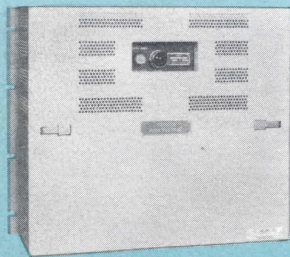
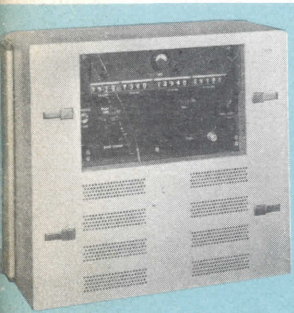
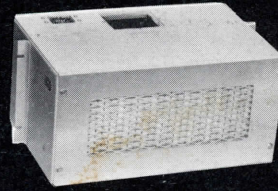
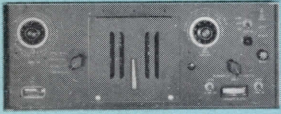


*Collins*



# **COMMUNICATIONS SYSTEMS**

**EMPLOYING**

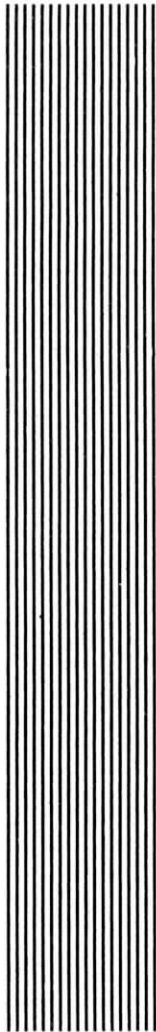
# **KWT-6**

# **COMPONENTS**

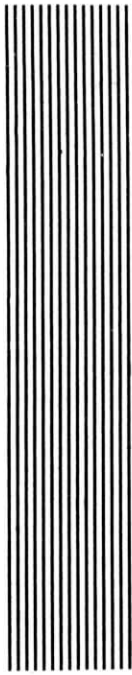


**COLLINS RADIO COMPANY**

# DESCRIPTIVE \_\_\_\_\_ SPECIFICATIONS



DESCRIPTIVE SPECIFICATIONS published by the Collins Radio Company are unofficial reports on Research and Development projects, to be used as preliminary information by agencies or individuals who are properly entitled to receive them.



PROPRIETARY NOTICE: This report is the result of technical investigations made by the engineering staff of the Collins Radio Company. The disclosure of the information herein may pertain to proprietary rights, and the furnishing of this report does not constitute an expressed or implied license to use such material.

Printed in U.S.A.

©

**COLLINS RADIO COMPANY**

**CEDAR RAPIDS, IOWA, U.S.A.**

1961

261 Madison Ave.  
NEW YORK 16

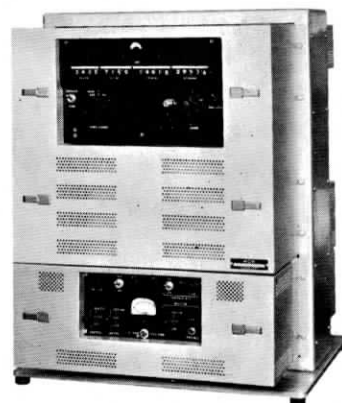
1930 Hi-Line Drive,  
DALLAS 7

2700 W. Olive Avenue,  
BURBANK

# **COMMUNICATIONS SYSTEMS**

## **EMPLOYING**

### **KWT-6 COMPONENTS**



# SYSTEMS EMPLOYING KWT-6 COMPONENTS

## INTRODUCTION

Collins KWT-6 components provide the basic units for fixed station high-frequency communications systems. Although designed for superior single-sideband (SSB) performance, provisions are included for compatible amplitude-modulation (AM) operation. With the proper adaptations, continuous wave (CW) and radio teletypewriter (RTTY) operations can be used with these systems.

The KWT-6 components have been designed for integration into several types of high-frequency communications systems or may be used as a complete basic system. The standard configuration is a complete transceiver with a 500-watt PEP output power amplifier. With changes in the configurations of the standard units and modules, the complete transceiver can be converted to a radio receiver, transmitter, receiver-exciter, exciter, or to partial functions of these.

Units and subassemblies, or modules, can be chosen and employed separately, depending upon the application or particular customer requirement. The purpose of this publication is to describe the individual KWT-6 components, typical system configurations, and methods of maintenance support. A cross-reference of the standard modules employed, with respect to modules used in other Collins equipments, is included.

## COMPONENT DESCRIPTIONS

### FREQUENCY GENERATOR 786E-1

Collins Frequency Generator 786E-1, shown in figure 1, serves as an i-f to r-f frequency translator during transmission and as an r-f to i-f frequency translator during reception. During transmission, the 786E-1 accepts a 300-kilocycle signal and translates it to any desired one-kilocycle frequency increment in the range of 2.000 to 30.000 megacycles, as selected by the BAND CHANGE and FREQUENCY CHANGE controls on the front panel. In receive, the 786E-1 accepts the selected receive signal, indicated on the band dial, and translates it to a 300-kilocycle i-f frequency for demodulation.

The main chassis of the 786E-1 mounts in a standard 19-inch open-type rack. The chassis is hinged on the rack to facilitate maintenance and adjustment. The unit is protected by a metal dust cover secured by thumb-release fasteners. A control panel is located on the front of the unit. All external power and control connections are made through two 16-pin connectors at the rear. The r-f and i-f connections are made through BNC coaxial connectors at the rear of the unit. Forced air cooling is supplied through a central air duct.

The modules used in the 786E-1, illustrated in figure 2, are as follows: (1) Stabilized Master Oscillator; (2) R-F Tuner; (3) Frequency Divider; (4) Sidestep Oscillator (optional); and (5) Reference Oscillator (optional) or Isolation Amplifier (optional).

Refer to the 786E-1 block diagram, figure 3. The Stabilized Master Oscillator (SMO) module is a very accurately controlled source of channel



V359-06-P

Figure 1. Frequency Generator 786E-1 translates intermediate frequencies to r-f or radio frequencies to i-f

r-f voltage. It provides injection voltage for the receive and transmit functions of the R-F Tuner from 2 to 4 megacycles in 1/8-kilocycle steps. By the nature of the circuitry, the frequency channel selected possesses the same degree of frequency accuracy and stability as that available in the frequency standard.

The Frequency Divider module takes a 100-kilocycle signal from the Reference Oscillator or Isolation Amplifier and divides it into 4-kilocycle and 1-kilocycle outputs for use by the SMO and Sidestep Oscillator modules, respectively.

The Sidestep Oscillator module takes a 2400-kilocycle signal from the Reference Oscillator or Isolation Amplifier and converts it to outputs of 2399, 2398, or 2397 kilocycles. These outputs are used in obtaining 1/8-kilocycle steps from the SMO. On bands 1, 2, 3-0, and 4-0 of the 786E-1, the 2400-kilocycle input is bypassed around the Sidestep Oscillator and injected into the SMO, permitting SMO output in 1/2-kilocycle steps. Because of this, the Sidestep Oscillator is not required for operation over certain frequency ranges. This includes the band from 2.000 to 7.700 megacycles, even kilocycles from 7.700 to 15.700 megacycles, and every fourth kilocycle from 15.700 to 30.000 megacycles. These are the frequency ranges covered by bands 1, 2, 3-0, and 4-0.

The Reference Oscillator module is a small, transistorized, self-contained frequency standard with outputs of 100 kilocycles and 2400 kilocycles having a typical stability of 1 part in  $10^6$  per month. The 100-kilocycle and 2400-kilocycle outputs are used in the frequency scheme of the SMO. The 100-kilocycle output is also supplied to Sideband Generator 786F-1.

The Isolation Amplifier module requires a 100-kilocycle input from an external frequency standard and provides outputs of 100 kilocycles and 2400 kilocycles. These outputs are used, as are those from the Reference Oscillator, in the frequency scheme of the SMO. The Isolation Amplifier plugs into the same location as the Reference Oscillator. It is normally used when the higher stability of an external frequency standard, such as the Collins 40N-1, is required or when several radios are operated from one external frequency standard.

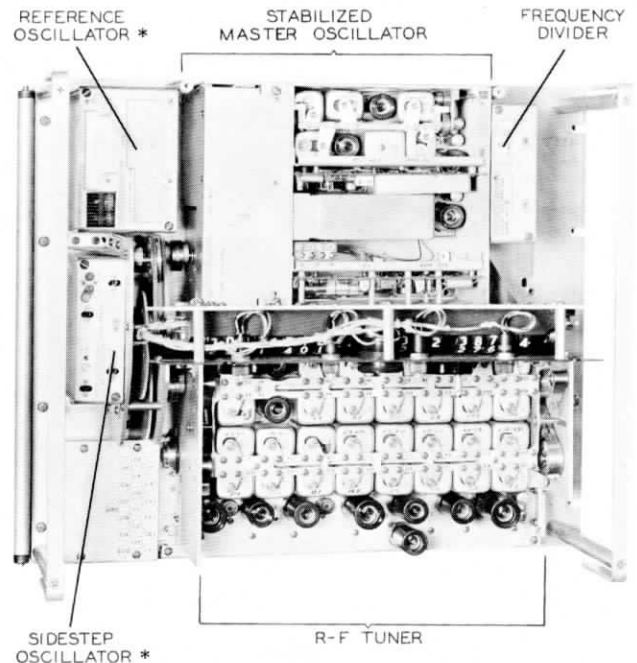
The R-F Tuner module is a double-conversion receiver and exciter in one unit, using common tuned circuits but separate amplifier and mixer tubes. It covers the frequency range from 2 to 30 megacycles in four bands. With the selected injection frequencies from the SMO, 28,000 channels spaced 1-kilocycle apart are provided for both transmission and reception.

## TECHNICAL CHARACTERISTICS

FREQUENCY RANGE: 2.000 to 30.000 mc in 4 bands.

FREQUENCY STABILITY: With Reference Oscillator - 1 part in  $10^6$  per month.  
With Collins 40N-1 - 1 part in  $10^8$  per day or better.

BANDWIDTH: 16 kc.



C220-58-P

Figure 2. Five modules, two of which are optional\*, are contained in the 786E-1

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

SIGNAL INPUTS: Receive - 2.000 to 30.000 mc at 1.0 uv for not less than 10-db signal plus noise-to-noise ratio, noise figure 10 db or better.

Transmit - 300 kc at 0.10 volt rms to produce 0.2 watt PEP, minimum.

SIGNAL OUTPUTS: Receive - 300 kc at not less than 100 uv with 5-uv signal at antenna.

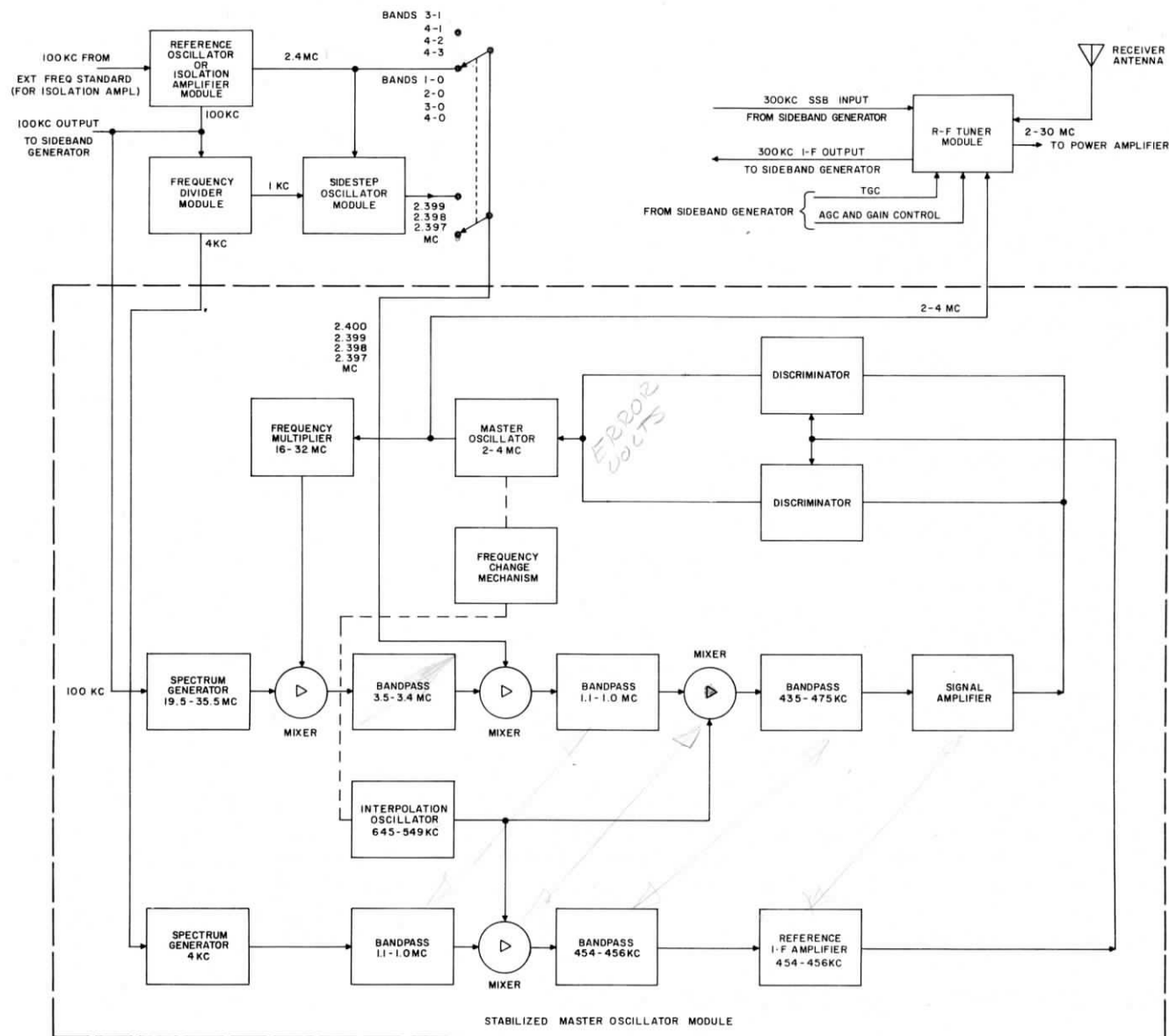
Transmit - 2.000 to 30.000 mc at 0.2 watt PEP, minimum.

R-F, I-F INPUT IMPEDANCE: Receive - 50 ohms nominal.

Transmit - 52 ohms nominal.

R-F, I-F OUTPUT IMPEDANCE: Receive - 50 ohms nominal.

Transmit - 50 ohms nominal.



V359-02-5

Figure 3. Frequency Generator 786E-1, Block Diagram

SPURIOUS SIGNALS: 50 db below rated PEP.

INTERMODULATION DISTORTION: 35 db below rated PEP.

POWER REQUIREMENTS: Supplied by Low Voltage Power Supply 429B-1.

WEIGHT: 41.5 pounds.

DIMENSIONS: 15-3/4 in. high x 18-7/8 in. wide x 7 in. deep.

RACK SPACE REQUIRED: 15-3/4 in.

### OPERATING CONTROLS AND INDICATORS

TUNE-OPERATE SWITCH: Disables the SMO feedback loop during tuning to prevent its locking on a spurious frequency.

BAND CHANGE SWITCH: Sets band of operation from among the 4 bands.

FREQUENCY CHANGE CONTROL: Selects frequency of operation, with selected frequency indicated on counter dial under lighted window.

DIAL LOCK: Locks frequency counter dials and tuning controls at selected frequency.

AFC METER: Indicates the corrective current applied to the master oscillator from stabilization circuits of the SMO.

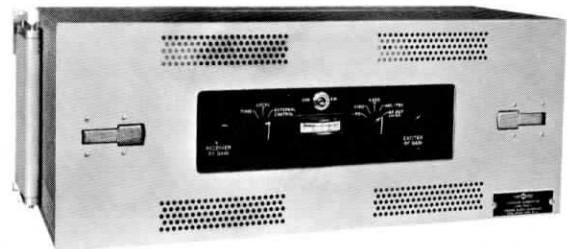
FREQUENCY WINDOW: Four windows, one for each band, indicate exact frequency of operation on digital counter.

