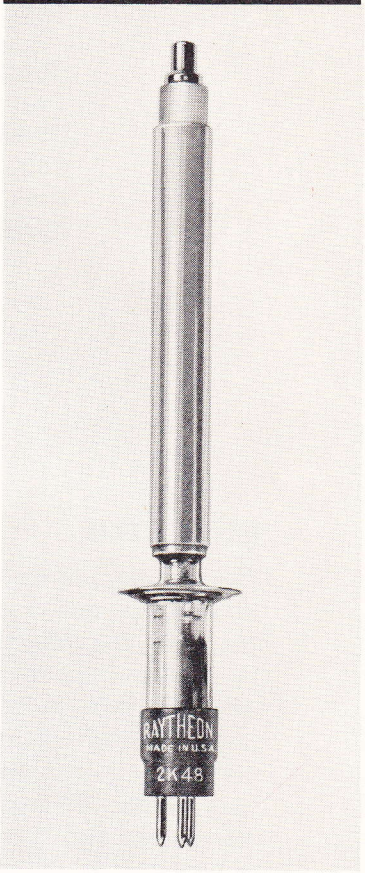
TYPE 2K48



The type 2K48 is a reflex velocity variation oscillator designed for use with an external coaxial cavity in CW operation over the 4200 to 10750 Mc range with an average power output of 20 milliwatts. Freely circulating and in some cases forced air is required for cooling of the grid ring cavity contacts. The extremely wide frequency ranges which can be achieved with a single reflector mode make this tube ideally suited for signal generator and special local oscillator applications.

GENERAL ELECTRICAL CHARACTERISTICS

Heater:

Heater Voltage	6.3 ±0.3 V
Heater Current	450 to 700 mA

Maximum Ratings:

Resonator Voltage	1500 Vdc
Resonator Current	15 mAdc
Reflector Voltage	
Minimum Negative	18 Vdc
Maximum Negative	400 Vdc
Dissipation (exclusive of heater power)	22.5 W
Heater Cathode Voltage	±50 V
Temperature at Grid Seals	120°C

Typical Ratings:

A. Operation @ 2¾ cycles Reflector Transit Mode

Frequency Range	4300 to 7200 Mc
Resonator Voltage	1250 Vdc
Resonator Current	12 mAdc
Power Output	
Minimum @ 4320 Mc	5 mW
Minimum @ 7050 Mc	20 mW
Reflector Voltage @ 4325 Mc	
Maximum Negative Value	50 Vdc
Minimum Negative Value	20 Vdc
Reflector Voltage @ 7200 Mc	
Maximum Negative Value	235 Vdc
Minimum Negative Value	175 Vdc

B. Operation @ 3¾ cycles Reflector Transit Mode

Frequency Range	7000 to 10750 Mc
Resonator Voltage	1250 Vdc
Resonator Current	12 mAdc
Power Output	
Minimum @ 7200 Mc	5 mW
Minimum @ 10700 Mc	20 mW
Reflector Voltage @ 7200 Mc	
Maximum Negative Value	110 Vdc
Minimum Negative Value	65 Vdc
Reflector Voltage @ 10700 Mc	
Maximum Negative Value	300 Vdc
Minimum Negative Value	240 Vdc

GENERAL MECHANICAL CHARACTERISTICS

Mounting	Any Position
Over-all Dimensions	See Outine Dwg.
Envelope	Glass
Cap	Miniature
Base	Pee-Wee 3 Pin, RMA A3-1
Net Weight	1.8 ounces

DETAILED ELECTRICAL INFORMATION

REFLECTOR

The reflector electrode is connected to the miniature cap on top of the tube. The power supply furnishing the reflector potential must be insulated to withstand the total resonator and reflector voltage. The reflector must never be allowed to become positive with respect to the cathode. If this precaution is not observed, damage to the tube may result. Where high reflector circuit impedances are used, it is advisable to shunt the high impedance of the power supply with a small diode.

