Temperature Phase Stability Test for RF Cable Assemblies

Phase stability vs. temperature is a measure of the signal speed variation when the cable is exposed to different temperatures. The temperature variation will induce the change of the dielectric constant εr, mechanical length, material character which will cause its phase variation. This variation can be unidirectional or multidirectional. The phase variation is characterized by the temperature coefficient of phase η_t, and the maximum variation of temperature coefficient of phase $\Delta|\eta|_{max}$

$$\eta_t = (\varphi_{25℃} - \varphi_t) / \Phi_{25℃} \qquad \Delta|\eta|_{max} = |\eta_{max} - \eta_{min}|$$

where

$\varphi_{25℃}$ is the phase at temperature 25℃, in (°)
φ_t is the phase at temperature t, in (°)
$\Phi_{25℃}$ is the total phase at 25℃, in (°)
$\Delta|\eta|_{max}$ is the maximum phase variation coefficient, in ppm

Test Equipment

A vector network analyzer (VNA), a temperature chamber.

Test Sample

The test cable shall be 3 m long and terminated with suitable connectors at each end.

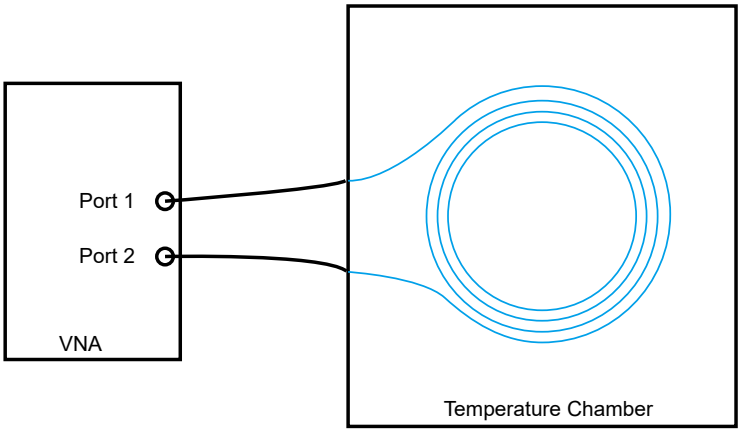
Test Procedure

1.Test sample shall be put into a temperature chamber in loose coils with the diameter not less than 10 times the cable's minimum static bending radius. Adjust temperature of the chamber for 6 cycles and maintain at least 30 min at each limit temperature (85℃ and -55℃).

2.Set the temperature chamber to 85℃ and maintain 10 min at least when it reaches the temperature. Connect Test sample with the VNA, test $\Phi_{25℃}$ and $\varphi_{25℃}$.

3.Adjust the temperature of the chamber from the lowest temperature -55℃ to each higher temperature until to the maximum temperature 85℃, and record φ_t.

4.Use each η_t and temperature t draw the curve of phase variation with temperature at specified frequency f.



RF ONE provides a wide series of temperature phase stable cables in various frequency ranges, attenuations, cable sizes, phase stability specs etc.

Among these thermal phase stable cables, our newly released TP220 features extinguished temperature phase stability under the room temperature. Built from PFA dielectric, TP220 cables offer outstanding 300 PPM (-40 to 60 °C) phase stability.

PTFE, despite its excellent properties at high frequencies, shows a steep shift in phase in the temperature range of 15°C to 25°C. This phenomenon also known as PTFE knee could cause several problems such as detecting inefficiency, test measurement error etc. TP series cables are developed to solve this challenge.

Features

- Excellent phase and insertion loss stability vs temperature
- No PTFE “Knee”
- Low loss operating to 40GHz
- Small bending radii and low profile for easy routing
- Available with 2.92mm, SMP, SSMP cable assemblies

Applications

- Phased array antennas
- Synthetic apeture radar satellites
- Network analyzer measurements

Temperature Phase Stability (PFA versus PTFE)