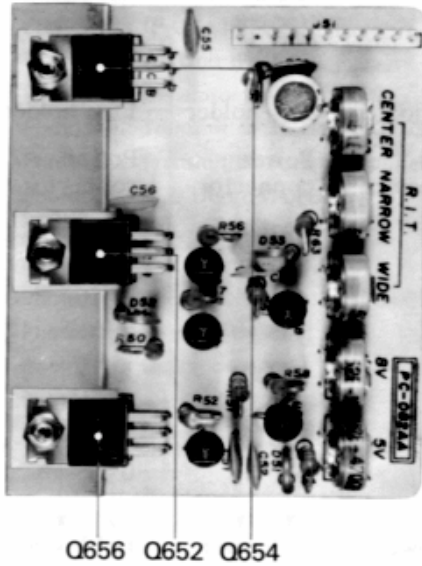
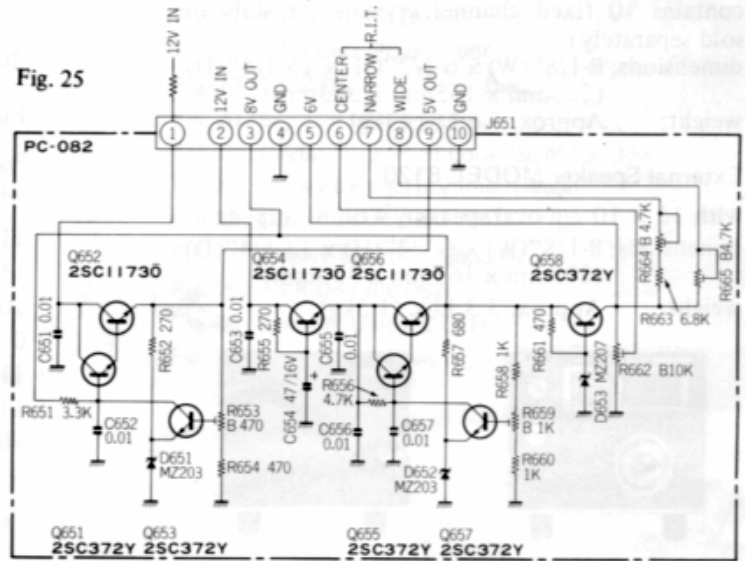


Fig. 25



5-15 Rectifier Unit (PC-081)

All different DC voltages for the power amplifier-plate the driver plate, the final and driver screen-grids and grid biases are obtained from this unit.

Photo. 30

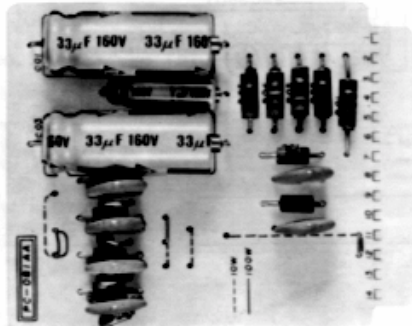
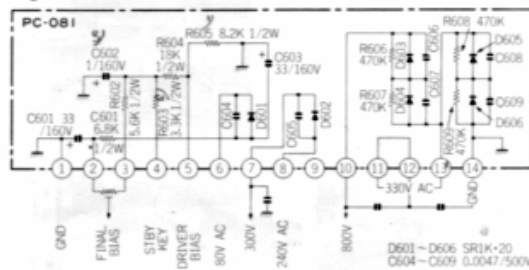


Fig. 26



Optional Accessories

There are matching Remote VFO and External Speaker for the 2020.

Remote VFO MODEL 8010

contains 10 fixed channel crystals (crystals are sold separately)
 dimensions; 8-1/8"(W) x 6-1/2"(H) x 13-1/4"(D)
 (205mm x 165mm x 333mm)
 weight; Approx. 6.6 Lbs. (3kg)

External Speaker MODEL 8120

with 15 x 10 cm oval speaker, 4 ohms impedance
 dimensions; 8-1/8"(W) x 6-1/2"(H) x 13-1/4"(D)
 (205mm x 165mm x 333mm)
 weight; Approx. 3.3 Lbs. (1.5kg)

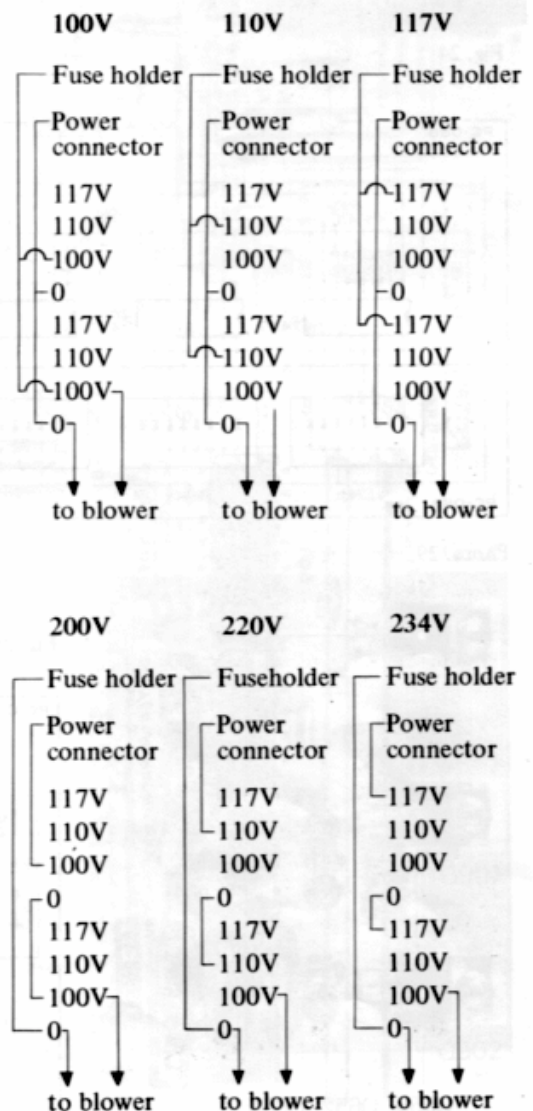


Photo. 31

Transformer Rewiring

It might be necessary to change the wiring of the transformer depending on the change of supplied AC current voltages. The power transformer is energized by two primary windings. These windings can be connected in series for 200/220/234 volts and in parallel for 100/110/117 volts operation. The illustration shows proper wiring for each voltage input.

Fig. 27



SECTION VI SERVICE AND MAINTENANCE

The transceiver has been carefully aligned and tested at the factory upon shipping, and it does not require special realignment or readjustment under the normal usage. However, it is important that the best possible care should be taken in order to expect good and long-lasting performance of the equipment.

It is advised that you should take care of the following inspection from time to time.

1. Cleaning of the air-passage.
2. Emission check of the final power tubes.
3. Loosening of control knobs.
4. Greasing of rotating sections.

Other service work should be performed only by experienced personnel, using the proper test equipment. And no realignment should be attempted unless the operation of the transceiver is fully understood.

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ACCESSORY CIRCUITS ALIGNMENT

1. **NOISE BLANKER Adjustment**

1-1. **Test Equipment Required**

(1) DC Voltage Meter

1-2. **Adjustment Procedures.**

- (1) Set MODE SWITCH to USB, and receive 14.200 Mhz.
- (2) Activate MARKER OSCILLATOR by pulling out RF ATT knob.
- (3) Set NOISE BLANKER SWITCH to OFF.
- (4) Tune the main dial to generate about 1,000 Hz beat from a speaker.
- (5) Put the meter to the COLLECTOR of Q119.
- (6) Adjust L139 and L140 to obtain minimum meter readings.

2. **MARKER OSCILLATOR ADJUSTMENT**

2-1. **Test Equipment Required**

(1) Frequency Counter.

2-2. **Adjustment Procedures**

- (1) Connect Frequency Counter to the Pin 1 (Marker output) of J751 on the operation unit.
- (2) Activate MARKER OSCILLATOR by pulling out RF ATT knob.
- (3) Tune trimmer capacitor C753, so that the counter indicates 25.000 KHz ± 2 Hz..

2-3 **Adjustment by Standard Radio Signals**

- (1) Connect antenna-to-antenna jack.
- (2) Set BAND SWITCH to 15.0 SEGMENT SWITCH at 0/500, and receive 15 MHz Standard Signal (JJY, WWV, etc.)
- (3) Pull out RF ATT knob to activate MARKER OSCILLATOR.
- (4) Set MODE SWITCH to AM.
- (5) Adjust trimmer C753 to make zero beat of calibration signal. It is easily adjustable Standard Radio Signal (A2), because double beat is generated.
- (6) Adjust attenuator control to make the calibration easy against excessive incoming signal.

