SECTION I

GENERAL INFORMATION

1-1. Introduction

This service manual contains all of the information normally required to install, operate, and maintain the GENAVE ALPHA/190 communications and navigation radio.

1-2. Description

The ALPHA/190 is a self-contained navigation and communications radio complete with integral regulated power supply and converter-indicator. It is a completely solid state design utilizing 54 active silicon transistors.

The navigation and communication frequencies are quartz crystal controlled and are selected by two independent digital readout dials. A front panel NAV-COM switch selects the mode of operation enabling instant conversion from one mode to the other. In addition, when operating in the navigation mode, internal electronic switching automatically tunes the transmitter to the selected communication frequency when the microphone button is keyed. This enables the pilot to listen on an Omni frequency and transmit on any selected communications frequency as easily as he does using simplex transmission.

The navigation receiver receives all 100 channels from 108.0 mHz to 117.9 mHz. The converter-indicator is a state-of-the-art design using solid state computer circuitry and provides Omni course indication.

The communications receiver covers 90 channels, spaced 100 kHz apart, from 118.0 mHz to 126.9 mHz. The communications transmitter is a wide band solid-state unit modulated by an audio system with audio bandpass and pre-emphasis circuitry to provide the best quality, distortion free transmission.

1-3. Specifications

GENERAL:

WEIGHT: 5.3 lbs.

FRONT PANEL SIZE: 6½" × 3½"

DEPTH BEHIND PANEL: 12"

INPUT POWER: Receive: 1.9 amps @ 14 VDC*
Transmit: 2.6 amps @ 14 VDC*

(*28 VDC adapter available)

NUMBER OF TRANSISTORS: 29 All Silicon

NUMBER OF INTEGRATED CIRCUITS: 7

AUDIO AMPLIFIER: Sidetone output: 30 mw nom. into 600 ohms.

Cabin Speaker output: 5 watts nom. into ¾ ohm speaker

RECEIVER (Front panel switch selects Nav or Com mode):

RECEIVER CIRCUIT: double-conversion, superheterodyne, crystal tuned

Navigation

FREQUENCY RANGE: 108.0 — 117.9 MHz

NUMBER OF CHANNELS: 80 Omni all crystal controlled

CHANNEL SPACING: 100 kHz

SENSITIVITY: 2 microvolts for 6 db $\frac{s+n}{n}$ nom. @ 30% modulation, 1000 Hz

PRIMARY IMAGE REJECTION & SPURIOUS RESPONSES: −40 db nom.

SELECTIVITY: −6 db 40 kHz
−50 db 200 kHz

VOR ACCURACY: ±3 degrees

AUDIO OUTPUT: 5 watts nom. into ¾ ohm speaker; 30 mw. nom. into 600 ohm headset

AGC: 3-6 db 10 — 10,000 microvolts

Communications:

FREQUENCY RANGE: 118.0 — 126.9 MHz

NUMBER OF CHANNELS: 90 all crystal controlled

CHANNEL SPACING: 100 kHz

SENSITIVITY: 2 microvolts for 6 db $\frac{s+n}{n}$ nom. @ 30% modulation, 1000 Hz

PRIMARY IMAGE REJECTION & SPURIOUS RESPONSES: −40 db nom.

SELECTIVITY −6 db 40 kHz
−50 db 200 kHz

AGC: 3-6 db 10 — 30,000 microvolts

AUDIO OUTPUT: 5 watts nom. into ¾ ohm speaker; 30 mw nom. into 600 ohm headset

TRANSMITTER:

(May be operated Simplex, or Duplex with Nav receive frequencies)

TRANSMITTER CIRCUIT: 6 stage, solid state, crystal tuned

FREQUENCY RANGE: 118.0 — 126.9 MHz

NUMBER OF CHANNELS: 90 all crystal controlled

CHANNEL SPACING: 100 kHz

POWER OUTPUT: 2 watts carrier nom.

MODULATION: Audio processed, high level, automatic limiting

1-4. Equipment Supplied

a. 1—ALPHA/190 Radio
b. 1—Mounting Tray with Hardware
c. 1—Cable Connector (12 Pin)
d. 2—RF Connectors (1 short, 1 long)

1-5. Equipment Required, But Not Supplied

a. 1—Microphone & Jack
b. 1—Communications Antenna (See Installation Manual)
c. 1—Navigation Antenna
d. Cabin Speaker and/or headphones
e. Coaxial Cable, as required (RG 58A/U or equiv.)
f. Wire for Harness, as required
g. 1—250 ohm, 5 watt Dimmer Pot (Optional, See Installation Manual)

SECTION II

INSTALLATION AND OPERATING MANUAL

The following Section

is reproduced

and included with every

ALPHA/190

It is made a part of

this manual

for your permanent

reference

Model: ALPHA/190

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GENERAL AVIATION ELECTRONICS, INC.
4141 KINGMAN DRIVE, INDIANAPOLIS, INDIANA 46226

INSTALLATION AND OPERATING MANUAL

ALPHA/190 NAV/COM

Please Note:

THIS UNIT MUST BE INSTALLED BY a properly certificated and authorized person in accordance with the Federal Aviation Regulations, Part 43. No responsibility for improper installation of this unit is either implied or assumed by the manufacturer. Units shown to be installed in violation of the FARs will not be covered by the warranty and will remove any and all responsibility from the manufacturer for such equipment.

Specifications:

GENERAL:

WEIGHT: 5.3 lbs.

FRONT PANEL SIZE: 6½" × 3½"

DEPTH BEHIND PANEL: 12"

INPUT POWER: Receive: 1.9 amps @ 14 VDC*
Transmit: 2.6 amps @ 14 VDC*

(*28 VDC adapter available)

NUMBER OF TRANSISTORS: 29 All Silicon

NUMBER OF INTEGRATED CIRCUITS: 7

AUDIO AMPLIFIER: Sidetone output: 30 mw nom. into 600 ohms.

Cabin Speaker output: 5 watts nom. into ¾ ohm speaker

RECEIVER (Front panel switch selects Nav or Com mode):

RECEIVER CIRCUIT: double-conversion, superheterodyne, crystal tuned

Navigation

FREQUENCY RANGE: 108.0 — 117.9 MHz

NUMBER OF CHANNELS: 80 Omni all crystal controlled

CHANNEL SPACING: 100 kHz

SENSITIVITY: 2 microvolts for 6 db $\frac{s+n}{n}$ nom. @ 30% modulation, 1000 Hz

PRIMARY IMAGE REJECTION & SPURIOUS RESPONSES: −40 db nom.

SELECTIVITY: −6 db 40 kHz
−50 db 200 kHz

VOR ACCURACY: ±3 degrees

AUDIO OUTPUT: 5 watts nom. into ¾ ohm speaker; 30 mw. nom. into 600 ohm headset

AGC: 3-6 db 10 — 10,000 microvolts

Communications:

FREQUENCY RANGE: 118.0 — 126.9 MHz

NUMBER OF CHANNELS: 90 all crystal controlled

CHANNEL SPACING: 100 kHz

SENSITIVITY: 2 microvolts for 6 db $\frac{s+n}{n}$ nom. @ 30% modulation, 1000 Hz

PRIMARY IMAGE REJECTION & SPURIOUS RESPONSES: −40 db nom.

SELECTIVITY −6 db 40 kHz
−50 db 200 kHz

AGC: 3-6 db 10 — 30,000 microvolts

AUDIO OUTPUT: 5 watts nom. into ¾ ohm speaker; 30 mw nom. into 600 ohm headset

TRANSMITTER:

(May be operated Simplex, or Duplex with Nav receive frequencies)

TRANSMITTER CIRCUIT: 6 stage, solid state, crystal tuned

FREQUENCY RANGE: 118.0 — 126.9 MHz

NUMBER OF CHANNELS: 90 all crystal controlled

CHANNEL SPACING: 100 kHz

POWER OUTPUT: 2 watts carrier nom.

MODULATION: Audio processed, high level, automatic limiting

Unpacking

CAREFULLY REMOVE the unit and its mounting accessories from the shipping container by removing the staples from the top of the carton and lifting the contents straight out. The carton should be saved until the installation is complete in the event that damage is discovered or return of the unit is necessary for some reason. Any damage due to shipping should be reported and a claim filed as soon as possible with the shipping company. (If it is necessary to re-ship, use our container which is specifically designed for that purpose.)

Pre-Installation Check

VISUALLY INSPECT the unit for any obvious external damage, such as dents, loose wires, etc. Any damage not related to shipping should be reported to General Aviation Electronics, Inc., 4141 Kingman Drive, Indianapolis, Indiana (46226), Area Code 317-546-1111, as soon as possible.

Damage due to shipping should be reported to and a claim should be filed promtly with the transportation company.

All units are shipped in perfect operating condition. However, a pre-installation electrical test may be performed to assure that the unit has suffered no internal damage during shipment. For a detailed test procedure, refer to the Maintenance Section of the Service Manual. DO NOT ATTEMPT to bench test the unit without proper equipment as specified in the Service Manual.

Installation Planning

THE LOCATION of the unit in the aircraft should be carefully selected with due consideration to the following:

1. The unit generates only a very small amount of heat and, as such, does not require any type of cooling. However, the unit must NOT be mounted directly above a vacuum tube device or any other equipments that generate a large amount of heat unless such equipments have cooling provisions installed to keep the heat generated therein from coming in contact with other equipments mounted in close proximity to them.

   MOUNTING THE UNIT DIRECTLY OVER UNCOOLED VACUUM TUBE EQUIPMENT OR IN THE HOT AIR BLAST OF ANY DEVICE, INCLUDING CABIN HEATERS, WILL AUTOMATICALLY VOID THE WARRANTY.

2. The placement of the unit should be such that all controls are easily accessible.

Installation

1. The aircraft panel cutout for the ALPHA/190 is 6 1/4" wide X 3 11/32" high. Make this cutout in the selected location.

2. Insert the supplied mounting rack into the cutout. Mark the rack mounting holes on the panel support brackets on both sides of the cutout. If the location chosen does not provide the brackets, two angle brackets must be made and Installed. Drill out the marked mounting holes with a #27 drill.

3. The mounting rack alone will provide sufficient support for the radio in most cases. If further support is required or desired, a rack support bracket must be fabricated and installed. A mounting hole in the rack for a support bracket has been provided. (See mounting rack illustration). Other locations will generally cause mechanical interference when inserting the radio.

4. Install the rack in the aircraft panel, using the holes drilled in step 2, the #6-32 Binder head screws, washers, and nuts supplied, and the support bracket if used. All screws must have their heads inside the rack.

5. Fabricate the power and signal cable using the connector socket supplied. A wiring diagram is shown in this manual. The cable wires should be long enough to allow the connector to be passed through the panel cutout from the rear and extended to about 2" in front of the panel.

6. Fabricate the two RF cables as illustrated using 50 ohm coax, such as RG-58 A/U. These cables should also be long enough to protrude 2" through the cutout.

7. Connect the 3 cables just fabricated to the appropriate points in the aircraft's electronic system. Bring the connector ends through the cutout. Mechanically secure the cables at appropriate support points.

8. Attach the cables to the radio. Make sure that the RF cables go to the proper jack on the radio. The COM antenna cable (long plug) goes to the recessed antenna jack.

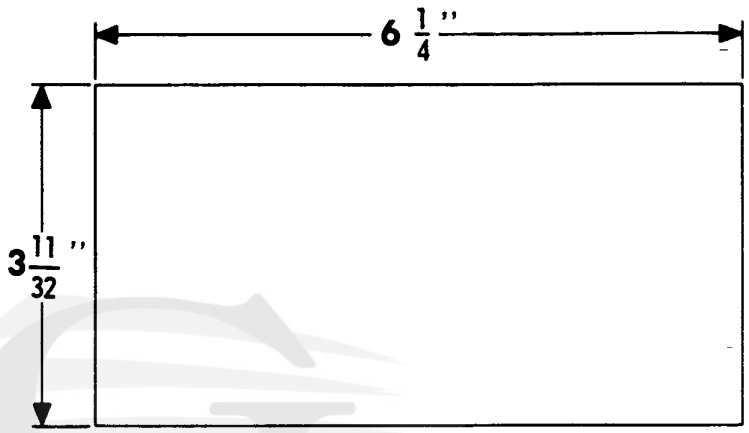
9. Insert the radio into the rack. Tighten the mounting bolt to secure the radio in the panel. Do not use excessive torque on the bolt. Tighten only until the radio is snugly secured against the front panel.

10. Update the appropriate logs and papers of the aircraft.

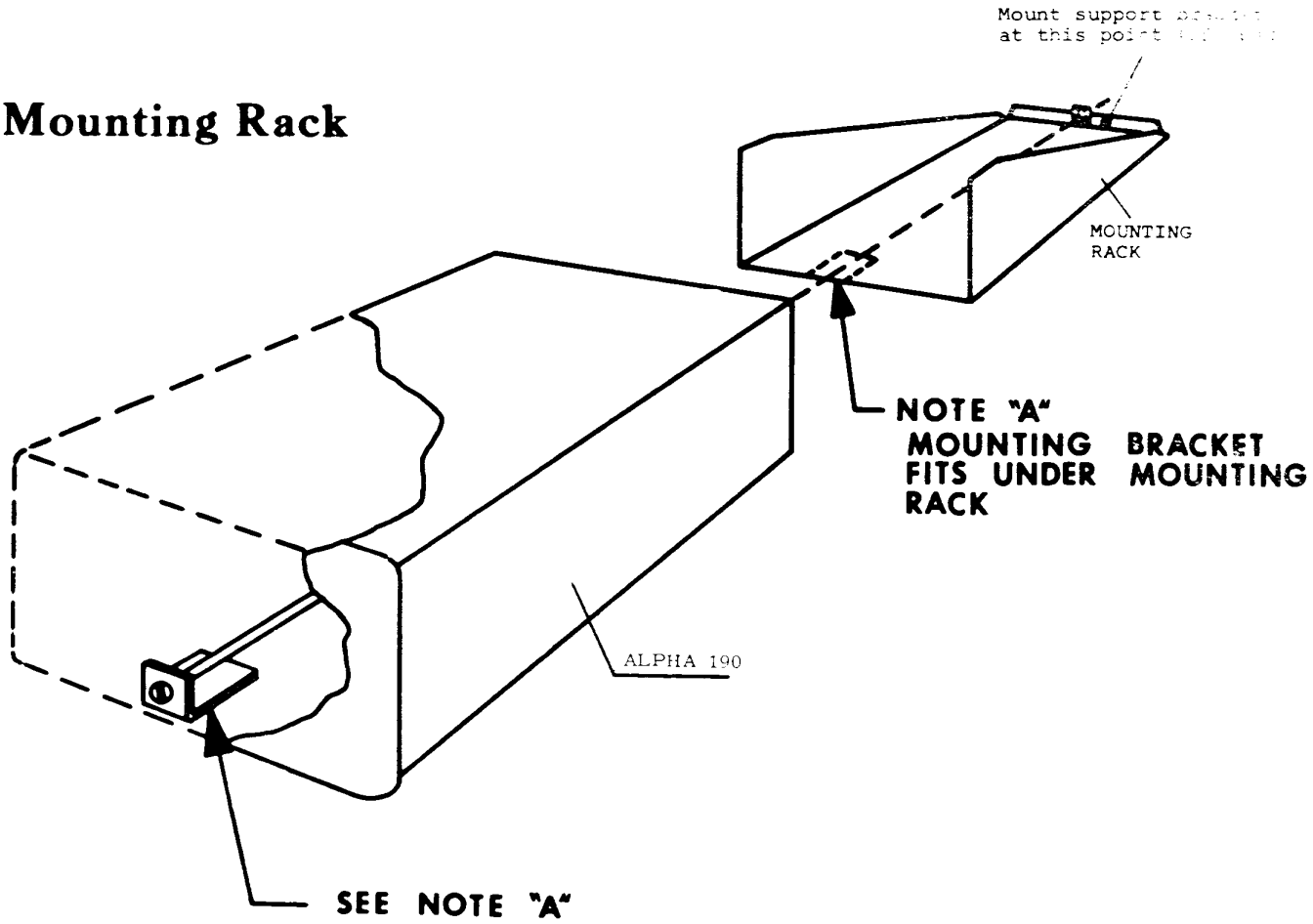
11. Fill out and return the bottom section of the warranty card.

12. Give the remainder of the warranty card and the Pilots Information Manual to your customer. The proper sections of the warranty card MUST be completed and returned to Genave by both the dealer and the customer for the warranty to be in effect.

Panel Cutout



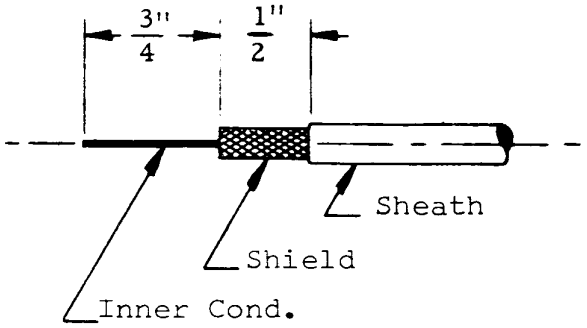
Mounting Rack



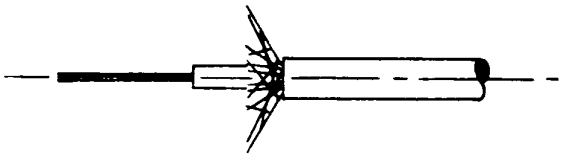
Post Installation Check

UPON COMPLETION of the installation, a flight test is desirable to insure that all three systems of the ALPHA/190 are operating properly. The navigation system should be checked on two or more different radials or on different Omni stations. The communications system should be checked for simplex operation on two or more frequencies and for duplex operation if possi... The localizer function should be checked if possible. A single frequency check is sufficient.

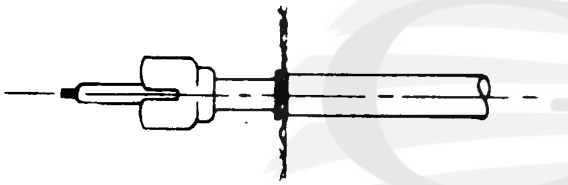
COM Antenna Connector Assembly



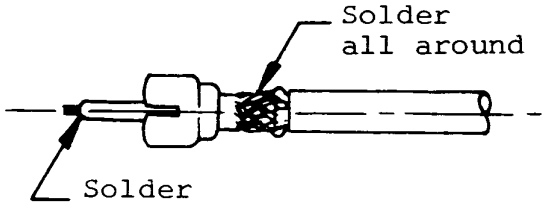
1. Cut and strip RG-58 A/U Coax as shown.



2. Spread shield. Do not pigtail.

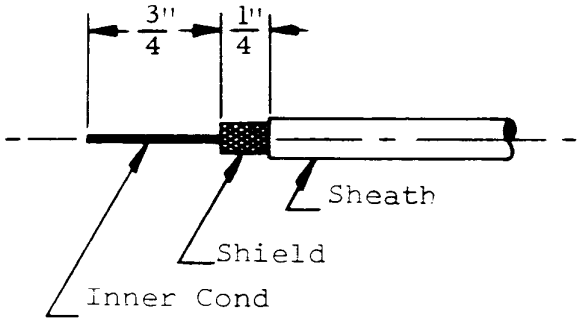


3. Press long shank connector onto wire and against shield.

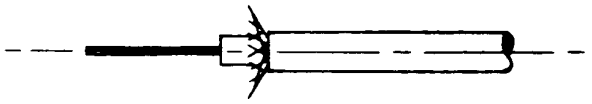


4. Fold shield over connector and solder all around. Flow solder into connector tip to secure inner conductor. Cut off tip of inner connector which protrudes from connector.

