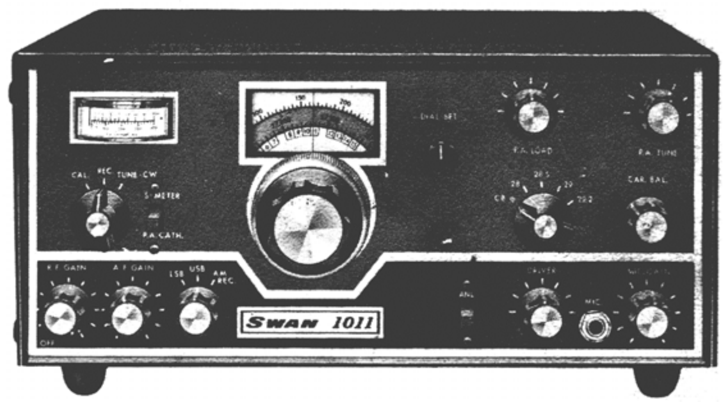
Swan Model 1011 Owner's Manual

OPERATION AND MAINTENANCE



SWAN MODEL 1011

SWAN
ELECTRONICS
OCEANSIDE, CALIFORNIA
A subsidiary of Cubic Corporation

OPERATION AND MAINTENANCE
SWAN MODEL 1011

INTRODUCTION

The Swan Model 1011 Single Sideband Transceiver is designed to be used in SSB, AM, or CW modes in the 10 meter amateur radio band. In addition, the 1011 is also a tunable receiver in the CB band.

Power input exceeds 260 watts, PEP, on single sideband 60 watts AM and 180 watts on CW. The Model 1011 includes automatic gain control, (AGC), automatic level control, (ALC), and grid block keying.

The internal AC power supply permits fixed station or portable operation wherever 117 volts 50-60 cycles is available. Export models for 208-220-240 volts are available on special order.

For 12-14 volts DC operation in mobile, marine or portable applications, a DC converter unit, model 14-A is available. It attaches to the back of the 1011 in place of the AC power cord connector. Its dimensions are only 1 ½ × 3 × 4 in.

The Model 1011 generates a single sideband signal by means of a crystal lattice filter, and the transceive operation automatically tunes the transmitter to the received frequency. Provisions are included in the transceiver for for operation on either upper or lower sideband.

Basic circuitry of the single conversion design has been proven in several thousand of the popular Swan transceivers. Mechanical, electrical, and thermal stability is exceptionally high. All oscillators are temperature compensated and voltage regulated. Push-to-talk operation is standard, with provision for plugging in the Model VX-2 accessory Vox unit for automatic voice control.

SPECIFICATIONS

FREQUENCY RANGES

28.0-28.5 mc
28.5-29.0 mc
29.0-29.5 mc
29.2-29.7 mc
26.96-27.26 mc (Receive only)

POWER INPUT

Single Sideband, Suppressed Carrier:
260 watts, PEP, minimum on all bands.
CW: 180 watts, dc input on all bands.
AM: (Single Sideband with Carrier)
60 watts dc input on all bands

DISTORTION

Distortion products down approx. 30 db.

UNWANTED SIDEBAND SUPPRESSION

Unwanted sideband down more than 50 db.

CARRIER SUPPRESSION

Carrier suppression greater than 50 db.

RECEIVER SENSITIVITY

Less than 0.5 microvolt at 50 ohms impedance for signal-plus-noise to noise ratio of 10 db.

AUDIO OUTPUT AND RESPONSE

Audio output, 3 watts to 3.2 ohm load. Response essentially flat from 300 to 3000 cps in both receive and transmit.

TRANSMITTER OUTPUT

Wide-range Pi-network output matches resistive loads from 50 to 75 ohms.

METERING

Power amplifier cathode current 0-400 ma on transmit, S-Meter 0-70 db over S9 on receive.

FRONT PANEL CONTROLS

AF Gain, RF Gain, Sideband Selector, CAL-REC-TUNE/CW, Mic. Gain, Bandswitch, Carrier Balance, PA Plate Tune, Driver Tune, PA Load, Dial Set, Meter Switch, ANL Switch.

REAR PANEL CONTROLS AND CONNECTIONS

Bias potentiometer, CW key jack, Jones plug power connector, Antenna jack, S-Meter zero, Auxiliary relay switching, Outboard VFO connector, Headphone Jack. The Vox Connector is located on the side of the chassis.

