



The Times Microwave Systems team played a crucial role in the success of NASA's Artemis 1 mission. This historic mission involved a 25.5-day, 1.4 million-mile journey, where the Orion spacecraft circumnavigated the moon and returned safely to Earth. Our RF assemblies were essential in ensuring the communication between the spacecraft's systems.

Our team's expertise was critical in overcoming technical challenges, such as preventing corona effects on the assemblies, leading to the development of a unique connector now used in future Artemis missions. Artemis 1 validated the integrated system's readiness for future crewed missions, setting the stage for Artemis 2, where astronauts will once again venture beyond low Earth orbit. The quality and precision of our work directly impact the safety and success of these missions, as their cables carry vital signals between the spacecraft's computers and engines.

The commitment and collaboration between Times Microwave Systems and NASA highlight the importance of these contributions to the broader goal of deep space exploration, including future missions to Mars and beyond.

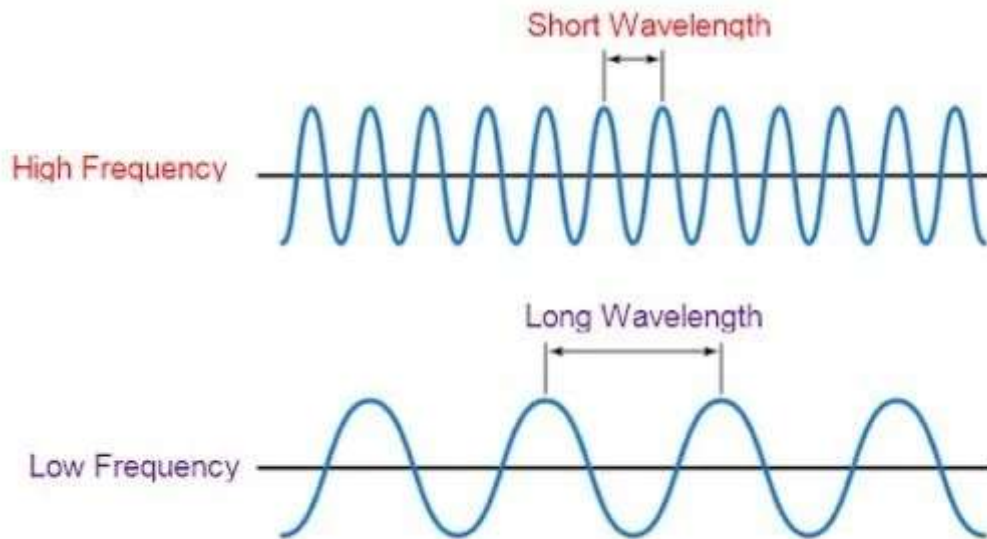
[Learn More about the Artemis Mission](#)

---

## **Why Phase Matters: Understanding Its Critical Role in Coaxial Cables and RF Systems**

## What is Phase?

Microwave signals propagate as sine waves, with each full cycle representing 360 degrees of electrical length. The frequency of these waves is determined by the number of cycles per second: lower frequencies have fewer cycles and thus longer wavelengths, while higher frequencies, with millions or billions of cycles per second, produce much shorter wavelengths.



### Key Factors of Phase for Coaxial Cables

#### ***Electrical Length***

Electrical length is the physical length of a cable divided by its wavelength and is influenced by frequency, signal delay, and the cable's dielectric material and dimensions. While the dielectric usually provides stable performance, environmental factors like temperature fluctuations and physical stress can significantly impact electrical characteristics.

#### ***Low Insertion Loss***

Low insertion loss is crucial for maximizing signal transmission distance, as it ensures the signal travels farther before weakening. This is especially important for long-range communication or data transfer, where maintaining signal integrity over extended distances is essential. Insertion loss is impacted by the material of the center conductors and dielectric, how they are constructed, and their size, weight, and quality of material.

#### ***Dielectric Material and Temperature***

RF coaxial cables often use PTFE dielectrics for their low dielectric loss properties, but the phase transition of PTFE near room temperature can cause non-linear phase length

variations and hysteresis. This poses challenges for phase-sensitive systems in varying temperatures. To address this, we have developed cable assemblies with stable dielectrics like silicon dioxide and proprietary TF4<sup>®</sup> and TF5<sup>™</sup> materials to minimize temperature-induced phase changes.

Learn more about Phase

---

## How Cable Characteristics Impact Phase Stability

**Cable Length:** The physical length of a cable directly impacts its electrical length, which affects the phase shift of the signal. Longer cables result in a greater phase shift than shorter cables.

**Bending:** Bending a cable can affect its phase, with tight bends or kinks disrupting signal propagation and causing phase inconsistencies.

**Temperature:** The dielectric core material in a cable can be sensitive to temperature changes, which may alter its electrical properties as the cable heats up or cools down, leading to fluctuations in the signal's phase.