3. R.I.T CIRCUIT ALIGNMENT

3-1 Test Equipment Required

- (1) None

3-2 Adjustment Procedures

- (1) Set the main dial at 50, on any BAND or SEGMENT selection.
- (2) Pull out RF ATT knob and make the marker oscillator work to obtain about 1,000 Hz beat.
- (3) Set R.I.T knob to 0 at the WIDE (normal) position.
- (4) Adjust potentiometer R665 in AVR unit to obtain the same beat at ON or OFF of the R.I.T SWITCH.
- (5) Again try the same adjustment on R664 in AVR at the NARROW (pull) position of R.I.T.

4. S-METER ADJUSTMENT

4-1 Test Equipment Required

- (1) Standard Signal Generator (SSG)

4-2 Adjustment Procedures

- (1) Connect SSG output to antenna jack.
- (2) Set MODE SWITCH to USB.
- (3) Set BAND SWITCH to 14.0, SEGMENT SWITCH at 200/300, and tune the main dial to receive 14.200 MHz signal.
- (4) Turn RF GAIN CONTROL fully clockwise.
- (5) Turn RF ATT CONTROL fully clockwise.
- (6) Tune PRESELECT knob to obtain maximum noise output.
- (7) Set SSG frequency at other than 14.200 MHz and keep minimum output level.
- (8) Turn potentiometer R387 in the IF unit fully counterclockwise. Then, return it slowly clockwise and stop just before S-Meter starts moving.
- (9) Feed 40 dB of 14.200 MHz unmodulated output to transceiver, and turn the dial to obtain maximum S-Meter readings.
- (10) Adjust potentiometer R389 on the IF unit, so that the S-Meter indicator shows S-9 readings.
- (11) Set SSG Output at 80 dB.
- (12) Adjust potentiometer R392 on the IF unit, so that the indicator shows full-scale readings.
- (13) Repeat (9) – (12) adjustment until both prospected readings are available.

5. ALC METER ADJUSTMENT

5-1. Test Equipment Required

- (1) RF Power Meter.
- (2) Audio Generator (AG) x 2.
- (3) Audio Attenuator (ATT)
- (4) AF Milli-volt Meter (mV)

5-2. Adjustment Procedures

- (1) Connect RF power meter to antenna jack.
- (2) Set two AGs and ATT as described in Fig. 5-2-1, to provide two-tone signals to the microphone jack.

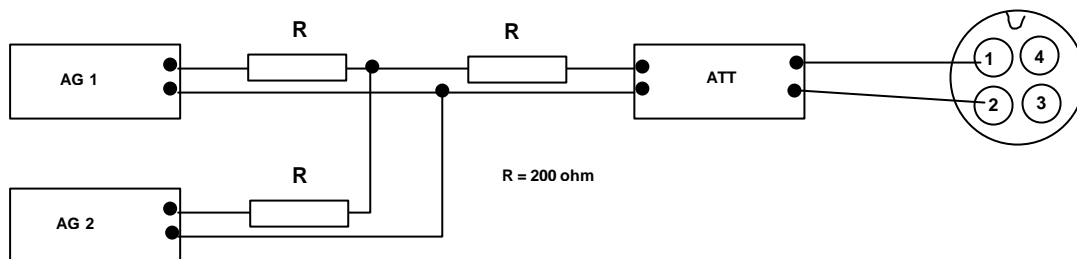


Fig 5-2-1

- (3) Tune and load transmitter at 14.2 MHz to obtain maximum output.
- (4) Set MODE SWITCH to USB.
- (5) Turn MIC GAIN CONTROL fully clockwise.
- (6) Set Meter Switch to ALC position.
- (7) Set AG 1 frequency to 1,900 Hz and AG 2's to 2300 Hz.
- (8) Measure each output voltage at the mV and set them to 10 mV.
- (9) Adjust and set the attenuator just before ALC Meter starts moving.
- (10) Reduce attenuation for 10 dB and increase microphone input.
- (11) Adjust potentiometer R388 on the IF unit so that the indicator points the right end of the green ALC scale on the meter.

RECEIVER ALIGNMENT

1. ALIGNMENT PREPARATIONS

1-1. Set controls and switches on the front panel as indicated below:

(1) FUNCTION SWITCH	INT.
(2) HTR SWITCH	OFF
(3) STANDBY SWITCH	PTT
(4) R.I.T SWITCH	OFF
(5) N.B. SWITCH	OFF
(6) AGC SWITCH	FAST
(7) MODE SWITCH	USB
(8) RF GAIN SWITCH	Fully Clockwise
(9) AG GAIN CONTROLL	Center position.
(10) SEGMENT SWITCH	0/500 KHz
(11) RF. ATT. CONTROL	Fully Clockwise
(12) OTHER CONTROLS & SWITCHES	Option

1-2. Set rera panel switch and jack as indicated below:

- (1) RF POWER AMP SWITCH Off
- (2) Connect external speaker (4 ohms), or 4 ohm dummy load to the EXT. SP jack.

1-3. Set PWR SWITCH to ON after completion of all preparations as mentioned above.

2. RX RF UNIT ALIGNMENT

2-1. Test Equipment Required

- (1) Standard Signal Generator (SSG)
- (2) AF milli-volt Meter (mV)

2-2. IF Trap Coil Alignment

- (1) Connect SSG output to antenna jack.
- (2) Connect mV to speaker or dummy load in parallel.
- (3) Set BAND Switch to 7.0, and SEGMENT SWITCH to 0/500.
- (4) Turn PRESELECT CONTROL fully counter-clockwise.
- (5) Provide 80 dB of 6.187 MHz unmodulated signal from SSG.
- (6) Adjust L01 and L207, so as indicate minimum readings on S-Meter or mV.

2-3. Tuning Coil Alignment

- (1) Connect SSG output and mV as 2-2 (1), (2).
- (2) Set PRESELECT CONTROL to center position.
- (3) Select BAND SWITCH and SEGMENT SWITCH in order, starting from 15.0 MHz according to the chart 2-2-1-A, and also provide listed frequency signals (unmodulated 40 dB) from SSG as show in the chart 2-2-1-B and receive them by tuning the main dial.
- (4) Get maximum S-Meter or mV readings by adjusting tuning coils as indicated (L201 – L213) on each band.
- (5) Control SSG output during this process to make adjustment easier.

Chart 2-2-1

	A	B	C
BAND	SEGMENT	FREQ. (MHz)	COIL No.
15.0	0/500	15.000	L201, L208
3.5	100/600	3.600	L202, L209
7.0	100/600	7.100	L203, L210
14.0	200/700	14.200	L204, L211
21.0	200/700	21.200	L205, L212
28.5	0/500	28.500	L206, L213

2-4. IF Tuning Coil Alignment.

- (1) Connect SSG and mV as 2-2 (1), (2)
- (2) Set BAND SWITCH to 14.0, and SEGMENT SWITCH to 200/700.
- (3) Provide 40 dB of 14.200 MHz unmodulated signal from SSG.
- (4) Tune the main dial and receive the input signal, then control PRESELECT knob to get maximum output readings.
- (5) Adjust L214 – L218 so as to get the maximum readings on S-Meter or mV.

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3. IF UNIT ALIGNMENT

3-1. Test Equipment Required

(1) Same as 2-1

3-2. Preparations

Take out IF UNIT (PC-078) and put SERVICE EXTENSION BOARD in its place, then CONNECT the IF UNIT to the EXTENSION BOARD.

3-3. Coil Adjustment.

(1) Process the same as 2-4, (1) – (4).

(2) Adjust L351 – L354 to get the maximum readings or S-Meter or mV.

3-4. Carrier Balance Adjustment.

(1) Process the same as 2-4, (1) – (4), but note that SSG output should be 20 dB.

(2) Adjust CARRIER BALANCE potentiometer R374 and trimmer capacitor C370 to get the maximum readings on mV.

TRANSMITTER ALIGNMENT

1. ALIGNMENT PREPARATION

1-1. Set control and switches on the front panel as follows.

- | | |
|-------------------------------|------------------------|
| (1) FUNCTION SWITCH | INT. |
| (2) STANDBY SWITCH | PTT |
| (3) METER SWITCH | IK |
| (4) MIC GAIN CONTROL | Fully counterclockwise |
| (5) CARRIER CONTROL | Fully counterclockwise |
| (6) OTHER CONTROLS & SWITCHES | Option |

1-2. Set rear panel switch and jack as indicated below:

- | | |
|---|----|
| (1) RF POWER SWITCH | ON |
| (2) Connect RF power meter (50 ohms impedance) to antenna jack. | |

1-3. Set PWR and HTR switch to ON after completion of all preparations as mentioned above.