VACUUM TUBE COMPLEMENT

V1	12BA6 VFO Amplifier
V2	12BE6 Transmitter Mixer
V3	6GK6 Driver
V4	6LQ6 Power Amplifier
V5	6BZ6 Receiver RF Amplifier
V6	6BZ6 Receiver Mixer
V7	12BA6 First IF Amplifier
V8	12BA6 Second IF Amplifier
V9	12AX7 Product Detector/Receive Audio
V10	6AV6 AGC Amplifier/Rectifier
V11	6AQ5 AF Output
V12	12BA6 100 KC Calibrator
V13	6JH8 Balanced Modulator
V14	12AX7 Microphone Amplifier

TRANSISTOR COMPLEMENT

Q1	2N706 Oscillator
Q2	2N5130 Buffer
Q3	2N706 Carrier Oscillator

POWER REQUIREMENTS

117 VAC, 60 cps at 4 amps. (208-220-248 volt, 50-60 cps at 2.5 amps., export model). 12-14 volts DC operation with model 14-A converter unit plugged into back of 1011. Current drain: 8 amps, receive mode. 12 amps average with voice modulation. 25 amps maximum in TUNE mode. (See Fig. 2, page 5)

DIMENSIONS

Height	5 ½ in.
Width	13 in.
Depth	11 in.

WEIGHT

Weight 24 lbs.

INSTALLATION

GENERAL

The installation of the Swan 1011 is not at all difficult and it involves only the placement of the transceiver in its operational area (fixed or mobile), connection of power (either 117 volts ac, or 12 volts dc), and the connection of an antenna. The following paragraphs are therefore devoted to the installation requirements involving microphones, fixed and mobile operation, and recommended antenna types. Before actual installation, be sure to check for possible shipment damage. Remove the cabinet, (three screws on each side), and check to make sure that all tubes are firmly in place.

FIXED INSTALLATION

Locate the 1011 in an area which is well ventilated and which provides complete operational freedom of the front panel controls. Connect the ac power cord to the 12 pin Jones connector on the back. If the 1011 is a 117 volt model, plug the power cord into a standard 117 volt, 50-60 cycle outlet having a capacity of at least 10 amps. If the 1011 is an Export model, it should be first set to the proper voltage tap: 208, 220, or 240 volts, 50-60 cycles. Remove the cabinet, and locate the terminal strip near the top of the power transformer. There are 3 terminal lugs, and a decal indicates the voltage tap for each. Connection has been made to the 220 volt tap at the factory. If your supply voltage is 208 or 240, unsolder the red colored wire and move it accordingly.

Connect an antenna to the 1011 which is suitable for 10 meter or CB operation.

FIXED ANTENNAS

A standard PL239 coax connector plug will fit the antenna jack, and 50 or 75 ohm coax cable to the antenna is recommended. RG58 or RG59 is satisfactory for runs up to 50 feet. For longer runs the larger RG8 or RG11 produces less line loss, particularly on 10 meters.

Any of the common antenna systems designed for use on the amateur 10 meter band will work well with the 1011. However, the amateur should consider an antenna system which best fits his operational requirements. For example, a rotatable beam antenna is usually best suited for DX operation. Methods for constructing antennas and antenna tuners are described in detail in the ARRL Antenna Handbook and similar publications. It is recommended that these publications be consulted during the design of any antenna system.

MOBILE INSTALLATION

Many different methods of mobile installation are possible, and it is expected that hams will find methods which are best suited for their installation requirements. Swan Electronics has available a Mobile Mounting Kit which is suitable for under-the-dash installations. Figure 1 shows the recommended mounting methods using this kit.

DC CONVERTER, MODEL 14A

For 12-14 volt DC operation in mobile installations, it will be necessary to use the 14-A converter, which plugs directly into the back of the 1011 in place of an AC power connector.

MOBILE ANTENNAS

The standard type mobile antennas designed for 10 meters or CB band will perform well with the 1011. Generally speaking a full length 8 or 9 foot whip will be more efficient than the shorter inductively loaded types.

