



FM

TYPE
GF-1-B

• 250
WATT

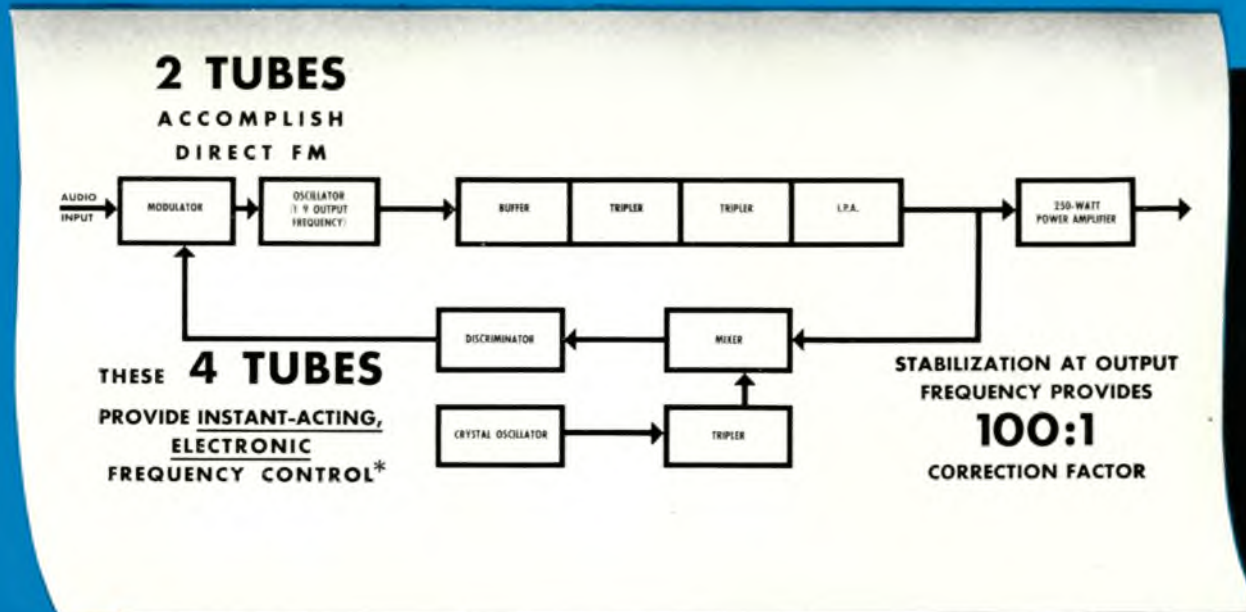


FM BROADCAST TRANSMITTER

FCC Approved

First of all

Here's How G-E Simplified FM Is Produced



This unique circuit assures you **MAXIMUM ON-THE-AIR RELIABILITY**

- Fewer parts, fewer tubes.
- Frequency stability is assured by instant-acting, electronic frequency control.
- Conservative operation of all component parts.
- Hermetically sealed, temperature-controlled crystal unit.
- Instruments are provided for checking tube and circuit performance.
- Complete accessibility without disassembly.
- FCC Approved—just specify Type GF-1-B (250-watt unit) on your construction-permit application.

* This control is so quick-acting that a 1/20-second time delay is introduced to prevent demodulation at frequencies above 20 cycles.

The 250-watt FM transmitter provides these **EXCELLENT PERFORMANCE GUARANTEES**

CARRIER-POWER OUTPUT: 250 watts.

CARRIER-FREQUENCY RANGE: 42 to 50 mc.

CARRIER-FREQUENCY STABILITY: Within ± 1000 cycles over normal room-temperature range (FCC requirements ± 2000 cycles).

FM CARRIER-NOISE LEVEL: 70 db below ± 75 -kc swing, unweighted.

AM CARRIER-NOISE LEVEL: 60 db below 100% amplitude modulation, unweighted.

R-F LOAD CHARACTERISTICS: A balanced or unbalanced r-f transmission line of 60 to 200 ohms impedance can be used. However, the use of a single concentric r-f line is recommended.

MODULATION CAPABILITY: ± 75 -kc carrier swing corresponds to 100% modulation.

A-F INPUT LEVEL: Normal, 0 db* for 100% modulation; a variable balanced H-pad in the transmitter permits audio-frequency input levels of -7 db to +8 db in 0.5-db steps for 100% modulation; input impedance, 600 ohms.

