

APPENDIX 2 – DETERMINING SWR FROM R + jX, METHOD 1

The SWR resulting from an impedance mismatch may be obtained from the expressions $SWR = R/Z_C$ or $SWR = Z_C/R$, *but only when the load is a pure resistance*. When the load is a complex impedance $Z = R + jX$, the exact SWR can be determined after finding the magnitude of the reflection coefficient ρ from Eq 3-1, repeated here in modified form.

$$\bar{\rho} = \rho \angle \theta = \frac{Z_L - Z_C}{Z_L + Z_C} = \frac{R - Z_C + jX}{R + Z_C + jX} \quad (\text{Eq 3-1})$$

where

Z_L = the complex load impedance, $R + jX$

Z_C = the characteristic impedance of the transmission line

The SWR may now be found from Eq 3-3, also repeated here.

$$SWR = \frac{1 + \rho}{1 - \rho} \quad (\text{Eq 3-3})$$

The SWR *cannot* be determined from any relationship between line impedance Z_C and the magnitude $|Z|$ of the complex load impedance, as shown in Appendix 2 Table 1. From the table, you can see that different values of load impedance Z_L can have the same magnitude $|Z|$, but produce different values of SWR on a feed line with a given Z_C , which in this case is 50 ohms.

Appendix 2 Table 1 Complex Load Impedances Versus SWR

Polar Form		Rectangular Form		SWR
$ Z $	at \pm Angle	R	$\pm jX$	
50	0.0°	50	0.0	1.0
50	25.84°	45	21.79	1.59
50	36.9°	40	30.0	2.00
50	45.0°	50	50.0	2.61803 †
50	53.1°	30	40.0	3.00
50	66.42°	20	45.83	4.79
50	72.54°	15	47.7	6.51
50	78.46°	10	48.99	9.90
50	84.26°	5	49.79	19.95
50	87.13°	2.5	49.94	39.98
50	88.85°	1	49.99	99.99
50	90.0°	0	50.00	∞

† See last paragraph of Appendix 3 for significance of this unusual value of SWR