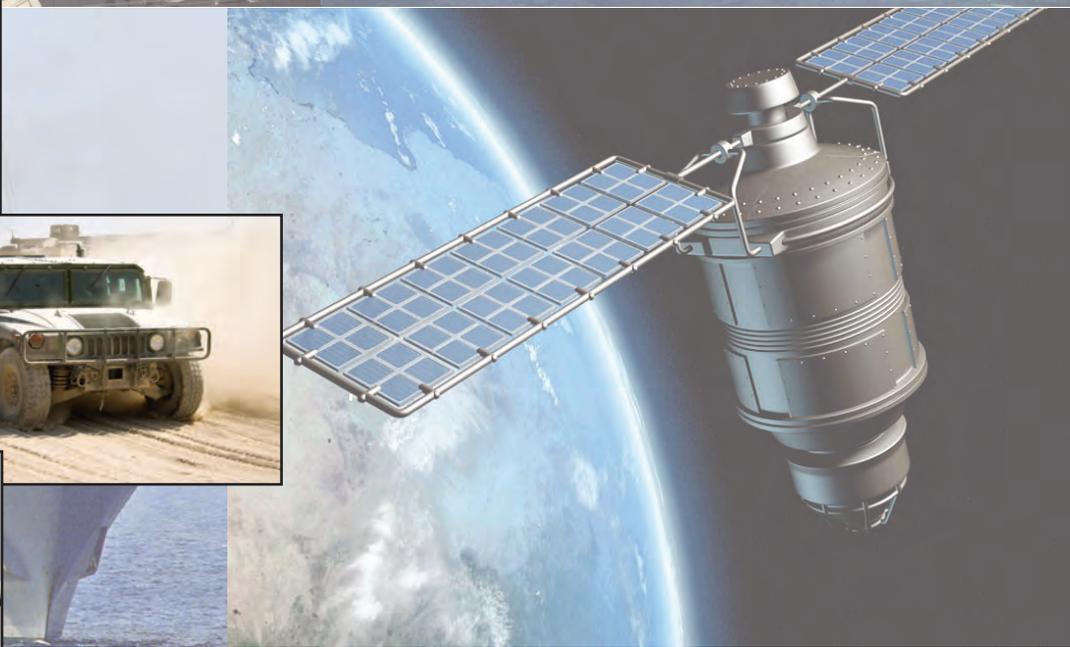


# PhaseTrack<sup>®</sup>



## Phase Stable Cable Assemblies

- **Phased Array Systems**
- **All Phase Sensitive Systems**
- **All Phase Sensitive Platforms**
- **All System Platforms**  
(Ground, Sea, Airborne, Space)

# INTRODUCTION

Phase stable interconnects are essential to the performance of many radio frequency and microwave systems. Until now, most solutions utilized PTFE based dielectric medium. The well documented problem with PTFE is a drastic change that occurs at a temperature of approximately 19 degrees C. This change is steep enough to cause significant phase difference between cables that are only fractions of a degree apart in temperature.

Over the last several years Times has developed a product line with a proprietary fluorocarbon material named TF4® that has completely eliminated the knee.

The product was launched in 2004 with the selection of our PT210 and PF402 for a radar mapping satellite requiring over 2000 phase critical assemblies. The success of the technology has led to the expansion of the product to cover a wide range of applications.



The Phasetrack (PT) line of flexible cables now available in sizes ranging from .110” to an 18 GHz .318” optimized design which addresses a wide range of interconnect applications.

Phaseflex (PF) and Phasetrack semi-Rigid (SR) are available in sizes commonly used in most in box applications and are compatible with existing connectors.

Phasetrack LSLT have been developed with a specially blended and processed foam polymer dielectric for longer lower frequency runs that demand a larger cable to minimize loss. Jacketed with our proprietary M17 zero halogen jacket this product is ideal for shipboard and other applications which are required to meet the stringent requirements of MIL-DTL-17.

The phasetrack product line is rounded out with our SiO2 dielectric cables that provide the ultimate in performance from cryogenic temperatures to those exceeding 1000 degrees C.