CATHODE

In most applications, the metal cavity to be used with the 2K48 is operated at ground potential. The cathode is therefore negative with respect to ground by the amount of the resonator potential. The cathode may be connected to one side of the heater or to the center tap of the heater transformer secondary. When cathode and heater are connected together, connection to the cathode should be made directly to the cathode contacts on the tube socket and never to a heater lead. When cathode and heater are not connected together, the heater-cathode voltage should not exceed ± 50 volts. In all cases where the resonator is operated at ground potential, the heater transformer must be insulated to withstand the maximum resonator voltage. To obtain maximum tube life, it is recommended that the heater be allowed to warm up for 30 seconds before other voltages are applied. Application of the beam potential must not precede the application of any of the other voltages.

ELECTRONIC TUNING

Vernier adjustment of the frequency of the 2K48 is accomplished by varying the reflector voltage. If the mechanical tuning mechanism employed in the external cavity and the reflector voltage are mutually adjusted to yield a maximum power output at a given frequency, and if then the reflector voltage is varied above and below the value for maximum power such that the power output is reduced to one half, the frequency change between the half power values is defined as the electronic tuning range. The range of electronic tuning and the linearity of its variation with reflector voltage is a function of the type of load and coupling used. Maximum electronic tuning range will be achieved with operation into a resistive load. Operation into a highly reactive load may be attended by excessive hysteresis and nonlinear variation of frequency with reflector voltage.

FREQUENCY STABILITY

The regulation of the voltages applied to the reflector and resonator will be reflected directly in the stability of the output frequency, hence the regulation of these voltage supplies must be commensurate with the stability requirements of the application.

The thermal frequency drift experienced with the 2K48 will be mainly a function of the change in the physical size of the resonant chamber with temperature. Careful consideration should therefore be given to the material from which the external cavity is constructed.

MODES OF OPERATION

The 2K48 is designed to cover the 4200 to 7300 Mc range in the 2¾ cycle reflector transit mode, and the 7000 to 10750 Mc range in the 3¾ cycle reflector transit mode. The tube is designed for use with non-contacting plunger coaxial cavities. Design and construction of such cavities can be quite troublesome and certain precautions must be observed to avoid interference from circumferential resonances, one quarter wavelength modes, and multi-frequency bunching. An extensive treatment of the design of wide range coaxial cavities is beyond the scope of this publication; however, the following references contain adequate information pertinent to their design:

1. W. H. Huggins "Multifrequency Bunching in Reflex Klystrons", Proc. IRE Vol. 36, pp. 624-630
2. W. H. Huggins "Broad Band Non-Contacting Short Circuits for Coaxial Lines", Proc. IRE Vol. 35, pp. 1324-1328
3. Radio Research Laboratory Staff "Very High Frequency Techniques", McGraw-Hill, 1947, Vol. II, pp. 916-919, 900-911