A-F RESPONSE: Within ± 1 db of FCC pre-emphasis standard from 30 to 16,000 cycles; if desired, within ± 1 db of 1000-cycle response, 30 to 16,000 cycles.

A-F DISTORTION: Less than 1.5% rms, unweighted, for any single modulating frequency from 30 to 15,000 cycles and for carrier swing up to ± 75 kc; less than 2% distortion, 30 to 15,000 cycles, up to ± 100 kc swing.

INTERMODULATION DISTORTION: Less than 1% rms at ± 75 -kc swing, with equal audio-input combinations of 400 and 700 cycles, or 4000 and 7000 cycles.

POWER SUPPLY: 115 volts $\pm 5\%$, 60 cycles, single-phase.

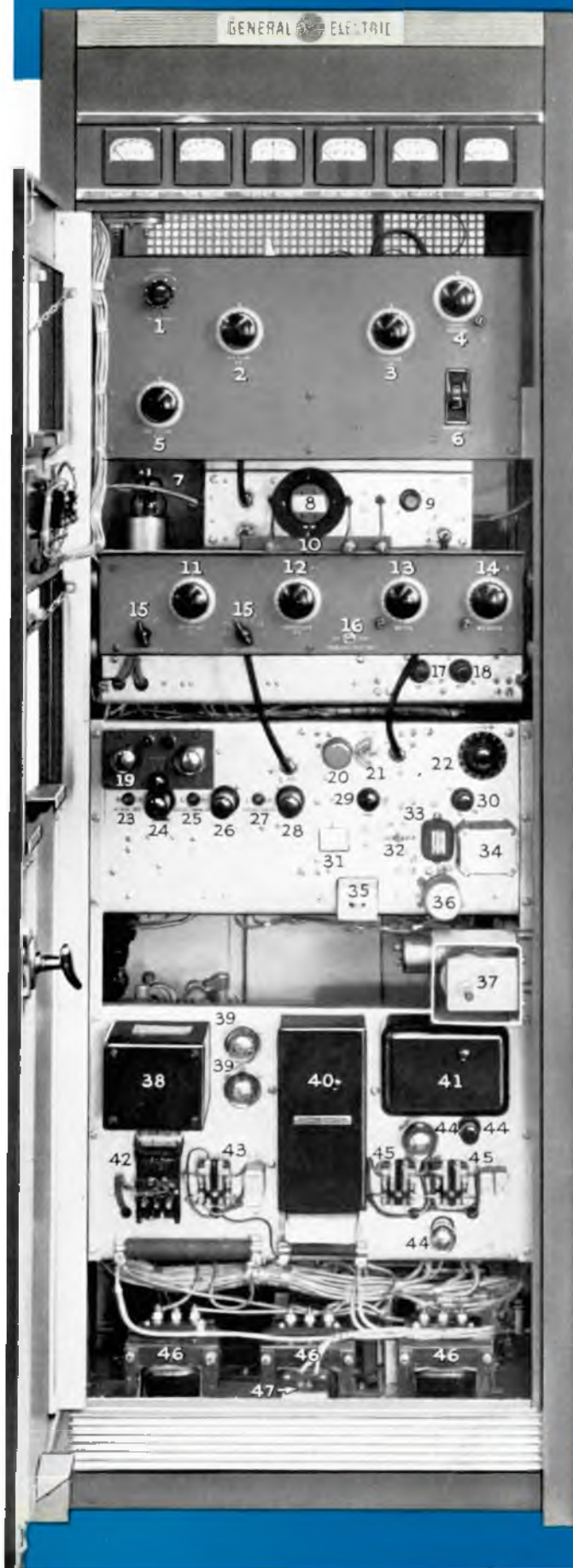
POWER INPUT: 1.25 kw at 90% power factor.

*0 db is 1 milliwatt of sine-wave power.



No matter what your future power requirements may be, this 250-watt transmitter will fit into the picture. It's the basic unit for all G-E FM transmitters. Its design is co-ordinated with amplifier units both mechanically and electrically to make it easy to increase power.

