

# Test+Measurement

Edition 2019/08



# Be precise



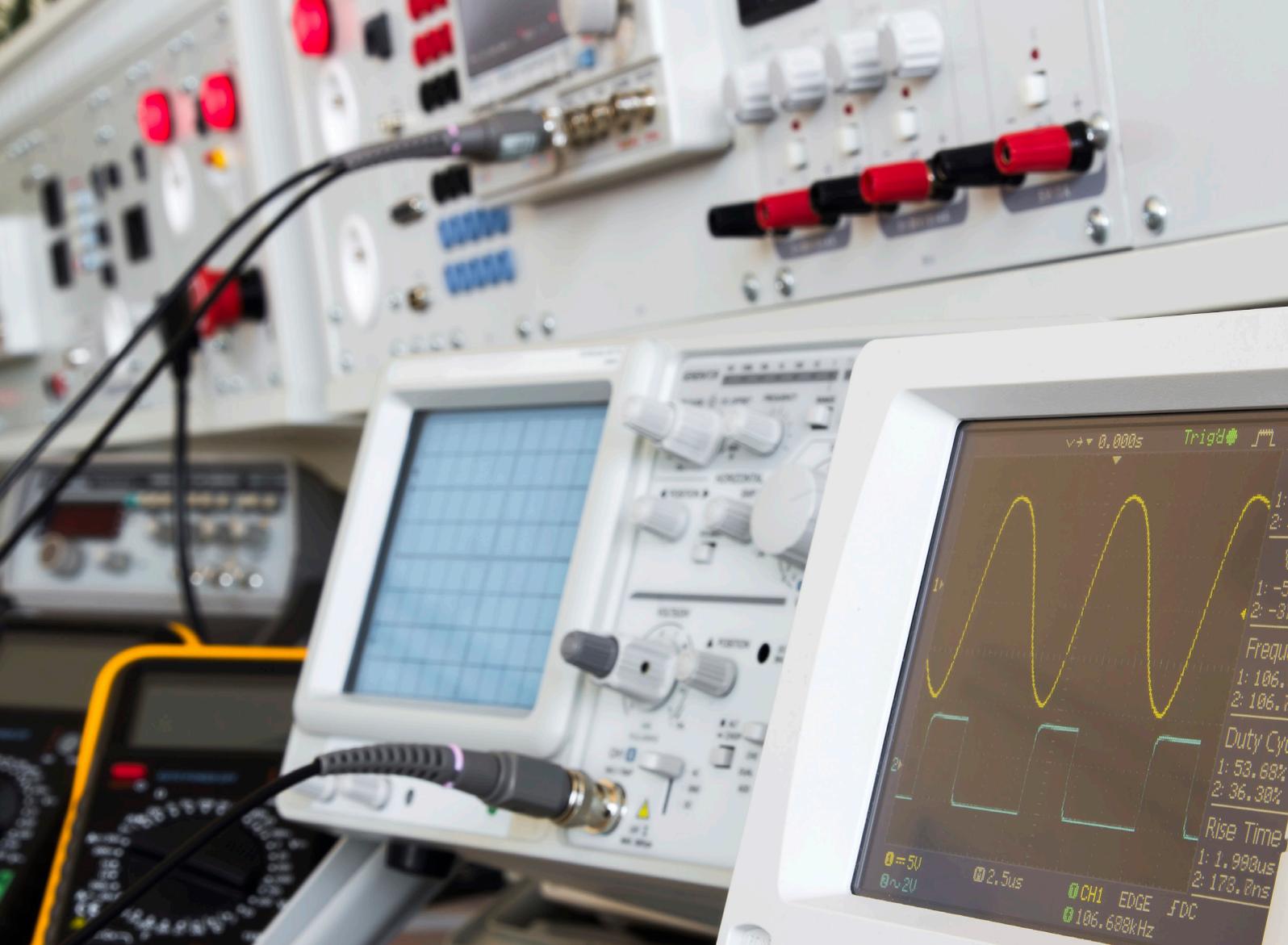


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#### Solutions and services for Test+Measurement

The best measurement setup is only as good as its weakest link. To obtain reliable and reproduceable measurement results, particular care must be taken in selecting the components required for the measurement setup.

HUBER+SUHNER's extensive range of high quality components are matched to the various needs in the field of test and measurement. All these products are distinguished by their high performance and stable characteristics - the result of years of experience in the development and production of radio frequency components.



## Test+Measurement equipment

Electronic test equipment has the main function of creating signals and capturing responses from electronic devices under test (DUT). In this way, the proper operation of the DUT can be proven and faults in the devices performance can be detected and corrected.

The HUBER+SUHNER cost-effective product line-up for your test equipment always helps you to achieve highest precision and reliability. Whether you're developing or producing equipment to test active or passive devices, the right mix of quality, performance and reliability gives you an edge.

### Applications

- Network analyzers
- PXI
- Oscilloscopes
- Handhelds

## Semi-rigid



Semi-rigid cables are available as formed assemblies. The cable provides greatly extended environmental parameters. It exhibits highly favourable electrical characteristics, particularly an impedance tolerance as low as  $0.5 \Omega$  for a 0.141" diameter cable, with nominal impedance of  $50 \Omega$ .

## Sucoform



Sucoform cables are applicable up to 40 GHz and have distinct mechanical advantages in comparison to semi-rigid cables. A tin-soaked copper braid for the outer conductor gives them outstanding hand-formability and therefore combines the excellent characteristics of semi-rigid cables with those of flexible coaxial cables.

## Minibend



The minibend family is a truly flexible, high performance alternative to semi-rigid cable assemblies, that eliminate the need for predefined custom lengths and bend configurations. The minibend family provides you with a preassembled and tested high performance, cost-effective alternative in a variety of standard lengths and connector configurations.

- Solderless, bend-to-the-end junction
- Triple shielded for high isolation
- Eliminates need for costly right angle connectors
- Direct replacement for semi-rigid cables

## Minibend CT



The minibend CTR family of cable assemblies combines the industry-renowned flexibility of bend-to-the-end connector termination technology with industry leading phase vs. temperature performance to create a stable, reliable, MIL-DTL-17 qualified interconnect solution to satisfy an endless range of customer applications where phase stability is key.

- Increased system accuracy over temperature change
- More reliable connectors due to solderless junctions

## RF cables – Performance line



The HUBER+SUHNER "Performance line" contains RG and Enviroflex RF cables, which are designed for high performance applications. While the RG series provides a wide temperature range, Enviroflex offers a halogen free and environmental friendly alternative. The product line is available with a comprehensive connector portfolio which results in individual and flexible cable assembly solutions.

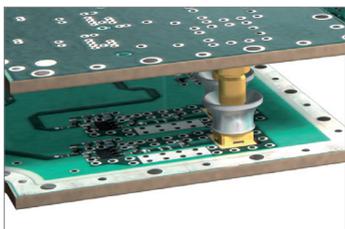
- Wide temperature range
- High performance
- RG standard

## Connectors



HUBER+SUHNER is a leading global provider of radio-frequency connectors for the transmission of analogue and digital signals and has many years of experience in the engineering and production of coaxial connectors. In addition to a broad selection of standard connectors for a wide range of different applications, customer-specific solutions are also developed and manufactured.

## Board-to-board connectors: MBX, MMBX



HUBER+SUHNER MBX and MMBX connectors are specifically developed for board-to-board and board-to-module RF interconnections. The outstanding mechanical design allows for mechanical misalignment in radial and axial directions while still maintaining excellent electrical performance.

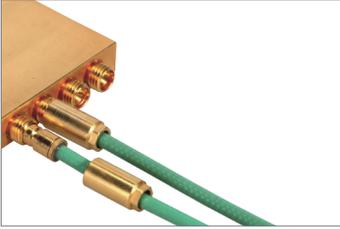
- Lower total cost of ownership
- Miniaturization
- Higher output power
- Reliable connection

## Series MMPX – 65 GHz/80 Gbps snap-on connectors



The MMPX snap-on connector family is the most ideal coaxial-to-PCB system solution for operating frequencies up to 65 GHz and data rates up to 80 Gbps. The comprehensive product range consists of cable connectors and assemblies. PCB connectors and adaptors to open standards are available as well. MMPX connectors feature excellent electrical performance at smallest mechanical dimensions. The broadband characteristics, small size and outstanding performance permit new solutions for applications in numerous markets such as high speed digital and radio frequency testing (60 GHz WPAN), industrial, mobile communications, space and defense.

## SMPM-T



The SMPM-T is the smallest threaded open source connector on the market. Its unique and innovative combination of a MIL-STD-348 SMPM female interface connector with a retractable threaded nut provides an integrated solution that offers unprecedented electrical and mechanical performance. The SMPM-T handles high density requirements with a connector centerline-to-centerline spacing of just 5 mm (0.20 in) while offering unmatched electrical stability at frequencies up to 65 GHz in even the harshest operating environments (> 12 000 shock).

## Adaptors

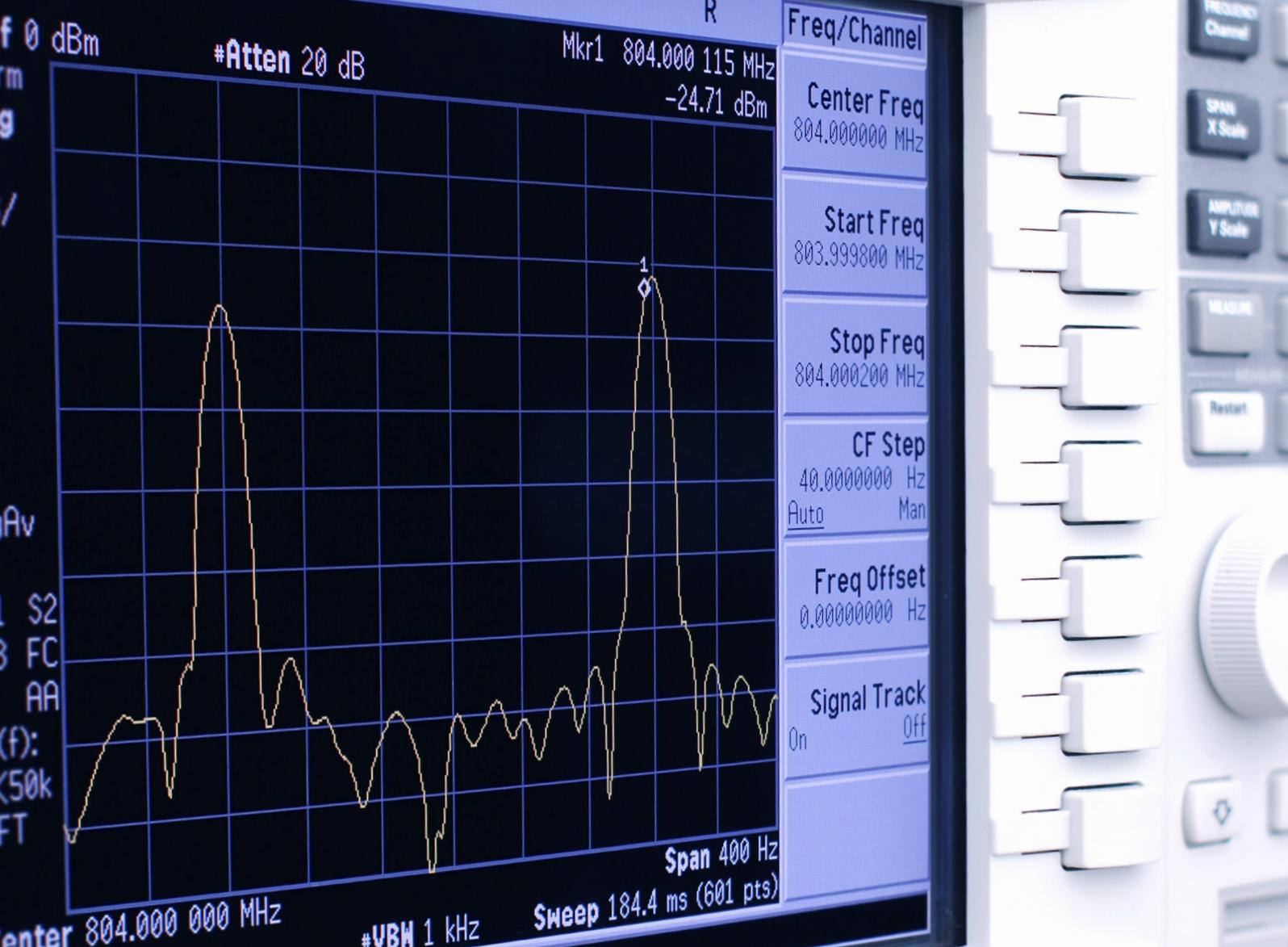


HUBER+SUHNER manufactures a wide range of adaptors to realise transitions from one interface style to another. Our RF adaptor assortment covers all commercially available RF interfaces, gender configurations, frequency requirement, and return loss specification. Any RF coaxial adaptor can be modified to fit specific applications.

## System solutions



HUBER+SUHNER Radio Frequency is committed to delivering more value to our customers. To this end, we have created a new organisation focused on the development and production of RF systems. The RF systems business organisation is quickly developing into a hub for hybrid assemblies, multi-product configurations, and black box solutions (especially RF-over-Fiber). The sub-systems area, which includes the hybrid assemblies and multi-product configurations, is proving to add significant value for our customers. HUBER+SUHNER is now able to provide complete models, which simplifies both the customer's supply chain and the system integration activities.



## Lab testing

Any research and development, test, or quality assurance department that works with RF signals is relying on precise and repeatable measurements. Since the quality of a test configuration is only as strong as the weakest link, HUBER+SUHNER offers a wide range of supreme flexible and rugged cable assemblies with excellent amplitude and phase stability and high-precision connectors, as well as terminations and adaptors. These state of the art reliability guarantees reduced equipment downtime, which is an economical advantage for testing in laboratories.

## SUCOFLEX® 500



When it comes to test and measurement, SUCOFLEX 500 assemblies guarantee the highest level of satisfaction

- Torque, crush and kink resistant
- Precise and repeatable measurements
- Long service life
- Reduce total cost of test with durable, reliable performance
- Increased test and measurement efficiency saving costs due to reduced calibration intervals

## SUCOFLEX® 100



SUCOFLEX 100 series flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications. This series provides optimal performance up to 50 GHz, where stringent electrical requirements – in particular stability and low loss – are important.

- Maintaining stable electrical characteristics when exposed to bending and temperature
- Can be provided with various ruggedisations to protect the assembly against different environmental influences
- Mechanical and climate resistance properties surpass those of standard flexible cables

## Sucotest 18 – the highest standard of measurement



Sucotest 18 is ideal for daily use in component and assembly shops, test labs and high speed digital testing applications. Sucotest 18A armoured test assemblies are ideal for testing wireless communication infrastructures and outdoor use.

- Low insertion loss
- Exceptional loss stability
- Excellent return loss
- No spring back effect

## Precision adaptors



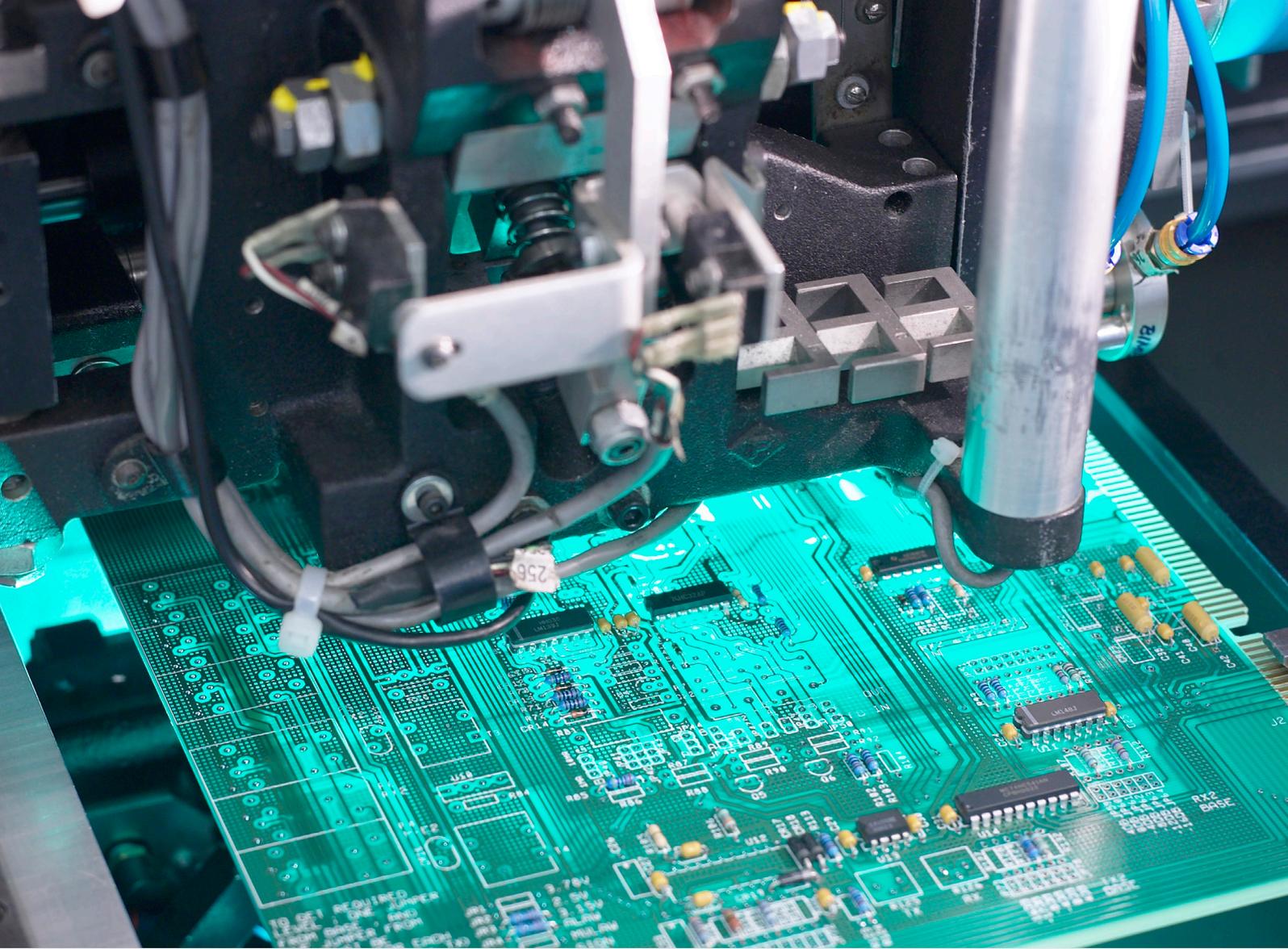
HUBER+SUHNER manufactures a wide range of standard and high-performance adaptors that are ideal for lab and production test applications where measurement accuracy, repeatability, and optimum electrical performance are critical.