1-4. Please note following instructions at the position of the wordings:

OBTAIN MAXIMUM OUTPUT AT.....MHz, which will be mentioned here after during tuning procedures and marked *

- (1) Make 1-1 1-3 preparations.
- (2) Set MODE SWITCH to TUNE.
- (3) Select BAND and SEGMENT SWITCHES according to the desired frequency.
- (4) Set METER SWITCH to ALC position.
- (5) Set PLATE CONTROL knob around the desired frequency range.
- (6) Set LOAD CONTROL knob to center position.
- (7) Set CARRIER CONTROL knob to center position.
- (8) Set STANDBY SWITCH to MANU.
- (9) Tune PRESELECT CONTROL to get maximum meter readings.
- (10) Set METER SWITCH to PWR.
- (11) Adjust PLATE and LOAD controls by turns to get maximum meter readings.
- (12) Reset the STANDBY SWITCH to PPT position.
- (13) Turn CARRIER CONTROL knob fully counterclockwise.

CAUTION

- (1) During transmitter tuning, do not keep the final tube running untuned for a long period of time. Make quick adjustment of PLATE and LOAD controls.
- (2) High voltage is generated especially inside of the final amplifier and also bottom of the PA compartment. Don't touch part of them.

2. PA IDLING CURRENT ADJUSTMENT

2-1. Test Equipment Required

- (1) None

2-2. Adjustment Procedure.

- (1) Set MODE SWITCH to USB.
- (2) Set STANDBY SWITCH to MANU
- (3) Adjust the BIAS potentiometer, R16 on the rear panel so as to indicate GREEN TRIANGLE MARK on the meter.

3. GENERATOR UNIT ALIGNMENT

3-1. Test Equipment Required

- (1) RF voltage Meter
- (2) AF milli-volt Meter (mV)
- (3) Audio Generator (AG)
- (4) Frequency Counter.
- (5) Oscilloscope

3-2. Preparations

Take out Generator Unit (PC-080) and put a SERVICE EXTENSION BOARD in its place, then connect the GENERATOR UNIT to the EXTENSION BOARD.

- 3-3.** (1) Connect RF voltage meter the (RF VTVM) to Pin 16 of J18.
- (2) Adjust L510 to get maximum meter readings.
- (3) Remove RF VTVM and connect frequency counter to Pin 16 of J18.
- (4) Set MODE SWITCH to USB, and adjust trimmer capacitor C541 so that the frequency counter indicates 6,187.000 kHz.
- (5) Set MODE SWITCH to TUNE, and adjust trimmer capacitor C542 so that the counter reading indicates 6,187.750 kHz.

3-4. Modulator Output Coil Adjustment

- (1) Connect RF VTVM to Pin 6 of J16 (IF UNIT).
- (2) Set RF AMP SWITCH on the rear panel to OFF.
- (3) Set MODE SWITCH to TUNE.
- (4) Turn CARRIER CONTROL knob fully clockwise.
- (5) Set STANDBY SWITCH to MANU.
- (6) Adjust L501 for maximum VFVM indication. It will indicate around 0.2V r.m.s.
- (7) Reset CARRIER CONTROL fully counter-clockwise and STANDBY SWITCH to PTT.
- (8) Connect AG output to the microphone jack and provide 1,500 Hz, 10 mV output.
- (9) Set MODE SWITCH to USB.
- (10) Turn MIC GAIN CONTROL fully clockwise.
- (11) Set STANDBY SWITCH to MANU.
- (12) Adjust L504 for maximum meter indication. It will indicate around 0,3V r.m.s.

3-5. Balanced Modulator Alignment.

- (1) This alignment should be taken place after completion of OUTPUT METER adjustment (5-1, 5-2).
- * (2) Obtain maximum output at 14.2 MHz.
- (3) Set MODE SWITCH to USB.
- (4) Connect RF meter to antenna jack.
- (5) Make sure that MIC GAIN CONTROL is set fully counter-clockwise.
- (6) Set STANBY SWITCH to MANU and adjust R530 for the minimum meter indication.
- (7) Change MODE SWITCH to LSB and USB by yurns, and make presise tuning by adjusting R530 to get equal meter readings on both modes.

3-6. AM Modulation Adjustment

- (1) This alignment also should be made after completion of OUTPUT METER adjustment (5-1, 5-2).
- * (2) Obtain maximum output at 14.2 MHz.
- (3) Set MODE SWITCH to AM
- (4) Set STANDBY SWITCH to MANU.
- (5) Turn CARRIER CONTROL to get 120 mV reading on the meter.
- (6) Connect AG output to microphone jack and provide 1,500 Hz, 10 mV output.
- (7) Set MIC GAIN CONTROL to 3 o'clock position.
- (8) Use Oscilloscope to observe output envelope.
- (9) Adjust R509 to keep about 80% of output modulation level.

4. TRANSMITTER RF CIRCUITS ALIGNMENT

4-1. Test Equipment Required

(1) RF Power Meter.

4-2. Tuning Coil Adjustment

*(1) Obtain maximum output at each frequency in chart 4-2-1-A, but note that PRESELECT CONTROL should be center position.

(2) Set METER SWITCH to ALC.

(3) Turn CARRIER CONTROL knob fully clockwise.

(4) Set STANDBY SWITCH to MANU.

(5) Adjust each coil in chart 4-2-1-B to get the maximum meter reading.

(6) Return CARRIER CONTROL counterclockwise so as to make tuning more easily upon adjustment.

(7) Repeat (1) to (6) procedures on each band in order as show in the chart 4-2-1.

Chart 4-2-1

A	B
Adjusting Frequency (MHz)	Adjusting Coil No.
3.600	L251, L252, L259
7.100	L253, L260
14.200	L254, L261
21.200	L255, L262
28.500	L256, L263

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5. RF output meter adjustment

5-1. Test Equipment Required

(1) RF Power Meter.

5-2. Adjustment Procedure.

*(1) Obtain maximum output at 14.2 MHz

(2) Set METER SWITCH to PWR.

(3) Turn CARRIER CONTROL knob fully clockwise.

(4) Adjust the meter adjustment potentiometer R08 on the rear panel, so that the IK reading shows 200 mA.

6. FEEDBACK NEUTRALIZING.

6-1. Test Equipment Required

(1) RF voltage Meter (RF VTVM)

6-2. Adjustment Procedures.

*(1) Obtain maximum output at 21.2 MHz.

(2) Set RF POWER AMP SWITCH on rear Panel to OFF.

(3) Connect VTVM to antenna jack.

(4) Turn CARRIER CONTROL FULLY clockwise.

(5) Set STANDBY SWITCH to MANU.

(6) Adjust the air trimmer C1037 to obtain minimum meter readings.

CAUTION use insulated screw driver only for this adjustment.

POWER SUPPLY ALIGNMENT

1. *AVR UNIT (PC-082) ALIGNMENT.*

1-1. **Test Equipment Required**

(1) DC Voltage Meter.

1-2. **Voltage Measurement and Adjustment.**

- (1) 8.2V DC Power Source:
Connect DC Voltage meter to Pin 3 of J651, and adjust potentiometer R659 to get $8.2V \pm 0.2V$ of meter readings.
- (2) 6V DC Power Source:
Connect the meter to Pin 5 of J651, and check that the meter reading indicates within 5.5 – 6.5V.
This process should be made after completion of (1) as mentioned above.
- (3) 5V DC Power Source:
Connect the meter to Pin 9 of J651 and adjust potentiometer R653 to get $5V +0.2 - 0.1V$ of meter readings.
- (4) R.I.T Power Source:
Connect the DC meter to Pin 6 of J651 and adjust potentiometer R662 to get $1.3V \pm 0.1V$ of meter readings.

LOCAL OSCILLATOR CIRCUITS ALIGNMENT

1. *VFO UNIT (PC-083, PC-084) ALIGNMENT*

1-1. **Test Equipment Required**

- (1) Frequency Counter
- (2) RF voltage Meter (RF VTVM)

1-2. **Oscillator Frequency Adjustment.**

- (1) Set FUNCTION SWITCH to INT
- (2) Set R.I.T SWITCH to OFF
- (3) Connect Frequency Counter to Pin 5 J701.
- (4) Turn the main dial and set it to 00 KHz (toward 90 kHz, 100 kHz), then adjust L702 to get 9,038 kHz counter reading.
- (5) Then turn the dial to 00 kHz (toward 10 kHz), and adjust trimmer C707 to get 9,138 kHz counter readings.
- (6) Repeat (4) and (5) adjustments until both readings are made correctly.

