INCH-POUND
MIL-PRF-1/208G
22 June 1998
SUPERSEDING
MIL-E-1/208F
27 October 1970

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, GAS SWITCHING
TYPE 1B27

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

DESCRIPTION:

TR, operational frequency range 2,600 to 3,700 MHz, nominal peak power 50 kw note 5.

ABSOLUTE RATINGS:

Parameter:	Ii	Ebb (open circuit)	Incident power	Du	Alt
Unit:	µA dc	V dc	kw	- - -	ft
Maximum:	200	-1,000	100	0.0005	10,000
Minimum:	100	-750	- - -	- - -	- - -

PHYSICAL CHARACTERISTICS:

See figure 1.

Weight: 1.5 ounces (approximate).

TEST CONDITIONS:

Parameter:	F	tp	prr	Du	Iz	Incident power
Unit:	MHz	µs	pps	- - -	µA dc	kw
Test 1:	3,300 ± 0.5 %	0.5	1,000	0.0005	note 6	5
Test 2:	3,300 ± 5.0 %	0.5	1,000	0.0005	100	50

GENERAL:

Qualification - Required.

TABLE I. Testing and inspection.

Inspection	Method	Conditions	Symbol	Limits min	Limits max	Unit
Conformance inspection, part 1						
Ignitor ignition time	4401	Ez = 675 V dc; Iz = 200 μA dc	t	- - -	5	sec
Ignitor voltage drop	4406	Iz = 100 μA dc	Eid	415	525	V dc
Ignitor interaction (ΔQ)	4421	Iz = 200 μA dc (note 4)	ΔQ	- - -	0.1	dB
Tuning range	4426	note 5	- - -	- - -	- - -	- - -
Flat-leakage power	4452	Test condition 1 (note 6)	pf pf	- - - - - -	25 40	mW mW
Intrinsic Q (relative)	4475	F = 3,000 MHz (note 7)	Q_O	2,250	- - -	- - -
Temperature cycling	1027	note 1	- - -	- - -	- - -	- - -
Conformance inspection, part 2						
Degradation due to vibration	4021	notes 8 and 9	- - -	- - -	- - -	- - -
Dielectric material strain	4101	note 10	- - -	- - -	- - -	- - -
Ignitor oscillation	4411	note 11	- - -	- - -	- - -	- - -
Periodic-check tests						
Temperature coefficient of frequency (method A)	4466	F = 3,160 MHz (note 2)	ΔF	0	-10	MHz
Recovery time	4471	Test condition 2 (note 3)	t	- - -	5	μs
Conformance inspection, part 3						
Life-test provisions	- - -	Group C; Iz = 200 μA dc	t	500	- - -	hr
Life-test end points	- - -					
Ignitor interaction (ΔQ)	4421	Iz = 200 μA dc (note 4)	ΔQ	- - -	0.5	dB
Recovery time	4471	Test condition 2 (note 3)	t	- - -	20	μs

NOTES:

1. The tube shall be clamped in the “ARO” cavity, as shown on Drawing 143-JAN, and subjected to 10 of the temperature cycles specified. Not less than 24 hours after the temperature test, the tube shall pass the leakage power test. (See method 4452.)

2. This test shall be made with the tube mounted in a cavity as shown on Drawing 142-JAN.

3. Ignitor series resistance shall be 0.5 MΩ. The loss of signal in the tube, at the specified time after the start of the transmitter pulse, shall not exceed the loss at 800 to 1,000 μs after the pulse, by more than 3 dB.

4. With the ignitor current adjusted to the given value, the change in intrinsic Q, as measured in note 7 (second test), shall be within the limits specified.

TABLE I. Testing and Inspection - Continued.

5. The test shall be made in the equipment specified in note 7. The tube shall cover a tuning range from less than 2,600 MHz to more than 3,000 MHz. No tube shall require less than five complete turns of the tuning screw to cover this range. As the tuning screw is turned through its complete range, the transmitted power shall show only one dip.