## PhaseTrack® Legacy

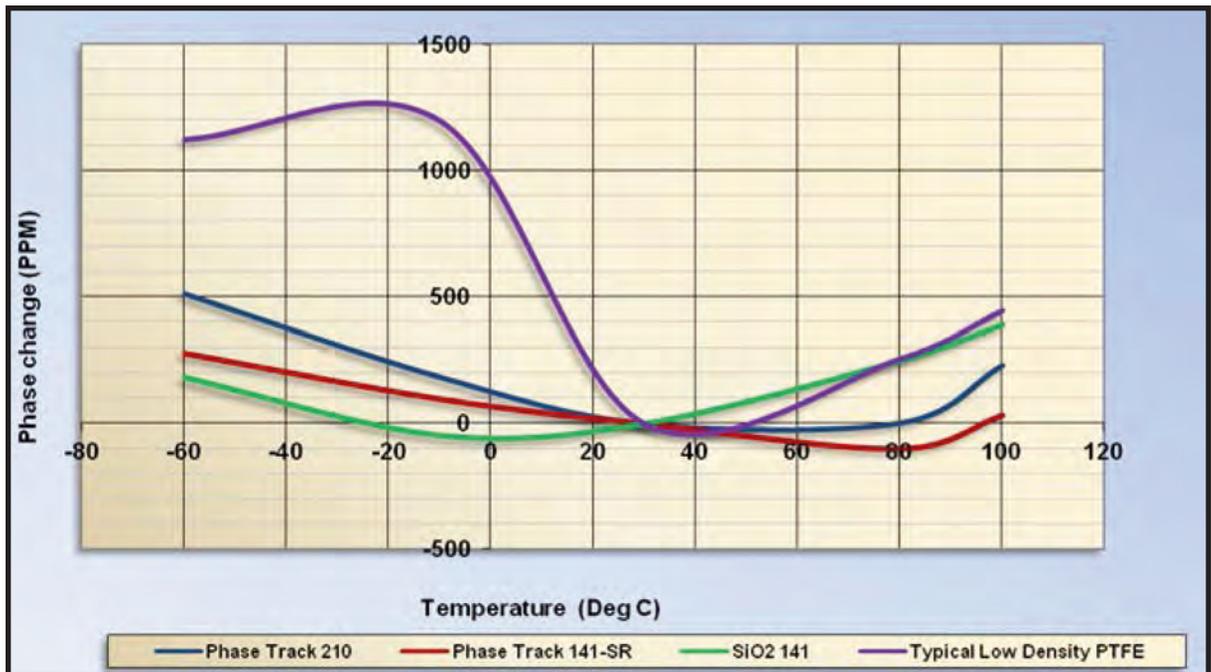
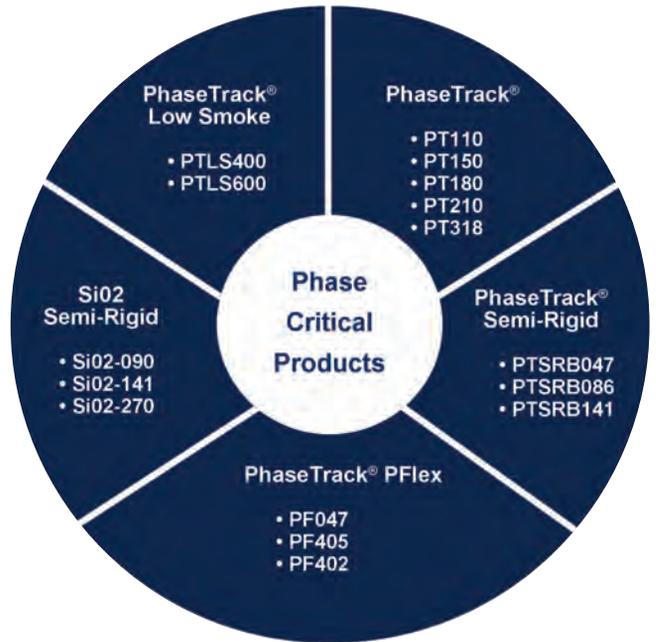
### Programs:

- *Terra SAR-X*
- *Tandem X*
- *EA 18-G*
- *Galactica*
- *F35*
- *TPS-80 G/ATOR*

### Applications:

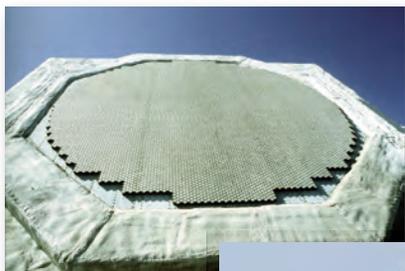
- *Phased Array Antennas*
- *Precision Differential Timing*
- *Synthetic Apertures*
- *Microwave Interferometry*
- *Direction Finding*
- *Test and Measurement*

# PhaseTrack® Cable



## *Phase Stable Cable Assemblies For:*

- *Phased Array Systems*
- *System Interconnects*
- *Phase Stable Test Cables*
- *All System Platforms*  
*(Ground, Sea, Airborne and Space)*