1-3. **Output Voltage Adjustment.**

- (1) Set switches to same as 1-2 adjustment.
- (2) Connect RF meter to Pin 5 of J701.
- (3) Turn and set the dial to 50 (center) readings.
- (4) Adjust L706 and L707 to get maximum meter readings. It will indicate around 0.4 – 0.5V r.m.s.

2. PLL UNIT (PC-086, PC-087) ALIGNMENT.

2-1. Test Equipment Required

- (1) Frequency Counter
- (2) RF voltage Meter (RF VTVM)

2-2. VCO Unlocked-oscillation Frequency Adjustment.

- (1) Set FUNCTION SWITCH to R. EXT.
- (2) Connect Frequency Counter to the DRAIN of Q807.
- (3) Adjust L801 so as to get 16.000 MHz counter readings.

CAUTION Don't use magnetized tools when adjusting PLL unit because magnetization of VCO coil core may make C/N of oscillation output worse extremely.

2-3. Bandpass Amplifier Alginment.

- (1) Set FUNCTION SWITCH to INT.
- (2) Set SEGMENT SWITCH to 200/700 kHz.
- (3) Turn and set the dial to 50 (center) readings.
- (4) Connect RF voltage meter to the BASE of Q817.
- (5) Adjust L804 – L807 to get maximum meter readings. It will indicate about 0.5V r.m.s.

3. LOCAL OSCILLATOR UNIT (PC-092) ALIGNMENT.

3-1. Test Equipment Required

- (1) RF Voltage Meter.
- (2) Frequency Counter.
- (3) Sweep Generator.
- (4) Oscilloscope.

3-2. Xtal Oscillator Output Adjustment.

- (1) Connect RF voltage meter to TP102.
- (2) Select BAND SWITCH in order, starting from 15.0 MHz, according to chart 3-2-1-A and adjust each coils in 3-2-1-B so as to get 1.5V r.m.s. meter readings, respectively.

Chart 3-2-1

A	B	C	D
BAND	COIL (see 3-2)	Freq. (see 3-3)	TRIMMER (see 3-3)
15.0	L101	37.025 MHz	C116
3.5	L102	25.525	C117
7.0	L103	29.025	C118
14.0	L104	36.025	C119
21.0	L105	43.025	C120
28.0	L106	50.025	C121
28.5	L107	50.525	C122
29.0	L108	51.025	C123
29.5	L109	51.525	C124
27.0	L110	49.025	C125

3-3. Xtal Oscillator Frequency Adjustment.

- (1) Connect Frequency Counter to TP102 through 1pF capacitor.
- (2) Select BAND SWITCH in order starting from 15.0 MHz according to the chart 3-2-1-A and adjust each trimmer in 3-2-1-D so as to obtain frequency readings as shown in 3-2-1-C respectively.

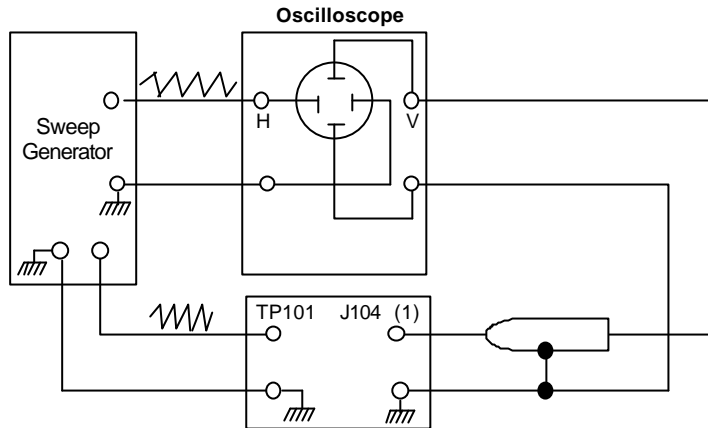
3-4. VCO Buffer Amplifier Adjustment.

- (1) Connect RF voltage meter to DRAIN of Q113.
- (2) Set BAND SWITCH to 3,5 MHz.
- (3) Set SEGMENT SWITCH to 200/700 kHz.
- (4) Turn and set the dial to 50 (center) readings.
- (5) Adjust L121 and L122 to get maximum meter readings.

3-5. Bandpass Filter Adjustment.

(1) Connect test equipments as show in Fig 3-5-1

Fig 3-5-1



(2) Select BAND SWITCH in order, starting from 15.0 MHZ according to the chart 3-5-1 and adjust each coil (3-5-1-C) so as to get the assigned wave from on oscilloscope (3-5-1-B) respectively.

(3) After completion of these adjustments, remove sweep generator and oscilloscope. Then, connect RF voltage meter to Pin 1 of J104 and confirm that meter readings on each band show 0.7 – 1.3V r.m.s.

Chart 3-5-1

A	B	C
BAND	WAVE FORM	COIL
15.0	Fig. 3-5-2	L123, L130
3.5	3-5-3	L124, L131
7.0	3-5-4	L125, L132
14.0	3-5-5	L126, L133
21.0	3-5-6	L127, L134
28.0	3-5-7	L128, L135
28,5	3-5-8	L129, L136

VOLTAGE MEASUREMENTS

1. TUBE

Section	Pin No Tube	T R	1	2	3	4	5	6	7	8	9	P
Final	V1001 6146B	T	0.29	(12.6)	205	0.29	-50	0.29	(6.3)	0	-	750
		R	0	(12.6)	215	0	-79	0	(6.3)	0	-	900
Final	V1002 6146B	T	0.29	(6.3)	205	0.29	-50	0.29	0	0	-	750
		R	0	(6.3)	215	0	-79	0	0	0	-	900
*Final	V1001 6146B	T	0.23	(12.6)	218	0.23	-50	0.23	(6.3)	0	-	430
		R	0	(12.6)	218	0	-79	0	(6.3)	0	-	460

2. Transistor & FET

Section	Q Nr.	TYPE	T or R	E or S	C or D	B or G1	G2
L.O	Q 101	2SC735Y	R	0	4.5	0	
	102	2SC784R	R	1.6	5.0	2.2	
	103	2SC372Y	R	1.6	5.0	2.2	
	104	2SC372Y	R	1.6	5.0	2.2	
	105	2SC784R	R	1.6	5.0	2.2	
	106	2SC784R	R	1.6	5.0	2.2	
	107	2SC784R	R	1.6	5.0	2.2	
	108	2SC784R	R	1.6	5.0	2.2	
	109	2SC784R	R	1.6	5.0	2.2	
	110	2SC784R	R	1.6	5.0	2.2	
	111	2SC784R	R	1.6	5.0	2.2	
	112	2SC380Y	R	1.7	11.7	2.4	
	113	3SK35BL	R	0.5	12.0	0	
	115	2SK19GR	R	2.0	11.5	0	
	116	2SC380Y	R	6.5	10.1	5.0	
	117	2SC380Y	R	6.5	10.1	5.0	
	118	2SC380Y	R	2.8	11.4	3.4	
	119	2SC372Y	R	0	10.3	0	
	120	2SC372Y	R	0	5.7	0	
RX-RF	Q 201	3SK35GR	R	0.6	10.6	0.5	3.8
	202	3SK35GR	R	1.1	11.8	0	4.4
	203	2SK19GR	R	1.4	11.8	0	-
	204	2SK19GR	R	0.7	0.9	0	-
TX-RF IF	Q 251	3SK35BL	T	0.7	11.0	0	1.3
	Q 351	3SK35GR	R	0.7	7.4	0.6	4.0
	352	3SK35GR	R	0.7	7.4	0.6	2.6
	353	3SK35GR	R	0.7	7.4	0.6	2.6
	354	2SC372Y	R	0.8	5.0	1.5	-
	355	2SK19GR	R	0.1	1.3	0	-
	356	2SC372Y	R	0.8	8.2	1.3	-
	357	2SC372Y	T	0	0.8	1.0	-
	357	2SC372Y	R	0	0.8	0	-