6. After a shelf life of 7 days, mount the tube in cavity as shown on Drawing 263-JAN. The peak leakage power shall be averaged over the pulse length. Two measurements of the leakage power shall be made. The first shall be made with ignitor current at 100 μA dc and the second, with no ignitor current.

7. The intrinsic Q shall be measured in the equipment depicted on figures 2 and 3, at a frequency of 3,000 MHz ± 1 percent. Ten feet of 50 Ω lossy cable shown (see figure 4) shall be used as a termination in order to provide a matched output. The 6- to 8- dB loss in the termination is sufficient to eliminate the mismatch of the transitions. With the attenuator flap raised completely out of the guide, the tube shall be tuned to resonance and VSWR measurements made, covering a band of 8 to 10 MHz centered at the resonant frequency. The value for r′, which is the VSWR at the frequency for which the normalized reactance of the tube is equal to unity, is given by the equation:

$$r' = \frac{\sqrt{\left(2R^2 + 2 + 1/R\right)+1} + \sqrt{R^2+1}}{\sqrt{\left(2R^2 + 2 + 1/R\right)+1} - \sqrt{R^2+1}}$$

Where:

R = effective shunt resistance across the guide (introduced by the tube)
ro, the VSWR at resonance, is given by ro = (1/R) +1

A curve of r' versus ro is shown on figure 5. After determining r' from figure 5, the frequencies f_1 and f_2, corresponding to values of normalized reactance equal to unity, are obtained from the curve of VSWR versus frequency.

A sample of this determination is shown on figure 6. The intrinsic Q is then determined by:

$$Q_O = \frac{1}{R} \times \frac{f_O}{(f_1 - f_2)}$$

Where:

f_O = resonant frequency of the tube.
f_1 = upper frequency at which normalized reactance equals unity.
f_2 = lower frequency at which normalized reactance equals unity.
R = effective shunt resistance of the tube.

The intrinsic Q can also be measured by a relative method in the equipment as shown on figure 3. The ratio of power in the load with the TR detuned to the power with the TR tuned is:

$$P = (1 + 1/2R)^2$$

Where:

R = effective shunt resistance of the tube.

A plot of P versus 1/R is shown on figure 7. If the intrinsic Q and R are measured for a TR tube in the test equipment as above, the Q of any other TR tube may be found by determining R and inserting it in the formula:

$$Q = \frac{(Q_O 1)\,(R_1)}{R}$$

Where:

$Q_O 1$ and R_1 are the constants for the calibrated tube.

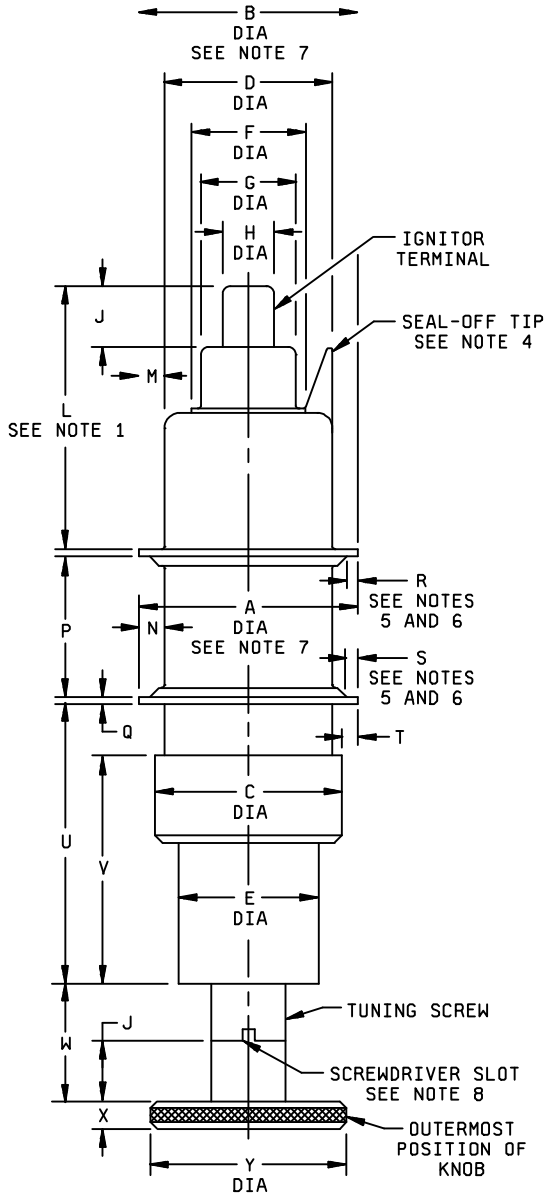
TABLE I. Testing and Inspection - Continued.