- Precision interfaces
- Excellent electrical performance
- Premium base materials and platings
- For precision laboratory measurements
- High repeatability and accuracy

## Attenuators, terminations and DC blocks



The comprehensive range of high-quality radio frequency attenuators, terminations, and DC blocks is based around the varying needs of test and measurement applications.



## Factory testing

In a factory environment the improvement of the overall efficiency in the supply chain is the main criteria. High repeatability, longer service life, and efficient usage are features of our HUBER+SUHNER factory test portfolio, which helps to decrease total operating costs through reduced replacement, retesting, and recalibration.

## TL-8A



HUBER+SUHNER TL-8A assemblies are designed for testing components or equipment up to 8 GHz with network analyzers (NA). This economical assembly family is made with a PE foamed double screened cable and protected with an armouring using a moulded cable entry. The excellent electrical performance combined with a high mechanical endurance is ideal for the use in test labs and in operations.

- High mechanical endurance
- Excellent insertion and return loss
- High mating cycle
- N connector with quick-lock nut

## Sucotest 18 – the highest standard of measurement



Sucotest 18 is ideal for daily use in component and assembly shops, test labs, and high speed digital testing applications. Sucotest 18A armoured test assemblies are ideal for testing wireless communication infrastructures and outdoor use.

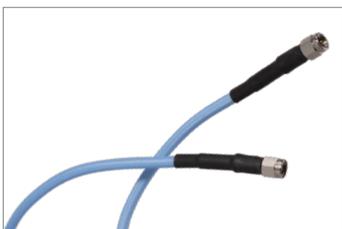
### Sucotest 18 test assemblies

- Low insertion loss
- Exceptional loss stability
- Excellent return loss

### Sucotest 18 (A) armoured test assemblies

- Excellent durability
- Excellent return loss
- High flexibility

## Sucotest 26/Sucotest 40



Sucotest 26/Sucotest 40 cable assemblies are high frequency, low loss cables which are five shielded for superior RF isolation. The internal stainless steel outer braid provides higher pull strength and lighter weight than RG style cable. Nomex and polyolefin jackets are also available:

- Amplitude stability: < 0.1 dB at 26.5 GHz for 200 flexes 180° in one plane around a 2" radius, 0.2 dB with 600 flexes
- Five shields for super RF shielding (-120 dB)
- Steel outer shield for high pull strength

## SUCOFLEX 100



SUCOFLEX 100 series flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications. This series provides optimal performance up to 50 GHz, where stringent electrical requirements – in particular stability and low loss – are important.

- Maintaining stable electrical characteristics when exposed to bending and temperature
- Can be provided with various ruggedisations to protect the assembly against different environmental influences
- Mechanical and climate resistance properties surpass those of standard flexible cables

## Standard and precision adaptors



HUBER+SUHNER manufactures a wide range of standard and high-performance adaptors that are ideal for lab and production test applications, where measurement accuracy, repeatability and optimum electrical performance are critical.

- De-embedding
- Phase matched adaptors



## Network testing

### Passive IM field and lab testing

In modern RF wireless installations the network performance has become more crucial than ever before. All failures related to component, wireless interference or incorrect installation or maintenance will need to be averted before they occur in order to deliver the ultimate subscriber experience and at the same time avoid costly downtime of your networks and time-consuming work to fix the problem by your field techs.

HUBER+SUHNER has a wide range of products to help you perform in-advance cable and antenna analysis, run interference detection test (distance to failure), monitor and verify network signals and run transmitter/receiver tests.

## Sucotest 18 – the highest standard of measurement



Sucotest 18 is ideal for daily use in component and assembly shops, test labs, and high speed digital testing applications. Sucotest 18A armoured test assemblies are ideal for testing wireless communication infrastructures and outdoor use.

## TL-P – high flexible PIM test lead



HUBER+SUHNER TL-P assemblies are designed for indoor and outdoor applications where passive intermodulation (PIM) and return loss (RL) has to be tested. Its excellent PIM and RL performance makes this product line unique on the market and a perfect component for the use in Test+Measurement applications. TL-P is based on a flexible cable which is optimized up to 4 GHz and protected with a steel armouring. The robust design is completed with a moulded protection between connector and cable.

## Low passive intermodulation adaptors



These low intermodulation adaptors have been specifically developed for applications in intermodulation test set-ups. They are made of non magnetic materials using a minimum number of piece parts to minimize intermodulation sources.

- Outstanding intermodulation performance
- Non magnetic materials
- Excellent electrical contacts
- Reliable and repeatable intermodulation measurements

## Low passive intermodulation load



HUBER+SUHNER offers high performance intermodulation loads for test+measurement in multicarrier high RF power radio applications. They are primarily used to terminate transmission lines in PIM sensitive applications such as an open port of a hybrid coupler. These intermodulation loads are made by using high performance material, especially selected to obtain the best PIM and VSWR results.

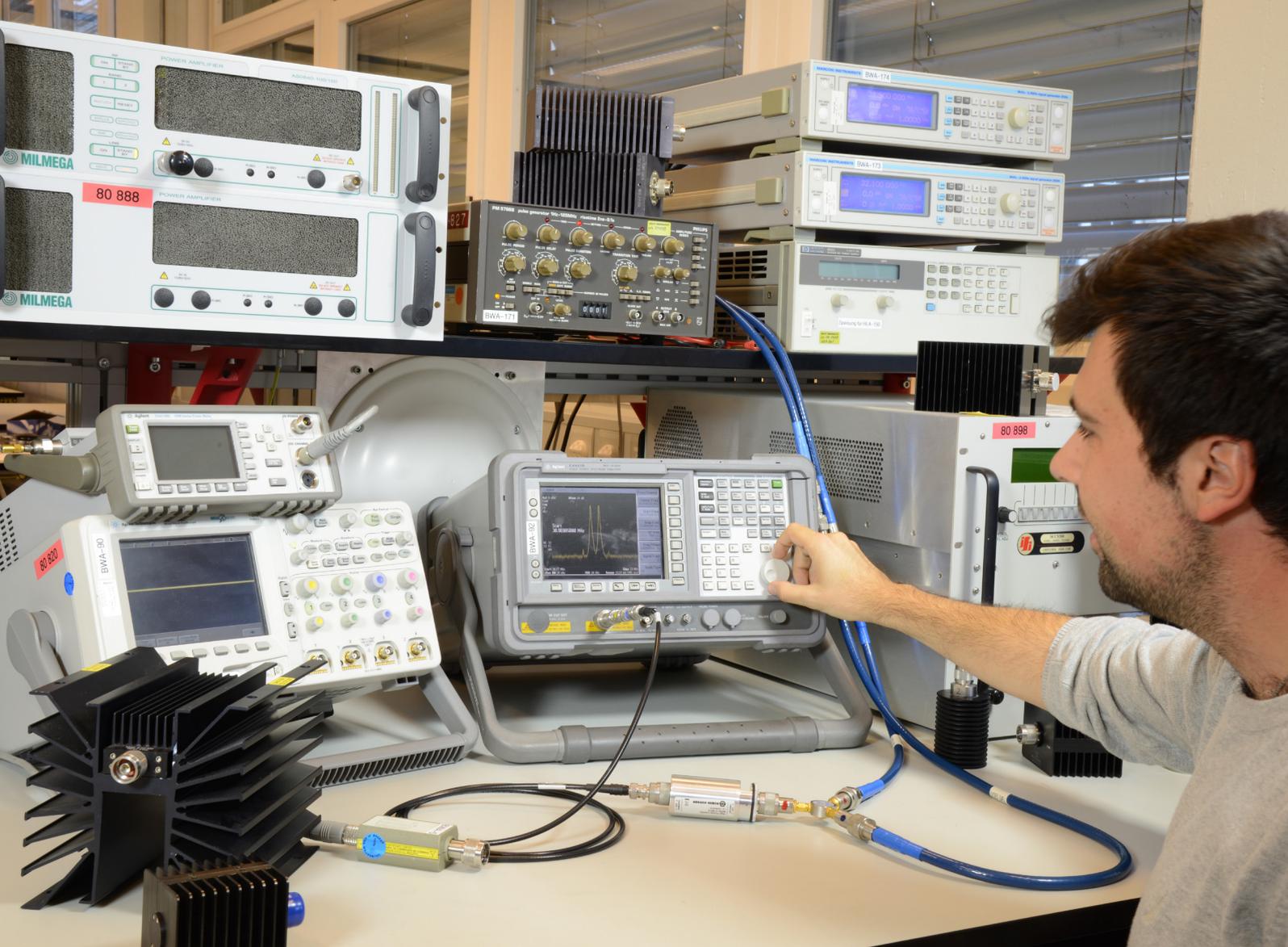
- High stability/high repeatability
- Outstanding low PIM levels (better than  $-160$  dBC)
- Reliable and repeatable intermodulation measurements

## Passive intermodulation standards



Intermodulation standards are special adaptors which generates intermodulation products of a certain preset level. They are used to verify intermodulation test benches for an instant and/or long-term level stability monitoring. If the third-order intermodulation value, displayed by the test instrument, deviates from the specified value of the intermod standard, it indicates a general measurement uncertainty which may be caused by the test setup rooting in one or several component or interconnection PIM sources.

- High repeatability
- Each item delivered with measurement protocol
- Verification traceability via serial number



## Power measurement

The quest for ever-higher energy efficiency is placing new demands on designers and test instruments requiring them to run specialized, complex and time consuming power measurements. But these measurements are essential to optimize the product design and comply with commercial, wireless, automotive, and MIL standards. Since RF and microwave signals must be made part of the product design and test, HUBER+SUHNER offers unique cable assemblies, terminations and attenuators portfolio to make these measurements as easy, fast and accurate as possible.

## Fixed attenuators



RF attenuators are used to reduce the power of a signal without causing distortion of its waveform. They are used in many test+measurement and communication applications.

- Power adjuster between different channels or inline subsystems
- As a protection for the input of the test equipment to reduce threatening RF power
- To improve the impedance matching between subsystems or to the test instrumentation

## Coaxial terminators



Terminators (also called RF loads or dummy loads) are applied to an open end of a transmission line, e.g. an RF port, to prevent the back-reflection of an RF signal. They are used in a large variety of test+measurement, defense, and communication applications

## Power test leads



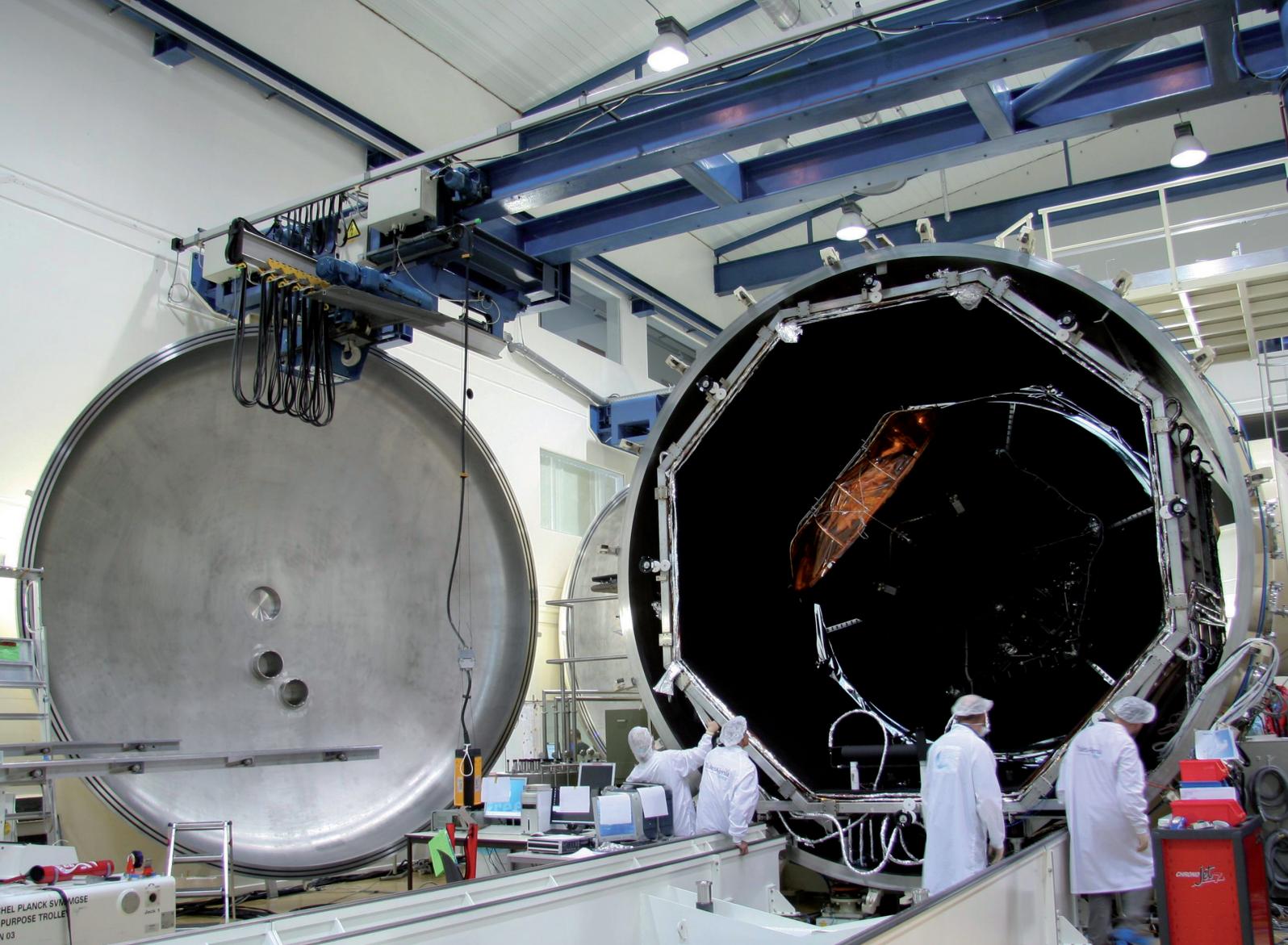
The test lead RG393/U is designed for low attenuation and high stability. This test lead is the ideal connection between the device under test and the measurement unit during power measurements.

## Boa-flex II - 32071



astro-boa-flex II cables utilize a microporous PTFE dielectric for low loss with minimal phase change due to temperature changes and flexure. Typical velocity is 77 % of the speed of light. The outer conductor is a helical wrapped silver-plated copper (SPC) foil covered with a SPC round braid.

- Low density PTFE for superior electrical performance
- Exceptional power handling capability
- Exceptional phase and I.L. stability with flexure
- Preferred for phase matching and tracking applications
- Operating temperature  $-65$  to  $200$  °C



## Thermal vacuum measurement

HUBER+SUHNER emerged in space as a partner for passive microwave components that can be used for satellite testing in clean rooms as well as in thermal-vacuum environment. These components support the satellite during the entire trial period prior to launch. The comprehensive product range is optimally matched to the needs of the space customers. From the comprehensive range of TVAC components in the vacuum chamber of the hermetic adaptors to the test assemblies in the clean room, the procurement process is simplified by offering "one stop shopping". This is true both for low power and high power applications.

The power handling capability of all assemblies is determined using simulations which are verified with real power tests and therefore performance predictions are accurate.

Our thermal vacuum assemblies pass thermal cycling qualification to guarantee stable interface dimensions. By request, our cable assemblies can be produced in clean room environment and stabilisation thermal cycling can be applied.

## TVAC cable assemblies



They are exposed to vacuum and extreme temperature variations. One important requirement is that the assemblies used within the vacuum chamber must meet the ECSS-Q-ST-70-02 C and NASA reference publication 1124 outgassing standard to prevent contamination of the chamber or equipment by solvents evaporating from certain materials. To prevent the assemblies becoming stressed and to ensure an extended service life, HUBER+SUHNER TVAC connectors contain venting holes that allow an unimpeded flow of air into and out of the components during the pressurisation/depressurisation cycles.

## Hermetic adaptors



HUBER+SUHNER offers a wide array of hermetic feed-thru style adaptors that offer both in-series and between series interface solutions for TVAC testing applications. The hermeticity is provided by a glass-fired seal within the adaptor body. The glass material is selected to provide the best electrical performance while also matching the coefficient of thermal expansion of the surrounding body and contact as closely as possible to prevent any loss of hermeticity. All of the hermetic adaptors are 100 % tested for hermeticity in accordance with ASTM E-498, MIL-STD-202, and MIL-STD-883.