NAV Antenna Connector Assembly

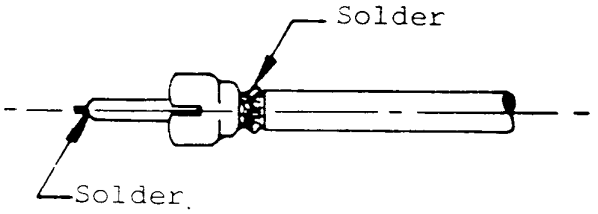


1. Cut and strip RG-58 A/U Coax as shown.



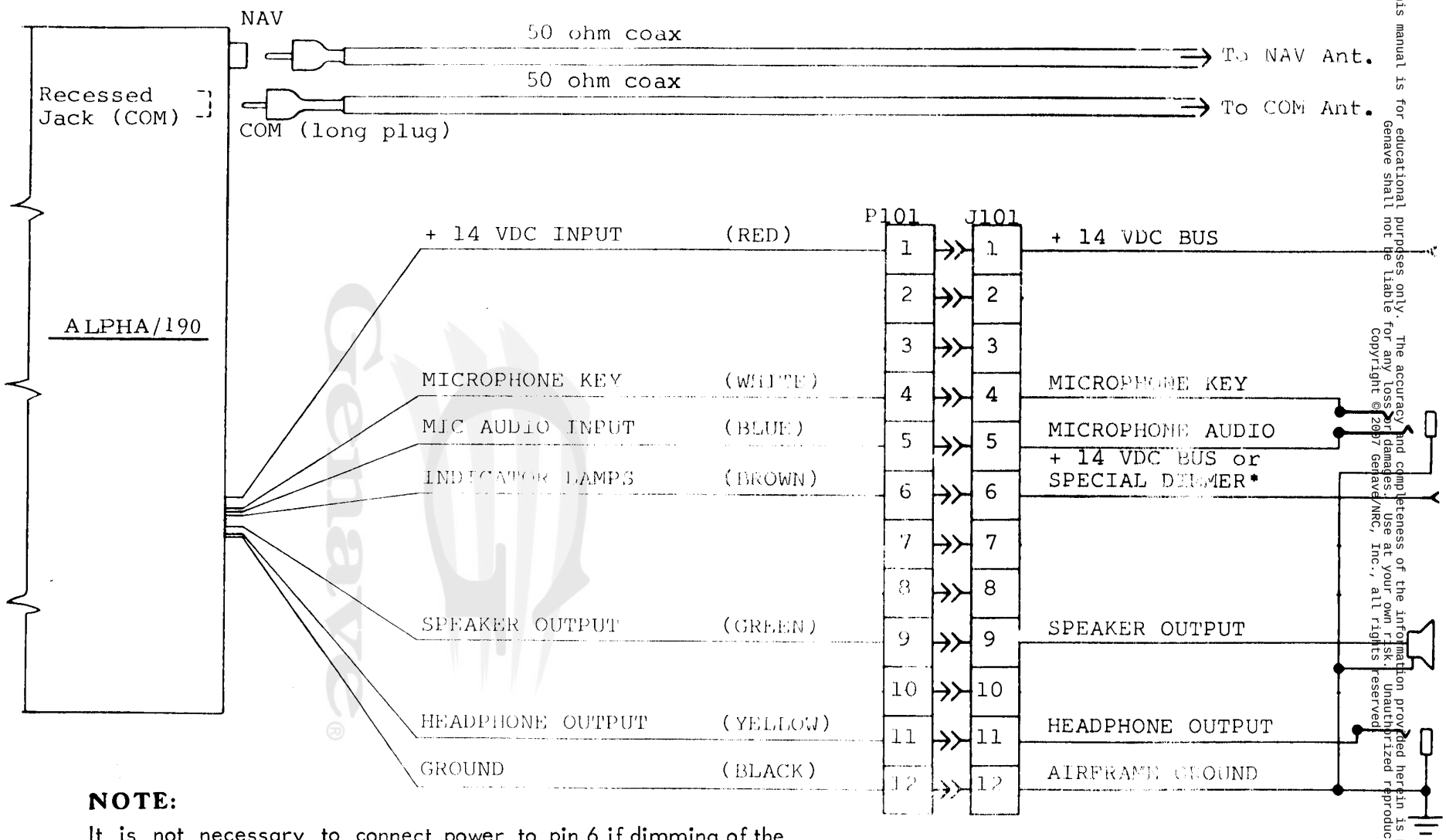
2. Spread shield. Do not pigtail.

3. Press short shank connector onto wire and against shield.



4. Fold shield over connector and solder all around. Flow solder into connector tip to secure inner conductor. Cut off tip of inner conductor which protrudes from connector.

Power and Signal Cable Connections



NOTE:

It is not necessary to connect power to pin 6 if dimming of the lamps is not required. The pin has been connected to switched A+ on the bottom of the unit with color coded jumper wires:

Brown jumper wire - Indicator lamps

IF DIMMING IS REQUIRED, the jumper MUST be removed. The wiring diagram should then be used to connect the lamps to the proper points in the aircraft electrical system.

*This input controls the intensity of the TO-FROM-OFF lamps. The following are alternate methods of installation:

1. Connect directly to the +14 VDC BUS, and the lamps will light at full intensity.
2. Connect through an auxiliary 250 ohm series dimmer potentiometer to the +14 VDC BUS.
3. Connect to existing panel dimmer, which will require panel lights be set at full brightness during the day for lights to be visible.
4. Install a dual "DAY-NIGHT" switch, connecting input to +14 VDC BUS for day mode and to existing panel dimmer for NIGHT mode.

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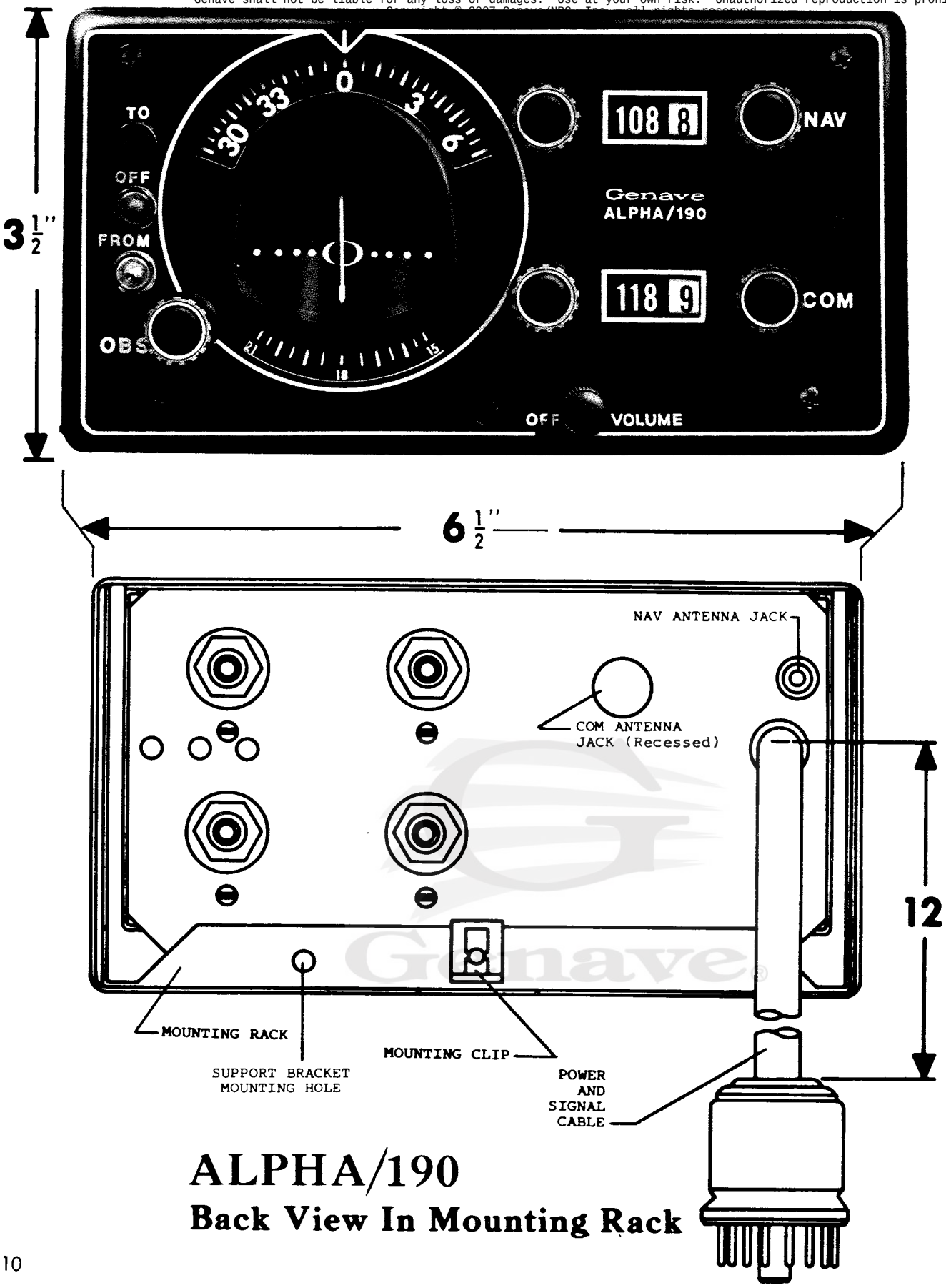
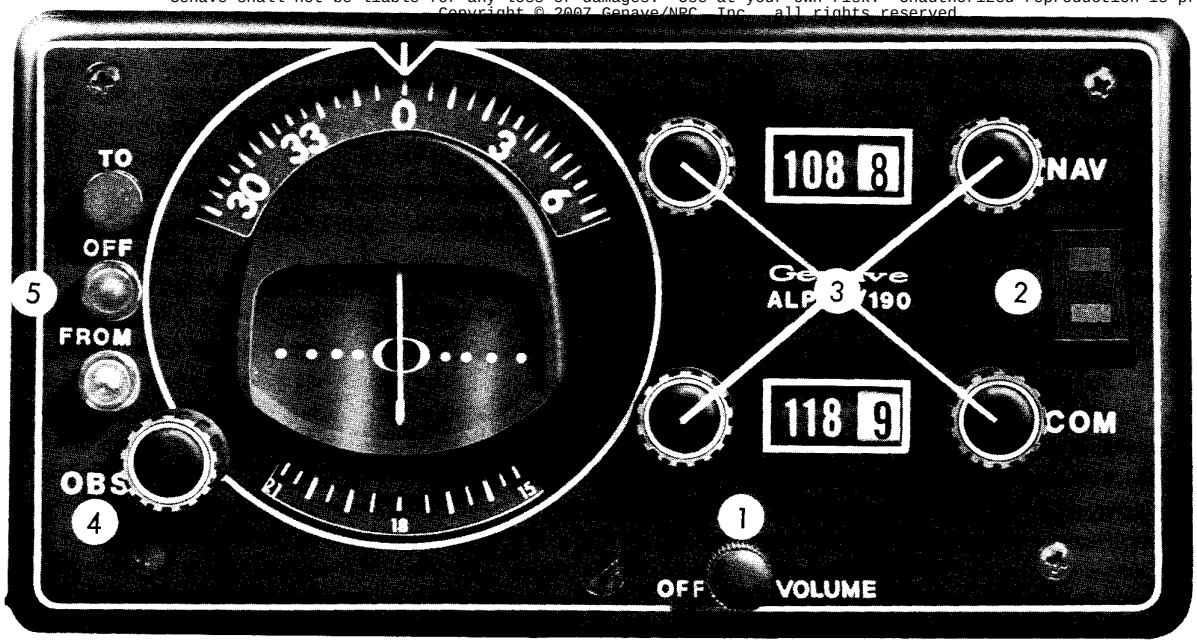
Front Panel



ALPHA/190
Back View In Mounting Rack



ALPHA/190 MAY BE USED FOR SIMPLEX AND DUPLEX COMMUNICATIONS

HOW TO OPERATE:

1. VOL control

Controls volume of receiver for both NAV and COM. Also controls ON-OFF for entire unit.

Rotate clockwise to turn set on and to increase volume. Rotate counter-clockwise to reduce volume and to turn set off.

2. NAV-COM switch

Selects the NAV or COM mode of the unit.

Depress the top of the switch to activate the NAV frequency shown in the upper digital readout window and the converter indicator. Depress the bottom of the switch to activate the COM frequency shown in the lower digital readout window.

3. FREQUENCY SELECTOR knobs

These knobs select the MHz (white numbers on black) or tenth MHz (black numbers on white) dial readout adjacent to the knob being turned.

Turn knobs clockwise to increase frequency. (When the readouts are blank the radio is inoperative. Knobs may be rotated through blank positions without damage to radio.) Knobs may be turned counter-clockwise to reduce frequency.

4. OMNI BEARING SELECTOR (OBS)

Adjusts OMNI to desired radial.

Turn knob clockwise or counter-clockwise to desired bearing on compass rose. Top numbers (larger size) indicate bearing. Bottom numbers (smaller size) are reciprocal.

5. TO-FROM-OFF lights

Provide pilot with TO-FROM-OFF information in relation to course deviation display.

GREEN : (to) Illuminates when OMNI signal of adequate strength is received, and the bearing selected on the OMNI Bearing Selector (OBS) is (or is close to) the reciprocal of the radial on which aircraft is located.

YELLOW: (from) Illuminates when OMNI signal of adequate strength is received, and the bearing selected on the OMNI Bearing Selector (OBS) is the same as (or close to) the radial on which the aircraft is located.

RED : (off) Illuminates when the NAV-COM switch is in COM position, or when microphone button is depressed.

Illuminates in the cone of silence over an OMNI station to indicate station passage.

NOTE: NEEDLE DEFLECTIONS OF COURSE DEVIATION DISPLAY METER SHOULD *NOT* BE USED WHEN OFF LIGHT (Red) IS PARTIALLY OR FULLY ILLUMINATED.

ALPHA/190 may be used for simplex and duplex communications:

SIMPLEX: Put NAV-COM switch in COM position. Both transmitter and receiver will operate on the frequency shown in lower digital readout window.

DUPLEX: Put NAV-COM switch in NAV position. Receiver now will operate on frequency shown in upper digital readout window (i.e. OMNI or LOC or ATIS)

Transmitter will operate on frequency shown in lower digital readout window, and will be activated by depressing microphone button.

ALPHA/190
Check List

BEFORE YOU FLY your aircraft newly equipped with the ALPHA/190, run through this checklist to assure yourself that all conditions are "GO":

1. **MAKE SURE THE WARRANTY CARD HAS BEEN FILLED OUT AND RETURNED TO THE FACTORY.**

   There are two parts to the warranty card that has to be filled out and returned to the factory.

   The lower part has to be filled out by the installer.

   The upper part has to be filled out by you. **BOTH PARTS HAVE TO BE COMPLETED AND SENT TO THE FACTORY SO THAT THE WARRANTY WILL BE IN EFFECT** (Your one-year warranty starts from the date of installation shown on the card.)

2. **APPLY TO THE FCC for your Aircraft Radio Station License (FCC Form 404, Sept. 1965).**

   In answering question 14, list the ALPHA/190 exactly as follows:

MANUFACTURER	TYPE NO.
General Aviation Electronics, Inc.	ALPHA/190

3. **BE SURE THE INSTALLER** has made the appropriate entries in your aircraft's log book as required by FAR 43.

4. Ask your installer for our shipping carton, which you can use in your aircraft as a litter-basket while flying.

GENERAL AVIATION ELECTRONICS, INC.
4141 KINGMAN DRIVE. INDIANAPOLIS, INDIANA 46226

3-1. INTRODUCTION

This section provides the basic information required to electronically test, align, and repair the ALPHA/190. It is assumed that the person working on the unit has a reasonable familiarity with the principles and terminology of communications and navigation electronics as applied to the aviation field.

3-2. THEORY OF OPERATION

I. General

The ALPHA/190 employs 7 integrated circuits, 29 silicon transistors and 25 diodes in an all solid state design. The following is a breakdown of the functions and circuits within the unit.

A. Receiver (Nav & Com)
B. Local Oscillator Assembly
C. Exciter
D. Transmitter
E. Converter Indicator
F. Audio Amplifier & Modulator
G. Power Supply

The local oscillators, the exciter, and the transmitter are contained within separate, replaceable shielded modules. The receiver, the converter indicator, the power supply and the audio amplifier-modulator circuits are on the main circuit board.

II. Detailed Theory

A. *Receiver*—The receiver in the ALPHA/190 is a shared receiver; that is, it may be crystal tuned on either Nav or Com channels. The NAV-COM switch on the front panel determines the mode of operation and the two frequency selectors control the frequency. The receiver is a double conversion superheterodyne with a 4.0 mHz second IF. The first IF is switched and its center frequency is 30.5 mHz in NAV and 22.5 mHz in COM. The receiver is unique in that it does not employ mechanically tracked, tuned filters, or an RF amplifier. Signals from the antenna (the omni antenna is used by the receiver in both NAV & COM) are applied to a broad band, 108.0 mHz to 126.9 mHz 5 pole Chebyshev filter consisting of L101, L102, L103, L104, L105 and their associated tuning and coupling capacitors. This filter allows signals in the range of 108 to 128 mHz to pass to the bases of Q101 (COM 1st mixer) and Q102 (NAV 1st mixer.

The 1st Local Oscillator, LO1 also applies a signal through C151 to the bases of Q101 and Q102. The input filter prevents radiation of the local oscillator signal. The local oscillator signal is controlled by the front panel NAV-COM switch and by the NAV & COM mHz dials. The LO1 signal is approximately 30.5 mHz above the selected signal when in NAV and 22.5 mHz above the desired signal when in COM. Q101 and Q102 are switched by the front panel NAV-COM switch so that Q101 functions in COM and Q102 in NAV. T101 is a tree pole filter tuned to a center frequency of 22.5 mHz and a bandwidth of 1 mHz. T102 is a three pole filter tuned to a center frequency of 30.5 mHz and a bandwidth of 1 mHz. The outputs of T101 and T102 are connected to Q103 the second mixer. CR109 and CR110 switch off the unused IF transformer. CR109 and 110 are controlled by the NAV-COM switch. The second local oscillator (LO2 is connected to the emitter of Q103 thru R165 and C124. LO2 operates 4.0 mHz above the first IF frequency in COM and 4.0 mHz below the first IF frequency in NAV. The exact frequency of LO2 is controlled by the NAV-COM switch and by the front panel of 0.1 mHz selector dials. Q103, 104, 105 and 106 and associated components form a 4.0 mHz center frequency second IF amplifier. CR102 functions as a detector. CR102 is biased above ground by R127 and R128 to provide a reference (No signal) AGC voltage. The DC output level of CR102 is amplified by emitter follower Q108 and is used as AGC applied to Q101, Q102, Q103 and Q104. C133 is connected as an additional AGC filter in NAV. The detected voice audio output from CR102 is applied through R140 (VOL control to emitter follower Q110. The output of Q110 is connected to the input of the audio amplifier through Relay RY 1 when in receive. CR104 with R136, R139 and C137 form a noise limiter that removes impulse noise from the voice audio. The detected output from CR102 is also connected to the base of Q109. Q109 is connected as an emit-

ter follower and provides Omni and localizer output to the converter indicator in NAV mode. CR 105 is switched off when the NAV-COM switch is in COM to block output to the converter indicator. Q107 functions as a squelch amplifier and is controlled by R132 (SQ control) when in COM. In NAV, Q107 is disabled by CR103.

B. *Local Oscillator Assembly*—The local oscillator assembly consists of two circuits, a high frequency oscillator and a low frequency oscillator.

The high frequency oscillator, composed of Q301 and associated components, is a modified Colpitts, crystal controlled, transistor oscillator. The crystals are selected mechanically by rotary switches SW301 (Nav) and SW302 (Com). The switching of the selected Nav or Com crystal is accomplished with CR301 (Nav), CR302 (Com Rcv), and CR303 (Com Xmit) which are activated by the front panel Nav/Com switch or, in the transmit condition, by the transmit/receive relay, RY1.

Output from the oscillator is coupled to Q302, a doubler stage, which multiplies the oscillator frequencies by 2. The resulting frequencies are 138.94 mHz to 152.94 mHz in 1.0 mHz steps. The output of Q302 is passed through a 3-pole Chebyshev bandpass filter consisting of L303, C309, C310 C317, L304, C311, C312, C313, C314, L305, C316 and C315. The bandwidth of the filter is nominally 16 mHz centered around a frequency of 146.2 mHz. This filter suppresses all harmonics and subharmonics of the output frequency to a level of 60 dB or more below the desired output. The output of the filter is matched to a 50 ohm coaxial cable which is routed to the main circuit board and then to the Exciter assembly.

