Relationship of VSWR to Return Loss:

VSWR and return loss are related quantities. Note that the reflection coefficient Γ can be written in terms of the VWSR as:

$$\Gamma = \frac{VSWR - 1}{VSWR + 1}$$

This expression can be derived as follows:

From the given relationship,

$$VSWR = \frac{V_{max}}{V_{min}} = \frac{1+\rho}{1-\rho}.$$

We can show that ρ is given by:

$$\rho = |\Gamma|,$$

thus,

$$VSWR = \frac{1 + |\Gamma|}{1 - |\Gamma|}$$

Which provides the relationship we started with. The return loss can then be cast in terms of VSWR as,

$$RL(DB) = -20\log_{10}\left[\frac{VSWR - 1}{VSWR + 1}\right]$$

Conversely,

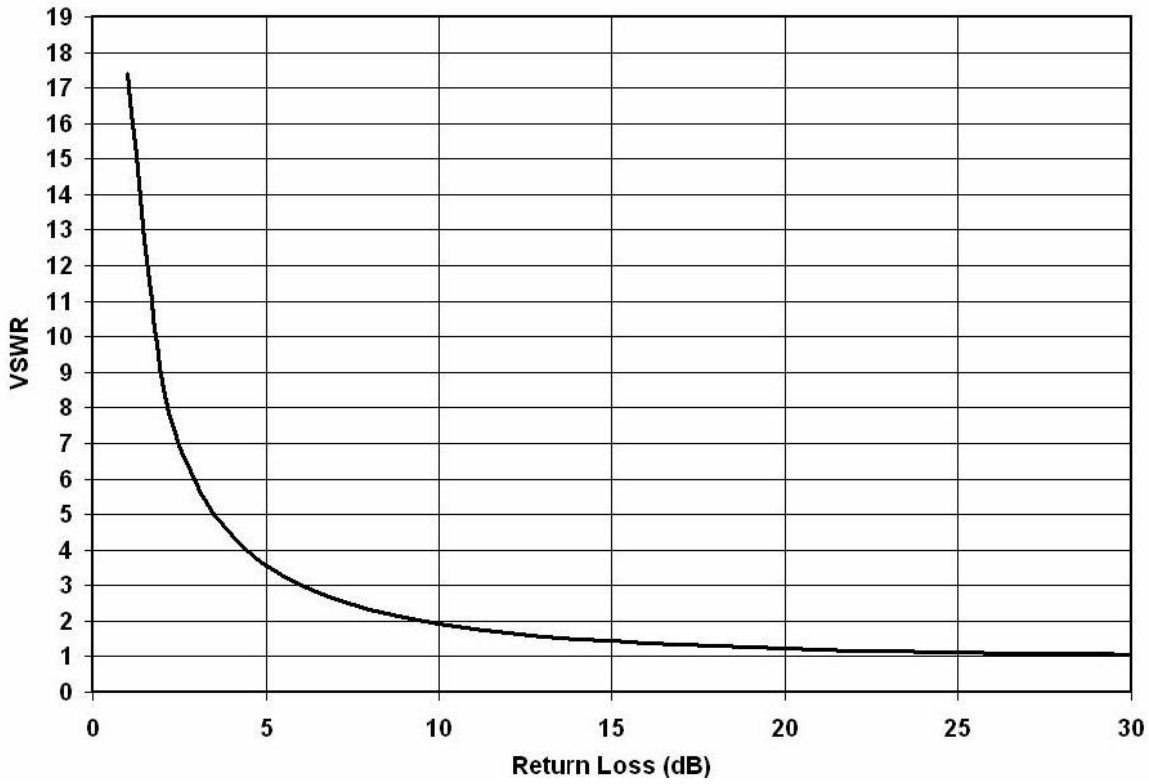
$$VSWR = \frac{\left[10^{\frac{RL(dB)}{20.0}}\right] + 1.0}{\left[10^{\frac{RL(dB)}{20.0}}\right] - 1.0}$$

So if either of the two quantities is known the other can be calculated from it. A table showing conversions is shown below for convenience

Return loss (db)	VSWR	Reflection coefficient
0	**Infinite**	**1.0**
1	**17.39**	**0.891**
2	**8.724**	**0.794**
3	**5.848**	**0.707**
4	**4.419**	**0.630**
5	**3.569**	**0.562**
6	**3.009**	**0.501**
7	**2.614**	**0.446**
8	**2.322**	**0.398**
9	**2.099**	**0.354**
10	**1.924**	**0.316**
11	**1.784**	**0.281**
12	**1.670**	**0.251**
13	**1.576**	**0.223**
14	**1.498**	**0.199**
15	**1.432**	**0.177**
16	**1.376**	**0.158**
17	**1.328**	**0.141**
18	**1.288**	**0.125**
19	**1.252**	**0.112**
20	**1.222**	**0.100**
20.8	**1.195**	**0.089**
21.7	**1.179**	**0.082**
22.6	**1.16**	**0.074**
23.1	**1.15**	**0.069**
23.7	**1.139**	**0.065**
24.3	**1.129**	**0.060**
24.9	**1.120**	**0.056**
25.7	**1.109**	**0.051**
26.4	**1.100**	**0.047**
27.3	**1.109**	**0.043**

28.3	**1.079**	**0.038**
29.4	**1.07**	**0.033**
30.7	**1.06**	**0.029**
32.3	**1.049**	**0.024**
34.1	**1.04**	**0.019**
36.6	**1.03**	**0.014**
40.1	**1.019**	**0.009**
46.1	**1.009**	**0.004**

It is instructive to examine a graphical view of the relationship between VSWR and the return loss presented below.



Note the slow variation of the return loss as the VSWR reaches between 1.0 to 2.0. Conversely for a VSWR of 7 or 8 the return loss is large. If the return loss is greater than 10dB the VSWR is less than 2.0.