### SIDEBAND GENERATOR 786F-1

Collins Sideband Generator 786F-1, shown in figure 4, translates audio frequencies to intermediate frequencies during transmission and intermediate frequencies to audio frequencies during reception. A block diagram of the 786F-1 is shown in figure 6. During transmit operation, the audio inputs from an external Audio and Control Unit are fed to the Balanced Modulator module, which contains two 300-kilocycle balanced modulators. One balanced modulator is followed with an upper-sideband (USB) filter, and the other is followed with a lower-sideband (LSB) filter. The two output signals are fed to the Transmit Gain Control (TGC) module where the amplitude of the output signal is controlled by a TGC voltage from an external power amplifier. During receive operation, the 300-kilocycle i-f input signal from an external tuner is fed to I-F/A-F Amplifier-Detector modules.

The 786F-1 is designed primarily for use with Frequency Generator 786E-1. It contains some of the control functions of the 786E-1 such as control of exciter and receiver gains, voltage control when changing from receive to transmit, and AGC-TGC control.

The main chassis of the 786F-1 mounts in a standard 19-inch open-type rack and is hinged



V359-07-P

Figure 4. Sideband Generator 786F-1 translates audio frequencies to i-f or i-f frequencies to audio

## SYSTEMS EMPLOYING KWT-6 COMPONENTS

to facilitate maintenance and adjustment. The 786F-1 is protected by a metal dust cover which is secured with thumb-release fasteners. A control panel is located on the front of the unit. All power and control wires extend to three 16-pin connectors at the rear of the unit. R-f and i-f connections are made at three coaxial connectors at the rear of the unit. Forced air cooling is employed.

The 786F-1 contains several plug-in modules. Various combinations of modules can be used to obtain the desired mode of operation. The modules of the 786F-1, illustrated in figure 5, are as follows: (1) Carrier Generator; (2) Balanced Modulator (optional); (3) Transmit Gain Control (optional) or TGC/VOX-Antivox (optional); (4) Upper Sideband, I-F/A-F (optional); (5) Lower Sideband, I-F/A-F (optional); and (6) AM, I-F/A-F (optional).

The Carrier Generator module takes the 100-kilocycle signal from the Reference Oscillator or Isolation Amplifier of the 786E-1 and triples this signal to 300 kilocycles. This is used for carrier insertion to the Balanced Modulator module, during transmit, and for carrier reinsertion to the USB and LSB I-F/A-F modules, during receive. The 300-kilocycle signal is also used for carrier insertion employed in tuning the transmitter. The 300-kilocycle output from the Carrier Generator has the same stability as that of the Reference Oscillator.

The Balanced Modulator module includes two balanced modulators. The two are identical with the exception of the band pass of their respective mechanical filters. One is used for USB operation, and the other for LSB operation. Each has separate audio input and carrier insertion and provides suppressed carrier outputs on either sideband or on both sidebands simultaneously.

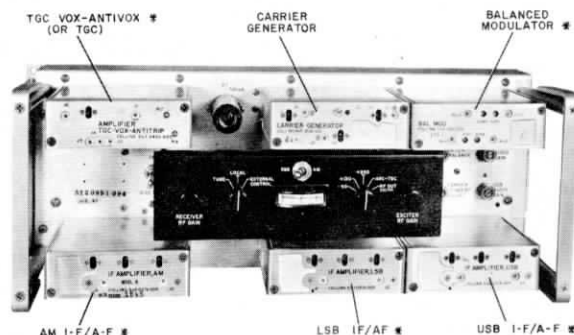
The Transmit Gain Control (TGC) module controls the signal level from the Balanced Modulator before it is fed to the input of the R-F Tuner of the 786E-1. The control of the TGC gain is derived from a d-c voltage fed back from a power amplifier whenever PA grid current is drawn. This ensures that the power amplifier is operating near its maximum power capability, but that it is not being overdriven. TGC voltages from the PA of a long time duration are fed to the R-F Tuner from the TGC module.

The TGC/VOX-Antivox module contains the same transmit gain control functions as are in the TGC module plus the VOX-Antivox feature. The VOX circuit automatically keys the transmitter whenever a predetermined level of input signal appears on the audio input line. The antivox circuit is incorporated to prevent the transmitter from being keyed by feedback from the receiver speaker.

The LSB I-F/A-F module takes the 300-kilocycle i-f from the R-F Tuner of the 786E-1, amplifies it, and mixes it in a product detector with a 300-kilocycle signal from the Carrier Generator. The audio intelligence is recovered and amplified. The module incorporates a fast attack, slow release AGC circuit for maintaining a constant audio output level.

The USB I-F/A-F module is identical to the Lower Sideband I-F/A-F unit except for the difference in the band pass of its mechanical filter.

The AM I-F/A-F module is used for reception of amplitude modulated signals. It contains three stages of i-f amplification, a conventional AM diode detector, and stages for audio amplification. An AGC circuit is used similar to that in the SSB I-F/A-F modules except for the time constant.



V359-51-P

Figure 5. Six modules are included in the 786F-1. Five are optional\*.

# DESCRIPTIVE SPECIFICATIONS

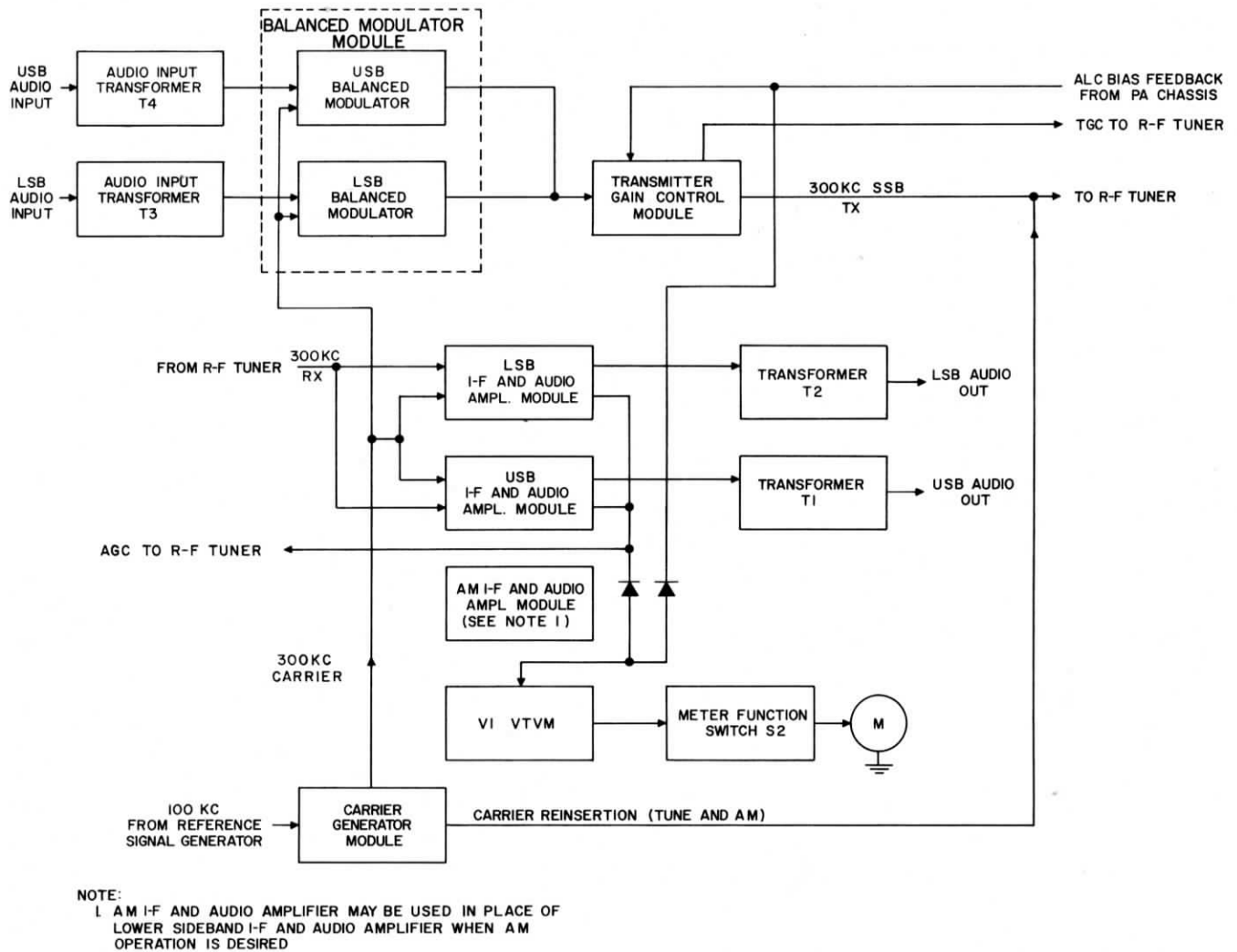


Figure 6. Sideband Generator 786F-1, Block Diagram

C220-35-3

The three I-F/A-F modules are optional, depending on the mode of operation desired. With both the LSB and USB I-F/A-F modules, single-sideband reception is obtained separately on either sideband or on both simultaneously. For AM reception, the use of the AM I-F/A-F module is required.

When modules are removed from the 786F-1, it is necessary that dummy plates be used so that cooling air does not escape from the unit. If the Balanced Modulator is removed, a dummy plate incorporating a dummy load must be plugged into the vacancy.

The transmitter portion of the 786F-1 permits the use of suppressed carrier LSB and USB transmission or AM (carrier plus either sideband) operation.

## TECHNICAL CHARACTERISTICS

### TRANSMIT

AUDIO INPUT SIGNAL: 2 volts rms into 600 ohms, USB, LSB, or AM, for 50-mv i-f output.

## **SYSTEMS EMPLOYING KWT-6 COMPONENTS**

300-KC OUTPUT SIGNAL: 50 mv into 50 ohms nominal.

AUDIO INPUT IMPEDANCE: 600 ohms balanced.

300-KC OUTPUT IMPEDANCE: 50 ohms nominal unbalanced.

TGC VOLTAGE REQUIRED: 0 to -4 volts d-c.

CARRIER SUPPRESSION: 40 db below PEP.

UNDESIRED SIDEBAND SUPPRESSION: 40 db below PEP.

BANDWIDTH: 3 kc each sideband.

### **RECEIVE**

300-KC INPUT SIGNAL: 80 uv for 40 mw into 600 ohms.

300-KC INPUT IMPEDANCE: 50 ohms nominal unbalanced.

AUDIO OUTPUT IMPEDANCE: 600 ohms balanced to ground.

AUDIO DISTORTION: 5 percent.

WEIGHT: 14.5 pounds.

DIMENSIONS: 19 in. wide x 7 in. high x 7 in. deep.

REQUIRED RACK SPACE: 7 in.

### **OPERATING CONTROLS AND INDICATORS**

RECEIVER R-F GAIN: Controls r-f gain of receive circuits in R-F Tuner (such as the 786E-1) and also gain of I-F/A-F amplifiers.

EXCITER R-F GAIN: Adjusts gain of r-f amplifier in R-F Tuner (such as in 786E-1).

TUNE-LOCAL-REMOTE SWITCH: Tune Position - Reinserts a calibrated carrier for tuning and disconnects audio input signals.  
Local Position - Normal operating position.  
Remote Position - Used when a remote r-f gain and TGC-AGC meter is used.

METER SELECTOR SWITCH: Selects indicated function for meter indication.

MULTIMETER: Indicates voltage levels of -90 v d-c, +130 v d-c, and 250 v d-c; TGC on transmit and AGC on receive; and r-f output of exciter when the appropriate position of meter switch is selected.

AM-SSB SWITCH: Reinserts calibrated carrier for compatible AM.

SIDETONE SWITCH (SUBPANEL): Provides for monitoring of transmitted intelligence.

## DESCRIPTIVE SPECIFICATIONS

### AUDIO, CONTROL UNIT 159B-1



V359-08-P

Figure 7. Audio and Control Unit 159B-1 handles one line and one audio or two line inputs

Collins Audio and Control Unit 159B-1, shown in figure 7, is a dual-channel amplifier which will handle two line inputs or one line input and one microphone or remote audio input during transmission. One channel is normally fed to the upper sideband (USB) balanced modulator of a Sideband Generator unit, and the other to the lower sideband (LSB) balanced modulator of the unit. In reception, the audio inputs may be fed through attenuators to line outputs. The inputs may also be fed to one attenuator and line output and one speaker-amplifier which drives a local speaker or earphones as selected. A microphone amplifier, for use with a high impedance dynamic microphone using a push-to-talk (PTT) switch, is also included.

The main chassis of the 159B-1 is designed for mounting in a standard 19-inch open-type rack. The chassis is hinged on the rack to facilitate maintenance and adjustment. A metal dust cover, secured by thumb-release fasteners, provides protection for the unit. A control panel is located on the front. All power and control wires are brought to two 16-pin connectors at the rear. A local microphone input jack and an earphone jack are located on the front panel. An external audio input extends to a coaxial connector at the rear. Forced air cooling is employed.

The modules of the 159B-1, illustrated in figure 8, are as follows: (1) Upper Sideband Line Amplifier (optional); (2) Lower Sideband Line Amplifier (optional); (3) Microphone Amplifier (optional); and (4) Speaker Amplifier (optional). Refer to the 159B-1 block diagram, figure 9.

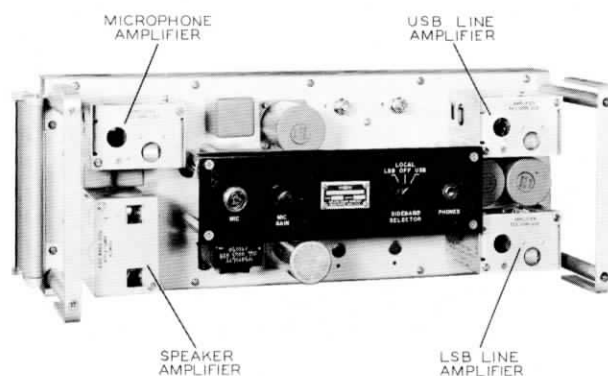
The Upper Sideband Line Amplifier is a transistorized audio amplifier which amplifies the audio signal from an external line input or from the Microphone Amplifier module, depending upon the position of the front panel switch. The output of the Line Amplifier is applied to the USB Balanced Modulator of the 786F-1.

The Lower Sideband Line Amplifier is identical and performs the same function for the lower sideband.

The Microphone Amplifier is identical to the USB and LSB Line Amplifiers. It is used to amplify the signal from a local microphone. Its output is applied to the input of either sideband line amplifier or removed from both, depending upon the position of the front panel switch.

The Speaker Amplifier module is a transistorized audio power amplifier used to amplify the audio signals received from the I-F/A-F modules, of the 786F-1, when a local speaker is used.

All of the modules in the 159B-1 are optional since each one is needed only to perform the function desired. For example, if line inputs are used on both transmit and receive, neither the Microphone Amplifier for the Speaker Amplifier would be required.



