

StabilityPlus™ Microwave/RF Cable Assemblies

DATA SHEET / 2Z-009

THE INDUSTRY'S BEST PHASE
STABLE CABLE ASSEMBLY JUST
GOT BETTER!



MODELS:

- SP-185 // 1.85mm color-coded StabilityPlus™ cables
- SP-24 // 2.4mm color-coded StabilityPlus™ cables
- SP-292 // 2.92mm color-coded StabilityPlus™ cables
- SP-35 // 3.5mm color-coded StabilityPlus™ cables
- SP-N // Type N color-coded StabilityPlus™ cables
- SP-TNCA // TNC-A StabilityPlus™ cables



StabilityPlus™ Microwave/RF Cable Assemblies

SERIES SP-185 , SP-24, SP-292, SP-35, SP-N, AND SP-TNCA

Features and Benefits

- > Industry's best phase phase stability with flexure
- > Amplitude stable with flexure
- > Increased flexibility
- > Reliable and repeatable measurements
- > Longer flex life

Typical Applications

- > Vector network analyzers (VNAs)
- > RF and microwave instruments
- > Bench-top testing
- > RF production testing
- > ATE systems



Description

Maury Microwave's StabilityPlus™ series sets the standard for high-performance ruggedized cable assemblies. Designed specifically for phase-stable and amplitude-stable applications, StabilityPlus™ offers excellent measurement repeatability even after cable flexure. StabilityPlus™ light weight, superior flexibility and small form factor make it ideal for daily use with VNA's, test instruments, bench-top testing and ATE systems.

StabilityPlus™ cable assemblies are now part of the ColorConnect™ family! Following the proposed IEEE high-frequency connector/adaptor color convention, StabilityPlus™ cable assemblies are the first commercially available assemblies to offer clear indications of compatibility and intermatability. ColorConnect™ makes it a simple matter to avoid and eliminate damaged equipment, degraded equipment reliability, degraded performance and lengthy maintenance times due to improper mating (and attempted mating) of incompatible interconnects.

Stability Specifications

| StabilityPlus™ Cable Type | Frequency | Typical Phase Stability with Flexure | Typical Amplitude Stability with Flexure |
|---------------------------|-----------|--------------------------------------|--|
| SP-185 | 67 GHz | ±8° | ±0.15 dB |
| SP-24 | 50 GHz | ±6° | ±0.05 dB |
| SP-292 | 40 GHz | ±4.5° | ±0.05 dB |
| SP-35 | 26.5 GHz | ±3° | ±0.05 dB |
| SP-N | 18 GHz | ±2° | ±0.05 dB |
| SP-TNCA | 18 GHz | ±2° | ±0.05 dB |

Standard Cable Assembly Specifications

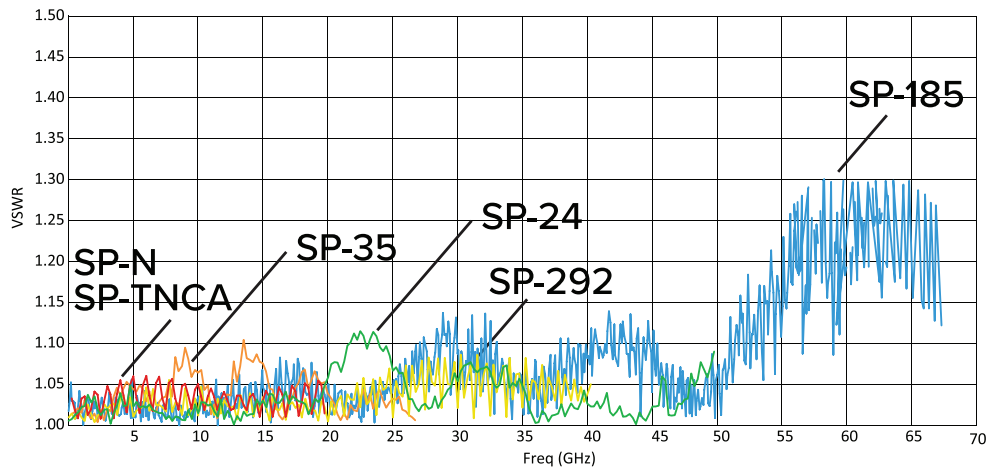
| StabilityPlus™ Cable Type | SP-185 | SP-24 | SP-292 | SP-35 | SP-N | SP-TNCA |
|--|------------------------|---------------|------------|------------|------------|---------|
| Maximum Frequency | 67 GHz | 50 GHz | 40 GHz | 26.5 GHz | 18 GHz | |
| VSWR (typical) | 1.40:1 | 1.30:1 | 1.25:1 | | | |
| Typical Insertion Loss (cable only) | 1.79 dB/ft | 1.00 dB/ft | 0.89 dB/ft | 0.72 dB/ft | 0.61 dB/ft | |
| Impedance (nominal) | 50 ohm | | | | | |
| Phase Stability vs Flexure (typical) | ±8° | ±6° | ±4.5° | ±3° | ±2° | |
| Phase Stability vs Flexure (maximum) | ±14° | ±10.5° | ±8.5° | ±5.5° | ±4.2° | |
| Amplitude Stability vs Flexure (typical) | ±0.15 dB | ±0.05 dB | | | | |
| Amplitude Stability vs Flexure (maximum) | ±0.20 dB | ±0.10 dB | | | | |
| Phase Stability vs Temp | <4°/m/GHz (-55°+105°C) | | | | | |
| Velocity of Propagation | 74% (nominal) | 76% (nominal) | | | | |
| Shielding Effectiveness | >100 dB (DC - 18 GHz) | | | | | |
| Time Delay (nominal) | 1.34 ns/ft (4.5 ns/m) | | | | | |

