

# OPERATION MANUAL

## 10 WATT 2 METER FM TRANSCEIVER

### MODEL 2030



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# SECTION I INTRODUCTION

## 1-1 GENERAL DESCRIPTION

UNIDEN's Model 2030 is an extremely rugged, completely solid state transceiver. Electrical design, mechanical construction and component selection assure reliable, high quality performance.

Although the 2030 has been designed principally for mobile operation, it is also suitable for base station operation with an external power supply Model 8110 (option).

The compact packaging and the clean, simple panel layout provides for ease of operation.

## 1-2 FEATURES

Besides its electrical efficiency, it has many convenient features as follows;

- a) "CALL channel switch" activates the pre-set frequency disregarding positions of a channel selector. It makes the "STAND BY" easy for the call of limited party.
- b) By installing a center meter (or an ordinarily 50 microampere meter) through an accessory plug, frequency alignment is easily accomplished. (see SECTION VI)
- c) The output power (1W or 10W) is easily switchable depending on the communication distance to be covered or conditions.
- d) Narrow band filter is equipped to keep  $\pm 5$  kHz frequency deviation.

## 1-3 SPECIFICATIONS

### GENERAL:

Frequency Coverage:	144.00 to 146.00 MHz
Operating Frequencies:	12 channels, plus 1 channel for preset frequency (CALL channel)
Modulation Type:	F3
Power Requirement:	DC 13.8V $\pm$ 15%, negative ground
Current Drain:	Transmit: HI (10W) . . . . . maximum 2.5A LOW (1W) . . . . . maximum 1.0A Receive: Maximum . . . . . below 0.8A Without signals . . . . . below 0.3A
Antenna Impedance:	50 ohms
Number of Transistors:	Transistors . . . . . 34 FETs . . . . . 3 ICs . . . . . 2 Diodes . . . . . 18
Dimensions:	2-1/4" (60mm) H 6-3/8" (160mm) W 8-7/8" (230mm) D
Weight:	4-1/2 lbs (2.1 kg)

## TRANSMITTER:

RF Power Output:	HI . . . . . 10W, LOW . . . . . 1W
Modulation System:	Variable reactance phase modulation
Maximum Frequency Deviation:	±5 kHz
Frequency Control:	Crystal (12 MHz) multiplied x 12
Spurious Radiation:	−60 dB or more
Microphone:	600 ohms Dynamic microphone with push-to-talk switch.

## RECEIVER:

Reception System:	Double Superheterodyne
Intermediate Frequencies:	1st IF . . . . . 10.7 MHz 2nd IF . . . . . 455 kHz
Frequency Control:	Crystal (14 MHz) multiplied x 9
Sensitivity:	30 dB or more S+N/N at 1 μV input
Squelch Threshold:	Less than 0.5 μV
Band width (−6 dB):	±6 kHz or less
Band width (−60 dB):	±13 kHz or less
Image Ratio:	−60 dB and more
Spurious Response:	−60 dB
Audio Output:	1.5W (10% distortion at 8 ohms load)

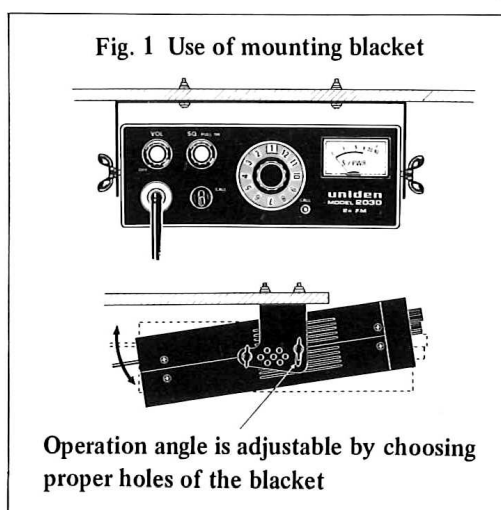
# SECTION II INSTALLATION

## 2-1 UNPACKING

Carefully remove your transceiver from the package carton and examine it for signs of shipping damage. Then make sure all standard accessory items are not missing.

The following accessories for the 2030 are included.

