



5 KW FM BROADCAST TRANSMITTER

TYPE BTF-5D

CATALOG

B.6545



FEATURES

- Designed for Multiplex Stereo and S.C.A. operations
- Widest frequency response: 30 - 15,000 cycles flat ± 1 db
Lowest distortion: 0.5% 30 - 15,000 cycles and harmonics to 30 kc
- Only two tubes beyond the exciter — 1 driver, 1 final
- No double tuned circuits
- Simplified controls with complete circuit protection
- Housed in two compact cabinets affording front and rear accessibility
- Uses silicon high voltage power supply. No rectifier tubes in the transmitter
- Designed and built for remote control. No accessories required
- Incorporates reflective type harmonic filter. Suppression exceeds FCC Specifications

DESCRIPTION

The RCA Type BTF-5D is another in RCA'S line of fine FM broadcast transmitters. The BTF-5D, 5 KW FM transmitter, is the successor to the time proven BTF-5B. Essentially it is the same transmitter with improved design features including building block approach (expandable to higher powers), completely siliconized high voltage rectifiers, separate grid bias in the final for added stability, etc. In addition the BTF-5D is designed for stereo or S.C.A. programming as specified by the FCC.

Compact and simplified mechanical construction with attractive cabinet styling produces an economical installa-

tion with dignified appearance. The entire transmitter is housed in two steel cabinets, occupying a floor space of 50½ inches by 32 inches. Accessibility and speedy circuit tracing are assured by vertical chassis construction, surface mounting of components, and tilt-out exciter chassis. One subcarrier generator may be placed in the exciter-driver cabinet of the BTF-5D. A second subcarrier generator, FM broadcast monitor, multiplex monitor, etc., may be placed in a matching cabinet that is attached to the left of the transmitter, giving a symmetrical appearance. This optional accessory rack cabinet, complete with hinged front and back doors, is available as ES 34211-A.

PRELIMINARY SPECIFICATIONS

Performance Specifications

Type of Emission	F3 and F9
Frequency Range	88 to 108 mc
Power Output	5 kw
Output Impedance (1 1/2" O.D. Line)	50/51.5 ohms
Frequency Deviation 100% modulation	±75 kc
Modulation Capability	±100 kc
Carrier Frequency Stability	±1000 cycles max.
Audio Input Impedance	600/150 ohms
Audio Input Level—*(100% mod.)	+10 ±2 dbm
Audio Frequency Response—**(30-15,000 cycles)	±1 db max.
Harmonic Distortion—*** (30-15,000 cycles)	0.5% or less
FM Noise Level (referred to 100% FM mod.)	-65 db max.
AM Noise Level (referred to 100% AM mod.)	-50 db max.
Subcarrier Input Level (30% mod. of Carrier)	5 volt max.
Subcarrier Input Impedance	10,000 ohms

Electrical Specifications

Main-to-Subchannel Crosstalk	-55 db referred to ±7.5 kc deviation of the subcarrier by a 400 cps tone. Main channel modulation 85% by 30-15,000 cps tones
Sub-to-Main-Channel Crosstalk	-65 db referred to ±75 kc deviation of the main carrier by a 400 cps tone. Subchannel modulated 100% (±7.5 kc/s) by 30-6000 cps tones. Subcarrier modulated 30% on main carrier
Power Line Requirements:	
Line	240/208 volt, 3 phase, 50/60 cycles
Slow Voltage Variation	±5%
Power Consumption	10,000 watts (approx.)
Power Factor (approx.)	90%
Crystal Heaters:	
Line	117 volt, single phase, 50/60 cycles
Power Consumption	28 watts

Tube Complement

Exciter:	5-6AH6	3-6AQ5	2-5763
	1-6146	1-6CL6	1-12A17
	1-6AS6	1-6AU6	1-OD3
	1-2D21	1-1E1	
Driver:	1-7034		
Power Amplifier:	1-4CX5000A		

- * Level measured at input to pre-emphasis network
- ** Audio Frequency response referred to 75 micro-second pre-emphasis curve
- *** Distortion includes all harmonics up to 30 kc and is measured following a standard 75 micro-second de-emphasis network.

Specifications subject to change without notice.

Mechanical Specifications

Dimensions (overall):	
Width	59 1/2"
Width (with additional optional monitor rack)	84 1/2"
Height	84"
Depth	32"
Weight	~1200 lbs. (approx.)
Finish:	
Cabinets	Dark umber gray, polished stainless steel trim
Doors	Burgundy red or dark umber gray
Altitude	7500 ft. max.†
Ambient Temperature Range	-20° to +45°C

† RCA can provide blowers, etc. for operation above this altitude.

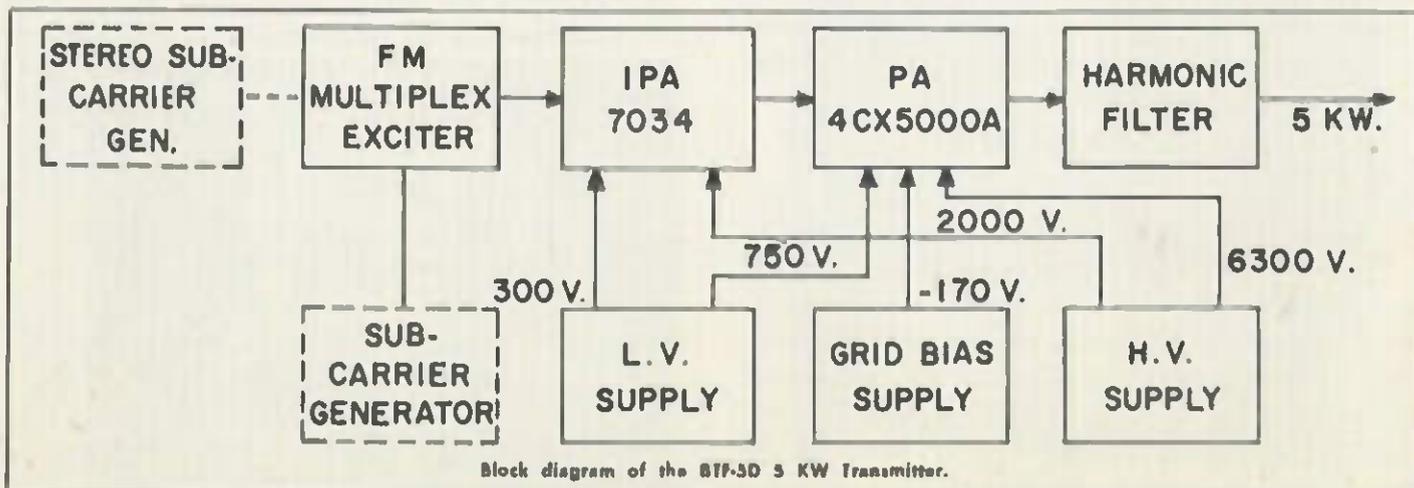
Equipment Supplied

BTF-5D FM Broadcast Transmitter (ES 34224)

Qty.	Description	Stock No.
1	250-Watt Driver	MI-34502 A
1	5-KW Amplifier (BTF 5D)	MI-34534
1	FM Exciter (BTE-10B)	ES-2727B
1	Plate Transformer	MI-34507
1	Blower	MI-34508-A
1	Side Panel (End Shield)	MI-34531-2
1	Harmonic Filter	MI-27967-1 or -2
1	Reducer 3/8" to 1 1/2"	MI-19112-7
2	Couplings	MI-19112-8
1	Tool Kit	MI-27088
1	Installation Material Kit	MI-34532
1	Finish Touch Up Kit	MI-27660
1	Set of Operating Tubes	ES-34227
1	Door, Right Hand, choose decor as follows:	
	Burgundy	MI-27645-D1
	Light Umber Gray	MI-27645-D2
1	Door, Left Hand, Choose decor as follows:	
	Burgundy	MI-27645-E1
	Light Umber Gray	MI-27645-E2
1	Nameplate	MI-28180-1

Optional and Accessory Equipment

Auxiliary Equipment Rack for BTF-5D Transmitter (Specify Door Color)	ES-34211-A
Complete Set of Spare Tubes for BTF-5D	ES-34227
Recommended Minimum Spare Tubes	ES-34238
Type BTR-11B Remote Control System	MI-27537/27538-A
Type BTX-1A Subcarrier Generator	ES-27295
Complete Set of Spare Tubes for BTX-1A Subcarrier Generator	MI-34514
Recommended Minimum Spare Tubes for BTX-1A Subcarrier Generator	MI-34519
Type BTS-1A Stereo Generator	ES-560202
Set of Spare Tubes for BTS-1A	MI-560005
53 KC Filter for use with BTX-1A when transmitting stereo and SCA	MI-560003



Block diagram of the BTF-5D 5 KW Transmitter.



RADIO CORPORATION OF AMERICA
Broadcast & Television Equipment
Camden, N. J.

"Direct FM" Exciter

The heart of the transmitter is the experience proven "Direct FM" exciter, Type BTE-10B, which is capable of multiplex operation for stereo and/or standard background music. This exciter produces the highest quality sound with the best bass response. By incorporating the BTE-10B exciter, the frequency response of the BTF-5D is essentially flat ± 1 db from 30 to 15,000 cycles. Distortion over the same wide range and harmonics to 30 kc is 0.5% or less.

The "Direct FM" exciter, including self-contained semiconductor DC power supply and line and plate breaker switches, is mounted on a single vertical chassis. The chassis hinges forward to provide instant accessibility to all components and wiring.

Frequency modulation is accomplished directly by push-pull reactance tubes connected across the frequency determining circuits of the modulated oscillator. The "direct modulation" process eliminates numerous multiplier and converter stages with resulting low noise and distortion levels. Effective decoupling minimizes the possibility of cross-talk between main and subcarrier channels. Only six tubes of the exciter are used in the r-f generating circuits. The remaining tubes (balance in AFC and OFF frequency Alarm circuits) do not affect the quality of transmission in any way.

The output frequency is automatically controlled by the AFC circuit in association with an off-frequency detector. Reference for the AFC is a crystal (MJ 34509). As a result frequency stability of the exciter is crystal controlled. In an emergency, the AFC circuits may be bypassed by means of an AFC switch and the transmitter frequency maintained manually by means of the frequency-control knob. Adjustment of the AFC circuits is simplified by means of a built-in cathode ray oscilloscope. A switch permits instantaneous checking and adjustment of the stable dividers. Lock-in is easily observed at any time without disturbing the operation of the transmitter by using the "scope" and multimeter.

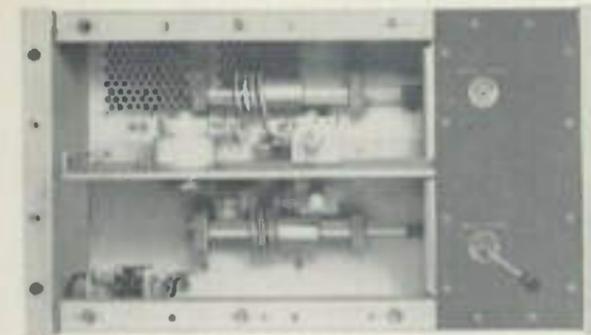
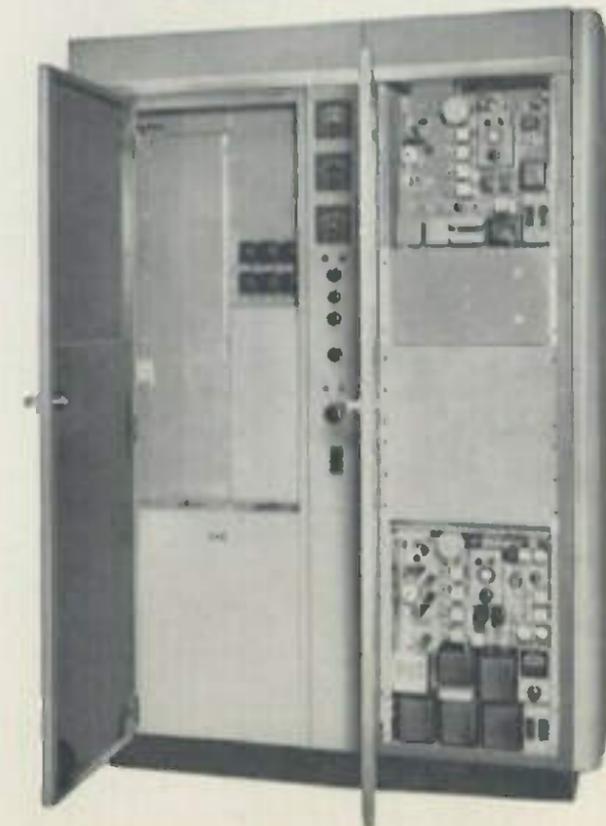
Amplifier

Two simplified single ended amplifiers operating class "C" follow the exciter. The 250-watt driver stage is a 7034 tube, and the final power amplifier is a 4CX5000A. The

250-watt stage is tuned by means of Pi network input and output circuits. No taps or sliding contacts are used. The inductors are varied by means of silver plated movable slugs. The power amplifier also uses familiar Pi network circuitry, but in this case tuning is accomplished by variable inductors operating at ground potential. Large area contacts having low current density are used. Neutralization is required only in the final amplifier. The adjustment is not critical and can be made by means of preset slides.

The tube, a ceramic tetrode, 4CX5000A, is designed for very high power gain with little drive. By using this tube, only two stages of amplification are required between the exciter and the antenna for 5,000 watts output. With fewer components there is better reliability and less possibility of error in tuning. Actual operating conditions have shown that the 4CX5000A will give excellent performance

Front view of the BTF-5D showing the convenient location of all components. On the right the Exciter is mounted at the bottom of the cabinet; above it is the IPA stage, and at the top the BTE-10A Multiplex Subcarrier Generator. The power supplies, tuning, and PA stage are in the cabinet on the left.



BTF-5D 250-Watt IPA with front panel removed.

and long life when used in the Type BTF-5D transmitters. The BTF-5D is very easy to tune and maintain. Power output is controlled by means of a variable motor-driven transformer connected in the primary of the screen voltage supply. The screen voltage is varied simultaneously on both the driver and final amplifier tubes.

For increased transmitter stability and reliability, a separate grid bias supply has been incorporated in the 5 kw amplifier. No rectifier tubes are used in the BTF-5D. The use of semiconductor rectifiers reduces operating and maintenance costs. Silicon diodes are used in the high voltage supply.

Harmonic Filter

To meet today's stringent requirements regarding spurious emission RCA includes with the BTF-5D, as standard equipment, a reflective type harmonic filter. As a consequence, transmitter performance meets and exceeds the FCC requirements for spurious emission. The filter is not merely a second harmonic trap, but consists of an M-derived half-T section, several low pass filter sections, and a constant K, half-T section. Attenuation of the harmonics is accomplished by the low pass filter sections, while the constant K, half-T section serves to give a termination impedance of 50 ohms at the other end of the unit. The use of such a filter assures compliance with FCC requirements regarding spurious radiation, as all harmonics through the seventh are effectively attenuated.

Protective Circuits

Power circuits are protected by magnetically tripped circuit breakers as well as overload relays. An interlock relay prevents application of plate power until all filaments have heated and the exciter has reached a proper operating condition. In addition, a latching relay automatically re-applies power to the transmitter two times before locking out in case of brief overlock or power interruptions. The overload relays are reset by means of an instantaneous key-switch on the front panel.

An overload indicator lamp signals when an overload has taken place. Access to high voltage areas is protected by built-in high-voltage shorting devices.

Cooling air for the BTF-5D is supplied by means of an blower that is mounted in the amplifier section of the transmitter. Heavy sound insulation is used to reduce noise to a minimum. The blower cools both the IPA and PA stages, which are each protected by air flow failure switches. To channel maximum air past the tubes, a chimney is mounted over the 7034, and the 4CX5000A is mounted in a chamber that is pressurized below the noise connection.

Control Features

The BTE-10B exciter has a self-contained multimeter. It is used to read modulator cathode current, second and third multiplier grid current, PA cathode and plate current, AFC control voltage and plate voltage.

The 5 kw amplifier cabinet provides metering of the PA plate current, plate voltage, hours elapsed time, VSWR—power output, u.c. line volts and a multimeter. All tuning adjustments can be made by means of front panel controls. They include key switches for filament-on, plate on and off, screen raise and lower, and overload reset. Front panel lights indicate all main functions such as transmitter on, transmitter ready, plate on, and overload.

Remote Control

Remote control facilities are provided in the transmitter, and terminals are provided for this type of use with remote control units such as the Type BTR-11B or BTR-20A. Terminals are provided for remote control of transmitter on-off, plate on-off, raise-lower power, and overload reset. Remote metering connections in the final amplifier for cathode current, IPA cathode current, plate voltage, and power output are also provided.

BTF-5D Power Amplifier shown behind hinged front door.