DETAILED MECHANICAL INFORMATION

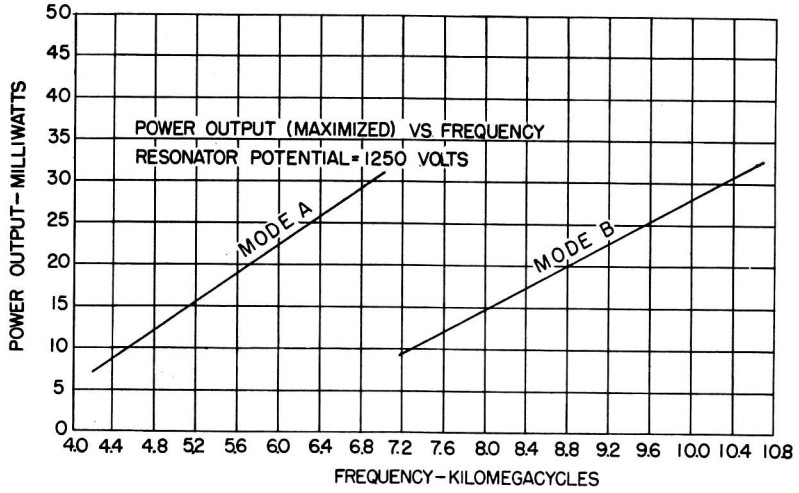
INSTALLATION

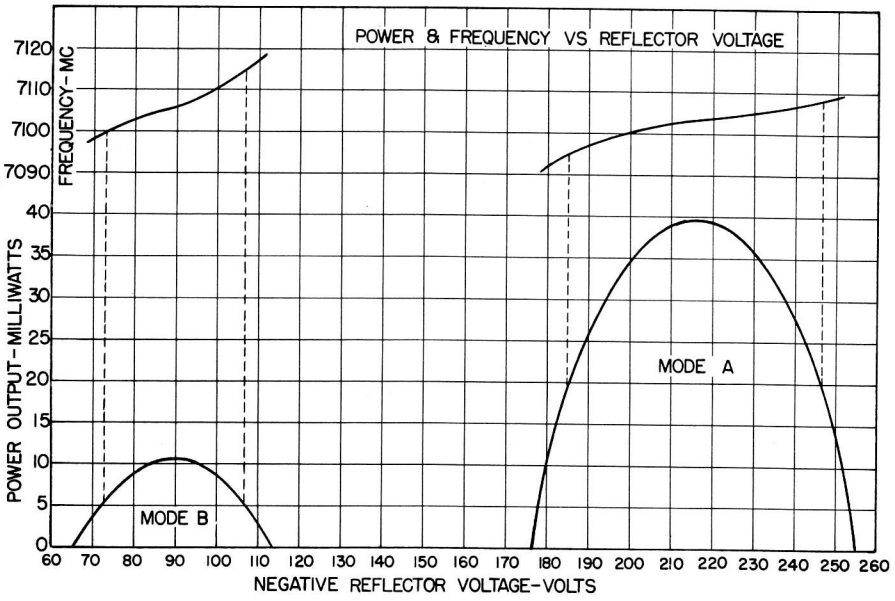
The tube mounts in any position and requires a Pee-Wee 3 prong socket.

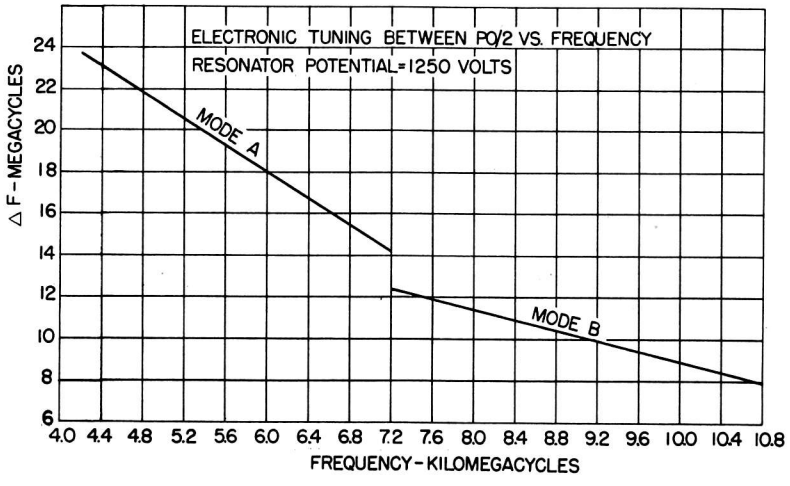
Extreme care must be exercised in handling the tube to avoid damage to the metal to glass seals, and to keep the tube in good alignment. Since the cylindrical extension on the second interaction gap grid is the heaviest and most rugged portion of the tube, the tube should be handled by this member as much as possible rather than by the base. Caution must be observed at all times to prevent damage to the delicate flange which forms the electrical connection and mechanical support for the first interaction gap grid. With the tube mounted rigidly in a cavity, a protecting cover should be placed over the protruding base portion of the tube because the slightest blow in this region may misalign the electron gun by bending or cracking the tube at the first copper to glass seal.

