618T

Single Sideband . . an explanation

The SSB illustration shows the three basic parts of an AM signal, a carrier and two sidebands. Simply, and directly, single sideband transmission takes away two of the three parts when the signal is sent — the carrier and one or the other of the sidebands.

This is what is meant when "suppressed carrier" single sideband is mentioned in connection with the 618T. The carrier wave and one of the sidebands are suppressed and not transmitted with the signal. If you are saying that a carrier wave is needed to receive the signal, you are correct. As much of the carrier wave as is required for reception is injected at the receiver instead of being transmitted with the intelligence.

In order to do this successfully it is necessary that the frequency of the transmitter and receiver be exactly the same and very stable. The high stability of Collins 618T (0.8 part per million per month) now makes airborne single sideband communication possible.

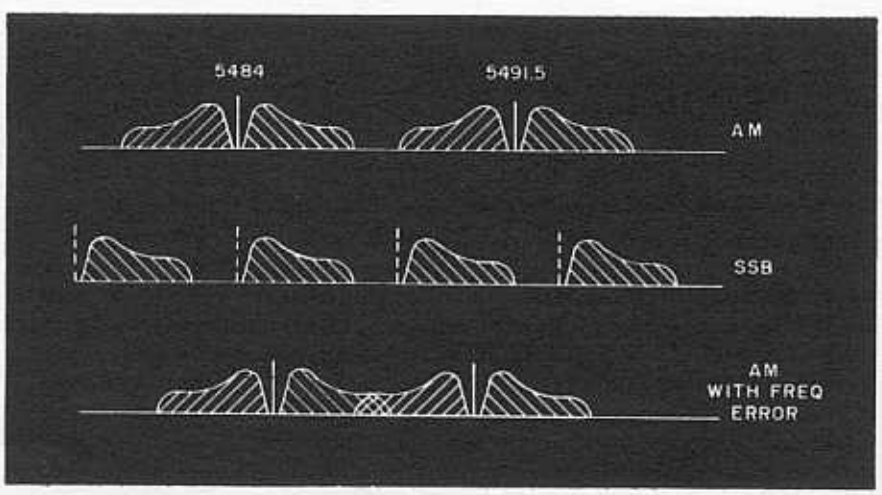
Some of the major advantages of single sideband over AM communication are greater talking power, reduced power requirement, more range, conservation of one-half the spectrum and clearer intelligence with comparable power.

Greater talking power is achieved because the signal is clearer and less susceptible to interference by adjacent transmitted messages. Because there is no carrier wave, there is little distortion due to selective fading — a phenomenon that makes AM signals unintelligible when the carrier fades — usually noticed at longer ranges.

For the same range, SSB communication can utilize less input power because no carrier wave is required. In conventional AM communication systems a great amount of input power is required to send the carrier wave. For example, compare two transmitters with the same total sideband power. A 100 watt AM transmitter puts ¼ of its rated carrier power in each of two sidebands, while a 50 watt SSB transmitter puts its full rated output in one sideband. In other words, in normal use, an SSB transmitter rated at 100 watts PEP will give equal performance with an AM transmitter rated at 400 watts carrier power. As a further bonus the 618T equipment concentrates the radiated energy in ½ the bandwidth.

It can be seen that suppression of the carrier wave and one of the sidebands effectively reduces the width of the transmitted signal. Since the two sidebands are equal in shape, the space required is cut in half. Channel frequencies are doubled. With SSB equipment it is practical for two transmissions to take place on the same frequency — one on the upper sideband and one on the lower — with no interference.

Single sideband provides the assets required of today's HF spectrum communication — using minimum bandwidth, minimized guard bands between channels for frequency drift and poor selectivity, keeping spurious radiation to a very low value to avoid interference between services and to provide a more reliable signal. All of these assets and desirable qualities are found in the 618T HF SSB Transceiver.



©Collins Radio Company 1965

COLLINS

Collins 618T HF Single Sideband Transceiver

The Collins 618T is a compact HF single sideband transceiver for long range voice, CW, data or compatible AM communication in the 2.0-29.999 mc frequency range. It is automatically tuned in 28,000 1 kc channel increments by means of an operator's remote control unit.

The operating frequency is indicated directly in a digital-type presentation. Nominal transmit power is 400 watts PEP in SSB or 100 watts in compatible AM.