- 1) Microphone (dynamic type) . . . . . 1
- 2) Microphone hanger . . . . . 1
- 3) Spare fuse (3A) . . . . . 2
- 4) Mounting bracket . . . . . 1
- 5) Mounting bracket studs . . . . . 4
- 6) Channel frequency ID card . . . . . 1
- 7) External speaker plug . . . . . 1
- 8) 6 prong accessory plug . . . . . 1
- 9) Crystals provided . . . . . 3
- 10) Operating Manual . . . . . 1



## 2-2 LOCATION

Where you place the transceiver in your automobile is not critical and should be decided by accessibility and driving safety. In general, the mobile mounting bracket will provide you with some guide as to placement. (Fig.1)

## **2-3 POWER REQUIREMENTS**

The transceiver is supplied ready to operate from any regulated 13.8V DC, 3.2 ampere negative ground source. Automobile's 12 volts, negative ground, system is usually more than adequate. Be sure, however, to the condition of the vehicle's electrical system.

**CAUTION: Excessive Voltage (above 16V DC) will damage your transceiver.**

Included with your transceiver is a DC power cable. The red wire is positive (+), and the black wire is negative (-).

If your mobile installation permits, it is best to connect these directly to the battery terminals to avoid unnecessary noise and transient spikes due to loose contact.

If an AC power supply other than model 8110 is used with your transceiver, make certain it is adequately regulated for both voltage and current.

## **2-4 ANTENNA**

The most important single item that will influence the performance of any communication system is the antenna. For that reason, a good, high-quality, gain antenna of 50 ohms impedance is recommended. When adjusting a mobile antenna, it is desired to keep the motor running preferably above normal idling speed. This will insure proper voltage level to the transceiver.

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, short circuit of a coaxial line or connector, or other antenna deficiency is present.

## **2-5 MICROPHONE**

A high quality dynamic microphone is supplied with your transceiver. Should you wish to use a different microphone, make certain it is of the low impedance type (600 ohms). Particular care should be exercised in wiring, as the internal electronic switching system is dependant on it.

## **2-6 CRYSTALS**

Your transceiver has twelve selectable channels and one fixed CALL channel, both transmit and receive, or a total of 26 crystal positions. The channel selector switch selects one transmit and one receive channel in each of its twelve positions. The CALL channel switch activates CALL channel crystals disregarding the position of the channel selector.

Extra crystals are available from UNIDEN, or through your local distributors, but when ordering to any other crystal dealers, they should be ordered to the following specifications.

## Crystal Data

Holder type:	HC-25/U
OSC. Mode:	Fundamental
Pin to pin capacitance:	7pF Max., 4pF Min.
Load capacitance:	30pF
Series resistance:	25 ohms Max.
Frequency tolerance:	±0.001% at 25°C
1) Transmitter Crystal Frequency:	<u>Desired operating frequency</u> <b>12</b>
2) Receiver Crystal Frequency:	<u>Desired operating frequency-10.7 MHz</u> <b>9</b>
Frequency stability:	±0.001% (-20°C to +50°C)

For mounting crystals, carefully examine the positions according to the layouts shown in the picture. (Fig. 2) Channel numbers are indicated beside the crystal sockets.

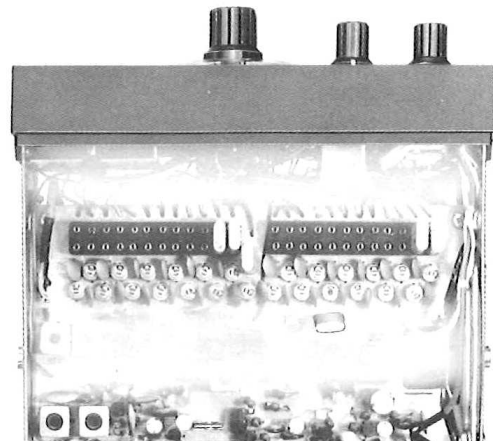


Fig. 2 Location of crystal holders on upper chassis

## 2-7 EXTERNAL SPEAKER

External speaker jack and plug is supplied with your unit in the event another speaker or headset is desirable. Their impedance should be 8 ohms.

# SECTION III CONTROL FUNCTIONS

## 3-1 FRONT CONTROLS AND CONNECTION



Fig. 3 Front view of UNIDEN 2030

### 3-1-1 Power Switch and Volume Control

Power switch turns transceiver "ON" for both DC and AC operation. Volume control adjust the audio level of the receiver.