8. On evidence of satisfactory conformance, the inspector may limit this test to 10 tubes per month when the tube is in continuous production.

9. The tube shall be mounted in a cavity as shown on Drawing 142-JAN and tuned to 3,160 MHz ± 1 percent. The tube and cavity shall be vibrated in the direction of the keep-alive axis for 12 hours with an amplitude of motion of 0.040 inch. After this test, the tuning shall have changed not more than 1 MHz from its initial value, and the tube shall satisfy all other electrical tests of this specification.

10. The entire tube shall be immersed for the purpose of testing the glass portions of the tube.

11. No tube shall require more than 50 µA dc ignitor current to prevent relaxation oscillation of the ignitor current.



Dimensions		
Ltr	Minimum	Maximum
Conformance inspection, part 1		
A	1.054 (26.77)	1.070 (27.18)
B	0.995 (25.27)	1.005 (25.53)
L	1.125 (28.58)	1.250 (31.75)
P	0.670 (17.02)	0.675 (17.15)
U	1.250 (31.75)	1.375 (34.93)
Conformance inspection, part 2		
M	0.093 (2.36)	
N	0.125 (3.18)	
Q		0.010 (0.25)
R	0.040 (1.02)	
S	0.070 (1.78)	
T	0.070 (1.78)	
V		1.094 (27.79)
W		0.500 (12.70)
Y		0.938 (23.83)
Conformance inspection, part 3 (periodic check)		
C		0.875 (22.23)
D	0.719 (18.26)	0.781 (19.84)
H	0.248 (6.30)	0.252 (6.40)
J	0.234 (5.94)	0.266 (6.76)
Nominal dimensions (see note 2)		
E	0.672 (17.07)	
F	0.500 (12.70)	
G	0.436 (11.07)	
X	0.188 (4.78)	

NOTES:

1. Dimension L may be increased 0.03 inch (0.76 mm) by solder.
2. Dimensions without tolerances are for information and are not required for inspection purposes.
3. The acceptance level for the combined mechanical defectives in conformance inspection, part 1, shall be 1.0 percent.
4. Seal-off tip is optional and must not extend above dimension J base line.
5. Contact portion of disk measured radially must be free from splits or tears and must be smooth and flat to the extent controlled by dimension P.

Figure I. Outline drawing of electron tube type 1B27.

Figure I Notes. - Continued.

6. Contact disks shall be gold plated 10 MSI minimum or silver plated 15 MSI minimum on external surfaces.
7. Contact disks shall be concentric within 1/64 inch (0.40 mm).
8. A screwdriver slot is provided in the head of the tuning screw and is exposed when knurled tuning knob is removed.
9. There shall be a perceptible clearance between the cone ends when the tuning screw is at its extreme inner position.