## High performance cable assemblies



The SUCOFLEX microwave assembly family has been specifically developed for Test+Measurement and high performance applications where low insertion loss, phase stability vs. temperature/flexure, return loss, and mechanical stability are of the utmost importance. The SUCOFLEX family meets these challenges and provides the opportunity to design with the highest performance microwave cable in its class.

## Multipaction free assemblies

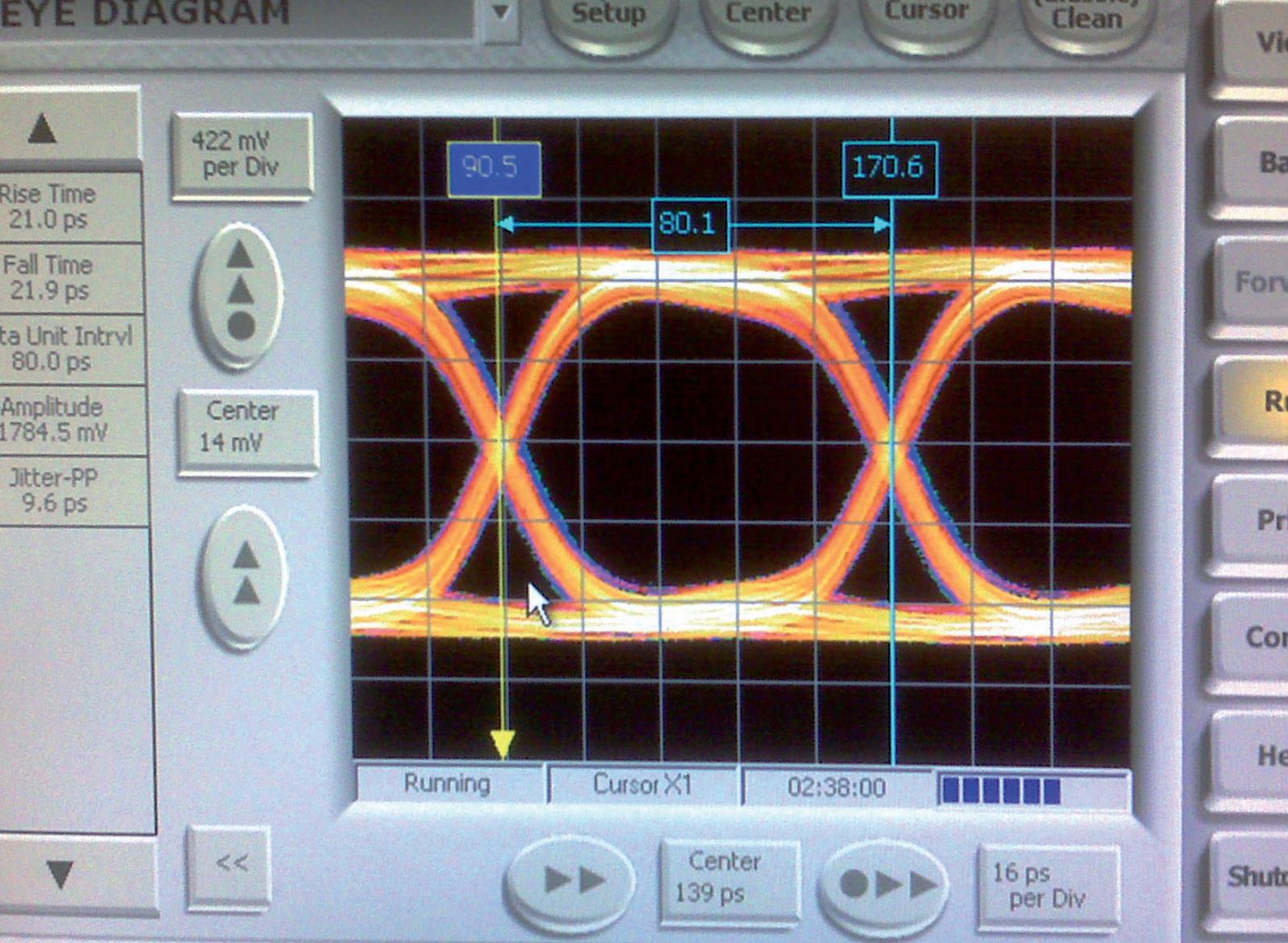


Boa-flex II - 32071 high power multipaction free cables utilise a microporous PTFE dielectric for low loss with minimal phase change due to temperature changes and flexure. In order to avoid the multipactor effect that causes RF signal loss/distortion or component-damaging heat build-up, connectors and cable assemblies are designed against air-gaps by utilizing interference fits with tight machine tolerances. Connectors are constructed with non-magnetic, black oxide-coated beryllium-copper bodies capable of excellent heat dissipation under vacuum. Typical velocity is 77 % of the speed of light. All offer very low loss and are extremely stable with flexure.

## Passive components



The comprehensive range of high-quality radio frequency components is based around the varying needs of Test+Measurement. The components are compatible with one another and have stable characteristics of a very high quality. This high quality level results from many years of experience in the development and production of radio frequency components. Multipaction free high power adaptor solutions are available.

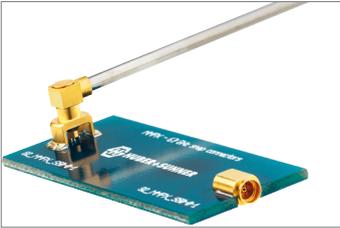


## High speed digital

HUBER+SUHNER is a leading international manufacturer and supplier of components and systems for electrical and optical connectivity. HUBER+SUHNER unites technical expertise in radio frequency technology, fiber optics and low frequency under one roof and offers a high-quality product range for the communication, transport and industrial markets.

HUBER+SUHNER is offering a broad range of high end RF test components and assemblies, developed and optimised for high speed digital testing. We stand for highest density, lowest loss and highest performance coaxial-to-PCB transitions and cabling solutions. Our solutions include extensive technical support, libraries of 3D files, electrical modelling data and customer specific optimised footprints.

## MMPX



- True 65 GHz/80 Gbps coaxial-to-PCB transition
- Broadband characteristics from DC to 65 GHz
- Excellent return loss
- Excellent shielding, low cross talk
- Via-in-pad capable
- 5.08 mm pitch (0.2 inch)
- Mechanically robust design
- Extensive technical support

## MXP18/MXP40/MXP50



- Operating range at up to 50 Gbps/50 GHz
- Standard absolute phase matching down to  $\pm 2$  ps
- Highest density – lowest loss
- Slide-on mating – no threading
- Highly flexible and ultra stable Multiflex cable
- Extensive technical support

## SUCOFLEX 100

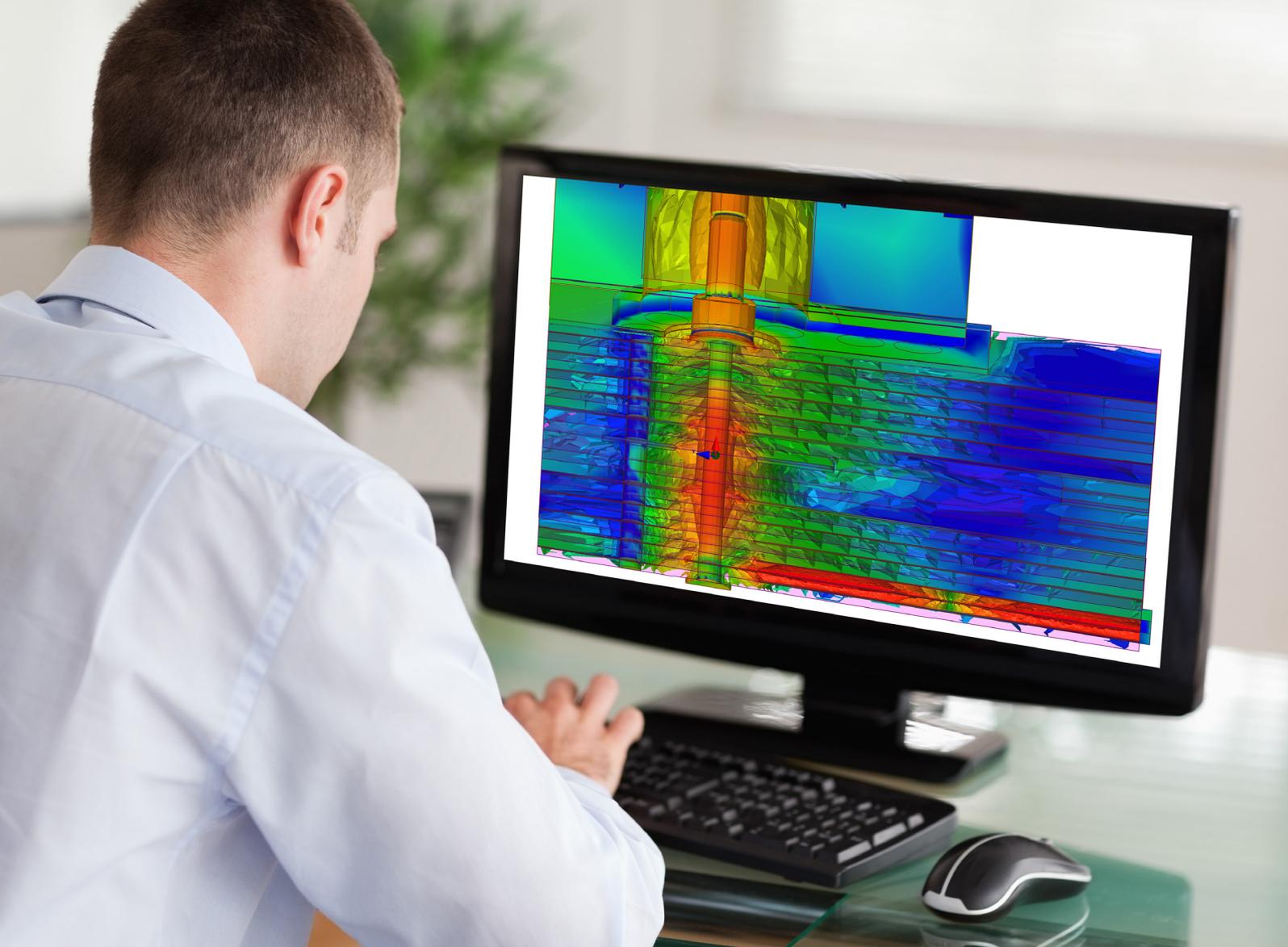


- SUCOFLEX 100 series flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications. This series provides optimal performance up to 50 GHz, where stringent electrical requirements – in particular stability and low loss – are important.
- Maintaining stable electrical characteristics when exposed to bending and temperature
  - Can be provided with various ruggedisations to protect the assembly against different environmental influences
  - Mechanical and climate resistance properties surpass those of standard flexible cables

## SMPT/SMPM/SMP



- The SMPT is the smallest threaded open source connector on the market and offers unprecedented electrical and mechanical performance. The SMPT handles high density requirements with a connector centerline-to-centerline spacing of just 5 mm (0.20 inch) while offering unmatched electrical stability at frequencies up to 65 GHz in even the harshest operating environments.
- No electrical length and phase variation under vibration, shock, or any other kind of movement
  - The smallest threaded interface available that complies with MIL-STD-348
  - A mated SMPT connector pair offers a 75 % size and 85 % mass reduction in comparison to a SMA connector solution



## Services and support

HUBER+SUHNER is committed to delivering more value to our customers. To this end, we have created a new organisation focused on the development and production of RF systems. The RF systems business organisation is quickly evolving into a hub for hybrid assemblies, multi-product configurations, and black box solutions (especially RF-over-Fiber). The sub-systems area, which includes the hybrid assemblies and multi-product configurations, is adding significant value for our customers. HUBER+SUHNER is now able to provide complete models, which simplifies both the customer's supply chain, as well as the system integration activities.

System solutions – HUBER+SUHNER offers design support which goes beyond the development of a connector, a cable or a cable assembly. We have a dedicated team in house which, in close cooperation with the customer, can provide:

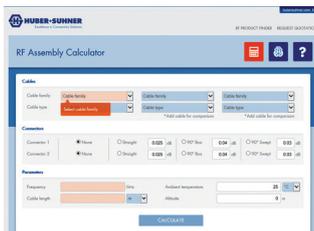
- Systems: A "black box" solution for specific applications or a solution, which, via a design service, configures/links HUBER+SUHNER and 3rd party products.
- Sub-systems: A product, which is designed by the customer, but engineered and produced by HUBER+SUHNER at an international location that is appropriate for the customer. These products may contain 3rd party content.
- Services: A service, whereby we provide kitting and other value-adding services, such as painted antennas, to customers in order to simplify the integration into a system or sub-system.

## Customised connector solutions



While HUBER+SUHNER offers an extensive product line of connectors and adaptors, we also understand that some application needs are unique. HUBER+SUHNER offers custom-engineered solutions through innovative design, using state-of-the-art development tools. These powerful tools allow us to demonstrate product feasibility, including prototyping, in a short amount of time. Our in-house type testing capabilities will further prove the design through intensive verification tests according to MIL standards or your specific requirements.

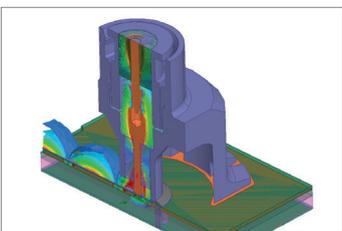
## Online support tools



HUBER+SUHNER offers a set of online tools which assists you in finding the right product, calculating the electrical performance of specific cable assembly configurations, and inquiring about the desired products once defined.

- Dynamic Product Finder
- RF Assembly Calculator
- RF Assembly Configurator (Request For Quotation)

## Optimized connector/PCB solutions



Only by using an optimized footprint can the performance of the connectors be unleashed. HUBER+SUHNER offers optimized connector/board solutions:

- 3D field simulation
- Optimized footprints (incl. connector) as gerber files

## Repair service



HUBER+SUHNER is offering a retermination service for the professional replacement of defective channels. Your HUBER+SUHNER representative will guide you if you are in need of a repair and want to benefit from this opportunity.

## Measurement accessories



Additional tools and accessories will allow extended possible applications for the HUBER+SUHNER RF connectors, like

- Precision torque wrench
- MMPX - decoupling tools

# Cable/connector portfolio - quick assembly selection matrix

High flexibility	Phase matching	Low insertion loss	Phase stability (mechanical)	Armouring	Cost efficient	Cable attenuation dB/m @ 18 GHz	Cable diameter (mm)	Cables	Interfaces															
									BNC				MCX				MMCX				QN			
									Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead
								Frequency in GHz	4				6				11							
•					•	1.1 dB/m @ 8 GHz	10.30	TL-8A																
						1.3 dB/m @ 4 GHz	10.30	TL-P																
		•			•	1.6	4.60	Sucotest_18																
•			•		•	1.6	10.30	Sucotest_18A																
		•				1.7	4.80	Sucotest_26																
		•				1.7	4.80	Sucotest_40																
	•	•			•	2.0	3.65	SUCOFLEX_101																
•	•		•		•	3.0	3.65	SUCOFLEX_101_P(E)																
	•	•			•	1.7	4.00	SUCOFLEX_102																
	•	•			•	1.3	4.60	SUCOFLEX_103	•															
	•	•			•	1.1	5.50	SUCOFLEX_104	•													•		
•	•	•	•		•	1.1	5.50	SUCOFLEX_126 (E)	•															
	•	•			•	0.8	7.90	SUCOFLEX_106														•		
•	•	•	•		•	0.8	7.90	SUCOFLEX_118																
•	•	•	•		•	1.1	7.70	SUCOFLEX 526S																
•			•		•	2.7	13.0	SUCOFLEX 526V																
•	•	•	•		•	2.0	6.1	SUCOFLEX 550S																
•	•		•			5.7	1.74	Multiflex_53																
•	•		•			3.6	2.65	Multiflex_86					•	•	•	•	•	•	•	•				
•	•		•			2.1	4.14	Multiflex_141					•								•	•		•
	•	•	•		•	5.4	1.20	Sucoform_47_CU					•	•	•	•	•	•	•	•				
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	•	•	•		•	1.4	6.30	Sucoform_250-01																
•	•	•				4.7	1.91	Microbend																
•	•	•				4.7	1.91	Microbend 1R																
•	•	•				3.8	2.49	Minibend									•							
•	•	•	•			2.8	2.64	Minibend L																
•	•	•	•			3.8	2.64	Minibend CT																
•	•	•	•			1.8	3.61	Mini 141																
	•		•			5.1	1.19	EZ_47_TP_M17					•	•			•	•						
	•		•			5.4	1.19	EZ_47_AL_TP					•	•	•	•	•	•						
	•	•	•			2.0	2.18	SR_86_LA_TP																
	•		•			3.2	2.18	EZ_86_TP_M17					•	•	•	•	•	•	•	•				
	•		•			3.3	2.18	EZ_86_AL_TP_M17					•	•	•	•	•	•	•	•				
	•		•			1.8	2.95	EZ_118_TP																
	•		•			2.1	3.58	EZ_141_TP_M17													•	•		•
	•		•			2.2	3.58	EZ_141_AL_TP_M17													•	•		•
	•		•			1.5	6.35	EZ_250_TP_M17																
		•	•			1.5	6.35	EZ_250_AL_TP																
			•			1.6	5.50	S-Series S_04																
•					•	1.8 dB/m @ 1 GHz	1.84	Enviroflex_178	•		•	•	•	•	•	•	•	•	•	•				•
•					•	1.0 dB/m @ 1 GHz	2.54	Enviroflex_316	•	•	•	•	•	•	•	•	•	•	•		•			
•					•	0.6 dB/m @ 1 GHz	5.00	Enviroflex_142	•	•	•	•									•	•		•
•					•	0.3 dB/m @ 1 GHz	10.10	Enviroflex_393													•	•		•

TNC				N				QMA				SMA				PC 3.5				SK (2.92 mm)				SMP		MXP		PC 2.4				PC 1.85				MMPX				SMPM-T		PC1.0						
Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Female straight	1x8A	2x8A	Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead	Male straight	Male right angle	Female straight	Female bulkhead	Female straight	Male straight							
11				18 (14 GHz: 32071)								26.5				40						50		65						110																		



## Qualified, high performance microwave cable assemblies

The flexible SUCOFLEX® series microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications. This series is a high-end product designed to provide optimal performance up to 50 GHz, where stringent electrical requirements, in particular electrical stability and low loss, are important. Ideally suited for test and measurement applications and defense systems. Additional lightweight high end versions are designed to meet the stringent needs of space flights systems (i. e. satellites) and aerospace systems (aircraft, helicopters, missiles), which are subject to extremely severe operating conditions. SUCOFLEX is only available as assembly. Order with confidence.