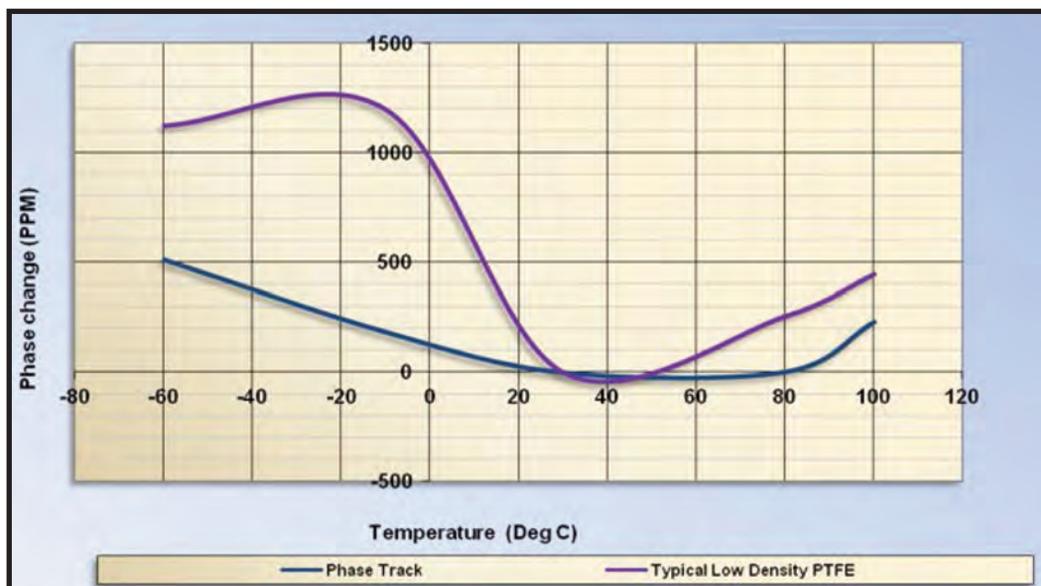


PhaseTrack® cable assemblies are designed for applications demanding minimal phase change over temperature. All PhaseTrack cables use proprietary TF4® dielectric that does not have the abrupt shift in the phase that occurs with solid or tape wrapped PTFE based products under normal room ambient temperature conditions.

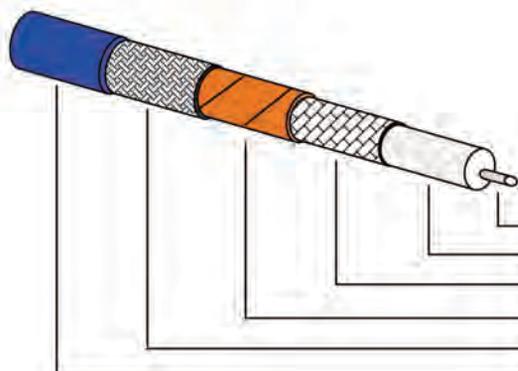
PhaseTrack cable has the same triple shield construction used in Times popular SF®, SFT®, SilverLine® and MT cables.

### Features:

- Superior Stability (vs LD PTFE)
- PTFE "Knee" is Nonexistent
- TF4® Dielectric Technology



## PhaseTrack® Construction



|                  |                            |
|------------------|----------------------------|
| Center Conductor | Silver Plated Copper*      |
| Dielectric       | TF4 Dielectric             |
| Shield           | Silver Plated Copper       |
| Interlayer       | Metalized Polyimide Tape   |
| Outer Braid      | Silver Plated Copper Braid |
| Jacket           | Blue FEP                   |

