Chapter 3 Arrays

3-1.1 Pattern Ripple

Equation (3-6) is the key to finding angular ripple rate in a pattern when there is an additional signal path, for example, in an antenna measurement. We consider the array to be along the *x*-axis and we change the cosine to sine. The minimum angular ripple rate occurs along the axis normal to the array axis. Given the spacing *d* between the two elements, the angle between the ripples at broadside is:

$$\Delta\theta_{broadside} = \sin^{-1}\left(\lambda / d\right) \text{ or } d = \frac{\lambda}{\sin\left(\Delta\theta_{broadside}\right)} \approx \frac{\lambda}{\Delta\theta_{broadside}(radians)}$$

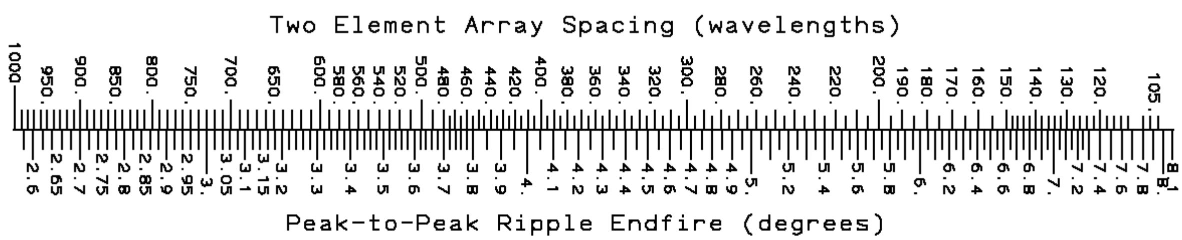
The approximation is useful for a large spacing when the ripple rate is small. In the end fire direction, the ripple rate reduces to

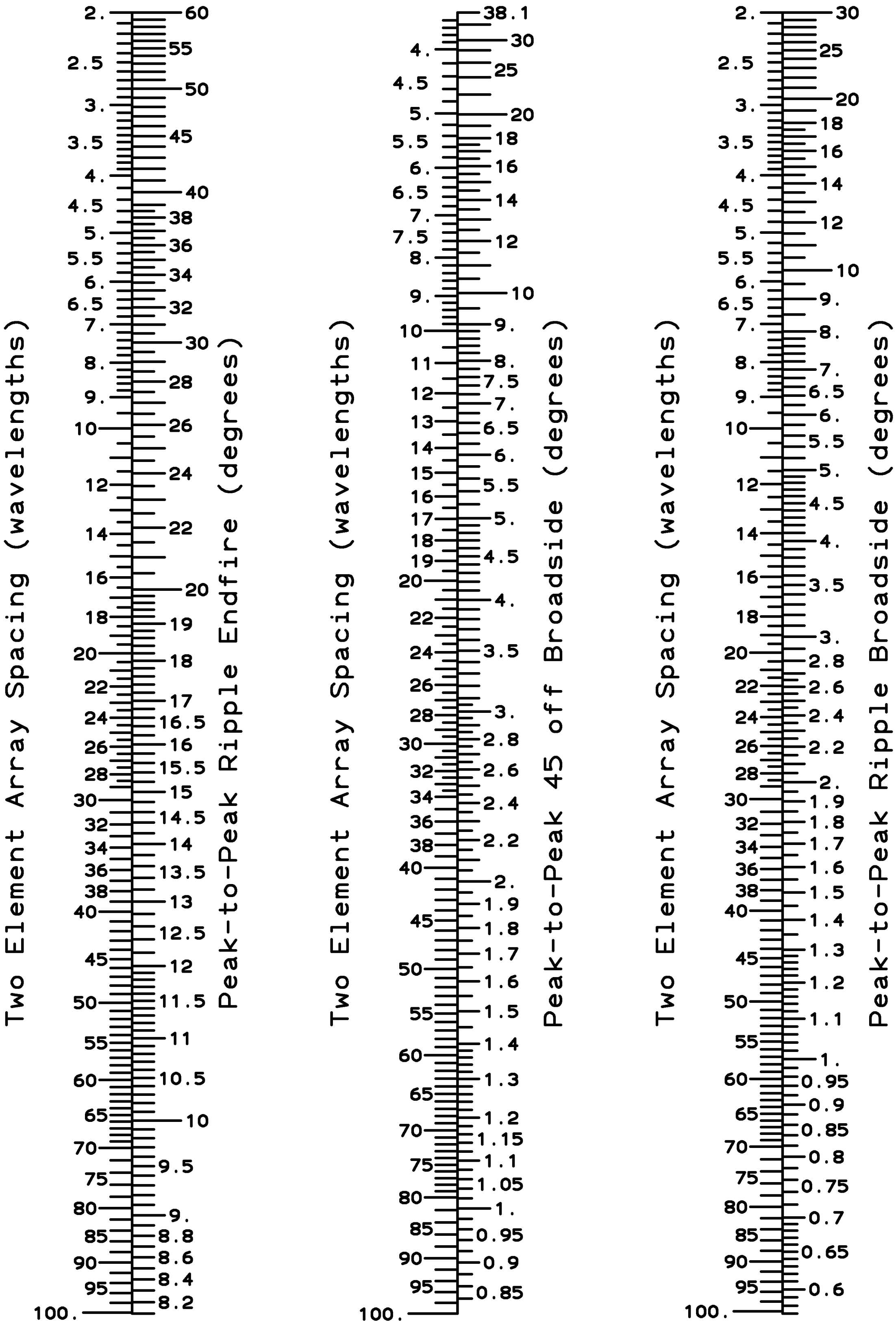
$$\Delta\theta_{endfire} = \cos^{-1}\left(1 - \lambda / d\right) \text{ or } d = \frac{\lambda}{1 - \cos\left(\Delta\theta_{endfire}\right)}$$

If we consider the two-element array scanned off broadside to θ_{scan}, the angular ripple to the next peak is found from manipulation of Eq. (3-6):

$$\Delta\theta = \sin^{-1}\left(\sin\theta_{scan} + \lambda / d\right) - \theta_{scan} \text{ or } d = \frac{\lambda}{\sin\left(\Delta\theta + \theta_{scan}\right) - \sin\theta_{scan}}$$

The following scale gives the relationship between pattern angular ripple rate for the two element array for three cases: end fire, beam scanned to 45º, and broadside.




Two Element Array Spacing (wavelengths)
Peak-to-Peak Ripple Endfire (degrees)
Two Element Array Spacing (wavelengths)
Peak-to-Peak 45 off Broadside (degrees)
Two Element Array Spacing (wavelengths)
Peak-to-Peak Ripple Broadside (degrees)