V359-09-P

Figure 8. Four modules are housed in the 159B-1, all of which are optional

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

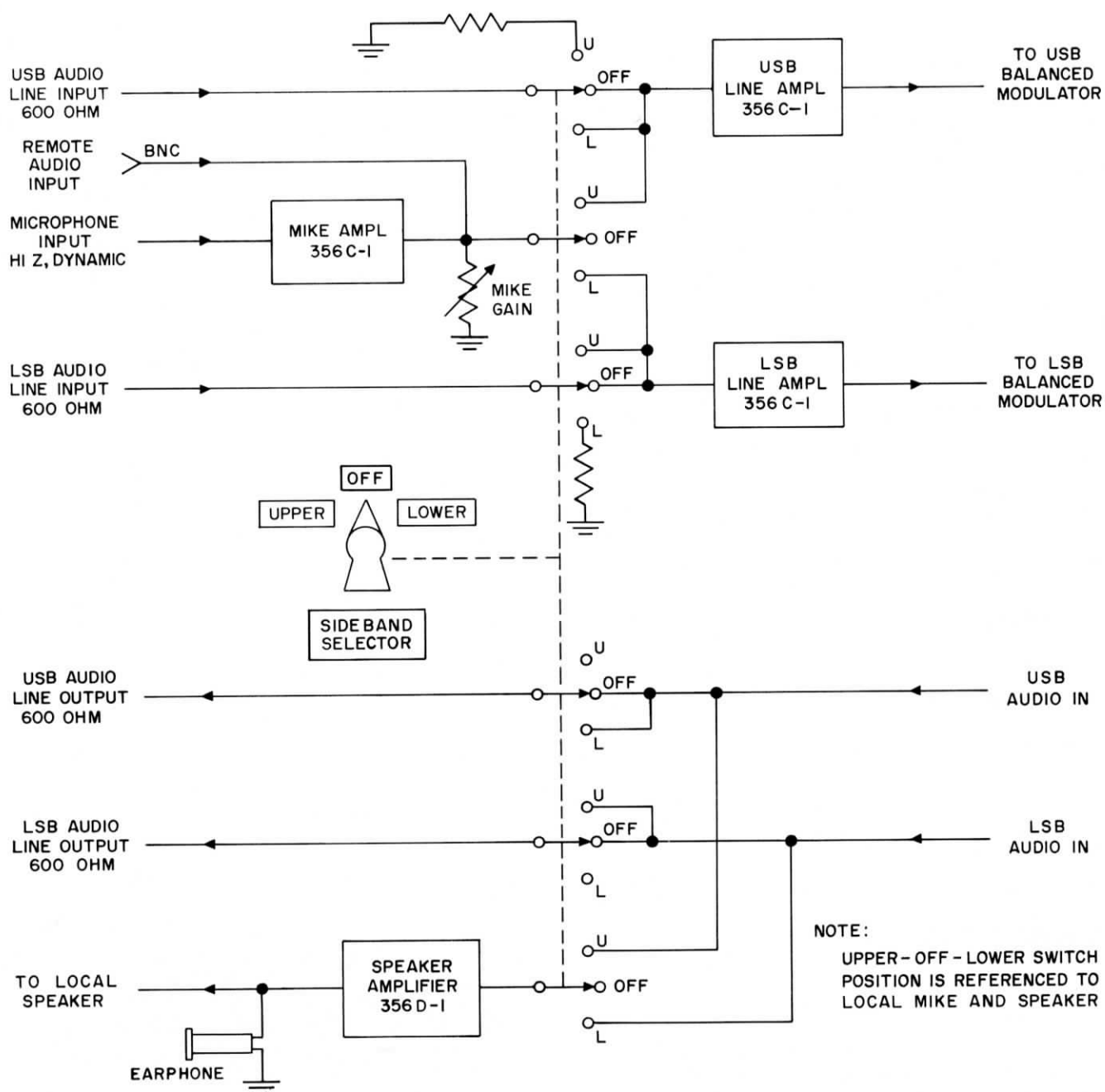
## TECHNICAL CHARACTERISTICS

### TRANSMIT

AUDIO FREQUENCY RESPONSE: Within 6 db, 350 to 3000 cps.

AUDIO GAIN: 48-db voltage gain for each Microphone and Line Amplifier.

DISTORTION: Less than 5 percent.



V359-04-3

Figure 9. Audio and Control Unit 159B-1, Block Diagram

## DESCRIPTIVE SPECIFICATIONS

MICROPHONE INPUT IMPEDANCE: 10,000 ohms for high impedance dynamic microphone.  
Low impedance input can be obtained by changing wires on microphone transformer.

OUTPUT IMPEDANCE: 600 ohms balanced to ground.

LINE AUDIO INPUT: USB: -40 to +8 dbm into 600 ohms balanced.  
LSB: -40 to +8 dbm into 600 ohms balanced.

### RECEIVE

AUDIO FREQUENCY RESPONSE: (Speaker Amplifier)  $\pm 2$  db, 350 to 3000 cps referenced at 1000 cps.

AUDIO GAIN: (Speaker Amplifier) 15-db power gain.

DISTORTION: (Speaker Amplifier) less than 15 percent at 2 watts.

LINE AUDIO OUTPUT: USB: +14 to -34 dbm into 600 ohms.  
LSB: +14 to -34 dbm into 600 ohms.

LINE AUDIO OUTPUT DISTORTION: 5 percent, either LSB or USB.

LINE INPUT AND OUTPUT IMPEDANCE: 600 ohms balanced.

OUTPUT IMPEDANCE: (Speaker Amplifier) 3-4 ohms or 600 ohms, both leads above ground.

POWER REQUIREMENTS: Supplied by Low Voltage Power Supply 429B-1.

WEIGHT: 15-1/4 pounds.

DIMENSIONS: 7 in. high x 19 in. wide x 7 in. deep.

RACK SPACE REQUIRED: 7 in.

### OPERATING CONTROLS

MICROPHONE GAIN: Controls gain of local microphone input and input through coaxial connector at rear of the unit.

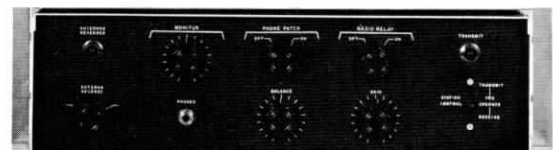
SIDEBAND SELECTOR: Connects microphone to either LSB or USB or disconnects from both; connects speaker to selected sideband output or disconnects from both.

PHONE JACK: Connects headphones to selected sideband output.

LINE GAIN CONTROLS: On subpanel for control of receiver and transmitter audio levels.

## RADIO-RELAY CONTROL PANEL 714Z-1

Collins Radio-Relay Control Panel 714Z-1, figure 10, provides radio-relay and phone patch service for a transceiver pair system. The unit is used for switching the receiver output to the transmitter input, patching a telephone line to the receiver and transmitter circuits, and providing an antenna switchover. A monitor



C220-184-P

Figure 10. Radio-Relay Control Panel provides radio-relay and phone patch service for transceiver pair systems

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

jack for 600-ohm headphones is provided. Figure 11 is a typical installation block diagram of two radio-relay control panels connected in a two transceiver system.

The main chassis of Radio-Relay Control Panel 714Z-1 mounts in a standard 19-inch open-type relay rack. When mounted, it extends seven inches beyond the rack surface. All connections are made at the rear of the unit through a 24-pin connector, a BNC jack, and a two-contact terminal board. The unit consists of controls and indicators, mounted to the main chassis, and a Phone Patch 189A-2 subchassis.

## TECHNICAL CHARACTERISTICS

### SIGNAL INPUT AND OUTPUT:

One 600-ohm telephone line; -13 dbm, minimum input required; 0 to -30 dbm output.

**POWER REQUIREMENTS:** +28 volts d-c, 0.6 amperes unfiltered.

**WEIGHT:** 7 pounds.

**DIMENSIONS:** 5-1/8 inches high, 19 inches wide, and 7 inches deep.

## OPERATING CONTROLS AND INDICATORS

**STATION CONTROL switch:** TRANSMIT position - Readies the transceiver for transmit condition.  
VOX OPERATE position - Readies the transceiver for voice-operated transmit condition.

RECEIVER position - Readies the transceiver for receive condition.

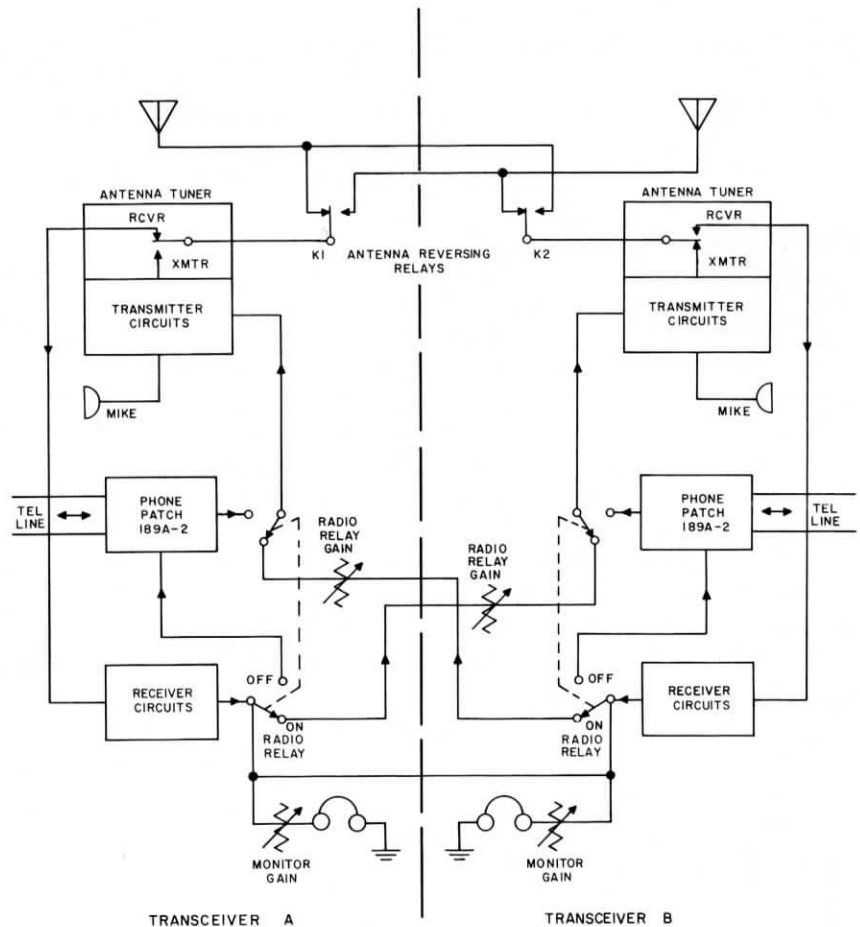
**TRANSMIT indicator:** Indicates the transceiver is in transmit condition.

**RADIO-RELAY ON-OFF switch:** Permits direct relay of receive information from one transceiver to transmit circuits of another transceiver.

**RADIO-RELAY GAIN control:** Provides control of radio relay gain for transmit circuits.

**PHONE PATCH ON-OFF switch:** Ties telephone handset to transceiver transmit and receive circuits.

**PHONE PATCH BALANCE control:** Provides an impedance-matching circuit between telephone line and phone patch circuit.



C220-178-3

Figure 11. Radio-Relay and Phone Patch Control Panel, Block Diagram

MONITOR gain control: Provides gain adjustment for headphones.

PHONES jack: Permits monitoring transceiver.

ANTENNA REVERSE switch: Energizes antenna reversing relay(s).

ANTENNA REVERSED indicator: Indicates antenna reversing relay or relays are energized.

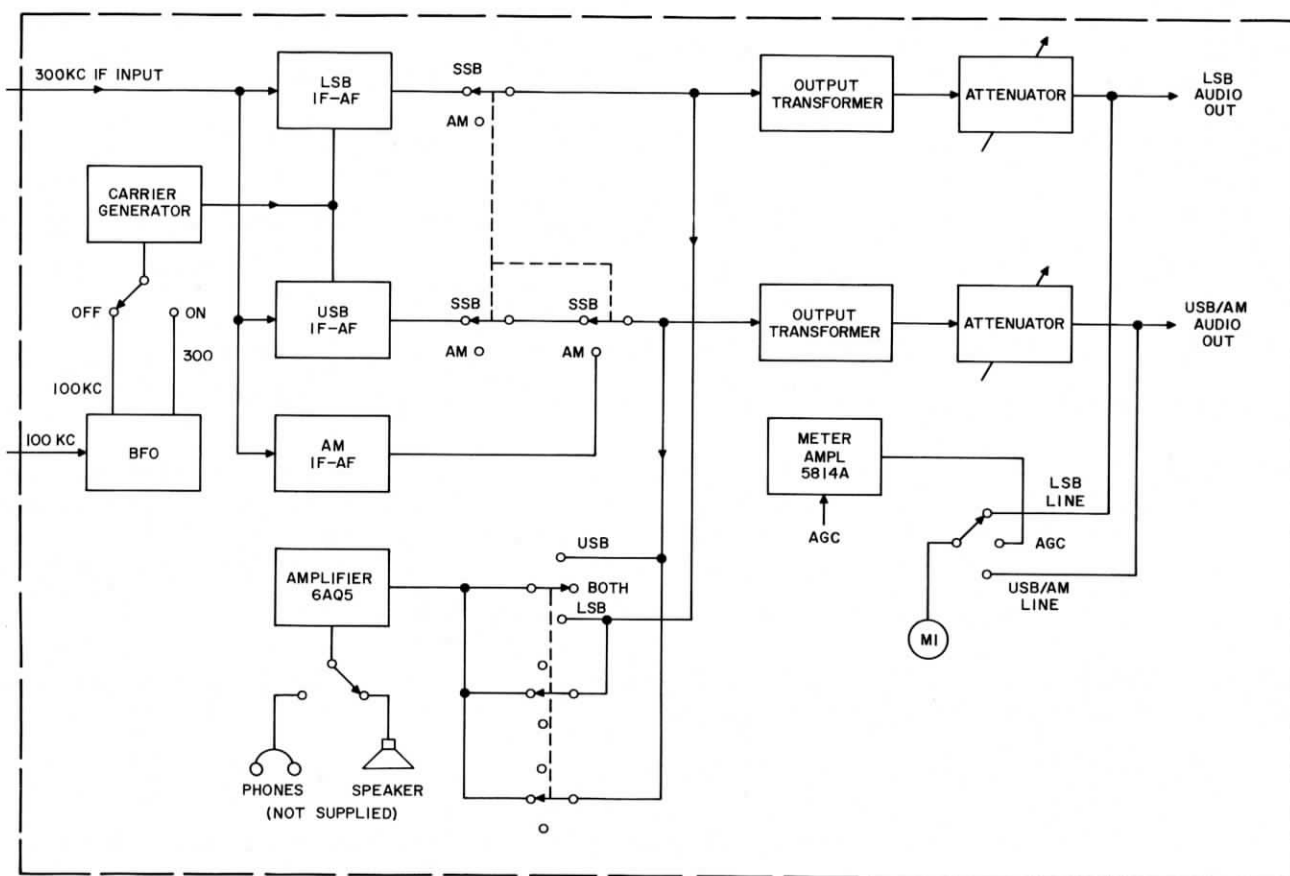
## IF TRANSLATOR 786K-1

Collins I-F Translator 786K-1, shown in figure 12, is designed for receiver applications only. Figure 13 is a block diagram of the 786K-1. Essentially, it combines the receive-function circuits of 786F-1 Sideband Generator and 159B-1 Audio and Control Unit into one chassis. The 300-kc intermediate frequency signals are converted to audio frequency which is fed simultaneously to a speaker and head-phone amplifier and through attenuators to line outputs. Also incorporated is a metering circuit which enables the monitoring of either sideband and the AGC level.



V359-10-P

Figure 12. I-F Translator 786K-1 combines receive-function circuits



V359-11-4

Figure 13. I-F Translator 786K-1, Block Diagram

## SYSTEMS EMPLOYING KWT-6 COMPONENTS

The 786K-1 contains four plug-in modules. The three I-F/A-F modules for USB, LSB, and AM are used for amplification, AGC generation, demodulation, and audio amplification. The fourth module is the Carrier Generator which develops the 300-kc signal necessary for demodulation of the SSB signal.

An AGC selector switch permits choice of using the AGC developed by either USB, LSB, or both. AM is received on the USB channel when AM reception is desired.

The I-F Translator is constructed for mounting in a standard 19-inch rack. The unit can be swung out for maintenance accessibility. All input and output power and control connections are made through two 16-pin connectors at the rear of the unit. The 300-kc I-F input and 100-kc reference signal are brought in through coax receptacles.

### TECHNICAL CHARACTERISTICS

INPUT SIGNALS: 300 kc I-F at 100 microvolts per 40-mw line output, 50 ohm nominal impedances unbalanced.

100-kc frequency standard at 1.5 vrms.

OUTPUT SIGNALS: Line output: -34 to +14 dbm (adjustable) into 600 ohms balanced line.

Monitor Output: 1 watt into a 4- or 600-ohm speaker with less than 5 percent distortion, or to headphones.

BFO RANGE:  $\pm 2$  kc.

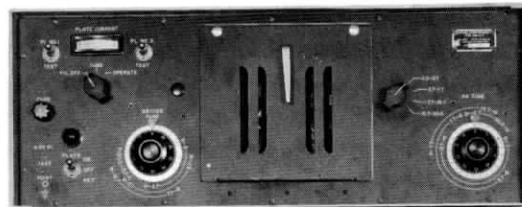
METER RANGE: -20 to +23 dbm in two ranges.

WEIGHT: 14 pounds.

DIMENSIONS: 19 in. wide x 7 in. high x 7 in. deep.