| Part Number                 | PT110                            | PT150                | PT180      | PT210      | PT318      |
|-----------------------------|----------------------------------|----------------------|------------|------------|------------|
| Dielectric Technology       | TF4®                             | TF4®                 | TF4®       | TF4®       | TF4®       |
| Diameter (in)               | 0.108                            | 0.145                | 0.180      | 0.220      | 0.315      |
| Minimum Bend Radius         | 0.550                            | 0.750                | 1.000      | 1.125      | 1.750      |
| Mass (lbs/1000 feet)        | 14.0                             | 24.0                 | 36.0       | 46.0       | 90.0       |
| Temperature Rating          | -55C to +150C                    |                      |            |            |            |
| Center Conductor            | Silver Plated Copper Clad Steel  | Silver Plated Copper |            |            |            |
| Outer Conductor             | Silver Plated Copper Strip Braid |                      |            |            |            |
| Jacket                      | Blue FEP                         |                      |            |            |            |
| Characteristic Impedance    | 50 Ohms                          |                      |            |            |            |
| Velocity of Propagation     | 82.5%                            | 82.5%                | 83.0%      | 83.5%      | 83.5%      |
| Cutoff Frequency (GHz)      | 80.0                             | 52.4                 | 38.7       | 29.0       | 18.9       |
| Delay (nS/foot)             | 1.23                             | 1.23                 | 1.23       | 1.23       | 1.22       |
| Capacitance (pF/foot)       | 24.7                             | 24.7                 | 24.6       | 24.4       | 24.0       |
| Shielding                   | -90 dB Minimum                   |                      |            |            |            |
| Loss @ 6 GHz (db/100 feet)  | 64.0                             | 38.4                 | 30.5       | 24.6       | 16.7       |
| Loss @ 18 GHz (db/100 feet) | 121.0                            | 70.5                 | 58.5       | 48.4       | 34.7       |
| K1                          | 0.72391                          | 0.4532               | 0.33627    | 0.25971    | 0.15565    |
| K2                          | 0.0013239                        | 0.00055605           | 0.00074129 | 0.00075526 | 0.00076725 |

\*PT110 uses silver plated, copper clad steel as a center conductor.

# PhaseTrack® SR

## Phase Stable Cable Assemblies For:

- Phase-Optimized
- Semi-Rigid Cables
- All Phase Sensitive Systems
- All System Platforms  
(Ground, Sea, Airborne and Space)



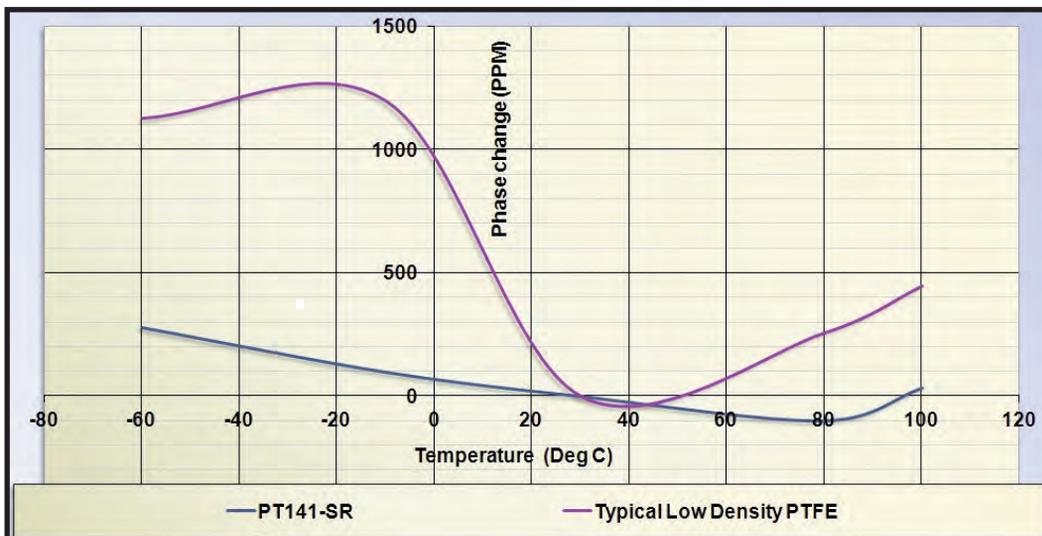
PhaseTrack® SR cable assemblies are designed for applications demanding minimal phase change over temperature.

PhaseTrack® SR cable assemblies are a classic semi-rigid-style cable with optimized phase performance.

PhaseTrack® SR cables use proprietary TF4™ dielectric that does not have the abrupt shift in phase that occurs with solid or tape wrapped PTFE based products under normal room ambient conditions.