UNIDEN 2020

Section	Q Nr.	TYPE	T or R	E or S	C or D	B or G1	G2
AF	Q 401	2SK30AY	R	0	1.3	4.7	-
	402	2SC372Y	R	4.5	9.8	5.0	-
	403	2SC372Y	R	0.1	3.5	0.7	-
	404	2SC372Y	R	1.4	7.9	0	-
	405	2SA495Y	R	10.2	0	0	-
	406	2SC372Y	R	1.4	1.5	2.0	-
	407	2SC735Y	R	0	12.0	0	-
	408	2SC372Y	CW R	1.7	5.9	2.3	-
	409	2SC372Y	R	1.1	3.3	1.8	-
	GE	Q 502	2SC380Y	T	0.2	2.5	1.2
503		2SC372Y	T	2.5	7.4	3.2	-
506		2SC372Y	SSB T	2.6	6.7	3.3	-
507		2SC380Y	T & R	2.1	6.6	2.7	-
508		2SC380Y	T & R	1.5	7.5	2.1	-
AVR	Q 651	2SC372Y	R	5.8	8.7	6.4	-
	652	2SC11730	R	5.0	8.7	5.8	-
	653	2SC372Y	R	2.6	6.4	3.2	-
	654	2SC11730	R	11.1	12.0	11.8	-
	655	2SC372Y	R	8.9	11.1	9.5	-
	656	2SC11730	R	8.2	11.1	8.9	-
	657	2SC373Y	R	2.6	9.5	3.2	-
	658	2SC372Y	R	6.0	8.2	6.7	-
	VFO	Q 701	2SK19GR	R	0.5	4.2	0
702		2SK19GR	R	1.0	4.5	0	-
703		2SC380Y	R	0.9	4.8	1.4	-
OPR RF-PA	Q 754	2SC380Y	R	0.7	4.3	1.4	-
	Q1001	2SC9830	T	-50	-1.0	-50	-
	Q1001	2SC9830	R	-79	0	-79	-

3. IC

Unit	I.C.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
GE	Q 501 MC 1496	1.6	0.9	0.7	1.4	1.0	4.8	0	3.8	0	3.8	0	4.8	0	0
	Q 504 MC 1496	2.5	1.8	1.8	2.5	1.0	5.1	0	4.6	0	4.6	0	5.1	0	0
	Q 505 TA7063P	1.3	0.6	0	0	0.7	4.5	7.2	-	-	-	-	-	-	-
AF	Q 410 TA7204P	0	5.8	12.0	7.1	1.4	10.4	11.3	5.6	5.8	5.5	-	-	-	-

Notes

- (1) Unit: Volt
- (2) Voltage depends on 10M ohm Impedance of V.T.V.M
- (3) T: Voltage at maximum TUNE output
R: Voltage at receiving at no signal
- (4) Voltage in the parentheses means on AC and others on DC
- (5) E: Emitter C: Collector B: Base S: Source
D: Drain G1: Gate 1 G2: Gate 2
- (6) Mark * means final section of 2020P which is modified to 10W for domestic marker use.

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VOLTAGE MEASUREMENT

PLL UNIT

Set SEGMENT SWITCH at 0 position
 Set BAND at 14.0 MHz
 Set VFO DIAL at 00

		E or S	B or G1	G2	C or D
Q 803	2SC1682	1.2 V	1.7 V		5.0 V
804	2SC373	0.7	1.2		3.3
805	2SC373	0	0.7		3.3
806	2SK19	0.5	-		3.2
807	2SK19	0.8	-		4.2
808	3SK35	0.9	-		8.8
809	2SK19	0.8	-		8.7

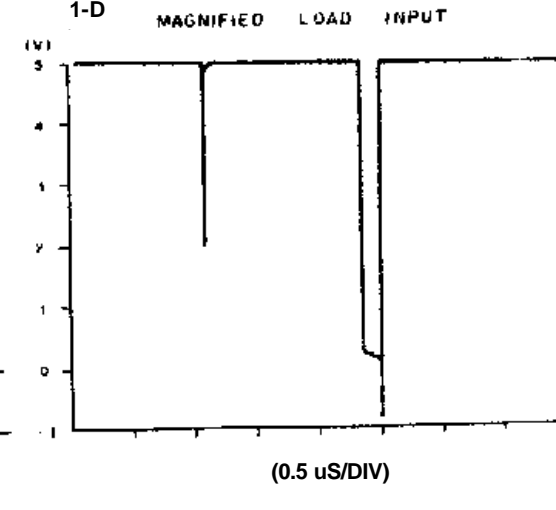
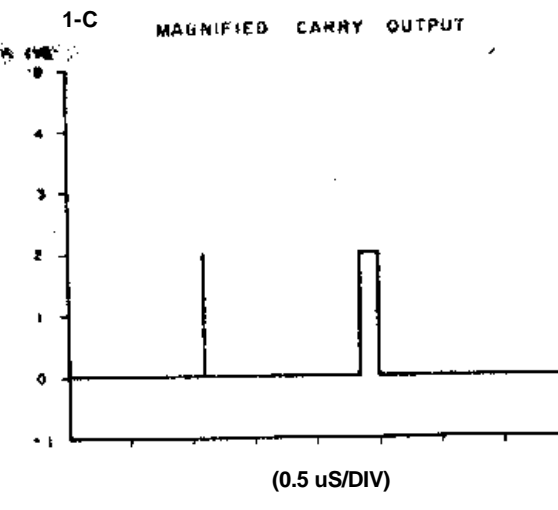
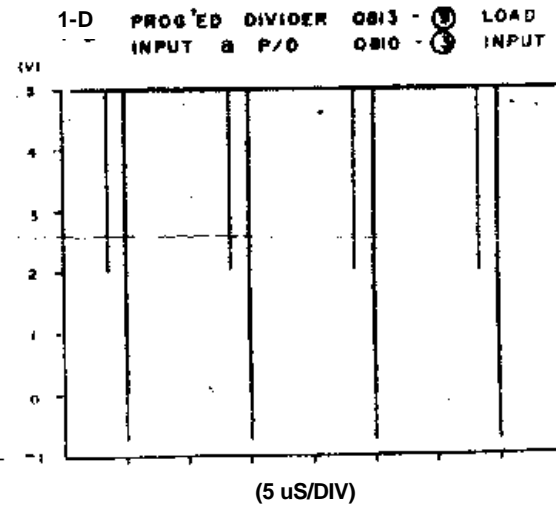
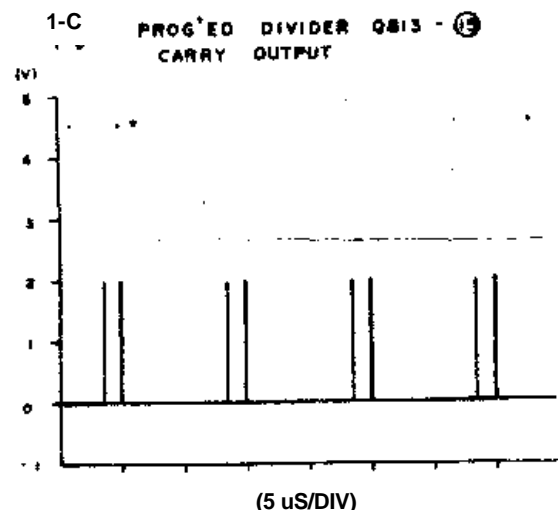
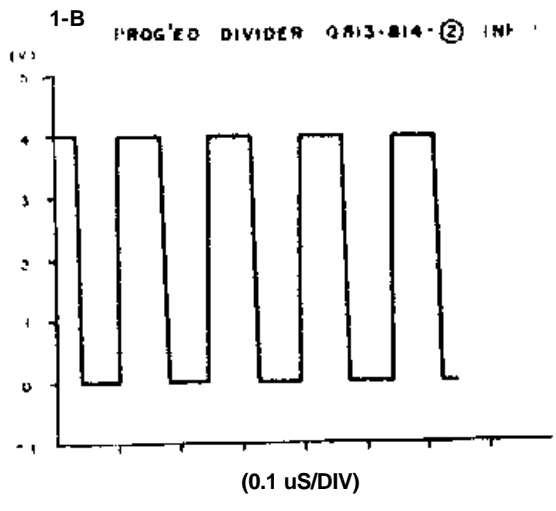
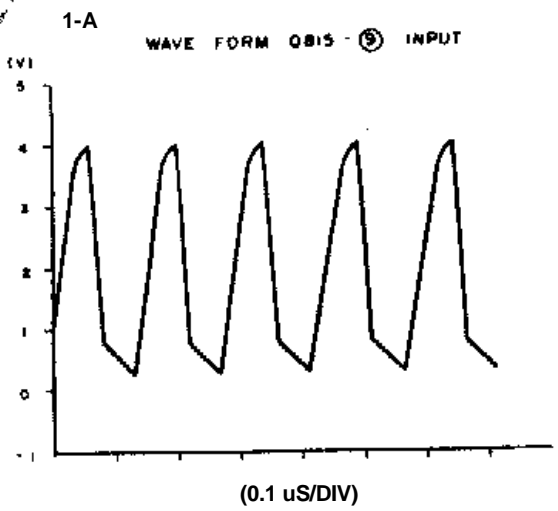
Measurement by DIGITAL VOLTMETER

