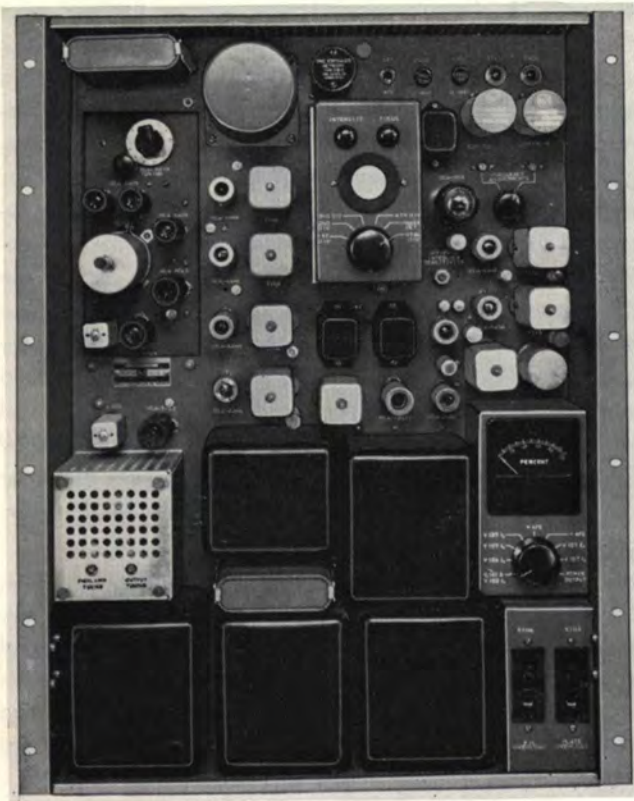




FM MULTIPLEX EQUIPMENT

CATALOG

B.6552



Type BTE-10B Multiplex Exciter.

FEATURES

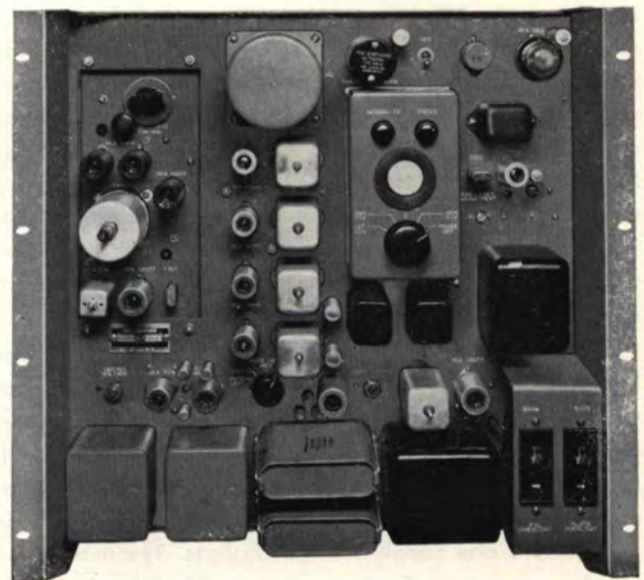
- "Direct FM" modulation
- Fewer stages—easier to tune
- Built-in scope
- No spurious frequencies generated by modulation process
- Exciter requires no special tuning when setting up for Multiplex
- All circuits single tuned
- Muting and cut-off protective circuits provide built-in protection
- Highest fidelity stereo with BTS-1A generator

USES

RCA FM Multiplex Equipment provides on-air FM stations with an inexpensive means of broadcasting two or more services simultaneously over their regularly assigned broadcast channel. With this equipment stations can offer background music services while retaining presently scheduled FM broadcast programming. The use of the equipment for subsidiary communications and stereo is subject to FCC approval.

Multiplexing is the simultaneous transmission of two or more separate program channels on the same r-f carrier. By employing the RCA BTE-10B Multiplex Exciter and one or two Type BTX-1A Subcarrier Generators, one or two additional program channels can be transmitted along with the regular FM program channel. This is accomplished by transferring the sub-channel programs into the super-sonic frequency range and frequency modulating the sub-channel programs on 30-67 kc subcarriers. The FM super-sonic carriers are then used to modulate the r-f carrier. Stereophonic programming requires the use of an optional Stereo Generator, Type BTS-1A. It can be used simultaneously with one BTX-1A, SCA Generator.

Type BTX-1A Subcarrier Generator.