Mechanical / Environmental Properties

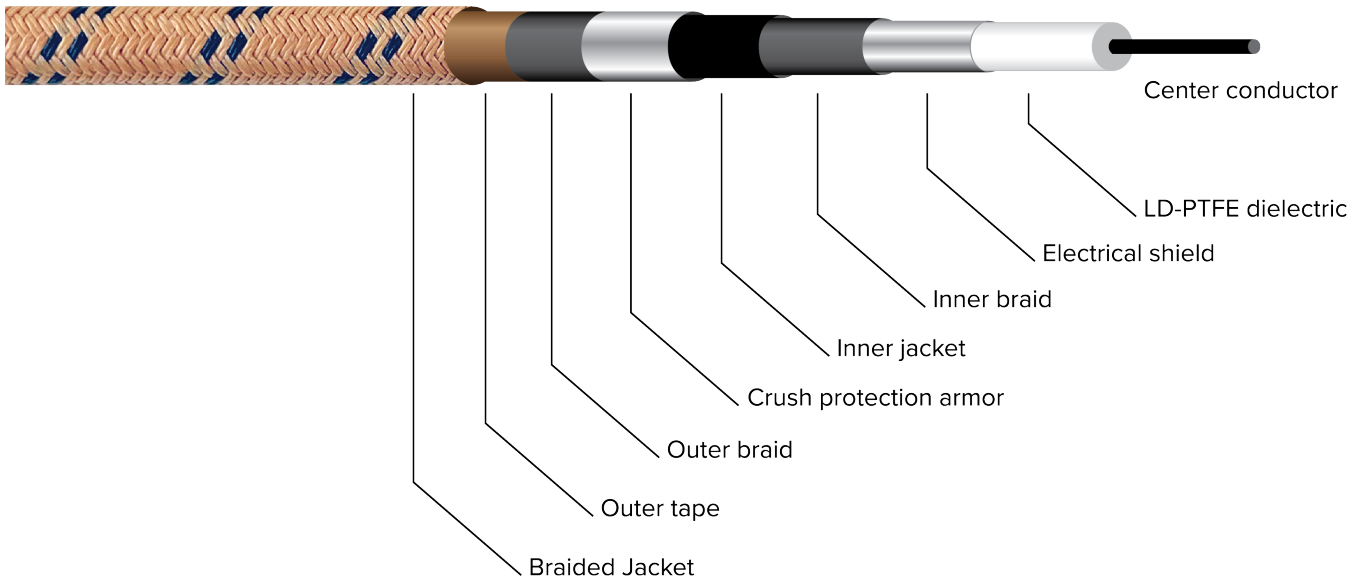
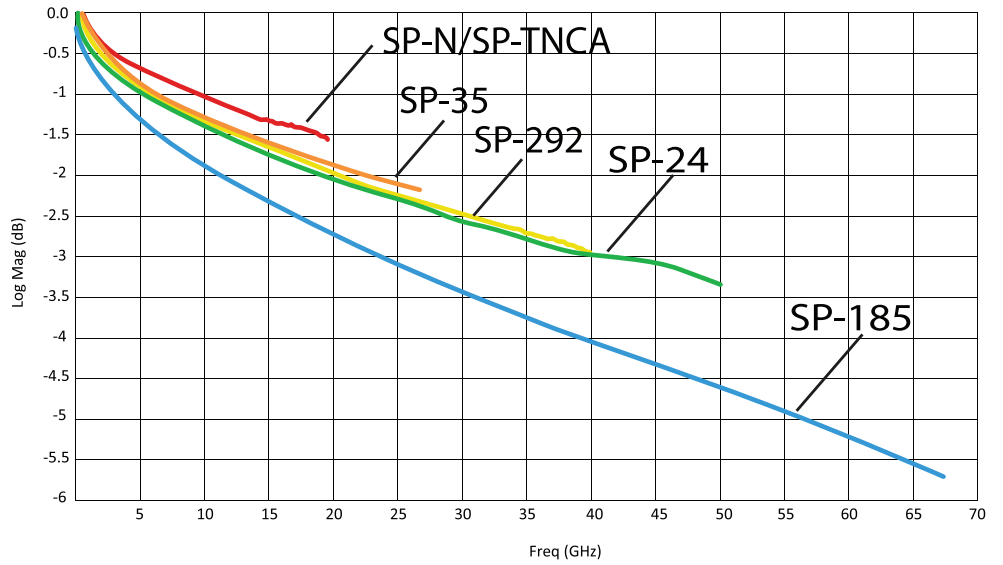
| StabilityPlus™ Cable Type | SP-185 | SP-24, SP-292, SP-35 | SP-N | SP-TNCA |
|--|---------------------------------|-------------------------|--------------|------------------|
| Center Conductor Material | Silver Plated Copper | | | |
| Maximum Outer Diameter (Connector) | 0.42 in (10.7mm) | 0.49 in (12.5mm) | 0.870 (22mm) | 0.64in (16.25mm) |
| Maximum Outer Diameter (Cable) | 0.2 in. (5mm) | 0.25 in (6.35mm) | | |
| Nominal Weight | 0.677 oz/ft (63g/m) | 0.97 oz/ft (90g/m) | | |
| Min. Static Bend Radius/ Min. Dynamic Bend Radius | 1.0 in (25.4mm)/2.0 in (50.8mm) | | | |
| Flex Life Cycles | >15,000 | | | |
| Connector Mating Cycles | >5,000 | | | |
| Crush Resistance | >254 lbf/in (44 kgf/cm) | >305 lbf/in (54 kgf/cm) | | |
| Operating Temperature Range | -67°F to 221°F (-55°C to 105°C) | | | |
| RoHS/REACH | Yes | | | |