SHIELDING

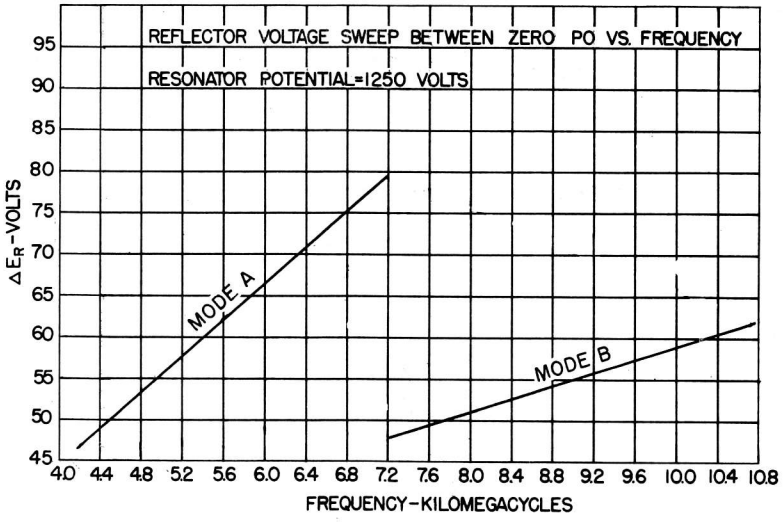
Where the 2K48 is to be operated in the presence of strong magnetic fields, shielding of the resonator and reflector voltage leads is usually required in order to avoid undesirable modulation of the tube output. In extremely troublesome magnetic environments, it may be advisable to place the portions of the 2K48 not covered by the cavity in a metal chamber with polyiron chokes provided to bring the voltages into the chamber. Care must always be taken not to exceed the maximum operating temperature of 120°C on the G1 fin.

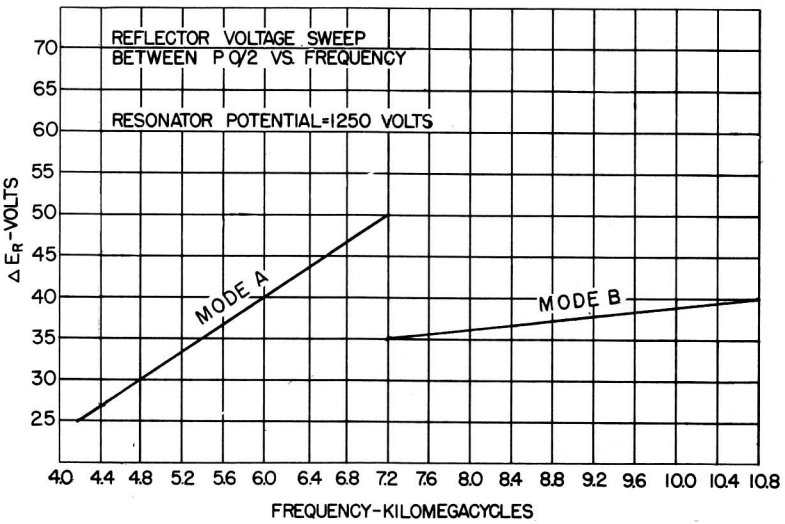

POWER OUTPUT (MAXIMIZED) VS. FREQUENCY
RESONATOR POTENTIAL = 1250 VOLTS
MODE A
MODE B
POWER OUTPUT - MILLIWATTS
FREQUENCY - KILOMEGACYCLES

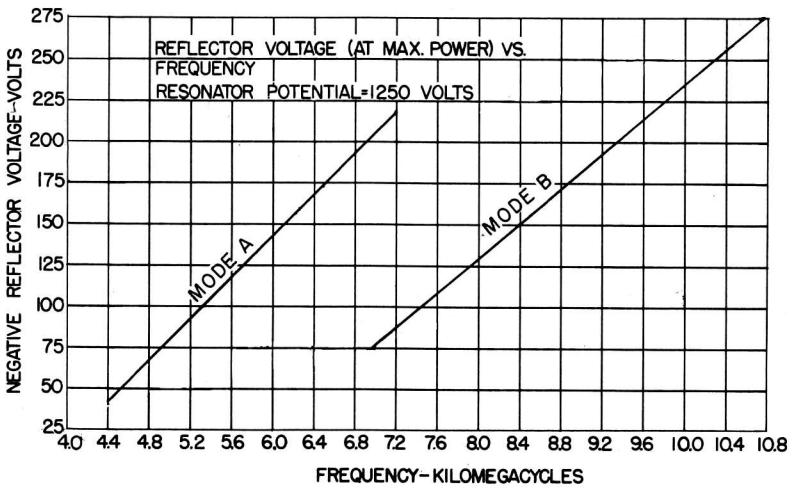

POWER & FREQUENCY VS REFLECTOR VOLTAGE
FREQUENCY - MC
POWER OUTPUT - MILLIWATTS
MODE A
MODE B
NEGATIVE REFLECTOR VOLTAGE - VOLTS