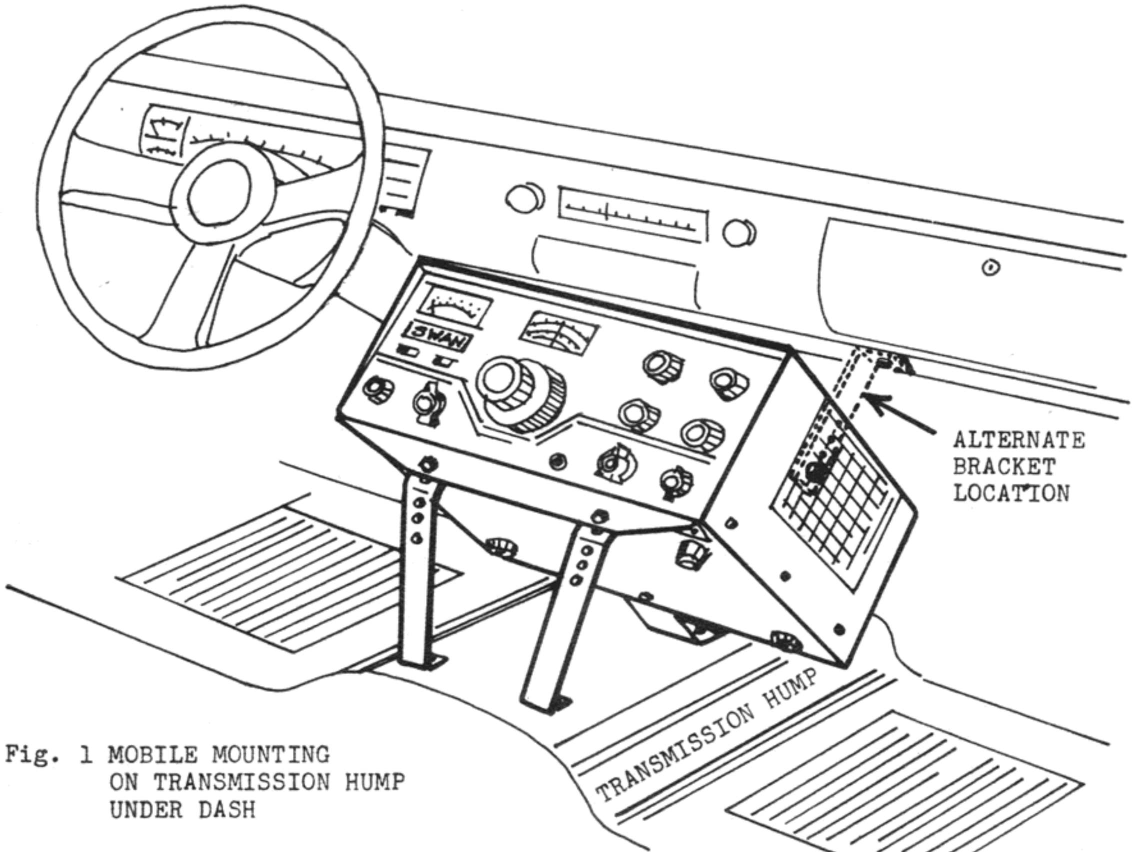
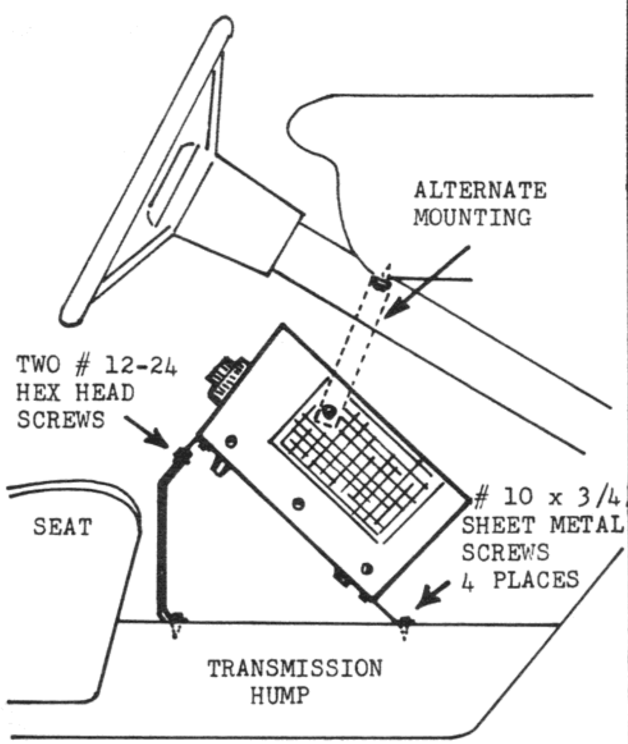
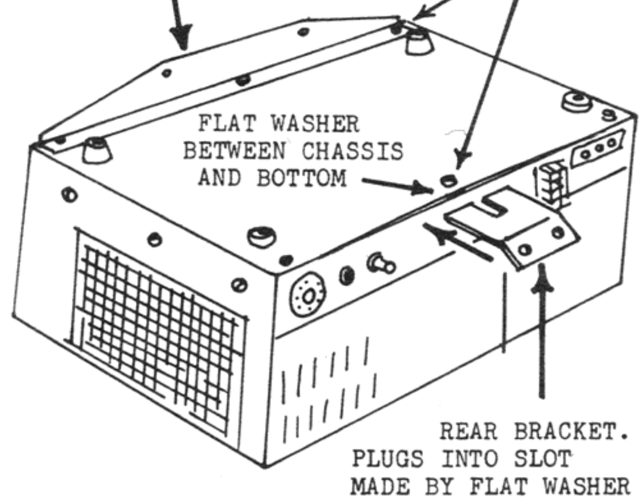


Fig. 1 MOBILE MOUNTING
ON TRANSMISSION HUMP
UNDER DASH



MOBILE MOUNTING, SIDE VIEW



TRANSCEIVER, BOTTOM VIEW

MICROPHONE

The microphone input is designed for high impedance microphones only. The choice of microphone is important for good speech quality, and should be given serious consideration. The crystal lattice filter in the transceiver provides all the restriction necessary on audio response, and further restriction in the microphone is not required. It is more important to have a microphone with a smooth, flat response throughout the speech range. The microphone plug must be a standard ¼ inch diameter three contact type. The tip connection is for push-to-talk relay control, the ring connector is the microphone terminal, and the sleeve is the common chassis ground. The microphone manufacturer's instructions should be followed in connecting the microphone cable to the plug. Either a hand-held or desk type microphone with push-to-talk control will provide a suitable installation.