3MB

DESCRIPTION

The RCA Type BTE-10B Multiplex Exciter is a compact, self-contained unit with built-in power supplies and an oscilloscope to facilitate alignment. Miniature tubes are used throughout, and semiconductor rectifiers are used in the power supplies. The BTE-10B incorporates features which make it very easy to adjust and maintain, and extremely reliable in operation.

The r-f multiplier and power amplifier stages of the exciter use relatively broadband, single-tuned circuits, thus simplifying adjustment. A built-in meter can be switched to read the following voltage and currents: modulator cathode current, second and third multiplier grid currents, PA cathode and plate current, AFC control voltage, and plate voltage. A monitor oscilloscope incorporated in the exciter simplifies adjustment and maintenance of the AFC frequency dividers. A switch permits instantaneous checking and adjustment of all five dividers and a check of the control action of the phase detector. Displays are in the form of Lissajous' figures, with the advantage that lock-in of the dividers can be easily observed. Checks can be made during operation without disturbing the AFC action in any way.

Self-contained power supplies for the BTE-10B employ semiconductor rectifiers throughout. The high voltage regulated supply which furnishes d-c plate and screen voltages utilizes a bridge-type germanium rectifier. Modulator and oscillator filaments are energized by a d-c supply employing a full-wave silicon rectifier.

All components of the BTE-10B are mounted on a vertical chassis designed for standard rack mounting. Special hinge-type mounting pins at the bottom corners permit the top of the chassis to be swung out for access to the wiring and circuit components on the underneath side.

Circuits of the BTE-10B, as shown in the block diagram, consist of a master oscillator which operates at 1/18 of the carrier frequency; two reactance modulators to provide modulation for the main channel; a third reactance modulator for the subcarrier; three frequency multipliers including the output stage to bring the output frequency up to the 88 to 108 mc range; automatic frequency control circuitry; and the power supplies necessary to furnish a-c and d-c voltages for these stages. The final amplifier of the exciter acts as a doubler.

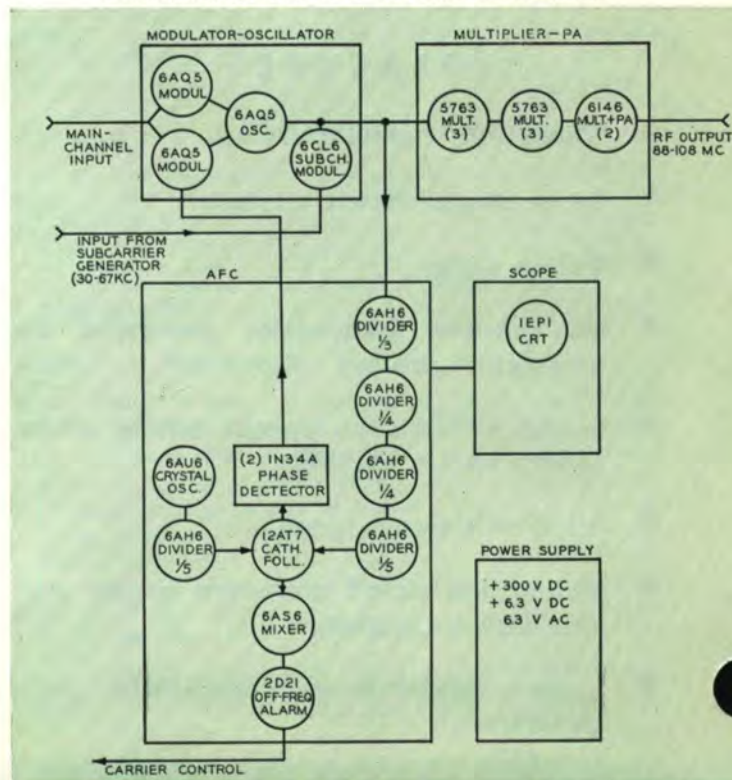
Circuit features include the use of a pushpull modulator and inductive coupling circuit that results in highly linear operation with very low harmonic distortion. Each tube becomes almost a pure reactance. Loading of the oscillator is greatly reduced thus providing better AFC action. Moreover, the pushpull modulator automatically balances out temperature and supply-voltage changes. The modulating circuits are very effectively decoupled, minimizing the

possibility of cross-talk between the main channel and subchannel.