### Features:

- Superior Stability (vs LD PTFE)
- PTFE “Knee” is Nonexistent
- TF4® Dielectric Technology



# PhaseTrack® SR

## PhaseTrack®-SR Construction



|                  |                       |
|------------------|-----------------------|
| Center Conductor | Silver plated Copper* |
| Dielectric       | TMS TF4 Dielectric    |
| Outer Conductor  | Bare Copper Tube      |

| Part Number                 | PTSRB047                        | PTSRB085  | PTSRB141             |
|-----------------------------|---------------------------------|-----------|----------------------|
| Dielectric Technology       | TF4™                            | TF4™      | TF4™                 |
| Diameter (in)               | 0.047                           | 0.085     | 0.141                |
| Minimum Bend Radius         | 0.15                            | 0.25      | 0.425                |
| Mass (lbs/1000 feet)        | 4.5                             | 14.2      | 29.0                 |
| Temperature Rating          | -55C to + 125C                  |           |                      |
| Center Conductor            | Silver Plated Copper Clad Steel |           | Silver Plated Copper |
| Outer Conductor             | Bare Copper                     |           |                      |
| Jacket                      | NA                              |           |                      |
| Characteristic Impedance    | 50 Ohms                         |           |                      |
| Velocity of Propagation     | 82.5%                           | 82.5%     | 82.5%                |
| Cutoff Frequency (GHz)      | 138.5                           | 80.2      | 38.4                 |
| Delay (nS/foot)             | 1.23                            | 1.23      | 1.23                 |
| Capacitance (pF/foot)       | 24.6                            | 24.6      | 24.6                 |
| Shielding                   | -110 dB Minimum                 |           |                      |
| Loss @ 6 GHz (db/100 foot)  | 96.3                            | 55.2      | 28.2                 |
| Loss @ 18 GHz (db/100 foot) | 173.8                           | 102.9     | 54.8                 |
| K1                          | 1.17249                         | 0.63712   | 0.30382              |
| K2                          | 0.00091751                      | 0.0009676 | 0.00077836           |

\*PTSRB047 and PTSRB085 use silver plated, copper clad steel as a center conductor.

# PhaseTrack® PFlex

## Phase Stable Cable Assemblies For:

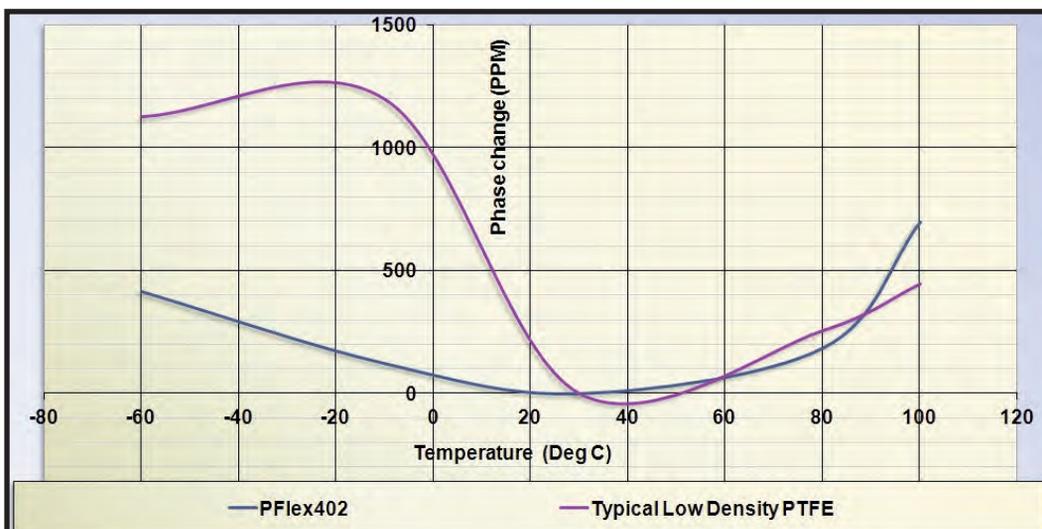
- All Phase Sensitive Systems
- Phase Optimized Flexible Alternative to Semi-Rigid
- All System Platforms  
(Ground, Sea, Airborne, Space)



PhaseTrack PFlex cable assemblies are designed for applications demanding minimal phase change over temperature. PFlex cable assemblies are a flexible interconnect-style cable often used as a semi-rigid replacement. PFlex cables use proprietary TF4™ dielectric that does not have the abrupt shift in phase that occurs with solid or tape wrapped PTFE based products under normal room ambient conditions. PFlex cable uses the same shield construction as Times popular TFlex® cables.