CONTROL FUNCTIONS

On-Off Switch (On AF Gain Knob)
Turns power supply on and off.

Cal-Rec-CW

Calibrate
All voltages are applied to receiver. Grounds cathode of V12.

Receive
All voltages are applied to receiver.

Tune - CW
Transmitting circuits are energized. 1502 is disconnected from ground shifting carrier frequency into filter passband. Carrier is fully inserted. P. A. cathode resistor is switched in, reducing input power.

Mic. Gain
Controls potentiometer R1404 in the grid of V14A and controls amount of audio to the balanced modulator.

Car. Balance
Controls potentiometer R1308 in the balanced modulator deflection plate circuit, and permits nulling out the carrier.

RF Gain
Controls variable resistor R505, common in the grids of Receiver Mixer V6, RF Amplifier, V7 and V8 IF Amplifiers.

AF Gain
Controls potentiometer R1101 in grid circuit of V11 AF Output, and controls audio volume.

Main Tuning
Controls 1608 in frequency determining tank circuit of VFO.

Driver
Controls C2A and C2B in plate tanks of transmitter mixer and driver.

PA Tune
Controls 407 in pi-network to tune final power amplifier plate to resonance.

PA Load
Controls 408 in pi-network to match impedance of output load. Tunes input to Receiver RF Amplifier.

Frequency Range
Switches tank coils and associated capacitors in VFO, VFO Amplifier, Driver and Transmit Mixer.

Mode Switch
LSB Receive and Transmit on Lower Sideband.
USB Receive and Transmit on Upper Sideband.
AM Receive AM signals. (Insert Carrier to transmit AM)

ANL Switch

Meter Switch

FIG. 2. SWAN CYGNET MODEL 1011, REAR VIEW, WITH 14-A D.C. CONVERTER ATTACHED.

OPERATION

PRE-OPERATION ADJUSTMENTS

Before connecting any cables to the Swan 1011 perform the following steps:

1. Rotate the PA BIAS control on the rear chassis apron fully counter clockwise.
2. Rotate the CAL-REC-TUNE-CW to REC.
3. Rotate the RF Gain Control counter clockwise to operate the power switch to OFF.

CONNECTIONS

1. Connect wire from earth ground to ground stud provided on rear of chassis. This is not essential, but is recommended.
2. Connect a 50 to 75 ohm antenna feed-line to the coaxial connector on rear panel.
3. Connect the AC power cable to the Jones connector on the rear panel.
4. Connect the AC power cable to the proper voltage source.

WARNING

Dangerous high voltage is present on the plate of the power amplifier whenever the power supply is energized.

RECEIVE OPERATION

1. Rotate the RF GAIN Control clockwise to about the 3 o'clock position. The power switch will operate applying voltage to the transceiver.
2. Wait approximately one minute to allow the tube filaments to reach operating temperature. During this period, perform the following steps:
   a. Rotate Frequency Range to desired range.
   b. Rotate MIC. GAIN fully counter-clockwise.
   c. Rotate CAR. BAL. control to the midscale position.
   d. Set PA TUNE control to mid-position.
   e. Set DRIVER control to mid-position.
   f. Set PA LOAD to mid-position.
   g. Set tuning dial to desired operating frequency.
   h. Set AF GAIN control to approximately 10 o'clock position.
3. Carefully adjust the DRIVER and the PA TUNE controls for maximum receiver noise.

NOTE

The DRIVER control resonates the transmitter driver stages and the receiver RF amplifier plate circuit. The PA TUNE and PA LOAD controls adjust the input and output capacitors in the transmitter power amplifier final plate circuit, as well as the receiver RF amplifier grid circuit. Proper adjustment of these controls in the receive position will result in approximately resonant conditions in the transmitter stages.

RECEIVER TUNING

Precise tuning of a single sideband signal is very important. Do not be satisfied to merely tune until the voice can be understood, but take the extra care of setting the dial to the exact spot where the voice sounds natural. Above all, avoid the habit of tuning so that the voice is pitched higher than normal. This is an unfortunate habit practiced by quite a number of operators. The following points help to explain the effects of mistuning:

1. If you tune so the received voice is higher than normal pitch, you will then transmit off frequency, and your voice will sound lower than normal pitch to the other station. He will probably retune his dial to make you sound right. If you keep this up, you'll gradually waltz one another across the band. If both of you are mistuning to an unnatural higher pitch, you'll waltz across the band twice as fast. (And someone will no doubt be accused of frequency drift.)

2. Mistuning results in serious harmonic distortion on the voice, and should be quite noticeable to the average ear. Some will claim that if they don't know how the other person's voice actually sounds, they can't tune him in properly, but this is not true. With a little practice, it will be fairly easy to tell. Some voices are relatively rich in harmonics, and are easier to tune in than a person with a "flat" voice. Also, a transmitter, which is being operated properly with low distortion will be easier to tune in than one which is being over-driven and is generating excessive distortion. There is no mistaking when you have a station tuned right on the nose. It will sound just like "AM," so to speak. Mainly, avoid the habit of tuning so everyone sounds higher than normal pitch, or like Donald Duck. This is incorrect, unnecessary, and sounds terrible.