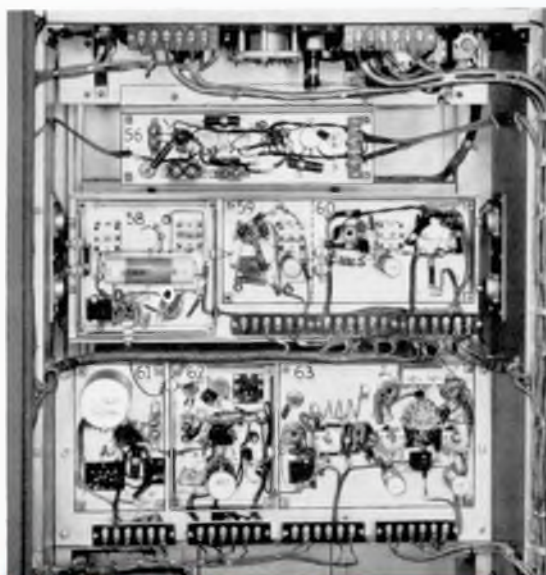
HERE'S THE



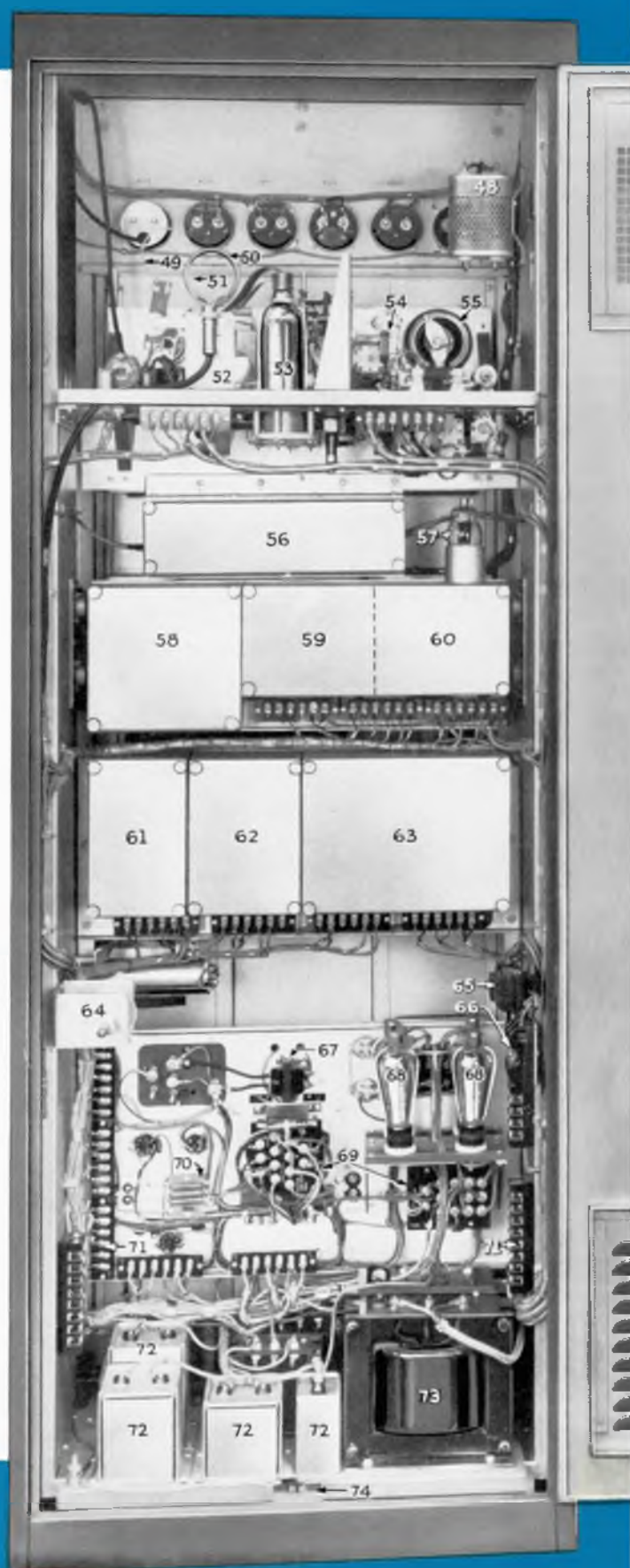
1. Master filament rheostat for exciter
2. IPA plate-tuning control
3. PA plate-tuning control
4. Output-coupling control
5. Second tripler plate-tuning control
6. Circuit-breaker-type power switch for exciter
7. GL-807 second tripler
8. Cathode-ray modulation indicator
9. 6SJ7 audio amplifier for modulation indicator
10. Modulation-indicator controls
11. First tripler tuning control
12. Buffer-amplifier tuning control
13. Master-oscillator fine-tuning control
14. Master-oscillator coarse-tuning control
15. Plate milliammeter transfer switches
16. Frequency-deviation indicator sensitivity switch
17. 6J5 master oscillator
18. 6AB7/1853 reactance-tube modulator
19. Crystal Thermocells, with indicator lights above and selector switch below
20. Audio feed-back reactor
21. Modulation-indicator calibrating control
22. Audio input attenuation
23. Crystal fundamental tuning adjustment
24. GL-1614 crystal oscillator
25. Crystal harmonic tuning adjustment
26. GL-1614 crystal tripler
27. Crystal tripler tuning adjustment
28. GL-1614 converter
29. 6H6 discriminator detector
30. 6SJ7 audio amplifier
31. Cover plate for discriminator-primary tuning adjustment
32. Discriminator-secondary tuning adjustment
33. Pre-emphasis reactor
34. Audio-input transformer
35. Frequency-control supervisory relay
36. Pyranol audio-by-pass capacitor
37. Safety grounding switch
38. Low-voltage plate transformer
39. 5Z3 low-voltage rectifiers
40. Plate contactor
41. Telechron motor operated time-delay relay for rectifier plate voltage
42. Constant-voltage filament transformer for master oscillator and modulator
43. Auxiliary control relay
44. Voltage regulator tubes (3)
45. D-c overload relays