While primarily designed as an air-

Collins 618T HF Single Sideband Transceiver

borne transceiver, the 618T has been employed in transportable, mobile, shipboard and semifixed station applications. Performance has been proven in thousands of installations throughout the world.

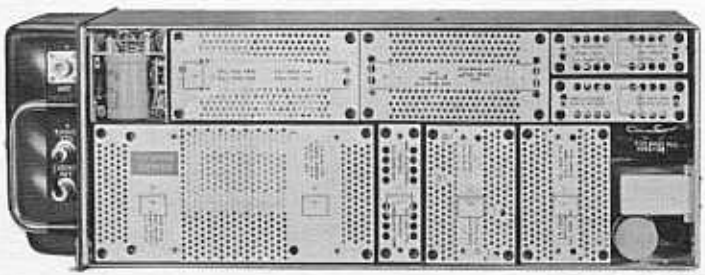
The transceiver provides RF spectrum conservation with immunity to multipath distortion and a much greater signal-to-noise ratio than conventional AM. With SSB all the power amplifier and power supply capacities are utilized in amplifying the intelligence portion of the transmitted signal, resulting in more usable power for transmission. Collins Mechanical Filters in the IF circuit provide maximum rejection of adjacent channel signals.

Through the use of phase-locking circuits, accurate frequency control is possible in both transmission and reception, making additional frequency control unnecessary. By use of phase-comparison circuits, all injections to the transmitter and receiver are phase locked to a single, highly accurate frequency standard.

The accurate frequency control in the 618T is necessary for the proper operation of the suppressed carrier SSB system. The carrier wave that is suppressed at the transmission point can be accurately re-injected by a local oscillator at the receiver.

Instant on-frequency operation is assured by a temperature-compensated frequency standard with a stability of 0.8 part per million per month.

To allow operation of conventional AM selective calling, a special audio output is provided on the 618T. This feature allows AM signals to be monitored regardless of the setting of the mode selection switch.



618T Left Side

618T Right Side

APPLICATIONS – A choice of optional accessory antenna tuners permits use of the 618T in a wide range of aircraft with peak performance at all frequencies. A Collins 49T Retrofit Adapter is available to facilitate retrofit installation in an airframe which has been wired for a Collins 618S HF AM system.

DATA TRANSMISSION – For voice transmission, a very minute frequency error can be allowed. Accurate reproduction of the transmitted frequency components for data and signaling systems is either unnecessary for 100 word per minute teletypewriters or can be accommodated by accessory units. This concept results in simplicity for the voice transceiver and adds automatic frequency control complexity only when required by high speed data systems.

SELECTIVE CALLING – The use of a selective calling (SELCAL) system on AM is facilitated by a special audio output, which allows signals to be monitored regardless of the mode selection switch setting.

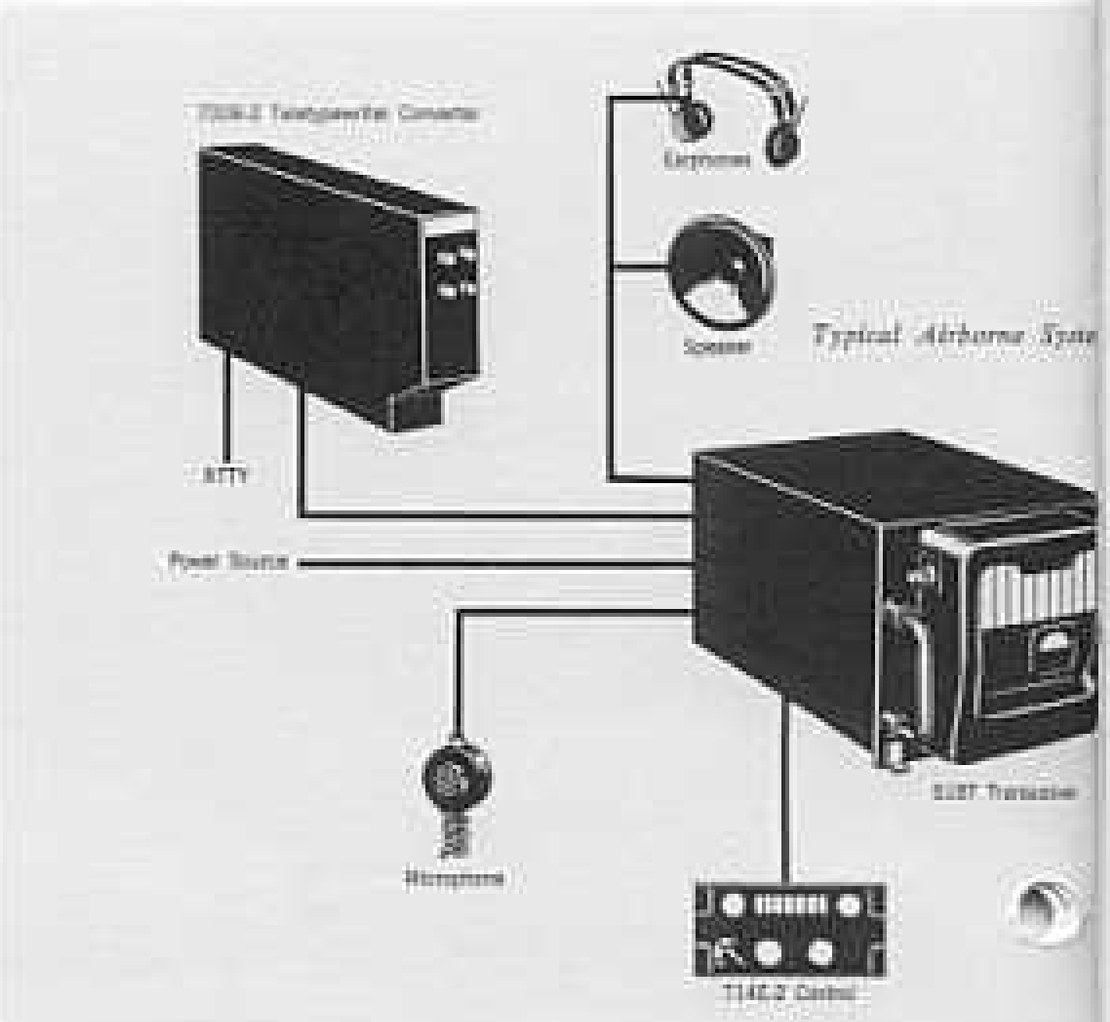
COOLING OPTIONS – Filtered air from a front panel blower is distributed to all portions of the transceiver requiring forced air cooling; the air is metered by vents of the proper

Front Panel Metering

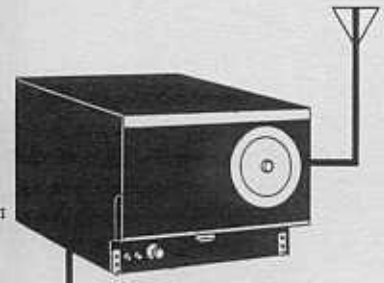
size in the main chassis. An exhaust port is provided for use with central cooling systems in accordance with ARINC Specification 404, if desired.

EASY MAINTENANCE – Low maintenance costs are achieved by the use of plug-in modular assemblies. Transistor circuitry employed wherever applicable results in a high degree of reliability, together with minimum weight and power consumption. Detailed stress analyses have been conducted on all the 618T components to insure proper derating and design safety margins.

Mission performance under a wide range of environments has been greatly enhanced by an extensive reliability testing program and long experience in service.



The 618T Transceiver is available in the following system configurations for airborne applications:



490T-1 Antenna Coupler

618T-1 – The 618T-1 includes a power supply module for 400 v, 400 cps primary source and is used only in certain retrofit installations. This power is furnished by the Collins 516H-1 external power supply. This two-package system can be used with the 49T-4 Retrofit Adapter to effect direct retrofitting into a 614C-2 Harness without wiring changes.

618T-2 – The 618T-2 is intended primarily for new installations and has a high voltage power supply module using 3 phase, 400 cps power. No external power supply is required. The system is contained in a 1 ATR case.

618T-3 – The 618T-3 also is completely self-contained and intended for new installations. However, retrofitting is also possible in certain aircraft through the use of the 49T-3 Retrofit Adapter. Equipped with 27.5 v electronic inverter-type high voltage power supply module, the 618T-3 requires a 27.5 v dc, 35 amp and 115 v, 1 phase, 400 cps, 1 amp source.

HF-101–618T-1 Transceiver and 714E-2 Control with external 516H-1 Power Supply for operation from 27.5 v dc, 35 amp and 115 v, 1 phase, 400 cps, 2 amp power source.

HF-102–618T-2 Transceiver and 714E-2 Control with self-contained power supply for operation from 27.5 v dc, 4 amp and 208 v, 3 phase, 400 cps, 800 watt source.

HF-103–618T-3 Transceiver and 714E-2 Control with self-contained power supply for operation from a 27.5 v dc, 35 amp, and 115 v, 1 phase, 400 cps, 1 amp source.

AN/ARC-94 – 618T-2 Transceiver and 714E-2 Control with self-contained power supply for operation from a 27.5 v dc, 4 amp and 208 v, 3 phase, 400 cps, 800 watt source.

AN/ARC-102–618T-3 Transceiver and 714E-2 Control with self-contained power supply for operation from a 27.5 v dc, 35 amp, and 115 v, 1 phase, 400 cps, 1 amp source.

AN/ARC-105 – A pressurized communication system especially designed for tactical jet aircraft with performance characteristics comparable to 618T. It operates from 115 v (line to neutral), 400 cps, 3 phase, 4 wire, 1039 watt power source.

COLLINS

Accessories . . . Antenna Tuning Units and Couplers

180L ANTENNA TUNERS – The 180L Antenna Tuners contain servo-controlled circuits which tune out the inductive or capacitive reactances encountered in fixed wire aircraft antennas between 45 and 100 feet in length. Complete flexibility of location permits the greater portion of the radiating wire to be outside the airframe.

The 180L-2 is used for applications which do not require reception before tuning of the antenna unit.

The 180L-2,-3,-3A Couplers are identical in design with the exception of an antenna transfer relay which is included in the 180L-3 and 180L-3A and an antenna grounding relay in the 180L-3A. The transfer relay connects the antenna to the receiver when the transmitter is unkeyed. The grounding relay connects the unused antenna to ground in a dual installation.

Maximum tuning time required is 30 seconds. Because the 180L series has an upper frequency of 22 mc, the complete 618T frequency range is not usable with these couplers.

Size: 10⅜" W, 9-3/16" H, 11⅜" D (26.35 cm W, 23.34 cm H, 28.89 cm D), including shockmount. Weight: 18.6 lbs. (8.44 kg). 180L-3 Size: 10⅜" W, 9-3/16" H, 13⅞" D (26.35 cm W, 23.34 cm H, 35.24 cm D). including shockmount. 180L-3 Weight: 20 lbs. (9.07 kg).

AT-101 ANTENNA TUNING SYSTEM– The AT-101 Antenna Tuning System is for use in aircraft employing a tailcap antenna. It consists of three units: a 452A-1 pressurized lightning arrester and relay assembly, a 180R-4 pressurized antenna coupler assembly, and a 309A-1 control unit. The lightning arrester and relay assembly serves as a mounting for the antenna coupler assembly. Provision is made for a second coupler should an installation using two transceivers be required. This would permit operation of two receivers simultaneously on a common tailcap antenna, although only one transmitter could be operated at a time. Two optional type 156G-1 receiver coupler modules plug into the 309A-1, permitting additional receivers to be used for monitoring.

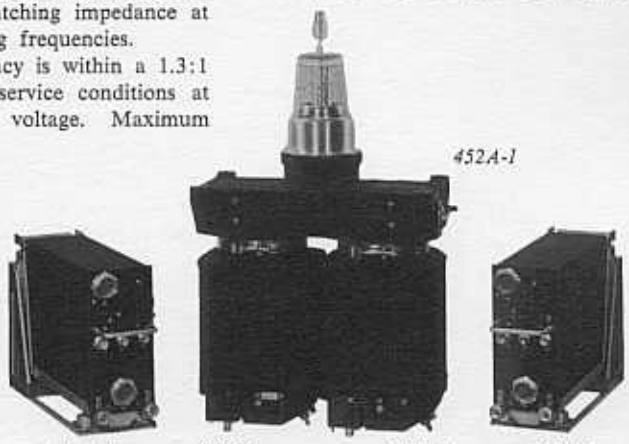
The antenna coupler assembly contains servo-controlled loading and phasing elements for resonating the antenna and matching impedance at various operating frequencies.

Tuning accuracy is within a 1.3:1 VSWR for all service conditions at nominal supply voltage. Maximum required tuning time is 10 seconds.

Protective circuits prevent damage to the equipment should loss of pressure or excessive temperature rise occur. The lightning arrester assembly contains no tubes, transistors or diodes. *Lightning Arrester and Relay Unit Size: 7½" W, 10⅝" H, 16-7/16" D (19.05 cm W, 26.99 cm H, 41.75 cm D). Weight: 10 lbs. (4.54 kg). Antenna Coupler Size: 7-7/16" W, 5-9/16" H, 11⅛" D (18.89 cm W, 14.13 cm H, 28.26 cm D). Weight: 13 lbs. (6.15 kg). Coupler Control Unit Size: ⅜ ATR short. Weight: 12¾ lbs. (5.78 kg).*

180R-6 ANTENNA COUPLER–Used in conjunction with the 309A-2D Antenna Coupler Control, the 180R-6 will automatically resonate 45-100 ft. wire antennas over the 2-30 mc frequency range. The addition of optional plug-in 156G-1 modules in the coupler permits the use of up to three additional receivers for monitoring other frequencies. *Antenna Coupler Size: 7" W, 9½" H, 17-7/32" D (17.78*

180L-3 Antenna Tuner



309A-1 180R-4 180R-4 309A-1

AT-101 Antenna Tuning System

Collins antenna tuning units require no manual adjustments for initial installation, change in frequency or change of antenna. Antenna tuning is constantly monitored as the transmitter operates so that changes in antenna impedance do not result in a mismatch at the transmitter.

cm W, 24.13 cm H, 43.74 cm D). Weight: 21.5 lbs. (9.75 kg). Antenna Coupler Control Size: 3-11/16" W, 7⅝" H, 14½" D (9.37 cm W, 19.37 cm H, 36.83 cm D). Weight: 12¼ lbs. (5.56 kg).

490T-1 ANTENNA COUPLER – The 490T-1 is a general purpose HF automatic antenna coupler for 25 ft. or longer whip and wire antennas in the 2-30 mc frequency range. Shorter antennas can be accommodated with proper loading coils. It features a short tuning cycle of five seconds maximum, less than three seconds average. Tuning accuracy is within a 1.3:1 VSWR. The high speed tuning capability reduces the over-all rechannel time and keeps radiation at a minimum for radio silence operation. Solid state logic circuits, capable of fast decisions with high speed switched and variable tuning elements, are used to insure reliable high speed tuning.

Optional application groups include exchange with either the 180L-3 or 180L-3A Antenna Coupler. These application groups can be added in the field.

The short tuning time greatly enhances reliability, since operating elements are energized for only brief periods. The servo system is controlled by a demand surveillance technique which causes the coupler to retune if the antenna impedance changes appreciably, but does not require the servo system to remain in constant operation.

The 490T-1 consists of four RF assemblies, three modules, a chassis, front panel and dust cover. All assemblies are easily removed from the unit, simplifying maintenance and support programs.

Power Requirements: 115 v, 400 cps, 1 phase, 130 watts maximum during tuning, 20 watts during operate. Altitude: 0-30,000 ft. operating. Size: 10.125" W, 7.625" H, 10.625" D (25.717 cm W, 19.367 cm H, 26.987 cm D). Weight: 18.7 lbs. (8.48 kg).

180R-12 ANTENNA COUPLER – The 180R-12, together with the 309A-9 Coupler Control Unit, automatically matches a probe antenna in the 2-30 mc frequency range. The system is automatically tuned in 16 seconds maximum. Typical tuning time is five seconds.

The 180R-12 Antenna Coupler, designed for the Boeing 727, can be easily retrofitted for the Boeing 707.

The servo loop is activated only during tuning or when the VSWR exceeds preset limits, contributing greatly to increased component life. All coupler components are tested to provide a predicted MTBF of 2000 hours.

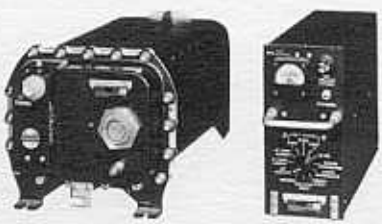
High voltage protection is provided by a ball gap that will fire at a voltage lower than that required to cause internal or external arcing. This activates a circuit that will cut off the transmitter power within 50 milliseconds. In the event the protective circuits function due to gap firing, the transmitter can be channeled to a new operating frequency, and if excessive voltage does not exist at that frequency, the coupler will tune properly.

A sensor removes RF power if internal air temperature exceeds 100° C.

Frequency Range: 2-30 mc. Power Requirements: 115 v, 400 cps, 3 phase, 0.6 amp per phase maximum. RF Power Input: 1200 watts PEP, 500 watts average power. RF Duty Cycle: 2-3 mc, 5 minutes on and 5 minutes off; above 3 mc, continuous duty. For installations other than the 727, the duty cycle is dependent upon the antenna impedance and environmental temperature. Tuning Time: 16 seconds maximum. Altitude: 45,000 feet maximum. Size: 180R-12 — 8.31" W, 7.5" H, 18.75" D (21.11 cm W, 19.05 cm H, 47.63 cm D). Weight: 21 lbs. (9.53 kg). 309A-9 — 3-11/16" W, 7-25/32" H, 14.5" D (9.68 cm W, 19.76 cm H, 36.83 cm D). Weight: 11 lbs. (4.99 kg).

180R-6 *309A-2D*

490T-1



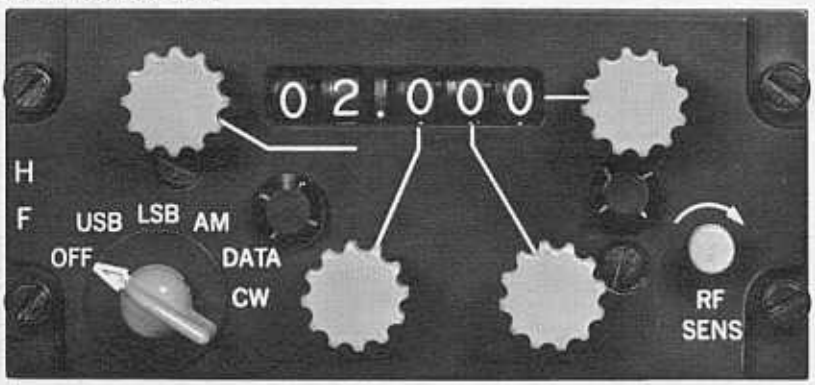
180R-12 *309A-9*

CONTROL UNITS – The 714E Control Units provide remote selection of the 28,000 communication channels available in the 618T. Frequencies are indicated in a direct reading digital readout and can be selected in 1 kc increments throughout the 2.0-29.999 mc range. Frequency selection is accomplished by rotating four knobs until the desired frequency appears in the window. A function selector and RF sensitivity adjustment are included.

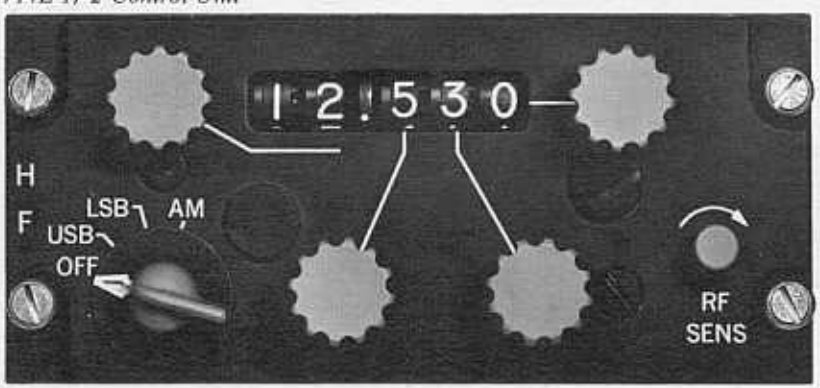
The 714E-1 and 714E-2 are similar in construction but not interchangeable. Either can be used in a new installation; however, only the 714E-2 replaces the 614C-2 Control Unit in retrofit applications. The 714E-3 is used with equipment operated in the data or CW mode. The 714E-3 uses a black edge-lighted panel with red lamps, and the 714E-3B uses a gray panel with blue lamps. *Size: 5¾" W, 2-9/16" H, 6-9/32" D (14.61 cm W, 6.51 cm H, 15.95 cm D). Weight: 1 lb. (0.45 kg).*

