Radiated Power Versus Feedline Loss

Table 1—How much power are you really radiating?

Assume that you have a 100-W transceiver connected to one of the transmission lines listed below. How much power (in watts) actually makes it to your antenna? Examples are shown for 80, 10 and 2 meters, with 100 feet of transmission line and SWRs of 1:1 and 6:1 on each of these bands.

Transmission Line Type	*3.5 MHz 1:1 SWR*	*3.5 MHz 6:1 SWR*	*28 MHz 1:1 SWR*	*28 MHz 6:1 SWR*	*146 MHz 1:1 SWR*	*146 MHz 6:1 SWR*
RG-58A	85	65	56	33	22	11
RG-8A	91	79	76	52	48	27
3/4-inch Hardline	98	93	93	81	83	63
450-Ω Ladder line	99	98	98	91	91	79

Table 1

SWR vs Reflected Voltage or Power

VSWR	*Voltage Reflected (%)*	*Power Reflected (%)*
1.0:1	0	0
1.1:1	5	0.2
1.2:1	9	0.8
1.3:1	13	1.7
1.4:1	17	2.8
1.5:1	20	4
1.6:1	23	5.3
1.7:1	26	6.7
1.8:1	29	8.2
1.9:1	31	9.6
2.0:1	33	11
2.5:1	43	18.4
3.0:1	50	25
4.0:1	56	36
5.0:1	67	44.4
10.0:1	82	67