The high frequency oscillator is contained within a separate shielded compartment of the total oscillator assembly.

The low frequency oscillator, consisting of Q401 and associated circuitry, is a modified Colpitts, crystal controlled, transistor oscillator. The crystal frequencies are 26.040 mHz to 26.940 mHz in 100 kHz steps. The crystals are selected mechanically by rotary switches SW401 (Com) and SW402 (Nav). The switching of the selected Nav or Com crystal is accomplished with CR401 and CR402 which are activated by the front panel Nav/Com switch or, in the transmit condition, by the transmit/receive relay RY1.

T401, used to adjust the low frequency oscillator, is provided with a pickup link. This link is the first element of a 7-pole Chebyshev lowpass filter consisting of the link on T401, C406, L403, C405, L402, C404 and L401. This filter suppresses all unwanted outputs to 70 dB below the output frequency. The nominal cutoff frequency is 32.0 mHz. The output of the filter is matched to a 50 ohm coaxial cable which is routed to the main circuit board and then to the exciter assembly.

The low frequency oscillator is contained within a separate shielded compartment of the total oscillator assembly.

C. *Exciter Assembly*—Inputs from the high and low frequency oscillators are fed through resistive attenuators to the balanced mixer, consisting of Q603 and Q604. The low frequency input is applied through a tuned transformer, T601, and fed differentially to the transistor bases. The high frequency input is applied in-phase to both bases. Using this method of feeding the mixer, the high frequency input, its harmonics, and all even order harmonics of the low frequency input are suppressed in the collector circuit. Mixing action occurs in the base-emitter junctions and produces primarily the high frequency input plus and minus the low frequency input. Harmonically related spurious outputs also occur, but at lower levels. The desired output frequency is the high frequency input minus the low frequency input. The sum and difference frequencies appear in the collector circuit across the primary of T602. A pick-up link on T602 forms the first element in a 3 pole Chebyshev bandpass filter consisting of the link on T602, C625, C624, C623, L604, C622, C621, C620, C619, C618 and L603. The nominal bandwidth of this filter is 11 mHz ceintered around a frequency of 122.8 mHz. The filter suppresses all undesired outputs of the mixer to 60 dB below the desired output frequency

The output of the filter is fed to a single-tuned bandpass amplifier, Q602. The output of Q602 is fed to an identical single-tuned stage, Q601. At this point all undesired outputs are over 70 dB below the desired.

The output of Q601 is matched to a 50 ohm coaxial cable which is routed to the transmitter power amplifier assembly. The entire exciter assembly is enclosed in a plated steel shield housing to eiliminate direct radiations.

D. *Transmitter Power Amplifier Assembly*—The signal from the exciter assembly is brought in on 50 ohm coax and fed to a single-tuned Class A amplifier or predriver, Q503. The output of Q503 is fed to a single-tuned Class C driver, Q502.

The signal from Q502 is matched into the input

of Q501 with a split inductor "Pi" matching sec-
tion consisting of Z503, C510, C509, L505 and
Z501. Q501 is the final power amplifier stage. It is single-tuned into a 7-pole Chebyshev lowpass filter. The primary function of this filter is to remove harmonics of the output frequency which are generated in the Class C amplifier stages.

The filter reduces all of the harmonic and spurious outputs to over 60 dB below the desired output. The output of the filter is designed to match a 50 ohm communications antenna system. The antenna jack is directly connected to the transmitter power amplifier shield and housing assembly and connection to it is made through an access port in the rear panel.

E. *Omni Converter/Indicator*—The converter-indicator circuitry is of the analog computer type and utilizes no transformers.

The Omni converter-indicator circuitry can be broken down into four sections: Demodulation Circuitry, Summing Amplifiers, Metering Circuitry, and Lamp Circuitry.

1. Demodulation Circuitry—When an Omni signal is applied to the Omni converter-indicator it is fed to two individual channels. One of these channels is the AM channel while the other is the Fm channel.

The Am channel consists of a low-pass active filter, IC 201 A; a unity-gain phase inverter, IC 201 B; a 90° phase shifting circuit; a unity-gain non-inverting amplifier, IC 202 A; another unity-gain phase inverter, IC 202 B; and the OBS potentiometer. The low-pass active filter consisting of IC 201 A, R203, and C202 removes the 30 Hz AM component of the 9960 Hz carrier. The low-pass filter provides one output 180° out-of-phase and the following inverting amplifier provides one output in-phase with the input signal.

These two outputs are applied to the 180° and 0° terminals of the OBS potentiometer, respectively, and to an RC phase shifting network consisting of C203, R206, and R207. R206 allows the shift to be set at exactly 90°.

Outputs from the 90° phase shifting network are applied to a unity-gain non-inverting amplifier IC 202 A. This amplifier provides one output in-phase and inverting amplifier IC 202 B provides one output 180° out-of-phase with the signal from the 90° phase shift network. These two ouputs are applied to the 90° and 270° terminals of the OBS potentiometer, respectively. The wiper on the OBS potentiometer, R210 will provide a 30 Hz AM signal, whose phase may be selected.

The FM channel consists of one 9960 Hz amplifier/limiter; a Schmitt trigger; a slope detector; and a low-pass active filter.

The Omni input is first applied to the 9960 Hz LC amplifier consisting of IC 203 B and associated circuitry. This amplifier/limiter is tuned to 9960 Hz by means of L201 and C205.

IC 203 A is used as a Schmitt trigger to "square" and limit the 9960 Hz input. This technique reduces the possibility of any residual AM interfering with the FM. The slope detector converts the FM signal to an AM signal and the diode doubler recovers the 30 Hz reference modulation.

The low-pass active filter consisting of IC 204 B, R218 and C209 provides an output 180° out-of-phase while IC 204 A and associated circuitry provide an output in-phase with the demodulated signal. These two FM channel outputs along with the AM channel output are then applied to the Omni summing amplifiers.

2. Omni Summing Amplifiers—The summing amplifiers are used to convert the processed Omni signal to a directional signal.

The three signals from the Omni circuitry are applied to the summing amplifiers. The Omni summing amplifiers are comprised of IC 205 A and IC 205 B and their associated circuitry. Each of the Omni summing amplifiers receives one of the FM Omni channel outputs and the AM channel output.

3. Omni Metering Circuits—The outputs from each of the summing amplifiers are fed to the metering circuits; here the directional signal is converted to a visual indication. The Omni indication is provided via M1, the course deviation indicator.

The Omni summing amplifier outputs are rectified by means of CR 205 and CR 206. The rectifier outputs, varying DC levels, are summed and applied to a low-pass active filter composed of IC 206 A, R239, and C219. The cutoff frequency of the low-pass active filter is 1 Hz (RC = 1 sec.) and thus the meter is prevented from responding to transients.

If the sum of the rectified voltages into IC 206 A is negative, current will flow from the output of IC 206 A into the meter. If that sum is positive, current will flow into the output of IC 206 A and therefore out of the meter. This action will cause

current flow through the meter and therefore a meter deflection.

4. Omni Lamp Circuitry—Two fixed 90° phase shift networks; R228 and C214, and R229 and C215; are connected to the outputs of the two summing amplifiers. The outputs of these networks have the same dependence upon the relative phase of the input signals as the summing amplifier outputs except that the amplitude response is shifted 90°. A negative (less than −.6 volts) output from IC 205 A permits CR 203 to conduct. This applies a negative voltage to IC 206 B which in turn causes Q202 and Q204 to conduct and the FROM light to turn on. If the output of IC 205 B is greater than .6 volts, IC 206 B will cause Q201, Q203, Q205, and the TO light to turn on. R235 and C218 (RC = 1 sec.) serve to eliminate 30 Hz ripple on the lights.

F. *Audio Amplifier Modulator*—The audio amplifier in the ALPHA/190 is used as a power amplifier to drive the speaker for COM or NAV receive and as a modulator for the transmitter during transmit. The switching required for the change of function is accomplished by RY1 the Transmit/Receive relay which is activated by the microphone switch.

The circuit of the audio amplifier consists of Q115, Q116, and Q121. The entire amplifier is biased and DC stabilized by a DC feedback loop comprising R155, R156, and R157. AC feedback is applied by R154 and C145 which determine the high frequency rolloff of the amplifier. The low frequency roll-off is controlled by the RC input networks.

When the radio is in the receive mode, the audio amplifier has three (3) inputs which may be in use simultaneously. One input is connected to the receiver output signal and is controlled by the volume control R140. The other two inputs are auxiliary inputs which may be connected to other systems in the airplane such as a marker beacon, ADF receiver, a second NAV/COM, etc. These inputs are designed to provide full audio output power with an input signal of 1 Vrms.

When the radio is being used as a transmitter, the audio amplifier has a single input from the microphone. Microphone bias is supplied by R146 from the regulated power supply. The output of the amplifier is taken from the collector of Q121 and routed to the transmitter through RY1. CR108 a 24 volt diode, is used to limit the positive modulation peaks and prevent over modulation of the RF carrier.

G. *Power Supply*—All circuitry within the ALPHA/190 which is sensitive to input voltage variations is operated from a regulated power supply consisting of IC 207 B, IC 207 A, Q207, and associated circuitry. CR 210 determines the reference voltage of IC 207 B. The output level of the regulator, 10 volts, is set by R255 which determines the other input of differential amplified IC 207 B. The differential amplifier applies regulating current to Q207. R251 supplies a portion of the load current, which allows Q207 to operate well within its dissipation characteristics.

CR 209, although not a direct part of the regulated supply, limits the maximum input to the supply to about 20 volts. This protects the supply from over-voltage spikes on the input line.

3-3. TEST EQUIPMENT REQUIRED

a. NAV/COM Generator or Simulator
   Tel-Instruments T-12A, ARC H-14, or equivalent
b. Sweep Generator covering at least 4 mHz ± .500 kHz, 22.5 mHz ± 1 mHz, 30.5 mHz ± 1 mHz, 118 mHz ± 15 mHz, and 73 mHz ± 5 mHz
   Heathkit IG-52 (Modified, Schematics available from GENAVE) or equivalent.
c. VTVM
   Any accurate instrument.
d. Frequency Counter usable to at least 159 mHz.
   Computer Measurements Corp. Model 616A
   Hewlett Packard Model 5254
e. Power Supply 14.00 VDC @ 3 amps, filtered
f. Oscilloscope, low frequency, DC coupled preferred
g. Audio Signal Generator
h. RF Signal Generator, 108 mHz to 128 mHz.
i. RF Power Meter, 0-5 watts
j. Dummy Detector
k. VOM

3-4. ALIGNMENT PROCEDURES

NOTE: Alignment procedures for the High Frequency Oscillator Doubler Filter, the Exciter Assembly, and the Transmitter Power Amplifier are not included since these are considered to be replaceable modules and not field repairable.

A. *General*—The receiver section of the ALPHA/190 employs several multi-element bandpass filters. These filters *MUST* be aligned using swept frequency techniques. Do not attempt to align any portion of the ALPHA/190 by "peaking" or other single frequency techniques.

increments of 1/8 to 1/4 turn are generally proper. The correct pattern will be symmetrical and will contain 5 distinct peaks. It is not possible to obtain the correct pattern if the radio is ON.

F. *First IF Alignment*

1. Connect the radio to the Alignment and test Setup shown in figure 3-4-2.
2. Turn the radio OFF.
3. Connect the sweep generator to the NAV antenna input jack using a 6 dB pad.
4. Connect the high impedance detector (figure 3-4-7 to the collector of Q103, the second mixer.
5. Turn the radio ON. Set the NAV/COM Switch to NAV. Set the mHz dial to 116. Set the NAV 4.1 mHz dial to a blank spot.
6. Set the sweep generator to Band D. Adjust the Frequency and Sweepwidth controls for a bandpass presentation on the oscilloscope. Keep the input signal level as low as possible.
7. Adjust the three slugs of T102 (*see figure 3-4-5*) for a bandpass approximately 1 mHz wide (see *figure 3-4-11*).
   Proper bandwidth and frequency can be checked by using the 0.1 mHz local oscillator of the radio in the 0 and 9 positions. The marker spikes generated by the oscillator in these positions should be positioned equally from the corners of the bandpass curve. A distortion in the passband will be present when the oscillator is operating.
8. Set the NAV/COM switch to COM. Set the COM mHz dial to 123. Set the COM to 0.1 mHz dial to a blank spot.
9. Repeat steps 6 and 7 and adjust T101 for the proper response (*See figure 3-4-12.*) The amplitude of the bandpass will generally be different than in the NAV position.

G. *4 mHz IF Alignment*

1. Connect the receiver to the Alignment and Test Setup shown in figure 3-4-2.
2. Connect an oscilloscope to the receiver detector output using the isolation network shown in figure 3-4-9. The detector output point is labeled X on the schematic.
3. Connect the sweep generator through a 10K resistor to the junction of R167, C120, and the tap of T102.
4. Connect the Omni Simulator to the NAV antenna input jack. Set the simulator up on a crystal controlled Omni frequency between 110 mHz and 117 mHz. Reduce all modulation to zero.
5. Turn on the receiver. Set the NAV/COM Switch to NAV. Tune the radio to the frequency selected in step 4.
6. Adjust the sweep generator frequency, width, and output controls for a bandpass presentation on the oscilloscope. Maintain the output well below clipping as indicated on the scope. The output level of the simulator should be adjusted to provide a marker for center band. Adjust both the cores in T103, T104, T105, and T106 for the pattern show in figures 3-4-13 and 3-4-14. Do not make large adjustments of any one core, 1/8 turn at a time is recommended. Several repeated adjustments of all 8 cores will generally be required before the bandpass is correct. Any attempt to align this IF strip by "peaking" or tuning it for a single peak response will seriously degrade the performance of the receiver. The bandpass MUST be similar to that shown in figures 3-4-13 and 3-4-14, or the alignment is not correct.
7. Set the NAV/COM Switch to COM. The bandpass shape should remain approximately the same. A slight adjustment in the bandpass shape may be necessary if the shape changes radically from NAV to COM. In this case, the shape of the bandpass in NAV is more important than in COM and if a compromise is necessary it should be biased toward a proper shape in NAV.

H. *Omni Alignment*

1. Connect the receiver to the Alignment and Test Setup shown in figure 4-4-1.
2. Set the Omni/Localizer Simulator to a convenient Omni frequency. Do not use a Localizer frequency. Adjust the RF output to 500 microvolts. Set the court selector for Omni modulation at 90°. Adjust the modulation of the carrier to the proper level.
3. Connect an ohmmeter between the yellow wire terminal and the gray wire terminal on R213 the OBC potentiometer (*see figure 4-4-12*). Set the ohm-meter to Rx1. Adjust the OBS control for a minimum resistance reading. The resistance will be less than 10 ohms. The minimum should occur within 1/2 degree of

90° indicated on the OBS dial. If it is further off than this, loosen the set screw in the collar of the OBS drum and set the dial to 90° with a minimum resistance reading on the ohmmeter. Tighten the set screw. Disconnect the ohmmeter.

4. Turn on the receiver. Set the NAV/COM Switch to NAV. Tune the radio to the frequency selected in step 2. Set the OBS dial on the receiver to 90°.
5. With no modulation, adjust R238 to center the needle on the Ohmi deviation meter, M1.
6. Delete the 9960 Hz modulation of the carrier. Adjust R222, AM BALANCE, for a centered meter (*see figure 3-4-5*).
7. Delete the 30 Hz modulation from the carrier and apply the 9960 Hz. Adjust R220, FM BALANCE, for a centered meter.
8. Rotate the OBS dial on the receiver to 270°. Readjust the FM BALANCE control for 1/2 of the indicated error if any.
9. Apply both 30 Hz and 9960 Hz modulation to the carrier. Set the receiver OBS dial to 90°. Adjust R201, PHASE CORRECT, for a centered meter. The "TO" light should be on.
10. Set the simulator course selecter to 270°. Readjust the PHASE CORRECT control for 1/2 of the indicated error if any. The "FROM" light should be on.
11. Set the simulator course selector and the receiver OBS dial to 0°. Adjust R206, PHASE SHIFT, for a centered meter. The "TO" light should be on.
12. Set the simulator course selector to 180°. Readjust the PHASE SHIFT control for 1/2 of the indicated error if any. The "FROM" light should be on.
13. Check the accuracy of the Omni at the cardinal points. The accuracy should be within 2°. An error greater than this at any one point can be reduced by "trimming" the PHASE CORRECT or PHASE SHIFT controls.

