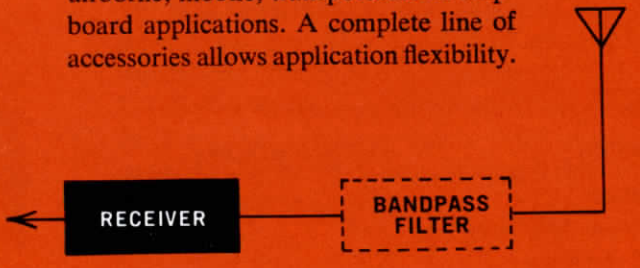
Receivers

Collins receivers will fulfill most HF single sideband communication requirements. The 51S-1 is a lightweight, general coverage receiver with extreme tuning accuracy. The automatically tuned 651F-1 is part of the Universal Radio Group of building block equipments and can be used in fixed station, airborne, mobile, transportable or shipboard applications. A complete line of accessories allows application flexibility.



51S-1 Communication Receiver
R-1122/GR (51S-1), R-1156/GR (51S-1F)

51S-1F

Features	Applications
Ruggedness	*SSB*
Operational Simplicity	*AM*
Tuning Accuracy	*CW*
Sensitivity	*RTTY*
Selectivity	*Facsimile*
Stability	*Laboratory Measurement*

The 51S-1 is a professional single sideband communication receiver providing continuous coverage from 2-30 megacycles. A high degree of sensitivity, selectivity, stability and tuning accuracy insures superior performance in SSB, CW, FSK and AM modes of operation.

The versatile 51S-1 Receiver is installed in a wide variety of military and commercial applications throughout the world. Examples of typical installations are:

1. *Fixed station communication and monitoring*
2. *Airborne communication and monitoring*
3. *Mobile communication (vehicular)*
4. *Shipboard communication and monitoring*
5. *Laboratory measurements*

There are two configurations of the 51S-1 — one for cabinet mounting and the other for conventional 19″ rack mounting. The rugged, compact, lightweight construction makes it possible for the receiver to be easily transported in a lightweight carrying case.

Different versions of the receiver are available for operation from either ac or dc power sources. The ac version will operate from 50-400 cycle power. The dc version operates from 26.5 v dc.

51S-1 in cabinet

Optional filters are available to suit a variety of bandwidth requirements. Separate Mechanical Filters for each sideband eliminate the necessity for oscillator shifting.

Highly selective Q multiplier rejection tuning enhances operation in the presence of interfering signals. Since no crystal filter is required, the problem of filter ringing is eliminated.

Nominal frequency drift after warm-up is less than 100 cps per week at normal room temperatures. The 51S-1 can be used in unattended RTTY operation.

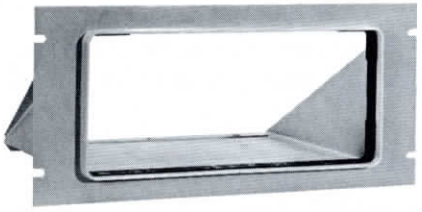
The 2-30 mc range is covered in 1 mc bands. The tuning dial mechanism has been designed with minimum reflected torque for smooth, effortless, finger-touch tuning. The counter-type dial indicates frequency directly. Linear dial calibration provides 7.8 ft. of bandspread for each megacycle

of coverage. Band change time is five seconds average and dial tuning from end to end requires only ten seconds average. The AGC system uses fast attack and slow release time constants for optimum SSB operation.

In addition to its normal communication functions, the 51S-1 provides coverage from 200 kc to 2 mc. While this coverage is not considered suitable for communication purposes, it is most useful in laboratory measurements. It is especially suited for investigation of SSB balanced modulator outputs, low IF exciter and receiver frequencies and low frequency mixer schemes.