# SUCOFLEX® series

## What are SUCOFLEX assemblies?

SUCOFLEX are flexible microwave cable assemblies offering better transmission characteristics than semi-rigid cables.

SUCOFLEX comprises an entire system of optimally matched components such as:

- Microwave cables
- Connectors
- Ruggedisations
- Marking sleeves

SUCOFLEX is manufactured by highly qualified HUBER+SUHNER employees and tested against strict quality standards under controlled conditions. This results in microwave cable assemblies meeting all of your needs for top quality and high precision reproducibility.

SUCOFLEX is always supplied as a complete, tested microwave cable assembly with defined and guaranteed radio frequency and mechanical values.

SUCOFLEX cables, connectors, and assemblies are entirely developed, manufactured, tested, and supplied by HUBER+SUHNER.



SUCOFLEX provides an optimum solution to your microwave transmission problems.

SUCOFLEX is defined in the following way:

One standard assembly consists of the following items if no additional specifications are provided:

- Microwave cable specified
- Connectors specified
- Marking sleeve with serial number
- RF test protocol showing insertion and return losses

SUCOFLEX is a registered trade mark for microwave cable assemblies from HUBER+SUHNER.

## Cross reference within product range

Outer diameter mm	Cable attenuation at 18 GHz dB/m	Interfaces Cables	Interfaces												
			BNC	QMA	QN	7/16	BMA	TNC	N	PC7	SMA	PC3.5	SK	PC2.4	
3.65	2.0	SUCOFLEX 101										26.5		40	50
3.65	3.0	SUCOFLEX 101P										26.5		40	50
4.00	1.7	SUCOFLEX 102					18	18	18			26.5		40	46
4.14	1.6	SUCOFLEX 240										26.5		40	
4.60	1.3	SUCOFLEX 103	4				18	18	18			18	26.5		
5.08	1.0	SUCOFLEX 229						18	18			26.5		29	
5.50	1.1	SUCOFLEX 104		6	6	7.5	18	18	18	18	18	18	26.5		
5.50	1.1	SUCOFLEX 126	4			7.5	18	18	18	18	18	18	26.5		
6.1	2.0	SUCOFLEX 550S												40	50
7.70	1.1	SUCOFLEX 526S								18		18	26.5		
7.90	0.8	SUCOFLEX 106			6	7.5		18	18	18	18				
7.90	0.8	SUCOFLEX 118						18	18			18			
13.0	2.7	SUCOFLEX 526V											26.5		

Frequency

# SUCOFLEX® 500



When it comes to test and measurement, the SUCOFLEX 500 assemblies guarantee the highest level of satisfaction. Thanks to their unique cable and connector design, they deliver the best phase and amplitude stability versus flexure, movement, temperature and tensile stress, in combination with outstanding return and insertion loss up to 50 GHz.

Due to the rotary swaged low-loss inner conductor and the rugged construction, all SUCOFLEX 500S assemblies withstand more than 100,000 flexures without degradation of performance and therefore have a very long life-time.

HUBER+SUHNER supplies all SUCOFLEX 500 standard length products within five working days and customised lengths are available within ten working days worldwide.



## SUCOFLEX 550S

40-50 GHz

- Very long life time (>100'000 flex cycles)
- Excellent insertion loss
- Phase and amplitude stability with flexure and movement



## SUCOFLEX 526S

26.5 GHz

- Very long life time (>100'000 flex cycles)
- Excellent insertion loss
- Phase and amplitude stability with flexure and movement



## SUCOFLEX 526V

26.5 GHz

- Extremely flexible and ease of handling
- High stable electrical performance
- Best-in-class phase and amplitude stability with flexure, movement, temperature and tensile stress



### Applications

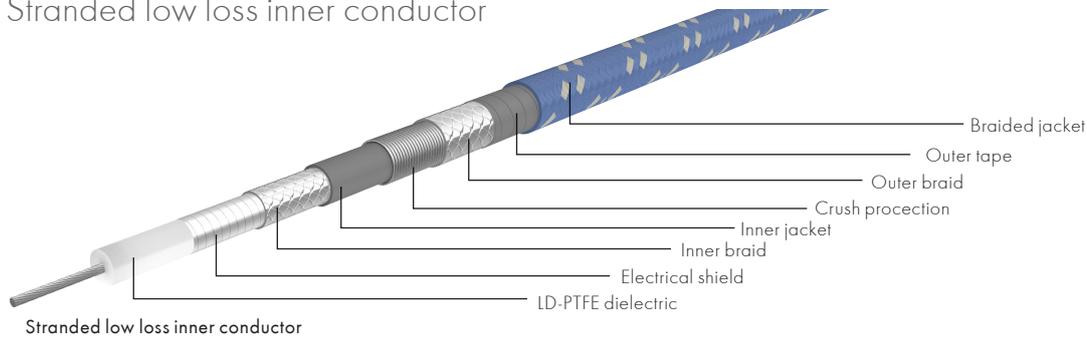
- Bench top testing
- RF production testing
- Automated test equipment
- Vector network analyzers (VNAs)
- Scalar analyzers
- Portable test equipment
- RF module testing
- High speed digital testing (HSDT)

„Historically, solutions come in standard lengths that are expensive with a long delivery wait, so we are thrilled to be able to offer high performance microwave cable assemblies that are customisable, affordable and quick.“

*Daniel Ulmer, Product Manager*

# SUCOFLEX 500S - Unique cable construction

Stranded low loss inner conductor



## Mechanical data

Frequency	26.5 GHz	40 GHz	50 GHz
Cable	SUCOFLEX 526S	SUCOFLEX 550S	SUCOFLEX 550S
Connector	PC3.5	SK / 2.92 mm	PC2.4
Diameter (mm)	7.7	6.1	
Min. bending radius (mm)	25.4		
Typ. flex life (cycles)	> 100'000		
Min. assembly length	300		
Max. assembly length	50'000	20'000	

## Environmental data

Operating temperature (°C)	-55 to +125
2011/65/EC (RoHS)	compliant

## Electrical data

Impedance (Ω)	50		
Velocity of propagation (%)	77		
Time delay (ns/m)	4.32		
Typ. return loss (dB)	25	19	17
Min. return loss (dB)	19	15	15
Typ. insertion loss assembly (dB/m)	1.63	3.41	3.87
Max. insertion loss assembly (dB/m)	1.77	3.72	4.22
Min. screening effectiveness (dB) up to 18 GHz	90		
Typ. amplitude stability vs. movement (dB)	±0.05		
Typ. amplitude stability vs. flexure (dB)	±0.05		
Typ. phase stability vs. flexure (°)	±3	±5	±6

# SUCOFLEX 550S – Stock assemblies

Delivery time within five working days worldwide

Art. No	Cable	Connector 1	Connector 2	Gender	Length (mm)	Length (inch)	Frequency (GHz)	max. IL (dB)	min. RL (dB)
85120065	SUCOFLEX 550S	11 PC24	11 PC24	male/male	610	24	50	2.89	14.9
85120066	SUCOFLEX 550S	11 PC24	11 PC24	male/male	914	36	50	4.07	14.9
85118941	SUCOFLEX 550S	11 PC24	11 PC24	male/male	1000		50	4.22	14.9
85120068	SUCOFLEX 550S	11 PC24	11 PC24	male/male	1219	48	50	5.24	14.9
85118942	SUCOFLEX 550S	11 PC24	11 PC24	male/male	1500		50	6.33	14.9
85120069	SUCOFLEX 550S	11 PC24	21 PC24	male/female	610	24	50	2.89	14.9
85120070	SUCOFLEX 550S	11 PC24	21 PC24	male/female	914	36	50	4.07	14.9
85118943	SUCOFLEX 550S	11 PC24	21 PC24	male/female	1000		50	4.22	14.9
85120072	SUCOFLEX 550S	11 PC24	21 PC24	male/female	1219	48	50	5.24	14.9
85124229	SUCOFLEX 550S	11 PC24	21 PC24	male/female	1500		50	6.33	14.9
85120073	SUCOFLEX 550S	11 SK	11 SK	male/male	610	24	40	2.58	14.9
85120074	SUCOFLEX 550S	11 SK	11 SK	male/male	914	36	40	3.61	14.9
85118944	SUCOFLEX 550S	11 SK	11 SK	male/male	1000		40	3.72	14.9
85120075	SUCOFLEX 550S	11 SK	11 SK	male/male	1219	48	40	4.65	14.9
85123652	SUCOFLEX 550S	11 SK	11 SK	male/male	1500		40	5.57	14.9
85123656	SUCOFLEX 550S	11 SK	21 SK	male/female	610	24	40	2.58	14.9
85123657	SUCOFLEX 550S	11 SK	21 SK	male/female	914	36	40	3.61	14.9
85118945	SUCOFLEX 550S	11 SK	21 SK	male/female	1000		40	3.72	14.9
85123658	SUCOFLEX 550S	11 SK	21 SK	male/female	1219	48	40	4.65	14.9
85123655	SUCOFLEX 550S	11 SK	21 SK	male/female	1500		40	5.57	14.9

# SUCOFLEX 526S – Stock assemblies

Art. No	Cable	Connector 1	Connector 2	Gender	Length (mm)	Length (inch)	Frequency (GHz)	max. IL (dB)	min. RL (dB)
85090623	SUCOFLEX 526S	11 PC35	11 PC35	male/male	500	20	26.5	1.01	1.25
85088164	SUCOFLEX 526S	11 PC35	11 PC35	male/male	914	36	26.5	1.64	1.25
85090624	SUCOFLEX 526S	11 PC35	11 PC35	male/male	1000	39	26.5	1.77	1.25
85092087	SUCOFLEX 526S	11 PC35	11 PC35	male/male	1500	59	26.5	2.52	1.25
85090625	SUCOFLEX 526S	11 PC35	11 PC35	male/male	2000	79	26.5	3.27	1.25
85090626	SUCOFLEX 526S	11 PC35	11 PC35	male/male	3000	79	26.5	4.77	1.25
85093097	SUCOFLEX 526S	11 PC35	21 PC35	male/female	500	20	26.5	1.01	1.25
85090629	SUCOFLEX 526S	11 PC35	21 PC35	male/female	914	36	26.5	1.64	1.25
85093184	SUCOFLEX 526S	11 PC35	21 PC35	male/female	1000	39	26.5	1.77	1.25
85091104	SUCOFLEX 526S	11 PC35	21 PC35	male/female	1219	48	26.5	2.10	1.25
85089172	SUCOFLEX 526S	11 N	11 N	male/male	1000	39	18	1.43	1.25
85089173	SUCOFLEX 526S	11 SMA	11 SMA	male/male	1000	39	18	1.43	1.25

# SUCOFLEX 500 - Available connectors

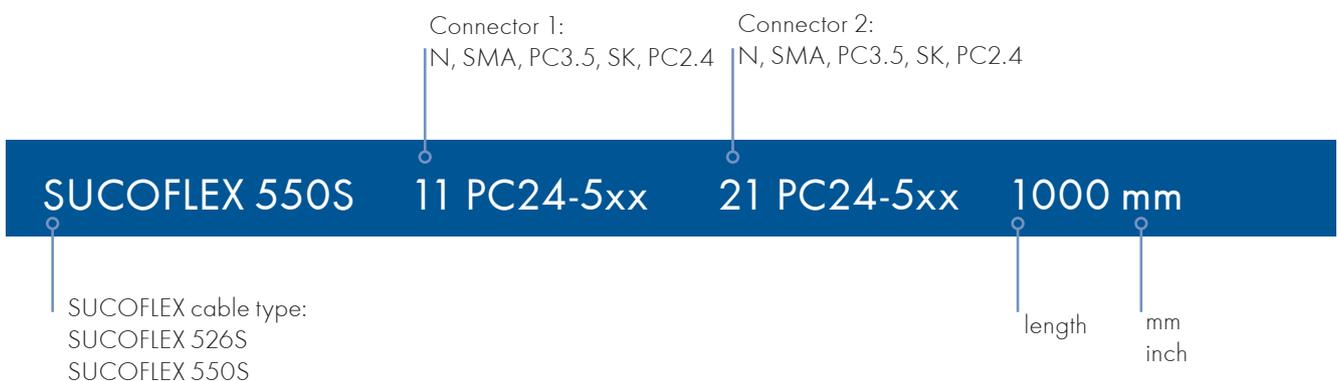
	SUCOFLEX 526S		SUCOFLEX 526V	SUCOFLEX 550S	
	18 GHz	26.5 GHz	26.5 GHz	40 GHz	50 GHz
N straight male	SF_11_N-501				
N straight female	SF_21_N-501				
SMA straight male	SF_11_SMA-501				
PC 3.5 straight male		SF_11_PC35-501			
PC 3.5 straight female		SF_21_PC35-501			
PC 3.5 ruggedised PORT female			35VF		
PC 3.5 ruggedised DUT male			35VM		
PC 3.5 DUT female			35F		
SK / 2.92 straight male				SF_11_SK-501	
SK / 2.92 straight female				SF_21_SK-501	
PC 2.4 straight male					SF_11_PC24-501
PC 2.4 straight female					SF_21_PC24-501

## Order information

Unlike other similar solutions, the SUCOFLEX 550S is available in tailored lengths and can be delivered within just ten days if the order is up to ten pieces.

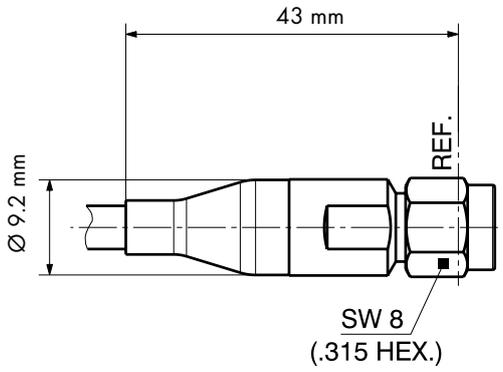
For ordering, please follow the instruction below.

