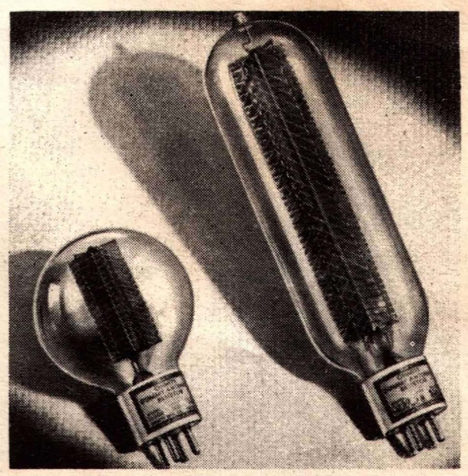
OHMITE

DUMMY ANTENNA RESISTORS

TO CHECK R. F. POWER
and Tune Up to Peak Efficiency Easily - Accurately



MODEL D-100
100 WATTS

MODEL D-250
250 WATTS

From the Ohmite laboratories comes an innovation in resistor design which makes possible a combination of constant R.F. resistance, low inductance, high wattage dissipation and compactness. The D-100 and D-250 Dummy Antenna resistors represent an outstanding achievement in resistor design making available for the first time a small, high wattage resistor suitable for high (15 to 30 megacycles and more) radio frequency power measurements. A simple, accurate and direct means of measuring R.F. power is thus made available to the amateur, experimenter and manufacturer, and to the operators of aviation, police and broadcast stations.

Hereafter, whenever reference is made to the D-100 Dummy Antenna, the information given also applies to the D-250 unless otherwise specified.

Among the outstanding applications of the Ohmite D-100 Dummy Antenna are: its use in tuning up a radio transmitter for maximum efficiency by making possible the accurate measurement of the R.F. power output (and consequently the efficiency) of the final amplifier as well as of preceding stages; and also its use while tuning up to keep the signal off the air and eliminate unnecessary interference. In short, the Ohmite Dummy Antenna resistor provides a new and useful test instrument for radio-frequency use.

This new Dummy Antenna Resistor has a non-inductive, space-wound resistance element of unique design which is mounted in a glass bulb, evacuated and gas filled. A four prong steatite tube base provides convenient mounting in a standard tube socket. Resistance values of 73 and 600 ohms are available to match concentric, twisted pair and open wire transmission lines.

The curves in Figures 1 and 2 show the frequency and load characteristics of the Model D-100 and serve to indicate the marked superiority of the Ohmite Model D-100 to other forms of resistors heretofore used for high frequency work. The radio frequency resistance of a Model D-100, it can be noted, is practically constant at all frequencies up to and even beyond 15 megacycles. The impedance also rises only very slightly with increase in frequency, changing less than 10% at 15 megacycles. The curves in Figure 2 illustrate the slight change in resistance with load of the Model D-100. Contrast this with the lamp bulbs, which have been heretofore used as the best loads available for high radio frequency use, where the change in resistance from no load to full load amounts to approximately 12 times for a tungsten lamp and 2 times for a carbon lamp. The constant impedance and resistance of the Ohmite Model D-100 insures that the impedance match is maintained at all loads and that the R.F. power can be simply calculated using Ohm's Law, knowing the current and the Dummy resistance.

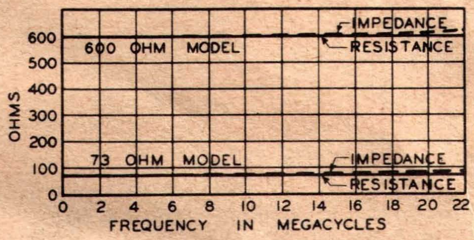


FIG. 1—R AND Z VERSUS FREQUENCY

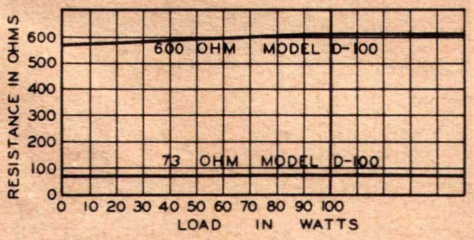


FIG. 2—R VERSUS WATTS LOAD

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Outstanding Uses of the Ohmite Dummy Antenna

1. To measure accurately radio transmitter final amplifier output.
2. To determine transmitter efficiency.
3. To measure accurately exciter output.
4. To serve as a radio frequency wattage indicator when used in conjunction with an R.F. ammeter and a coupling link to tune individual stages, etc.
5. To determine transmission line losses.
6. To check the impedance match between transmission line and antenna.
7. To provide a non-radiating load to reduce interference and prevent off-frequency operation during periods of test and adjustment.
8. To reduce band congestion during neighborhood transmission.
9. To enable transmitter adjustment during Quiet Hours.
10. To serve as a non-inductive, non-capacitive resistor in other R.F. circuits. (See Figures 1 and 2 for characteristics.)