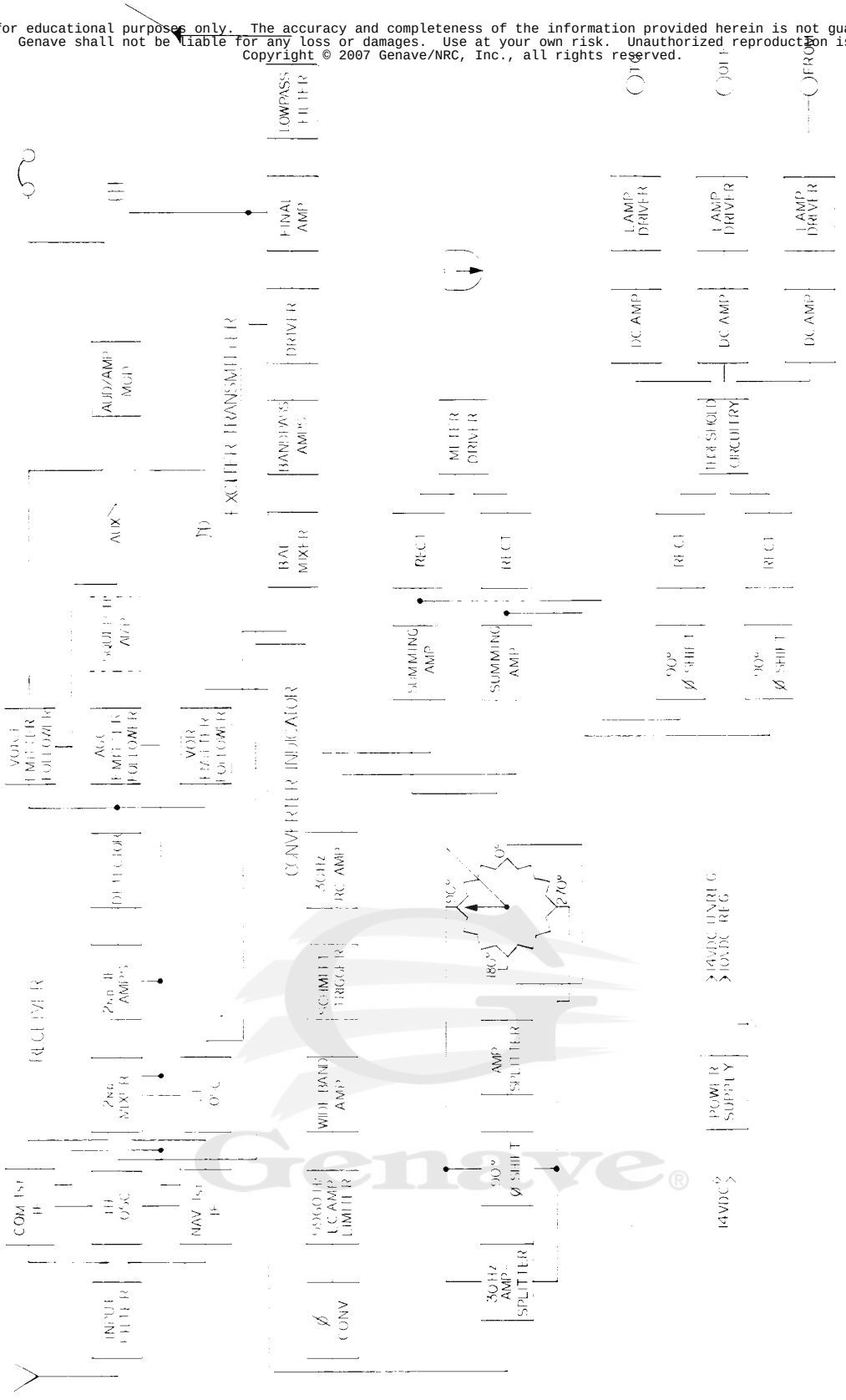


Figure 3-4-1

Model: ALPHA/190 **BLOCK DIAGRAM**

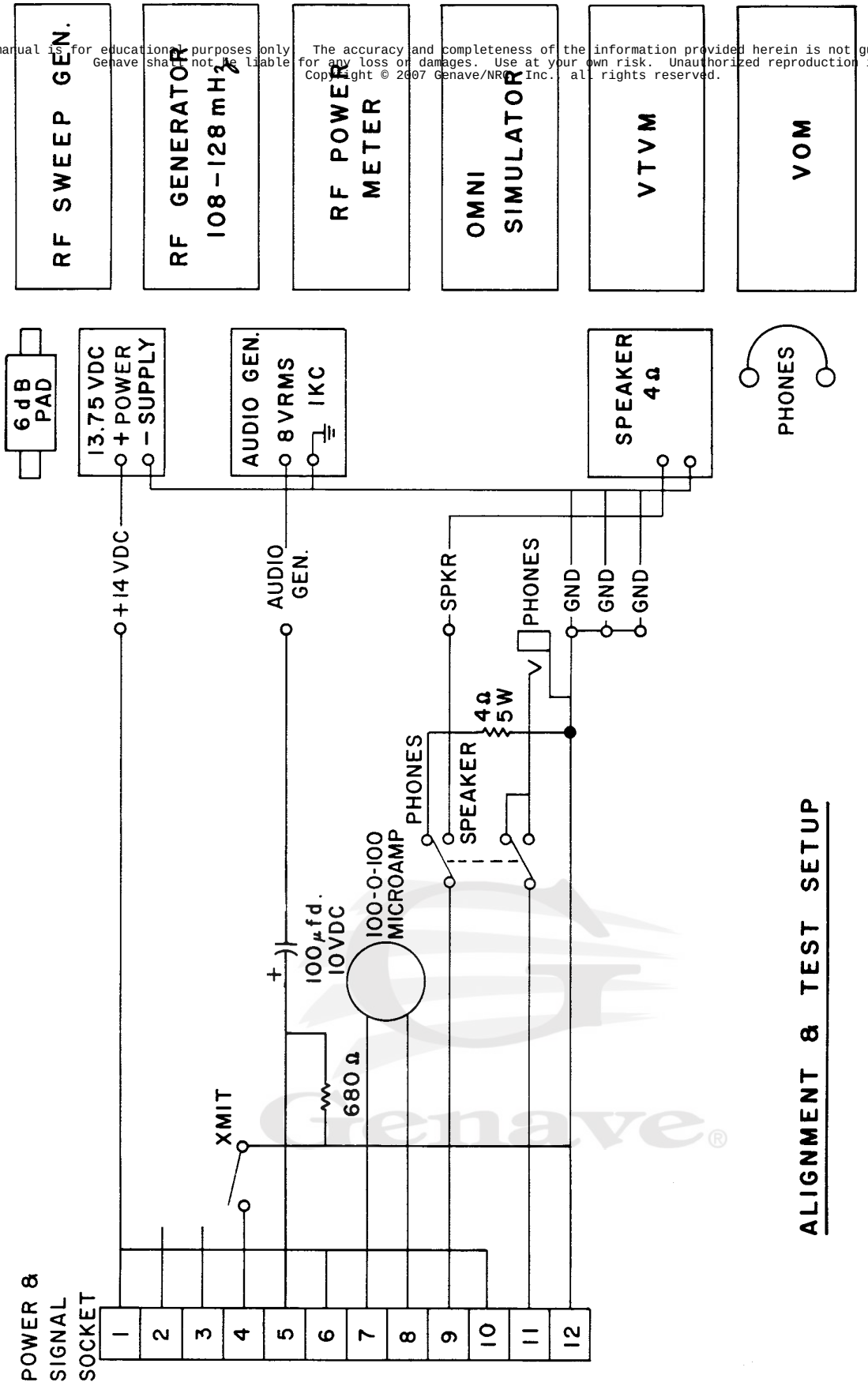


Figure 3-4-2

ALIGNMENT AND TEST SETUP

Model: ALPHA/190

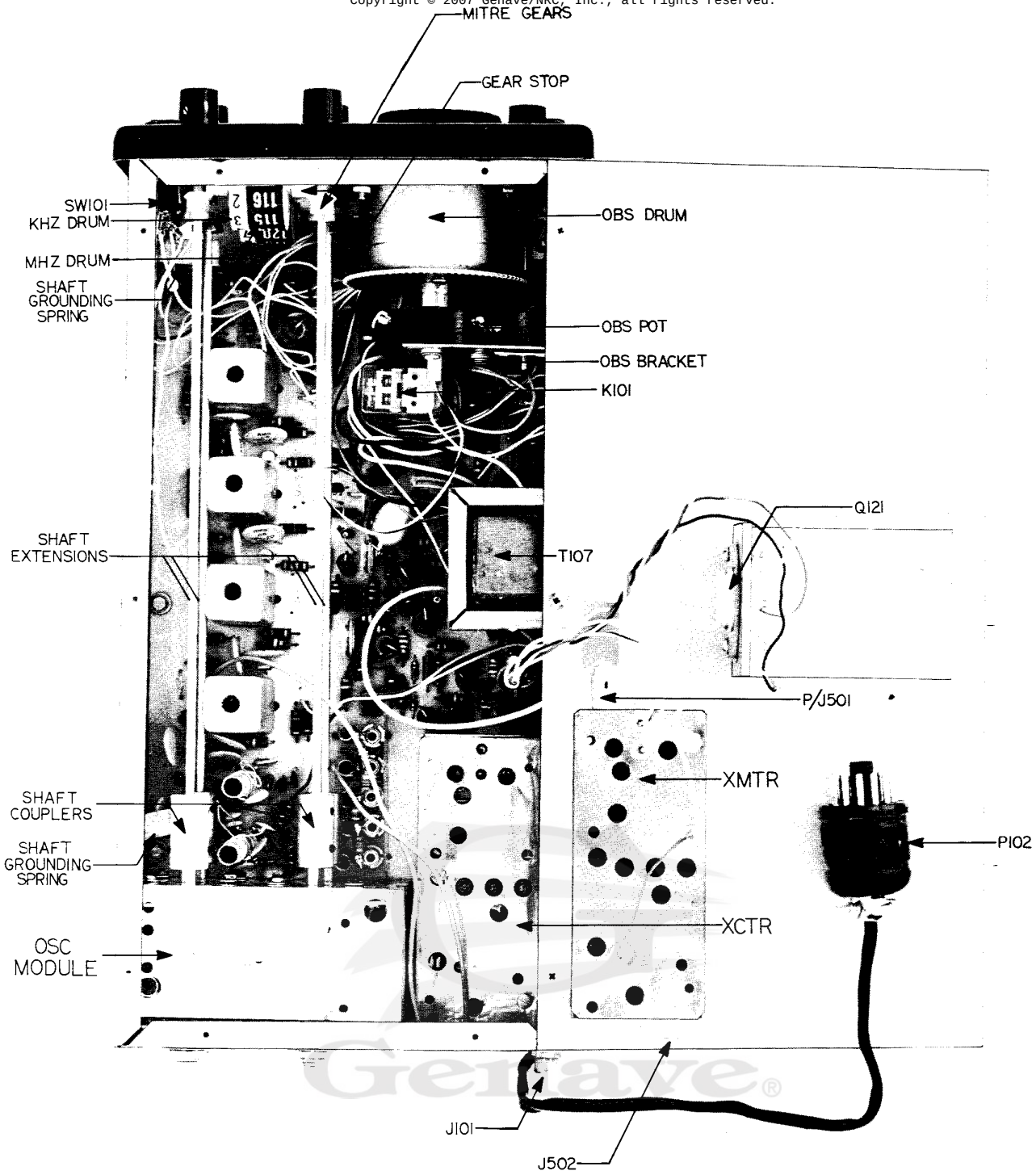


Figure 3-4-3

Model: ALPHA/190 **TOP VIEW**

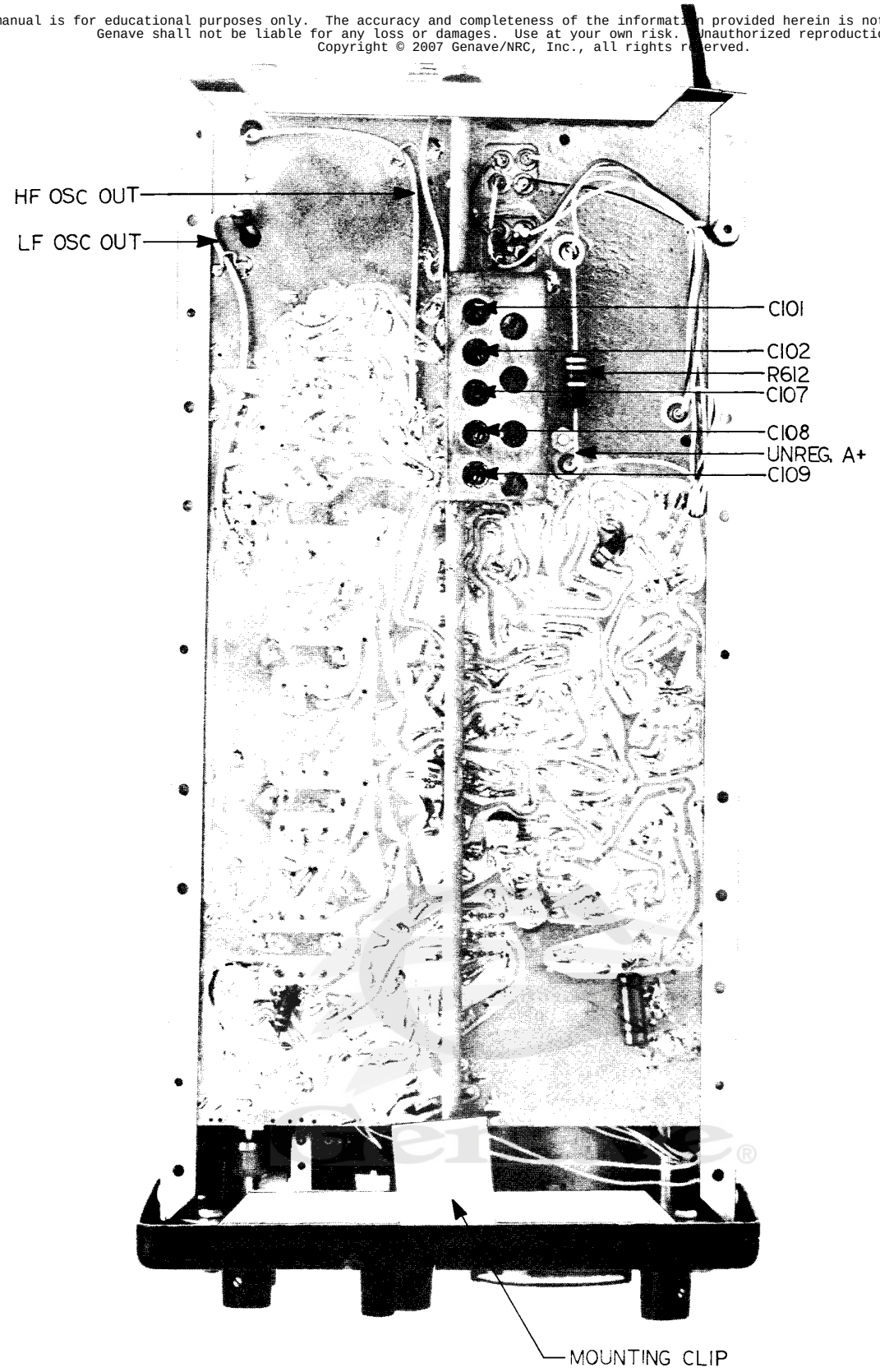


Figure 3-4-4

RADIO, BOTTOM VIEW

Model: ALPHA/190

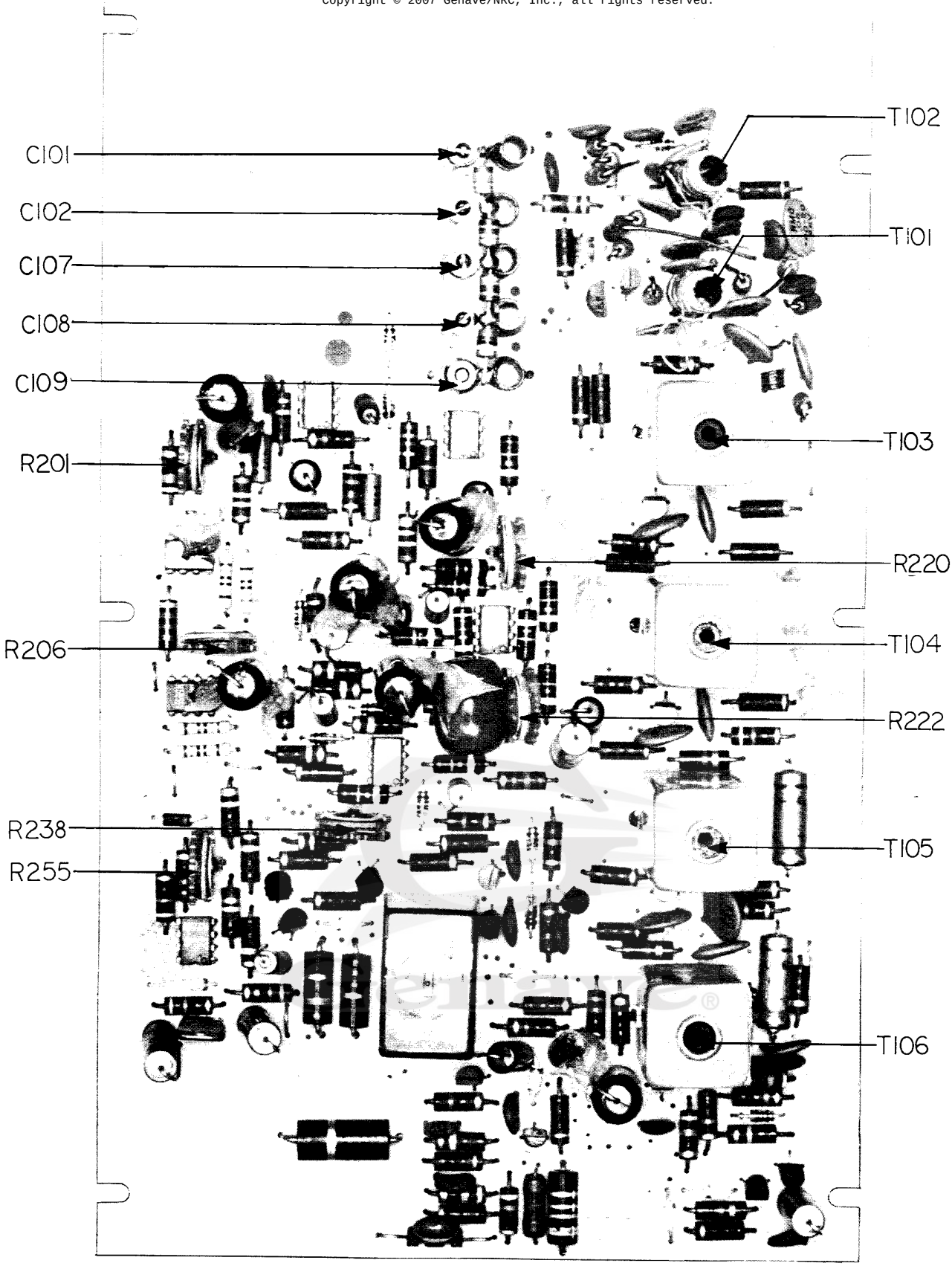


Figure 3-4-5

Figure 3-4-6 OSCILLATOR FREQUENCY TABLES

LOW FREQUENCY OSCILLATOR, ALL CONDITIONS

DIAL READING	CRYSTAL & OUTPUT FREQ.
0	26.940 mHz ± 1 kHz
1	26.840 mHz ± 1 kHz
2	26.740 mHz ± 1 kHz
3	26.640 mHz ± 1 kHz
4	26.540 mHz ± 1 kHz
5	26.440 mHz ± 1 kHz
6	26.340 mHz ± 1 kHz
7	26.240 mHz ± 1 kHz
8	26.140 mHz ± 1 kHz
9	26.040 mHz ± 1 kHz

HIGH FREQUENCY OSCILLATION

NAV RECEIVE

DIAL READING	CRYSTAL FREQ.	OSC. OUTPUT FREQ.
108	69.470 mHz ± 1.1 kHz	138.940 mHz ± 2.24 kHz
109	69.960 mHz ± 1.1 kHz	139.920 mHz ± 2.24 kHz
110	70.470 mHz ± 1.1 kHz	140.940 mHz ± 2.30 kHz
111	70.970 mHz ± 1.1 kHz	141.940 mHz ± 2.30 kHz
112	71.470 mHz ± 1.1 kHz	142.940 mHz ± 2.30 kHz
113	71.970 mHz ± 1.2 kHz	143.940 mHz ± 2.42 kHz
114	72.470 mHz ± 1.2 kHz	144.940 mHz ± 2.42 kHz
115	72.970 mHz ± 1.2 kHz	145.940 mHz ± 2.45 kHz
116	73.470 mHz ± 1.2 kHz	146.940 mHz ± 2.45 kHz
117	73.970 mHz ± 1.25 kHz	147.940 mHz ± 2.51 kHz

COM RECEIVE

DIAL READING	CRYSTAL FREQ.	OSC. OUTPUT FREQ.
118	70.470 mHz ± 1.25 kHz	140.940 mHz ± 2.54 kHz
119	70.970 mHz ± 1.25 kHz	141.940 mHz ± 2.54 kHz
120	71.470 mHz ± 1.25 kHz	142.940 mHz ± 2.54 kHz
121	71.970 mHz ± 1.25 kHz	143.940 mHz ± 2.54 kHz
122	72.470 mHz ± 1.25 kHz	144.940 mHz ± 2.54 kHz
123	72.970 mHz ± 1.25 kHz	145.940 mHz ± 2.54 kHz
124	73.470 mHz ± 1.25 kHz	146.940 mHz ± 2.54 kHz
125	73.970 mHz ± 1.375 kHz	147.940 mHz ± 2.75 kHz
126	74.470 mHz ± 1.375 kHz	148.940 mHz ± 2.75 kHz

COM TRANSMIT

DIAL READING	CRYSTAL FREQ.	OSC. OUTPUT FREQ.
118	72.470 mHz ± 1.25 kHz	144.940 mHz ± 2.54 kHz
119	72.970 mHz ± 1.25 kHz	145.940 mHz ± 2.54 kHz
120	734.70 mHz ± 1.25 kHz	146.940 mHz ± 2.54 kHz
121	73.970 mHz ± 1.25 kHz	147.940 mHz ± 2.54 kHz
122	74.470 mHz ± 1.25 kHz	148.940 mHz ± 2.54 kHz
123	74.970 mHz ± 1.25 kHz	149.940 mHz ± 2.54 kHz
124	75.470 mHz ± 1.25 kHz	150.940 mHz ± 2.54 kHz
125	75.970 mHz ± 1.375 kHz	151.940 mHz ± 2.75 kHz
126	76.470 mHz ± 1.375 kHz	152.940 mHz ± 2.75 kHz