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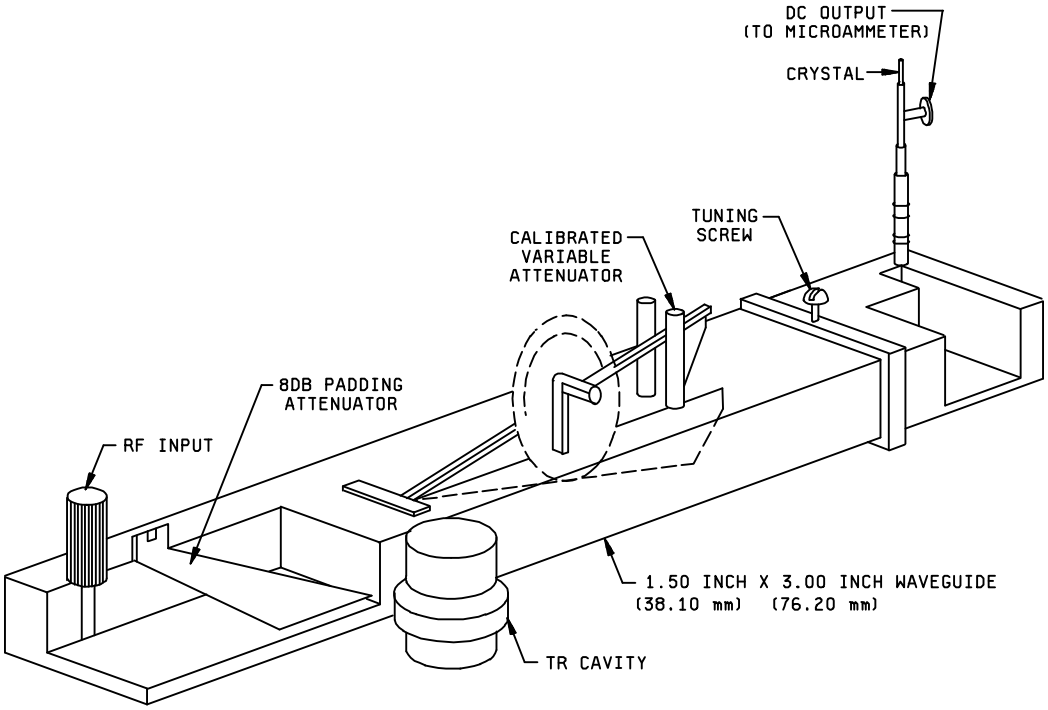
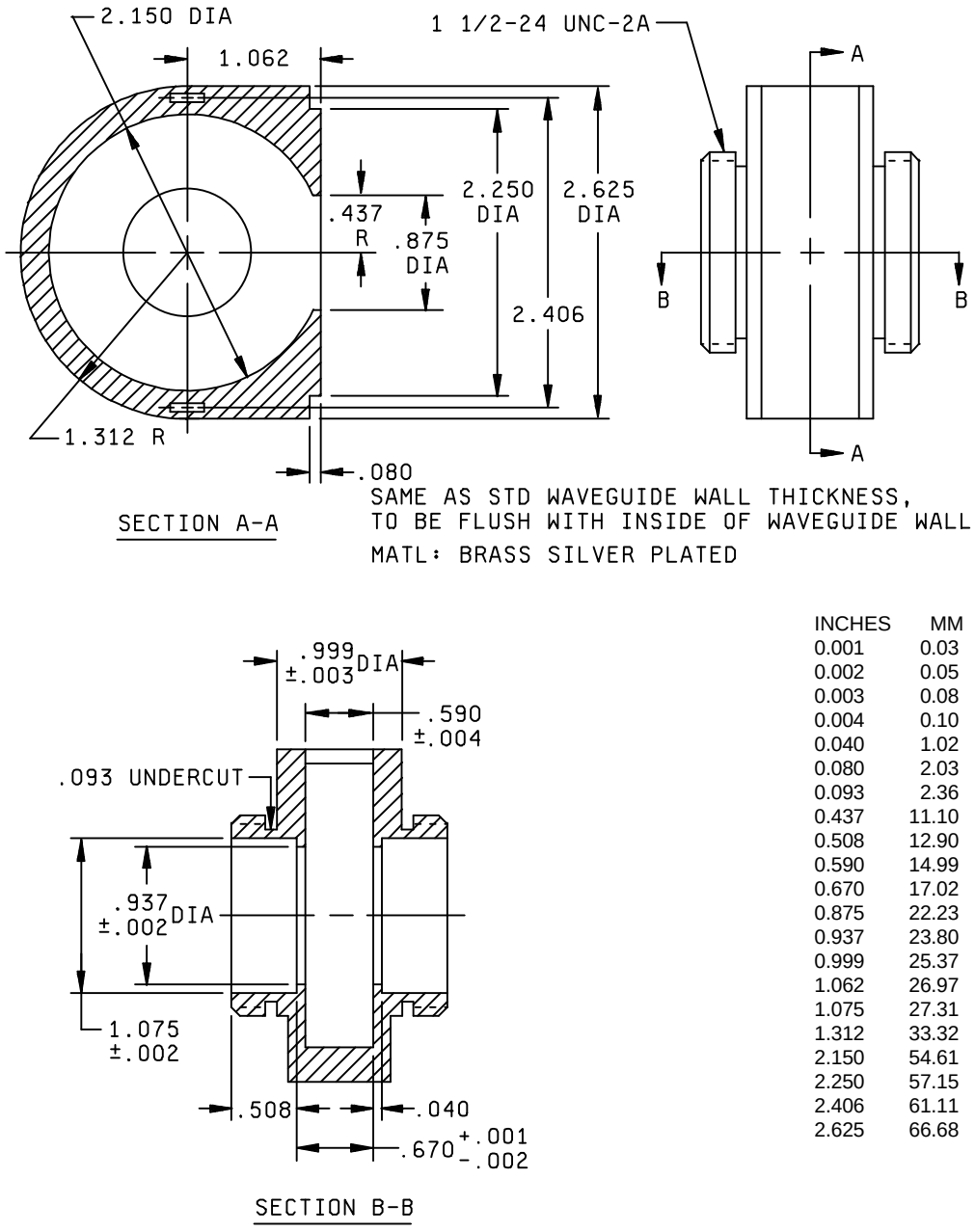