Maury StabilityPlus™ Cable Assembly Typical Performance

Maury StabilityPlus™
36" Cable Assembly
Typical VSWR



Maury StabilityPlus™ 36"
Cable Assembly Typical
Insertion Loss



Max Insertion Loss/Attenuation

(1:1 VSWR, 25 C, Sea Level, Cable Only)

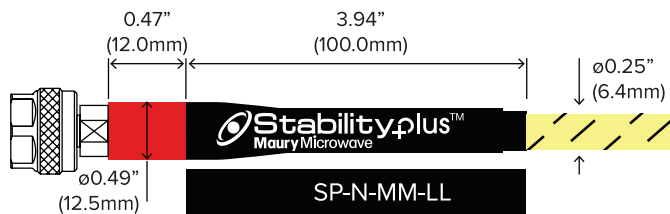
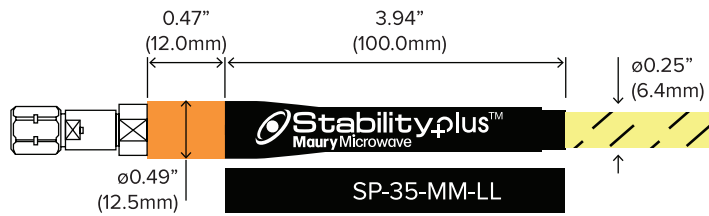
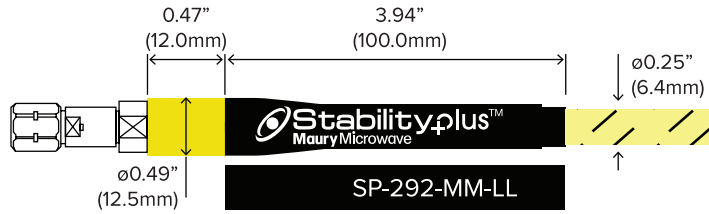
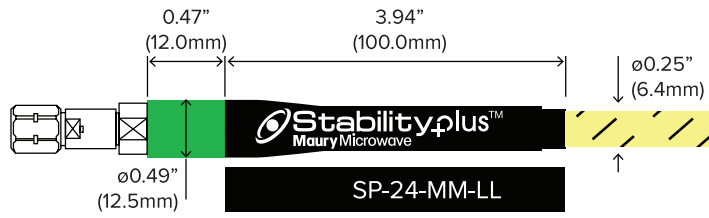
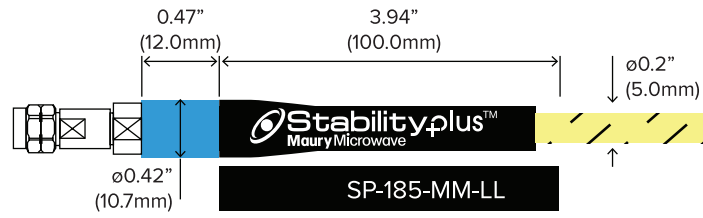
| Freq (GHz) | SP-185 (dB/100 ft) | SP-24 (dB/100 ft) | SP-292 (dB/100 ft) | SP-35 (dB/100 ft) | SP-N/SP-TNCA (dB/100 ft) |
|------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------------|
| 1 | 19.20 | 13.3 | 13.3 | 13.3 | 13.3 |
| 2 | 27.37 | 19.00 | 19.00 | 19.00 | 19.00 |
| 4 | 39.14 | 27.00 | 27.00 | 27.00 | 27.00 |
| 6 | 48.35 | 33.20 | 33.20 | 33.20 | 33.20 |
| 8 | 56.23 | 38.40 | 38.40 | 38.40 | 38.40 |
| 12 | 69.70 | 47.40 | 47.40 | 47.40 | 47.40 |
| 18 | 86.57 | 58.50 | 58.50 | 58.50 | 58.50 |
| 26.5 | 106.77 | 71.60 | 71.60 | 71.60 | — |
| 40 | 133.94 | 88.90 | 88.90 | — | — |
| 50 | 151.70 | 100.10 | — | — | — |
| 67 | 179.00 | — | — | — | — |