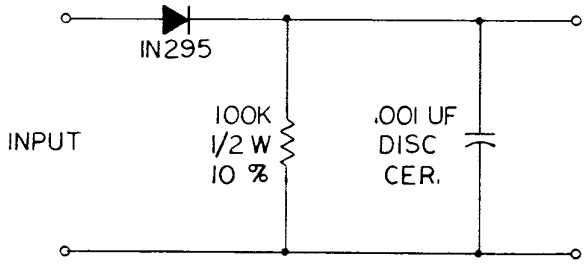


Figure 3-4-7
HIGH IMPEDANCE DETECTOR

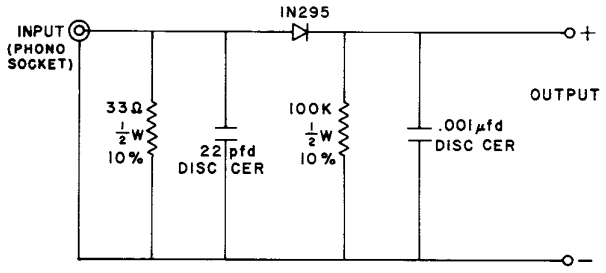


Figure 3-4-8
LOW IMPEDANCE DETECTOR

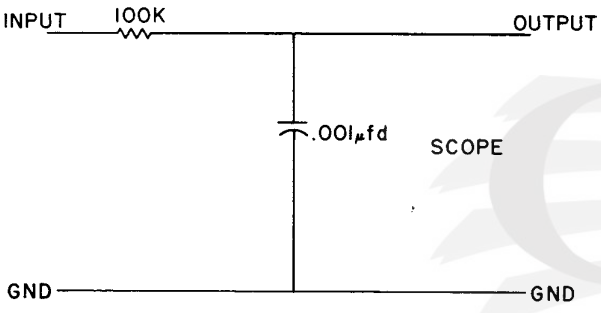


Figure 3-4-9
SCOPE ISOLATION NETWORK

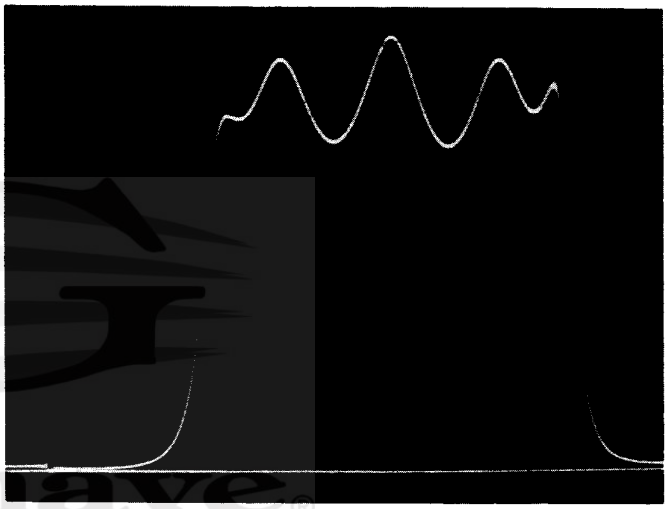


Figure 3-4-10
INPUT FILTER PASSBAND

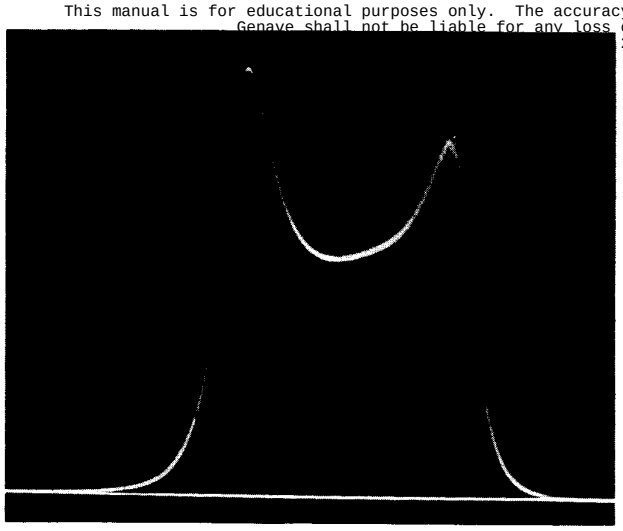


Figure 3-4-11
NAV 1st IF PASSBAND

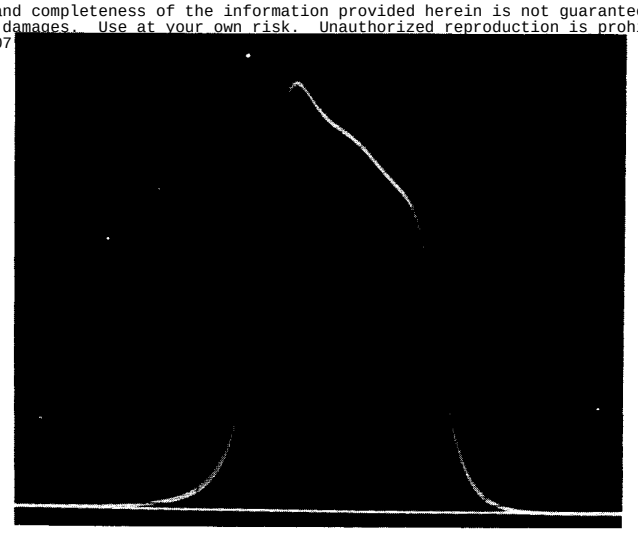


Figure 3-4-12
COM 1st IF PASSBAND

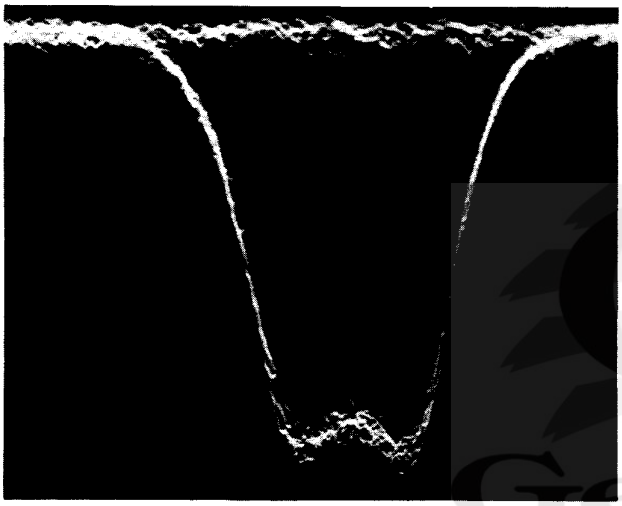


Figure 3-4-13
4 MHz PASSBAND (WITHOUT MARKER)

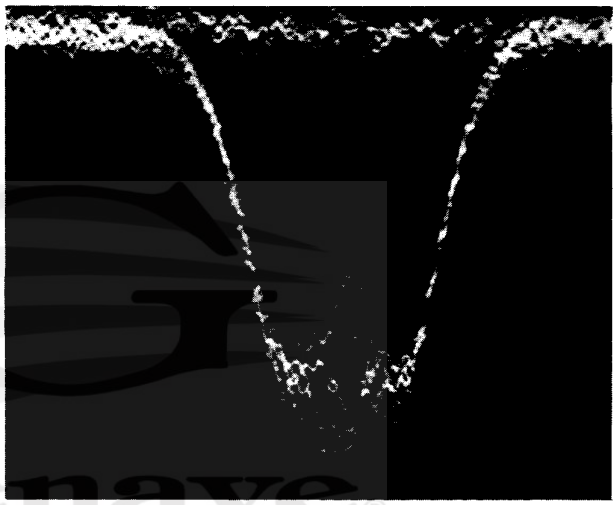


Figure 3-4-14
4 MHz PASSBAND (WITH MARKER)

3-5. TROUBLESHOOTING INFORMATION

I. General

It is assumed that the technician performing any troubleshooting or repair work on the unit is familiar with the principles of aviation electronics and the procedures of troubleshooting electronic equipment. It is further assumed that he has a working knowledge of transistorized circuitry and the use of all the normal test equipment found in the field.

The primary aids to troubleshooting the radio are the DC Voltage Measurements given in Table 3-5-1, the Omni Waveform Photographs (Figures 3-5-2 through 3-5-8), the Schematic Diagrams (Figures 3-5-9 through 3-5-13), and the Mainboard Parts/Track Map (Figure 3-5-14).

The above aids will locate the problem area in almost all cases. In some instances, however, the problem may be of such a nature that other approaches must be found. Table 3-5-15 lists a few such problems, and indicates possible causes and solutions.

II. Table of Figures

DC VOLTAGE MEASUREMENTS

All voltages shown in this table must be measured with a VTVM. The input voltage to the radio should be set to 13.75 VDC and the 10.0 VDC power supply should be set to 10.00 VDC. A variation of ±20% of the measured voltages from those listed may be considered normal.

Ref. No.	Control Mode Setting	No Signal Condition			500 microvolt signal on appropriate frequency with omni "TO" modulation except as noted.			Notes
		E	B	C	E	B	C	
Q101	Nav	4.7	1.9	8.5	4.7	0.7	8.6	
Q101	Com	1.5	2.0	8.6	0.2	0.8	8.7	1300 Hz, 30% Modulation
Q102	Nav	1.4	1.9	8.5	0.2	0.7	8.6	
Q102	Com	4.8	2.0	8.6	4.9	0.8	8.7	1300 Hz, 30% Modulation
Q103	V CW	1.2	1.9	8.6	0.1	0.7	9.8	1300 Hz, 30% Modulation
Q104	V CW	1.3	1.8	8.7	0.1	0.7	9.8	
Q105	V CW	2.3	3.0	9.5	2.3	3.0	9.5	
Q106*	V CW	2.6	3.3	9.3	2.6	3.3	9.3	*10 K from B to C for Osc.
Q108	V CW	2.0	2.6	9.2	0.7	1.3	9.9	
Q109	Nav V CW	3.4	2.7	0	1.9	1.3	0	
Q109	Com V CW	3.5	2.8	0	1.9	1.3	0	1300 Hz, 30% Modulation
Q110	Nav V CW	2.2	2.8	10.0	1.3	1.9	10.0	
Q110	Nav C CCW	2.5	3.1	10.0	2.4	3.1	10.0	
Q110	Com V CW	2.3	2.9	10.0	1.3	1.9	10.0	1300 Hz, 30% Modulation
Q110	Com V CCW	2.5	3.1	10.0	2.5	3.1	10.0	1300 Hz, 30% Modulation
Q201		5.0	5.0	10.0	5.0	5.8	5.1	TO Signal
Q202		5.0	5.0	0.1	5.0	4.3	5.0	FROM Signal
Q203		5.7	5.1	0.8	5.7	5.1	0.8	TO Signal
Q204		0	0.1	13.8	0	0.1	13.8	FROM Signal
Q205		0	0.1	13.8	0	0.8	0.1	TO Signal
Q206		0	0.7	0.2	0	0.2	13.8	Either TO or FROM
Q207		12.9	12.1	10.0	—	—	—	
Q115	V CCW	0	0.6	2.1	—	—	—	
Q116	V CCW	1.5	2.1	11.3	—	—	—	
Q121	V CCW	0.9	1.5	13.8	—	—	—	

Figure 3-5-1 No Signal, except as noted

IC Number	Pins	1	2	3	5	6	7	Notes
IC 201		5.0	5.0	5.0	5.0	5.0	5.0	
IC 202		5.0	5.0	4.9	5.0	5.0	5.0	
IC 203		6.3	5.0	5.2	5.0	5.0	5.0	
IC 204		5.0	5.0	5.0	5.0	5.0	5.1	
IC 205		5.0	5.0	5.0	5.0	5.0	5.0	
IC 206A		5.0	5.0	4.9	....	....	....	Centered Needle
IC 206B		....	....	....	5.2	5.3	8.2	TO Signal
IC 206B		....	....	....	4.7	4.7	2.1	FROM Signal
IC 207		5.0	5.0	4.9	5.4	5.4	12.1	

Figure 3-5-1

DC VOLTAGE MEASUREMENTS **Model: ALPHA/190**

Omni Waveform Photographs

The OMNI waveform photographs were taken under the following conditions:

Frequency: Any Omni channel
RF Input: 500 microvolts
Modulation: Standard Omni 0°
OBS Pot: Set at 0°
Horizontal Sweep: 30° Hz reference modulation from Omni generator

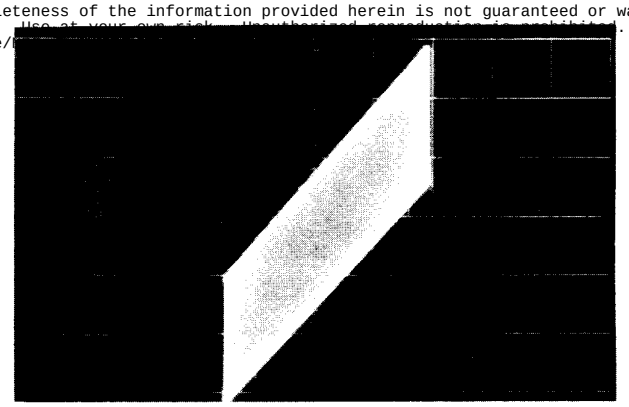


Figure 3-5-2
OMNI INPUT 0°

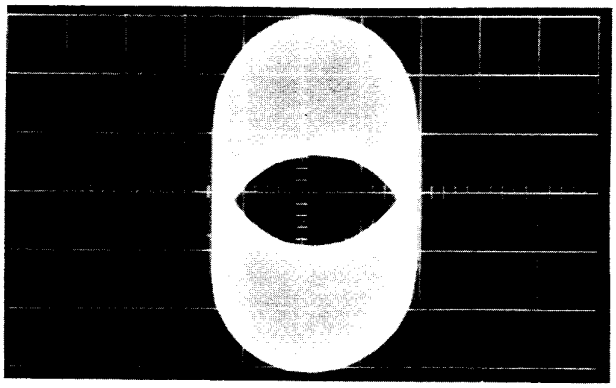


Figure 3-5-3
OMNI INPUT 90°

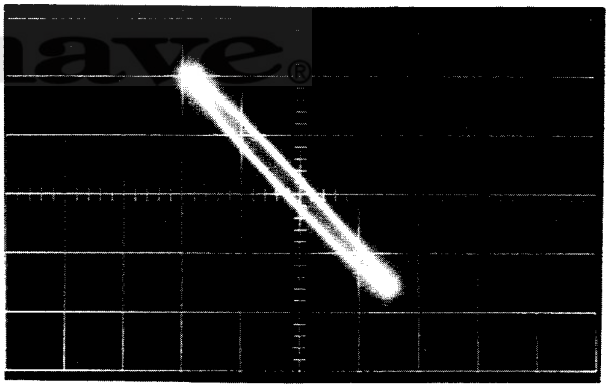


Figure 3-5-4
OUTPUT IC 201A

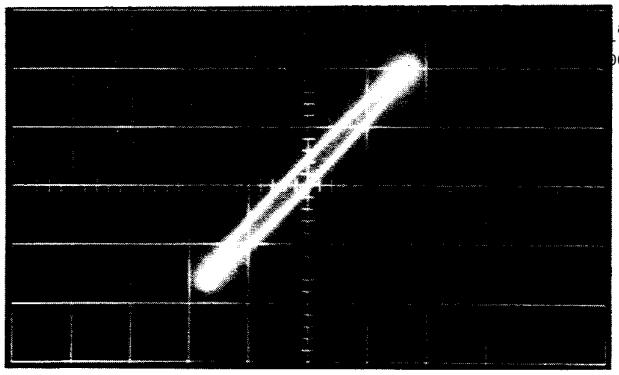


Figure 3-5-5
OUTPUT IC 201B

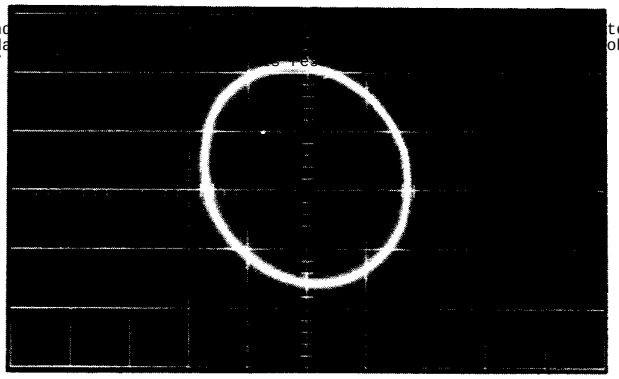


Figure 3-5-6
OUTPUT IC 202A

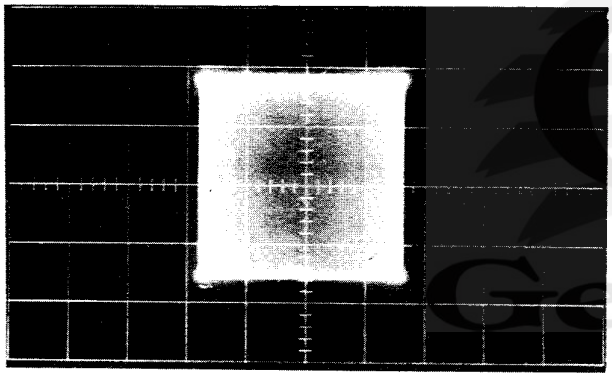


Figure 3-5-7
OUTPUT IC 203B

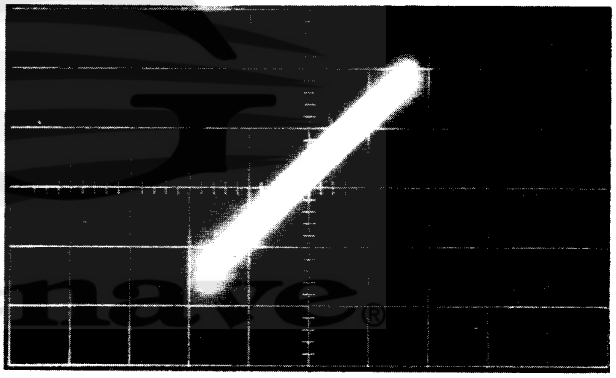
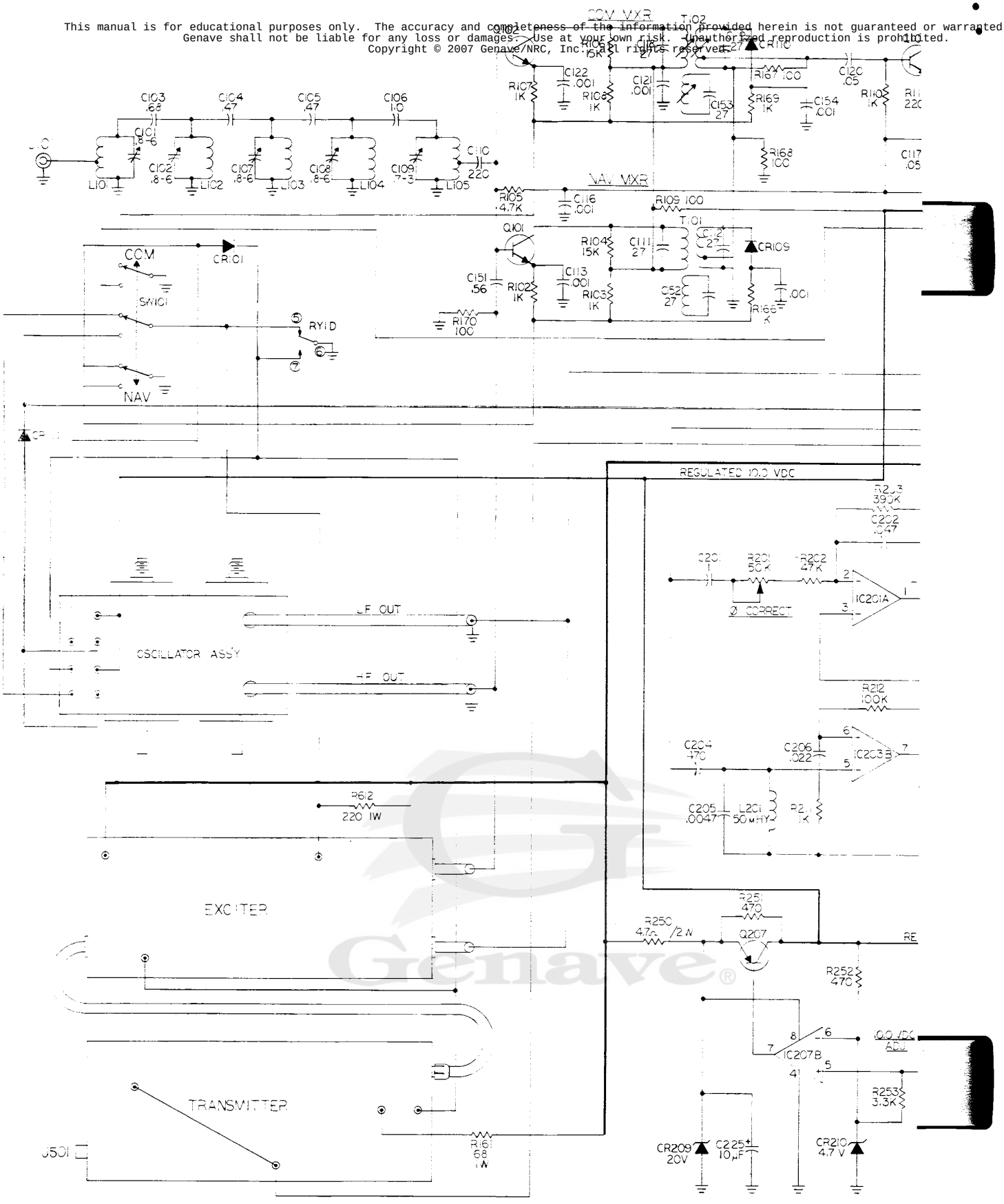
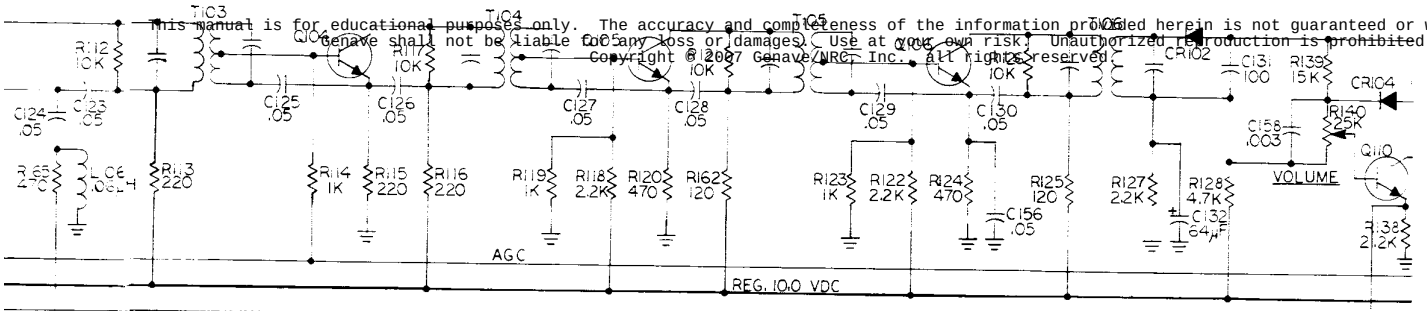