FIGURE 2. Equipment-intrinsic Q and tuning range measurements.



INCHES	MM
0.001	0.03
0.002	0.05
0.003	0.08
0.004	0.10
0.040	1.02
0.080	2.03
0.093	2.36
0.437	11.10
0.508	12.90
0.590	14.99
0.670	17.02
0.875	22.23
0.937	23.80
0.999	25.37
1.062	26.97
1.075	27.31
1.312	33.32
2.150	54.61
2.250	57.15
2.406	61.11
2.625	66.68

FIGURE 3. Intrinsic Q and tuning range cavity.

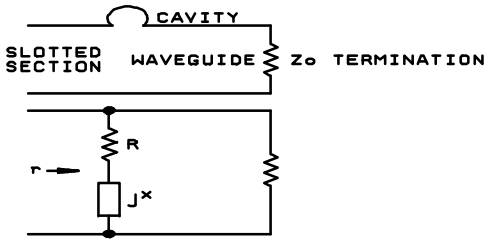


FIGURE 4. Circuit; 50-ohm lossy cable.

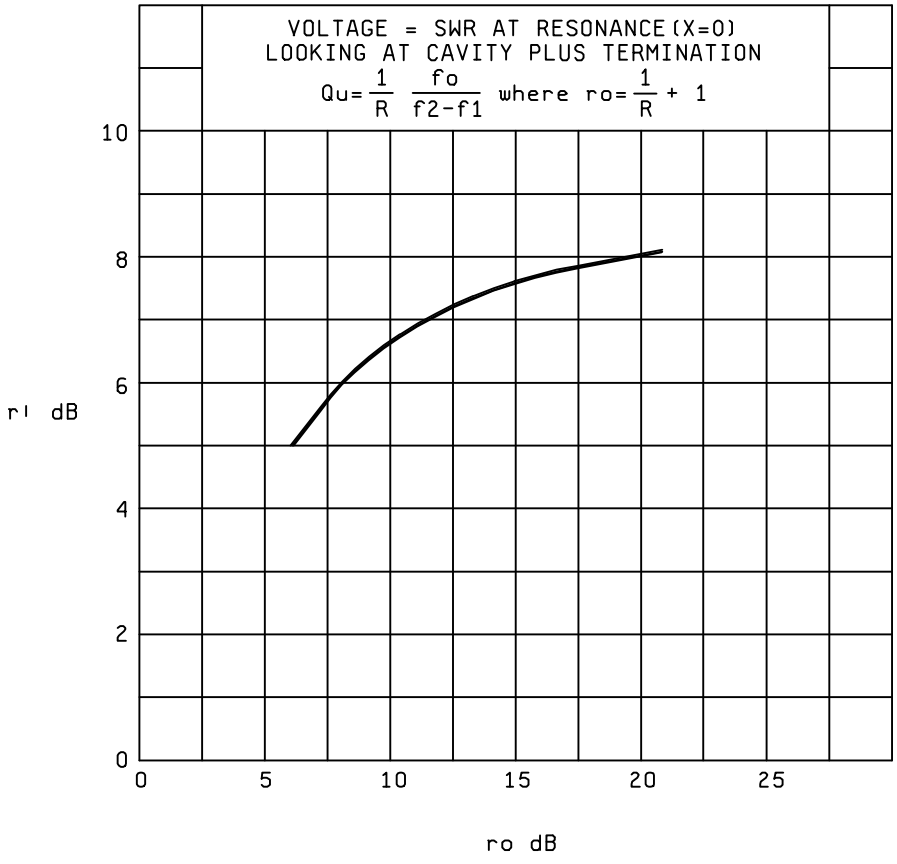


FIGURE 5. Curve r' versus r□.

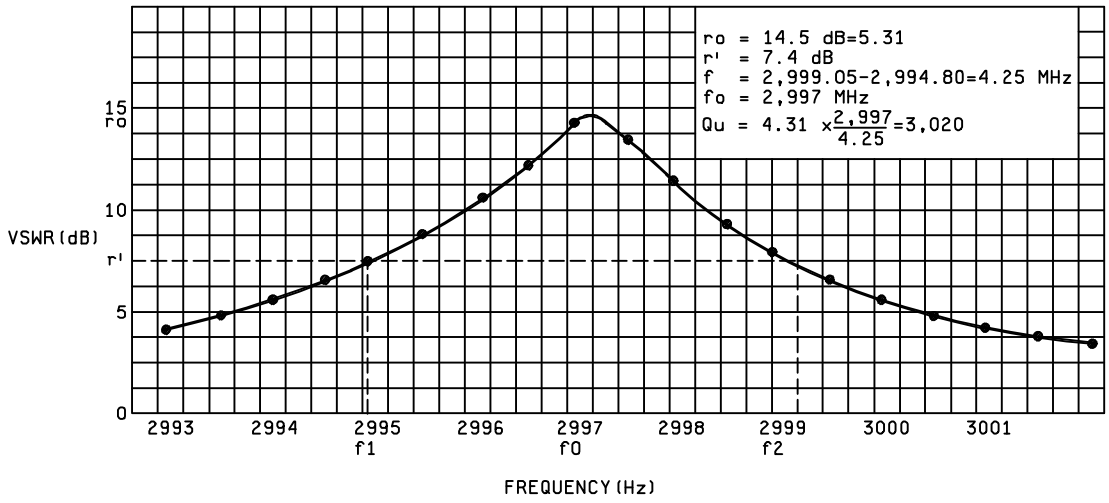


FIGURE 6. Sample determination of VSWR versus frequency.