Average Power Handling

(1:1 VSWR, 25 C, Sea Level, Cable Only)

| Freq (GHz) | SP-185 Watts (Max) | SP-24 Watts (Max) | SP-292 Watts (Max) | SP-35 Watts (Max) | SP-N/SP-TNCA Watts (Max) |
|------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------------|
| 1 | 271 | 409 | 409 | 409 | 409 |
| 2 | 190 | 288 | 288 | 288 | 288 |
| 4 | 133 | 202 | 202 | 202 | 202 |
| 6 | 108 | 165 | 165 | 165 | 165 |
| 8 | 93 | 142 | 142 | 142 | 142 |
| 12 | 75 | 115 | 115 | 115 | 115 |
| 18 | 60 | 93 | 93 | 93 | 93 |
| 26.5 | 49 | 76 | 76 | 76 | — |
| 40 | 39 | 61 | 61 | — | — |
| 50 | 34 | 55 | — | — | — |
| 67 | 29 | — | — | — | — |

StabilityPlus™
Dimensions

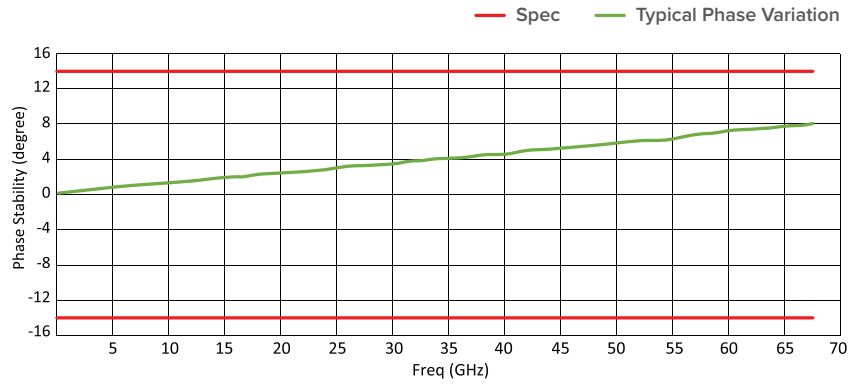


Phase Stability

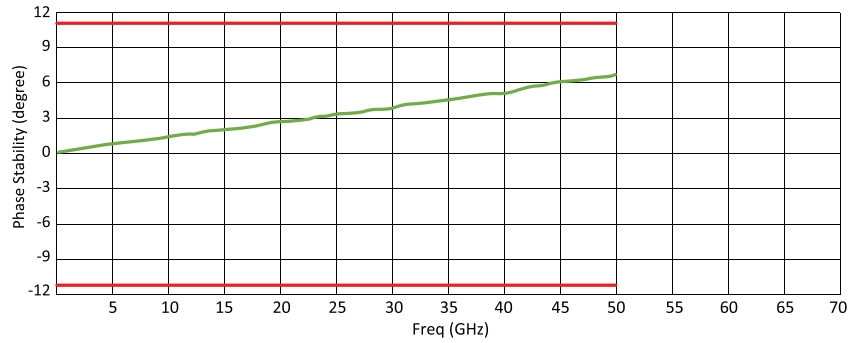
The maximum value for phase and amplitude stability was established using the following method. The cable was terminated with a short. With the cable in a straight position the VNA was normalized. The cable was then coiled 360° around a mandrel 4 inches in diameter counter-clockwise and held in position for one sweep. The maximum deviation over the frequency range was recorded. The cable was then coiled 360° around the mandrel clockwise and held in position for one sweep and the maximum deviation was recorded. The cable was then returned to its original position for one sweep and the maximum deviation was recorded.

The plots on the right show the recorded worst-case phase variation.