RF VOLTAGE

		B or G1	G2	C or D
Q 806	2SK19	-		2.2 V P-P
807	2SK19	0.8 V P-P		2.0 V P-P
808	3SK35	240 mV P-P	1.6 V P-P	0.9 V P-P
809	2SK19	0.8 V P-P		7.5 V P-P
817	2SC735	1.4 V P-P		5.0 V P-P

Measurement by CRT Oscilloscope

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PLL Unit (PC-086)

Fig. 17

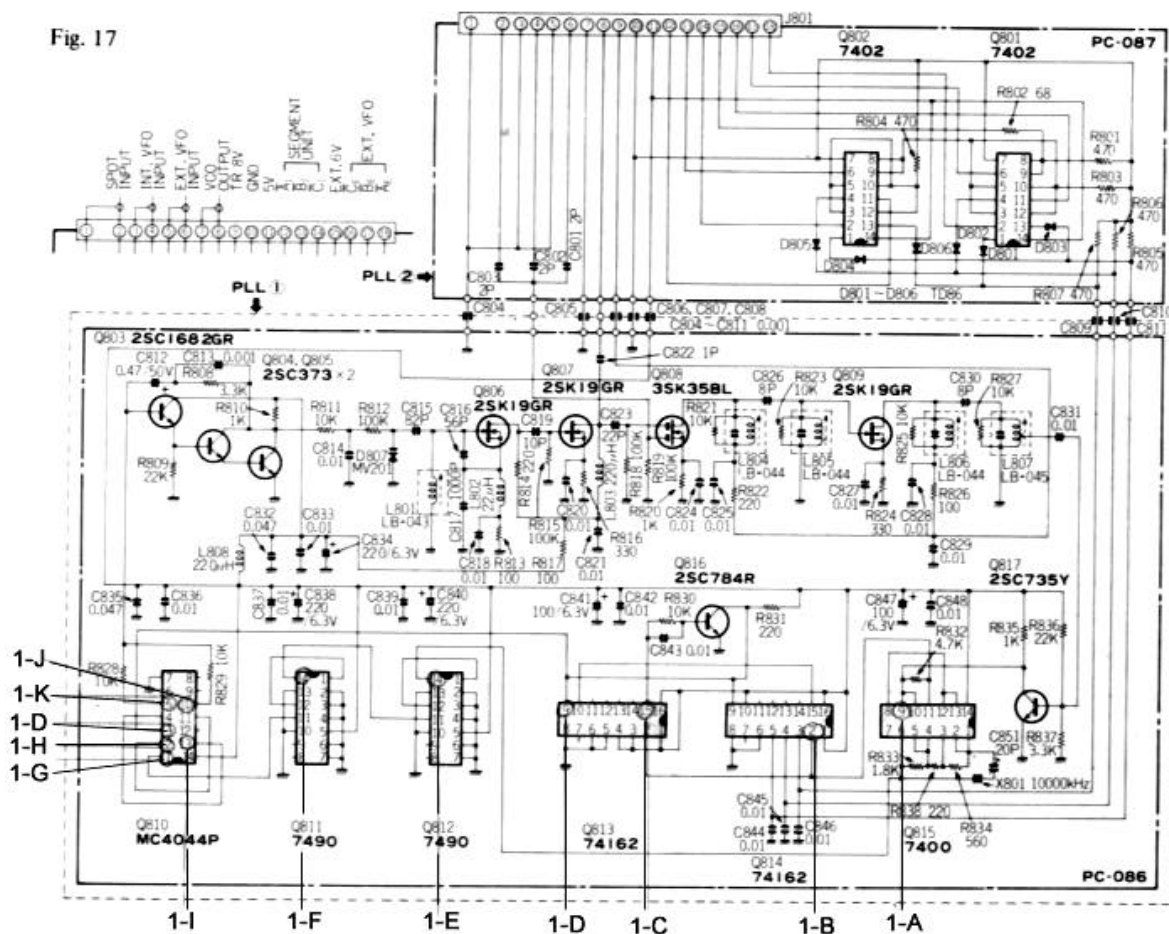
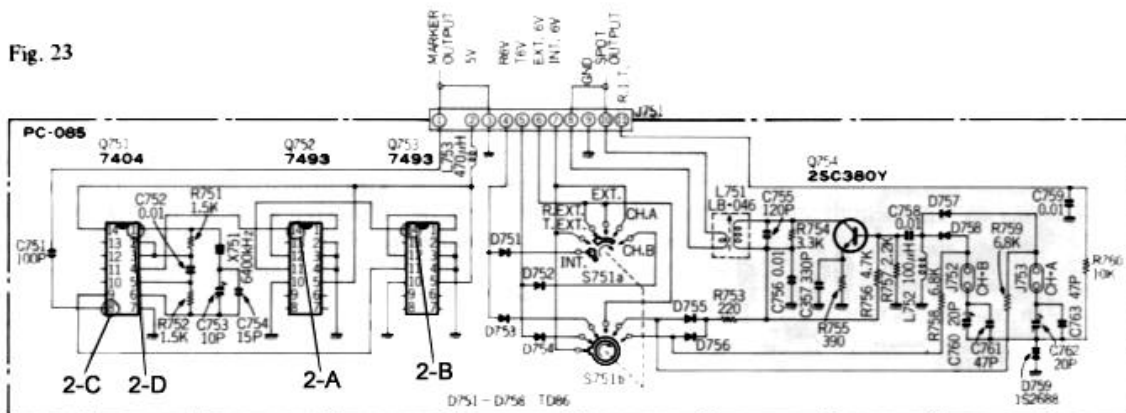
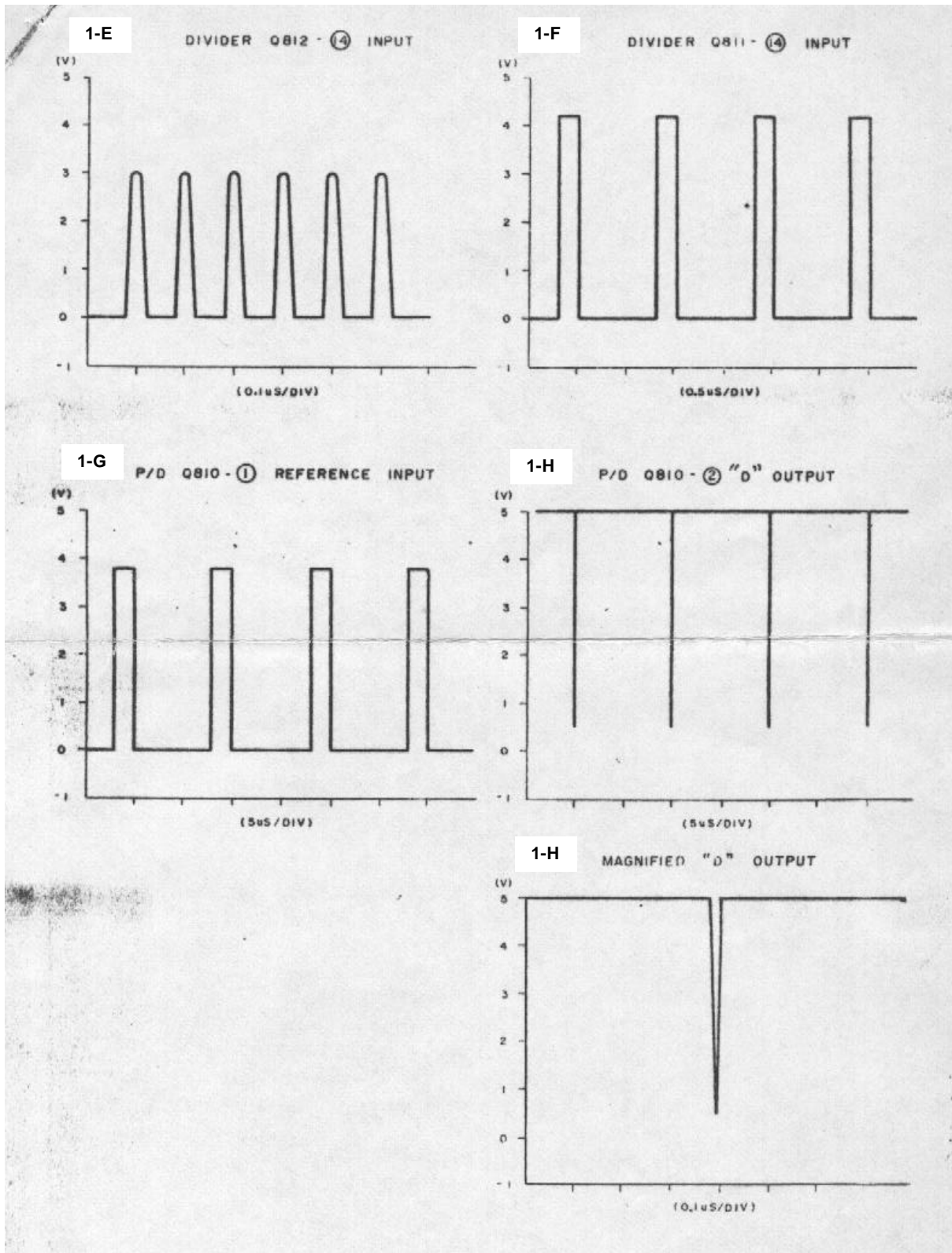