The automatic frequency control circuitry of the BTE-10B Exciter is characterized by a long record of dependable operation. A phase detector is used to develop a control voltage which establishes and maintains a phase lock between a reference crystal oscillator and the derived signal. Thus the system is actually an automatic phase control system which achieves a stability precisely matching that of the crystal reference source. The master oscillator frequency and swing are reduced to confine phase deviations. Limited pull-in range normally associated with precise frequency control is overcome by the use of an off frequency circuit which simultaneously provides a safeguard against uncontrolled and possible off-frequency operation. The a-c overload switch can be used as a power "ON-OFF" switch, if desired, and the d-c overload switch for "Standby Plate" switching. Manual control of the oscillator is provided so that failure of any tubes or components in the AFC section will not require shutdown of the transmitter.

The BTE-10B Exciter is used in the RCA BTF-1D, 5B/D, 10C/D, and 20D transmitters. In many instances it may be used to replace the exciters in previously designed transmitters that will not meet the stringent requirements of multiplex operation. For stereo, the BTE-10B is type accepted when used with the optional BTS-1A Stereo Generator.

Simplified block diagram of a BTE-10B Exciter. The modulator-oscillator is shown with provisions for inserting one subcarrier.



BTX-1A Subcarrier Generator

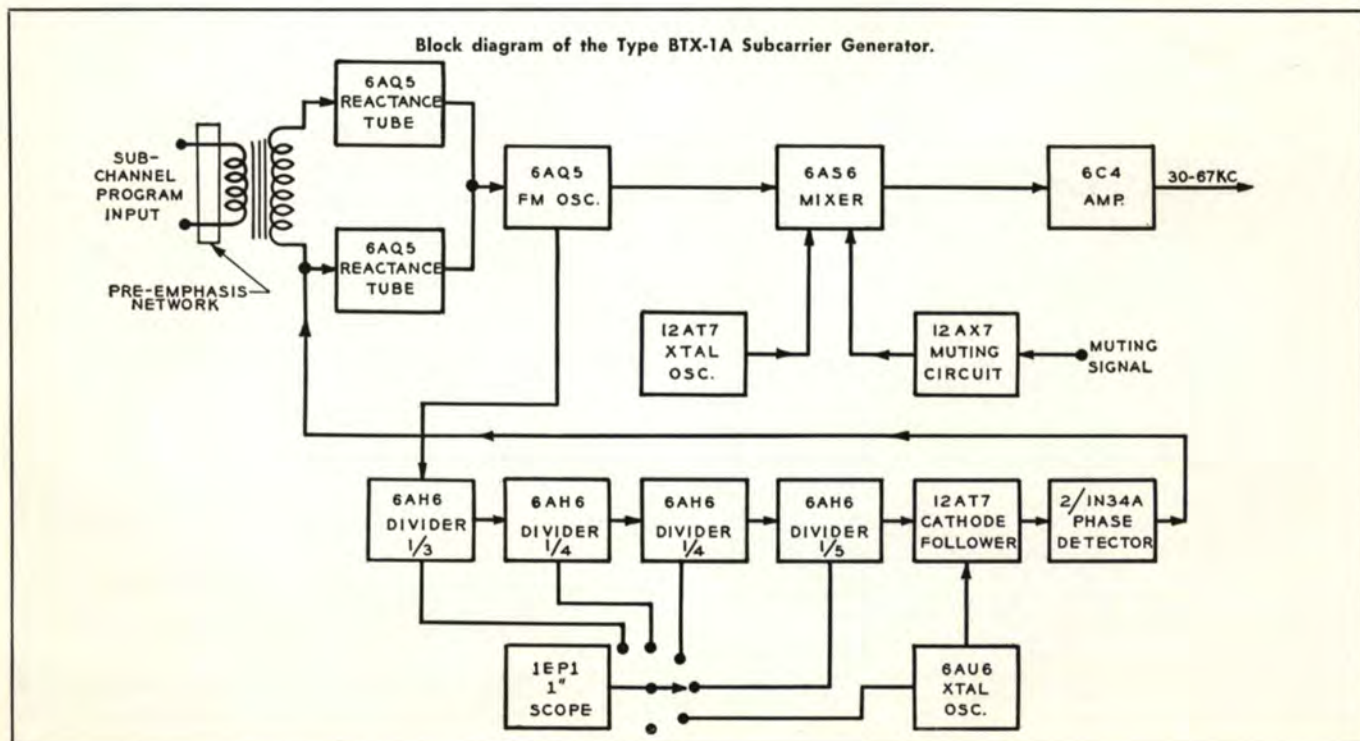
The BTX-1A Subcarrier Generator is designed to provide a frequency modulated r-f signal having a center frequency in the range of 30 to 67 kc. When used in conjunction with the RCA BTE-10B FM Exciter, an FM station can multiplex up to two channels in addition to the regular program channel on a single r-f carrier. Crystal units providing a center frequency of 32.5, 42, 59, and 67 kc are currently available for use in the generator.