**Dielectric Material:** Different dielectric materials have distinct electrical properties. For example, PTFE can experience significant phase shifts around room temperature, causing instability. In contrast, materials like foam fluoropolymer TF4<sup>®</sup> or TF5<sup>™</sup> provide excellent phase stability with minimal variation over a broader temperature range.

**Connectors:** The quality and design of connectors in an assembly can affect phase stability. Loose connections or poorly designed interfaces may cause unwanted reflections and phase shifts.

**Frequency:** Higher frequencies are generally more sensitive to phase variations compared to lower frequencies.

Explore our Phase Stable Cable Assemblies

---

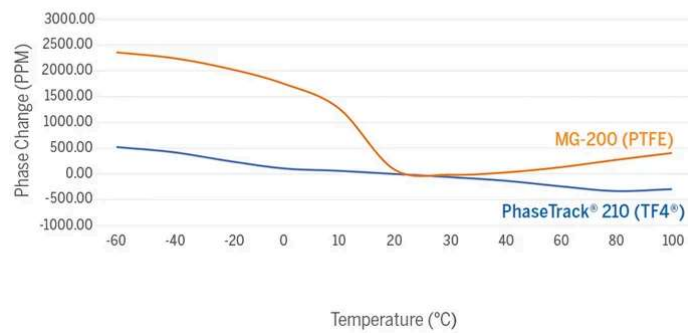
## Product Spotlight: PhaseTrack<sup>®</sup> Cable Assemblies

[Our PhaseTrack<sup>®</sup> cable assemblies](#) are ideal for applications requiring precise phase control over temperature. Featuring proprietary TF4<sup>®</sup> foam fluoropolymer dielectrics, these assemblies maintain minimal phase change compared to PTFE dielectrics, especially between 15°C and 25°C. Available in diameters from 0.047" to 0.318", they support a wide

frequency range and offer a broad operating temperature range. Their versatility is further enhanced by a wide selection of connectors, including standard and high-frequency options, and four jacket materials.



### Phase Change VS Temperature



Learn more about PhaseTrack Cable Assemblies

---

## Upcoming Tradeshows

Check out all our upcoming tradeshows and stop by our booth!

<b>2024</b> <b>Bicsi FALL CONFERENCE &amp; EXHIBITION</b> Leading the Future for the Connected World	<b>SEPTEMBER 16<sup>TH</sup> - 18<sup>TH</sup></b> <b>LAS VEGAS, NEVADA</b>	<b>Booth #</b> <b>1713</b>
 <b>EuMW</b>	<b>SEPTEMBER 24<sup>TH</sup> - 26<sup>TH</sup></b> <b>PARIS, FRANCE</b>	<b>Booth #</b> <b>807 B</b>
 <b>California APCO</b> Leaders in Public Safety Communications	<b>OCTOBER 2<sup>ND</sup></b> <b>GARDEN GROVE, CALIFORNIA</b>	<b>Booth #</b> <b>208</b>

Schedule time to meet with our team!

## Related video

Check out our video on custom assemblies!



Watch the Video

## Recent Article

Check out our recent article!



Read the Article



**Q: What is the PTFE knee?**

**A:** Dielectric materials affect phase stability by influencing how the signal's phase changes with temperature variations. Materials like PTFE can experience significant phase shifts near room temperature, leading to instability. In contrast, materials such as foam fluoropolymer provide superior phase stability with minimal variation over a wide temperature range. To address this, alternative dielectric materials with more stable phase characteristics across temperature ranges are often used in high-performance coaxial cables.

---

**Follow Us!**

*Like, share, and subscribe*



**How can we help?**

**Email us** : [salesinquiry@timesmicro.com](mailto:salesinquiry@timesmicro.com)

**Call us** : 1-800-867-2629

Copyright © 2023 Times Microwave Systems. All rights reserved.

You are receiving this email because you opted-in at our website at <https://timesmicrowave.com/>

Times Microwave Systems, 358 Hall Ave, , Wallingford,CT,06492-3574,USA,(800) 867-2629  
[Unsubscribe](#) [Manage Preferences](#)

InstaBend<sup>®</sup>, LLPL<sup>®</sup>, LLPX<sup>®</sup>, LLSB<sup>®</sup>, LMR<sup>®</sup>, M8<sup>®</sup>, M8M<sup>®</sup>, MaxGain<sup>®</sup>, Miltech<sup>®</sup>, nu-Trac<sup>®</sup>, PhaseTrack<sup>®</sup>, Stripflex<sup>®</sup>, T-COM<sup>®</sup>, Testmate<sup>®</sup>, TF4<sup>®</sup>, T-Flex<sup>®</sup>, Times Microwave Systems<sup>®</sup>, Times-Protect<sup>®</sup>, T-Rad<sup>®</sup>, TuffGrip<sup>®</sup>, Xtended Flex<sup>®</sup> are Registered Trademarks of Times Microwave Systems.