Figure 3-5-8
OUTPUT IC 204B

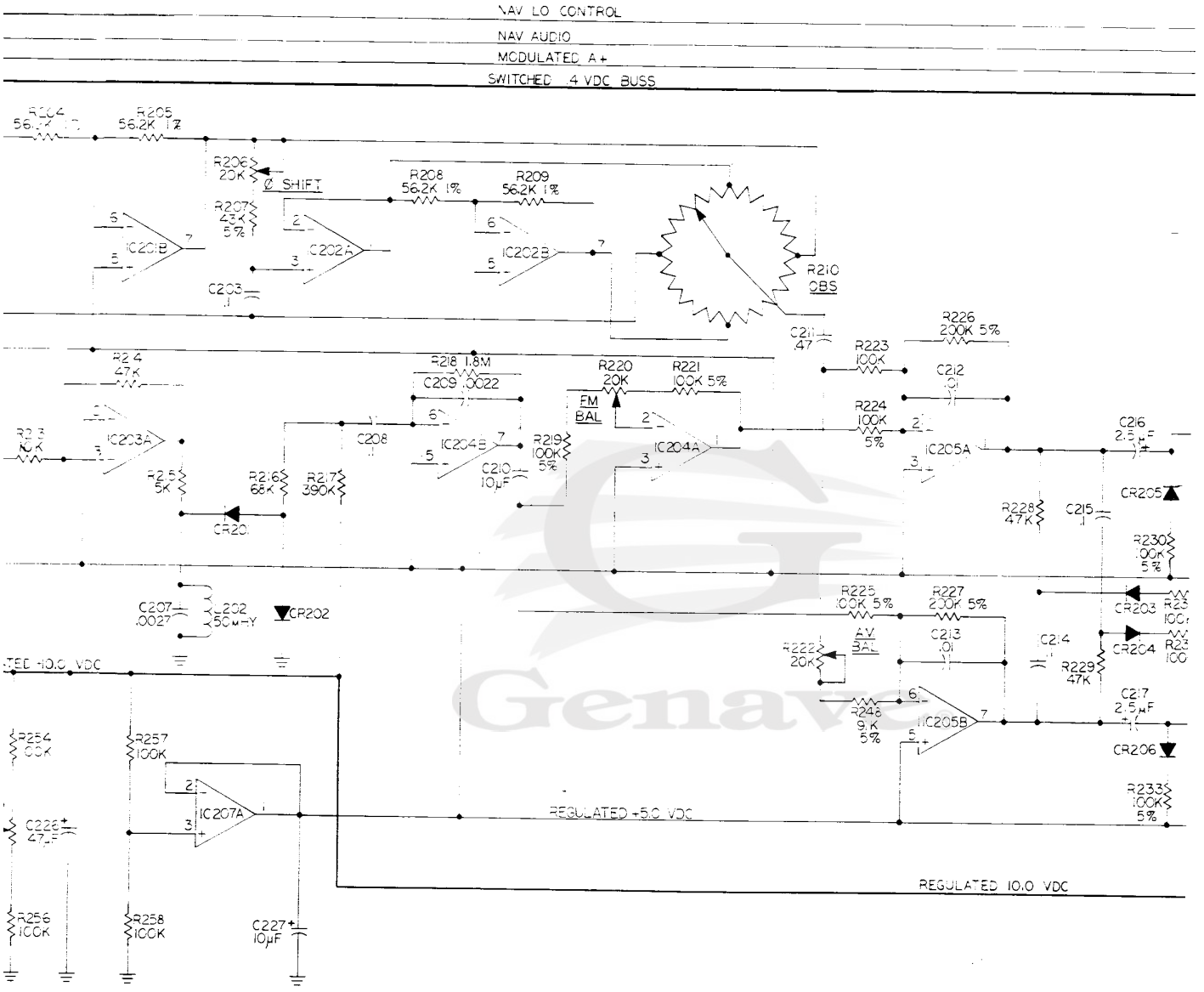


Model: ALPHA/190



UNLESS OTHERWISE NOTED:

1. ALL RESISTANCES ARE IN OHMS
2. ALL CAPACITANCES GREATER THAN 1.0 ARE IN PFD
3. ALL CAPACITANCES LESS THAN 1.0 ARE IN MFD.
4. PARTS MARKED WITH * ARE OPTIONAL



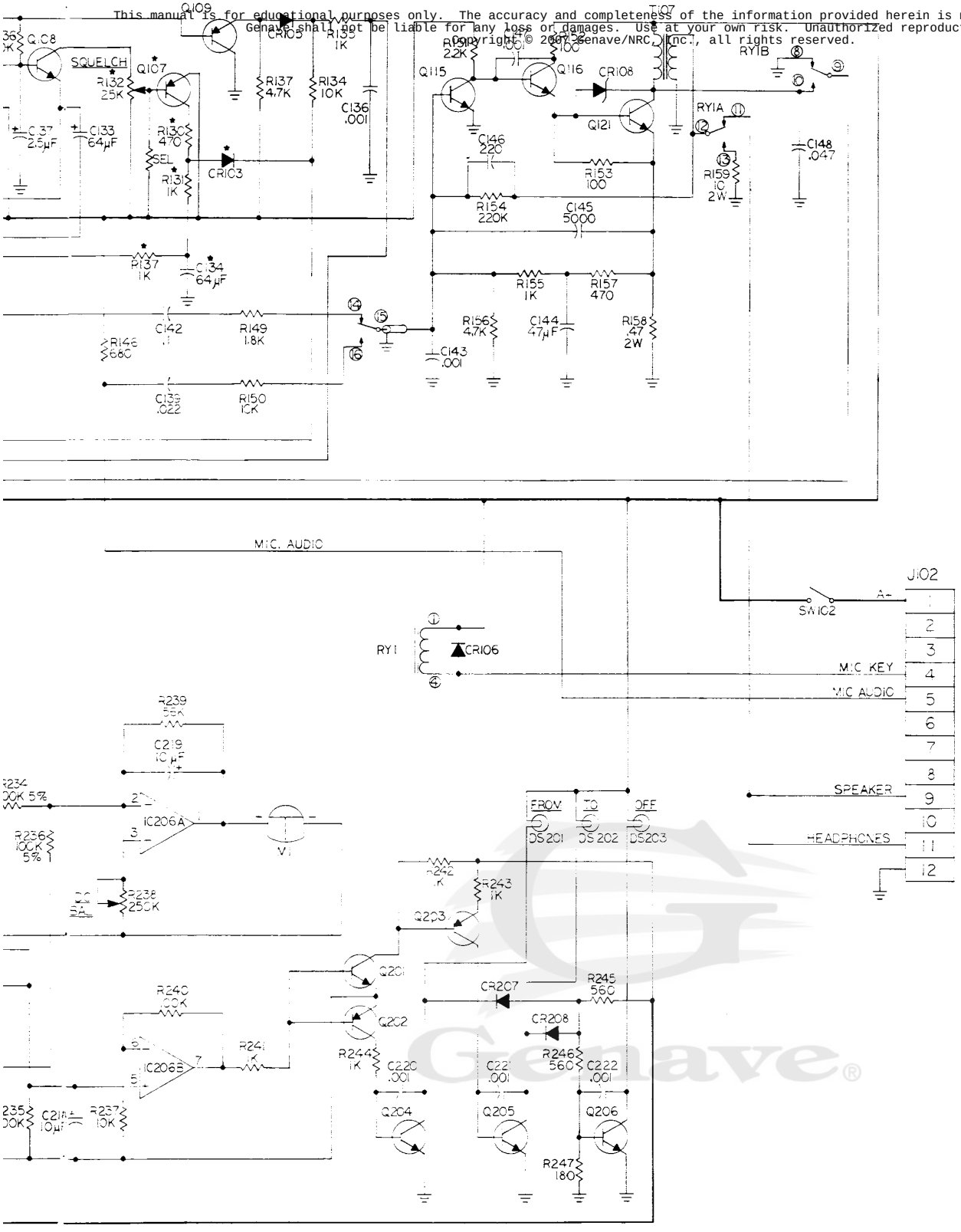


Figure 3-5-9
ALPHA/190 MAINBOARD SCHEMATIC

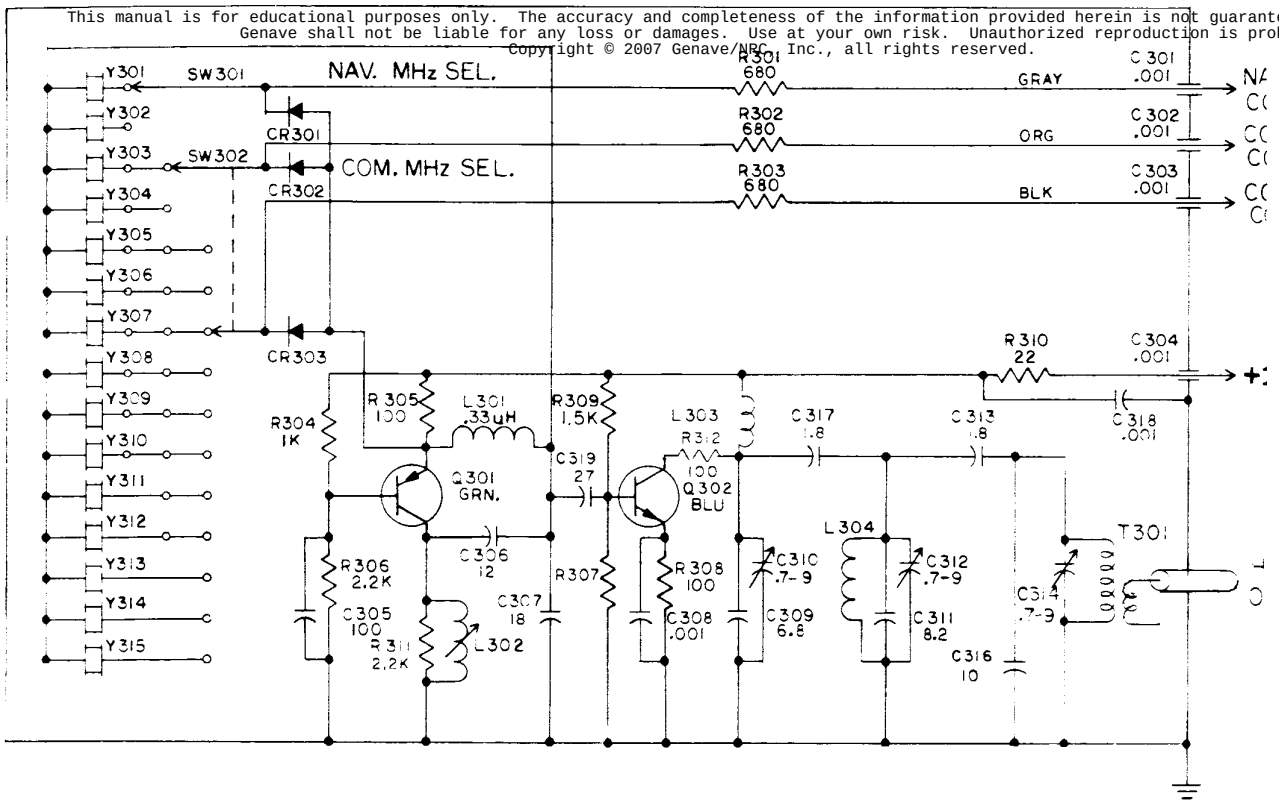


Figure 3-5-10
HF OSCILLATOR SCHEMATIC

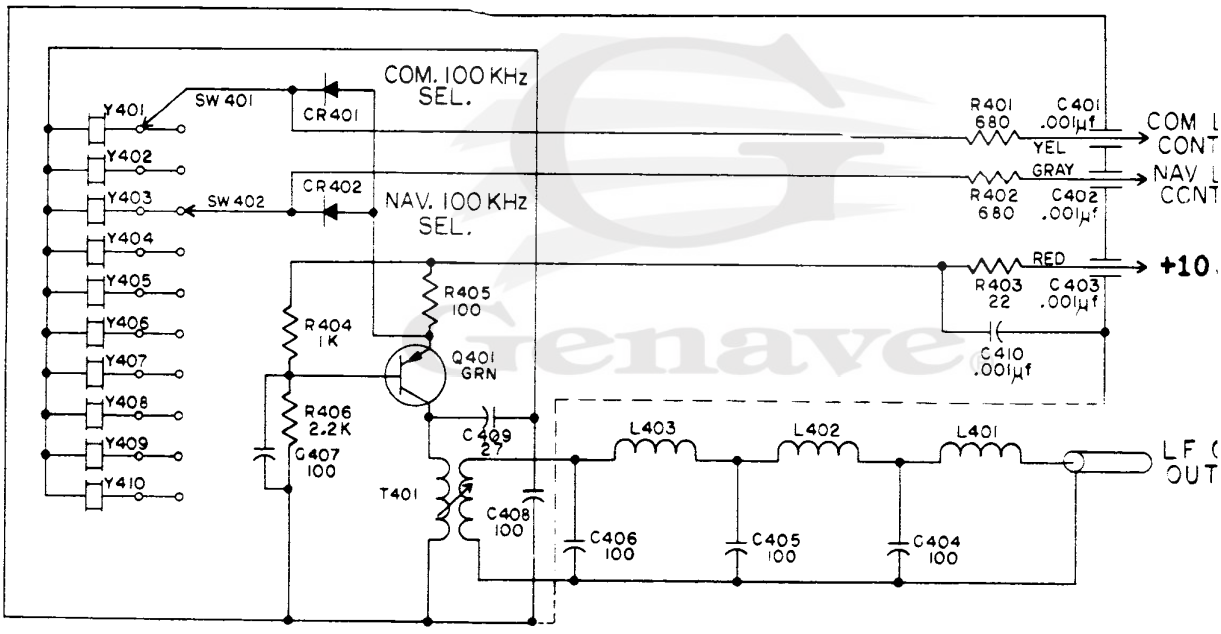
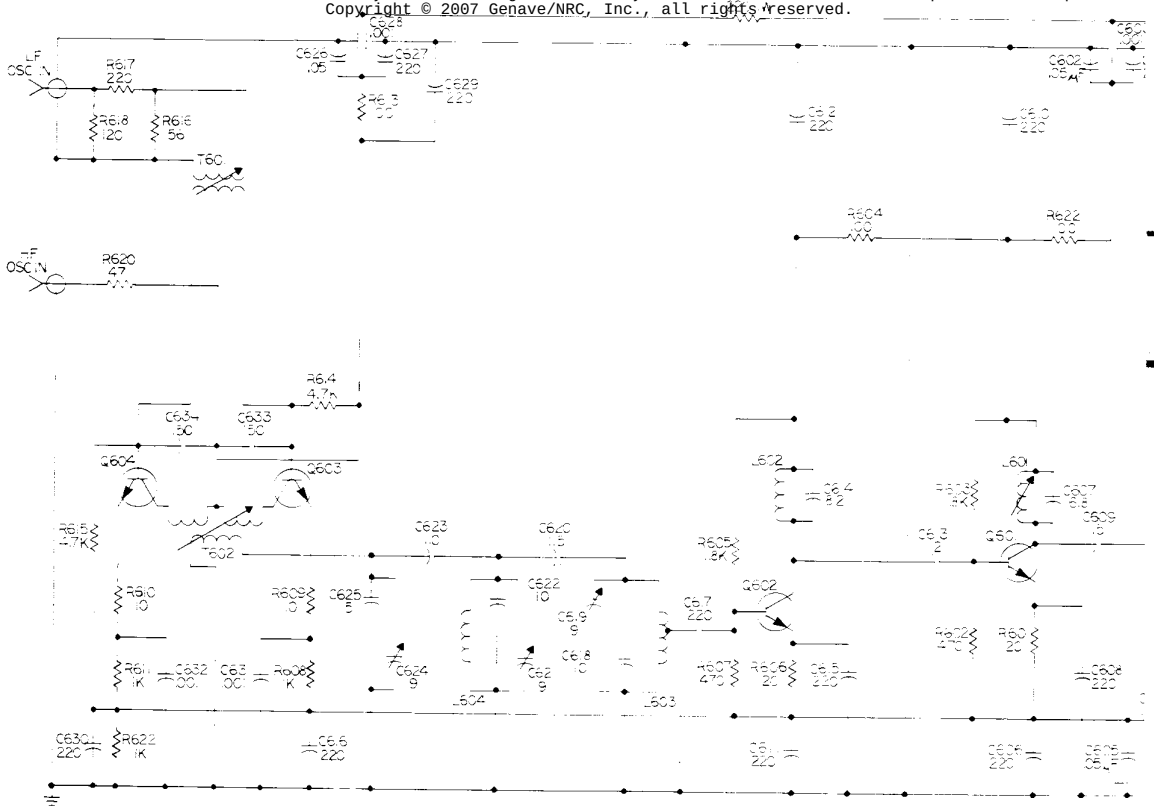
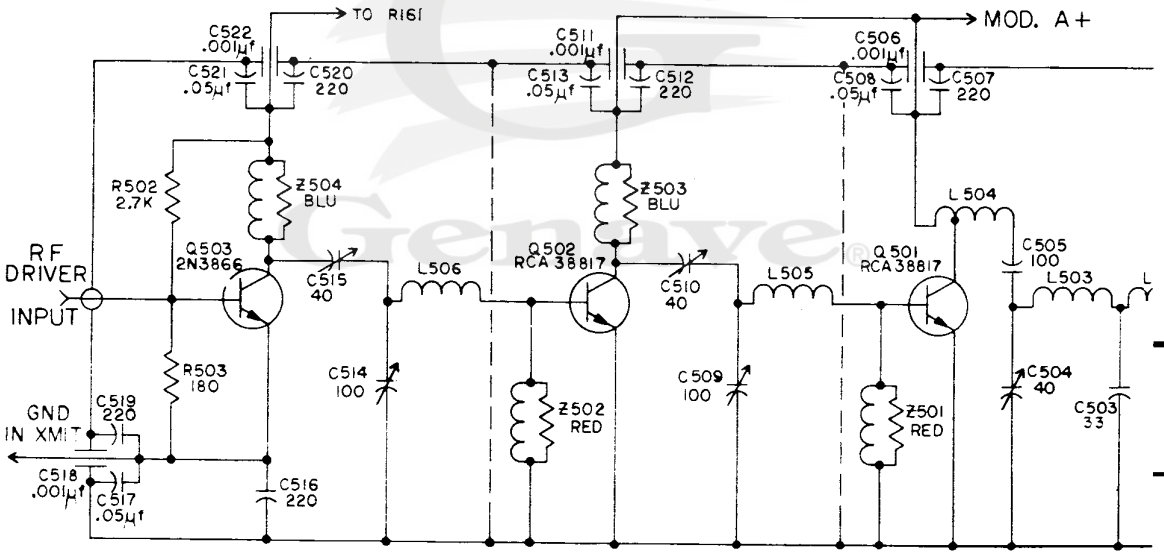