3. A vernier control for receive frequency, sometimes referred to as "incremental tuning," is not available on the Swan 1011. Such a device is not necessary if proper tuning habits are exercised.
4. Your Swan 1011 will automatically transmit on exactly the same frequency as the one to which you are listening. There is no adjustment for making them the same, since by using the same oscillator for both send and receive, it happens automatically. If separation of receive and transmit frequency control is desired, the Model 508 or 510X VFO unit may be used.

TRANSMITTER TUNING

Special Notes: Read Carefully. Be sure that you understand and remember these notes when tuning the transmitter.

1. The most important detail to keep in mind when tuning the transmitter portion of your Swan 1011 is that the P.A. TUNE control must be resonated as quickly as possible!

2. This is accomplished by adjusting the P.A. TUNE for minimum meter reading with function switch in TUNE mode. P.A. cathode current, as indicated by the meter will show a "dip" as P.A. TUNE is rotated through resonance. Stop at the "dip," or minimum reading.

3. The P.A. tube is dissipating all the power input when it is not in resonance, and can be permanently damaged in just a few seconds.

4. Once resonance has been established, the P.A. can operate at full power input for quite awhile, although we recommend 30 seconds as a safe maximum. But, it is most important to realize that the 30 second limit assumes that the P.A. TUNE control has been immediately resonated. This rule applies generally to all transmitters.

5. Do not tune more often than necessary. You should not have to retune except when changing bands or antennas. The P.A. tube will last for many months or even years of normal operating, but excessive tuning will shorten tube life.

TRANSMITTER TUNING STEPS

1. The Sideband Selector must be in USB position while tuning. Set Tuning Dial to desired frequency. MIC. GAIN at minimum, CAR. BAL. straight up at 12 o'clock. Microphone with press-to-talk switch plugged into Mic. Jack on front of panel. Function switch in REC. position. Meter switch in P.A. CATH. position.

2. Press the Mic. Switch, and quickly rotate CAR. BAL. control for minimum meter reading. If the control has no effect at this time, do not be concerned. The P.A. (Power Amplifier) stage is now resting, or "idling," and there is no grid drive being applied. The meter is reading "idling" current, which should be about 40 ma. This point is indicated on the meter scale by a small triangular symbol. The permissible idling range is 30 to 50 ma. If the meter does not read within this range, adjust P.A. BIAS on back of the transceiver. This requires a screw driver, and should not be required often. If idling current tends to creep upward slightly with warm-up, set it at 30 ma. Excessive creep indicates that the P.A. tube is gassy, and may need to be replaced soon.

3. If this is the first time you are tuning the transmitter, set P.A. LOAD to 9 o'clock. After experience in tuning, this control may be pre-set to the previously determined position.

Note Up to now the transmitter has been "idling," and there has been no particular time limit involved. The following steps apply grid drive, and require caution. Observe, the recommended 30 second time limit.

4. With the function switch still in REC. position, again press the Mic. button and:
   a. Set the CAR. BAL. control to 3 o'clock or 9 o'clock.
   b. Rotate the DRIVER control for maximum meter reading.
   c. *Immediately* rotate the P.A. TUNE control for minimum meter reading, or "dip." This is the critical "resonating" adjustment which *must be done quickly* to preserve P.A. tube life!
   d. Re-adjust CAR. BAL. for minimum meter reading.

5. Switch to TUNE position and observe meter reading. Begin advancing the P.A. LOAD control clockwise in small steps, each time "dipping" the P.A. TUNE control for minimum meter reading. As P.A. LOAD is turned further clockwise, the P.A. TUNE "dip" will become more shallow, until finally it may be difficult to see the dip.

The proper degree of loading is when the dip is about 10 per cent down from the maximum off-resonance reading. In other words, if the meter reads 200 Ma. when P.A. TUNE is off resonance, it should dip to about 180 Ma. at resonance. Or, if the meter reads 250 Ma. off resonance, then adjust P.A. LOAD so that P.A. TUNE dips to 225 Ma. at resonance.

The specific meter reading is not vitally important. Tube condition and line voltage can affect the meter reading. It will normally read 200 Ma. or more when off resonance. With high line voltage and new tubes it may be as high as 300 Ma. Remember, the P.A. should never be held out of resonance for more than a second or two, just long enough to observe the meter reading and tune for the dip.

6. The preceding Step completes Transmitter Tuning procedure. Return the function Switch to REC. position.

Note that the 1011 operates at reduced power in TUNE-CW mode. The P.A. cathode bias resistor, R406 , is in the circuit during TUNE and CW operation. In voice mode the bias resistor is shorted out, and the 1011 operates at full P.E.P. input rating.

