Standing Wave vs. Travelling Wave Viewpoint

As mentioned previously, the Thruline Wattmeter reacts to forward and reverse travelling waves to measure power in a transmission line. The standing wave viewpoint, also widely used, is highly developed both in theory and in practice. This viewpoint can be traced to the early use of slotted transmission lines.

The slotted line measures the standing wave ratio by mechanically positioning a voltage detector at peaks and nulls along a length of line section. Its drawbacks are that it is usually too long, too expensive for good accuracy, not portable, and too slow. These problems grow rapidly as the measurement frequency drops below 1000 MHz. The Thruline Wattmeter by comparison is fast, convenient, and accurate. It provides the same information as a slotted line with the exception of the phase angle of the reflection coefficient (distance, load to minimum).

ρ *vs.* ϕ

The simple relationships:

$$\rho = \frac{1+\sqrt{\phi}}{1-\sqrt{\phi}} \quad \textit{and} \quad \phi = \left[\frac{\rho - 1}{\rho + 1}\right]^2 \qquad \textit{Where } \rho = \text{VSWR} \quad \textit{and } \phi = W_r / W_f$$

can be used to convert between the standing wave ratio (ρ) and the reflected/forward power ratio (ϕ), which can be directly read from the Thruline Wattmeter. The relationship between ρ and ϕ is graphed in Figure 4 and Figure 5.

☞ NOTE: Attenuation, measured in dB, can be derived from the power ratio by the equation $N_{db} = 10 \log \phi$.

VSWR scales and their attendant controls for setting the reference point have been intentionally omitted from the Bird 43. Experience using the Thruline Wattmeter for transmitter tune-up, antenna matching, etc. will show that the power ratio measurement is as useful in practice as the standing wave ratio.

A trial is suggested – forget about VSWR for a few days and think in terms of $\phi = W_r / W_f$. The two meter readings, W_r and W_f, give a useful, approximate picture of the results without bothering to calculate the power ratio exactly. Consider that, for an antenna matching problem, the main objective usually is to minimize W_r. Anything done experimentally to this end will be seen when the element is turned to the reflected power position.

Figure 4
Percent Reflected Power vs. VSWR (1.0 – 1.3)

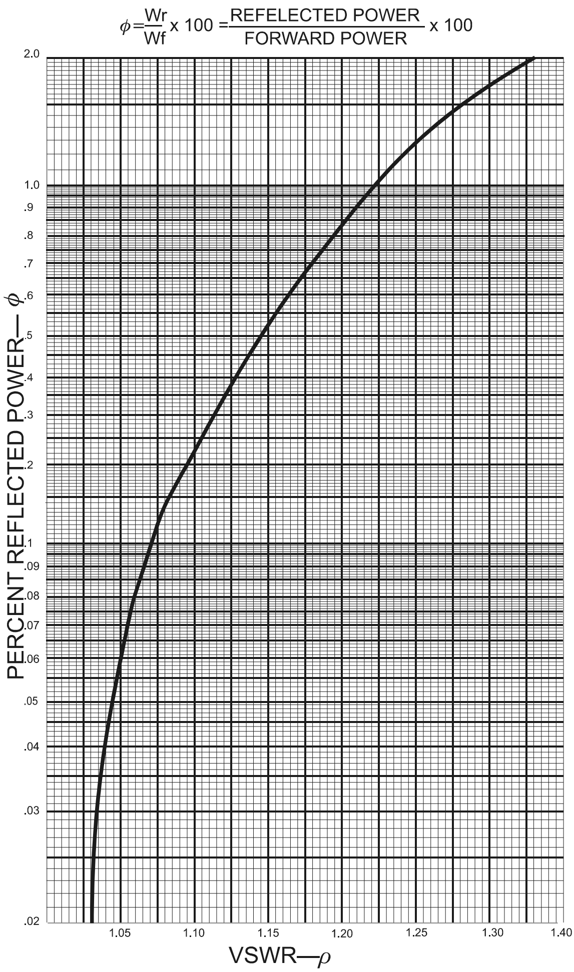

Figure 5
Percent Reflected Power vs. VSWR (1.0 – 8.0)

$$\phi = \frac{Wr}{Wf} \times 100 = \frac{\text{REFELECTED POWER}}{\text{FORWARD POWER}} \times 100$$