Figure 3-5-11
LF OSCILLATOR SCHEMATIC





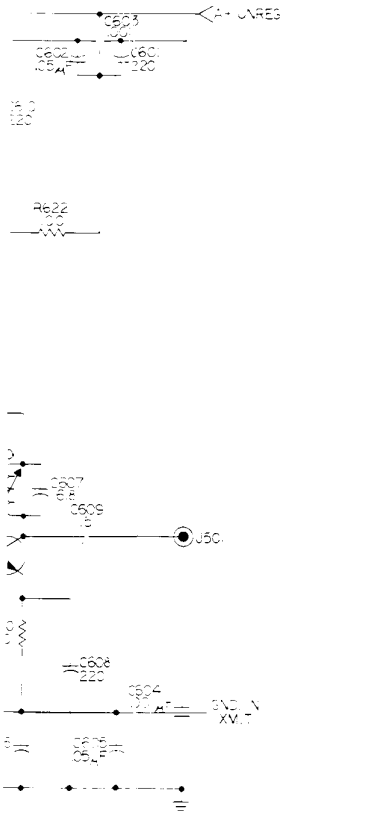


Figure 3-5-12
EXCITER SCHEMATIC

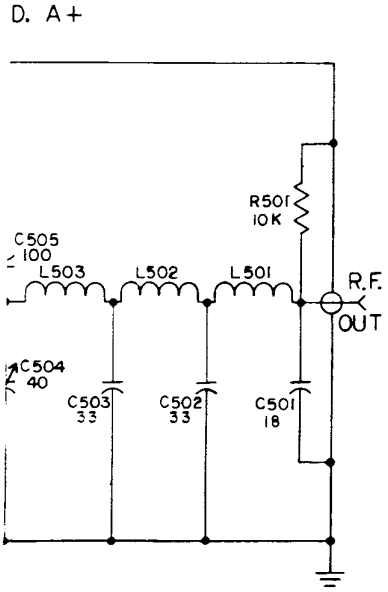


Figure 3-5-13
TRANSMITTER SCHEMATIC

Model:

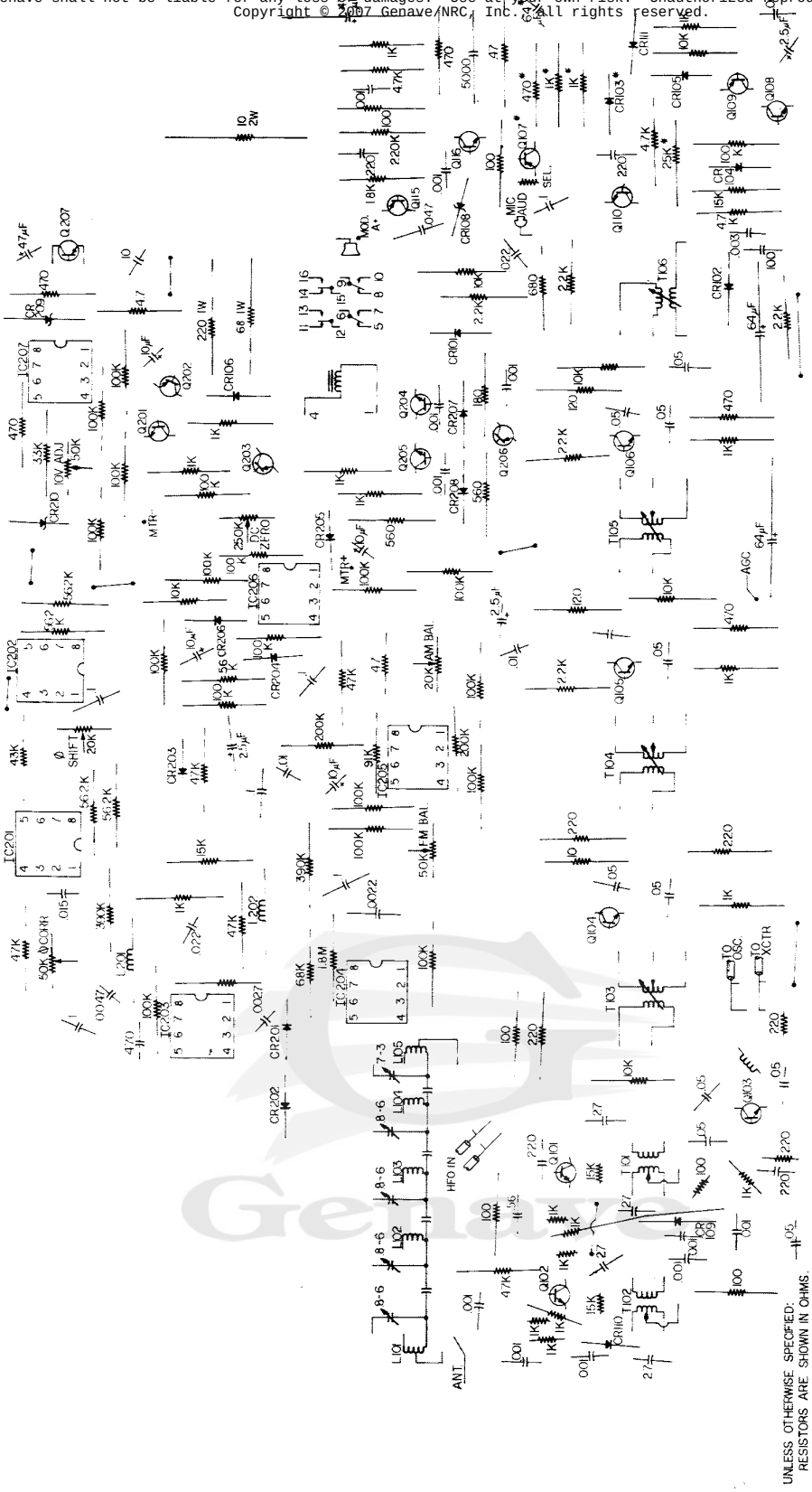


Figure 3-5-14
MAINBOARD PARTS/TRACK MAP

Model: ALPHA/190

Figure 3-5-15
SELECTED TROUBLESHOOTING PROBLEMS

PROBLEM	POSSIBLE SOLUTION
Unit inoperative on some channels, operative on others.	Check RF output of both oscillators using the high impedance detector and VTVM or VOM. Retune oscillators if necessary.
Extreme insensitivity on all channels.	Check all coaxial cables & input connector for opens or shorts. Check that antenna(s) are properly connected.
Unit inoperative in one mode, operative in another.	Check switching signals to oscillator assembly.
Severe changes in Omni accuracy with changes in RF input level.	Check for proper grounding signal to C133 from Nav/Com switch. Check or replace C133.
Transmitter inoperative.	Check RF output of both oscillators using the high impedance detector and a VTVM. Check output of exciter assembly using the Low Impedance Detector and VTVM. Output should be 0.6 VDC or greater from exciter.

Figure 3-5-15
SELECTED TROUBLESHOOTING PROBLEMS

A. *Front Panel Removal*

Removing the front panel (trim panel) allows access to the volume control, frequency readouts, course deviation indicator, indicator lamps, and the Nav/Com switch.

1. Remove all of the control knobs from their shafts.
2. Remove the four (4) Phillips head machine screws from the corners of the front panel using a screwdriver and open end wrench.
3. Collect the four (4) spacers, nuts, and lockwashers for reassembly.
4. Pull the front panel off over the control shafts being careful not to damage the indicator lamps or their leads.
5. To reassemble reverse the above steps.

B. *Dial and Gear Servicing*

The following procedure is used to gain access to the frequency selector dials and gear train without major disassembly of the unit.

1. Remove the four (4) frequency selector knobs from the front panel.
2. Loosen the bushing setscrew on the rear of the OBS drum.
3. Disconnect meter leads and allow about three (3) inches of slack.
4. Remove the four sheet metal screws (2 per side) from the subpanel.
5. Pull the subpanel straight out over the switch shafts.
6. The dial bearing assembly is now accessible by sliding them off the switch shafts.
7. To reassemble reverse the above steps. The OBS pot must be realigned as described in the Alignment Procedure. Be sure to check to insure proper operation of frequency selectors and readouts upon reassembly.

C. *OBS Pot Removal and Replacement*

1. Remove front panel as described in Part A.
2. Disconnect leads from meter, noting their locations for reassembly.
3. Loosen bushing setscrew on rear of OBS drum and remove OBS drum.
4. Remove the three (3) 3/16″ hex head screws from the OBS pot using an open end wrench.
5. Remove the five (5) wires from the OBS pot, noting their position for reassembly.

D. *Exciter Module Removal and Installation*

1. From the bottom of the mainboard unsolder the leads from the exciter feedthroughs noting their position for reassembly.
2. Remove the two (2) exciter mounting screws.
3. Unsolder and remove the two exciter input cables from the mainboard. The shortest cable is the high frequency input.
4. Disconnect the exciter output cable.
5. To reassemble reverse the above steps. Be sure to trim excess leads off the feedthrough prior to resoldering leads.

E. *Transmitter Module Removal and Installation*

1. Unsolder the leads from the feedthroughs noting their positions for reassembly.
2. Remove the four screws from the transmitter.
3. Disconnect the cable from the exciter.
4. To reassemble, reverse the above steps. Be sure to trim excess leads off the feedthroughs prior to resoldering leads.

F. *Oscillator Module Removal and Installation*

1. Loosen the shaft couplers on all four oscillator shafts.
2. Unsolder the ground connection between the oscillator module case and input filter shield.
3. Unsolder and remove wires from oscillator assembly feedthroughs on the bottom of mainboard noting their positions for reassembly.
4. Unsolder and remove the two coaxial cable oscillator outputs from the mainboard. The shortest cable is the high frequency output.
5. Remove the four switch mounting nuts from the rear panel.
6. Remove the four rear panel mounting screws and remove the rear panel.
7. The oscillator assembly can now be removed.
8. To reassemble reverse the above steps.

SECTION IV

A/190 PARTS LIST

Ref. No.	Genave Part No.	Description
		CAPACITORS
C101	1570004	Trimmer, 0.8-6 pfd
C102	1570004	Trimmer, 0.8-6 pfd
C103	1510009	NPO Gimmick, .68 pfd, ±10%
C104	1510007	NPO Gimmick, .47 pfd, ±10%
C105	1510009	NPO Gimmick, .68 pfd, ±10%
C106	1510011	NPO Gimmick, 1.2 pfd, ±10%
C107	1570004	Trimmer, 0.8-6 pfd
C108	1570004	Trimmer, 0.8-6 pfd
C109	1570003	Trimmer, 0.7-3 pfd
C110	1520033	Z5F Disc, 220 pf, ±10%
C111	1520012	NPO Disc, 27 pf, ±10%
C112	1520012	NPO Disc, 27 pf, ±10%
C113	1520048	X5R Disc, .001 mfd, ±10%
C114	1520050	Z5F Disc, .003 mfd, ±20%
C115	1520048	X5R Disc, .001 mfd, ±10%
C116	1520048	X5R Disc, .001 mfd, ±10%
C117	1520054	25V, Disc, .05 mfd, +80%−20%
C118	1520012	NPO Disc, 27 pfd, ±10%
C119	1520012	NPO Disc, 27 pfd, ±10%
C120	1520054	25V, Disc, .05 mfd, +80%−20%
C121	1520048	X5R Disc, .001 mfd, ±10%
C122	1520048	X5R Disc, .001 mfd, ±10%
C123	1520054	25V, Disc, .05 mfd, ±80%+20%
C124	1520054	25V, Disc, .05 mfd, +80%−20%
C125	1520054	25V, Disc, .05 mfd, +80%−20%
C126	1520054	25V, Disc, .05 mfd, +80%−20%
C127	1520054	25V, Disc, .05 mfd, +80%−20%
C128	1520054	25V, Disc, .05 mfd, +80%−20%
C129	1520054	25V, Disc, .05 mfd, +80%−20%
C130	1520054	25V, Disc, .05 mfd, +80%−20%
C131	1520024	N1500 Disc, 100 pfd, ±10%
C132	1540022	Electrolytic, 64 mfd, 10V
C133	1540022	Electrolytic, 64 mfd, 10V
C134	1540022	Electrolytic, 654 mfd, 10V
C135	1520033	X5F Disc, 220 pfd, ±10%
C136	1520048	X5R Disc, .001 mfd, +10V
C137	1540005	Electrolytic, 2.5 mfd, 16V
C138		Unassigned
C139	1500024	Mylar, .022 mfd, 10V
C140		Unassigned
C141		Unassigned
C142	1500035	Mylar, .1 mfd, 10V
C143	1520048	X5R Disc, .001 mfd, ±10%
C144	1540022	Electrolytic, 64 mfd, 10V
C145	1500015	Mylar, .0056 mfd, ±10%
C146	1520033	Z5F Disc, 220 pfd, ±10%
C147	1520048	X5R Disc, .001 mfd, ±10%
C148	1520054	25V, Disc, .05 mfd, +80%−20%
C149		Unassigned
C150		Unassigned
C151	1510008	NPO Gimmick, .56 pfd, ±10%
C152	1520012	NPO Disc, 27 pfd, ±10%
C153	1520012	NPO Disc, 27 pfd, ±10%
C154	1520048	X5R Disc, .001 mfd, ±10%
C155		Unassigned
C156	1520034	25V, Disc, .05 mfd, +80%−20%
C201	1500035	Mylar, .1 mfd, 10V
C202	1500020	Mylar, .015 mfd
C203	1500035	Mylar, .1 mfd, 10V
C204	1520040	Z5F Disc, 470 pfd, ±10%
C205	1500013	Mylar, .0047 mfd, 10V
C206	1500024	Mylar, .022 mfd, 10V
C207	1500011	Mylar, .0027 mfd, ±10%
C208	1520035	Mylar, .1 mfd, 10V
C209	1500008	Mylar, .0022 mfd, 10V
C210	1540014	Electrolytic, 10 mfd, 16V
C211	1500042	Mylar, .47 mfd, ±10%, 80V
C212	1500018	Mylar, .01 mfd, 10V
C213	1500018	Mylar, .01 mfd, 10V
C214	1520035	Mylar, .1 mfd, 10V
C215	1500035	Mylar, .1 mfd, 10V
C216	1540005	Electrolytic, 2.5 mfd, 16V
C217	1540005	Electrolytic, 2.5 mfd, 16V
C218	1540014	Electrolytic, 10 mfd, 16V
C219	1540014	Electrolytic, 10 mfd, 16V
C220	1520048	X5R Disc, .001 mfd, ±10%
C221	1520048	X5R Disc, .001 mfd, ±10%
C222	1520048	X5R Disc, .001 mfd, ±10%
C223		Unassigned
C224		Unassigned
C225	1540015	Electrolytic, 10 mfd, 64V
C226	1540014	Electrolytic, 10 mfd, 10V
C227	1540014	Electrolytic, 10 mfd, 10V
C301	1520058	Feedthrough, .001 mfd
C302	1520058	Feedthrough, .001 mfd
C303	1520058	Feedthrough, .001 mfd
C304	1520058	Feedthrough, .001 mfd
C305	1520024	N1500, 100 pfd, ±10%
C306	1520008	NPO Disc, 12 pfd, ±10%
C307	1520010	NPO Disc, 18 pfd, ±10%
C308	1520048	X5R Disc, .001 mfd, ±10%
C309	1520005	NPO Disc, 6.8 pfd, ±10%
C310	1570005	Trimmer, .7-9 pfd
C311	1520006	NPO Disc, 8.2 pfd, ±10%
C313	1510014	NPO Gimmick, 1.8 pfd, ±10%
C314	1570005	Trimmer, .7-9 pfd
C315		Unassigned
C316	1520007	NPO Disc, 10 pfd, ±10%
C317	1510014	NPO Gimmick, 1.8 pfd, ±10%
C318	1520048	X5R Disc, .001 mfd, ±10%
C319	1520012	NPO Disc, 27 pf, ±10%
C401	1520058	Feedthrough, .001 mfd
C402	1520058	Feedthrough, .001 mfd
C403	1520058	Feedthrough, .001 mfd
C404	1520024	N1500 Disc, 100 pfd, ±10%
C405	1520024	N1500 Disc, 100 pfd, ±10%
C406	1520024	N1500 Disc, 100 pfd, ±10%
C407	1520024	N1500 Disc, 100 pfd, ±10%
C408	1520024	N1500 Disc, 100 pfd, ±10%
C409	1520012	NPO Disc, 27 pfd, ±10%
C410	1520048	X5R, Disc., .001 mfd, ±10%
C501	1520010	NPO Disc, 18 pfd, ±10%
C502	1520013	NPO Disc, 33 pfd, ±10%
C503	1520013	NPO Disc, 33 pfd, ±10%
C504	1560001	Trimmer, 4-40 pfd
C505	1520024	N1500 Disc, 100 pfd, ±10%
C506	1520058	Feedthrough, .001 mfd
C507	1520033	Z5F Disc, 220 pfd, ±10%
C508	1520054	25V, Disc, .05 mfd, +80%−20%
C509	1560002	Trimmer, 7-100 pfd
C510	1560001	Trimmer, 4-40 pfd
C511	1520058	Feedthrough, .001 mfd
C512	1520033	Z5F Disc, 220 pfd, ±10%
C513	1520054	25V, Disc, .05 mfd, +80%−20%
C514	1560002	Trimmer, 7-100 pfd
C515	1560001	Trimmer, 4-40 pfd
C516	1520033	Z5F Disc, 220 pfd, ±10%
C517	1520054	25V, Disc, .05 mfd, +80%−20%
C518	1520058	Feedthrough, .001 mfd
C519	1520033	Z5F Disc, 220 pfd, ±10%
C520	1520033	Z5F Disc, 220 pfd, ±10%
C521	1520054	Z5F Disc, .05 mfd, +80%−20%
C522	1520058	Feedthrough, .001 mfd
C523		Unassigned
C524		Unassigned
C601	1520033	Z5F Disc, 220 pfd, ±10%
C602	1520054	25V, Disc, .05 mfd, ±80%+20%
C603	1520058	Feedthrough, .001 mfd
C604	1520058	Feedthrough, .001 mfd
C605	1520054	25V, Disc, .05 mfd, +80%−20%
C606	1520033	Z5F Disc, 220 pfd, ±10%
C607	1520005	NPO Disc, 6.8 pfd, ±10%
C608	1520033	Z5F Disc, 220 pfd, ±10%
C609	1520009	NPO Disc, 15 pfd, ±10%
C610	1520033	Z5F Disc, 220 pfd, ±10%
C611	1520033	Z5F Disc, 220 pfd, ±10%
C612	1520033	Z5F Disc, 220 pfd, ±10%
C613	1520008	NPO Disc, 12 pfd, ±10%
C614	1520006	NPO Disc, 8.2 pfd, ±10%
C615	1520033	Z5F Disc, 220 pfd, ±10%
C616	1520033	Z5F Disc, 220 pfd, ±10%
C617	1520033	Z5F Disc, 220 pfd, ±10%
C618	1520007	NPO Disc, 10 pfd, ±10%
C619	1570005	Trimmer, .7-9 pfd
C620	1510014	NPO Gimmick, 1.8 pfd, ±10%
C621	1570005	Trimmer, .7-9 pfd
C622	1520307	NPO Disc, 10 pfd, ±10%
C623	1510014	NPO Gimmick, 1.8 pfd, ±10%
C624	1570005	Trimmer, .7-9 pfd
C625	1520007	NPO Disc, 10 pfd, ±10%
C626	1520054	25V, Disc, .05 mfd, +80%−20%
C627	1520033	Z5F Disc, 220 pfd, ±10%
C628	1520058	Feedthrough, .001 mfd
C629	1520033	Z5F Disc, 220 pfd, ±10%
C630	1520033	Z5F Disc, 220 pfd, ±10%
C631	1520048	X5R Disc, .001 mfd, ±10%
C632	1520048	X5R Disc, .001 mfd, ±10%
C633	1520029	N1500 Disc, 150 pfd, ±10%
C634	1520029	N1500 Disc, 150 pfd, ±10%
C635		Unassigned
C636		Unassigned
		DIODES
CR101	4810013	Silicon, General Purpose, 100V, 1 A
CR102	4810021	Germanium, General Purpose 1N34A
CR103	4810017	Silicon, High Frequency Switching, FD 1936
CR104	4810017	Silicon, High Frequency Switching, FD 1936
CR105	4810017	Silicon, High Frequency Switching, FD 1936
CR106	4810013	Silicon, General Purpose, 100V, 1 A
CR107		Unassigned
CR108	4810011	Zener, 24V, 1 V