VOICE TRANSMISSION

After tuning up as outlined above, switch to REC. position. Press the microphone switch and then carefully set the CAR. BAL. control for minimum meter reading. While speaking into the mike, slowly rotate the MIC. GAIN control until occasional peak readings of 100 to 120 ma. are obtained. With most microphones, the MIC. GAIN control will be set between 9 and 12 o'clock, but it may vary considerably. The ALC circuit will help limit cathode current, but turning the MIC. GAIN up too high will still produce flat-topping and spurious signals, so it is important to hold it down. The meter is quite heavily damped, and its reading with average voice modulation may not look very impressive, but the voice peaks are going well over the 260 watt power rating of your Swan transceiver.

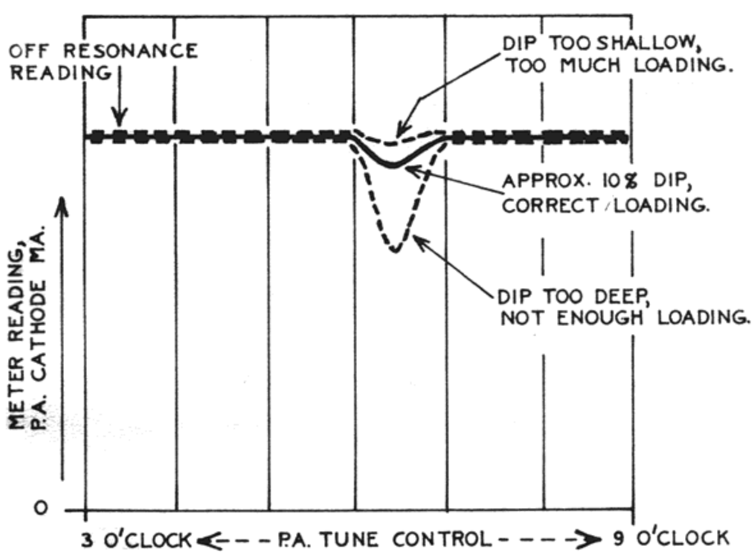


FIGURE 3.

ILLUSTRATING PROPER P.A. LOAD ADJUSTMENT AS INDICATED BY "DIP" IN P.A. CATHODE CURRENT WHEN TURNING P.A. TUNE CONTROL THROUGH RESONANCE.

NOTE

Transceiver will not modulate with Function Switch in CAL. position.

AM TRANSMIT (Upper Sideband With Carrier)

1. Tune transmitter to full output on upper sideband as described above.
2. Rotate MIC. GAIN control to minimum, full CCW.
3. With Push-to-talk pressed, rotate CAR. BAL. control until cathode current is approximately 75 ma.
4. While talking in a normal tone of voice into the microphone, increase MIC. GAIN setting until the meter kicks upward slightly. This setting will result in excellent AM transmission.

CW OPERATION

1. Insert a CW Key in the Key Jack on back of the Transceiver.
2. Close the key and tune the transmitter as outlined in Step 5. Power input will be approximately 180 watts.
3. In CW operation it will be necessary to switch the Function control back to REC. for receiving and then to CW for transmitting.
4. While receiving, the carrier oscillator frequency is located 300 cycles outside the passband of the crystal lattice filter, thus providing a single heterodyne note, or "single-signal" for CW reception. When transmitting in CW mode, the carrier frequency is moved approximately 800 cycles higher, placing it well inside the passband. This frequency shift is termed "Off-set CW transmit frequency," and avoids the problems encountered when the receive and transmit frequency are exactly the same. This is desirable for voice communication, of course, but when using the CW Keying mode the receiver must be tuned off frequency several hundred cycles in order to hear an audio beat. By providing this shift automatically, CW operation is greatly simplified.

CIRCUIT THEORY

GENERAL DISCUSSION

The Swan 1011 transceiver provides single sideband, suppressed carrier transceive operation, and generates the single sideband signal by means of a crystal lattice filter. To permit a logical discussion of this mode of operation certain definitions are necessary. In a normal AM signal, (double sideband with carrier), a radio frequency signal is modulated with an audio frequency signal. This is considered by many to be merely a case of varying the amplitude of the carrier at an audio rate. In fact, however, there are actually sideband frequencies generated, which are the results of mixing the RF and the AF signals. These sidebands are the sum of, and the difference between the two heterodyned signals. In the detection of this conventional AM signal, the two sidebands are mixed with the carrier to recover and reproduce the audio intelligence. This is an inefficient means of transmission, because only 25 percent of the transmitted power is used to transmit intelligence. There are other attendant drawbacks, also. The bandwidth of AM voice transmission is approximately 6 kc, while the actual demodulated audio is only approximately 3 kc. The result is inefficient use of the frequency band, and over half of the allotted band is unusable due to heterodynes, interference, and congestion.

In the single sideband, suppressed carrier mode of transmission, only one of the sideband signals is transmitted. The other sideband and the carrier are suppressed to negligible level. In addition to increasing the transmission efficiency by a factor of four, single sideband effectively doubles the number of stations or channels which can be used in a given band of frequencies.