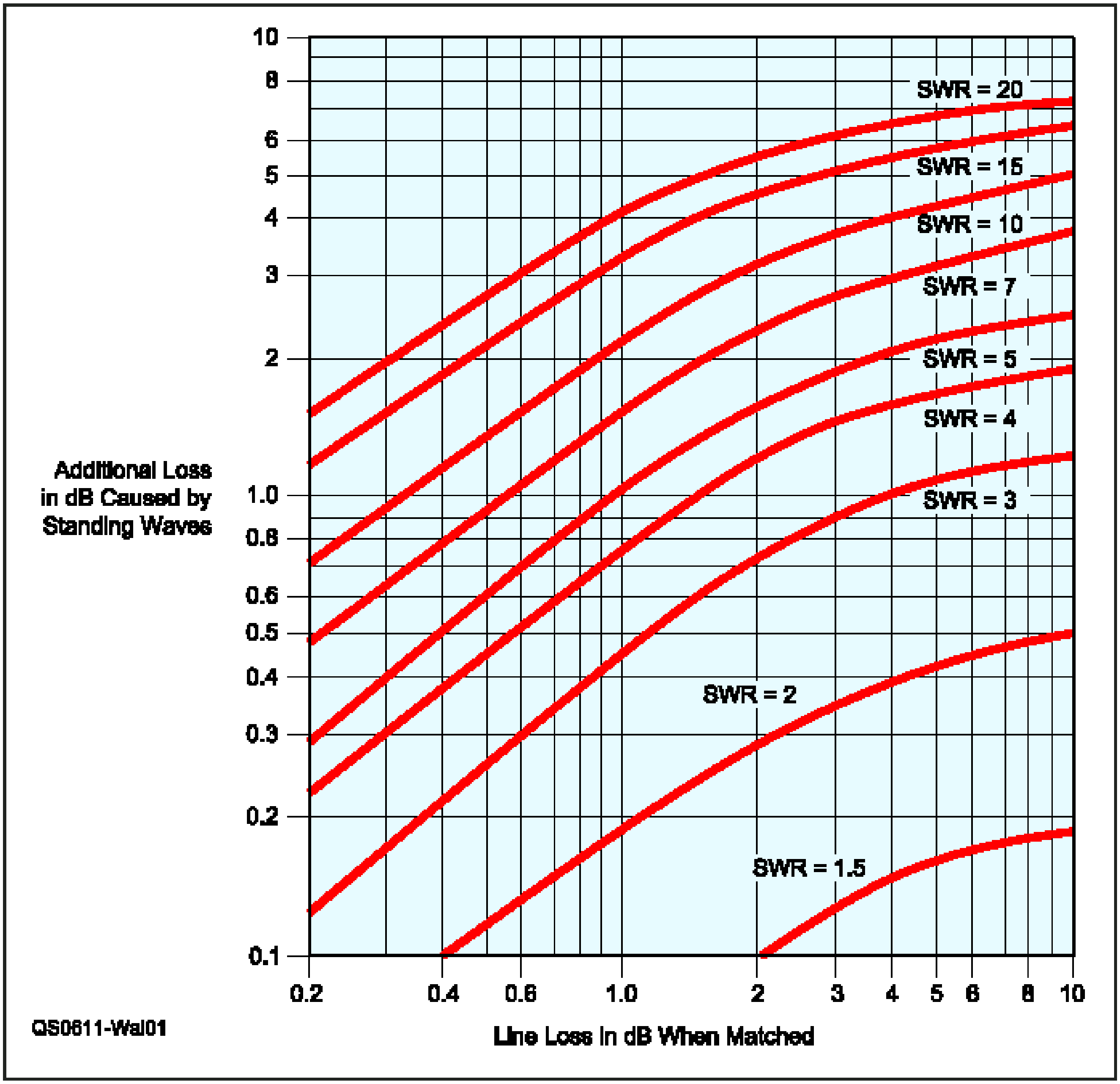

Figure 1 — A graph showing the additional loss in a transmission line due to SWR higher than 1:1.

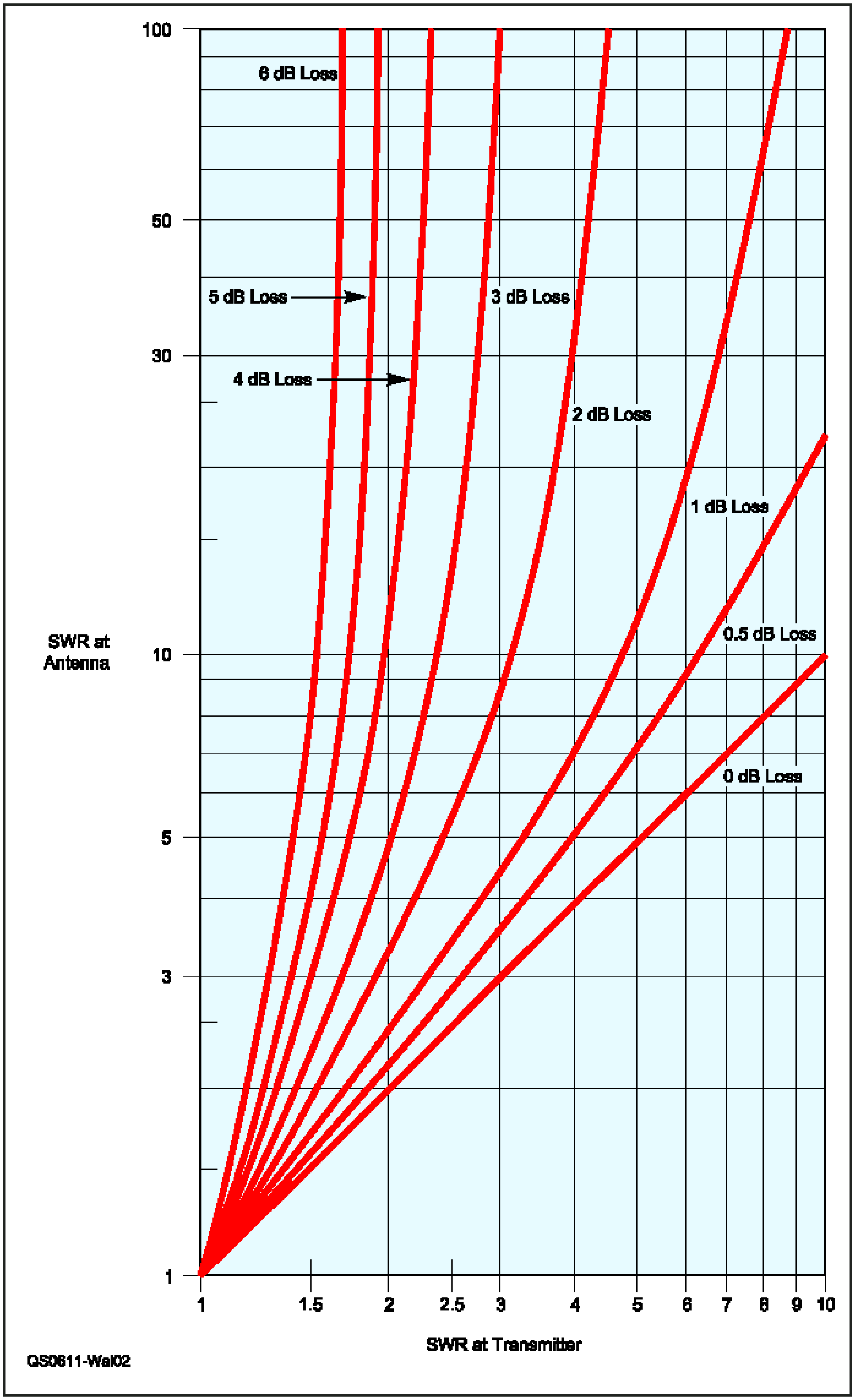

Figure 2 — A graph showing the actual SWR at an antenna based on measured SWR at the transmitter end of a transmission line with loss.