Ref. No.	Genave Part No.	Description
CR109	4810017	Silicon, High Frequency Switching, FD 1936
CR110	4810017	Silicon, High Frequency Switching, FD 1936
CR111	4810013	Silicon, General Purpose, 100V, 1 A
CR112		Unassigned
CR201	4810017	Silicon, High Frequency Switching, FD 1936
CR202	4810017	Silicon, High Frequency Switching, FD 1936
CR203	4810017	Silicon, High Frequency Switching, FD 1936
CR204	4810017	Silicon, High Frequency Switching, FD 1936
CR205	4810021	Germanium, General Purpose, 1N34A
CR206	4810021	Germanium, General Purpose, 1N34A
CR207	4810017	Silicon, High Frequency Switching, FD 1936
CR208	4810017	Silicon, High Frequency Switching, FD 1936
CR209	4810010	Zener, 20V, 3 W
CR210	4810003	Zener, 4.7V, 1 W
CR210		Unassigned
CR211		Unassigned
CR301	4810017	Silicon, High Frequency Switching, FD 1936
CR302	4810017	Silicon, High Frequency Switching, FD 1936
CR303	4810017	Silicon, High Frequency Switching, FD 1936
CR304		Unassigned
CR401	4810017	Silicon, High Frequency Switching, FD 1936
CR402	4810017	Silicon, High Frequency Switching, FD 1936
		LAMPS
DS201	3900006	Green, 14V, 80 Ma, 50,000 Hr.
DS202	3900005	Red, 14V, 80Ma, 50,000 Hr.
DS203	3000007	Yellow, 14V, 80 Ma, 50,000 Hr.
		INTEGRATED CIRCUITS
IC201	1310012	Dual OP-AMP, MC 1458
IC202	3130012	Dual OP-AMP, MC 1458
IC203	3130012	Dual OP-AMP, MC 1458
IC204	3130012	Dual OP-AMP, MC 1458
IC205	3130012	Dual OP-AMP, MC 1458
IC206	3130012	Dual OP-AMP, MC 1458
IC207	3130012	Dual OP-AMP, MC 1458
		COILS
L101	1800023	Input Filter
L102	1800009	Input Filter
L103	1800009	Input Filter
L104	1800009	Input Filter
L105	1800024	Input Filter
L106	1800014	Mixer
L201	1800033	50 mhy
L202	1800033	50 mhy
L301	1800030	.33 mhy, ±15%
L302	1800013	HF Oscillator
L303	1800014	HF Doubler
L304	1800014	HF Doubler
L401	1800015	LF Filter
L402	1800017	LF Filter
L403	1800017	LF Filter
L501	1800012	Transmitter Output
L502	1800018	Transmitter Output
L503	1800012	Transmitter Output
L504	1800019	Transmitter Matching
L505	1800020	Transmitter Matching
L506	1800020	Transmitter Matching
L601	1800010	Exciter
L602	1800010	Exciter
L603	1800011	Exciter Filter
L604	1800012	Exciter Filter
		TRANSISTORS
Q101	4800024	Silicon, NPN, Blue, 2N3563
Q102	4800024	Silicon, NPN, Blue, 2N3563
Q103	4800026	Silicon, NPN, White, MPS3593S
Q104	4800026	Silicon, NPN, White, MPS3593S
Q105	4800026	Silicon, NPN, White, MPS3593S
Q106	4800026	Silicon, NPN, White, MPS3593S
Q107	4800008	Silicon, NPN, Black, 2N5086
Q108	4800029	Silicon, NPN, Orange, MPS6514S
Q109	4800008	Silicon, NPN, Black, 2N5086
Q115	4800029	Silicon, NPN, Orange, MPS6514S
Q116	4800008	Silicon, NPN, Black, 2N5086
Q121	4800001	Silicon, NPN, 2N3055
Q122		Unassigned
Q201	4800033	Silicon, NPN, MPS5172
Q202	4800043	Silicon, PNP, 2N5227
Q203	4800043	Silicon, PNP, 2N5227
Q204	4800042	Silicon, NPN, 2N5220
Q205	4800042	Silicon, NPN, 2N5220
Q206	4800042	Silicon, NPN, 2N5220
Q207	4800023	Silicon, PNP, MPS U52
Q208		Unassigned
Q301	4800030	Silicon, NPN, Green, MPS6519
Q302	4800024	Silicon, NPN, Blue, 2N3563
Q401	4800030	Silicon, NPN, Green, MPS6519
Q501	4800039	Silicon, NPN, RCA 38817
Q502	4800039	Silicon, NPN, RCA 38817
Q503	4800004	Silicon, NPN, 2N3866
Q601	4800024	Silicon, NPN, Blue, 2N3563
Q602	4800024	Silicon, NPN, Blue, 2N3563
Q603	4800031	Silicon, NPN, Yellow, MPS6544
Q604	4800031	Silicon, NPN, Yellow, MPS6544
		RESISTORS
R101		Unassigned
R102	4700025	1K, ±10%, ½ W
R103	4700025	1K, ±10%, ½ W
R104	4700039	15K, ±10%, ½ W
R105	4700033	4.7K, ±10%, ½ W
R106	4700039	15K, ±10%, ½ W
R107	4700025	1K, ±10%, ½ W
R108	4700025	1K, ±10%, ½ W
R109	4700013	100 ohms, ±10%, ½ W
R110	4700025	1K, ±10%, ½ W
R111	4700017	220 ohms, ±10%, ½ W
R112	4700037	10K, ±10%, ½ W
R113	4700017	220 ohms, ±10%, ½ W
R114	4700025	1K, ±10%, ½ W
R115	4700017	220 ohms, ±10%, ½ W
R116	4700017	220 ohms, ±10%, ½ W
R117	4700037	10K, ±10%, ½ W
R118	4700029	2.2K, ±10%, ½ W
R119	4700025	1K, ±10%, ½ W
R120	4700021	470 ohms, ±10%, ½ W
R121	4700037	10K, ±10%, ½ W
R122	4700029	2.2K, ±10%, ½ W
R123	4700025	1K, ±10%, ½ W
R124	4700021	470 ohms, ±10%, ½ W
R125	4700014	120 ohms, ±10%, ½ W
R126	4700037	10K, ±10%, ½ W
R127	4700029	2.2K, ±10%, ½ W
R128	4700033	4.7K, ±10%, ½ W
R129		Unassigned
R130	4700021	470 ohms, ±10%, ½ W
R131	4700025	1K, ±10%, ½ W
R132	4760009	Squelch, 25K, potentiometer
R133	4700021	1K, ±10%, ½ W
R134	4700037	10K, ±10%, ½ W
R135	4700025	1K, ±10%, ½ W
R136	4700049	100K, ±10%, ½ W
R137	4700033	4.7K, ±10%, ½ W
R138	4700029	2.2K, ±10%, ½ W
R139	4700039	15K, ±10%, ½ W
R140	4760007	Vol/Off, 25K, potentiometer, with switch
R146	4700023	680 ohms, ±10%, ½ W
R147		Unassigned
R148		Unassigned
R149	4700028	1.8K, ±10%, ½ W
R150	4700040	18K, ±10%, ½ W
R151	4700029	2.2K, ±10%, ½ W
R152	4700013	100 ohms, ±10%, ½ W
R153	4700013	100 ohms, ±10%, ½ W
R154	4700053	220K, ±10%, ½ W
R155	4700025	1K, ±10%, ½ W
R156	4700033	4.7K, ±10%, ½ W
R157	4700064	470 ohms, ±10%, ½ W
R158	4740001	.47 ohm, ±10%, 2 W
R159	4740003	10 ohms, ±10%, 2 W
R160		Unassigned
R161	4730005	68 ohms, ±10%, 1 W
R162	4700014	120 ohms, ±10%, ½ W
R165	4700021	470 ohms, ±10%, ½ W
R166	4700025	1K, ±10%, ½ W
R167	4700013	100 ohms, ±10%, ½ W
R168	4700013	100 ohms, ±10%, ½ W
R169	4700025	1K, ±10%, ½ W
R170	4700013	100 ohms, ±10%, ½ W
R177		4.7K to 10K (Select), ±10;, ½ W
R178		4.7K to 10K (Select), ±10%, ½ W
R201	4700021	⅁ Correction, 50K, potentiometer
R202	4700045	47K, ±10%, ½ W
R203	4700056	390K, ±10%, ½ W
R204	4720011	56.2K, ±1%, ¼ W
R205	4720011	56.2K, ±1%, ¼ W
R206	4760021	⅁ Shoft, 50K, potentiometer
R207	4720033	27K, ±10%, ½ W
R208	4720011	56.2K, ±1%, ¼ W
R209	4720011	56.2K, ±1%, ¼ W
R210	4720011	OBS, 10K, ±5%, potentiometer
R211	4700025	1K, ±10%, ½ W
R212	4700049	100K, ±10%, ½ W
R213	4700037	10K, ±10%, ½ W
R214	4700045	47K, ±10%, ½ W
R215	4700039	15K, ±10%, ½ W
R216	4700047	68K, ±10%, ½ W
R217	4700056	390K, ±10%, ½ W
R218	4700059	1.8M, ±10%, ½ W
R219	4700049	100K, ±10%, ½ W
R220	4760021	FM Balance, 50K, potentiometer
R221	4700049	100K, ±10%, ½ W
R222	4760021	AM Balance, 50K, potentiometer

Ref. No.	Genave Part No.	Description
R223	4700049	100K, ±10%, ½ W
R224	4700049	100K, ±10%, ½ W
R225	4700049	100K, ±10%, ½ W
R226	4700049	100K, ±10%, ½ W
R227	4700049	100K, ±10%, ½ W
R228	4700049	47K, ±10%, ½ W
R229	4700049	47K, ±10%, ½ W
R230	4700049	100K, ±10%, ½ W
R231	4700049	100K, ±10%, ½ W
R232	4700049	100K, ±10%, ½ W
R233	4700049	100K, ±10%, ½ W
R234	4700049	100K, ±10%, ½ W
R235	4700049	100K, ±10%, ½ W
R236	4700049	100K, ±10%, ½ W
R237	4700049	100K, ±10%, ½ W
R238	4760022	Meter Balance, 250K, potentiometer
R239	4700049	100K, ±10%, ½ W
R240	4700058	1M, ±10%, ½ W
R241	4700025	1K, ±10%, ½ W
R242	4700025	1K, ±10%, ½ W
R243	4700025	1K, ±10%, ½ W
R244	4700025	1K, ±10%, ½ W
R245	4700022	560 ohms, ±10%, ½ W
R246	4700022	560 ohms, ±10%, ½ W
R247	4700016	180 ohms, ±10%, ½ W
R248	4720039	91K, ±5%, ½ W
R249		Unassigned
R250	4700002	4.7 ohms, ±10%, ½ W
R251	4700021	470 ohms, ±10%, ½ W
R252	4700021	470 ohms, ±10%, ½ W
R253	4700031	3.3K, ±10%, ½ W
R254	4700049	100K, ±10%, ½ W
R255	4760021	+10V, Adjust, 50K, potentiometer
R256	4700049	100K, ±10%, ½ W
R257	4700049	100K, ±10%, ½ W
R258	4700049	100K, ±10%, ½ W
R301	4700023	680 ohms, ±10%, ½ W
R302	4700023	680 ohms, ±10%, ½ W
R303	4700023	680 ohms, ±10%, ½ W
R304	4700025	1K, ±10%, ½ W
R305	4700013	100 ohms, ±10%, ½ W
R306	4700029	2.2K, ±10%, ½ W
R307	4700016	220 ohms, ±10%, ½ W
R308	4700013	100 ohms, ±10%, ½ W
R309	4700027	1.5K, ±10%, ½ W
R310	4700005	22 ohms, ±10%, ½ W
R311	4700029	2.2K, ±10%, ½ W
R312	4700013	100 ohms, ±10%, ½ W
R401	4700023	680 ohms, ±10%, ½ W
R402	4700023	680 ohms, ±10%, ½ W
R403	4700006	22 ohms, ±10%, ½ W
R404	4700025	1K, ±10%, ½ W
R405	4700013	100 ohms, ±10%, ½ W
R406	4700029	2.2K, ±10%, ½ W
R501	4700037	10K, ±10%, ½ W
R502	4700030	2.7K, ±10%, ½ W
R503	4700016	180 ohms, ±10%, ½ W
R601	4700014	120 ohms, ±10%, ½ W
R602	4700021	470 ohms, ±10%, ½ W
R603	4700028	1.8K, ±10%, ½ W
R604	4700013	100 ohms, ±10%, ½ W
R605	4700028	1.8K, ±10%, ½ W
R606	4700014	120 ohms, ±10%, ½ W
R607	4700021	470 ohms, ±10%, ½ W
R608	4700025	1K, ±10%, ½ W
R609	4700003	10 ohms, ±10%, ½ W
R610	4700003	10 ohms, ±10%, ½ W
R611	4700025	1K, ±10%, ½ W
R612	4730009	220 ohms, ±10%, ½ W
R613	4700013	100 ohms, ±10%, ½ W
R614	4700033	4.7K, ±10%, ½ W
R615	4700033	4.7K, ±10%, ½ W
R616	4700010	56 ohms, ±10%, ½ W
R617	4700021	470 ohms, ±10%, ½ W
R618	4700014	120 ohms, ±10%, ½ W
R619		Unassigned
R620	4700009	47 ohms, ±10%, ½ W
R621		Unassigned
R622	4700013	100 ohms, ±10%, ½ W
R623	4700025	1K, ±10%, ½ W
R624		Unassigned
		SWITCHES
S201	4760007	Off/On, Part of R140
SW101	5100020	Nav/Com Rocker, 3PDT
SW301	5100017	Nav Frequency, MHz
SW302	5100017	Comm Frequency, MHz
SW401	5100018	Nav Frequency, KHz
SW402	5100016	Comm Frequency, KHz
		TRANSFORMERS
T101	5600022	Com IF, 22.5 MHz
T102	5600023	Nav IF, 30.5 MHz
T103	5600009	Low IF, 4 MHz
T104	5600009	Low IF, 4 MHz
T105	5600009	Low IF, 4 MHz
T106	5600009	Low IF, 4 MHz
T107	5600006	Audio.

Ref. Nno.	Genave Part No.	Description
T301	5600027	High Frequency, Oscillator
T401	5600026	Low Frequency Oscillator
T601	5600024	Balanced Mixer Input
T602	5600025	Balanced Mixer Output
		CRYSTALS
Y301	2300015	69.470 MHz
Y302	2300016	69.960 MHz
Y303	2300017	70.470 MHz
Y304	2300018	70.970 MHz
Y305	2300019	71.470 MHz
Y306	2300020	71.970 MHz
Y307	2300021	72.470 MHz
Y308	2300022	72.970 MHz
Y309	2300023	73.470 MHz
Y310	2300024	73.970 MHz
Y311	2300025	74.470 MHz
Y312	2300026	74.970 MHz
Y313	2300027	75.470 MHz
Y314	2300028	75.970 MHz
Y315	2300029	76.470 MHz
Y401	2300014	26.940 MHz
Y402	2300013	26.840 MHz
Y403	2300012	26.740 MHz
Y404	2300011	26.640 MHz
Y405	2300010	26.540 MHz
Y406	2300009	26.440 MHz
Y407	2300008	26.340 MHz
Y408	2300007	26.240 MHz
Y409	2300006	26.140 MHz
Y410	2300004	26.040 MHz
		CHOKES
J501	2100020	Connector, Phono, Socket (Solder-in)
Z502	1800021	Bias Choke
Z503	1800022	Bias Choke
Z504	1800022	Bias Choke
		MISCELLANEOUS
CV101	2100018	Cover, (Part of J102)
CV102	2100018	Cover, (Part of P102)
HS501	2500431	Heatsink for Q501
HS502	5300001	Heatsink for Q502
HS503	5300001	Heatsink for Q503
J101	2100021	Connector, Phono, Socket (Nut mount)
J102	2100010	Connector, 12 Pin, Female
J501	2100020	Connector, Phono, Socket(Solder-in)
J502	2100020	Connector, Phono, Socket (Solder-in)
K101	4500007	Relay, Transmit/Receive
M201	2900003	Meter, Course Deviation, 500-0-500 micro amp
P101	2100023	Connector, Phono Plug, Short Shank
P102	2100013	Connector, 12 Pin, Male
P501	2100024	Connector, Phono Plug, Long Shank
P502	2100023	Connector, Phono Plug, Short Shank
		HARDWARE
	2840010	Grommet, Rubber, 5/16" Dia., 3/16" ID (3 req'd)
	2840015	Grommet, Rubber, 7/16" Dia., 5/16" ID
	2500527	Panel, Trim
	2500511	Panel, Rear
	2500740	Panel, Sub
	2500921	Panel, Top
	2500766	Panel, Side (Left or Right)
	2500571	Rack Mounting
	2500370	Drum, OBS
	2500440	Gear, Spur, OBS Shaft
	3500004	Gear Spur, OBS Drum
	3500001	Gear, Mitre
	2500405	Bushing, Internal, OBS centering
	2500400	Bushing, OBS Drum
	2501255	Bearing, External
	2500925	Bracket, OBS pot.
	2500415	Clip, Mounting
	6070006	Clamp, Cable 7/8"
	2500385	Coupler, Shaft Steel, 1/8" to 1/4"
	2500375	Dial, OBS
	2500350	Shaft, Dial 1/8" x .6", Knurled
	2500425	Shaft Extension 1/8"
	2500410	Shaft, OBS Drive
	2500345	Shaft, Dual
	2500335	Drum, Nylon, MHz
	2500340	Drum, Nylon, KHz
	2500445	Spring, OSC grounding
	2500450	Spring, Shaft grounding, Rear
	2500455	Spring, Shaft grounding, Front
	2400008	Decal, Nav MHz
	2400009	Decal, Com MHz
	2400010	Decal, 100 KHz
	2400011	Decal, OBS
	2400021	Knob, Black
	2400020	Knob, Black 1/8" Flat Shaft
	2500465	Spacer, Dial Shaft
	2500380	Coupler Shaft, Delrim
	6070016	Clamp, Cable 1/4"
	6070019	Clamp, Cable 1/2"
	2800320	Screw, Retaining #8-32 x 1 3/4"

Specifications subject to change without notice.

GENERAL AVIATION ELECTRONICS INC.

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INDIANAPOLIS, IND. 46226
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Correction Bulletin

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The following corrections should be made in the ALPHA 190 Maintenance Manual prior to its use.

Figure 3-5-9

Change value R256 from 100k to 82k metal film.
Change value R254 from 100k to 120k metal film.
Add .001 disc cer cap Q204, Q205, Q206 C to ground in some units.