It should be remembered that in the single sideband, suppressed carrier mode of transmitting, the unwanted sideband and carrier are only suppressed, not entirely eliminated. Thus, with a transmitted signal from a transmitter with 50 db sideband suppression, the other or unwanted sideband will be present, and will be transmitted, but its level will be 50 db below the wanted sideband. When this signal is received at a level of 20 db over S9, the unwanted sideband will be present at a level of approximately S5. The same is true of carrier suppression. With carrier suppression of 60 db, and a signal level of 20 db over S9, carrier will be present at a level of approximately S3 to S4.

For the following discussion refer to the schematic diagram, and to Figures 4, 5, and 6.

SIGNAL GENERATION

When the push-to-talk switch on the microphone is pressed, the transmitter portion of the transceiver is activated, and it generates a single sideband, suppressed carrier signal in the following manner. Carrier is generated by Q3 Carrier Oscillator, which is a Pierce oscillator with the crystal operating in parallel resonance. This stage operates in both the transmit and receive modes. When transmitting, the RF output of the oscillator is injected into the control grid of the Balanced Modulator, V13. This balanced modulator is a beam deflection tube, and operates similar to a cathode ray tube in that the electron beam from the cathode is deflected to one output plate or the other by the charge appearing on the deflection plates. The carrier signal fed to the control grid of the balanced modulator appears on both plates of the output. The two plates are connected to Transformer T1301 in push-pull, so the carrier signal cancels itself out in T1301. The deflection plate dc voltages are adjusted by means of the carrier balance control so that the RF being fed to the output plates will cancel out, and the output from T1301 will be zero. Audio signals from the Microphone Amplifier, V14, are applied as a modulating voltage to one deflection plate, and the two sidebands resulting from the sum and difference frequencies of the audio and carrier signals appear in the output of transformer T1301. Carrier suppression is approximately 60 db.

The double sideband, suppressed carrier signal is then coupled from the secondary winding of T1301 to the crystal filter, which suppresses the lower sideband, and permits only the upper sideband to be fed to the First IF Amplifier V7. The carrier frequency is generated at approximately 5500.0 kc, normal sideband. With the opposite sideband crystal, the carrier crystal frequency will be 5503.3 kc, and this positions the double sideband signal on the other side of the filter response curve, attenuating the upper sideband by at least 50 db. In the single conversion mixing process, these sidebands become inverted on 80 and 40 meters. Thus the Swan 270B normally operates on lower sideband on 80 and 40, while on 20, 15, and 10 meters normal operation is on upper sideband.

Q1, the VFO 2N706 Oscillator, operates in the common base configuration as a Colpitts oscillator. Q2, the buffer is used for isolation. The extremely good regulation achieved through using the Zener diode regulator D1712 across the bias supply voltage, also contributes to the stability.

The VFO in the Model 1011 exhibits extremely good stability after the initial warm-up period. Drift from a cold start will be less than 2 kc during the first hour. After the initial warm-up period, drift will be negligible.

The single sideband, suppressed carrier signal from the first IF Amplifier is fed to the Transmitter Mixer, V2, where it is heterodyned with the VFO signal. The resultant signal at the desired transmit frequency is amplified by the Driver, V3, and the Power Amplifier, V4. The signal from the VFO Amplifier is initiated in the transistorized VFO/Buffer circuit Q1 and Q2. The signal from the VFO is routed to the VFO Amplifier, and is mixed with the single sideband from the IF Amplifier, resulting in output in the 10 meter band.

