This can be seen by taking the Fourier transform of a finite-length {time duration Δt_o} pure-tone/single frequency {$f = f_o$} ***time domain*** sinusoidal signal $p(t) = p_o \sin\omega_o t$ to the ***frequency domain*** $p(f)$:

If $p(t) = p_o \sin\omega_o t = p_o \sin 2\pi f_o t$ for $|t| \le \tfrac{1}{2}\Delta t_o$, and: $p(t) = 0$ for $|t| > \tfrac{1}{2}\Delta t_o$, and defining the {rectangular} ***window function*** $\mathrm{w}(t) = 1\ (=0)$ for $|t| \le \tfrac{1}{2}\Delta t_o$ $\left(|t| > \tfrac{1}{2}\Delta t_o\right)$, respectively, then:

$$p(f) = \int_{t=-\infty}^{t=+\infty} p(t)\cdot\sin\omega t\, dt = p_o \int_{t=-\infty}^{t=+\infty} \mathrm{w}(t)\cdot\sin\omega_o t\cdot\sin\omega t\, dt = p_o \int_{t=-\frac{1}{2}\Delta t_o}^{t=+\frac{1}{2}\Delta t_o} \sin\omega_o t\cdot\sin\omega t\, dt$$

Using the trigonometric identity $\sin A \sin B = \tfrac{1}{2}\left[\cos(A-B) - \cos(A+B)\right]$:

$$p(f) = \tfrac{1}{2} p_o \int_{t=-\frac{1}{2}\Delta t_o}^{t=+\frac{1}{2}\Delta t_o} \left[\cos(\omega-\omega_o)t - \cos(\omega-\omega_o)t\right] dt = \tfrac{1}{2} p_o \Delta t_o \left\{ \frac{\sin\left[\frac{1}{2}(\omega-\omega_o)\Delta t_o\right]}{\left[\frac{1}{2}(\omega-\omega_o)\Delta t_o\right]} - \frac{\sin\left[\frac{1}{2}(\omega-\omega_o)\Delta t_o\right]}{\left[\frac{1}{2}(\omega-\omega_o)\Delta t_o\right]} \right\}$$

The ***sinc function*** $\mathrm{sinc}(x) \equiv \dfrac{\sin x}{x}$ {*n.b.* $\mathrm{sinc}(0) = 1$}, hence we can write $p(f)$ as:

$$p(f) = \tfrac{1}{2} p_o \Delta t_o \left\{ \mathrm{sinc}\left[\tfrac{1}{2}(\omega-\omega_o)\Delta t_o\right] - \mathrm{sinc}\left[\tfrac{1}{2}(\omega+\omega_o)\Delta t_o\right] \right\}$$

The ***power spectral density functions*** $S_{pp}(f) \propto |p(f)|^2$ (a ***frequency domain*** quantity) for infinite length and finite length sine-wave signals are shown below: