10 KW FM BROADCAST TRANSMITTER

TYPE BTF-10D

CATALOG B .6548

FEATURES

- Proven high power design
- Extremely stable — Frequency response 30 to 15,000 cycles
- Incorporates "Direct FM" Exciter
- Highest fidelity for stereo
- Only two tubes beyond the exciter— 1 driver, 1 final
- No double tuned circuits
- Simplified controls with complete circuit protection
- Minimum floor space
- Uses silicon high voltage power supply
- Designed and built for remote control
- Incorporates low pass harmonic filter. Harmonic suppression exceeds FCC specifications
- Vertical chassis construction — front and rear accessibility

DESCRIPTION

The RCA Type BTF-10D, 10 KW FM Transmitter is designed for use in the standard FM broadcast band, 88 to 108 mcs, and is specifically designed to meet the stringent requirements of multiplex service transmission. The design of the BTF-10D, which includes the popular "Direct FM" exciter, Type BTE-10B, has proven itself in actual commercial operations.

Compact and simplified mechanical construction with attractive cabinet styling produces an economical installation with dignified appearance. The entire transmitter is housed in two steel cabinets, occupying a floor space of 59½ by 32 inches. Accessibility and speedy circuit tracing are assured by vertical chassis construction, surface mounting of components, and tilt-out chassis.

The exciter unit of the BTF-10D employs "Direct FM" modulator circuits, which require no special tuning when setting up for Multiplex. All circuits are single tuned. There is a built-in scope for ease of tuning. An absolute minimum of tubes and components is required in the new transmitter, and all tubes operate at conservative ratings for long life. The transmitter is designed to operate from a three-phase 240/208 volt, 50/60 cycle power line.

The BTF-10D is specifically designed for highest fidelity stereo. One SCA multiplex channel may also be transmitted simultaneously with stereo. Optional stereo and SCA generators are available. The "Direct FM" system assures stable, reliable stereo transmission.

5MB

Unitized Construction

The Type BTF-10D FM transmitter consists of a 250-watt driver housed in a Type BR-84 cabinet and a 10 kw amplifier which includes the power supply and forced air blower in a matching cubicle. The plate transformer is mounted externally in any convenient location. The heart of the transmitter is the exciter designed for use with one or two subcarrier generators. It is housed in the same cabinet as the 250-watt driver.

Accessibility is achieved by vertical chassis construction plus surface mounting of components and wiring for easy and speedy circuit tracing and servicing. Six meters and all controls are grouped on two panels located at either side of the amplifier cubicle. Interlock circuits protect operating personnel from high voltages when doors or panels are opened. The cabinets have been styled functionally to present a pleasing appearance, and the doors of the transmitter may be ordered in burgundy red or dark umber gray.

Multiplex Exciter

The well known Type BTE-10B Multiplex Exciter contains a modernized version of RCA's modulator and frequency control circuits that require fewer tubes and components. The exciter, including self-contained semiconductor d-c 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. A subcarrier reactance tube is coupled to a small portion of the oscillator coil for modulating one or two subcarriers in multiplex operation. Effective decoupling minimizes the possibility of cross-talk between main and subcarrier channels. Only seven tubes of the exciter are used in the r-f generating circuits. The remaining tubes do not affect the quality of transmission in any way.

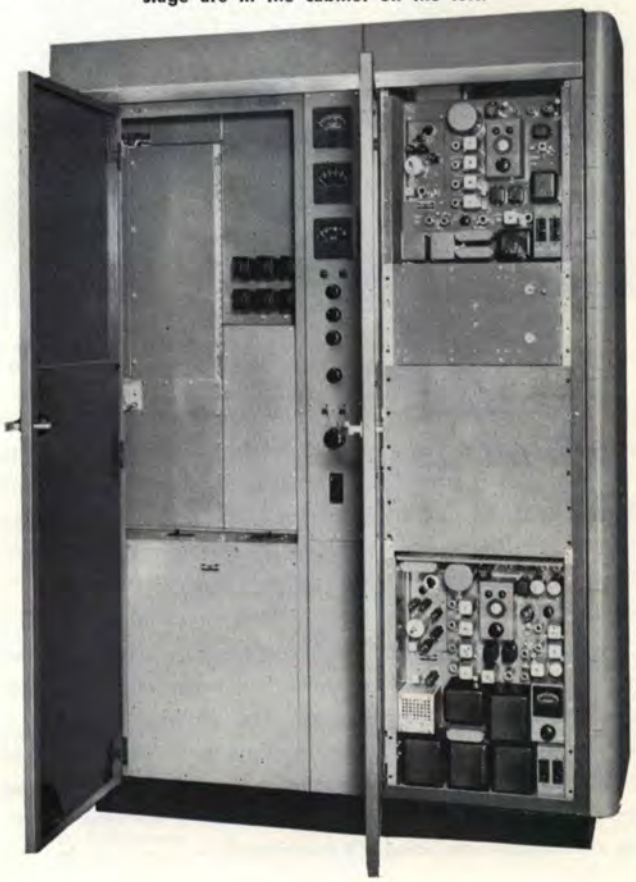
The output frequency is automatically controlled by the AFC circuit in association with an off-frequency detector. This circuit has a long record of reliable operation. The transmitter is automatically taken off the air if the operating frequency goes beyond normal tolerances. However, all of the AFC circuits may be by-passed 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. Single-tuned circuits are used in the r-f multiplier and output stages of the BTE-10B Exciter.

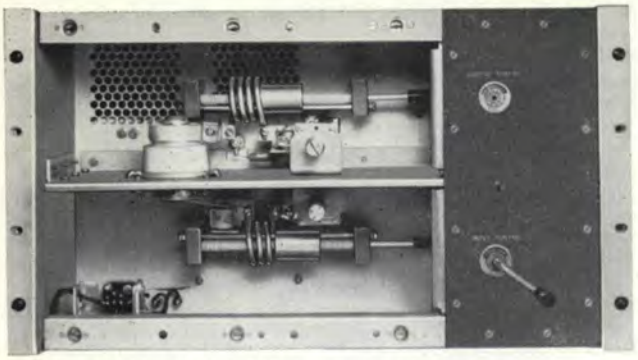
Amplifier

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

Front view of the BTF-10D 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 BTX-1A Multiplex Subcarrier Generator. The power supplies, cooling, and PA stage are in the cabinet on the left.





BTF-10D 250-Watt IPA with front panel removed.

the exciter and the antenna for 10,000 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 and long life when used in the Type BTF-10D transmitters.

The BTF-10D 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 10 kw amplifier, no rectifier tubes are used in the BTF-10D. The use of semiconductor power supplies reduces operating and maintenance costs.

Harmonic Filter

The harmonic filter supplied with all RCA FM transmitters is not a simple harmonic trap. The filter consists of an M-derived half-T section, several low-pass filter sections, and a constant-K, half-T section. The M-derived section provides rapid cut-off in the second harmonic region, and a termination impedance at one end of the filter of 50 ohms. 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 stable operating condition. In addition, a latching relay automatically re-applies power to the transmitter three times before locking-out in case of brief overloads 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-10D is supplied by means of one 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 anode 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 10 kw amplifier cabinet provides metering of the PA plate current, plate voltage, hours elapsed-time, VSWR—power output, a-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-10D Power Amplifier shown behind hinged front door.