Example: SUCOFLEX 550S/11 PC24-501/21 PC24-501/1000mm

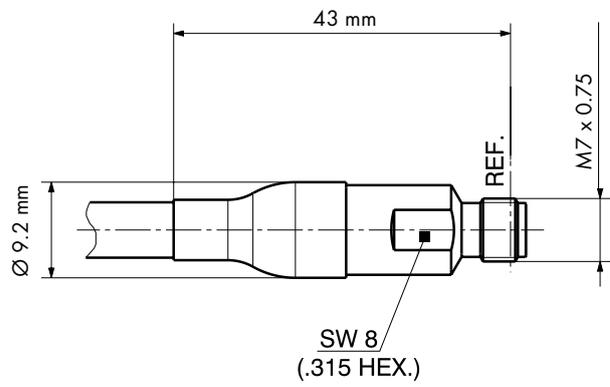


# SUCOFLEX 500S - Connector configuration

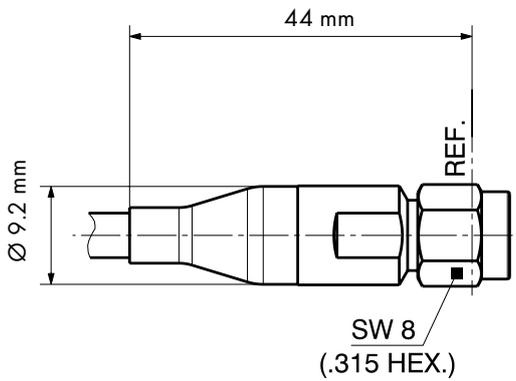
SF\_11\_PC24-501



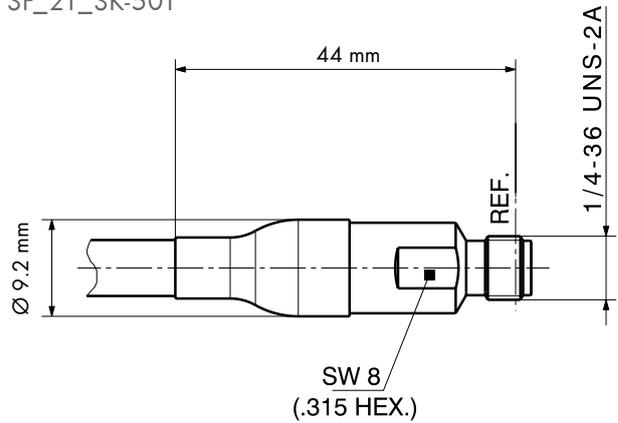
SF\_21\_PC24-501



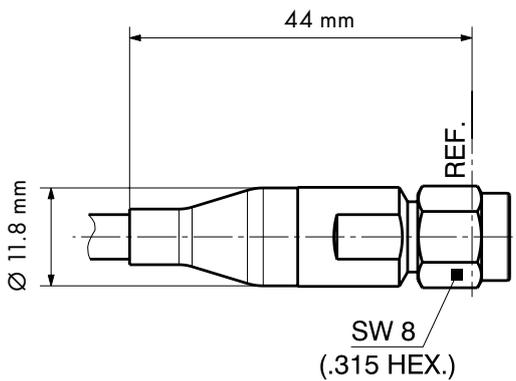
SF\_11\_SK-501



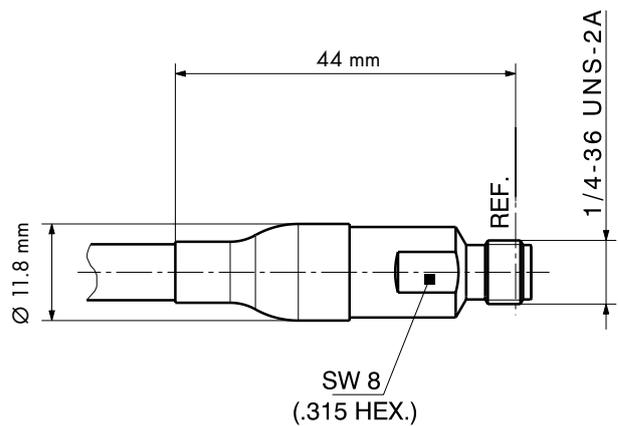
SF\_21\_SK-501



SF\_11\_PC35-501

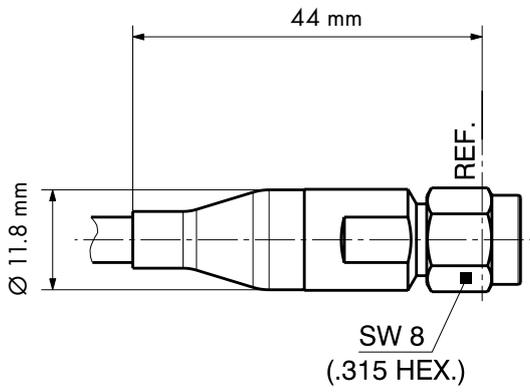


SF\_21\_PC35-501

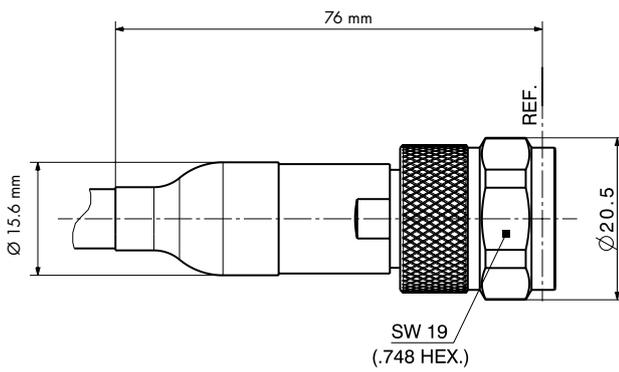


# SUCOFLEX 500S - Connector configuration

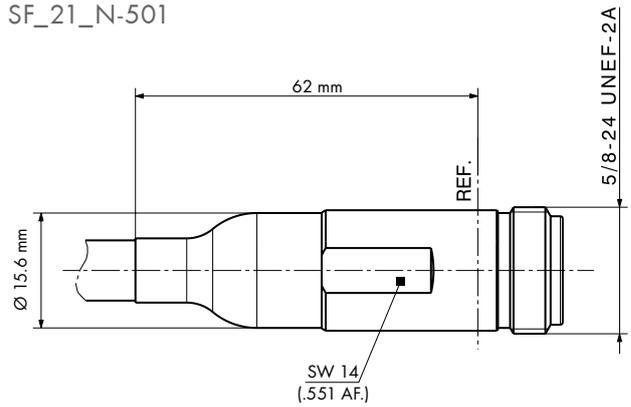
SF\_11\_SMA-501



SF\_11\_N-501



SF\_21\_N-501



# SUCOFLEX 526V

The only VNA microwave cable worldwide with a typical 50 ppm phase variation vs. temperature between +15 and +30 °C. No "PTFE phase knee" at +19 °C as seen on conventional VNA test cable assemblies which cause phase variations and unstable measurements in critical laboratory conditions.



## Available assemblies

### Product configuration

Art. No.	85069744	85081169	85070046	85081172	85070047	85081177
Cable type	SUCOFLEX 526V					
Length	25" (635 mm)	25" (635 mm)	38" (965 mm)	38" (965 mm)	48" (1219 mm)	48" (1219 mm)
Connector 1	3.5 mm ruggedised PORT female (35VF)					
Connector 2	3.5 mm ruggedised DUT male (35VM)	3.5 mm DUT female (35F)	3.5 mm ruggedised DUT male (35VM)	3.5 mm DUT female (35F)	3.5 mm ruggedised DUT male (35VM)	3.5 mm DUT female (35F)

### Mechanical data

Diameter	13 mm
Min. bending radius	50 mm
Crush resistance	80 kN/m
Typ. flex life	>100 000 cycles 2.0 Mio. for slight movements

### Environmental data

Operating temperature	laboratory conditions, analyser specific (+15 to +30 °C)
2011/65/EC (RoHS)	compliant

### Electrical data

Art. No.	85069744	85081169	85070046	85081172	85070047	85081177
Impedance	50 Ω					
Operating frequency	up to 26.5 GHz					
Velocity of propagation	80 %					
Time delay	4.15 ns/m					
Return loss	typ. 25 dB min. 20 dB					
Insertion loss	max. 2.5 dB		max. 3.6 dB		max. 4.4 dB	
Min. screening effectiveness	> 90 dB					
Amplitude stability vs. movement	max. 0.05 dB					
Amplitude stability vs. flexure	max. 0.08 dB					
Phase stability vs. flexure	max. 3.9°		max. 7.4°		max. 10°	
Phase stability vs. tensile stress	max. 0.1°/GHz (100 N)					
Phase stability vs. temperature	typ. 50 ppm (+15 to +30 °C)					

### Order information

Art. No.	Description
85069744	SF526V/35VF/35VM/25in
85081169	SF526V/35VF/35F/25in
85070046	SF526V/35VF/35VM/38in
85081172	SF526V/35VF/35F/38in
85070047	SF526V/35VF/35VM/48in
85081177	SF526V/35VF/35F/48in

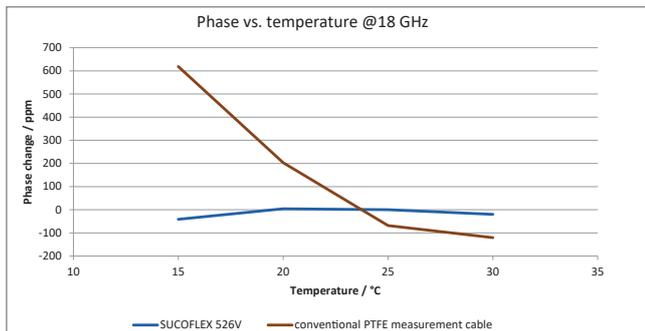
# SUCOFLEX 526V

Phase shift vs. temperature (+15°C to +30°C)

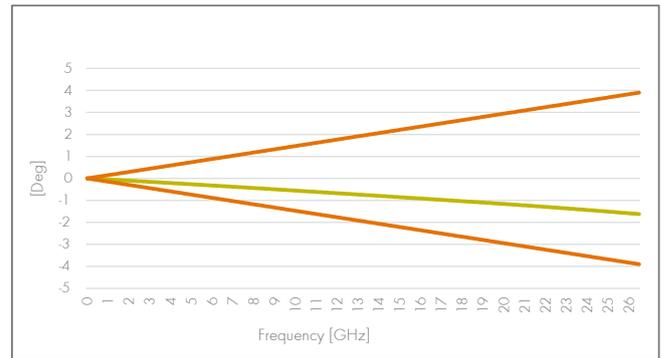
		SUCOFLEX 526V	Conventional VNA test lead
Assembly length (in (mm))	Frequency (GHz)*	Phase shift /° (for 50 ppm, 80% VOP)	Phase shift /° (for 700 ppm, 84% VOP)
25 (635)	18	0.9	11.4
25 (635)	26.5	1.3	16.7

\*Other frequencies on request

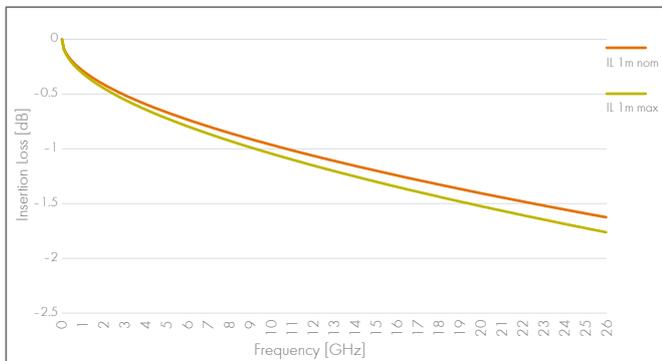
Phase stability vs. temperature performance



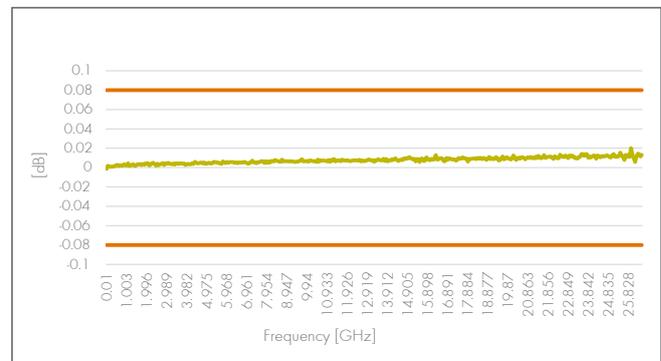
Phase stability vs. flexure



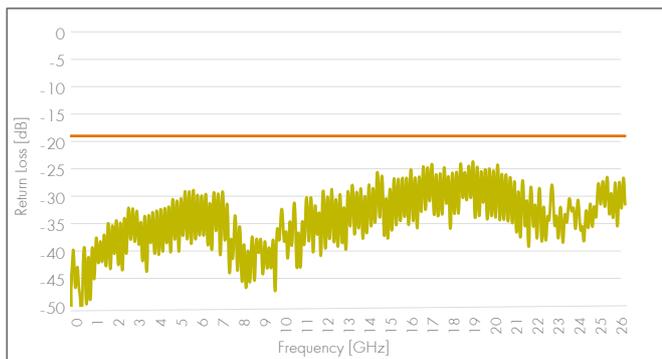
Insertion loss



Loss stability vs. flexure

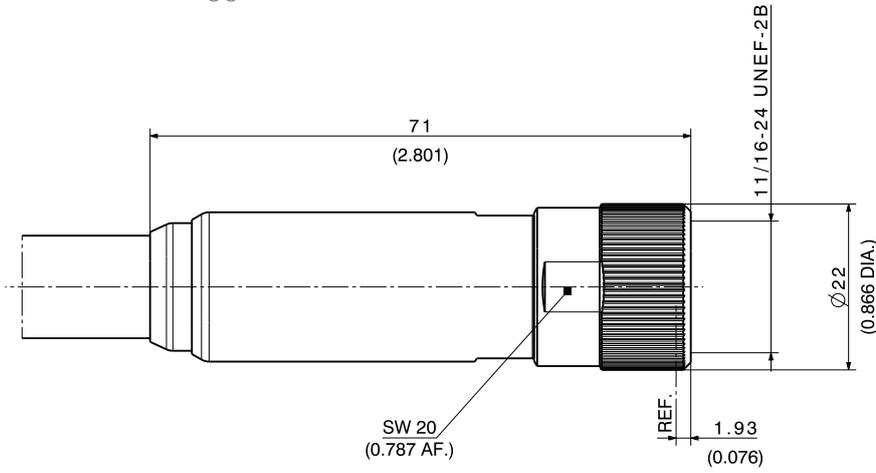


Return loss SUCOFLEX 526V with PC3.5 connectors

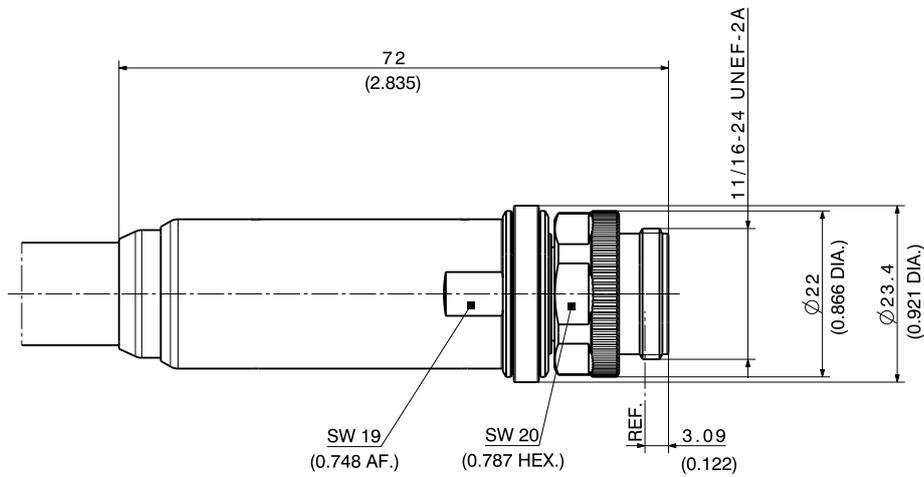


# SUCOFLEX 526V - Connector configuration

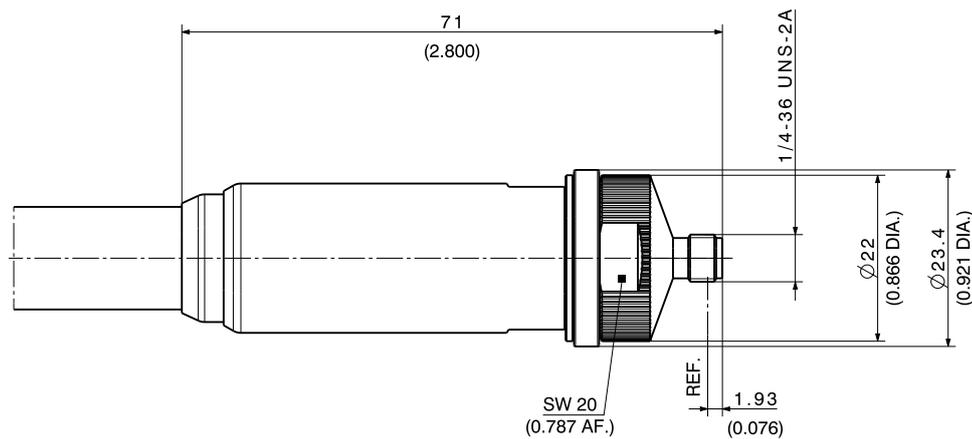
35VF (3.5 mm ruggedised PORT female)



35VM (3.5 mm ruggedised DUT male)

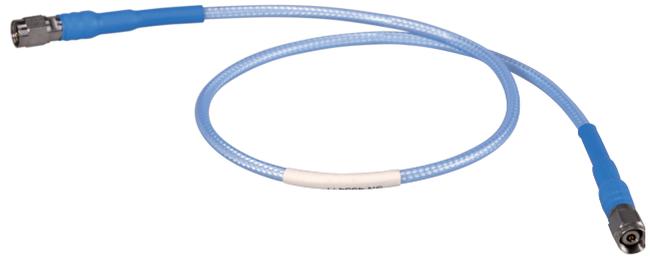


35F (3.5 mm DUT female)



# SUCOFLEX® 101

The SUCOFLEX 101 high end cable assemblies are designed to provide optimal performance up to 50 GHz where stringent electrical requirements - in particular stability and low loss - are important. Their mechanical and climate resistance properties surpass those of standard flexible cable. Additionally protected by an A ruggedisation, the SUCOFLEX 101PE becomes a flexible measurement and test cable up to 50 GHz!