### POWER AMPLIFIER 367A-3

Collins Power Amplifier 367A-3, shown in figure 14, is a linear r-f power amplifier. The unit consists of a power amplifier stage, driver stage, and necessary bias and control circuits. The chassis is constructed for mounting in a standard 19-inch open-type rack. The unit is hinged on the rack to facilitate maintenance. The controls are accessible at the front panel, and the power and control wires extend to two 16-pin connectors at the rear. The r-f input and output connections and high-voltage input connections are made through coaxial connections at the rear of the unit. Forced air cooling is employed. A block diagram of the 367A-3 is shown in figure 15.



V359-52-P

Figure 14. Power Amplifier 367A-3 acts as a linear r-f power amplifier

### TECHNICAL CHARACTERISTICS

FREQUENCY RANGE: 2 to 30 mc in 4 bands.

R-F SIGNAL INPUT: 0.15 watt PEP for 500 watts PEP output.

POWER OUTPUT: 500 watts PEP.

125 watts carrier power for compatible AM.

INTERMODULATION DISTORTION: 35 db below PEP output.

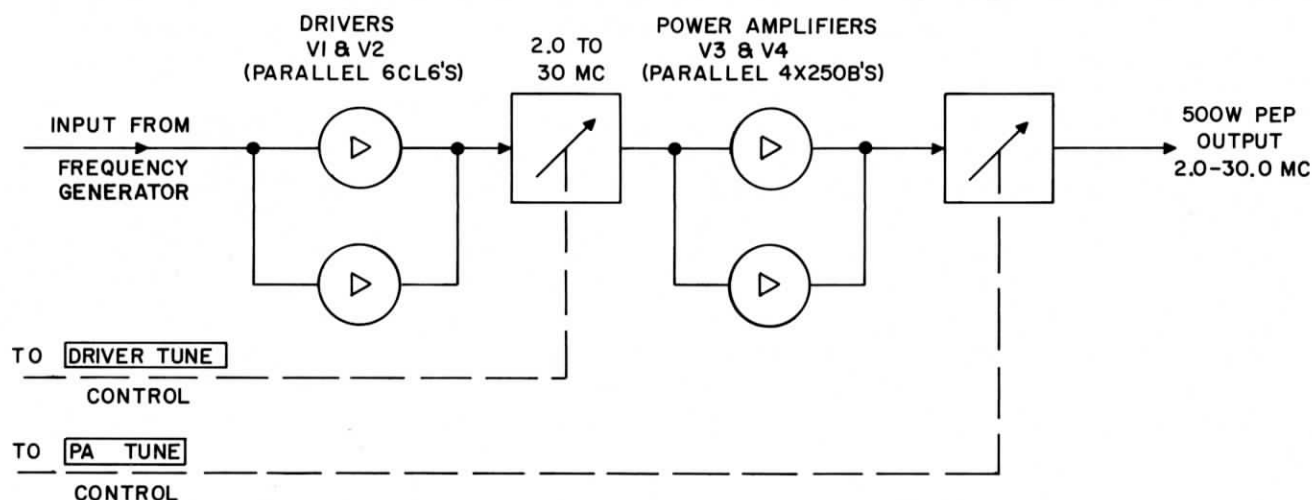


Figure 15. Power Amplifier 367A-3, Block Diagram

C220-46-2

R-F INPUT IMPEDANCE: 50 ohms nominal unbalanced.

R-F OUTPUT IMPEDANCE: 50 ohms nominal unbalanced through Pi - output network.

TGC OUTPUT VOLTAGE: A d-c bias voltage is provided for automatic gain control.

POWER REQUIREMENTS: Supplied by High Voltage Power Supply 428B-1.

WEIGHT: 21 pounds.

DIMENSIONS: 6-7/8 in. high x 18-7/8 in. wide x 8-1/2 in. deep.

RACK SPACE REQUIRED: 7 in.

## OPERATING CONTROLS AND INDICATORS

DRIVER TUNE: Tunes driver amplifier plate circuit.

PA TUNE: Tunes power amplifier plate circuit.

BAND SWITCH: Selects band of operation for PA tuning circuits.

PL No. 1 and No. 2 TEST: Test switch used to check balance of power amplifier tubes.

PLATE CURRENT METER: Indicates plate current of power amplifier tubes.

FIL-OFF-TUNE-OPERATE SWITCH:

Fil-Off Position - Removes filament and bias voltage from PA and disables High Voltage Power Supply 428B-1.

Tune - Applies power to unit with reduced power amplifier screen voltage.

Operate - Normal operating position.

PLATE ON-OFF KEY:

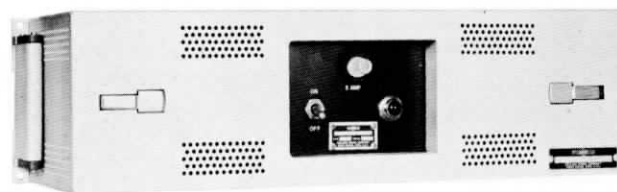
Plate On-Off Position - Controls application of plate and screen voltage to power amplifier tubes.

Key Position - Performs same functions as above plus keying the unit.

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

## LOW VOLTAGE POWER SUPPLY 429B-1

Collins Low Voltage Power Supply 429B-1, shown in figure 16, provides several outputs of relatively low voltage. The unit is constructed for mounting in a standard 19-inch open-type rack. It is hinged to facilitate maintenance and adjustment. A metal cover, secured by thumb-release fasteners, provides protection for the unit. Power inputs and outputs extend from two 16-pin connectors at the rear of the chassis. Forced air cooling is employed. A block diagram of the 429B-1 is shown in figure 17.



V359-14-P

Figure 16. Low-Voltage Power Supply 429B-1 supplies several relatively low voltages

### TECHNICAL CHARACTERISTICS

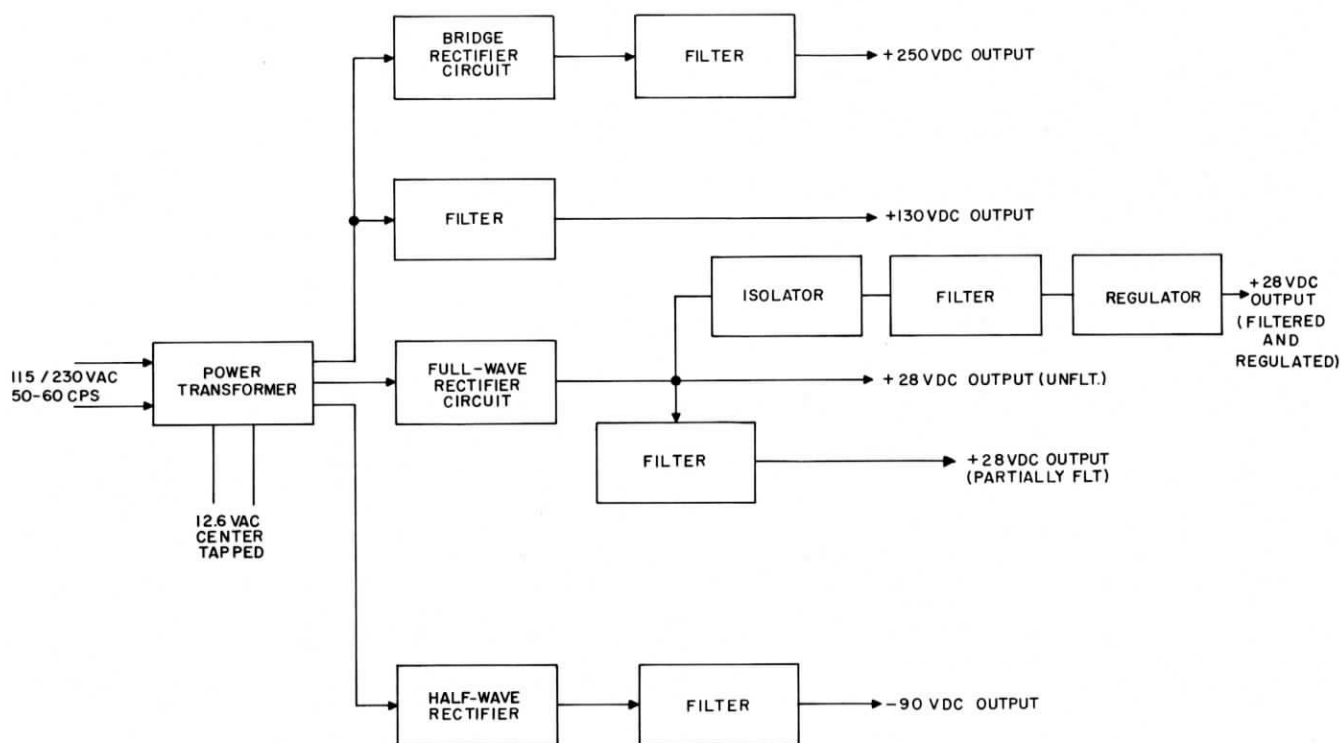
OUTPUT RATINGS: +250 volts d-c filtered at 37 ma, no more than 0.1 percent ripple.  
+130 volts d-c filtered at 315 ma, no more than 0.1 percent ripple.  
+28 volts d-c unfiltered at 1.5 amps, 120 cps ripple.  
+28 volts d-c partly filtered at 580 ma, no more than 1 percent ripple.  
-90 volts d-c filtered at 6 ma, no more than 0.1 percent ripple.  
12.6 volts a-c, 5.2 amp, center tapped.  
+28 volts d-c regulated at 180 ma.

INPUT RATING: 115/230 volts a-c, 50 to 60 cps, single phase, 185 watts.

WEIGHT: 23 pounds.

DIMENSIONS: 5-1/8 in. high x 18-7/8 in. wide x 7 in. deep.

REQUIRED RACK SPACE: 5-1/8 in.



V359-01-3

Figure 17. Low-Voltage Power Supply 429B-1, Block Diagram

## OPERATING CONTROLS AND INDICATORS

ON-OFF SWITCH: Controls input power to 429B-1 and blower.

FUSE INDICATOR: Fuse receptacle and open fuse indicator light.

PILOT LIGHT: Lights when unit is on.

## HIGH VOLTAGE POWER SUPPLY 428B-1

Collins High Voltage Power Supply 428B-1, shown in figure 18, is designed for supplying high voltages for power amplifier operation. The unit consists of two bridge rectifiers, protective fuses, and an interlock switch. The main chassis is constructed for mounting in a standard 19-inch open-type rack. The cover, secured by thumb-release fasteners, protects the equipment and protects personnel from the high voltages. All connections are made through a terminal board at the rear of the unit, except for the 2000-volt d-c line which is extended from a coaxial type high voltage connector. Forced air cooling is employed, but the design is such that full power operation is possible with convection cooling. A block diagram of the 428B-1 is shown in figure 19.

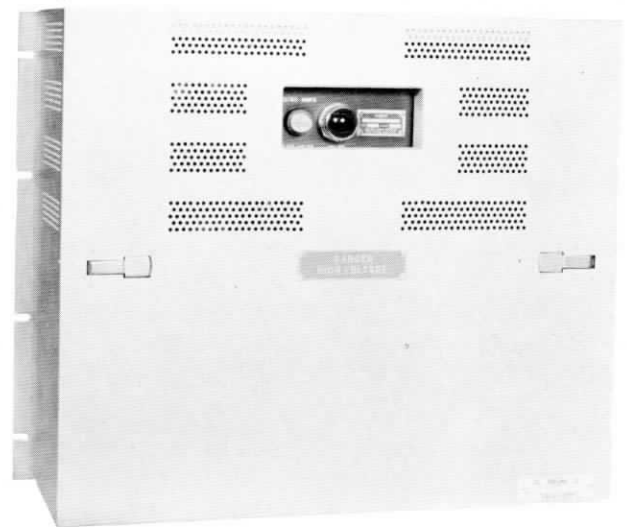
## TECHNICAL CHARACTERISTICS

### OUTPUT RATINGS:

2000 volts d-c at 600 ma maximum, no more than 1.25 percent ripple.

400 volts d-c at 80 ma maximum, no more than 0.1 percent ripple.

INPUT RATING: 115/230 volts a-c, singlephase, 50 to 60 cps, 1245 watts.



V359-16-P

Figure 18. High-Voltage Power Supply 428B-1 provides high voltages for PA operation

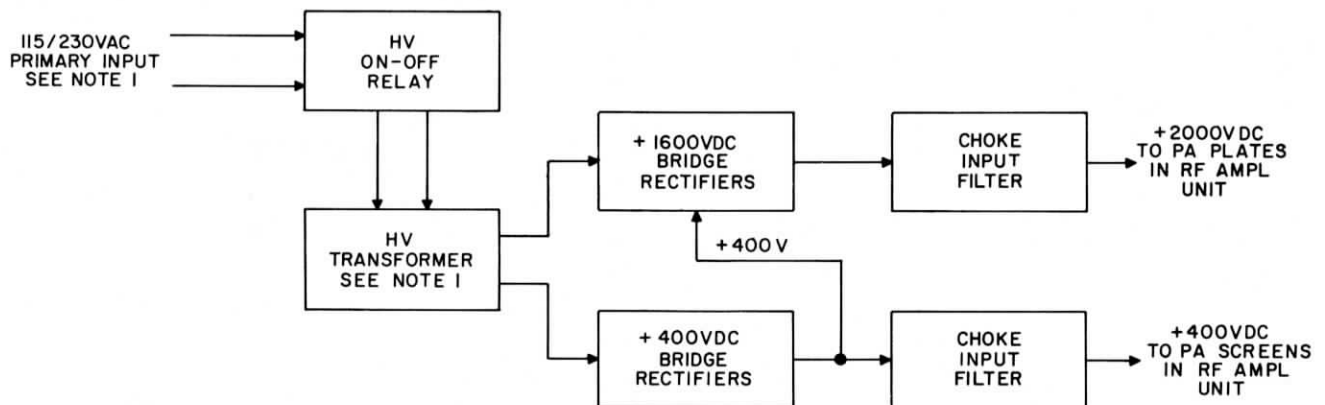


Figure 19. High-Voltage Power Supply 428B-1, Block Diagram

C220-31-3

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

WEIGHT: 93 pounds.

DIMENSIONS: 15-3/4 in. high x 19 in. wide x 7 in. deep.

RACK SPACE REQUIRED: 15-3/4 in.

## INDICATORS

HIGH VOLTAGE LIGHT: Goes on when primary power is applied.

FUSE INDICATOR: Fuse receptacle and open fuse indicator.

## BLOWER 199G-3

Collins Blower 199G-3, shown in figure 20, is a centrifugal blower capable of delivering 125 cfm of air at a pressure equivalent to 1.83 inches of water. The 199G-3 includes a double-pole, single-throw switch which is actuated by air pressure. The switch contacts are used as interlocks for the primary power to the system. A block diagram of the 199G-3 is shown in figure 21.

The unit mounts in a standard 19-inch open-type rack. Cooling air is supplied to the units mounted in the rack through a central air duct. All power and control connections are made through an 8-pin connector located on the top of the 199G-3. Access to components is obtained by removing the front cover and air filter.

## TECHNICAL CHARACTERISTICS

VOLTAGE SOURCE: 115/230 volts a-c, 50 to 60 cps.

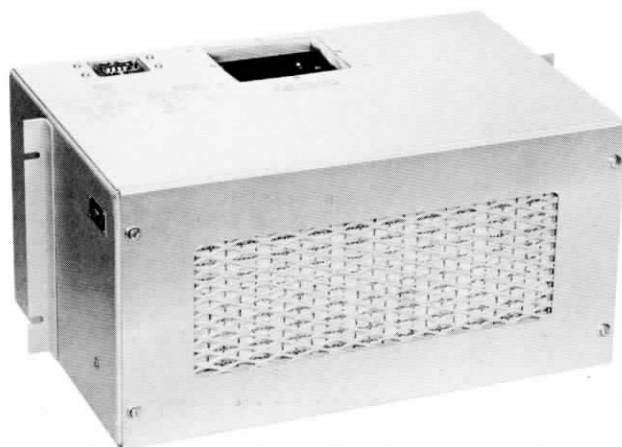
POWER INPUT: 215 watts at 1.0-in. water gauge pressure.

OUTPUT CAPACITY: 125 cfm at 1.83-in. water gauge static pressure.

DIMENSIONS: 8-7/8 in. high x 11-1/4 in. deep x 19 in. wide.