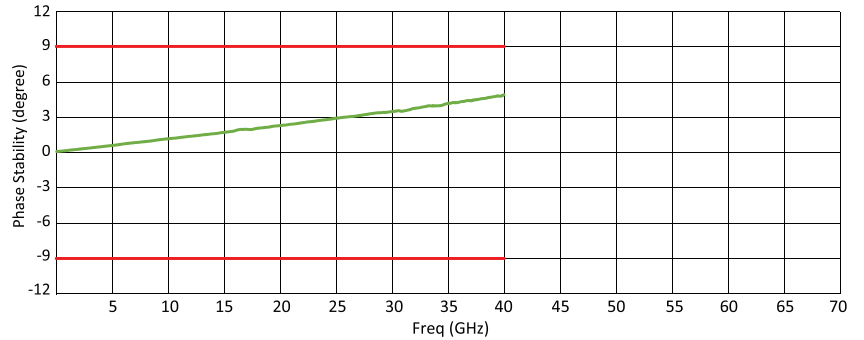
Exemplary data for
SP-185-MM-36



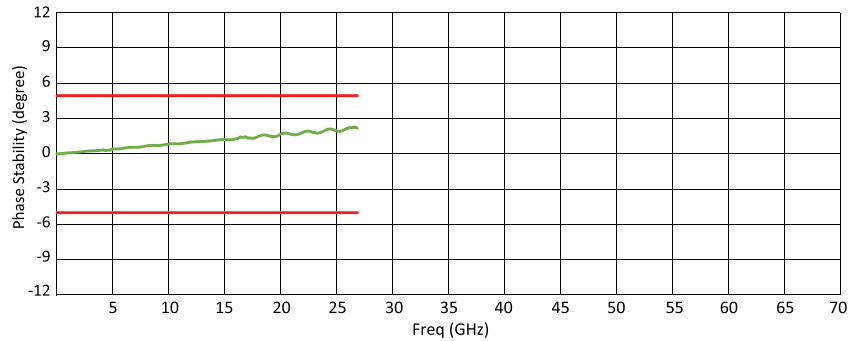
Exemplary data for
SP-24-MM-36



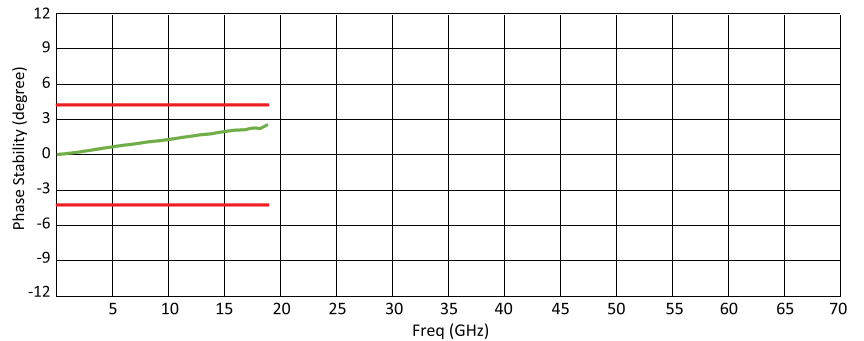
Exemplary data for
SP-292-MM-36



Exemplary data for
SP-35-MM-36



Exemplary data for
SP-N-MM-36/
SP-TNCA-MM-36



S-parameter measurements with uncertainty

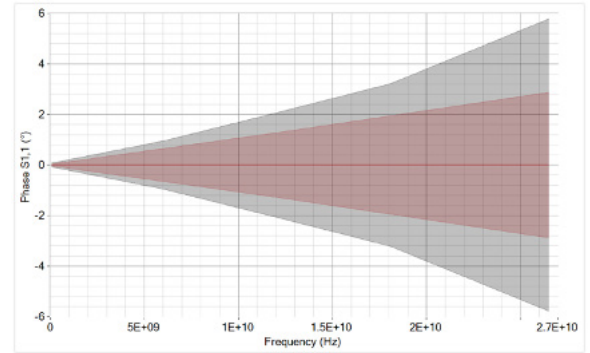
A cable's *phase stability with flexure* specification is a metric used to communicate the impact of cable movement on a DUT measurement. It implies that lower specifications lessen the impact on the measurement (i.e. a cable with a 2° phase stability with flexure specification will have a lesser impact on a measurement than a cable with a 5° phase stability). However, the methods used to determine this specification may not be consistent across manufacturers, and likely do not represent the actual cable movement range of a user.

A better metric to understand a cable's impact on a DUT measurement is "uncertainty contribution". The cable's impact on measurement uncertainty can be calculated by moving the cable through a user's actual range of motion and recording the S-parameters across the movement. This technique has been thoroughly documented by the European Association of National Metrology Institutes (EURAMET)* and has been made commercially available in Maury's Insight™** calibration and measurement software platform.

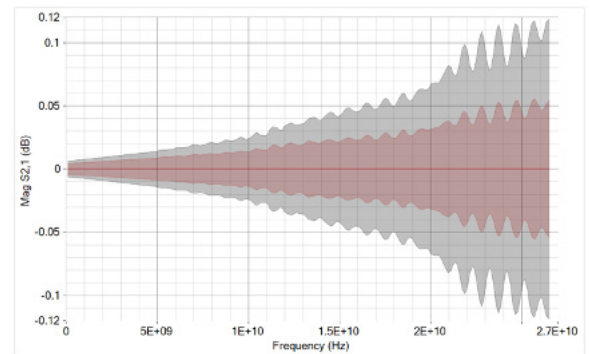
The plots on the right show typical S-parameter measurements with uncertainty boundaries on different types of DUTs. The boundaries shown only consider the cable's direct contribution on measurement uncertainty.