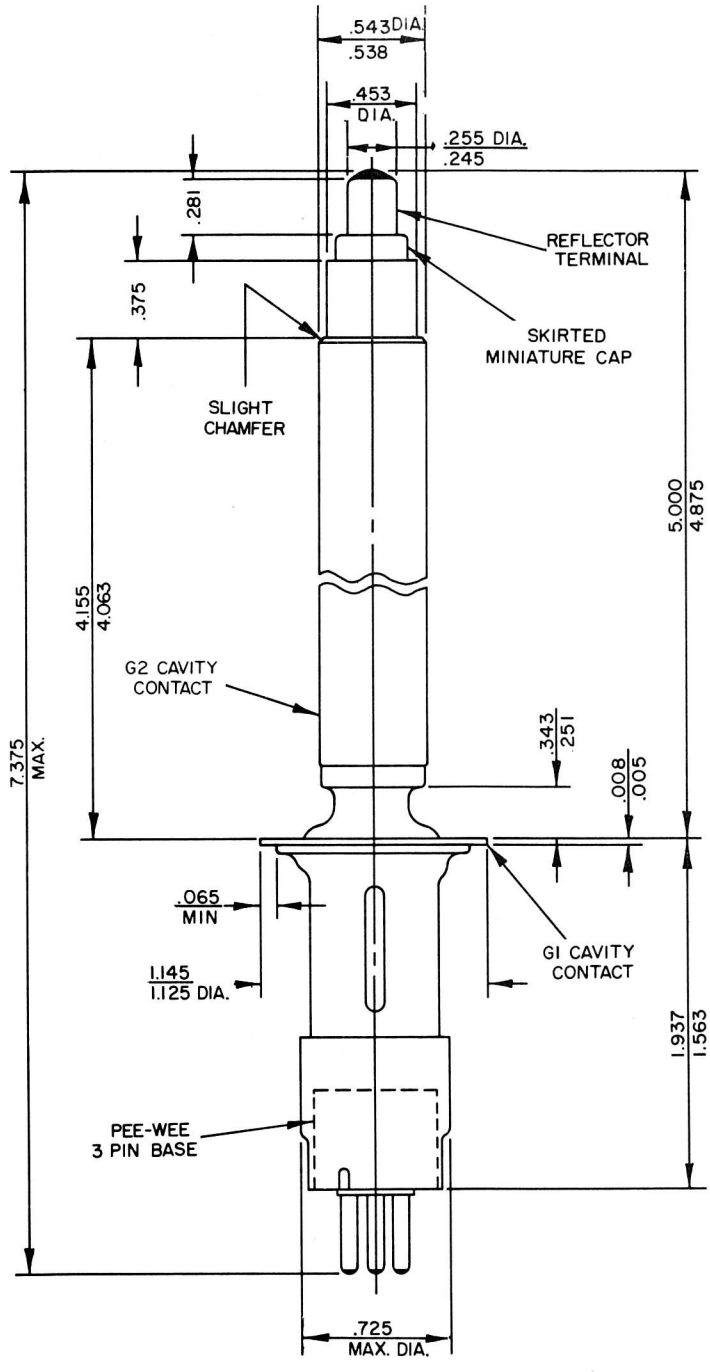

ELECTRONIC TUNING BETWEEN PO/2 VS. FREQUENCY
RESONATOR POTENTIAL = 1250 VOLTS
MODE A
MODE B
Δ F - MEGACYCLES
FREQUENCY - KILOMEGACYCLES

VELOCITY VARIATION OSCILLATOR









2K48
ELECTRON TUBE
OUTLINE DRAWING