## Product features

- Impedance 50 Ω
- Applicable up to 50 GHz
- High stability and low loss
- Wide range of connectors
- VNA-specific connectors

Assembly types		SUCOFLEX 101	SUCOFLEX 101E	SUCOFLEX 101P	SUCOFLEX 101PE	SUCOFLEX 101EA	SUCOFLEX 101PEA
Max. operating frequency	GHz	50	50	50	50	50	50
Application		static	static	dynamic	dynamic	static	dynamic
Velocity of propagation	%	77	77	77	77	77	77
Weight	g/m	36	33	33	30	114	111
Min. bending radius static	mm	11	11	11	11	20	20
Min. bending radius repeated	mm	20	20	20	20	40	40
Temperature range	°C	-55 to +125	-40 to +85	-55 to +125	-40 to +85	-40 to +85	-40 to +85
Crush resistance	kN/m	8	8	8	8	80	80
Tensile load	N	100	100	100	100	400	400
Inner conductor		solid wire	solid wire	strand	strand	solid wire	strand
Dielectric		LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE
Outer conductor		tape/braid	tape/braid	tape/braid	tape/braid	tape/braid	tape/braid
Jacket		FEP	PUR	FEP	PUR	PUR	PUR
Ruggedisation		no	no	no	no	stainless steel/ PUR	stainless steel/ PUR
Outer diameter	mm	3.7	3.7	3.7	3.7	7.7	7.7
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90	> 90	> 90	> 90
Phase stability vs. flexure (360°, diameter 40 mm)	°el/GHz	< 1.2	< 1.2	< 0.9	< 0.9	< 1.2	< 0.9
Phase stability vs. temperature (-40 to +85 °C)	ppm	< 1500	< 1500	< 1500	< 1500	< 1500	< 1500
Assembly phase matching tolerances	°el/GHz	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph	see graph	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2	± 0.2	± 0.2	± 0.2	± 0.2
Insertion loss stability vs. temperature	%/°C	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1	± 0.1	± 0.1	± 0.1	± 0.1
Power handling		see graph	see graph	see graph	see graph	see graph	see graph

# SUCOFLEX® 102

SUCOFLEX 102 are ideal for applications up to 46 GHz or wherever the weight or the diameter are the critical factors to be taken into account. The connectors mainly used here are PC2.4 and SK, but SMA, N, and TNC are also available for low frequency applications. Typical applications include test laboratories and aircraft manufacture. The available ruggedisations are matched to the particular applications.



## Product features

- Impedance 50 Ω
- Applicable up to 46 GHz
- High stability and low loss
- Wide range of connectors
- LSFH jacket and further ruggedisations on request

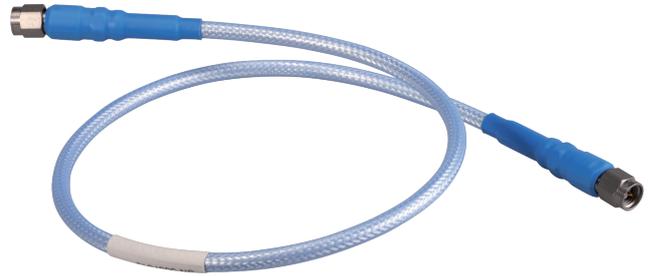
Assembly types		SUCOFLEX 102	SUCOFLEX 102E	SUCOFLEX 102D	SUCOFLEX 102EA
Max. operating frequency	GHz	46	46	46	46
Application		static	static	static	static
Velocity of propagation	%	77	77	77	77
Weight	g/m	40	37	45	120
Min. bending radius static	mm	12	12	15	20
Min. bending radius repeated	mm	20	20	30	40
Temperature range	°C	-55 to +125	-40 to +85	-55 to +125	-40 to +85
Crush resistance	kN/m	8	8	8	80
Tensile load	N	150	150	150	400
Inner conductor		solid wire	solid wire	solid wire	solid wire
Dielectric		LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE
Outer conductor		tape/braid	tape/braid	tape/braid	tape/braid
Jacket		FEP	PUR	FEP	PUR
Ruggedisation		no	no	aramid yarn braid	stainless steel/PUR
Outer diameter	mm	4.0	4.0	4.6	7.7
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90	> 90
Phase stability vs. flexure (360°, diameter 55 mm)	°el/GHz	< 1.2	< 1.2	< 1.2	< 1.2
Phase stability vs. temperature (-40 to +85 °C)	ppm	< 1500	< 1500	< 1500	< 1500
Assembly phase matching tolerances	°el/GHz	± 0.5	± 0.5	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2	± 0.2	± 0.2
Insertion loss stability vs. temperature	%/°C	< 0.2	< 0.2	< 0.2	< 0.2
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1	± 0.1	± 0.1
Power handling		see graph	see graph	see graph	see graph

# SUCOFLEX® 103

SUCOFLEX 103 is the ideal solution for systems in which the attenuation to weight ratio is very important. Different ruggedisations and a large number of the common connector types complete this range.

## Product features

- Impedance 50 Ω
- Applicable up to 33 GHz
- High stability and low loss
- Wide range of connectors
- LSFH jacket and further ruggedisations on request



Assembly types		SUCOFLEX 103	SUCOFLEX 103E	SUCOFLEX 103D	SUCOFLEX 103EA
Max. operating frequency	GHz	33	33	33	33
Application		static	static	static	static
Velocity of propagation	%	77	77	77	77
Weight	g/m	53	52	63	142
Min. bending radius static	mm	13	13	20	30
Min. bending radius repeated	mm	22	22	30	50
Temperature range	°C	-55 to +125	-40 to +85	-55 to +125	-40 to +85
Crush resistance	kN/m	8	8	8	80
Tensile load	N	200	200	200	400
Inner conductor		solid wire	solid wire	solid wire	solid wire
Dielectric		LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE
Outer conductor		tape/braid	tape/braid	tape/braid	tape/braid
Jacket		FEP	PUR	FEP	PUR
Ruggedisation		no	no	aramid yarn braid	stainless steel/PUR
Outer diameter	mm	4.6	4.6	5.1	10.3
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90	> 90
Phase stability vs. flexure (360°, diameter 55 mm)	°el/GHz	< 1.4	< 1.4	< 1.4	< 1.4
Phase stability vs. temperature (-40 to +85 °C)	ppm	< 1500	< 1500	< 1500	< 1500
Assembly phase matching tolerances	°el/GHz	± 0.5	± 0.5	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2	± 0.2	± 0.2
Insertion loss stability vs. temperature	%/°C	< 0.2	< 0.2	< 0.2	< 0.2
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1	± 0.1	± 0.1
Power handling		see graph	see graph	see graph	see graph

# SUCOFLEX® 104

SUCOFLEX 104 cables that can be universally applied with the widest range of connector types, are available with most ruggedisations.



## Product features

- Impedance 50 Ω
- Applicable up to 26.5 GHz
- High stability and low loss
- Wide range of connectors
- VNA-specific connectors, Quick lock nuts
- LSFH jacket and further ruggedisations on request

Assembly types		SUCOFLEX 104	SUCOFLEX 104E	SUCOFLEX 104D
Max. operating frequency	GHz	26.5	26.5	26.5
Application		static	static	static
Velocity of propagation	%	77	77	77
Weight	g/m	73	65	96
Min. bending radius static	mm	16	16	20
Min. bending radius repeated	mm	25	25	30
Temperature range	°C	-55 to +125	-40 to +85	-55 to +125
Crush resistance	kN/m	8	8	8
Tensile load	N	250	250	250
Inner conductor		solid wire	solid wire	solid wire
Dielectric		LD-PTFE	LD-PTFE	LD-PTFE
Outer conductor		tape/braid	tape/braid	tape/braid
Jacket		FEP	PUR	FEP
Ruggedisation		no	no	aramid yarn braid
Outer diameter	mm	5.5	5.5	6.1
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90
Phase stability vs. flexure (360°, diameter 55 mm)	°el/GHz	< 1.7	< 1.7	< 1.7
Phase stability vs. temperature (-40 to +85 °C)	ppm	< 1500	< 1500	< 1500
Assembly phase matching tolerances	°el/GHz	± 0.5	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2	± 0.2
Insertion loss stability vs. temperature	%/°C	< 0.2	< 0.2	< 0.2
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1	± 0.1
Power handling		see graph	see graph	see graph

# SUCOFLEX® 126

SUCOFLEX\_126 cables combines the low loss and power of SUCOFLEX 104 with the phase stability of SUCOFLEX 104P. Where low loss, combined with phase and amplitude stability is required, SUCOFLEX\_126 must be applied.

## Product features

- Applicable up to 26.5 GHz
- Excellent return loss
- Excellent phase- and amplitude stability
- Low loss
- Wide range of connectors
- Crush resistant armour available



## Assembly types

		SUCOFLEX 126	SUCOFLEX 126E	SUCOFLEX 126EA
Max. operating frequency	GHz	26.5	26.5	26.5
Application		dynamic	dynamic	dynamic
Velocity of propagation	%	77	77	77
Weight	g/m	70	66	171
Min. bending radius static	mm	16	16	30
Min. bending radius repeated	mm	25	25	50
Temperature range	°C	-55 to +125	-40 to +85	-40 to +85
Crush resistance	kN/m	8	8	80
Tensile load	N	250	250	500
Inner conductor		stranded - low loss	stranded - low loss	stranded - low loss
Dielectric		LD-PTFE	LD-PTFE	LD-PTFE
Outer conductor		tape/braid	tape/braid	tape/braid
Jacket		FEP	PUR	PUR
Ruggedisation		no	no	stainless steel/PUR
Outer diameter	mm	5.5	5.5	10.3
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90
Phase stability vs. flexure (360°, diameter 55 mm)	°el/GHz	< 0.9	< 0.9	< 0.9
Phase stability vs. temperature (-40 to +85 °C)	ppm	< 1500	< 1500	< 1500
Assembly phase matching tolerances	°el/GHz	± 0.5	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2	± 0.2
Insertion loss stability vs. temperature	%/°C	< 0.2	< 0.2	< 0.2
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1	± 0.1
Power handling	watt	see graph	see graph	see graph

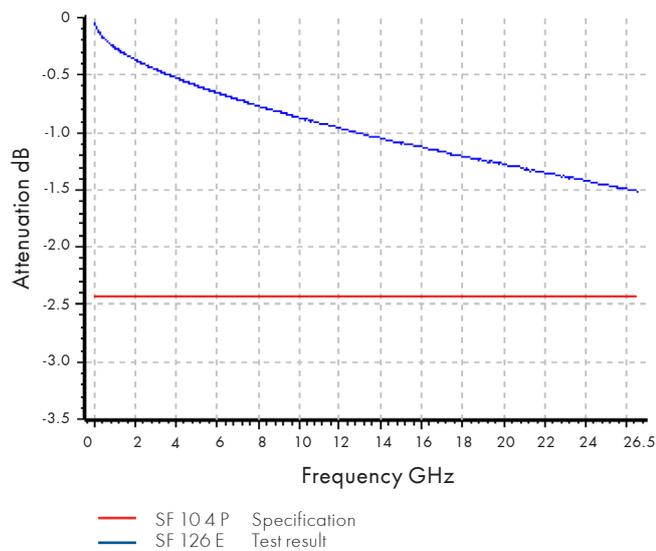
# Advantages of SUCOFLEX<sup>®</sup> 126 versus SUCOFLEX<sup>®</sup> 104 P

- 30 % lower loss
- 20 % higher power
- Improved return loss
- Same phase/loss stability
- Same flexibility
- Same connectors
- Same price

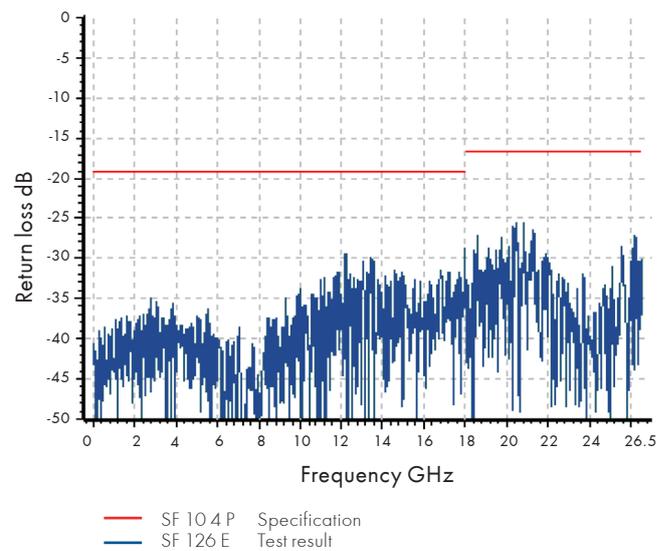
## Example

Test report SUCOFLEX126/PC35m/PC35m/1000mm

Attenuation  
(nominal values at +25 °C ambient temperature)



Return loss  
(maximum values at 25 °C ambient temperature and sea level)



# SUCOFLEX® 106 / 118

SUCOFLEX 106/118 are used in applications where special consideration must be given to low attenuation or high power handling capacity. Wherever phase stability is additionally demanded, the suitable type is the SUCOFLEX 118. Most ruggedisations can be used in conjunction with these cables, and also the main connector series.



## Product features

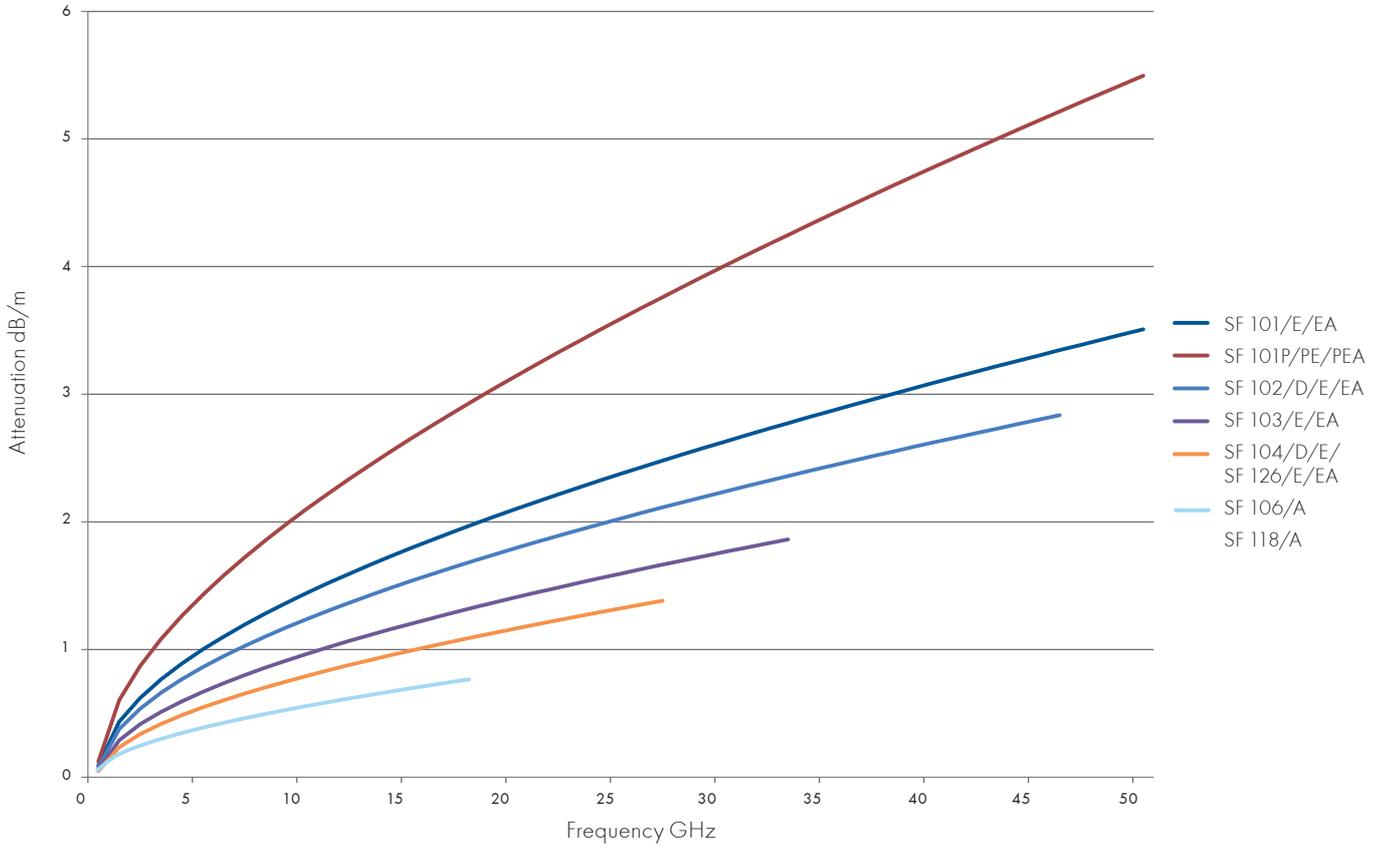
- Impedance 50 Ω
- Applicable up to 18 GHz
- High stability and low loss
- Wide range of connectors
- Further ruggedisations on request