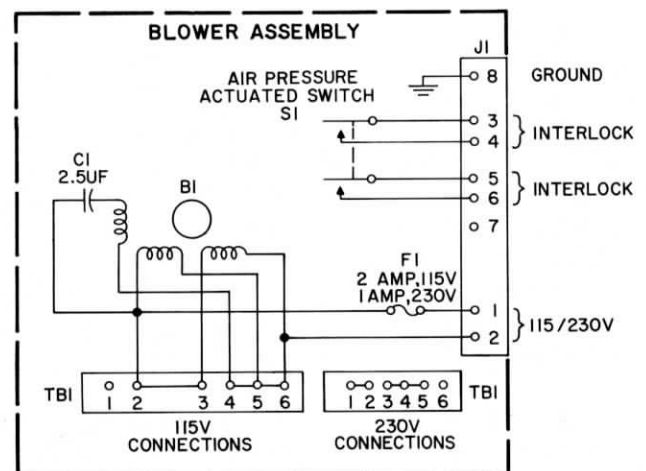
WEIGHT: 22 pounds.

REQUIRED RACK SPACE: 8-7/8 in.



V359-18-P

Figure 20. Blower 199G-3 supplies cooling air to all rack-mounted units



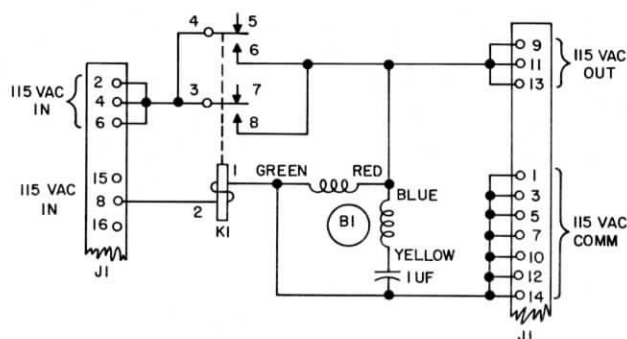
C220-26-3

Figure 21. Blower 199G-3, Block Diagram

## SMALL BLOWER

A smaller Blower Unit, similar to type 199G-3, is available. The blower unit contains a centrifugal blower and a power relay. It is designed to provide filtered cooling air into the central air duct of smaller sized radios, such as the 50E-7. It is capable of delivering 45 cfm continuously at 1.0-inch water gauge pressure.

The power control relay is mounted in the unit and provides for the switching of high current requirements.



V359-21-2

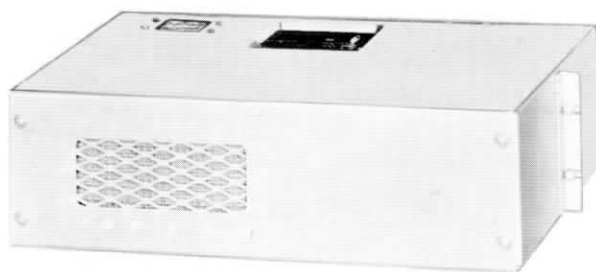
Figure 23. Small Blower, Block Diagram

## ANTENNA NETWORK 180U-2

Collins Antenna Network 180U-2, shown in figure 24, consists of an antenna line tuner, speaker assembly, r-f wattmeter with directional coupler, and a transmit-receive antenna changeover relay. All are mounted on a standard 19-inch rack panel.

The antenna line tuner consists basically of an "L" network which matches the 50-ohm output from a power amplifier to either a high- or low-impedance antenna line having a standing-wave ratio of 2:1 or less. The "L" network, which can be reversed for impedance matching through the use of a front panel switch, is capable of tuning the transmission line to a standing-wave ratio of 1.1:1 or less. Loading capacitors and a loading coil are used to adjust the tuning range.

The speaker assembly contains a 4-inch permanent magnet speaker with an on-off switch. The switch terminates the speaker output lines when it is turned off. Speaker operating level is 2 watts maximum.



V359-20-P

Figure 22. Blower 199M-1 cools smaller sized radios with 45 cfm at 1.0 water gauge pressure

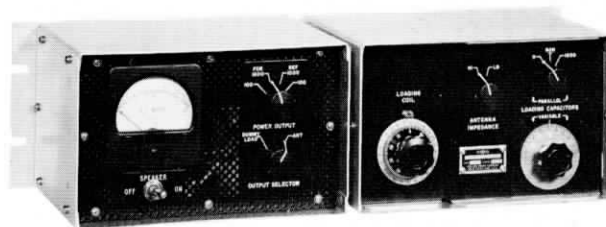
## TECHNICAL CHARACTERISTICS

**DIMENSIONS:** 5-1/4 in. high x 1-1/4 in. deep x 19 in. wide.

**VOLTAGE SOURCE:** 115/230 volts a-c, 50 to 60 cps.

**POWER INPUT:** 30 watts for 1.0-in. water gauge pressure.

**OUTPUT CAPACITY:** 45 cfm at 1.0-in. water gauge pressure. 68 cfm at free air.

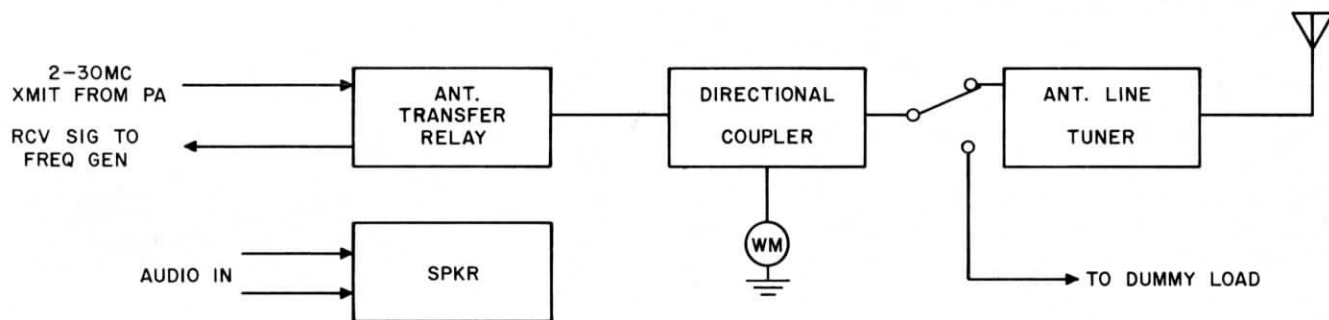


CU-737

V359-22-P

Figure 24. Antenna Network 180U-2 includes a line tuner, speaker assembly, changeover relay, and r-f wattmeter with directional coupler

# SYSTEMS EMPLOYING KWT-6 COMPONENTS



C220-11-2

Figure 25. Antenna Network 180U-2, Block Diagram

The r-f wattmeter, operating in conjunction with the directional coupler, has two forward power ranges, 0 to 100 watts and 0 to 1000 watts, and two reflected power ranges, 0 to 100 watts and 0 to 1000 watts. The antenna changeover relay provides a set of d-c contacts for use in interlocking the r-f power output with the antenna relay. The relay itself, mounted at the rear of the unit, contains two Type N coaxial connectors for input and output r-f connections and one Type BNC connector. All other r-f connectors are Type N. Interconnections with other units are made with Type RG-8/U coaxial cable. A block diagram of Antenna Network 180U-2 is shown in figure 25.

## TECHNICAL CHARACTERISTICS

FREQUENCY RANGE: 2 to 30 mc.

INPUT AND OUTPUT R-F IMPEDANCE: 50 ohms nominal unbalanced.

R-F INPUT LEVEL: 500 watts continuous; 1000 watts maximum.

LINE TUNING CAPABILITIES: 2:1 vswr or less to 1.1:1 vswr or less.

SPEAKER OPERATING LEVEL: 2 watts maximum.

WATTMETER RANGES: Forward - 0 to 100 and 0 to 1000 watts.  
Reflected - 0 to 100 and 0 to 1000 watts.

POWER REQUIREMENTS: 28 volts d-c at 125 ma for operation of antenna changeover relay.  
Supplied by Low Voltage Power Supply 429B-1.

DIMENSIONS: 5-1/4 in. high x 19 in. wide.

RACK SPACE REQUIRED: 5-1/4 in.

## OPERATING CONTROLS AND INDICATORS

POWER OUTPUT SWITCH: Selects wattmeter range.

OUTPUT SELECTOR SWITCH: Feeds output to dummy load or antenna.

WATTMETER: Indicates forward or reflected power, depending upon switch position.

SPEAKER ON-OFF SWITCH: Turns speaker on and off.

ANTENNA IMPEDANCE SWITCH: Reverses the "L" network for high or low impedance matching.

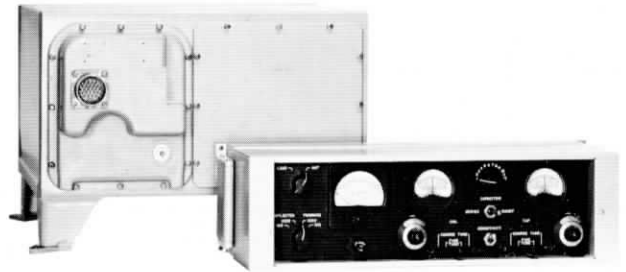
LOADING COIL: Varies the amount of series inductance.

LOADING CAPACITORS, VARIABLE: Vary the amount of shunt capacitance.

LOADING CAPACITORS, PARALLEL: Add parallel capacity of shunt capacitance.

## ANTENNA COUPLER 180T-2

Collins Antenna Coupler 180T-2, shown in figure 26, consists of an Antenna Tuner and a Remote Control Unit. The Antenna Tuner, normally mounted at the base of an antenna, is controlled from the Remote Control Unit. The latter is mounted in a standard 19-inch rack at the equipment location.



V359-24-P

Figure 26. Antenna Coupler 180T-2 matches antenna impedances to a 52-ohm coaxial output

The antenna coupler is completely sealed and uses waterproof connectors to prevent all undesirable effects caused by exposure to the elements. It contains the reactive components required to match the antenna to the transmitter, motors to tune the circuits, associated switches and indicator potentiometers, and a cooling blower.

These equipments constitute an antenna tuning system that will, by manual remote operation, match typical long wire and whip antenna impedances to a 50-ohm coaxial output. A block diagram of the 180T-2 is shown in figure 27.

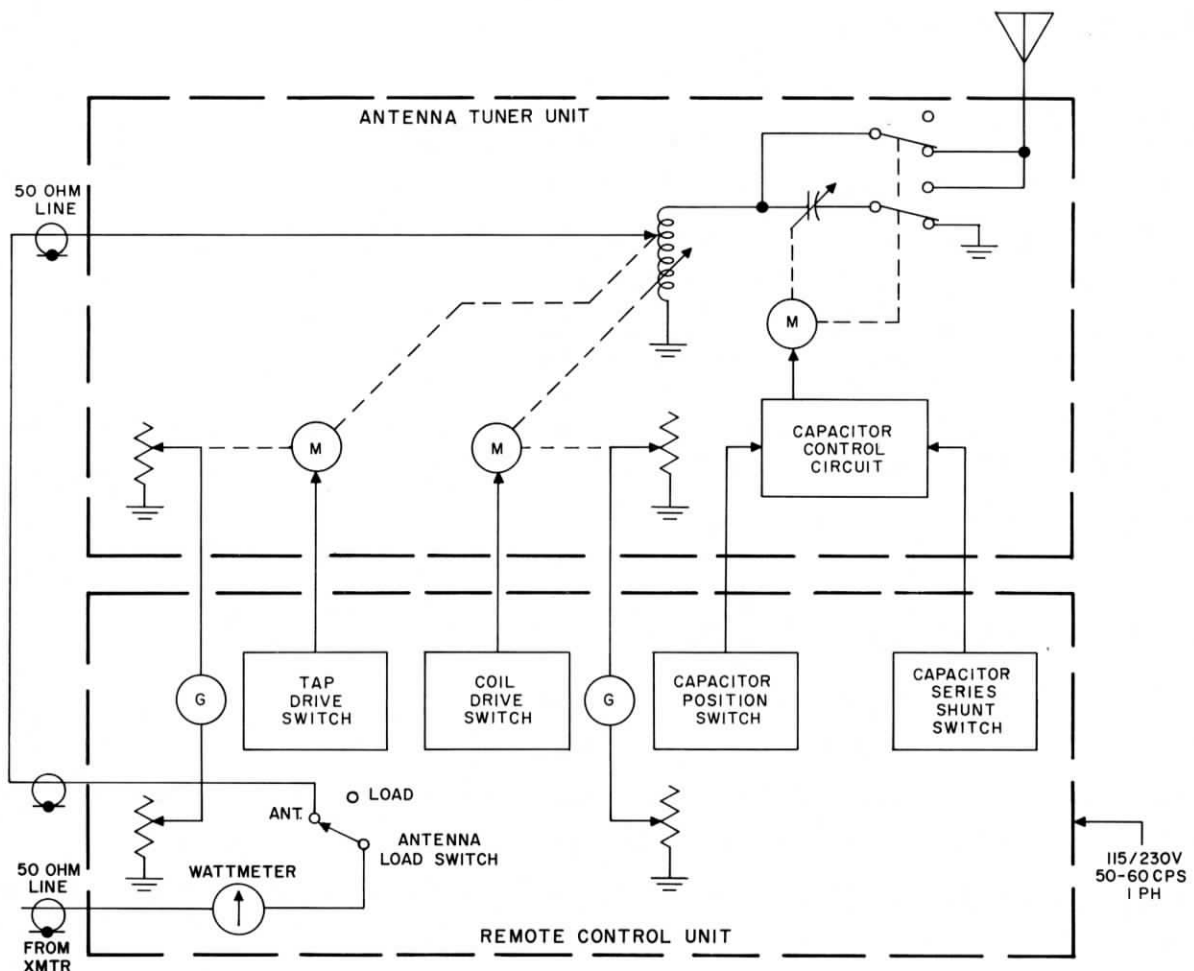


Figure 27. Antenna Coupler 180T-2, Block Diagram

V332-02-3

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

## TECHNICAL CHARACTERISTICS

FREQUENCY RANGE: 2 to 30 mc.

R-F POWER INPUT: 1000 watts PEP, maximum (2.5 kw PEP voice only).  
500 watts average power maximum.

TUNING METHOD: Manual remote.

TUNING ACCURACY: 1.3:1 vswr maximum.

TUNING RANGE: Will match 35-foot whip or any typical long wire antenna greater than 35 feet in length.

POWER REQUIREMENTS: 115/230 volts a-c, 50 to 60 cps, single phase, 130 watts.

WEIGHT: Antenna Tuner - 35 pounds.  
Remote Control Unit - 10 pounds.

DIMENSIONS: Antenna Tuner - 12 in. high x 19 in. wide x 17-1/2 in. deep.  
Remote Control Unit - 5-1/2 in. high x 19 in. wide x 6-7/8 in. deep.

REQUIRED RACK SPACE: Remote Control Unit - 5-1/4 in.

## OPERATING CONTROLS AND INDICATORS

(All located on the Remote Control Unit)

CAPACITOR POSITION: Selects amount of capacity desired.

SERIES-SHUNT SWITCH: Places variable capacitor in series or shunt.

COIL SWITCH: Selects desired inductance.

TAP SWITCH: Sets coil tap for proper loading.

SELECTOR SWITCH: Selects Antenna Tuner or dummy load.

WATTMETER: Indicates reflected or forward power.

TUNING METERS: Two zero center meters indicate tap and coil position.

## FREQUENCY COMPARATOR 54Q-1

Collins Frequency Comparator 54Q-1, shown in figure 28, compares any reference oscillator signal with an external frequency standard. Two comparison methods are provided. The first method compares a 100-kc reference oscillator frequency with a 100-kc external standard without interrupting normal operation. The second method, which results



Figure 28. Frequency Comparator 54Q-1 compares reference oscillator signal with external standard.