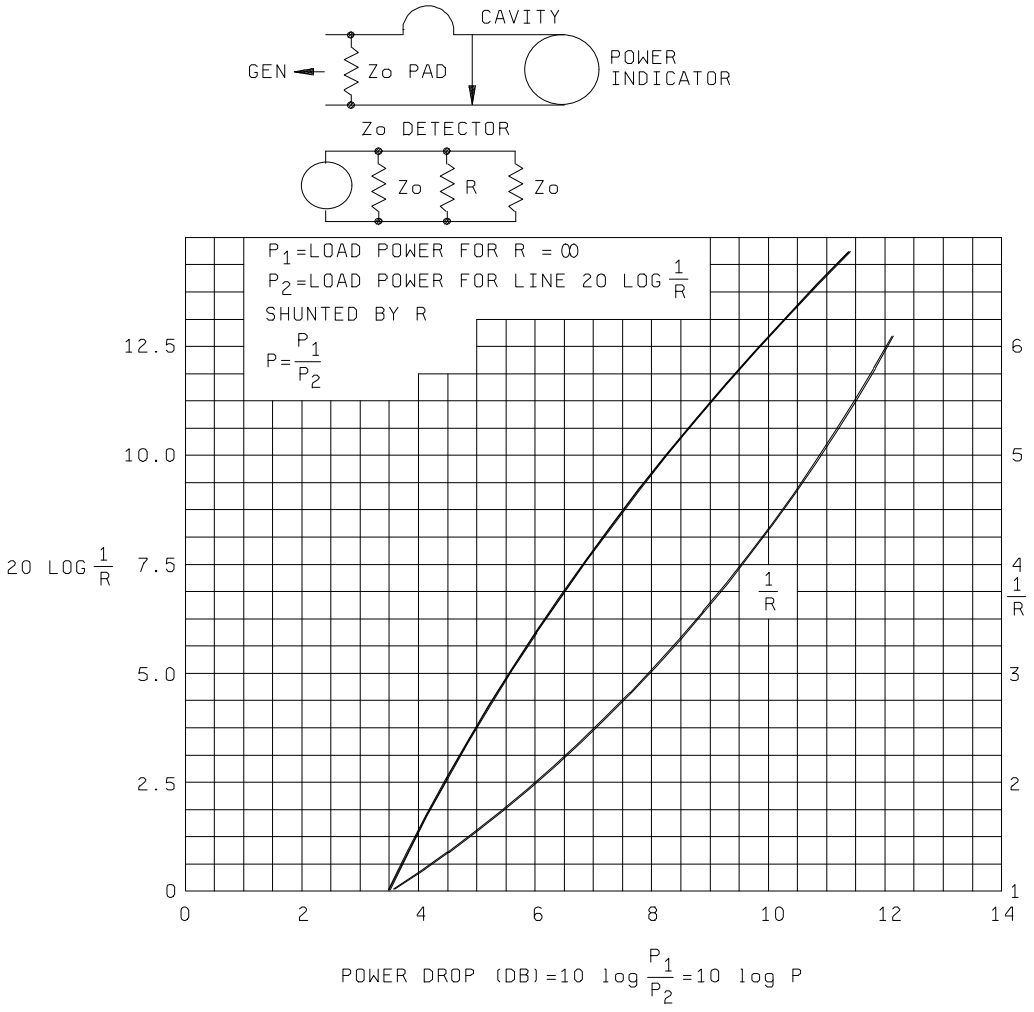


FIGURE 9. Plot of P versus 1/R.

Custodians:
Army - CR
Navy - EC
Air Force - 85

Review activities:
Navy - AS, CG, MC, SH
Air Force - 11, 99

Preparing activity:
DLA - CC

(Project 5960-3449)