## Assembly types

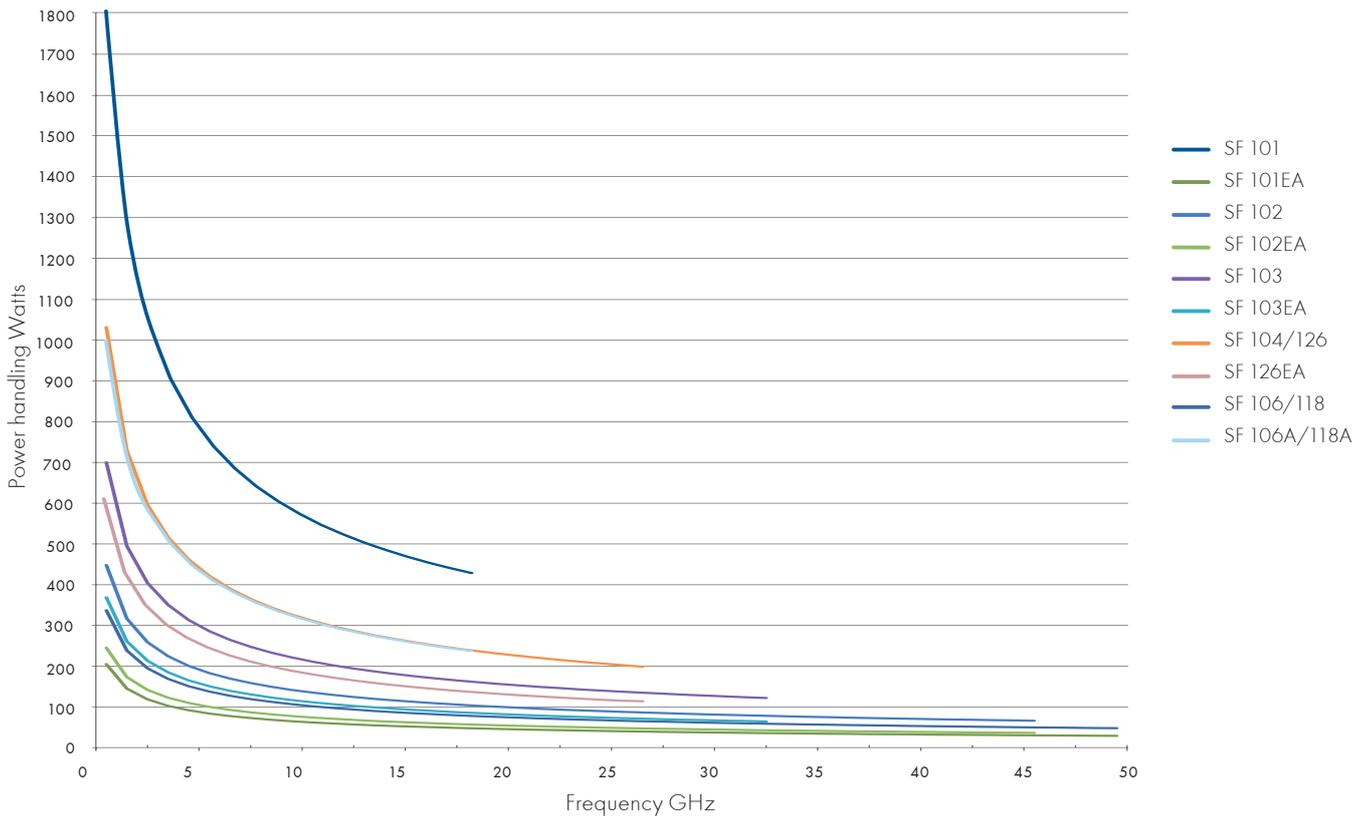
		SUCOFLEX 106	SUCOFLEX 118	SUCOFLEX 106A	SUCOFLEX 118A
Max. operating frequency	GHz	18	18	18	18
Application		static	dynamic	static	dynamic
Velocity of propagation	%	77	77	77	77
Weight	g/m	145	145	224	224
Min. bending radius static	mm	24	24	50	50
Min. bending radius repeated	mm	40	40	70	70
Temperature range	°C	-55 to +125	-55 to +125	-40 to +85	-40 to +85
Crush resistance	kN/m	12	12	80	80
Tensile load	N	400	400	400	400
Inner conductor		solid wire	strand - low loss	solid wire	strand - low loss
Dielectric		LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE
Outer conductor		tape/braid	tape/braid	tape/braid	tape/braid
Jacket		FEP	FEP	FEP	FEP
Ruggedisation		no	no	stainless steel/PUR	stainless steel/PUR
Outer diameter	mm	7.9	7.9	13.2	13.2
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90	> 90
Phase stability vs. flexure (360°, diameter 8.5 mm)	°el/GHz	< 2.0	< 1.2	< 2.0	< 1.2
Phase stability vs. temperature (-40 to +85 °C)	ppm	< 1500	< 1500	< 1500	< 1500
Assembly phase matching tolerances	°el/GHz	± 0.5	± 0.5	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2	± 0.2	± 0.2
Insertion loss stability vs. temperature	%/°C	< 0.2	< 0.2	< 0.2	< 0.2
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1	± 0.1	± 0.1
Power handling	watt	see graph	see graph	see graph	see graph

# SUCOFLEX® 100 - Attenuation/power handling

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



# SUCOFLEX® 100 – Stock assemblies

Item no.	Type	Length	Frequency	Max. insertion loss at 25 °C	Max. VSWR	RoHS compliant
		mm	GHz	dB		
<b>SUCOFLEX_102</b>						
84017146	SF102/SK <sub>m</sub> /SK <sub>m</sub> /500 mm	500	40	1.76	1.44	yes
84017149	SF102/SK <sub>m</sub> /SK <sub>m</sub> /1000 mm	1000	40	3.21	1.44	yes
<b>SUCOFLEX_104</b>						
84016754	SF104/SMA <sub>m</sub> /SMA <sub>m</sub> /500 mm	500	18	0.82	1.25	yes
84017157	SF104/N <sub>m</sub> /N <sub>m</sub> /1000 mm	1000	18	1.43	1.35	yes
84016755	SF104/SMA <sub>m</sub> /SMA <sub>m</sub> /1000 mm	1000	18	1.43	1.25	yes
84017158	SF104/PC35 <sub>m</sub> /PC35 <sub>m</sub> /1000 mm	1000	26.5	1.77	1.35	yes
84016756	SF104/SMA <sub>m</sub> /SMA <sub>m</sub> /1500 mm	1500	18	2.03	1.25	yes
84016757	SF104/SMA <sub>m</sub> /SMA <sub>m</sub> /2000 mm	2000	18	2.64	1.25	yes
<b>SUCOFLEX_126_E</b>						
85072824	SF126E/SMA <sub>m</sub> /SMA <sub>m</sub> /500mm	500	18.0	0.82	1.25	yes
85072825	SF126E/SMA <sub>m</sub> /SMA <sub>m</sub> /1000mm	1000	18.0	1.43	1.25	yes
85072826	SF126E/PC35 <sub>m</sub> /PC35 <sub>m</sub> /1000mm	1000	26.5	1.77	1.35	yes
<b>SUCOFLEX_126_EA (armoured)</b>						
85072828	SF126EA/N <sub>m</sub> /N <sub>m</sub> /1000mm	1000	18.0	1.43	1.25	yes
85072827	SF126EA/SMA <sub>m</sub> /SMA <sub>m</sub> /1000mm	1000	18.0	1.43	1.25	yes
85072830	SF126EA/N <sub>m</sub> /N <sub>m</sub> /1500mm	1500	18.0	2.03	1.25	yes

# Armouring options

Type A



Consists of steel spring (round wire), steel braid and polyurethane (TPU) jacket. Up to +85 °C, this ruggedisation offers excellent protection against compression, tension, abrasion and other mechanical forces acting upon the cable.

**Armouring:**

- Surface material: TPU
- Max crush resistance: 80 kN/m
- Torsional stiffness  $8.5 \times 10 \text{ Nm}^2/\text{°}$

**Max tensile force:**

- Ruggedisation 1 500 N
- Cable connector junction 400 N

Type B



Consists of a flexible hose of stainless steel. The ruggedisation protects the cable against compression, abrasion, mechanical injuries and open fire and hot objects (e.g. soldering irons). The continuous temperature is limited by the cable to +165 °C, and in the immediate proximity of the connectors to the maximum connector temperature.

**Armouring:**

- Surface material: stainless steel
- Max crush resistance: 80 kN/m
- Torsional stiffness  $3.2 \times 10 \text{ Nm}^2/\text{°}$

**Max tensile force:**

- Ruggedisation 1000 N
- Cable connector junction 500 N

Type D



Consists of an aramid yarn braid impregnated with silicon varnish. The ruggedisation protects the cable against abrasion and brief high temperatures.

**Armouring:**

- Surface material:
- Aramid yarn braiding impregnated with silicon varnish

# SUCOFLEX<sup>®</sup> 200

The tape wrapped SUCOFLEX 200 microwave cable assemblies have been specifically developed for high performance and anywhere the best insertion loss, high phase stability versus temperature, excellent return loss, and mechanical stability are of the utmost importance.

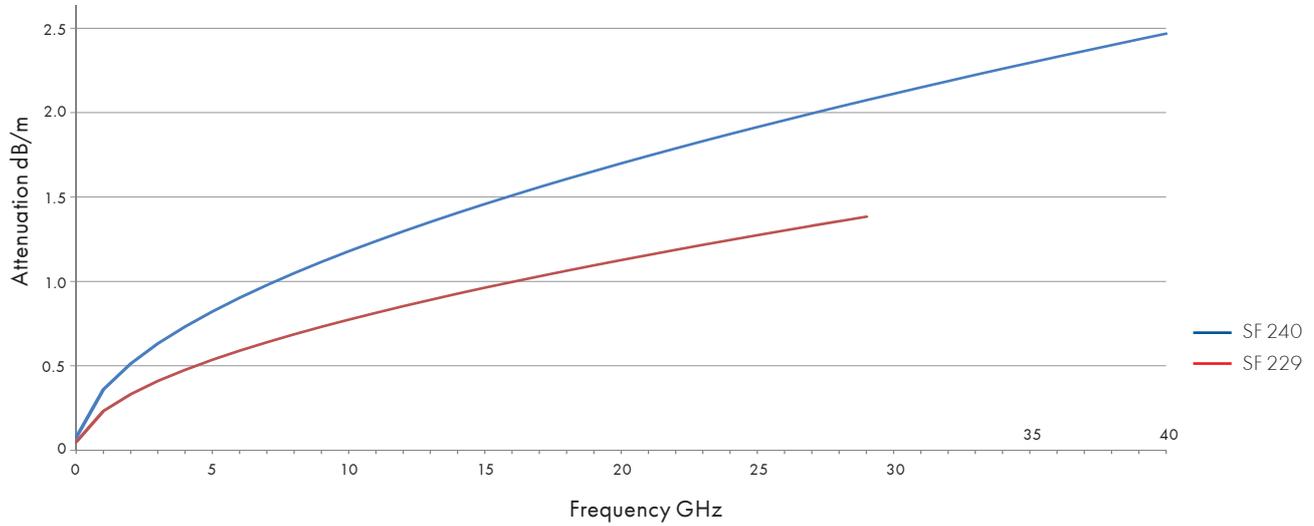
## Product features

- Impedance 50 Ω
- Ultra low loss
- Phase stable vs. temperature
- Robust mechanical construction
- Phase stable vs. bending
- Operating frequency up to 40 GHz
- Velocity of propagation 82 %

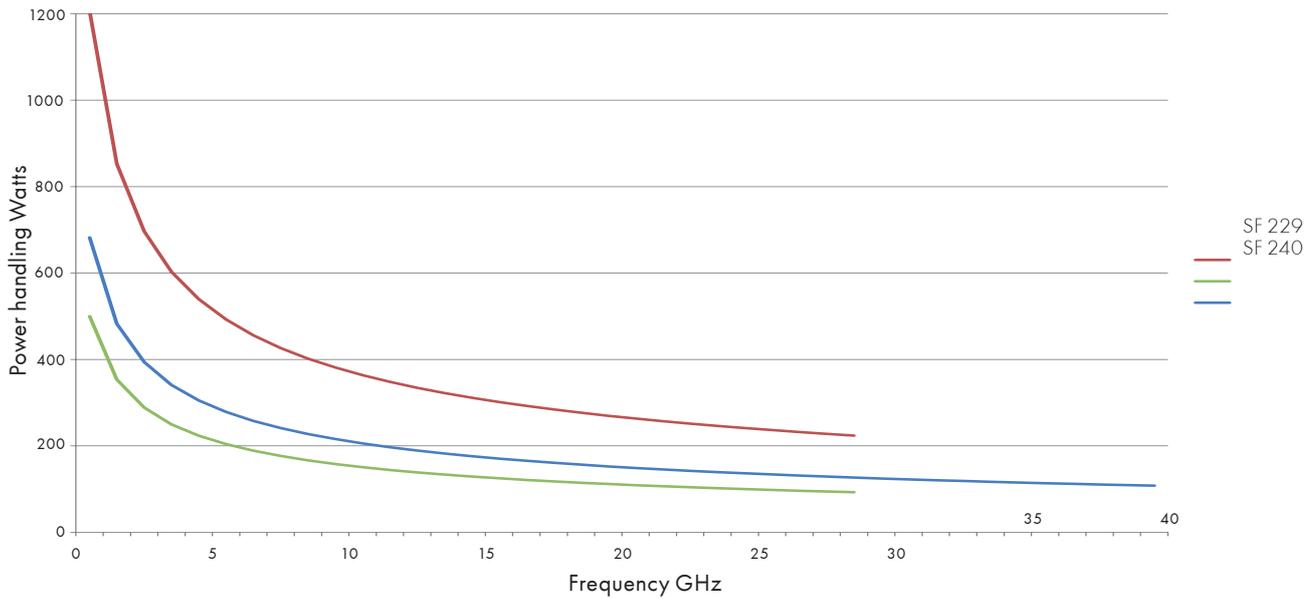


Assembly types		SUCOFLEX_229	SUCOFLEX_240
Max. operating frequency	GHz	29	40
Application		static and dynamic	static and dynamic
Velocity of propagation	%	82	82
Weight	g/m	61	37
Min. bending radius static	mm	23	8.4
Min. bending radius repeated	mm	70	25
Temperature range	°C	-55 to +125 (-65 to +200 on request)	-55 to +125 (-65 to +200 on request)
Tensile load	N	133	133
Inner conductor		solid wire	solid wire
Dielectric		PTFE microporous	PTFE microporous
Outer conductor		flat wire braid	flat wire braid
Barrier		tape/braid	tape/braid
Jacket		FEP	FEP
Ruggedisation		no	no
Outer diameter	mm	5.1	4.2
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90
Phase stability vs. flexure (360°, diameter 55 mm)	°el/GHz	< 1.1	< 1.1
Phase stability vs. temperature (-40 to +85 °C)	ppm	< 600	< 600
Assembly phase matching tolerances	°el/GHz	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2
Insertion loss stability vs. temperature	%/°C	< 0.21	< 0.21
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1
Power handling		see graph	see graph

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



### SUCOFLEX® 229 - Stock assemblies

Item no.	Type	Length		Frequency GHz	Max.VSWR	RoHS comp.
		mm	inch			
80395241	SF229/SK <sub>m</sub> /SK <sub>m</sub> /36 inch	914	36	29	1.30	yes
80395242	SF229/SK <sub>m</sub> /SK <sub>m</sub> /48 inch	1219	48	29	1.30	yes
80395243	SF229/SK <sub>m</sub> /SK <sub>m</sub> /72 inch	1829	72	29	1.30	yes
80395250	SF229/SM <sub>Am</sub> /SM <sub>Am</sub> /36 inch	914	36	26.5	1.30	yes
80395251	SF229/SM <sub>Am</sub> /SM <sub>Am</sub> /48 inch	1219	48	26.5	1.30	yes
80395252	SF229/SM <sub>Am</sub> /SM <sub>Am</sub> /72 inch	1829	72	26.5	1.30	yes
80395256	SF229/TNC <sub>m</sub> /TNC <sub>m</sub> /36 inch	914	36	18	1.30	yes
80395257	SF229/TNC <sub>m</sub> /TNC <sub>m</sub> /48 inch	1219	48	18	1.30	yes
80395258	SF229/TNC <sub>m</sub> /TNC <sub>m</sub> /72 inch	1829	72	18	1.30	yes
80395253	SF229/N <sub>m</sub> /N <sub>m</sub> /36 inch	914	36	18	1.30	yes
80395254	SF229/N <sub>m</sub> /N <sub>m</sub> /48 inch	1219	48	18	1.30	yes
80395255	SF229/N <sub>m</sub> /N <sub>m</sub> /72 inch	1829	72	18	1.30	yes

# Sucotest 26/40

Sucotest 26/Sucotest 40 cable assemblies are high frequency, low loss cables which are triple shielded for superior RF isolation. The internal stainless steel outer braid provides higher pull strength and lighter weight than RG style cable. Nomex and polyolefin jackets are also available.