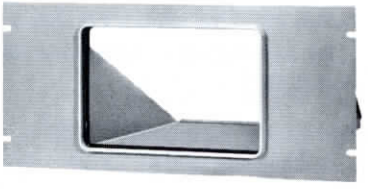
The 51S-1, mounted in a desk top cabinet, operates from 115 v or 230 v, 50-400 cps power source. The 51S-1A is identical except it is supplied for 26 v dc operation. The 51S-1F, for mounting in a standard 19″ RETMA rack, operates from a 115 v or 230 v, 50-400 cps power source, and the 51S-1AF from 26 v dc.

Accessories



351R-1

351R-2



351R-1 and 351R-2 RACK MOUNTS

The 351R-1 can be used to mount a desk top style 51S-1 in a standard 19″ (48.26 cm) rack. The 351R-2 will accommodate a 312B-3 speaker. Each is 8¾″ (22.23 cm) high and front panels have slotted mounting holes.

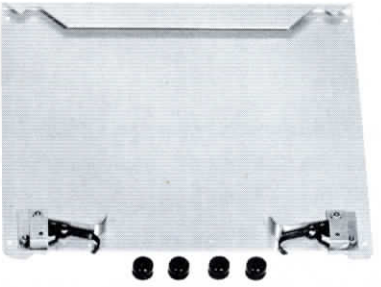
312B-3 CABINET SPEAKER

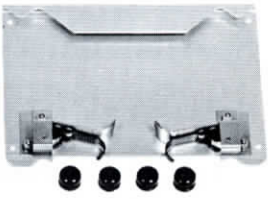
The 312B-3 is housed in an attractively styled cabinet which matches the 51S-1 Receiver. It contains a 5″ x 7″ speaker and is complete with connecting cable.

Impedance: 4 ohms. *Size:* 10″ W, 7¾″ H, 8″ D (25.4 cm W, 19.69 cm H, 20.32 cm D). *Weight:* 4 lbs. (1.81 kg).

312C-1,-2,-3 PANEL MOUNTED SPEAKERS

For rack mounted receiver assemblies. Single, dual or triple speaker groupings. Panel size is 19″ W, 8¾″ H (48.26 cm W, 22.23 cm H).

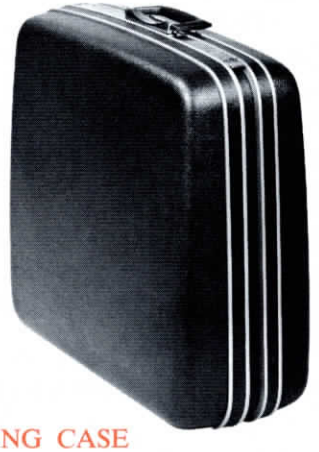




351E-4 351E-3

351E MOUNTING PLATES

The 351E can be used to secure the 51S-1 or 312B-3 equipments to bench or table in shipboard, airborne or vehicular installations. The 351E-3 will mount the 312B-3 Speaker. The 351E-4 has two snap-in clamps for secure installation of the 51S-1. The equipment can be easily unclamped for removal without the use of tools. The unit is removed by pulling forward and lifting.



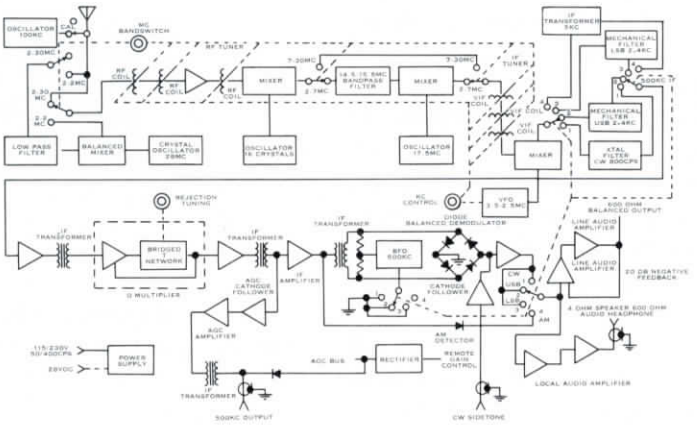
CC-2 CARRYING CASE

The CC-2 is designed to hold the components of a portable Collins SSB or CW station. The 51S-1 can be transported in the case. The CC-2 is adapted from the Samsonite Silhouette and includes a shock-resistant molded interior for the equipment. The CC-2 weighs 9.5 lbs. (4.31 kg) empty.

HS-1 HEADSET

The model HS-1 is a 600 ohm headset complete with plug and rubber-cushioned earphones. The color is light gray.

Functional Circuits



Specifications

FREQUENCY RANGE: 2-30 mc continuous coverage; additional coverage from 0.2-2.0 mc for laboratory measurements. (Specifications do not apply below 2 mc.)

MODES OF OPERATION: USB, LSB, AM or CW (all bands).

CALIBRATION: 1 kc per dial division. Direct reading in megacycles and kilocycles (all bands).

TUNING: Frequency range, divided into linear 1 mc bands.

FREQUENCY STABILITY: After 90 minute warm-up, frequency stability will be nominally within 100 cps per week at normal room temperature.

SENSITIVITY: SSB and CW — 0.6 uv for not less than 10 db S+N/N (2-30 mc). AM — 3 uv for not less than 10 db S+N/N (2-30 mc).

SELECTIVITY: SSB — 300-3050 cps when using 2.75 kc Mechanical Filter; 300-2700 cps when using optional 2.4 kc Mechanical Filter (at 3 db points). CW — 800 cps or 300 cps, depending on filter used. AM — 5 kc using normal IF transformers or 6 kc with optional Mechanical Filter.

AGC TIME CONSTANTS: Rise time — 0.8 millisecond. Decay time — 0.1 second.

AGC CHARACTERISTICS: Audio output variation less than 6 db for RF inputs from 5-50,000 uv. Not more than 3 db change in audio output with RF signals from 50,000 uv to 1 v.

RF INPUT: 50 ohms unbalanced.

CROSS-MODULATION: Inputs for 10 db cross-modulation (2.30 mc).

Desired Signal	*Interfering Signal uv Level and % of Frequency Removed*		
(uv)	(1%)	(2%)	(4%)
5	25,000	100,000	300,000
50	50,000	150,000	800,000
500	100,000	300,000	1 v

SPURIOUS RESPONSE: Not less than 80 db (2-30 mc). Image rejection not less than 50 db (2-25 mc). Not less than 40 db (25-30 mc) measured at midband.

INPUT-OUTPUT METER: Input calibrated in decibels above AGC threshold. Output level calibrated for either 0 dbm or +10 dbm.

IF OUTPUT: 500 kc; 50 millivolts at 50 ohms.

AUDIO OUTPUT: 4 ohms and 600 ohms unbalanced 1.0 watt, distortion less than 10%. Separate 600 ohm balanced output for connection to telephone line, distortion less than 1.2% at 0 dbm.

FREQUENCY RESPONSE: SSB — Within 3.5 db, 300-3050 cps, line output; within 3.5 db, 350-3050 cps, local output (with optional 2.4 kc Mechanical Filter within 3.5 db, 300-2700 cps). AM — Within 6 db, 100-2500 cps, line output; within 6 db, 200-2500 cps, local output.

AMBIENT TEMPERATURE RANGE: 0°-50° C.

AMBIENT HUMIDITY: Up to 90%.

POWER REQUIREMENTS: 125 watts, 115 v ±10%, or 230 v ±10%, 50-60 cps; 400 cps operation with reduced hum specification at full audio output. For 26.5 v ±10% operation, the internal ac supply unit is replaced by an optional dc unit.

REJECTION NOTCH: Not less than 40 db.

BFO: Supplied by 500 kc crystal.

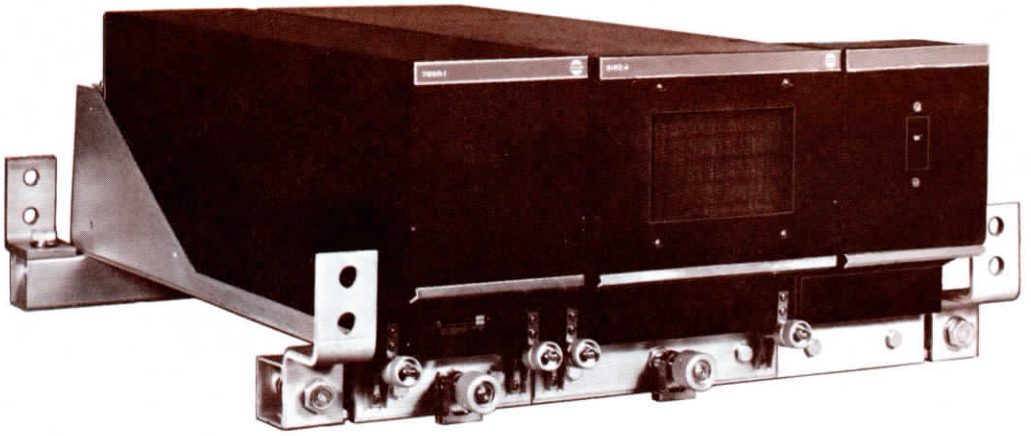
SIZE AND WEIGHT:

	Size			*Weight*
	W	*H*	*D*	(approx.)
Rack mounted	19" 48.26 cm	8¾" 22.23 cm	13 1/64" 33.06 cm	26 lbs. 11.8 kg
Cabinet mounted	14¾" 37.47 cm	6 9/16" 16.67 cm	13 1/64" 33.06 cm	26 lbs. 11.8 kg

Related Equipment

Antennas, p. 92-99

651F-1 universal radio group Receiver



Features	Applications
Automatic Tuning	*Fixed Station*
Compact Packaging	*Transportable*
Telephone Compatibility	*Shipboard*
Installation Flexibility	*Mobile*
Remote Operation	

The 651F-1 is a shelf mounted receiver covering the 2.0-29.999 mc frequency range in 28,000 1.0 kc channel increments or 2.0-29.9999 mc in 280,000 0.1 kc increments. Modes of reception include a choice of upper sideband, lower sideband, independent sideband (separate channels on each sideband), four channel multiplex, conventional AM or compatible AM with AFC. Bandwidths of 3 kc or 6 kc are optional. The 651F-1 is part of the Collins Universal Radio Group of building block equipments, which can be selected to meet a wide range of communication requirements.

SYSTEM APPLICATION

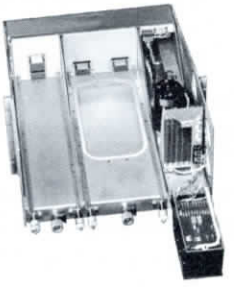
The 651F-1 URG Receiver is suitable for continuous operation in fixed station, transportable, mobile or shipboard communication systems. A simplified automatic tuning system permits control from a local shelf or console mounted unit or a dial pulse remote arrangement over telephone lines. The channel frequency can be phase locked to the internal 100 kc standard or to an external standard. Automatic frequency control can be employed to allow compatibility with unstable signals.

RECEIVER CONSTRUCTION

The 651F-1 consists of an IF translator, an RF translator, and distribution frame on a rack mounting shelf with an integral cooling air plenum. It is compatible with either Unistrut racking or cabinet enclosures. The IF translator employs card cage construction to permit a choice of operational capability for the initial installation and to facilitate modification as communication needs change. The RF translator contains the RF tuner and frequency stabilizing circuits.

EASE OF MAINTENANCE

Transistors and semiconductors are used wherever applicable to minimize weight, size and power consumption. Each individual card or module contains a complete circuit division facilitating maintenance procedures.



Wiring easily accessible

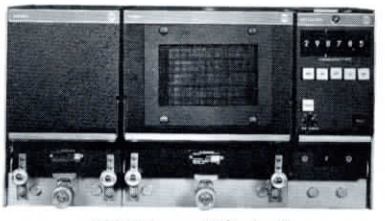
BASIC CONFIGURATION

The 651F-1 Receiver is normally supplied for 3 kc USB channels, 1 kc tuning increments, internal frequency standard and operation from a 27.5 v dc power source. It includes a 499L-1 22″ wide mounting shelf with cooling air plenum for attachment to rack cooling systems. A wiring distribution frame and circuit breaker are also included.