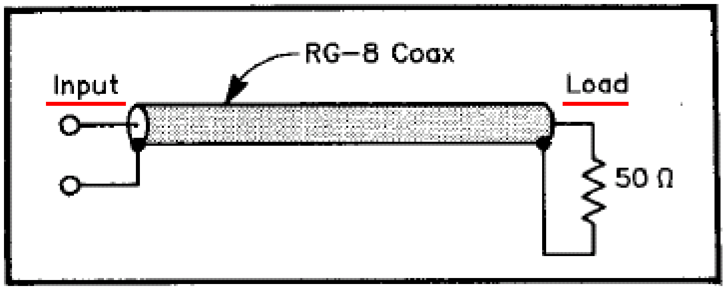

Fig 1—A length of RG-8 with 50 Ω connected across one end will look like 50 Ω at the input end of the line.

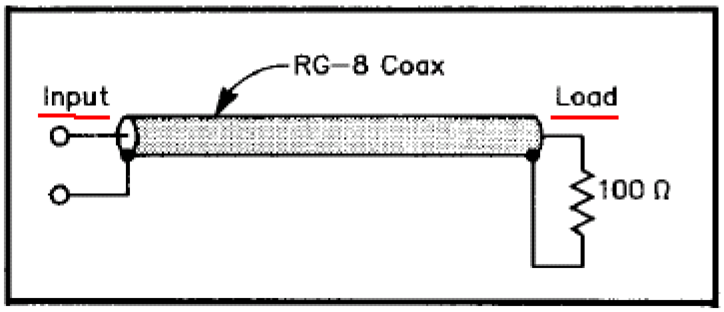

Fig 2—With 100 Ω connected at the load end of a length of RG-8, the problem is to determine what the line looks like at the input end.

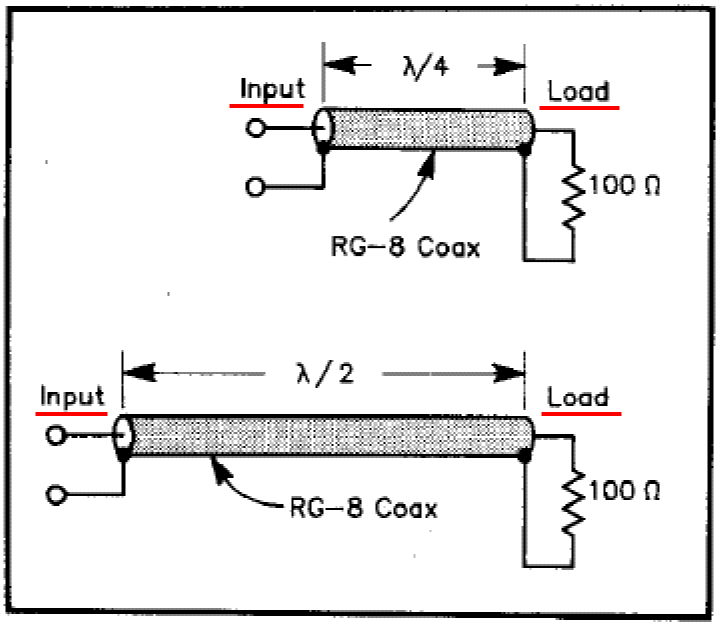

Fig 3—Part of the answer to the problem posed in Fig 2. When the line is ¼ λ long, it looks like 25 Ω at the input end when the load is 100 Ω. When the line is ½ λ long, the input end shows an impedance equal to that connected at the load end.

