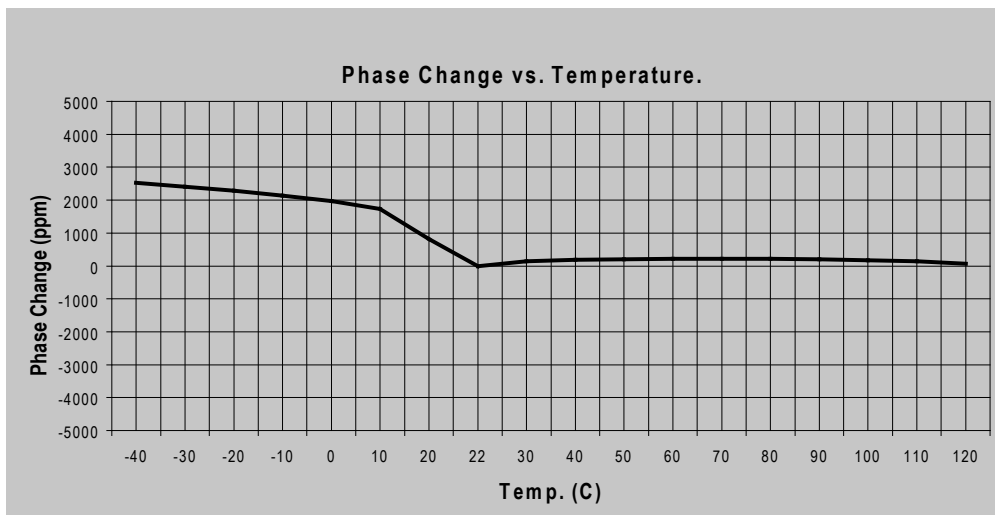


# Phase Stability over Temperature



## Phase Change:

The electrical length for a given frequency will “shift” as a result of environmental changes. The *degree* of change is based on mechanical stresses, connector torque and thermal conditions.

The *degree* of phase shift as a result of temperature variation can be calculated by using the following formula:

$$\Delta\Phi = \Phi * \left\{ \frac{\text{ppm}}{10^6} \right\}$$

Before calculating the expected phase shift there are a few additional questions that need to be answered.

- What is the mechanical length of the assembly (ft)
- What is the frequency of interest (Ghz)
- What is the electrical length at the frequency of interest ( $\Phi$ )
- What is the dielectric constant of the insulation (E)
- What is the temperature of interest ( $^{\circ}\text{C}$ )

Once these questions are answered the phase shift can be calculated.

For example, what would be the change in phase for a 10 ft cable assembly of LL142 at 80  $^{\circ}\text{C}$  at 18 Ghz.?

## Step 1:

Calculate the electrical length using the following formula:

$$\Phi = 365.7 * \sqrt{E} * (\text{ft}) * (\text{Ghz})$$

$$\Phi = 365.7 * \sqrt{1.478} * 10 * 18 = 80,032^{\circ}$$

## Step 2:

Using the chart above determine the parts per million (ppm) at 80 $^{\circ}\text{C}$ .

212 ppm @ 80 $^{\circ}\text{C}$

## Step 3:

Now solve

$$\Delta\Phi = \Phi * \left\{ \frac{\text{ppm}}{10^6} \right\}$$

$$\Delta\Phi = 80,032^{\circ} * \left\{ \frac{212}{10^6} \right\} = 16.97^{\circ}$$

The cable assembly will become 16.97 $^{\circ}$  longer at 80 $^{\circ}\text{C}$  at 18 Ghz