OPTIONAL CONFIGURATIONS

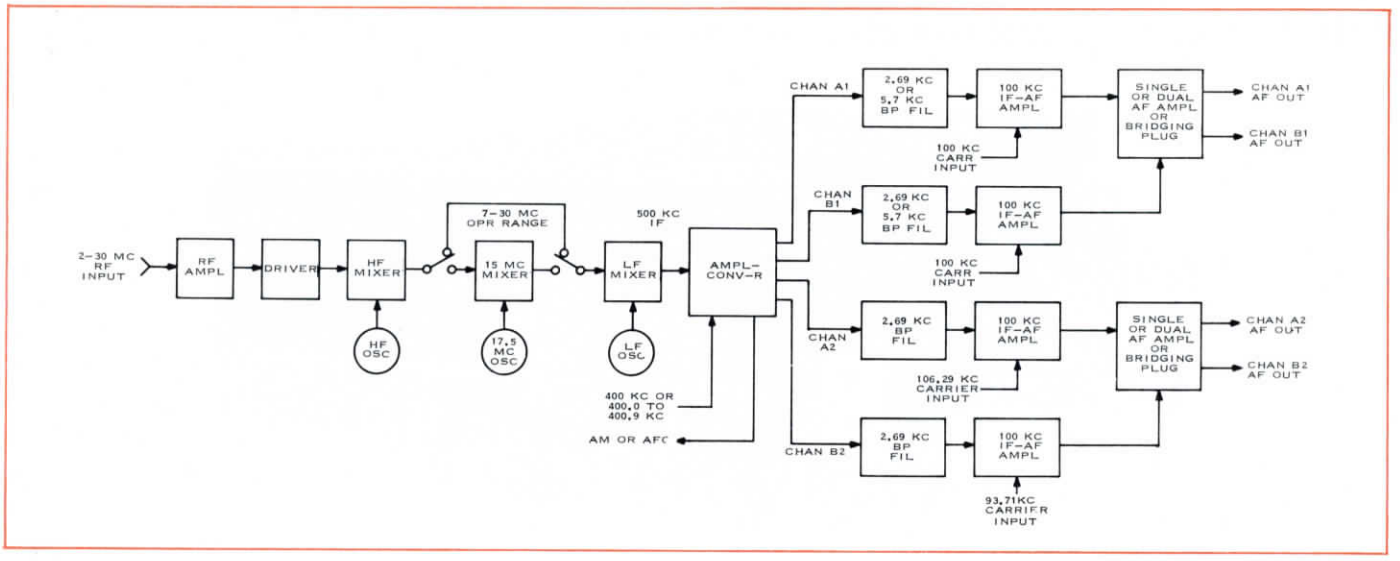
Mode Options The following choices are available to meet specific operating requirements: LSB, 3 kc bandwidth; LSB, 6 kc bandwidth; USB, 6 kc bandwidth; AM; or four channel multiplex.

Tenth KC Channel Increment Option The number of RF channels can be increased to 280,000 for more effective spectrum utilization.



651F-1 on 19″ shelf

Functional Circuits



Automatic Frequency Control Option The AFC option can be implemented to permit the frequency of the 651F-1 to be phase locked to the pilot carrier of an incoming signal. It is used when the 651F-1 is operated in a communication network with unstable transmitting equipment. This option is only available when the 0.1 kc channel increment option is employed.

Line Amplifier Options Plug-in audio line amplifiers can be used if a higher channel output level is needed. Both single and dual amplifier card modules are available. Audio levels can be adjusted individually.

External Frequency Standard Option This option offers greater frequency stability for data communication applications.

Memory Matrix Option The memory matrix is necessary only in systems sharing frequency control equipments. The 0.1 kc digit information is retained in the absence of continuous frequency information until a new frequency is selected. It is intended primarily for installations using the 313 series of wire line control equipments.