* <https://www.maurymw.com/pdf/I-CAL-GUI-012.pdf>

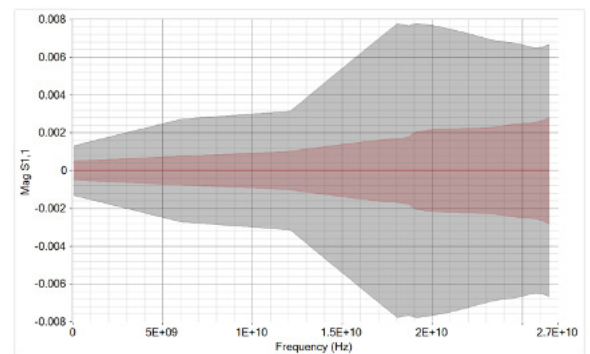
** https://www.maurymw.com/Precision/Insight_Software.php



*S11_phase measured on a short circuit termination
SP-35-MM-36 shown in red; leading global
competitor shown in grey*



*S21_mag measured on an airline
SP-35-MM-36 shown in red; leading global
competitor shown in grey*

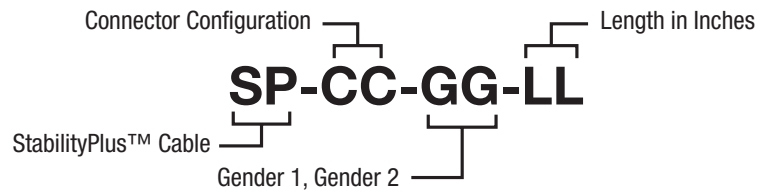


*S11_mag measured on a 50Ω termination
SP-35-MM-36 shown in red; leading global
competitor shown in grey*



Ordering Instructions for StabilityPlus™ Cable Assemblies

Standard StabilityPlus™ Cable Assemblies



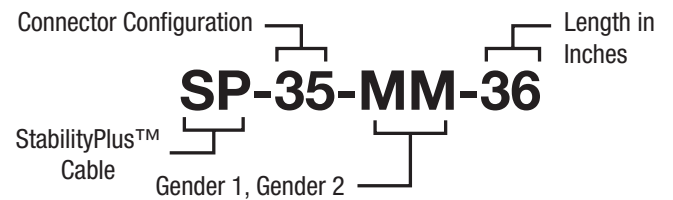
| CC | GG | LL (Standard Lengths) |
|--------------|-----------------------|-----------------------|
| TNCA | | |
| N (Type N)* | | 24 |
| 35 (3.5mm) | MM (Male To Male) | 36 |
| 292 (2.92mm) | MF (Male to Female) | 48 |
| 24 (2.4mm) | FF (Female To Female) | 60 |
| 185 (1.85mm) | | 78 |

* Type N available in male only.

EXAMPLE:

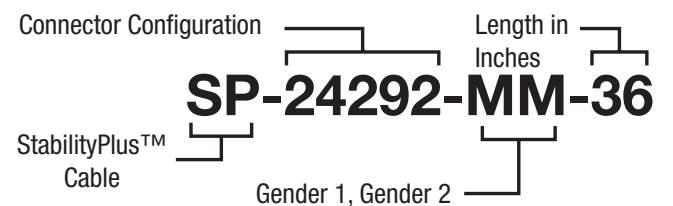
The following is a StabilityPlus™ cable assembly with 3.5mm male connectors on both ends, and 36 inches overall length.