### 3-1-2 Squelch Control and Output Power Switch

Controls the squelch threshold point of the receiver. By pulling out the knob, the output power is switched to 1 watt.

### 3-1-3 Microphone Jack

Accepts 4 prong mike plug supplied on microphone.

### 3-1-4 Call Channel Switch

Pushing up the switch, you can operate the transceiver by the pre-set frequency, disregarding positions of the channel selector.

### 3-1-5 Channel Selector

Selects one of twelve pairs of transmit/receive crystals.

### 3-1-6 Call Channel Lamp

Comes on when the call channel is used.

### 3-1-7 S-RF Meter

Read Signal strength in receive mode and relative RF output in transmit mode. The meter face is illuminated with a green lamp when the transceiver is switched on in-receive condition and with red lamp during transmission.

## 3-2 REAR PANEL CONNECTIONS

### 3-2-1 Antenna Connector

Accepts standard PL-259 coaxial connector.

**Note: Some transceivers may come with a metric threaded connector. Use a connector provided with your transceiver.**

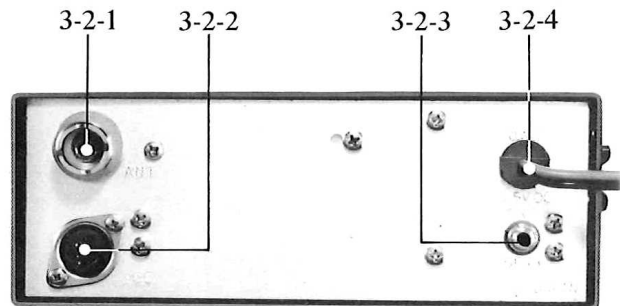


Fig. 4 Rear view of UNIDEN 2030

### 3-2-2 Accessory Jack

Accepts accessory 6 prong plug supplied for discriminator meter. (Connection is described in Section VI)

### 3-2-3 External Speaker Jack

This jack mates with the accessory Ext. Speaker plug supplied for external 8 ohms speaker or headset use. The use of this jack mutes the internal speaker.

### 3-2-4 Power Cable

Cable for connecting to either car battery or regulated AC power supply. The red wire is positive (+).

## SECTION IV OPERATION

### 4-1 INITIAL PREPARATIONS

- a) Connect the microphone to the microphone jack.
- b) Connect the antenna to the antenna coax connector. Make sure the coax line is of the correct impedance (50 ohms) and is neither shorted nor open circuited.

- c) Make sure the power switch is in the “OFF” position. The red lead should be connected to the positive side of the power source and the black lead to the negative side.
- d) Turn the squelch control to the maximum counter clockwise position. And set the output power switch at the desirable position.

#### **4–2 OPERATION**

- a) When the set is switched on, the channel indicator window and meter will be illuminated.
- b) Switch the channel selector to the desired channel.

#### **4–3 RECEPTION**

- a) Adjust the volume control to a comfortable listening level of noise, if no signal is present.
- b) Carefully adjust the squelch control clockwise until the noise just disappears. If the squelch is unstable due to the reception of weak or unstable signals, adjust the squelch control further until the proper threshold is obtained.
- c) When signal comes in, it opens the squelch, and the S meter indicates the signal strength. An input signal of approx.  $5 \mu\text{V}$  will provide S-9 reading.

#### **4–4 TRANSMITTING**

- a) Push the PTT (push-to-talk) button on the microphone and the transceiver is set for transmitting. At the same time, the meter is illuminated red and provides an indication of relative power output. The pointer will be somewhere between 7 and 9 on the meter scale on high power and just a little over one on low power operation.
- b) Hold the microphone about three inches from your mouth and speak in a normal voice. Shouting does not increase your communication range, but a good antenna does!
- c) To receive again, just release the PTT button. This also turns the red illumination of the meter to green.