All components of the BTX-1A are mounted on a vertical chassis designed for standard rack mounting. The equipment employs miniature tubes in all stages except in the power supply which utilizes an OD3 voltage regulator and germanium rectifiers in a bridge circuit. Other features include a built-in monitor oscilloscope which permits instantaneous check and adjustment of all five AFC frequency dividers, and the control action of the phase detector.

The BTX-1A circuitry consists of a master oscillator, push-pull reactance modulators, crystal oscillator, automatic frequency control, subcarrier muting stage, mixer, cathode follower output stage, alignment oscilloscope and a power supply. Two reactance modulators are connected to the oscillator plate, and the pushpull grids are inductively coupled to the plate tank. R-f voltages on the two modulator grids are 180 degrees out of phase with respect to each other, and each is 90 degrees out of phase with the oscillator plate. Thus one tube appears as a capacitive reactance and the other appears as an inductive reactance

across the oscillator tank. The magnitude of the reactive component presented to the tank coil varies with the audio voltage applied to the modulator grids. The frequency of the oscillator is varied accordingly. The mean frequency is controlled by the bias voltage applied to one grid by the automatic frequency control circuit.

The modulated output from the master oscillator and the r-f output from a 12AT7 crystal oscillator are then fed into a mixer. This stage supplies the modulated beat frequency in the range of 30 to 67 kc, which is connected to the cathode follower. A subcarrier muting stage is used to disable the mixer and thus suppress subcarrier output when no audio voltage is present at the audio input terminals of the generator. Operation of this stage is such that with no audio voltage present at the input, the plate of the second half of the 12AX7 tube clamps the grid voltage of the mixer to a very low value, reducing output of the mixer to zero. Audio applied to the input of the muting stage, however, is amplified in the first half of the 12AX7, rectified by a 1N38A crystal diode and applied as bias to disable the clamping section of the tube. A five-position switch is provided for switching the muting stage in and out of the circuit, and also selection of three different values of time delay before muting takes place. The pushpull modulation of the BTX-1A is similar to that in the BTE-10B and has the same features as previously outlined. The automatic frequency control circuitry used in the BTX-1A is also very similar to that in the BTE-10B Exciter, and it performs the same function.



SPECIFICATIONS

Type BTE-10B Exciter

Performance Specifications

Type of Emission.....	F3
Frequency Range.....	88-108 mc/s ¹
Power Output.....	10 watts
Output Impedance.....	50 ohms
Frequency Deviation for 100% modulation.....	±75 kc/s
Modulation Capability.....	±100 kc/s min.
Carrier Frequency Stability.....	±1000 cps max.
Audio Input Impedance.....	600/150 ohms
Audio Input Level (100% mod.).....	+10 ±2 dbm ¹
Audio Frequency Response (30-15,000 cps).....	±1 db max. ²
Harmonic Distortion (30-15,000 cps).....	0.5% or less ³
FM Noise Level (referred to 100% FM mod.).....	-65 db max.
AM Noise Level (referred to carrier voltage).....	-50 db max.
Subcarrier Input Level (30% mod. of carrier max.).....	5 volts max. ⁴
Subcarrier Input Impedance.....	10,000 ohms
Subcarrier Center Frequency Range.....	30-67 kc/s
Main-to-Sub-channel Crosstalk.....	-53 db ⁵
Sub-to-Main Channel Crosstalk.....	-65 db ⁵

Electrical Specifications

Power Line Requirements:

Transmitter:

Line.....	240/208 or 117 V, a-c, 50/60 cps, single phase
Slow Voltage Variations.....	±5%
Power Consumption.....	300 watts

Crystal Heaters:

Line.....	117 V, a-c, 50/60 cps, single phase
Power Consumption.....	28 watts

Tube Complement

1 Cathode Ray Tube.....	1EP1	1 Frequency Divider (1/5) 6AH6	
2 Reactance Modulator.....	6AQ5	1 Crystal Oscillator.....	6AU6
1 Master Oscillator.....	6AQ5	1 Crystal Frequency	
1 Subcarrier Modulator.....	6CL6	Divider (1/5).....	6AH6
2 Frequency Tripler.....	5763	1 Cathode Follower.....	12AT7
1 Frequency Doubler and		1 Off-Frequency Detector.....	6AS6
Power Amplifier.....	6146	1 Off-Frequency Control.....	2D21
1 Frequency Divider (1/3) 6AH6		1 Voltage Regulator.....	OD3
2 Frequency Divider (1/4) 6AH6			

Mechanical Specifications

Overall Dimensions.....	24 1/2" high, 19" wide, 11" deep
Weight.....	80 lbs.
Maximum Altitude.....	7500 feet
Ambient Temperature Range.....	0-45°C

Equipment Supplied

Type BTE-10B FM Exciter..... ES-27278

Comprising the following:

1 FM Exciter Unit.....	MI-34501
1 Crystal Unit.....	MI-34509*
(*Sales Order must specify crystal frequency)	
1 Set of Operating Tubes.....	MI-34510
2 Instruction Book.....	IB-30262

¹ Level measured at input to pre-emphasis network using 400 cps tone.

² Audio frequency response referred to 75 μs pre-emphasis curve.

³ Distortion includes all harmonics up to 30 kc/s and is measured following a standard 75 μs de-emphasis network.

⁴ Subcarrier modulation percentage can be brought to 50% if required.

⁵ Reference shall be ±7.5 kc/s deviation of the subcarrier by a 400 cps tone. Main-channel modulated 85% by 30-15,000 cps tones.

Type BTX-1A Sub-Carrier Generator

Performance Specifications

Type of Modulation.....	FM
Center Frequency Range of Sub-carrier.....	30-67 kc/s
Output Voltage.....	5 volts min.
Source Resistance.....	Approx. 400 ohms, cathode follower
Frequency Deviation (100% subcarrier mod.).....	±7.5 kc/s
Modulation Capability.....	±25 kc/s
Carrier Frequency Stability.....	±500 cps
Audio Input Impedance.....	600/150 ohms
Audio Input Level (100% mod.).....	+10 ±2 dbm ¹
Audio Frequency Response (30-60,000 cps).....	±1 db max. ²
Harmonic Distortion (30-60,000 cps).....	0.75% ³
FM Noise Level (referred to 100% mod.).....	-60 db max.
AM Noise Level (referred to carrier).....	-50 db max.

Electrical Specifications

Power Line Requirements:

Line.....	240/208 V, a-c, 50/60 cps, single phase
Slow Voltage Variation.....	±5%
Power Consumption.....	100 watts

Tube Complement

2 Reactance Modulator.....	6AQ5	1 Frequency Divider (1/5) 6AH6	
1 Master Oscillator.....	6AQ5	1 Crystal Oscillator #2.....	6AU6
1 Crystal Oscillator #1.....	12AT7	1 Cathode Follower.....	12AT7
1 Mixer.....	6AS6	1 Subcarrier Muting.....	12AX7
1 Cathode Follower.....	6C4	1 Voltage Regulator.....	OD3
1 Frequency Divider (1/3) 6AH6		1 Cathode Ray Tube.....	1EP1
2 Frequency Divider (1/4) 6AH6			

Mechanical Specifications

Overall Dimensions.....	17 1/2" high, 19" wide, 10" deep
Weight.....	40 lbs.
Maximum Altitude.....	7500 feet
Ambient Temperature Range.....	0-45°C

Equipment Supplied

Type BTX-1A Subcarrier Generator..... ES-27295

Comprising the following:

1 Subcarrier Generator Unit.....	MI-34500
1 Set of Operating Tubes.....	MI-34514
1 Crystal Unit, Type CR-18/U.....	MI-34520*
(*Order must specify frequency of 67, 58, 42, or 32.5 kc)	
1 Instruction Book.....	IB-30262

Accessory Equipment

BTS-1A Stereo Generator.....	ES-560202
Spare Set of Tubes for BTS-1A.....	MI-560005
53 kc Filter (required if transmitting Stereo).....	MI-560003
Spare Set of Operating Tubes for BTE-10B Exciter.....	MI-34510
Set of Spare FCC Tubes for BTE-10B Exciter.....	MI-34515
Spare Set of Operating Tubes for BTX-1A	
Subcarrier Generator.....	MI-34514
Set of Spare FCC Tubes for BTX-1A Sub-carrier Generator.....	MI-34519
Spare Crystal for BTE-10B Exciter.....	MI-34529*
(*Sales order must specify channel frequency.)	

⁶ Preference shall be ±7.5 kc deviation of the main-carrier by a 400 cps tone. Sub-channel modulated 100% (±7.5 kc/s) by 30-6,000 cps tones.

⁷ Coil furnished for 44 to 54 mc for use where a doubler follows the exciter.



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