Measuring the Output of a Transmitter Having an Untuned Line

Transmitters having untuned transmission lines are particularly well suited to power output measurement by means of a Dummy Antenna. These transmitters have a pick-up coil or an antenna network to match the output circuit to the surge impedance of the transmission line. Since properly terminated untuned lines present a constant resistance load of value equal to the surge impedance of the line, a non-inductive resistor may be substituted for the feeders if the resistor matches the line surge impedance. A D-100 of the proper resistance may, therefore, be interchanged with the feeders to measure transmitter output. The illustration in Figure 3 shows the method of connecting the D-100 to the transmitter antenna terminals. A 73 ohm Dummy Antenna should, of course, be used to replace a concentric or twisted pair line (approximate value 73 ohms) and a 600 ohm Dummy to replace an open line (600 ohm approximate resistance).

With the D-100 connected as shown, the transmitter should be retuned and the excitation and antenna coupling **carefully** adjusted for maximum output as indicated by the radio frequency ammeter. The D-100 does not become incandescent within its rating and **any color brighter than a dull red glow indicates serious overload.** Ohm's Law for power may be used to determine the output. As an example, let us assume that a transmitter normally operates into a 600 ohm line. When a 600 ohm Dummy is connected, as shown in Figure 3, assume the R.F. ammeter reads 0.38 amperes. Substitute 0.38 for I and 600 ohms for R into the equation, $I^2R = \text{Watts}$.

$$I^2R = 0.38^2 \times 600 = 0.38 \times 0.38 \times 600$$
$$= 86.6 \text{ watts}$$

Figure 10 provides curves for quickly and conveniently determining output from ammeter readings.

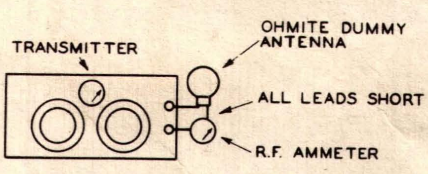

FIG. 3—DUMMY ANTENNA REPLACING UNTUNED LINE

Meters

For maximum ease and accuracy in reading, the range of the ammeter used should be such that the current reading for full power will fall in the upper half of the scale. From the curves shown in Figure 10, the current for full power readings can be determined for any stock Dummy Antenna.

Higher Power or Special Resistance

The D-100 is rated to carry 100 watts, and the D-250 is rated to carry 250 watts of unmodulated R.F. Either, however, will carry the intermittent increase in average power caused by modulation. For loads over 100 or 250 watts (or when special resistances are desired) several units may be connected in parallel, in series, or in series-parallel. Circuits of Figures 4 and 5 can be used as required. Ammeters of range suitable to the maximum power will be required for these circuits.

Measuring the Output of a Transmitter Having Tuned Feeders

For transmitters using the Hertz type antenna with tuned feeders, a short twisted-pair line and pick-up coil should be substituted for the feeders

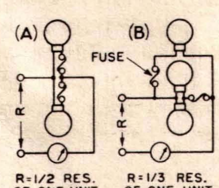

FIG. 4—200 WATTS (A) OR 300 WATTS (B) USING D-100 AND 500 WATTS (A) OR 750 WATTS (B) USING MODEL D-250

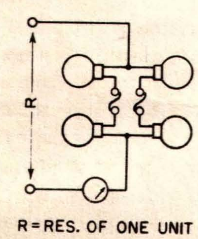

FIG. 5—CONNECTION FOR 400 WATTS (D-100) OR 1000 WATTS (D-250)

and regular coupling coil. Figures 6, 7 and 8 illustrate a 73 ohm D-100 Dummy coupled to the three general types of amplifier circuits. Note that in all cases the coupling coil is placed at a point of low radio frequency potential (at the point where the plate supply is connected). The regular antenna feeders are disconnected when the dummy is connected to the transmitter. When parallel tuning is used in the feeder coupling system, the tuning condenser must be removed from the circuit.