Fig. 23

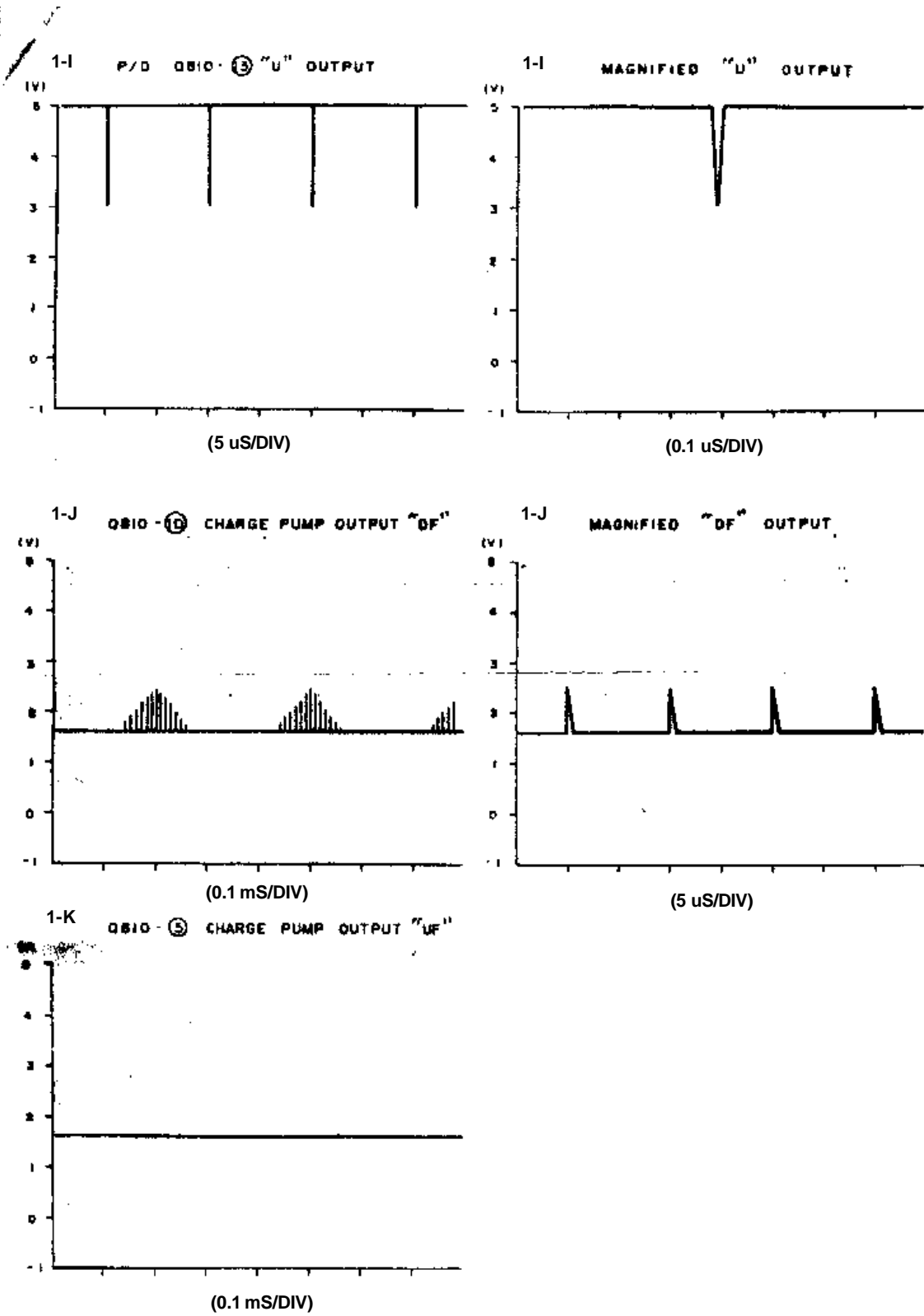


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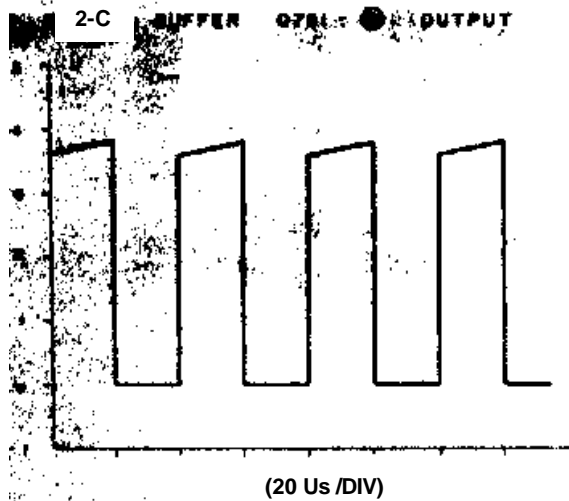
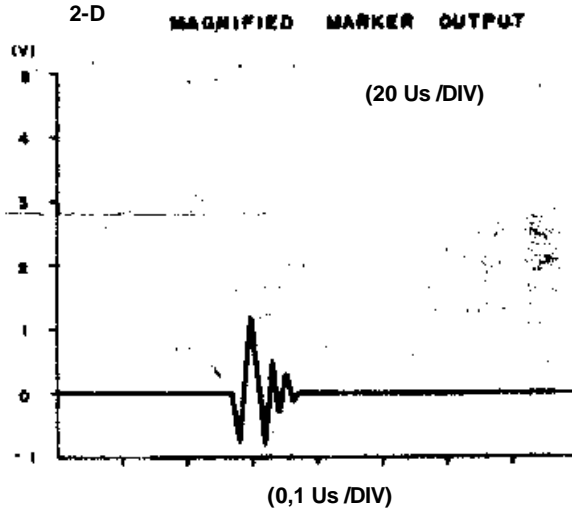
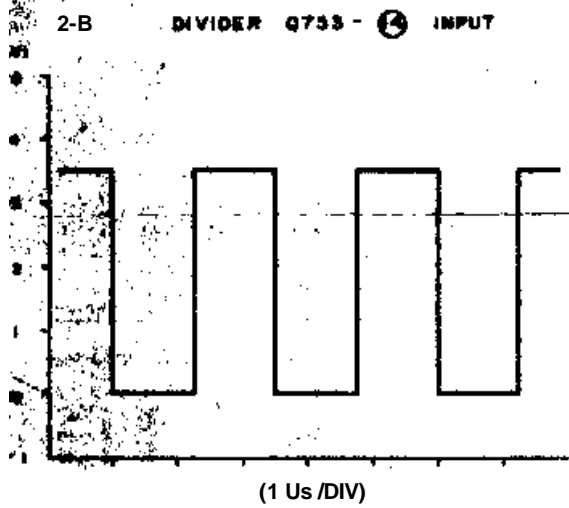
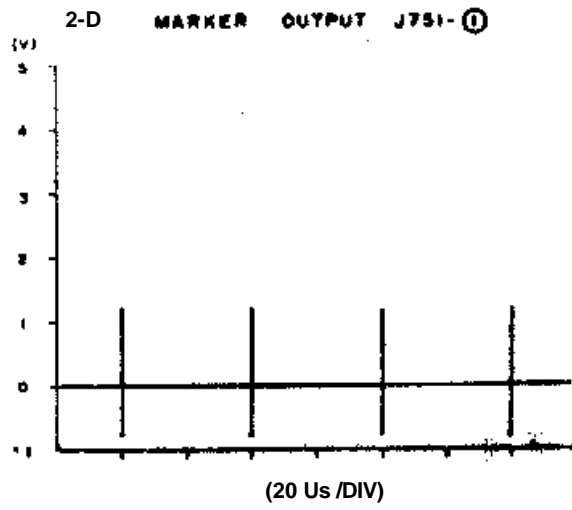