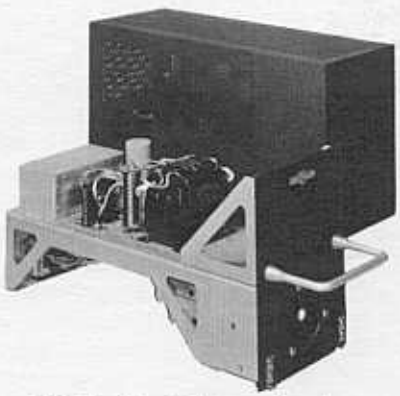
RETROFIT POWER SUPPLY – The 516H-1 is a solid state power supply to replace the 416W-1 in Collins 618S-1 retrofit installations. It can be located on the same shockmount that was used previously. A self-contained blower assures adequate cooling. Output is 400 v, 1500 cps for the 618T-1 Transceiver, where it is used to obtain the high voltage for the power amplifier.

714E-3 Control Unit



714E-1/-2 Control Unit



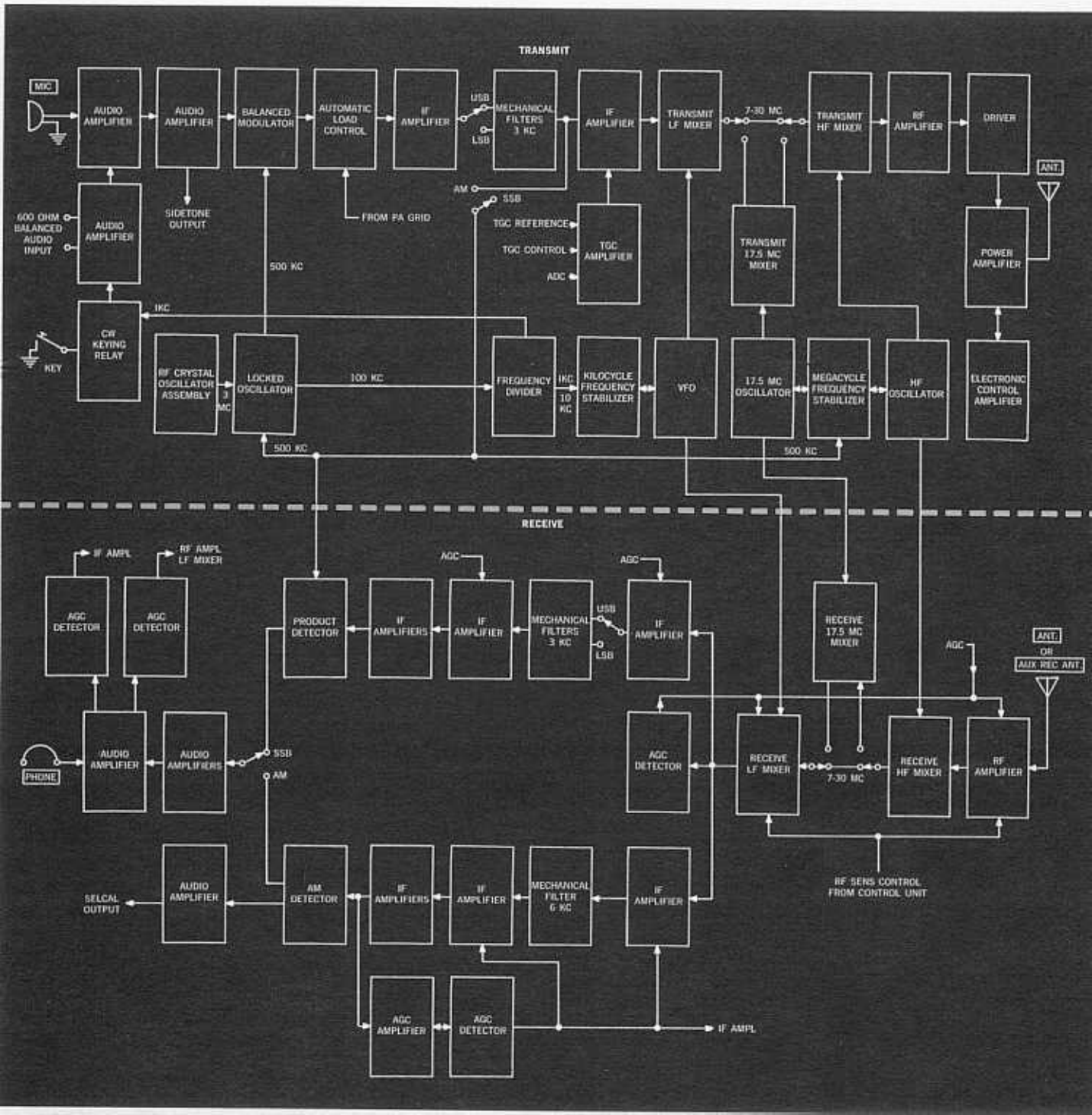


516H-1 Retrofit Power Supply

618T-1 and 49T-4/-4A Retrofit

618T-3 and 49T-3/-3A Retrofit

Functional Block Diagram



Specifications

	SIZE			WEIGHT
	W	H	D	
618T-1 transceiver	10⅛" 25.7 cm	7⅝" 19.4 cm	22-3/16" 56.4 cm	50.0 lbs. 22.68 kg
618T-2 transceiver	10⅛" 25.7 cm	7⅝" 19.4 cm	22-3/16" 56.4 cm	52.0 lbs. 23.59 kg
618T-3 transceiver	10⅛" 25.7 cm	7⅝" 19.4 cm	22-3/16" 56.4 cm	50.0 lbs. 22.68 kg

FREQUENCY RANGE:
2.0-29.999 mc.

NUMBER OF CHANNELS:
28,000.

METHOD OF FREQUENCY CHANGE:
Autopositioner®-type, remotely controlled switching mechanisms. Automatic resonating power amplifier and antenna matching circuits.

POWER SOURCE:
618T-1 and 516H-1 — 27.5 v dc and 115 v, 400 cps, single phase.
618T-2 — 27.5 v dc and 208 v, 400 cps, 3 phase. Note: 618T-2 is 208 v (208 v line to line), 3 phase, wye connected with grounded neutral.
618T-3 — 27.5 v dc and 115 v, 400 cps, single phase.

POWER REQUIREMENTS:
Receive — 180 watts. Transmit SSB — 800 watts. Transmit AM — 1050 watts.

FREQUENCY STABILITY:
0.8 part per million per month.

NOMINAL CHANNEL CHANGE TIME:
618T — 8 seconds; 30 seconds, including antenna tuner.

AMBIENT TEMPERATURE RANGE:
−40° C to +55° C with 30 minute operation at +70° C.

AMBIENT HUMIDITY RANGE:
Up to 95% relative humidity at 50° for 48 hours.

ALTITUDE RANGE:
Pressure equivalent of 30,000 feet.

TRANSMITTING CHARACTERISTICS

RF POWER OUTPUT:
SSB — 400 watts PEP. AM — 100 watt carrier.

RF OUTPUT IMPEDANCE:
52 ohms.

VSWR:
Transmitter shall provide specified power output into 52 ohm load with SWR not to exceed 1.3:1.

AUDIO INPUT IMPEDANCE:
100 ohms unbalanced; 600 ohms balanced.

AUDIO FREQUENCY RESPONSE:
5 db peak-to-valley ratio from 300-3000 cps.

DISTORTION:
SSB — third order products down at least 30 db. AM — less than 20% at 85% modulation.

RECEIVING CHARACTERISTICS

SENSITIVITY:
SSB — 1 uv for a 10 db S+N/N ratio. AM — 3 uv modulated 30% at 1000 cps for a 6 db S+N/N ratio.

SELECTIVITY:
SSB — 2.85 kc, 6 db down; 6.0 kc, 60 db down. AM — 5.5 kc, 6 db down; 14.0 kc, 60 db down.

AGC CHARACTERISTICS:
Maximum variation of audio output is 6 db for signals from 10-100,000 uv. No overload below 1 v signal input.

IF REJECTION:
80 db minimum.

AUDIO OUTPUT POWER:
100 mw into a 300 ohm load.

AUDIO DISTORTION:
Less than 10%.

AUDIO FREQUENCY RESPONSE:
5 db peak-to-valley ratio from 300-3000 cps.

COLLINS

COMMUNICATION / COMPUTATION / CONTROL

Collins Radio Company, *World Headquarters, Dallas, Texas*

074 3127 00 7.5M-WP-3-65 Printed in U.S.A.