Figures 6 and 7 show the method of coupling to either push-pull or plate neutralized amplifiers

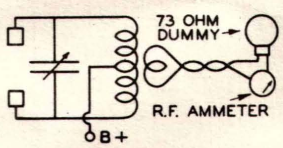

FIG. 6—PUSH-PULL STAGE

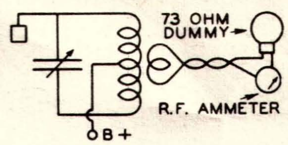

FIG. 7—PLATE NEUTRALIZED STAGE

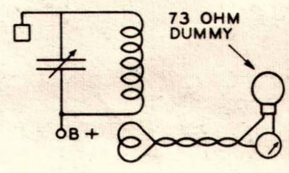

FIG. 8—SCREEN-GRID, PENTODE OR GRID NEUTRALIZED STAGE

with the coupling coil placed around the center of the tank coil. Correct placement of the coupling coil is shown in Figure 8 for either screen grid, pentode or grid neutralized circuits. Transmitter type 73 ohm twisted pair or concentric cable is recommended for the link to insure correct impedance match. The line may be of any short convenient length. With the Dummy Antenna connected, the transmitter should be retuned and the coupling coil and excitation **carefully** adjusted for maximum output as indicated by the ammeter. The output in watts is obtained from Figure 10 or from Ohm's Law. The D-100 should **not** show any appreciable color (**beyond a dull red at 100 watts**) as it is not intended to become incandescent. **Any appreciable color indicates serious overload.**

Measuring Exciter Output

Figure 9 illustrates a convenient type of mounting for a 73 ohm Dummy Antenna and a 1.5 ampere R.F. ammeter which provides short leads between the Dummy and meter and a twisted pair coupling link for proper impedance match. This assembly is in effect a convenient and accurate radio frequency wattage indicator which can be used to tune individual stages to peak efficiency. The twisted pair link should be some convenient length (3 to 6 ft.) and the pick-up coil on a short wand is particularly well adapted for tank coils wound on receiving type plug-in forms. The coupling to the succeeding stage must be removed and the special coupling loop (of size and turns suited to the coil) placed around the coil at the point where the plate supply is connected. As before, the stage should be carefully adjusted for maximum output. The output in watts is determined from Figure 10, or from Ohm's Law. Stages not operating properly and exciters not delivering enough power to drive succeeding stages can be quickly located.

Determining Transmitter Efficiency

Every amateur wants to know the plate circuit efficiency of all stages of his transmitter in order to secure the maximum transmission miles per input dollar. This is only possible with the transmitter operating at peak plate efficiency, as readily determined with the Ohmite Dummy Antenna. Plate circuit efficiency equals watts output divided by watts input, the input being the plate voltage multiplied by the current in amperes (1000 milliamperes equal 1 ampere).

Example: Suppose an amplifier is operating so that the radio frequency output, as obtained by one of the methods previously described using a D-100 resistor, is 90 watts. The plate voltage is assumed to be 1000 volts and the plate current 150 milliamperes (0.15 amperes).

$$\text{INPUT} = E \times I = 1000 \times 0.15 = 150 \text{ watts.}$$

$$\text{EFFICIENCY} = \frac{\text{Output watts}}{\text{Input watts}} \times 100 = \frac{90}{150} \times 100 = 60\%$$

Untuned Transmission Line Losses—Line to Antenna Impedance Match

To measure transmission line loss, the antenna is disconnected and a D-100 is connected in series with a radio frequency ammeter across the end of the line. Short connecting leads between line, D-100 Dummy Antenna and ammeter should be used. A 73 ohm Dummy should be used for concentric and twisted pair lines and a 600 ohm unit for open wire 600 ohm lines. The transmitter