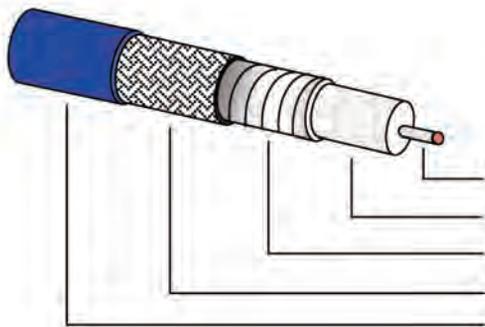
### Features:

- Superior Stability (vs LD PTFE)
- PTFE “Knee” is Nonexistent
- TF4® Dielectric Technology



# PhaseTrack® PFlex

## PhaseTrack® PFlex Construction



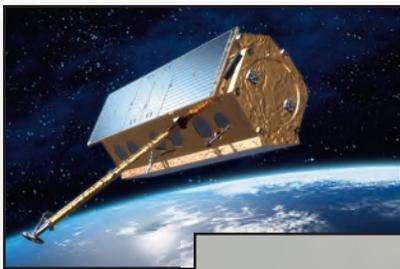
|                  |                            |
|------------------|----------------------------|
| Center Conductor | Silver Plated Copper*      |
| Dielectric       | TMS TF4™ Dielectric        |
| Outer Conductor  | Silver Plated Copper       |
| Outer Shield     | Silver Plated Copper Braid |
| Jacket           | Blue FEP                   |

| Part Number                 | PF047                           | PF405     | PF130                | PF402     |
|-----------------------------|---------------------------------|-----------|----------------------|-----------|
| Dielectric Technology       | TF4™                            | TF4™      | TF4™                 | TF4™      |
| Diameter (in)               | 0.064                           | 0.094     | 0.130                | 0.160     |
| Minimum Bend Radius         | 0.250                           | 0.500     | 0.625                | 0.750     |
| Mass (lbs/1000 feet)        | 4.5                             | 11        | 18                   | 28.0      |
| Temperature Rating          | -55C to + 125C                  |           |                      |           |
| Center Conductor            | Silver Plated Copper Clad Steel |           | Silver Plated Copper |           |
| Outer Conductor             | Silver Plated Copper Strip      |           |                      |           |
| Jacket                      | Blue FEP                        |           |                      |           |
| Characteristic Impedance    | 50 Ohms                         |           |                      |           |
| Velocity of Propagation     | 82.5%                           | 82.5%     | 82.5%                | 82.5%     |
| Cutoff Frequency (GHz)      | 142.3                           | 79.9      | 52.3                 | 38.7      |
| Delay (nS/foot)             | 1.23                            | 1.23      | 1.23                 | 1.23      |
| Capacitance (pF/foot)       | 24.4                            | 24.4      | 24.4                 | 24.4      |
| Shielding                   | -90 dB Minimum                  |           |                      |           |
| Loss @ 6 GHz (db/100 foot)  | 102.74                          | 59.34     | 37.96                | 30.92     |
| Loss @ 18 GHz (db/100 foot) | 185.95                          | 110.16    | 71.61                | 59.36     |
| K1                          | 1.24487                         | 0.69102   | 0.43043              | 0.3399    |
| K2                          | 0.0010516                       | 0.0009697 | 0.00077              | 0.0007645 |

\*PF047 and PF405 use silver plated, copper clad steel as a center conductor.

## *SiO<sub>2</sub> Phase Stable Cable Assemblies*

- *Ultimate in Phase Tracking*
- *All Phase Sensitive Systems*
- *Semi-Rigid Style*
- *Extreme Environments*
- *All System Platforms*  
(Ground, Sea, Airborne and Space)