Power Supply Option An internal power supply offers operation from a 115 v or 230 v, 45-450 cps power source in lieu of the normal 27.5 v dc.

Mounting Shelf Options (1) A 499L-1 shelf as normally supplied, except designed for a 19″ rack and including an integral blower. (2) A 499L-1 shelf as in option 1, except an AM control unit is included. (3) A 499L-1 shelf as in option 1, except a control for AFC operation is included. (4) A 499L-1 22″ wide shelf as normally supplied, with a control unit for AM operation. (5) A 499L-1 22″ wide shelf as normally supplied, with a control unit for AFC operation.

Specifications

FREQUENCY RANGE: 2.0-29.999 mc or 2.0-29.9999 mc with 1.0 kc or 0.1 kc channel increments.

TYPES OF RECEPTION: SSB — USB (nominal 3 kc, 6 kc), LSB (nominal 3 kc, 6 kc), ISB (nominal 3 kc, 6 kc), four nominal 3 kc channel multiplex. AM — conventional or compatible AM when implemented with AFC.

TUNING TIME: 8 seconds after completion of desired channel frequency selection.

SENSITIVITY: SSB — not less than 10 db S+N/N ratio for a single tone input signal of 0.5 uv below AGC threshold. AM — not less than 10 db S+N/N ratio for a 30% modulation carrier of 2 uv below AGC threshold.

SELECTIVITY: Determined by individual bandpass filter electrical characteristics.

Filter	*1 DB Maximum Ripple From*	*60 DB Attenuation Points*
A-1 (nominal 3 kc)	100.35-103.04 kc	NLT 99.925 kc NMT 103.30 kc
A-2 (nominal 3 kc)	103.25-105.94 kc	NLT 102.99 kc NMT 106.31 kc
B-1 (nominal 3 kc)	96.96-99.65 kc	NLT 96.70 kc NMT 100.075 kc
B-2 (nominal 3 kc)	94.06-96.75 kc	NLT 93.69 kc NMT 97.01 kc
A-1 (nominal 6 kc)	100.30-106.00 kc	NLT 99.70 kc NMT 107.00 kc
B-1 (nominal 6 kc)	94.00-99.70 kc	NLT 93.00 kc NMT 100.30 kc
AM (nominal 6 kc)	97.15-102.85 kc	96.55 kc minimum 103.45 kc maximum
Carrier (nominal 250 cps)	99.875-100.125 kc at 3 db roll-off points	NLT 99.50 kc NMT 100.50 kc

Maximum ripple in the filter passband — 1.0 db from +15° C to +65° C, 1.5 db from −30° C to +15° C and 3.0 db from −40° C to −30° C.

PILOT CARRIER *AGC*: Threshold — 2 uv nominal, equivalent to full level carrier reception; 0.2 uv nominal 20 db suppression. Audio Rise—Not more than 3 db increase in audio output for increase in RF input from 2 uv to 100 mv; not more than 3 db increase in audio output referenced to 2 uv input level when input is increased to 1 v. Time Constants — Rise

time 0.1 second; decay time 1 second. Enabling Method — A ground on the enable line. Level Control — Choice of three levels. Two preset levels are available by individual enabling commands; one preset continuously adjustable and one preset adjustable in 3 db steps for a total of 30 db. Pilot carrier amplifier is enabled automatically whenever one of the pilot carrier presets is enabled. A third external control can be used to continuously vary level from a remote position. (Remote line operation is not terminated when one of the preset levels is desired.)

AFC Operation: Carrier Sensitivity — AFC operation is possible on pilot carrier signals in the range of 0.5 uv to 0.1 v. Carrier Selectivity and Acquisition — Control is possible on pilot carrier signals in the frequency range of ±100 cps from dial frequency. Acquisition covers a ±50 cps frequency range and is attained in less than 10 seconds (1 second typical). Manual acquisition provided for a ±1000 cps frequency range.

Tracking Rate — Automatic frequency control will remain locked on carrier frequencies which vary up to 10 cps/second (30 cps/second typical).