SPECIFICATIONS

Performance Specifications

Type of Emission	F3 and F9
Frequency Range	88 to 108 mc
Power Output	10 kw
Output Impedance (1⅝" 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 ±2dbm
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.)	—65db max.
AM Noise Level (referred to 100% AM mod.)	—50db max.
Subcarrier Input Level (30% mod. of Carrier)	.5 volt max.
Subcarrier Input Impedance	10,000 ohms
Subcarrier Frequency	30-67 kc

Electrical Specifications

Main-to-Subchannel Crosstalk.....—53 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 ±7.5 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, 3φ, 50/60 cycles
Slow Voltage Variation	±5%
Power Consumption (approx.)	17,000 watts
Power Factor (approx.)	90%

Crystal Heaters:

Line	117 volt, 1φ, 50/60 cycles
Power Consumption	28 watts

Tube Complement

Exciter:

5—6AH6	3—6AQ5	2—5763
1—6146	1—6CL6	1—12AT7
1—6AS6	1—6AU6	1—OD3
1—2D21	1—1EP1	

Driver:
1—7034

Power Amplifier:
1—4CX5000A

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* 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.

Mechanical Specifications

Dimensions (overall):	
Width	59½"
Width (with additional optional monitor rack)	84½"
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

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

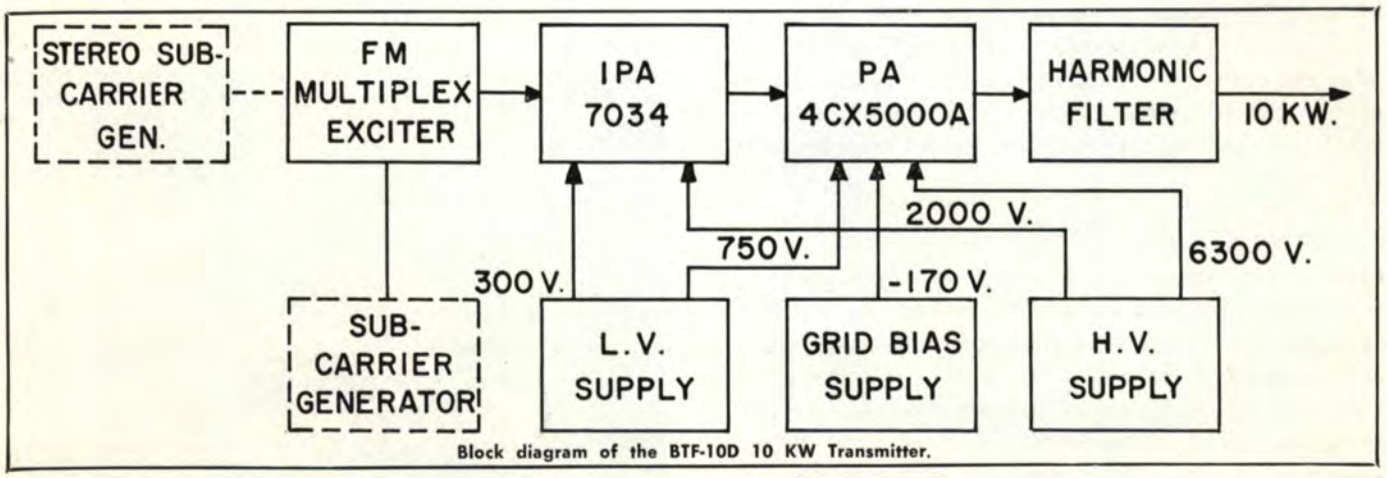
Equipment Supplied

BTF-10D FM Broadcast Transmitter (ES-34225)

Qty.	Description	Stock No.
1	250-Watt Driver	MI-34502-A
1	10-KW Amplifier (BTF-10D)	MI-34554
1	FM Exciter (BTE-10B)	ES-27278
1	Plate Transformer	MI-34555
1	Blower	MI-34556
1	Side Panel (End Shield)	MI-34531-2
1	Harmonic Filter	MI-27967-1 or -2
1	Reducer 3⅛" to 1⅝"	MI-19112-7
2	Couplings	MI-19112-8
1	Tool Kit	MI-27088
1	Installation Material Kit	MI-34553
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
2	Instruction Book	IB-30280P

Optional and Accessory Equipment

Auxiliary Equipment Rack for BTF-10D Transmitter (Specify Door Color)	ES-34211-A
Complete Set or Spare Tubes for BTF-10D	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 Subcarrier 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-10D 10 KW Transmitter.

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