INSIDE STORY

46. Plate smoothing reactors
47. Safety interlock
48. Plate-voltmeter multiplier
49. Exciter-output coupling coil
50. Exciter-output tank coil
51. Coupling coil for FM station monitor
52. Exciter-output tank-tuning capacitor
53. GL-810 exciter output tubes
54. RF coupling capacitor
55. Filament rheostat
56. Cathode-ray modulation indicator
57. GL-807 second tripler
58. Modulator-oscillator
59. Buffer-amplifier
60. First tripler
61. Audio amplifier
62. Discriminator
63. Crystal oscillator, tripler, and mixer
64. Safety grounding switch
65. Crystal Thermocell heater transformer
66. Crystal heater fuses
67. Indicator-light transformer
68. GL-866A/866 mercury-vapor rectifiers
69. Filament transformers
70. Voltage-regulator resistors
71. Thermal boards for all external wiring
72. Filter capacitors
73. High-voltage plate transformer
74. Safety interlock



Frequency control, audio, and low power stages (shields removed)





This is the hermetically sealed G-31 Thermocell crystal unit. It utilizes a new method of controlling crystal temperature, which far surpasses older methods in the frequency stability obtained. Although only one Thermocell is used in General Electric's simplified circuit, provision is made for switching to a spare during operation.

TUBE ECONOMY

The careful designing that is characteristic of all General Electric FM transmitters has resulted in great reliability with very few tubes. This reduces maintenance expense and the possibility of tube failures. All tubes are operated well within their Continuous-Commercial-Service (C.C.S.) ratings.

1 2A3	1 902
2 5Z3	1 VR-105-30
1 6H6	3 GL-807
1 6J5	2 GL-810
1 6AB7/1853	1 GL-866A
3 6SJ7	5 GL-1614

MECHANICAL FEATURES

- **LITTLE FLOOR SPACE REQUIRED:** Width, 28 in.; height, 78 in.; depth, 24 in.
- **LIGHT IN WEIGHT:** 67½ lb, net
- **NEAT CONSTRUCTION:** Completely self-contained in a grounded steel cabinet with gray-ripple finish.
- **NATURAL DRAFT VENTILATION**
- **CONCEALED EXTERNAL CONNECTIONS:** Power and control wiring is concealed by the use of convenient entrances in the bottom of the cabinet. R-f output connections are made through knockouts provided in the right side and top.

HOW IT OPERATES

Radio-frequency Circuits

The radio-frequency circuits of the GF-1-B are characterized by their simplicity. Modulation is applied through a "reactance tube" to a low-power, low-frequency oscillator, producing a wide-band, frequency-modulated signal.

A buffer amplifier, two stages of frequency-multiplication, and a push-pull intermediate power amplifier precede the push-pull power-amplifier stage. A variable coupling circuit in the power-amplifier stage provides easy adjustment of the output loading.

Operation of all r-f stages as Class C amplifiers results in high-efficiency and noncritical adjustment.

A temperature-controlled crystal oscillator stabilizes the modulated oscillator, holding the center frequency of the carrier, to within ± 1000 cycles of its assigned value, over a wide variation in room temperature.