Selectivity Range — Automatic frequency control is possible on pilot carrier signals in the frequency range of ±1000 cps from dial frequency.

Hold Time — Frequency is maintained within ±10 cps for a minimum of one minute after loss of input signal.

Locking Error — Lock is maintained within less than ±1 cps of the received carrier frequency.

Carrier Loss Alarm — Carrier loss is indicated by a ground-on-line command for operation of an external alarm when the suppressed carrier fades to a level less than necessary for automatic frequency control.

Frequency Deviation Meter — External connections for a 0-100 ua meter provide indication of the frequency deviation corrected by the AFC. The external meter should have two ranges, 0-1000 cps and 0-100 cps, selected by external shunts.

Frequency Control: All injection sources except channel A-2 and B-2 multiplex carriers are phase locked to the internal frequency standard (or to the external standard, if used).

Frequency Stability: Internal Standard — 1 part in 10^8 per day due to aging; rms stability factor does not exceed 1 part in 10^8 in any 10 minute period. Multiplex channels A-1 and B-1 determined by reference sources; A-2 and B-2 have an additional deviation of ±2 cps.

Hum and Noise: SSB — At least 50 db below rated output. AM — At least 40 db down. With F1A noise weighting, at least 60 db below rated output.

Spurious Response: At least 60 db below response to normal inband signals.

Harmonic Distortion: SSB — Not more than 1% (2000 uv CW input, 1500 cps audio output). AM — Not more than 5% (2000 uv, 30% modulation at 1000 cps).

Intermodulation Distortion: All intermodulation products at audio output are not less than 40 db down from one of two equal test signals applied to input terminals at 100 uv level and at +10 dbm audio output level.

Quieting: For each 10 db increase of input signal, the signal-to-noise ratio will increase 10 ±1 db up to 30 db above AGC threshold. Ultimate quieting at +50 db above AGC threshold, at least 50 db.

Internal Spurious: Except for three LFO crossover frequencies, which are not more than 3.0 uv equivalent; not more than 0.5 uv equivalent at any other frequency.

Image Rejection: At least 60 db except 55 db at 200 kc above or below dial frequency.

IF Rejection: At least 90 db.

Automatic Gain Control: Threshold — SSB, 1 uv nominal; AM, 2 uv nominal. Audio Rise — SSB, not more than 4 db increase in audio output when the RF input is increased from threshold to 1 v; AM, not more than 6 db increase in audio output when the RF input is increased from threshold to 100 mv. Time Constants — All times are referred to within 3 db of equilibrium levels; SSB Voice, rise time 8 milliseconds, decay time 0.15 second; SSB Data, rise time 0.2 second, decay time 0.15 second; AM, rise and decay time 0.2 second. Control Method — Isolated individual channel control up to a nominal 60 uv RF input signal with strongest signal channel controlling common AGC stages above 60 uv signal.

RF Input: 0.5 uv to 1.0 v into nominal 50 ohms. AGC threshold 1.0 uv nominal (2.0 uv on AM).

AF Output: −10 dbm nominal and can be internally amplified to +10 dbm nominal into 600 ohms for single tone input above AGC threshold.

Power Requirements: 24.0-30.25 v dc (27.5 v nominal) negative ground with no more than 1 v peak-to-peak, 200 watts maximum. Can be implemented for ac power, 115 v or 230 v, 45-450 cps.

Size: 22 5/16" W, 8¾" H, 24½" D (56.67 cm W, 22.23 cm H, 62.23 cm D), including shelf.

Weight: 62 lbs. (28.12 kg), minimum implementation; 80 lbs. (36.29 kg), maximum implementation, including shelf.

Basic Units

789R-1 IF Translator, p. 88-90
618Z-4 RF Translator, p. 87

Related Equipment

313 Series Controls, p. 83-85
Racks and Cabinets, p. 91
Antennas, p. 92-99
635R-1 Bandpass Filter, p. 110, 111
635T-2 Bandpass Filter, p. 111, 112
635V-1 Bandpass Filter, p. 112