## **SECTION V THEORY OF OPERATION**

### **5–1 RECEIVER RF AMPLIFIER AND FIRST MIXER**

The input signal is amplified by the Field Effect Cascade Amplifier (Q101, Q102), and passed into the RF filter. This filter is a high Q helicalized resonators with excellent bandpass characteristics and shock-proof construction. From this resonators, the signal is fed to the gate of the First Mixer (Q103), where it is mixed with the output from the receiver crystal oscillator, which is fed into the source of Q103 to obtain the 10.7 MHz IF signal. All transistors in the receiver RF stage are FETs, which have the highest possible sensitivity and signal to noise ratio and the lowest possible cross modulation.

## 5-2 RECEIVER CRYSTAL OSCILLATOR

Transistor Q104 operates as a fundamental oscillator at a frequency of 14 MHz. The trimmers in series with the crystals make it possible to alter the crystal frequency several kHz. The output signal is tripled by Q105, and again tripled by Q106, then fed into the First Mixer (Q103), producing the first IF signal of 10.7 MHz.

## 5-3 RECEIVER 1ST IF AMPLIFIER, 2ND MIXER, 2ND IF AMPLIFIER, LIMITER AND DISCRIMINATOR

The 10.7 MHz signal from the RF stage is amplified by Q107. The 2nd Oscillator Q109 is crystal controlled and operates on 10.245 MHz. The output is taken from the emitter of Q109 and fed into the base of the 2nd Mixer Q108 to obtain the 455 kHz. The IF signal, which is passed through the ceramic filter (FL101), and amplified by Q110, Q111(IC) and Q112(IC). The output of Q112 is then detected in the discriminator circuit, consisting of L118, L119, D101 and D102.

## 5-4 RECEIVER AUDIO AMPLIFIER AND SQUELCH SPEECH AMPLIFIER

The output of the discriminator drives two circuits: the audio amplifier, and the squelch. The audio signal, after being adjusted by the volume control (R602), is then fed into the pre-amplifier circuit (Q118 and Q119), then mixed in the audio power amplifier circuit (Q120, Q121 and Q122), in order to get an audio output power of 1.5 watts.

The squelch control is made of Q114, Q115, Q116, Q117, Diode D106 and D107. In the absence of a signal, the noise component at the output of the discriminator is amplified by Q114 and Q115. This amplified noise component is rectified by Diode D106 and D107 through the squelch control (R601), and then coupled to the DC amplifier (Q116 and Q117). The output of Q117 is coupled to the emitter circuit of Q118 via D108. When the squelch control is adjusted, the amount of DC required to cut off Q118 is found, thus establishing the squelch threshold. When a signal is incoming through the discriminator, this bias is overcome, permitting the audio amplifier and driver to perform normally.

## 5-5 POWER SUPPLY CIRCUIT

This circuit provides TX drive circuit (Q302) with a regulated power source, and control the TX output power when the antenna is mismatched.

The action of transistors Q501, Q502, Q503 and Q504 is described in the APC circuit. (5-8)

Resistor R502 connected to the resistor network, consisting of resistor R504 and R508, is used to provide an adjustment in output when the output power switch is set in the low power position. Adjustment of this resistor controls the base drive of the regulator transistors Q502, Q503 and Q504. This adjustment in effect controls the actual voltage supplied to the driver transistor Q302, when the output power switch is in the low power position. The output power can be set to any value from tenth of a watt to a few watts.



## **5-6 TRANSMITTER CRYSTAL OSCILLATOR AND PHASE MODULATOR**

Transistor Q201 operates as a fundamental oscillator at a frequency of 12 MHz. Q202 which operates as a buffer amplifier between the oscillator and phase modulator circuit. Trimmer capacitors are provided in series with each crystal which allows the frequency of the oscillator to be varied by several kHz. Thus the final output of the transmitter can be set precisely on the desired frequency.

The signal from the microphone is amplified by Q203 and Q204, then fed into the deviation limiter, which consists of D201, D202 and the active audio filter, and further amplified by Q205 before being fed into the modulation circuit in the transmitter unit. The phase modulator circuit consists of Varactor diode D203 and L202. This audio voltage is derived from the speech amplifier.

## **5-7 TRANSMITTER MULTIPLIER AND PRE-DRIVER**

The modulated signal from diode D203 is multiplied twelve times to a final frequency of 144 MHz by transistors Q207, Q208 and Q209. These transistors act as, in order, frequency tripler, doubler, and doubler. The 144 MHz signal is amplified by Q210 and Q301 to a power of 0.3 watt. This signal is fed into the power amplifier.