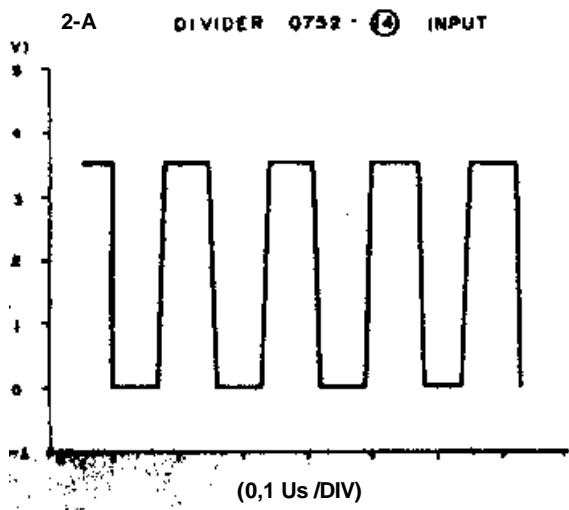
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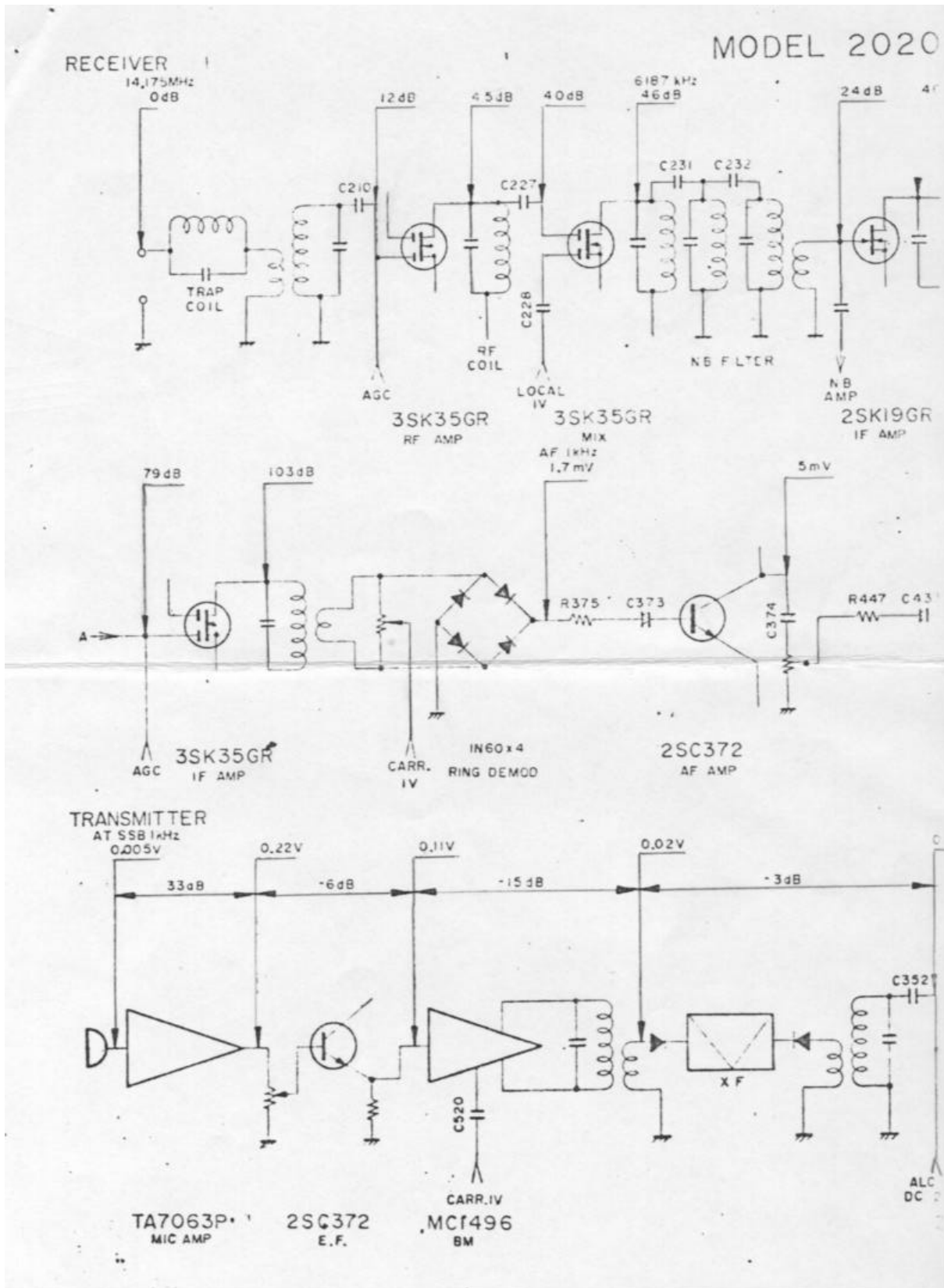
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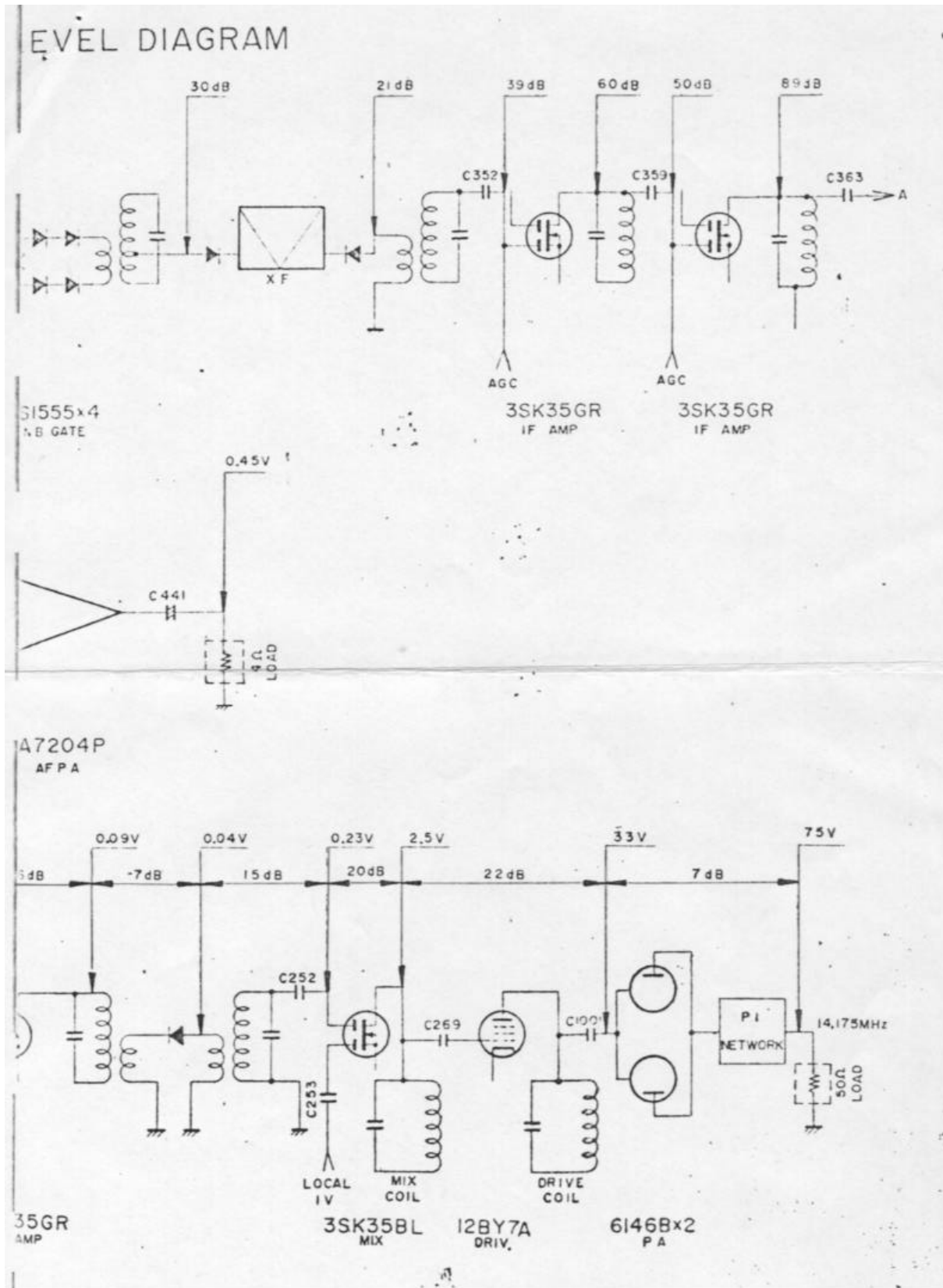


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