Configuration Sample



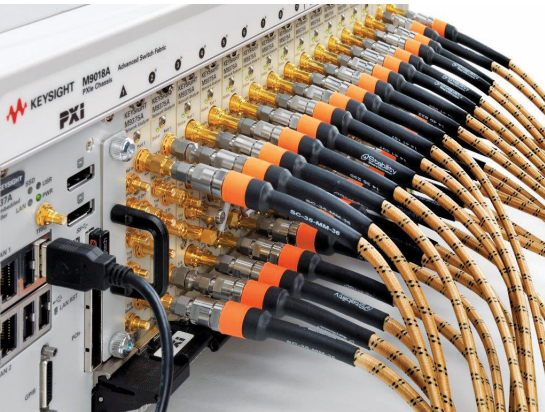
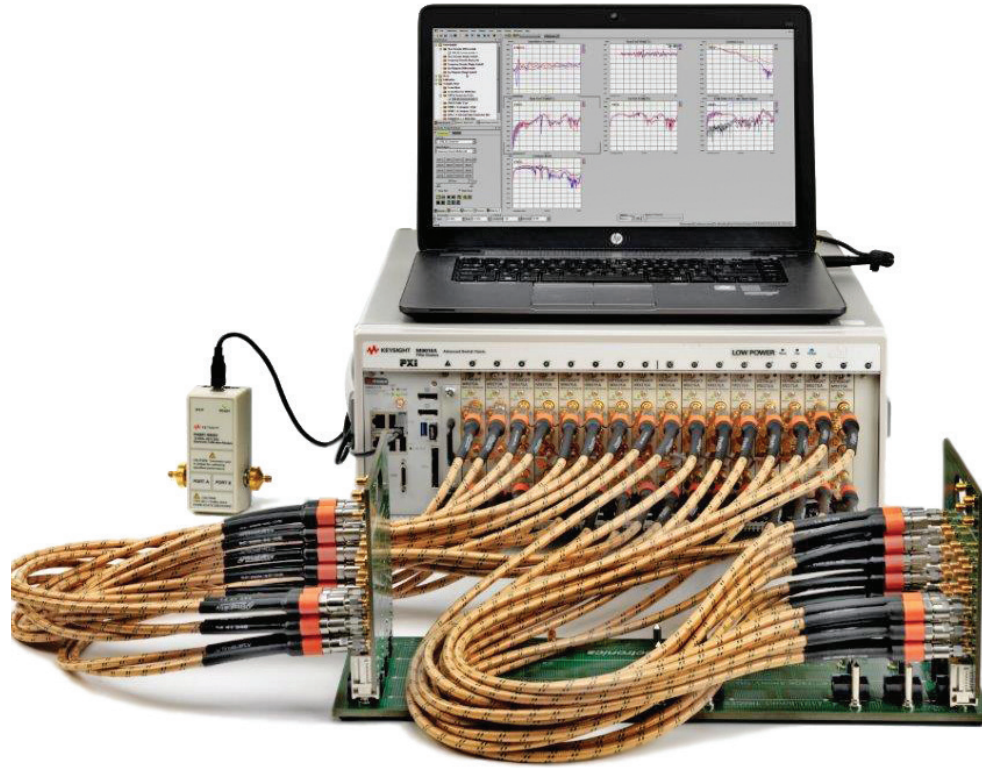
EXAMPLE:

The following is a StabilityPlus™ cable assembly with 2.4mm male connector on one end and 2.92mm male connector on the other end, and 36 inches overall length.



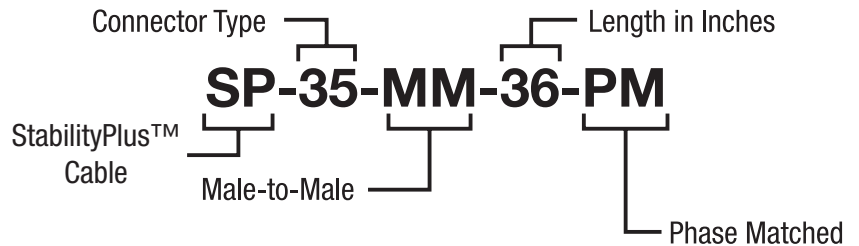
StabilityPlus™ Phase-Matched (PM) Cable Assembly Sets

StabilityPlus™ Phase-Matched Cable Assemblies have been designed for applications where strict phase equality between multiple paths are required. StabilityPlus™ PM Cable Assemblies are matched within $\pm 0.5^\circ/\text{GHz}$ and available as sets of two or more assemblies. StabilityPlus™ PM Cable Assemblies are offered in both standard and low-profile formats and maintain the mechanical and electrical characteristics of the original assembly. Phase-matched assemblies are available with 1.85mm, 2.4mm, 2.92mm, 3.5mm and Type-N connectors and in all lengths.



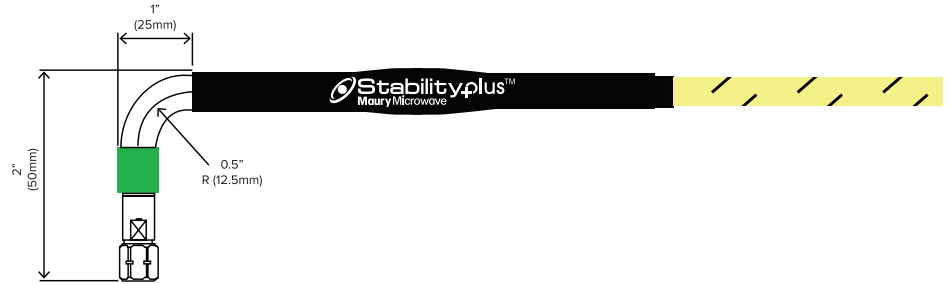
Ordering Instructions for StabilityPlus™ Phase-Matched (PM) Cable Assembly Sets

To specify a StabilityPlus™ Phase-Matched Cable Assembly set, add "PM" at the end of the SP model number, as shown in the example below. "PM" indicates standard configuration Phase-Matched sets.