C220-82-P

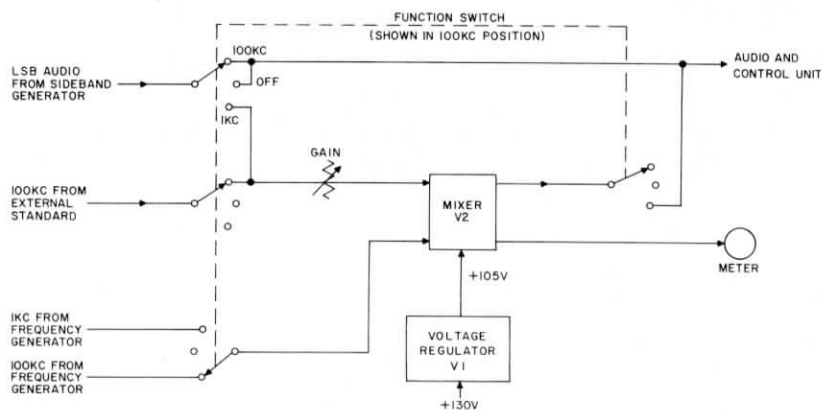


Figure 29. Frequency Comparator 54Q-1, Block Diagram

C220-78-3

in an interruption of service, compares an operating frequency with a net control frequency standard or any other transmitted frequency such as WWV. A front panel meter oscillates at the frequency difference rate between the signals being compared. By counting the number of oscillations during a period of time, the frequency difference can be determined. When an operating frequency is compared with a transmitted frequency standard, the output from the frequency comparator can be supplied to an accessory speaker. This permits frequency differences, which are too great to be indicated on the meter, to be heard as a beat note. A block diagram of the 54Q-1 is shown in figure 29.

When used in a communications system using KWT-6 components, a 1-kilocycle reference signal is generated from the Reference Oscillator and Frequency Divider, both in Frequency Generator 786E-1. This signal is compared with a 1-kilocycle signal converted down from a received r-f signal. A 100-kilocycle signal, generated by the Reference Oscillator in the 786E-1, also may be compared with an external 100-kilocycle signal.

The 54Q-1 Frequency Comparator mounts in a standard 19-inch, open-type relay rack and is hinged to facilitate maintenance. The 54Q-1 is protected by a metal dust cover which is secured with thumb-release fasteners. A control panel is located on the front of the unit, and all inputs and outputs are terminated in one 16-pin connector and two BNC-type coaxial connectors located on the rear of the unit.

## TECHNICAL CHARACTERISTICS

**SIGNAL INPUTS:** 1 kc fixed, 0.5 to 2 volts.  
 1 kc variable, 0.5 to 10 volts.  
 100 kc fixed, 0.5 to 3 volts.  
 100 kc variable, 0.5 to 5 volts.

**INPUT IMPEDANCE:** 1 kc fixed, 1 megohm.  
 1 kc variable, 680 ohms.  
 100 kc fixed, 1 megohm.  
 100 kc variable, 1 megohm.

**WEIGHT:** 5.75 pounds.

**DIMENSIONS:** 19 in. wide, 3-1/2 in. high, and 7 in. deep.

**REQUIRED RACK SPACE:** 3-1/2 inches.

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

## OPERATING CONTROLS AND INDICATORS

**FREQUENCY SELECTOR:** In the OFF position, disconnects input signals from mixer; applies short across meter terminals.

In the 1 KC position, connects the two 1-kc input signals to mixer; opens LSB audio line; connects mixer output to LSB audio line.

In the 100 KC position, connects the two 100-kc input signals to mixer.

**GAIN:** Adjusts input voltage applied to the mixer from LSB audio input or 100-kc external standard.

**METER ZERO:** Applies a balancing voltage to zero the meter.

## FREQUENCY COMPARATOR 54Q-2

Collins Frequency Comparator 54Q-2 shown in figure 30, is used to compare two 1-kilocycle signals or two 100-kilocycle signals. The two signals being compared are applied to the deflection plates of a built-in oscilloscope. The difference frequency is then presented as a Lissajous pattern on the oscilloscope screen.

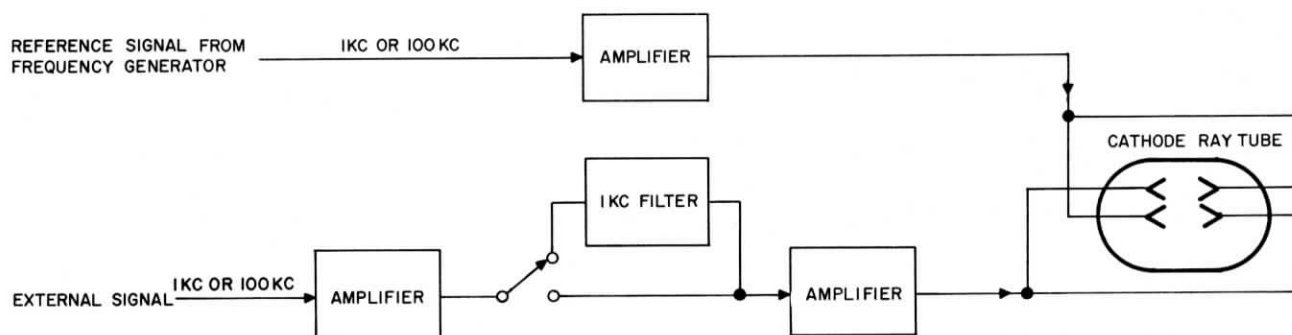
When used in a communications system using KWT-6 components, a 1-kilocycle reference signal is generated from the Reference Oscillator and Frequency Divider, both in Frequency Generator 786E-1. This signal is compared with a 1-kilocycle signal converted down from a received r-f signal. A 100-kilocycle signal, generated by the Reference Oscillator in the 786E-1, may also be compared with an external 100-kilocycle signal.

The 54Q-2 is mounted in a standard 19-inch, open-type rack and is hinged to facilitate maintenance. The unit is protected by a metal dust cover secured by thumb-release fasteners. A control panel is located on the front of the unit. All signal and power and control connections are made through two BNC coaxial connectors and a 16-pin connector at the rear. A block diagram of the 54Q-2 is shown in figure 31.



V359-26-P

Figure 30. Frequency Comparator 54Q-2 compares two 1-kc or two 100-kc signals



V359-05-3

Figure 31. Frequency Comparator 54Q-2, Block Diagram.

## TECHNICAL CHARACTERISTICS

INPUT LEVEL: 0.3 to 10 volts.

INPUT IMPEDANCE: 100-kc input - 100,000 ohms.  
1-kc input - 100,000 ohms.

WEIGHT: 8.75 pounds.

DIMENSIONS: 19 in. wide x 3-1/2 in. high x 7 in. deep.

REQUIRED RACK SPACE: 3-1/2 in.

## OPERATING CONTROLS AND INDICATORS

OSCILLOSCOPE: Provides visual presentation of difference frequency with Intensity, Horizontal Position, and Vertical Position Controls.

REFERENCE GAIN: Controls level of 1-kilocycle or 100-kilocycle reference frequency.

SIGNAL GAIN: Controls level of 1-kilocycle signal or 100-kilocycle external signal.

OFF-LOCAL-REMOTE: Turns unit on and off, with local used for 1-kilocycle comparison and remote for 1-kilocycle or 100-kilocycle comparison depending upon internal connections.

## HANDSET ADAPTER

Collins Handset Adapter, shown in figure 32, permits local operation of a receiver, using a Navy Type 51007A Handset, or remote operation, using a C-1138/UR Radio Set Control and a Navy Type 51007A Handset. A connector and holder are provided on the control panel for the handset. For improved audio quality, the Collins Dynamic Handset is recommended.

The Handset Adapter mounts in a standard 19-inch open-type rack and is hinged to facilitate maintenance. The unit is protected by a metal dust cover which is secured with thumb-release fasteners. A block diagram of the Handset Adapter is shown in figure 33.



C220-83-P

Figure 32. Collins Handset Adapter permits local or remote receiver operation

## TECHNICAL CHARACTERISTICS

POWER REQUIREMENTS: 115 volts, a-c, 50-60 cps.

DIMENSIONS: 3-1/2 in. high x 19 in. wide x 7 in. deep.

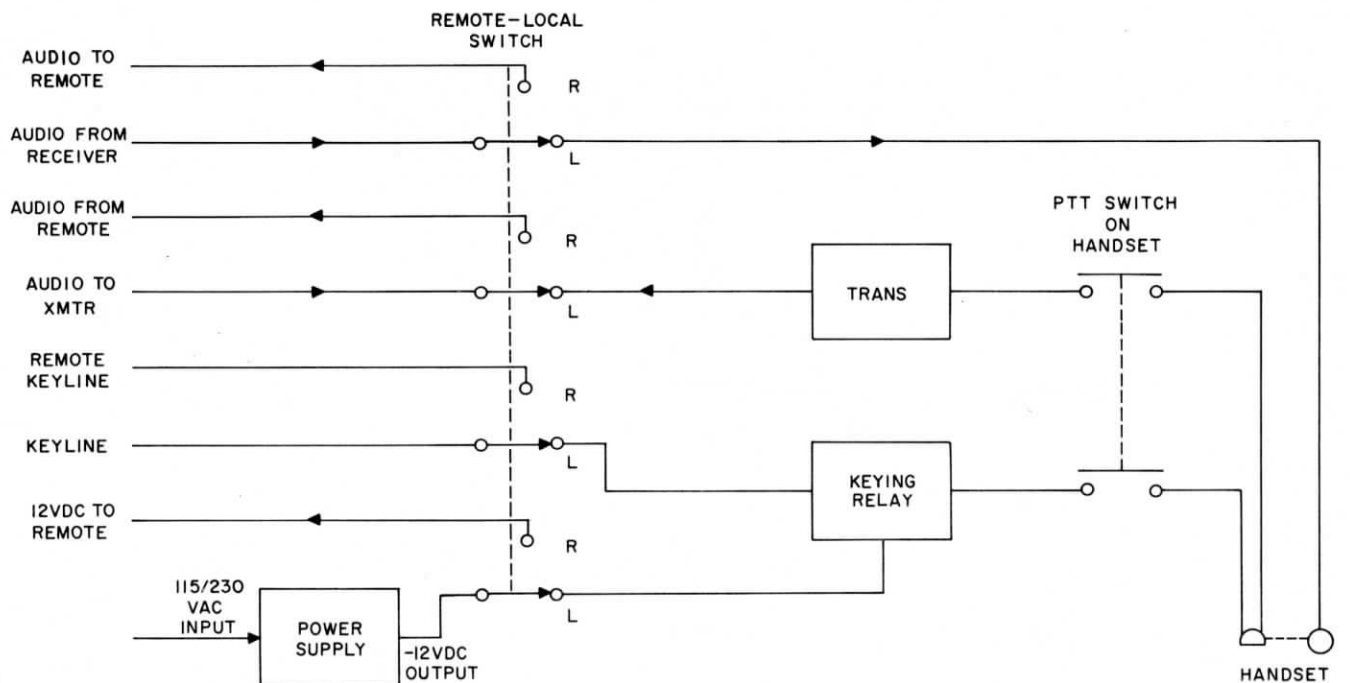
WEIGHT: 12 pounds.

REQUIRED RACK SPACE: 3-1/2 in.

## CONTROLS

LOCAL-REMOTE: Selects indicated operation for local or remote handset.

## SYSTEMS EMPLOYING KWT-6 COMPONENTS



V359-03-3

Figure 33. Collins Handset Adapter, Block Diagram

## DYNAMIC HANDSET

The Dynamic Handset, shown in figure 34, consists of a noise-canceling dynamic microphone incorporating a transistor amplifier, a dynamic receiver, and a push-to-talk switch. It is directly interchangeable with Navy Type 51007A carbon handset. The Dynamic Handset has the same plug connections, output impedance, and output level as the Type 51007A carbon handset, but offers improved audio quality. The handset is supplied with a 51-inch cord, terminated in a type AN-3106-145-5P connector, and is recommended for use with the Handset Adapter.

### TECHNICAL CHARACTERISTICS

#### TRANSMITTER:

TYPE: Dynamic noise-canceling transistor amplifier.

OUTPUT: 7 mw max into 30-ohm load.

SENSITIVITY: 0.4 to 0.08 volts across 30-ohm load of the handset with input of 28 dyne/cm<sup>2</sup> at 1000 cps.

POWER REQUIRED: 12 v d-c.

#### RECEIVER:

TYPE: Dynamic.

IMPEDANCE: 600  $\pm$ 100 ohms at 1000 cps.

SENSITIVITY: .0002 dyne/cm<sup>2</sup> with input of 1 mw at 1000 cps.



V359-30-P

Figure 34. Dynamic Handset offers improved audio quality over the Type 51007A carbon handset



V359-31-P

Figure 35. CW and FSK Unit also monitors the receive and transmit audio outputs of the audio and control units

## CW AND FSK SIMULATOR

The CW and FSK Unit, shown in figure 35, enables an SSB suppressed carrier transceiver to be operated in CW and FSK modes of operation. On FSK transmit operation the CW and FSK Unit converts the keying input from a neutral teletypewriter loop to audio tones, 1575 cps for space and 2425 cps for mark. On CW transmit operation, the unit provides a keyed audio tone of 1000 cps or 1500 cps, selected by front panel switch. On FSK receive operation, the CW and FSK Unit provides a bfo output signal. This signal is centered on 300.550 kc and is variable approximately 1 kc above or below this frequency. The CW and FSK Unit also has a relay circuit for break-in CW operation and a metering circuit for monitoring the receive and transmit audio outputs of the audio and control unit, in addition to monitoring the output of the CW and FSK Unit. The CW and FSK Unit, mounts in a standard 19-inch open-type relay rack and is hinged to facilitate maintenance. The unit is protected by a metal dust cover which is secured with thumb-release fasteners.

### TECHNICAL CHARACTERISTICS

WEIGHT: 7.5 pounds.

DIMENSIONS: 3-1/2 in. high x 19 in. wide x 7 in. deep.

REQUIRED RACK SPACE: 3-1/2 in.

POWER REQUIREMENTS: +28 v d-c unfiltered, 2 ma.  
+130 v d-c 18 ma, less than 0.5 percent ripple.  
-90 v d-c 2.5 ma, less than 0.5 percent ripple.  
6.3 v a-c, 60 cps, 0.75 amp.

### SIGNAL INPUT

FSK: 0 ma for space and up to 60 ma for mark from a neutral teletypewriter loop.

CW: CW key.

### SIGNAL OUTPUT

FSK: 2 volts rms 600 ohms, 1575 cps on space and 2425 cps on mark.

CW: 2 volts rms 600 ohms, 1000 cps or 1500 cps.

BFO: 0.2 volt rms high impedance, 300.550 kc variable  $\pm 1$  kc.

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

## FREQUENCY STABILITY

FSK: 5 percent.

CW: 10 percent.

BFO: 0.05 percent.

## OUTPUT IMPEDANCE

FSK and CW: 600 ohms balanced.

BFO: High impedance.

## KEYING CHARACTERISTICS

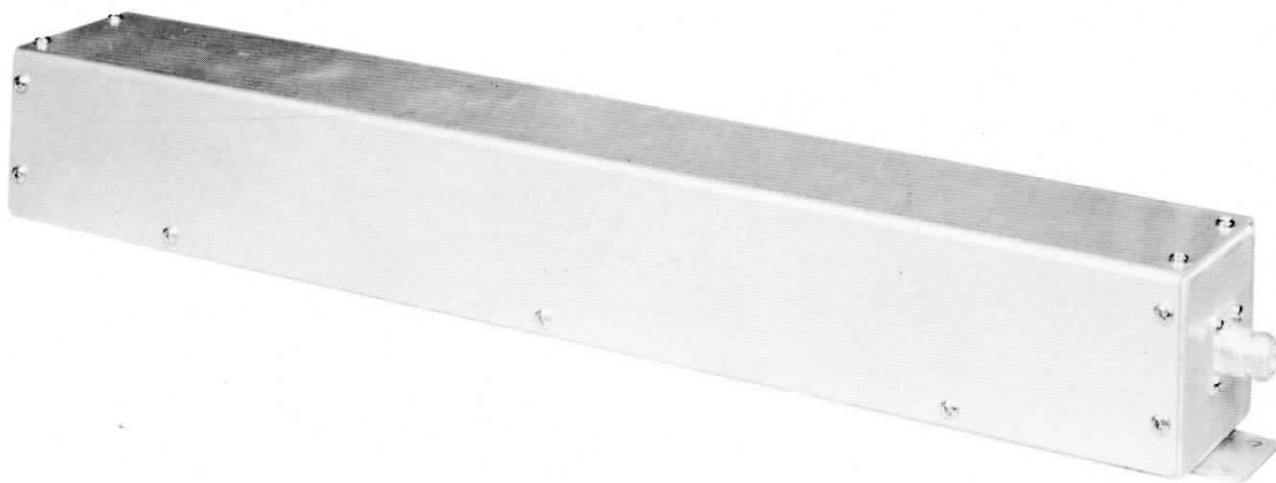
FSK: 100 words per minute maximum.