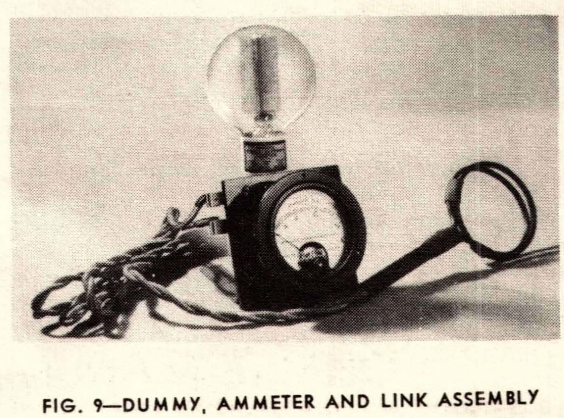

FIG. 9—DUMMY, AMMETER AND LINK ASSEMBLY

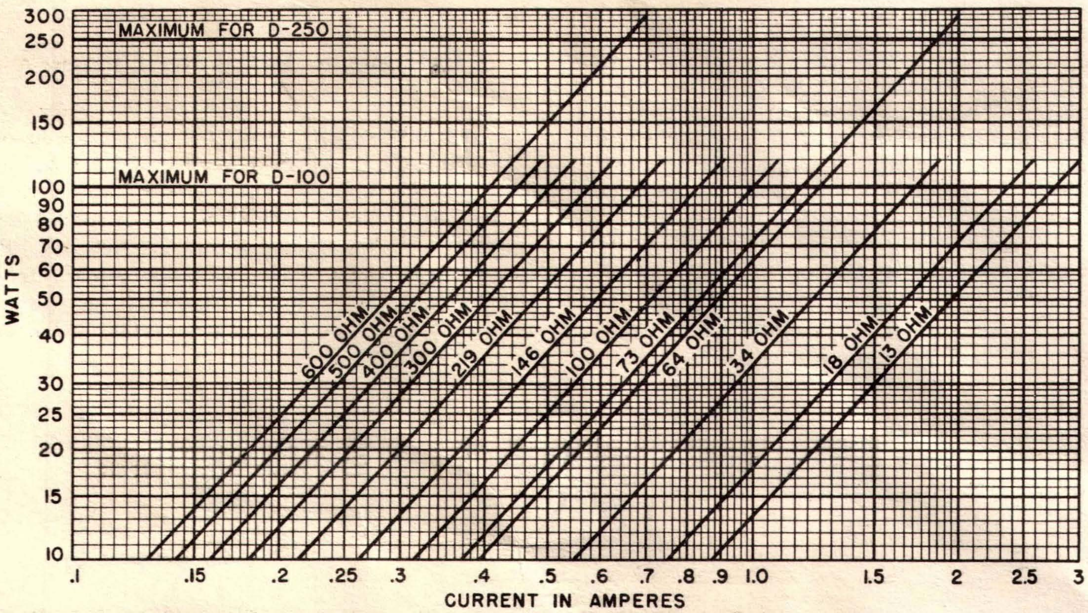

FIG. 10—WATTS VERSUS CURRENT FOR STOCK DUMMY ANTENNAS

should be carefully tuned for maximum output using the loosest coupling which will still give an accurate indication on the meter. The power in watts can be obtained from Figure 10. A second reading of power is then made with the line disconnected and the dummy at the transmitter—with excitation, input and coupling maintained the same as in the first reading. The difference between the output measured at the transmitter and that measured at the end of the line will then equal the line loss. A serious mismatch between line and antenna will be indicated by an increased line current when the dummy is substituted for the antenna.

Eliminating Interference

By substituting an Ohmite Dummy Antenna, it is possible to tune up or test parts of the transmitter at full power without radiating unnecessary interference to great distances, or, in many cases, to tune up during quiet hours. Neighborhood or local duplex transmission can be accomplished by means of the weak field radiated directly from the transmitter itself. This is of considerable aid, as it permits working closer to the transmitter frequency without blocking the receiver. This method is even more successful than reducing power, as even a few watts in a good antenna will cover great distances.

Operating Instructions: Important

These Dummy Antennas are resistors and dissipate heat while in use thus requiring free and adequate natural ventilation. They are not intended to be operated incandescent, and under full load the resistance element should glow only a dull red, visible only in semi-darkness.

Physical and Electrical Characteristics

Description	MODEL D-100	MODEL D-250
Bulb diameter..............	$3\frac{1}{8}$"	$2\frac{1}{2}$"
Height from bottom of base....	$4\frac{3}{8}$"	$9\frac{1}{16}$"
Overall height.............	$4\frac{15}{16}$"	$9\frac{5}{8}$"
Base diameter..............	$1\frac{11}{32}$"	$1\frac{11}{32}$"
Resistance tolerance.........	±5%	±5%
Distributed Cap., mmf. (Approx.)	5	13

Connections are made to the two large prongs except for the D-250-600 which has one connection at the top.

Stock No.	Watts	Ohms	Induc. Microh. ±10%	List Price
D-100-13	100	13	0.19	$5.50 $6.50
D-100-18	100	18	0.19	5.50 6.50
D-100-34	100	34	0.19	5.50 6.50
D-100-64	100	64	0.33	5.50 6.50
D-100-73	100	‡ 73	0.33	5.50 6.50
D-100-100	100	100	0.33	5.50 6.50
D-100-146	100	†146	0.33	5.50 6.50
D-100-219	100	†219	1.0	5.50 6.50
D-100-300	100	300	1.0	5.50 6.50
D-100-400	100	400	1.0	5.50 6.50
D-100-500	100	500	1.0	5.50 6.50
D-100-600	100	‡600	1.0	5.50 6.50
D-250-73	250	‡ 73	0.33	11.00 13.00
D-250-600	250	‡600	1.1	11.00 13.00

† For parallel operation to obtain 73 ohms (see Fig. 4).
‡ Most popularly used resistances.

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