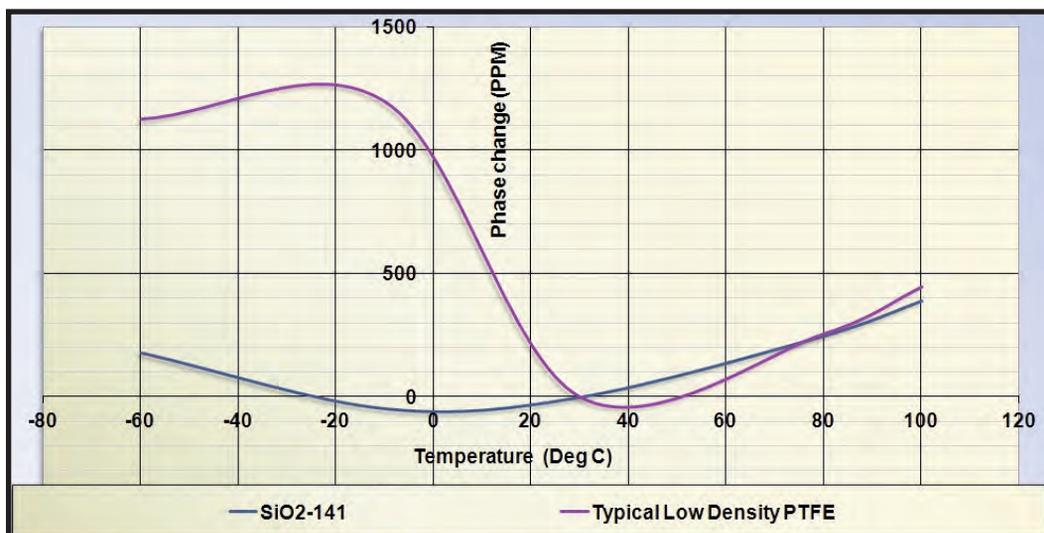


Times SiO<sub>2</sub> cable assemblies are used in applications demanding the ultimate in phase tracking performance. SiO<sub>2</sub> semi-rigid cable assemblies use a proprietary Silicon Dioxide dielectric material allowing use in extreme environments.

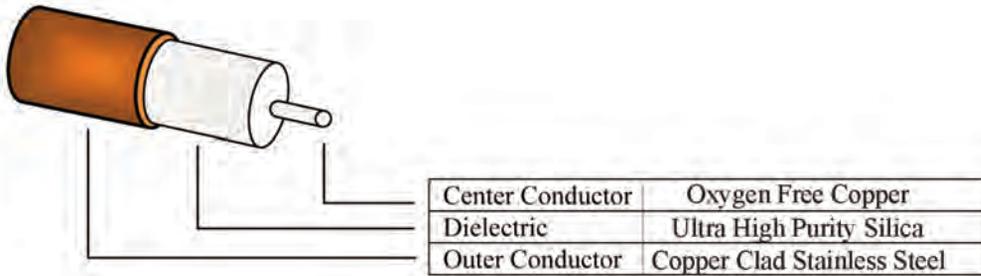
As with other products in the PhaseTrack<sup>®</sup> product line, the dielectric formulation does not have the abrupt shift in phase that occurs with solid or tape wrapped PTFE based products under normal room ambient conditions.

### Features:

- Ultimate Phase Tracking Performance
- PTFE “Knee” is Nonexistent
- SiO<sub>2</sub> Dielectric Technology
- Semi-Rigid Construction
- Withstands Extreme Environments



## SiO2® Construction



| Part Number                 | SiO2-090            | SiO2-141         | SiO2-270               |
|-----------------------------|---------------------|------------------|------------------------|
| Dielectric Technology       | Silica Paste        | Silica Paste     | Silica Paste           |
| Diameter (in)               | 0.090               | 0.141            | 0.270                  |
| Minimum Bend Radius         | 0.360               | 0.564            | 1.080                  |
| Mass (lbs/1000 feet)        | 15.0                | 24.0             | 75.0                   |
| Temperature Rating          | (Available)         | -273C to + 1000C | Standard (-80 to +300) |
| Center Conductor            | Oxygen Free Copper  |                  |                        |
| Outer Conductor             | Oxygen Free Copper  |                  |                        |
| Jacket                      | 304 Stainless Steel |                  |                        |
| Characteristic Impedance    | 50 Ohms             |                  |                        |
| Velocity of Propagation     | 80%                 | 80%              | 80%                    |
| Cutoff Frequency (GHz)      | 60                  | 50               | 18                     |
| Delay (nS/foot)             | 1.27                | 1.27             | 1.27                   |
| Capacitance (pF/foot)       | 25                  | 25               | 25                     |
| Shielding                   | -120 dB Minimum     |                  |                        |
| Loss @ 6 GHz (db/100 foot)  | 41.25               | 27.3             | 14.8                   |
| Loss @ 18 GHz (db/100 foot) | 80.6                | 56.4             | 34.8                   |
| K1                          | 0.439557            | 0.259307         | 0.098031               |
| K2                          | 0.0012              | 0.0012           | 0.0012                 |
| Product Code                | AA9790              | AA9789           | AA9779                 |
| Stock Code                  | 25090               | 25141            | 25270                  |

# PhaseTrack® LS

## Phase Stable Cable Assemblies

- *Low-Smoke Phase-Optimized Flexible Cable*
- *All Phase Sensitive Systems*
- *Low Smoke Formulation*
- *All System Platforms*  
(Ground, Sea, Airborne and space)