## **5-8 TRANSMITTER POWER AMPLIFIER AND AUTOMATIC PROTECTION CIRCUIT**

The signal from the multiplier and pre-driver unit is amplified to 10 watts by transistors Q302 and Q303, which is coupled to the antenna through the spurious filter consisting of L306, L307 and L308, and the Automatic Protection Circuit (APC). The APC acts to decrease output of transistors Q302 and Q303 if the antenna is seriously mismatched. A reflected power is detected by L401 and D401. When the antenna is mismatched, this circuit senses a high reflected power and provides base drive to transistor Q501 in the power supply unit.

The transistor Q501 will conduct sufficient base drive to reduce the base drive of transistor Q502. When transistor Q502 begins to turn off, it reduces the complementary transistor pair Q503 and Q504, which acts as a series regulator for the voltage supplied to the driver transistor Q302 and Q303. When they begin to turn off, due to a lack of base drive, the voltage being supplied to Q302 and Q303 is reduced to about six or eight volts, which reduces the power output to a safe value. This lower power prevents damage to Q302 and Q303 when the antenna is mismatched.

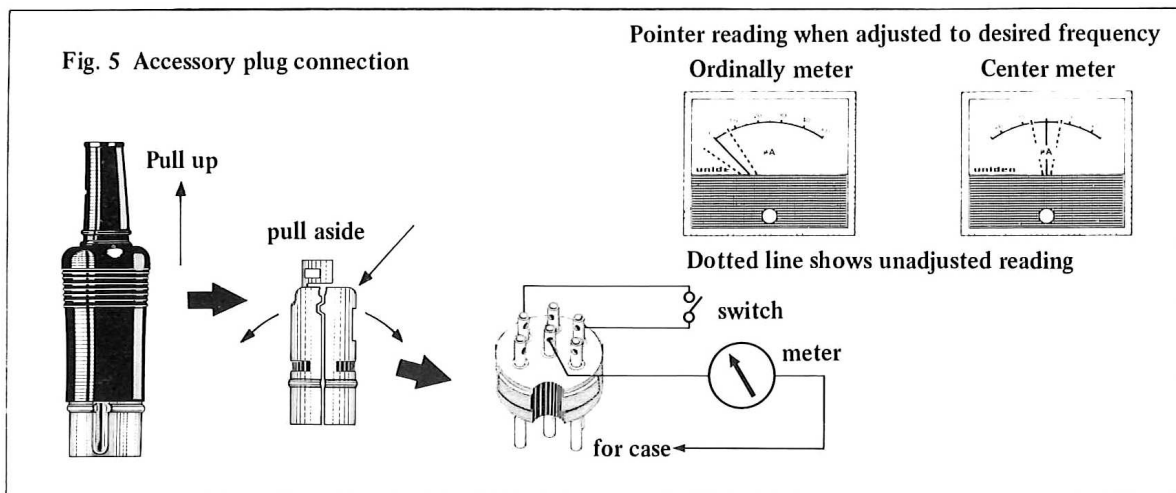
# **SECTION VI ALIGNMENT**

## **6-1 OVERALL ALIGNMENT**

The UNIDEN Model 2030 has been carefully aligned and tested at the factory upon shipping, and it does not require special realignment or readjustment under the normal usage. In case of replacing major component or change of operating range over a different portion of the 2 meter band will require realignment.

## 6-2 FREQUENCY NETTING (TRANSMITTER)

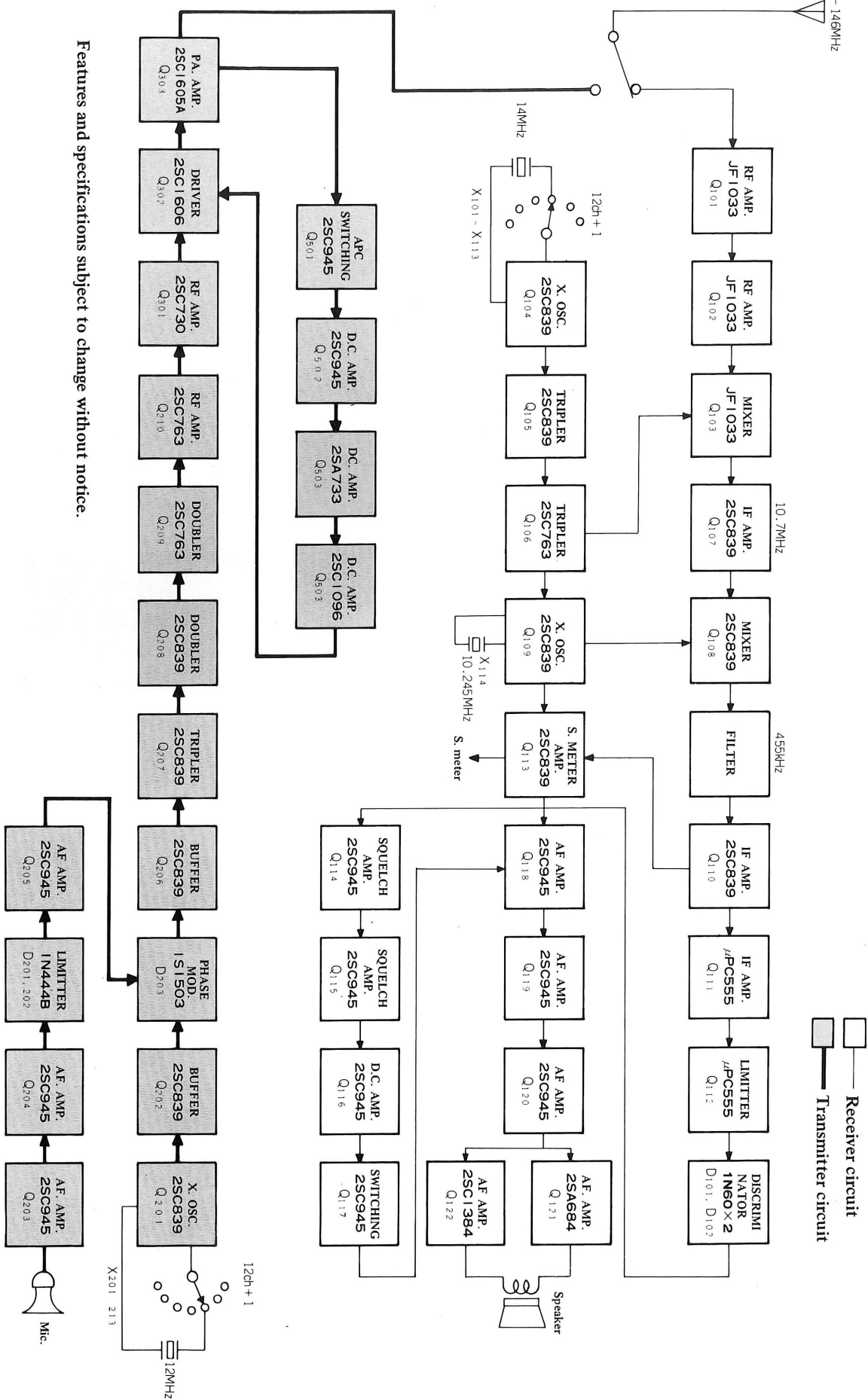
- a) Remove the four self tapping screws on the both sides of the cabinet and remove the upper cover.
- b) Connect a dummy load (50 ohms) on wattmeter to coax connector.
- c) Connect the microphone to the microphone jack.
- d) To align the transmitter on a desired frequency, switch the channel control to the desired channel. Slowly adjust the trimmer capacitor for that channel until the desired frequency is achieved. These trimmers should be adjusted very slowly while the transmit frequency is observed on suitable measuring equipment. (Frequency Counter)
- e) Without counter, install a 50 microampere meter (center meter is preferable) to accessory plug as indicated in the picture. (Fig. 5)  
With the 2030 meter installed, in the receive mode on the channel desired, adjust the trimmer capacitor for the null point on the meter.