CIRCUIT THEORY

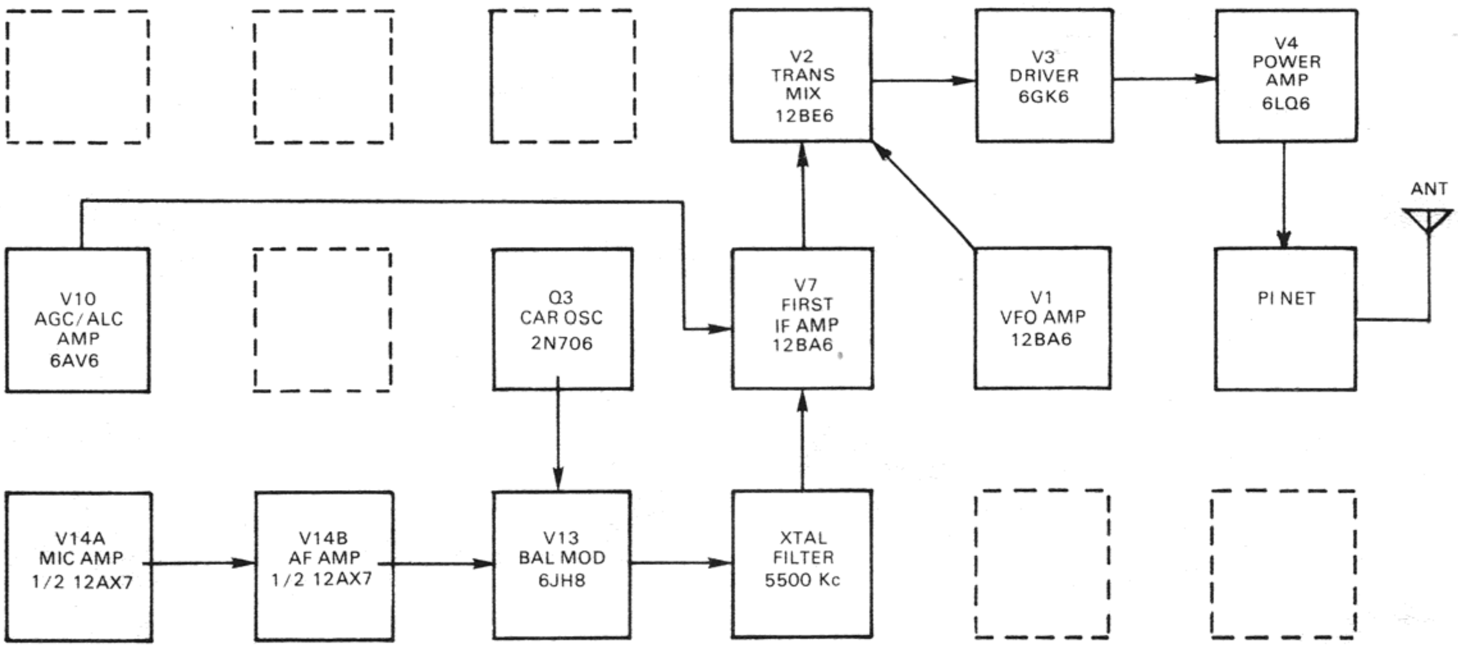


FIGURE 4. BLOCK DIAGRAM, TRANSMIT MODE

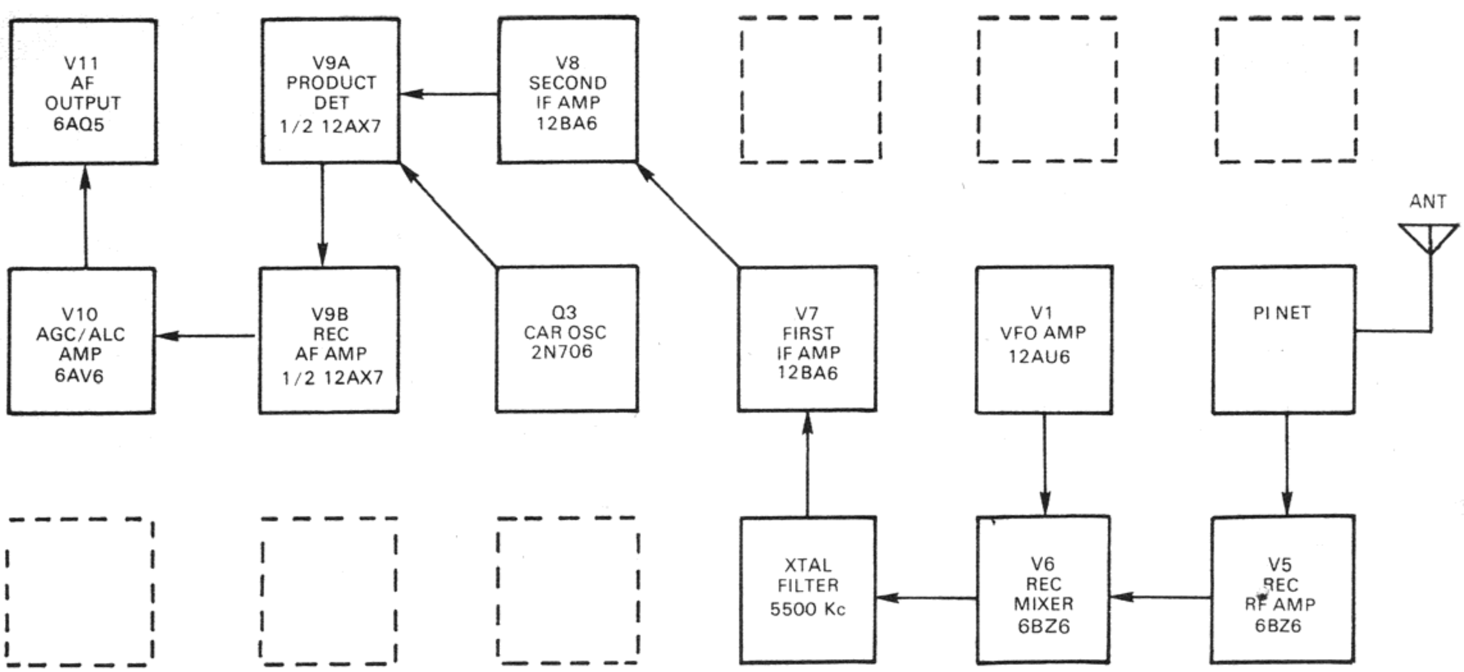


FIGURE 5. BLOCK DIAGRAM, RECEIVE MODE