This is better by ± 1000 cycles than the deviation permitted by FCC rules. Deviations in carrier center frequency due to temperature, humidity or voltage changes are instantaneously corrected by automatic applications of a corrective voltage to the reactance-tube modulator.

Audio Circuits

A single audio-amplifier stage with balanced "H" type attenuator is provided, and a 100-microsecond pre-accentuation filter (RMA standard) is used.

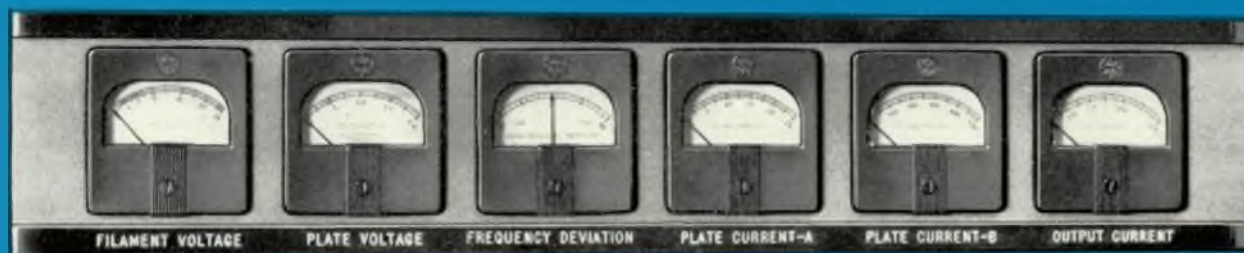
Rectifier Circuits

Two rectifiers, each with a d-c overload relay, are incorporated in the GF-1-B. The low-voltage unit supplies the low-level stages. Plate voltage for the r-f oscillator and the frequency modulator is held constant by an automatic electronic voltage regulator. The second rectifier supplies power at two voltages; the lower for the final frequency multiplier and the i-p-a; the higher for the final p-a.

Monitoring

A cathode-ray monitor is mounted in the transmitter for continuous observation of frequency swing and relative output of the transmitter. A special audio channel is provided to feed a high-impedance monitoring amplifier and loud-speaker, such as the G-E Type A19A amplifier and JCP-10 high-fidelity speaker. A pickup coil and cable are provided for external monitoring as required by the FCC. For the latter we recommend the G-E FM station monitor, Cat. No. 6933906, FCC approval No. 2431-2441.

INSTRUMENTS



These conveniently mounted instruments are provided for checking tube and circuit performance. The radio-frequency output ammeter

(farthest right) is a thermocouple-type instrument recently developed by General Electric for direct measurement of transmission-line cur-

rent. It is not provided, however, when the GF-1-B is to be used as an exciter.

DETAILS, BUT IMPORTANT



Red and green plate OFF-ON push buttons are conveniently placed on the front door of the transmitter. These are translucent, and contain 6-volt indicating lamps. The center opening displays cathode-ray modulation monitor.

This hand-operated circuit-breaker-type switch, controlled from the front panel, provides full protection against short circuits and excessive overloads without the use of fuses.

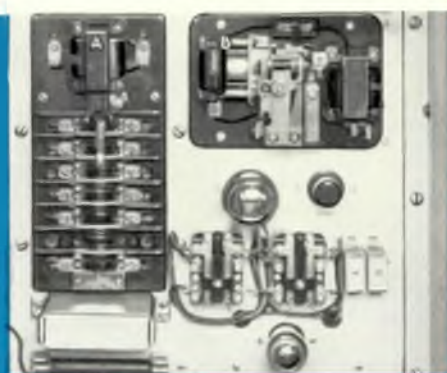


Plate contactor (A) and Telchroon motor time-delay relay (B) with covers removed. The time delay relay protects the rectifier tubes against premature application of plate voltage.



Safety to operating personnel is assured by interlocks (left) and grounding switches on the front and rear doors. The former open the primary circuits of the plate transformer; the latter ground both the high-voltage and low-voltage plate circuits when a door is opened.

TESTING AND INSTALLATION

General Electric FM transmitters are thoroughly tested and adjusted before they leave the factory. These tests assure the operating characteristics given under "Excellent Performance Guarantees," and include thorough square-wave measurements. Final tuning to operating frequency must, of course, be done after installation.