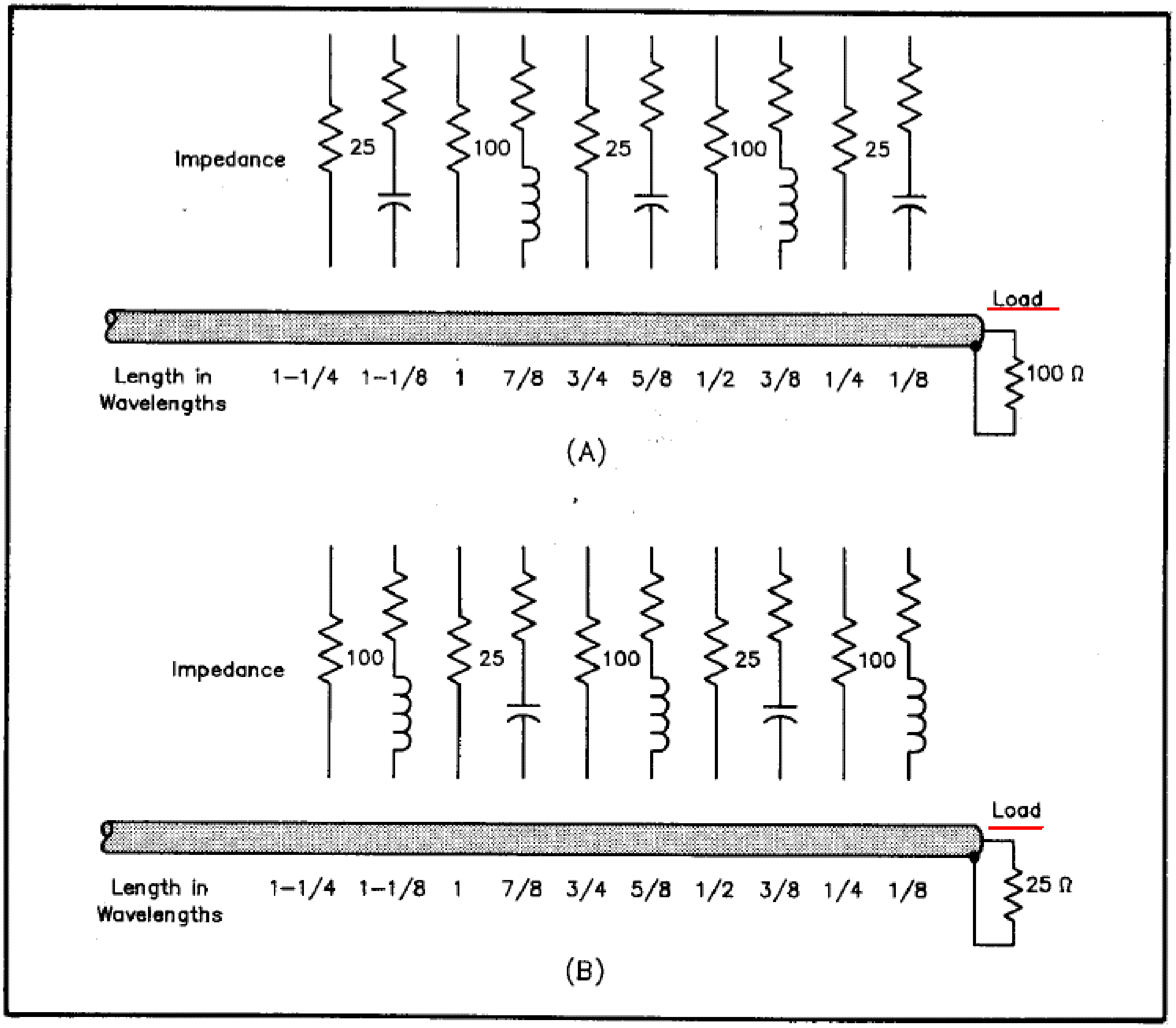

Fig 4—These two examples show how the input impedance of a 50-Ω line varies with the length of the line when the line is terminated in something other than the characteristic impedance of the line. It should be realized that the impedance is continually changing along the line, repeating every half wavelength. The impedance is purely resistive only at the ¼-λ (and multiples) point, and it becomes reactive either side of this point. When the load includes reactance as well as resistance, the impedance along the line varies in the same manner as shown here, but the purely resistive points do not occur at multiples of ¼ λ from the load.

Table I

Transmission-Line Behavior

Length	Open-Circuited Line	Short-Circuited Line
Less than ¼ wave-length	Capacitive Reactance	Inductive Reactance
¼ wave-length	Series-resonant circuit	Parallel-resonant circuit
Between ¼ and ½ wave-length	Inductive Reactance	Capacitive Reactance
½ wave-length	Parallel-resonant circuit	Series-resonant circuit

The line behavior goes through the same series of changes with each added quarter wavelength.

Table 1

Loss Comparisons for Belden 8214 Coaxial Cable and 450-ohm Ladder Line.

Cable length: 50 feet.
Antenna: 66-foot dipole at a height of 30 feet.
Calculated by Dean Straw, N6BV, Senior Assistant Technical Editor

Frequency (MHz)	*Loss (in dB) 8214*	*Ladder line*
1.9	26.9	8.62
3.8	13.7	1.37
7.15	0.19	0.07
10.14	2.85	0.07
14.27	5.30	0.15
18.14	6.96	0.31
21.40	0.78	0.12
24.90	3.94	0.13
28.50	5.69	0.18

Dipole Length in Feet = 468 / Frequency in Megahertz = 468 / 7.150MHz = 65.45 Feet (Rounded to 66 Feet Long)