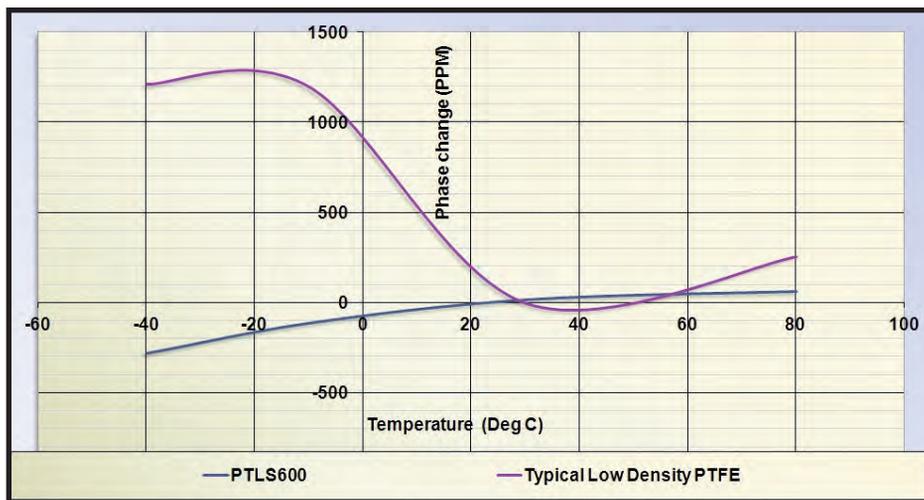
PhaseTrack® LS cable assemblies are designed for applications demanding minimal phase change over temperature.

PhaseTrack® LS cable assemblies are a phase performance optimized version of the Times-exclusive low-loss flexible Low Smoke cables.

PhaseTrack® LS cables use proprietary TF5™ dielectric that does not have the abrupt shift in phase that occurs with solid or tape wrapped PTFE based products under normal room ambient conditions.

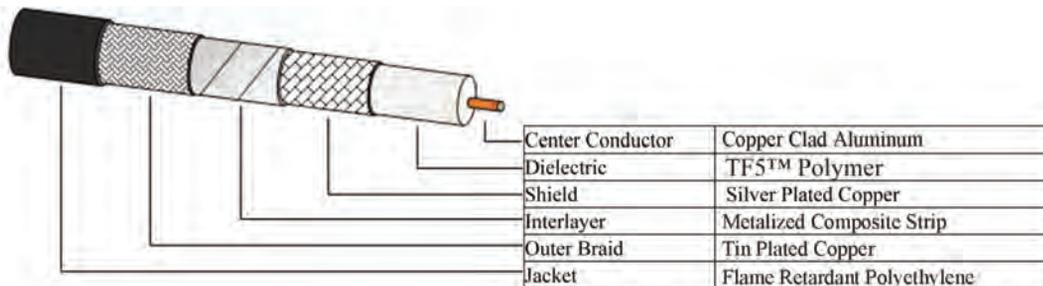
### Features:

- Superior Stability (vs LD PTFE)
- PTFE “Knee” is Nonexistent
- TF5 Dielectric Technology



# PhaseTrack® LS

## PhaseTrack®- LS Construction



| Part Number                 | PTLS400                          | PTLS600      |
|-----------------------------|----------------------------------|--------------|
| Dielectric Technology       | Polymer Foam                     | Polymer Foam |
| Diameter (in)               | 0.400                            | 0.600        |
| Minimum Bend Radius         | 4.000                            | 6.000        |
| Mass (lbs/1000 feet)        | 100.0                            | 160.0        |
| Temperature Rating          | -40C to +85C                     |              |
| Center Conductor            | Copper Clad Aluminum             |              |
| Outer Conductor             | Silver plated Copper Strip Braid |              |
| Jacket                      | Flame Retardant Polyethylene     |              |
| Characteristic Impedance    | 50 Ohms                          |              |
| Velocity of Propagation     | 84.0%                            | 84.0%        |
| Cutoff Frequency (GHz)      | 16.2                             | 10           |
| Delay (nS/foot)             | 1.21                             | 1.21         |
| Capacitance (pF/foot)       | 23.4                             | 23.4         |
| Shielding                   | -90 dB Minimum                   |              |
| Loss @ 6 GHz (db/100 feet)  | 13.2                             | 8.7          |
| Loss @ 10 GHz (db/100 feet) | 17.6                             | 11.3         |
| K1                          | 0.150138                         | 0.092086     |
| K2                          | 0.000262                         | 0.000256     |

Notes:

Notes:

## Our Mission

TIMES MICROWAVE SYSTEMS designs and manufactures high performance RF transmission lines. These products consist of flexible coaxial cable, connectors, accessories and cable assemblies.

We are committed to understanding the needs and requirements of our customers and providing highly engineered, cost effective products.

TIMES MICROWAVE SYSTEMS is dedicated to total customer satisfaction and superior results for our shareholders in all we do.



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