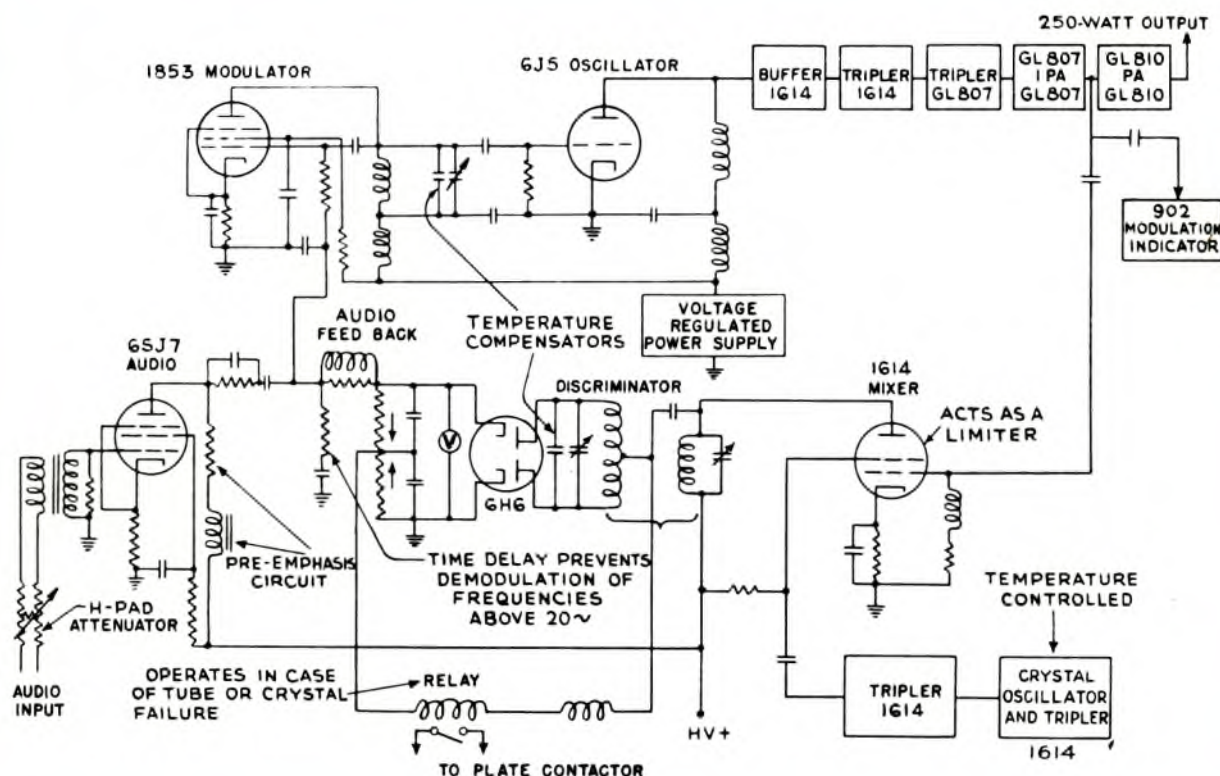
TRANSMITTER DESIGN APPROVED BY FCC

Complete technical data on the G-E 250-watt FM broadcast transmitter, Type GF-1-B, have been filed with the FCC and its approval has been given on this design. In applying for an FM construction permit, it is necessary only to specify "General Electric Type GF-1-B transmitter," in lieu of filing a complete description of the equipment.

STANDARD EQUIPMENT

- Complete 250-watt G-E transmitter
- Two complete sets of G-E tubes
- One Type G-31 Thermocell crystal unit, complete with a low-temperature-coefficient crystal that is ground to customer's operating frequency
- Installation and operating instructions.

ADDITIONAL INFORMATION FOR THE ENGINEER



Simplified schematic of G-E 250-watt FM broadcast transmitter

ADDITIONAL EQUIPMENT AND SERVICE

General Electric also offers FM broadcast transmitters with the standard ratings 1-, 3-, 10-, and 50-kw; broadcast-quality FM transmitters of the "S-T" class for carrying the program from studio to transmitter (50 watts, 156-168 mc and 25 watts, 260-350 mc); the new FM station monitor for checking center-frequency, percentage modulation, and fidelity; the G-E square-wave generator; and a complete line of transmitting tubes, crystals, and antennas.

4-42 (SM)
Filing No. 6914



FOR

FM Broadcast Transmitters
250 to 50,000 Watts



ALL

S-T Transmitters



YOUR

Measuring & Testing
Equipment



FM

Receivers for Home
and S-T Service



NEEDS

FM Police and Emergency
Transmitters and Receivers



Tubes



GENERAL ELECTRIC