StabilityPlus™ Cable Assemblies — Swept Right-Angle

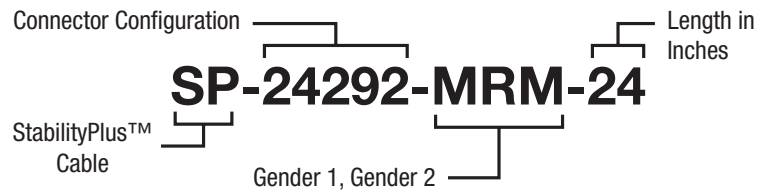
StabilityPlus™ Cable Assemblies with swept right-angle connectors are designed for applications requiring a fixed and stable bend where traditional cable assemblies may be inconvenient. With a bend radius of 0.5 inches and a cable-to-connector length of 2 inches, right-angle connectors allow StabilityPlus™ Cable Assemblies to retain the electrical and mechanical specifications of the traditional assembly while removing stresses related to hand-formed bends. StabilityPlus™ assemblies with swept right-angle connectors are built on demand and are available with 1.85mm, 2.4mm, 2.92mm, 3.5mm and Type-N connectors.



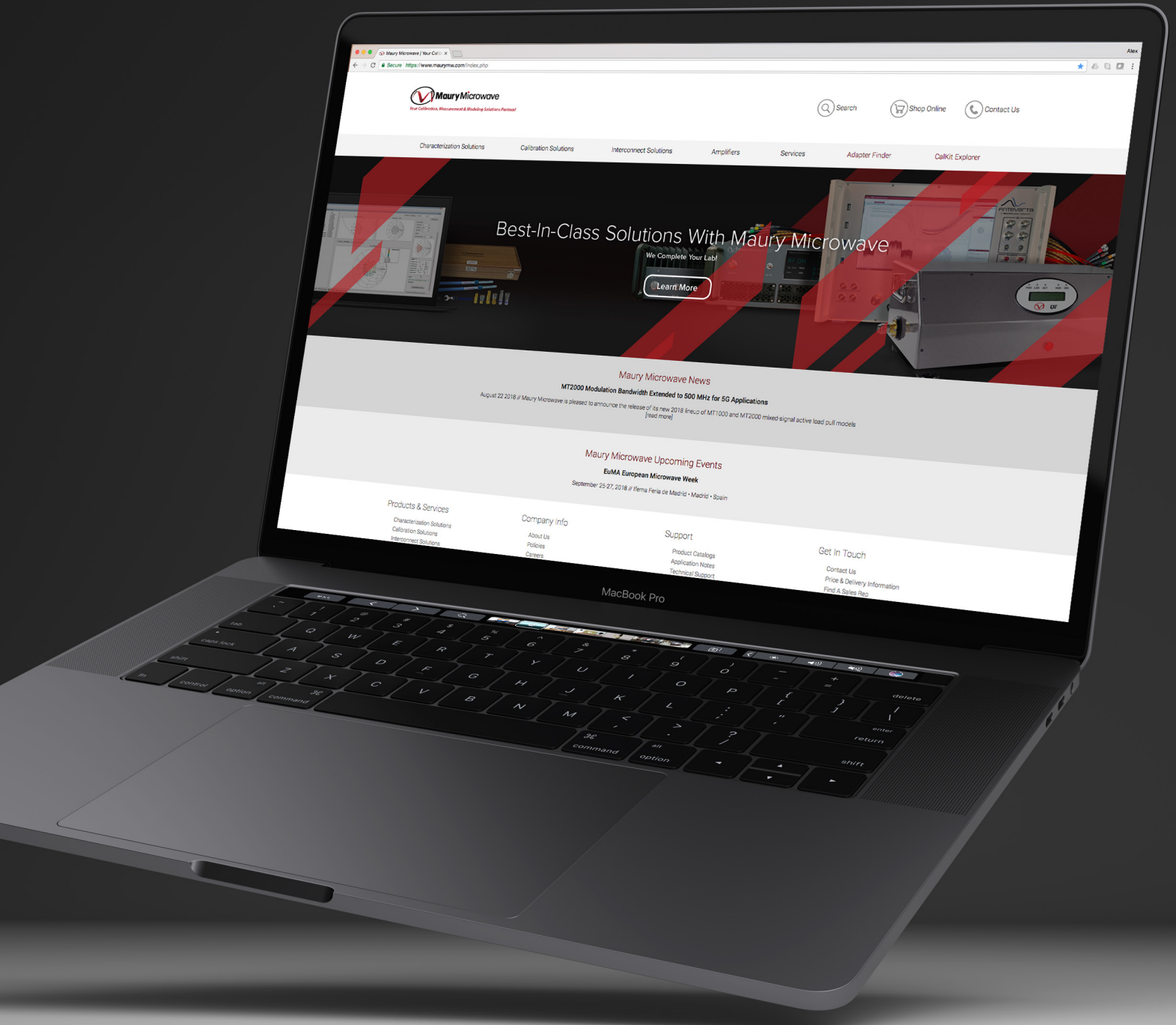
| CC | G | LL |
|--|--|---------------|
| TNCA N (Type N) 35 (3.5mm) 292 (2.92mm) 24 (2.4mm) 185 (1.85mm) | M (Male) MR (Male swept right-angle) F (Female) FR (Female swept right-angle) | Custom length |

Example:

The following is a StabilityPlus™ cable assembly with one 2.92mm male connector and one 2.4mm male swept right-angle connector, and 24 inches overall length.



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OUR PRODUCTS



www.maurymw.com



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