CW: 60 words per minute maximum, back wave at least -50 db.

## DUMMY ANTENNA 172J-1

Dummy Antenna 172J-1, shown in figure 36, terminates a transmitter in a nonradiating 50-ohm unbalanced load for transmitter tuning and testing purposes. The 172J-1 has a power rating of 500 watts continuous when supplied with 50 lb/hr of cooling air. The construction of the unit is such that the input swr is no greater than 1.18 to 1 in the frequency range of 2 to 30 megacycles. The 172J-1 consists of a 50-ohm, 500-watt, noninductive resistor which is enclosed in an aluminum case to prevent radiation. The case has a removable cover to permit inspection of the resistor and internal connections.

The 172J-1 is mounted on the air duct of the equipment rack with four screws. The unit receives cooling air from the air duct through a 7/8-inch-diameter hole in the mounting surface, and



V359-32-P

Figure 36. Dummy Antenna 172J-1 is used for transmitter tuning and testing purposes

the cooling air is exhausted through vents in the bottom of the case. A type UG-48A/U r-f input connector is located at the top of the unit. A coaxial cable, consisting of a five-foot length of type RG-8A/U coaxial cable with a type N coaxial connector on each end, connects the 172J-1 to the r-f output of the transmitter.

### TECHNICAL CHARACTERISTICS

POWER RATING: 500 watts continuous with cooling of 50 lb of air per hr.

FREQUENCY RANGE: 2. to 30 mc.

INPUT RESISTANCE: 50 ohms  $\pm 10$  percent.

INPUT SWR: 1.18 to 1 or less from 2-30 mc.

DIMENSIONS: 20-7/8 in. high x 2-7/8 in. wide x 2-5/8 in. deep.

WEIGHT: 4 pounds.

### DYNAMIC MICROPHONE

The Electro-Voice model 606, shown in figure 37, is a high-impedance dynamic, noise-canceling microphone. It is mounted on an Electro-Voice model 428 table stand and supplied with 8 feet of shielded cable and connectors. The stand incorporates an SPDT push-to-talk switch. It is designed to be used where high background noise levels are present, or where feedback conditions might exist.



V359-33-P

### TECHNICAL CHARACTERISTICS

#### MICROPHONE

IMPEDANCE: 25,000 ohms.

OUTPUT LEVEL: Voltage - -55 db.  
(0 db - 1 volt/dyne/cm<sup>2</sup>).  
Voltage developed by normal speech -  
.018 v.

FREQUENCY RESPONSE: 100-6000 cps, substantially flat.

STAND COUPLER: 5/8-27 thread.

CASE: High purity pressure cast metal.

FINISH: Satin chromium.

HEAD TILT: 22 degrees.

NOISE CANCELLATION: Discrimination against noise is approximately 20 db.

Figure 37. Noise cancelling Dynamic Microphone improves voice transmission quality in the presence of high background noise levels

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

## MISCELLANEOUS

### MOUNTING RACK

An open-type mounting rack is used for containing the KWT-6 components that have standard 19-inch chassis. The rack is constructed of 6-inch heavy aluminum channel with steel angle stock across the bottom, front and back, serving as the mounting base. The mounting base is provided with holes for lag screws or for bolt mounting to the floor. The side channels of the rack are drilled for mounting standard 19-inch chassis. The rack is 20-1/2 inches wide overall, 6 inches deep, and available in any desired height. Units may be mounted on either or both sides of the rack.

### SHOCKMOUNT

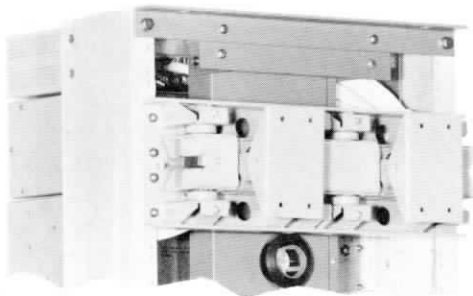
For use where vibration becomes a problem, as in a shipboard installation, Collins offers a shockmount to isolate the radio rack from excessive vibration. The shockmounts are mounted underneath and on the rear of the rack as shown in figures 38 and 39.

### AIR DUCT

An air duct is used to conduct cooling air from a blower, such as the 199G-3, to the various KWT-6 components in the rack. The duct, 2 inches deep, 8 inches wide, and available in any desired length, fits in a central location in the rack between the front and rear-mounted chassis. It is provided with valved ports which mate with the cooling air holes at the back of each individual chassis. If a chassis is swung out for inspection during operation, its valve will close and prevent loss of cooling air pressure for other units.

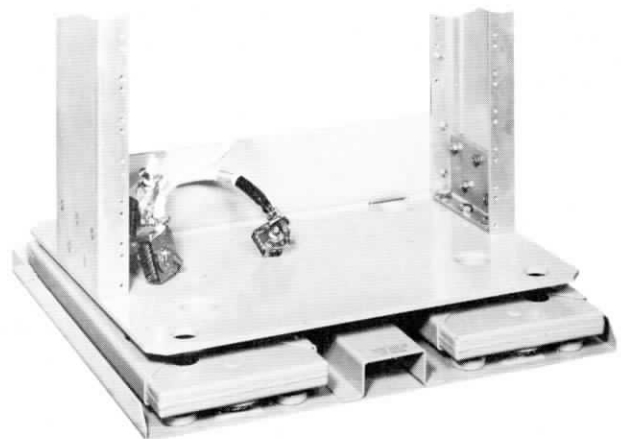
### SPEAKER-PLATE ASSEMBLY

A speaker-plate assembly may be used containing a 6-inch permanent magnet speaker and a switch for removing audio signals from the speaker. The speaker is mounted on a plate 7 inches high for mounting in a standard 19-inch rack. Over-all size of the speaker box is 6-1/2 inches high, and 7 inches deep. The speaker impedance is a nominal 4 ohms.



V359-34-P

Figure 38. Shockmounts compensate for horizontal vibration



V359-35-P

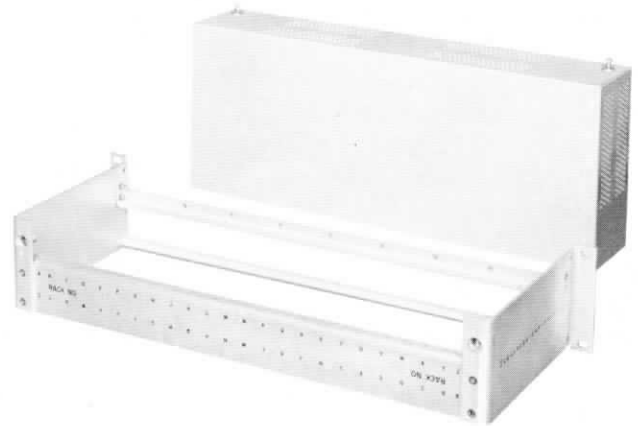
Figure 39. Shockmounts for vertical vibration

## CABLE, TERMINAL BLOCKS, PLUGS

Each component is interconnected to other units of the KWT-6, or to other units of the particular system, through a common junction box. Twenty-pin terminal blocks that fit into Collins Junction Boxes 153H-1 or 153H-2 are used. For the units with 16-pin rear connectors, a terminal block connected to a standard length 9-pair cable and terminated in a 16-pin keyed plug is available. In order to eliminate the possibility of combining the wrong plug and unit receptacle, there are five different keying arrangements for the connector plugs.

All of the KWT-6 components use the standard terminal block, cable, and plug combination with the exception of the High Voltage Power Supply 428B-1, Antenna Network 180U-2, and Blower 199G-3. The 428B-1 uses the standard terminal block and 9-pair cable but is terminated with lugs for connection to a terminal block on the unit. The 199G-3 uses the standard terminal block and 9-pair cable, but the cable is terminated in an 8-pin rather than 16-pin connector. Figure 40 shows a set of terminal blocks, cable, and plugs mounted in Junction Box 153H-2. When Frequency Standard 40N-1 is used with the KWT-6, no interconnection to other units is required except by coaxial cable.

Each KWT-6 component requires a cable assembly consisting of the terminal block which mounts in the junction box, the cable, and the connector plugs when required. The list that follows points out the Collins part number of the cable assembly for each unit. It will be noted that some of the units require more than one cable assembly.



V359-36-P

Figure 40. Cable, Terminal Blocks, and Plugs connect the components to a junction box, such as the 153H-2 shown here

### UNIT CABLE ASSEMBLIES

COMPONENT	PART NUMBER	COMPONENT	PART NUMBER
Frequency Generator 786E-1	544-2578-002 544-2579-002	Sideband Generator 786F-1	544-2580-002 544-2581-002 544-2582-002
Audio and Control Unit 159B-1	544-2578-002 544-2579-002	Handset Adapter	544-2581-002
Low Voltage Power Supply 429B-1	544-2581-002 544-2582-002	Frequency Comparator 54Q-1 and 54Q-2	544-2580-002
High Voltage Power Supply 428B-1	544-2583-003	Antenna Coupler 180T-2 and 180U-2	544-2581-002
Power Amplifier 367A-3	544-2578-002	Control Panel 714Z-1 CW and FSK Simulator	544-9020-002
Blower 199G-1 and 199G-3	544-2577-002		

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

## JUNCTION BOXES 153H-1, 153H-2, 153H-3

Three types of junction boxes are available for making interunit and external connections. The Collins 153H-1, shown in figure 41, will hold 24 of the standard 20-pin terminal blocks. The Collins 153H-2, shown in figure 40, and 153H-3, shown in figure 42, will each hold 16 of the standard 20-pin terminal blocks. In addition, the 153H-2 contains a fuse block and fuses for the primary power of the system; the 153H-3 contains a thermal relay receiver input protector unit and fuses for the primary power of the system.

The boxes are designed for mounting in a standard 19-inch, open-type rack requiring 3-1/2 inches of rack space. A metal dust cover, secured by thumb-release fasteners, provides protection for the connections and personnel. The over-all dimensions are 7-inches deep, 19-inches wide, and 3-1/2 inches high.

Junction Box 153H-2 and 153H-3 are normally used where a maximum of 16 terminal blocks are needed and primary fusing of the 155/230-volt line is desired on the equipment rack itself. The 153H-1 is used when more than 16 terminal blocks are required and/or primary fusing is desired at an external location.

A special feature of Junction Box 153H-3 is the thermal relay receiver input protector unit which provides the receiver with protection from excessive currents entering the receiver antenna input. Excessive currents are those that are 100 milliamperes or greater. A coaxial relay, thermal relay, indicator lamp, and reset button are the protector components.

Figure 43 is a schematic diagram of the thermal relay receiver input protector unit. When the 28-volt supply is off the antenna is normally disconnected from the receiver input. When 28 volts is applied, the coaxial relay is energized through the thermal relay normally closed contacts. When the coaxial relay is energized, the antenna is connected to the receiver input through the series

combination of contacts and the thermal relay heater element. However, should a high r-f voltage be induced in the antenna, the excessive current developed will warm the thermal relay heater element sufficiently to cause its contacts to open. This will remove the 28 volts from the coaxial relay causing it to become de-energized.

A new path will supply d-c current to the thermal relay in order that its contacts will stay



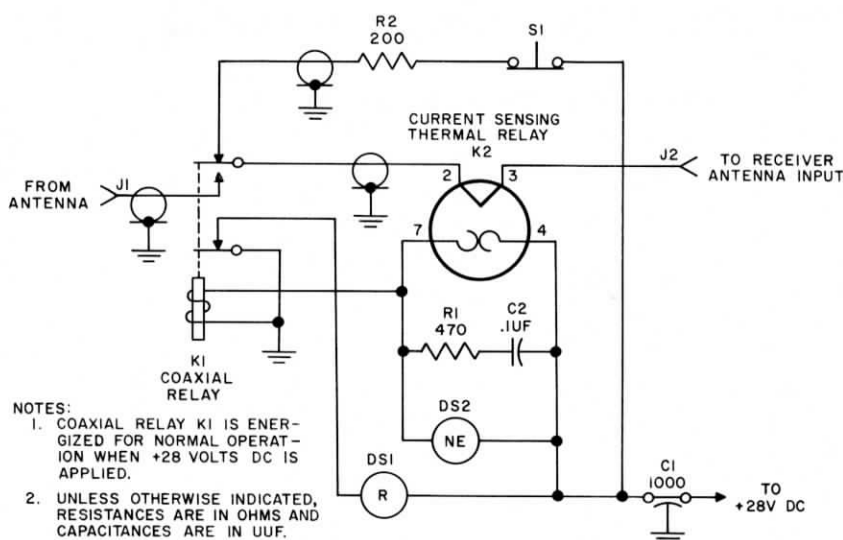
Figure 41. Junction Box 153H-1 holds up to 24 of the 20-pin terminal blocks



Figure 42. Junction Box 153H-3 holds up to 16 terminal blocks

open and keep the coaxial relay de-energized. This series path is from 28 volts through normally closed reset switch S1, resistor R2, the relay contacts, and the thermal relay heater to the receiver input, and within the receiver to a band coil and to ground.

The red indicator lamp will light to indicate that excessive current has been detected and to indicate that the antenna has been disconnected from the receiver. The thermal relay contacts are protected from arcing by the series resistor, R1, and capacitor C2 in parallel with neon lamp DS2 across the thermal relay contacts.

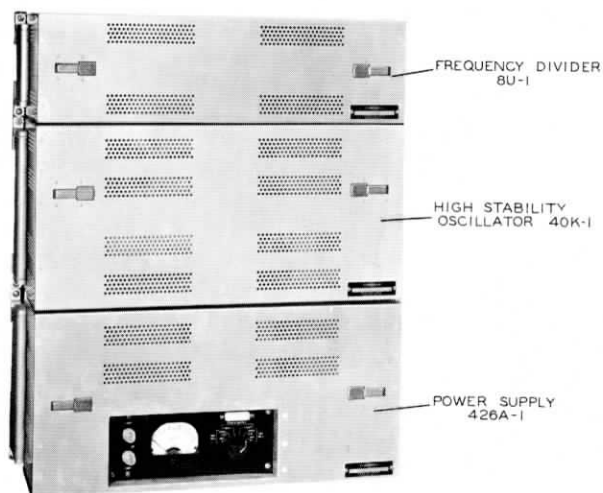


C401-132-3

Figure 43. Thermal Relay Input Protector, Schematic Diagram

## FREQUENCY STANDARD 40N-1

Collins Frequency Standard 40N-1, shown in figure 44, produces very stable 1-mc, 100-kc, and 10-kc outputs which can be used as reference signals for transmitting and receiving equipments. These reference signals are produced from a one-mc, crystal-controlled oscillator circuit with a stability of one part in  $10^8$  per day. The 40N-1 is composed of High Stability Oscillator 40K-1, Frequency Divider 8U-1, and Power Supply 426A-1. These units are of similar and matching design and can be mounted in a standard 19-inch open relay rack. Tubes and adjustments are accessible from the front after the dust covers have been removed. Cables, connected to terminal strips at the rear of the units, interconnect the power supply and oscillator. Also located at the rear of the 40K-1 and the 8U-1 are BNC-type connectors to bring out the one-mc outputs. The 8U-1 is furnished with similar connectors to bring out the 10-kc and 100-kc outputs.



V130-01-P

Figure 44. Frequency Standard 40N-1 with stability of one part in  $10^8$  per day

The 40K-1, 8U-1, and 426A-1 units can be used with Transceiver KWT-6, H-F Receiver 50E-1, H-F Receiver 50E-6, H-F Exciter 310F-1, H-F Exciter 310F-6E, and Stabilized Master Oscillator 708B-1.

## OPERATOR'S DESK ASSEMBLY

Collins Operator's Desk Assembly, shown with the equipment in figure 51, is designed for mounting on a standard 19-inch rack. The assembly requires 14-13/16 inches of rack space. Its top or desk surface is 27-7/8 inches by 14-13/16 inches.

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

PART NAME	COLLINS PART NUMBER	REMARKS	50E-7 522-1863-00 50E-6DA 522-2095-00 50E-6D 522-1498-00 50E-6 522-1684-00 310F-7 522-1640-00 310F-6E 522-1504-00 310F-6B 522-1765-00 310F-6A 522-1707-00 AN/URC-32 522-1298-00 KWT-6/8 522-2052-00 KWT-6/5 522-1639-00 KWT-6/5 522-1203-018(020) 522-1203-00												
			A	B	C	D	E	F	G	H	I	J	K	L	M
786E-1 Frequency Generator	522-0860-00	Contains all modules, ref osc option.													
Frequency Generator	522-0860-012	Contains all modules, isolation ampl option.													
Frequency Generator	522-0860-011	Modules removed.	1	1	2	1	1	1	1	1	3	1	2	1	
Frequency Generator	522-0860-026	Modules removed 6-kc mod.						1						2	
Frequency Generator	522-0860-013	Same as 522-0860-00 handset hgr included.													
Frequency Generator	522-0860-014	Modules removed 6-kc mod handset hgr included.													
Frequency Divider Module	542-7697-004		1	1	2	1	1	1	1	1	3	1	2	2	1
Varicap SMO Module Model C	528-0176-005														
Sidestep Osc Module	543-1501-004		1	1	2	1	1	1	1	1	3	1	2	2	1
R-F Tuner Module	542-7792-005		1	1	2	1	1	1	1	1	3	1	2	2	1
R-F Tuner Module	546-2148-005	6-kc mod.	1	1	2	1	1	1	1	1	3	1	2	2	1
Reference Osc Module	542-7729-004		1	1											
Isolation Amp Module	543-6255-004	Use with 40N-1	1	1											
Handset Hanger Dust Cover	544-9016-00				2			1	1	1	3	1			
786F-1 Sideband Generator	522-0861-004	Contains all modules TGC/VOX option. No AM module.													
Sideband Generator	522-0861-024	Contains all modules TGC option. No AM module.													
Sideband Generator	522-0861-014	Modules removed.	1	1	2	1	1	1	1	1	3	1	2	2	
Sideband Generator	522-0861-034	Contains all modules TGC option. AM module.													
TGC/VOX-Antivox Module	543-2834-003		1	1	2						3				
TGC Module	543-5181-003					1	1	1	1	1					
TGC/VOX Module (6 Kc)	546-1390-003	6-kc option.						1							
I-F/A-F/USB Module	543-0275-005		1	1	2	1	1						1	2	1
I-F/A-F/USB Module (6 Kc)	546-1396-005	6-kc option.												2	
I-F/A-F/LSB Module	543-0274-005		1	1	2	1	1						1	2	1
I-F/A-F/LSB Module (6 Kc)	546-1395-005	6-kc option.												2	
I-F/A-F/AM Module	543-0276-005				2	1	1						1		1
Carrier Generator Module	543-1500-004		1	1	2	1	1	1	1	1	3	1	2	2	1





## EQUIPMENT CONFIGURATIONS

The KWT-6 components, described in the previous section, offer a high degree of flexibility in using different configurations to satisfy a particular need. It should be kept in mind that, although they are primarily designed for superior SSB operation, provisions may be made for compatible AM, CW, or teletypewriter operation as well. The following categories of operation can be obtained with an appropriate configuration of KWT-6 components:

1. Complete Transceiver with 500-Watt PEP Power Amplifier.
  - a. Single sideband, upper and lower.
  - b. Single sideband, upper.
  - c. Single sideband, lower.
  - d. Single sideband, upper and lower - AM.
  - e. Single sideband, upper - AM.
  - f. Single sideband, lower - AM.

### NOTE:

This transceiver has the following options: (1) Reference frequency standard with or without 54Q-2 Frequency Comparator (see 786E-1 Description); (2) VOX operation (see 786F-1 Description); (3) Frequency coverage (see 786E-1 Description); (4) CW/FSK operation; and (5) Handset Adapter.

2. Exciter with 0.2-watt PEP output.  
(Same as a through f above, same options as noted.)

3. Receiver functions.  
(Same as a through f above, options (1) and (3) as noted.)

These operational configurations perform the complete functions indicated. However, variations in these arrangements can be made to provide partial functions of a system. For example, an installation may have a requirement for a receiver-exciter and have its own provisions for audio amplification and control. It would not be necessary, therefore, to supply the Audio and Control Unit 159B-1.

Several configurations using KWT-6 components have been established under Collins type names, such as HF Transceiver KWT-6, Type 5; Exciter 310F-6E; and HF Receiver 50E-6. These are suggested equipment patterns and should not be considered as the only types available. These KWT-6 components are actually system "building blocks" that may be engineered to fit particular requirements.



Figure 47. Another typical pattern (Column D) is the KWT-6 Type 8 transceiver with power amplifier and other units



V359-41-P

Figure 46. H-F Transceiver KWT-6 Type 5, (Column A) gives complete SSB operation

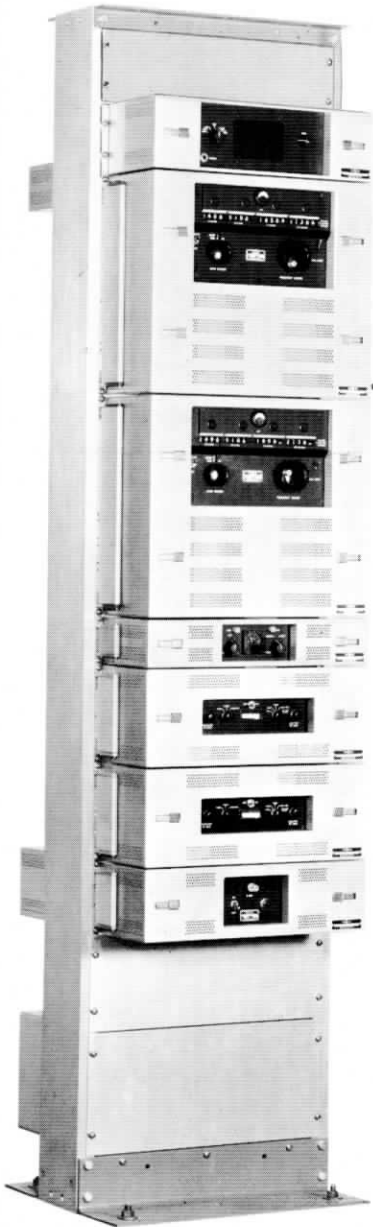
The reference chart, shown in figure 45, indicates various KWT-6 components used in several typical installations. The column at the left includes KWT-6 units, modules, and some accessory items, and the second column contains the respective Collins part number. It may be noted that units that employ modules have more than one part number, particularly the 786E-1, 786F-1, and 159B-1. This is due to the flexible system used in handling optional modules. For example, a 786E-1 with part number 522-0860-00 consists of the chassis and all its modules with a Reference Oscillator module chosen rather than the Isolation

Amplifier. A 786E-1 with part number 522-0860-012 is the same but includes an Isolation Amplifier module rather than the Reference Oscillator. A 786E-1 with part number 522-0861-011 consists of the chassis only. The modules for the chassis may then be chosen separately by the module part numbers. The latter part number is used if, for example, the Sidestep Oscillator module is to be deleted.

Column A shows the configuration for Collins H-F Transceiver KWT-6, Type 5, used for single sideband (upper and lower sideband) operation with a 500-watt PEP power amplifier. This equipment is shown in figure 46. Column D lists the KWT-6/8 components for a complete transceiver with a 500-watt PEP power amplifier and several accessory units. A typical configuration is shown in figure 47.

The KWT-6 components for a complete exciter for SSB operation are shown in figure 48 and listed in column H. This equipment is referred to as the Collins H-F Communications Exciter 310F-6E. This is but one particular pattern of units and modules and should not be considered as the only means for creating an exciter with the available component "building blocks".

H-F Communications Receiver 50E-6D (column K of the chart) is a manually operated, fixed station, diversity receiver for reception from 2 to 30 megacycles. The frequency range is covered in four bands, and the desired operating frequency is set to any one of 28,000 integral-kilocycle frequencies on a direct-reading frequency counter. Frequency accuracy and stability is the same as that of the external 100-kilocycle frequency standard (not supplied as part of the 50E-6D).



V359-50-P

Figure 49. H-F Communications Receiver 50E-6D (Column K)



V359-43-P

Figure 48. Collins Exciter 310F-6E illustrates one of many component combinations (Column H)

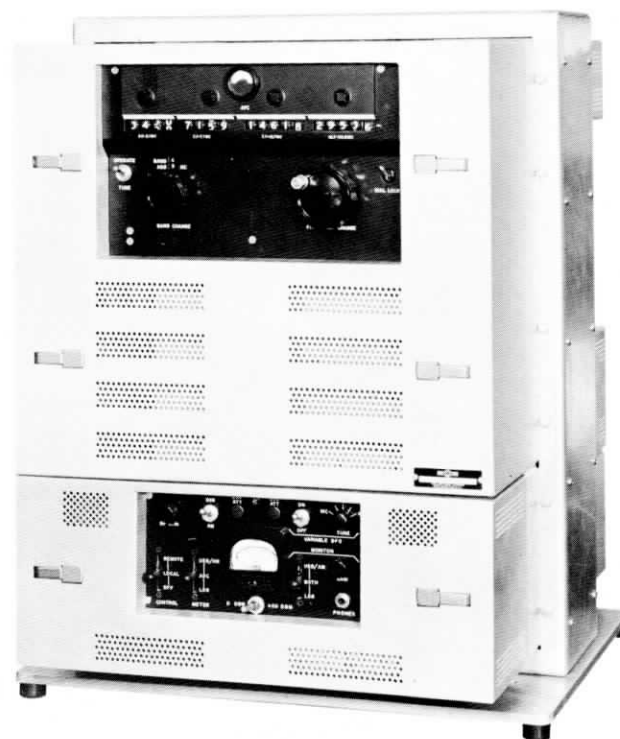
## SYSTEMS EMPLOYING KWT-6 COMPONENTS

The 50E-6D, shown in figure 48, consists of one monitor panel, two Frequency Generators 786E-1, one Diversity Selector 170G-1, two Sideband Generators 786F-1, two Low-Voltage Power Supplies 429B-1, one Blower 199G-3, a standard 19-inch open type system rack, a junction box, connecting cables, and miscellaneous hardware.

Column M indicates the KWT-6 components needed for a complete single-sideband receiver. This equipment, shown in figure 50, is referred to as the Collins H-F Receiver 50E-7.

Other accessory items, which will usually be required in an installation but are not shown in the chart, are the rack, air duct assembly, interconnecting cables and coaxial line, mounting, dummy rack plates, and miscellaneous hardware. These amounts and sizes, for example, cannot be determined before a particular configuration is known.

This section has pointed out the flexibility of the KWT-6 components in obtaining different types of equipment configurations and has illustrated this flexibility through several examples. The chart shown in figure 45 is intended for reference purposes only.



V359-42-P

Figure 50. Collins H-F Receiver 50E-7 is a complete single sideband receiver (Column L)

## MAINTENANCE SUPPORT

Spare parts requirements will vary considerably among different types of customer installations. Many variables enter into the determination of an adequate spare parts list, such as the locality, the number of equipments per installation, and the actual usage. It is, therefore, impractical to establish a standard predetermined spare parts list that would cover a wide range of conditions.

In order to provide some basis for determining spare parts for a given installation, the Collins Research and Development (Engineering) Division has compiled several lists of spare parts consisting of the minimum amounts that should be supplied. Figure 52 is a recommended list of spare modules for five equipment types. Other lists, available upon request, are broken down by units, unit chassis and modules. Only those items of concern need be consulted. In most cases, the parts and quantities recommended will be sufficient. However, other cases may arise requiring a more complete set of spares or increased quantities.



V359-46-P

Figure 51. Pendant Cable Service Kit contains 6 cables and combination module tray and cable storage box

MODULE	PART NUMBER	KWT-6/5	KWT-6/8	50E-6D	50E-7	310F-6E
Stabilized Master Oscillator	528-0021-005	x	x	x	x	x
R-F Tuner	546-2148-005	x	x	x	x	x
Frequency Divider	542-7697-004	x	x	x	x	x
Sidestep Oscillator	543-1501-004	x	x	x	x	x
Reference Oscillator	542-7729-004	x	x	x	x	
Isolation Amplifier	543-6255-004					x
I-F/A-F LSB	543-0274-005	x	x	x	x	
I-F/A-F USB	543-0275-005	x	x	x	x	
I-F/A-F AM	543-0276-005		x		x	
Carrier Generator	543-1500-004	x	x	x	x	x
Balanced Modulator	543-1351-004	x	x			x
TGC Amplifier	543-5181-003		x			x
TGC/VOX Amplifier	543-2834-003	x				
356C-1 Line Amplifier	522-0395-003	x	x			x
356D-1 SPKR Amplifier	522-0388-003	x	x	x		

Figure 52. Typical Spare Module List

Test equipment requirements also involve many variables. Instruction books for each unit should be consulted for the lists of required test equipment.

Pendant cables for use in maintenance of the units containing modules are vitally important. These cables allow removal of a module from the chassis with the pendant cable connecting the module and chassis for power and signal provisions. This eases the maintenance problem considerably and, in some cases, may be the only way to locate a fault within a specific module.

A pendant Cable Service Kit (part number 544-2632-00), shown in figure 51, is available as an accessory item. The kit contains six pendant cables, for use with the 786E-1 and 786F-1, and a combination module tray and cable storage box. The combination tray and storage box is designed for mounting on a standard 19-inch rack and requires 3-1/2 inches of rack space.

When servicing a module, the tray is mounted on the front of the unit being serviced. The module can then be set up and connected to its parent unit through a pendant cable, with the tray serving as the working surface.

A Service and Tool Kit (part number 543-8124-00) contains pendant cables, various servicing tools, and servicing aids. It is recommended for use at each equipment installation.

# SYSTEMS EMPLOYING KWT-6 COMPONENTS

## MODULE CROSS REFERENCE

The following modules and modular subassemblies are identical with and directly interchangeable with those in other Collins equipment, as indicated:

### MODULES

UNIT	PART NUMBER	EMPLOYED IN EQUIPMENTS
Balanced Modulator	543-1351-004	KWT-6, 18Z, 310F-1, 310F-6E
Carrier Generator	543-1500-004	KWT-6, 18Z, 310F-1, 50E-1, 310F-6E, 50E-6
Reference Oscillator	542-7729-004	KWT-6, 18Z, 310F-1, 50E-1, 310F-6E, 50E-6
Frequency Divider	542-7697-004	KWT-6, 18Z, 310F-1, 50E-1, 310F-6E, 50E-6
Sidestep Oscillator	543-1501-004	KWT-6, 18Z, 310F-1, 50E-1, 310F-6E, 50E-6
I-F/A-F Amplifier (USB)	543-0275-005	KWT-6, 18Z, 310F-1, 50E-1, 50E-6
I-F/A-F Amplifier (LSB)	543-0274-005	KWT-6, 18Z, 310F-1, 50E-1, 50E-6
I-F/A-F Amplifier (AM)	543-0276-005	KWT-6, 18Z, 310F-1, 50E-1, 50E-6
Isolation Amplifier	543-6255-004	KWT-6, 310F-1, 50E-1, 310F-6E, 50E-6

### SUBASSEMBLIES

UNIT	PART NUMBER	EMPLOYED IN EQUIPMENTS
Master Oscillator (SMO)	522-1768-004	KWT-6, 18Z, 310F-1, 50E-1, 50E-6, 310F-6E
Signal I-F (SMO)	545-5866-005	KWT-6, 18Z, 310F-1, 50E-1, 50E-6, 310F-6E
I-F Mixers (SMO)	543-1768-003	KWT-6, 18Z, 310F-1, 50E-1, 50E-6, 310F-6E
Spectrum Generator (SMO)	544-2640-004	KWT-6, 18Z, 310F-1, 50E-1, 50E-6, 310F-6E
Reference I-F (SMO)	544-2634-004	KWT-6, 18Z, 310F-1, 50E-1, 50E-6, 310F-6E

The equipments shown in these tables are, as follows:

KWT-6	Manually tuned, high-frequency, single-sideband, transceiver.
18Z	Automatically tuned, single-sideband, airborne transceiver.
310F-1	Automatically tuned, high-frequency, single-sideband, ground station exciter.
50E-1	Automatically tuned, high-frequency, single-sideband, ground station receiver.
50E-6	Manually tuned, high-frequency, single-sideband, ground station receiver.
310F-6E	Manually tuned, high-frequency, single-sideband, ground station exciter.



**"CREATIVE LEADER IN ELECTRONICS"**