## 6-3 FREQUENCY NETTING (RECEIVER)

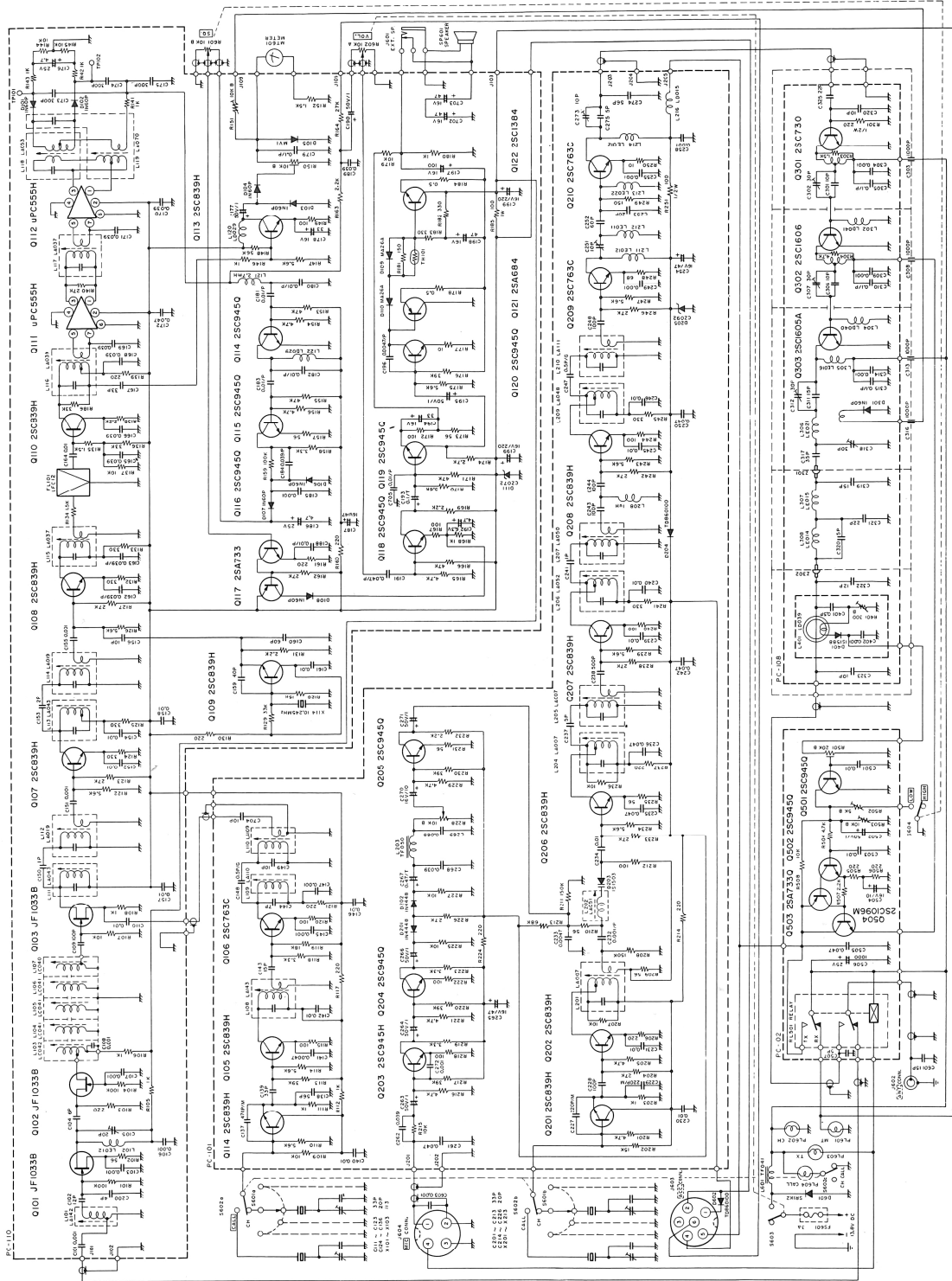
- a) Remove the microphone from the transceiver to prevent accidental transmission during receiver alignment.
- b) Connect the stabilized oscillator or generator to the antenna coax connector. Set the test oscillator or generator to the desired frequency. Set the squelch control to the maximum counter clockwise position.

# BLOCK DIAGRAM OF 2030



Features and specifications subject to change without notice.

# CIRCUIT DIAGRAM OF 2030



**NOTE:**

- (1) All capacitors are "μF" unless specified
- (2) All resistors are "ohms" unless specified

Prices and specifications subject to change without notice.



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