## Product features

- Impedance 50 Ω
- Applicable up to 26/40 GHz
- Amplitude stability: < 0.1 dB at 26.5 GHz for 200 flexes  
180° in one plane around a 2" radius,  
0.2 dB with 600 flexes
- Five shields for super RF shielding (-120 dB)
- Steel outer shield for high pull strength
- Low cost, available from stock

## Recommended connectors

ST26	SMA
ST40	SK

## Specifications

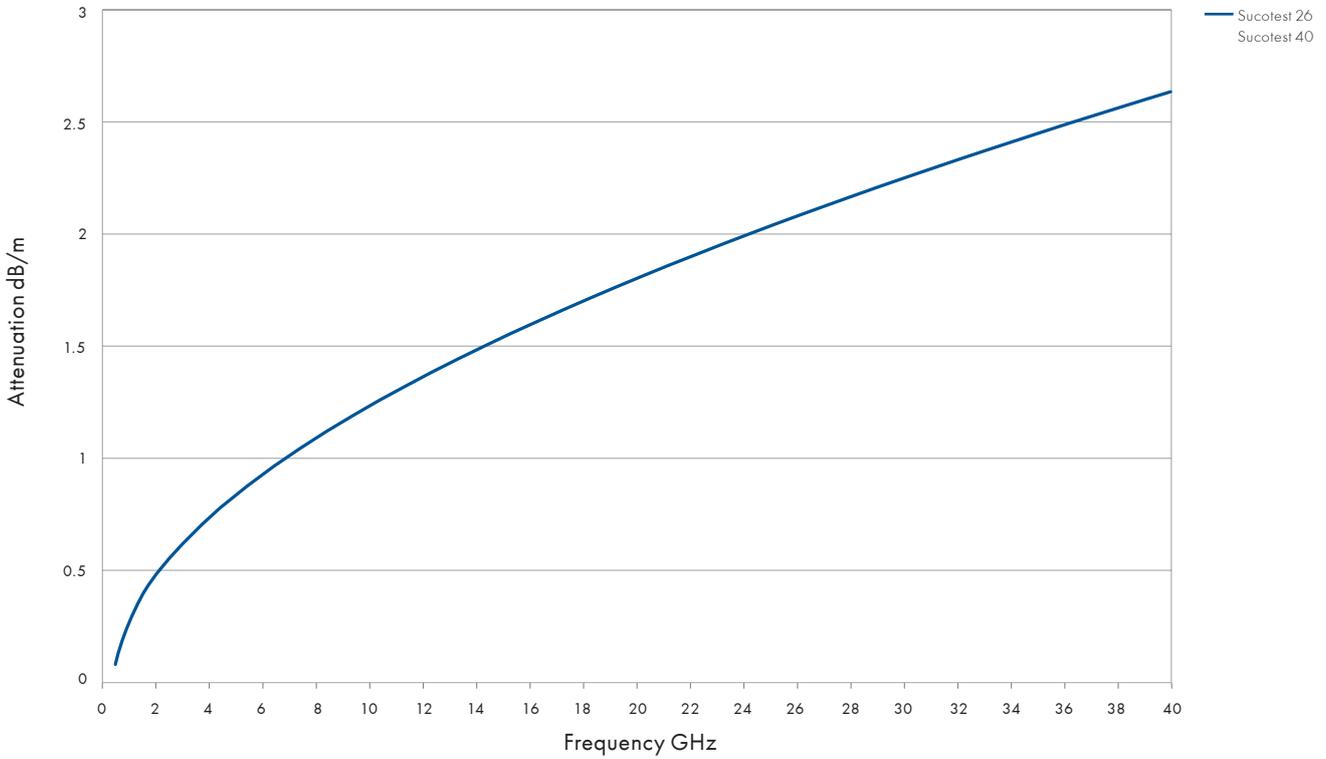
Cable	Max. operating frequency	Velocity of propagation	Weight	Min. bending radii		Temperature range
	GHz			%	g/m	
Sucotest_26	26	76.3	62.5	17.8	53.3	-55 to +200
Sucotest_40	40	76.3	62.5	17.8	53.3	-55 to +200

## Stock assemblies

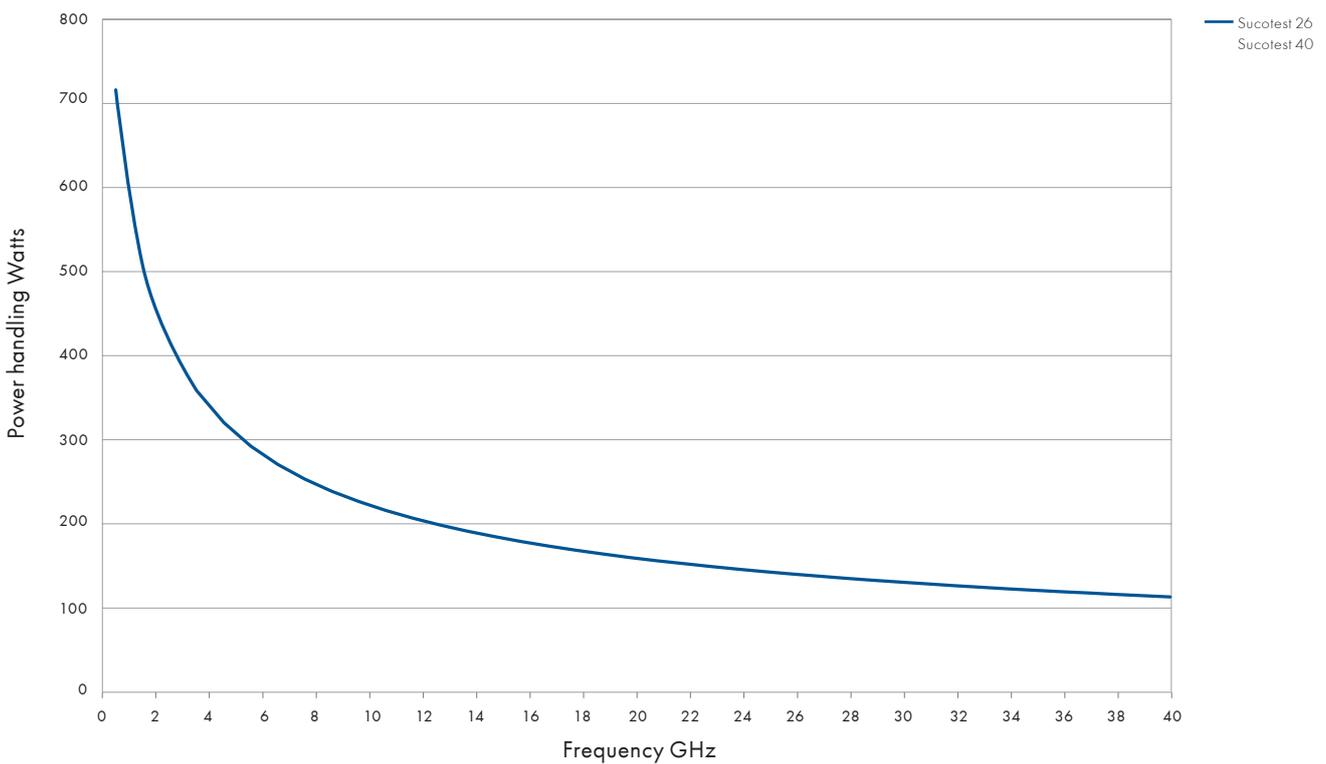
Item no.	Type	Length	Frequency	Max. insertion loss at 25 °C	Max. VSWR	RoHS compliant
		mm	GHz	dB		
80391541	ST26/SMAm/SMAm/24 inch	610	26.5	1.74	1.45	RoHS 6
80391542	ST26/SMAm/SMAm/36 inch	914	26.5	2.41	1.45	RoHS 6
80391543	ST26/SMAm/SMAm/48 inch	1219	26.5	3.08	1.45	RoHS 6
80391545	ST40/SKm/SKm/24 inch	610	40	2.20	1.50	RoHS 6
80391546	ST40/SKm/SKm/36 inch	914	40	3.03	1.50	RoHS 6
80391547	ST40/SKm/SKm/48 inch	1219	40	3.87	1.50	RoHS 6

# Sucotest 26/40 – Attenuation/power handling

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



# Sucotest 18(A)

Sucotest 18 is ideal for daily use in component and assembly shops, test labs, and high speed digital testing applications.

Sucotest 18A armoured test assemblies are ideal for testing wireless communication infrastructures and outdoor use.

## Features and benefits

- Applicable up to 18.0 GHz
- Low insertion loss
- Excellent VSWR
- Unique loss stability
- High flexibility despite of armouring
- Phase and loss stability with flexure
- Crush-, torque- and kink-resistant
- Waterproof IP68



## Recommended connectors

ST_18	SMA, QMA, N
ST_18A	N, 7/16

## Specifications

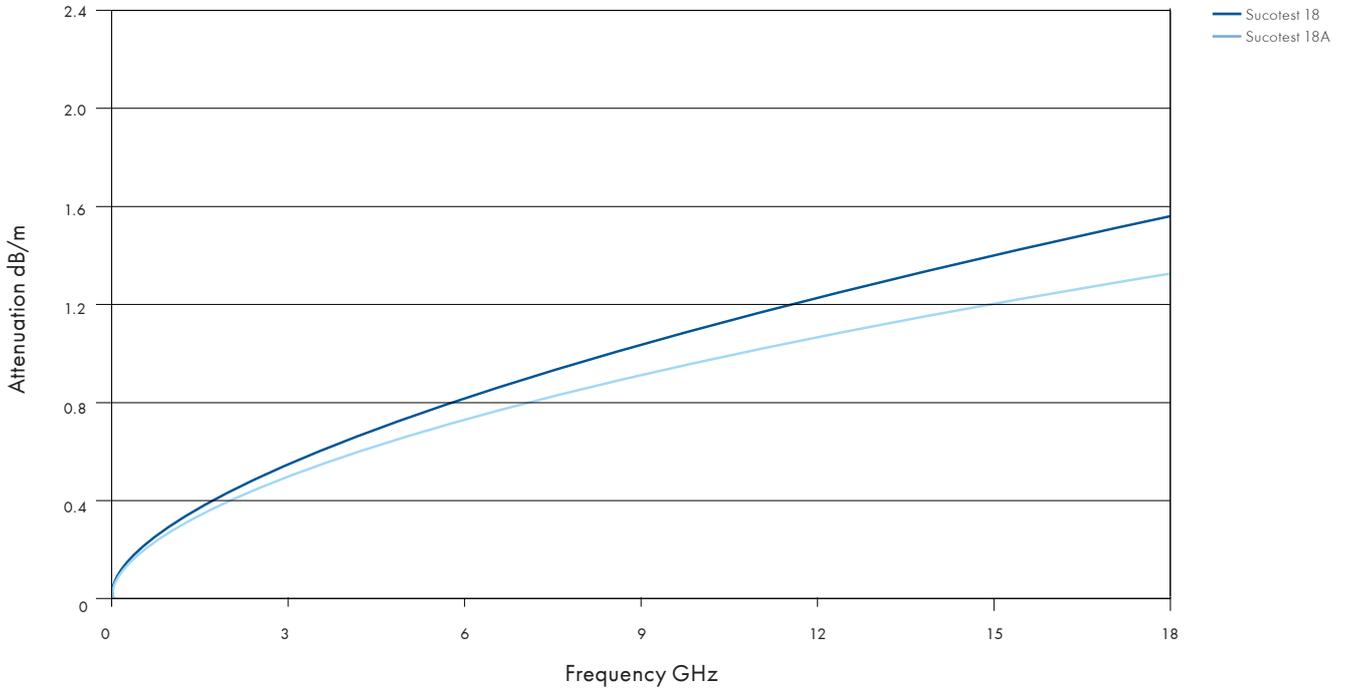
Frequency range	2 GHz	2.01 - 4 GHz	4.01 - 6 GHz	6.01 - 12 GHz	12.01 - 18 GHz
Power handling 25 °C, sea level (W)	> 391	> 277	> 225	> 160	> 131
Return loss (dB)	> 30	>28	> 25	> 21	> 19
Insertion loss stability vs. shaking (dB)	<0.03	<0.03	<0.03	<0.03	<0.03
Insertion loss stability vs. bending (dB)	<0.03	<0.04	<0.04	<0.05	<0.05
Insertion loss stability vs. torsion (dB)	<0.03	<0.04	<0.04	<0.05	<0.05

## Product assortment

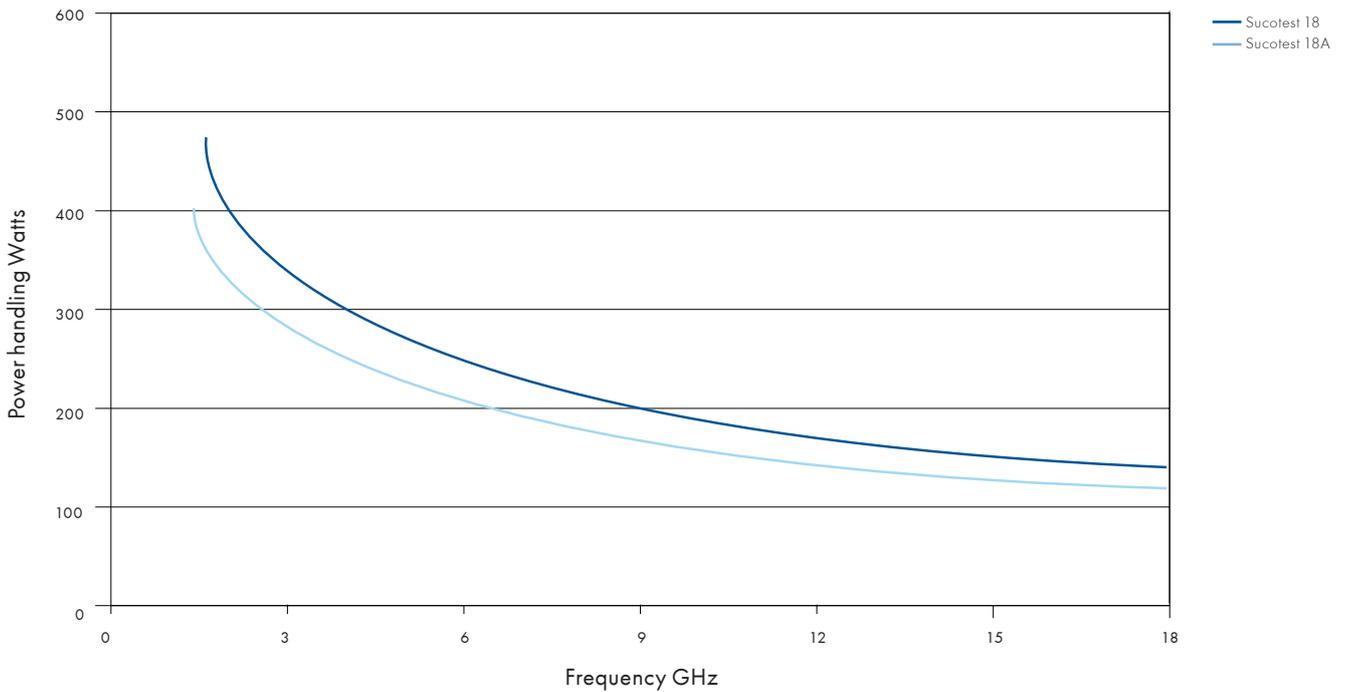
Item no.	Type	Length	Frequency	Max. insertion los	Max. VSWR	ROHS compliant
		mm/inch	GHz	at 25 °C		
84002061	ST-18/SMAm/SMAm/36 inch	914/36	18	< 1.51		
84002060	ST-18/Nm/Nm/36 inch	914/36	18	< 1.51		
84004594	ST-18/SMAm/Nm/36 inch	914/36	18	< 1.51		
84003373	ST-18/SMAm/SMAm/48 inch	1219/48	18	< 1.95		
84003372	ST-18/Nm/Nm/48 inch	1219/48	18	< 1.95		
84004006	ST-18/SMAm/Nm/48 inch	1219/48	18	< 1.95		
84004007	ST-18/SMAm/SMAm/72 inch	1829/72	18	< 2.85		
84004070	ST-18/Nm/Nm/72 inch	1829/72	18	< 2.85		
84004595	ST-18/SMAm/Nm/72 inch	1829/72	18	< 2.85		
84013029	ST18A/Nm/Nm/1500 mm	1500	18	2.74	1.25	yes
84013030	ST18A/Nm/Nf/1500 mm	1500	18	2.74	1.25	yes
84013031	ST18A/Nm/Nm/3000 mm	3000	18	5.30	1.25	yes
84013032	ST18A/Nm/Nf/3000 mm	3000	18	5.30	1.25	yes
84013033	ST18A/Nm/716m/1500 mm	1500	7.5	1.65	1.29	yes
84013034	ST18A/Nm/716f/1500 mm	1500	7.5	1.65	1.29	yes
84013035	ST18A/Nm/716m/3000 mm	3000	7.5	3.18	1.29	yes
84013036	ST18A/Nm/716f/3000 mm	3000	7.5	3.18	1.29	yes

# Sucotest 18(A)

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



# TL-8A

TL-8A assemblies are designed for testing components or equipments up to 8 GHz with network analyser (NA). This economical assembly family is made with a double screened, foamed PE cable and protected with an armouring using a moulded cable entry. The excellent electrical performance combined with a high mechanical endurance is ideal for use in test labs and in operations.

## Product features

- Impedance 50 Ω
- Applicable up to 8 GHz
- High mechanical endurance
- Excellent insertion and return loss
- High mating cycle
- N connector with quick-lock nut
- Excellent performance to price ratio
- Free of halogen



## Recommended connectors

TL-8A	SMA, N
	Other connectors available on request.

## Specifications

Key values						
Frequency		up to 8 GHz				
Return loss		1 GHz	2 GHz	4 GHz	6 GHz	8 GHz
	up to 1 m	≤ -30 dB	≤ -27 dB	≤ -25 dB	≤ -23 dB	≤ -21 dB
	≥ 3.0 m	≤ -29 dB	≤ -26 dB	≤ -24 dB	≤ -22 dB	≤ -20 dB
Attenuation		1.24 dB/m at 8 GHz (typical)				
Waterproof		no gasket on interface				
Durability (matings)		> 3000 cycles				
Assembly length		min. 300 mm, max. 3000 mm				

## Standard assemblies

Item no.	Type	Length mm	Frequency GHz	Max. insertion los at 25 °C	Max. VSWR	ROHS compliant
85006682	TL-8A-11N-11N-01500-51	1500	8	1.84	1.20	yes
85014643	TL-8A-11N-11SMA-01500-51	1500	8	1.84	1.18	yes
85021664	TL-8A-11N-21N-01500-51	1500	8	1.84	1.20	yes

# TL-P series

HUBER+SUHNER TL-P assemblies are designed for indoor and outdoor applications where passive intermodulation (PIM) has to be tested. This assembly family is based on a flexible cable which is optimised up to 4 GHz and protected with a steel armouring. The robust design is completed with a molded protection between connector and cable.

## Product features

- Impedance 50 Ω
- Applicable up to 4 GHz
- Excellent PIM performance ( $\leq -160$  dBc)
- High mechanical endurance
- Return Loss performance
- High mating cycle ( $> 2\,000$ )
- Highly flexible, rugged and reliable design
- Easy to handle for work in field
- Excellent performance to price ratio



## Recommended connectors

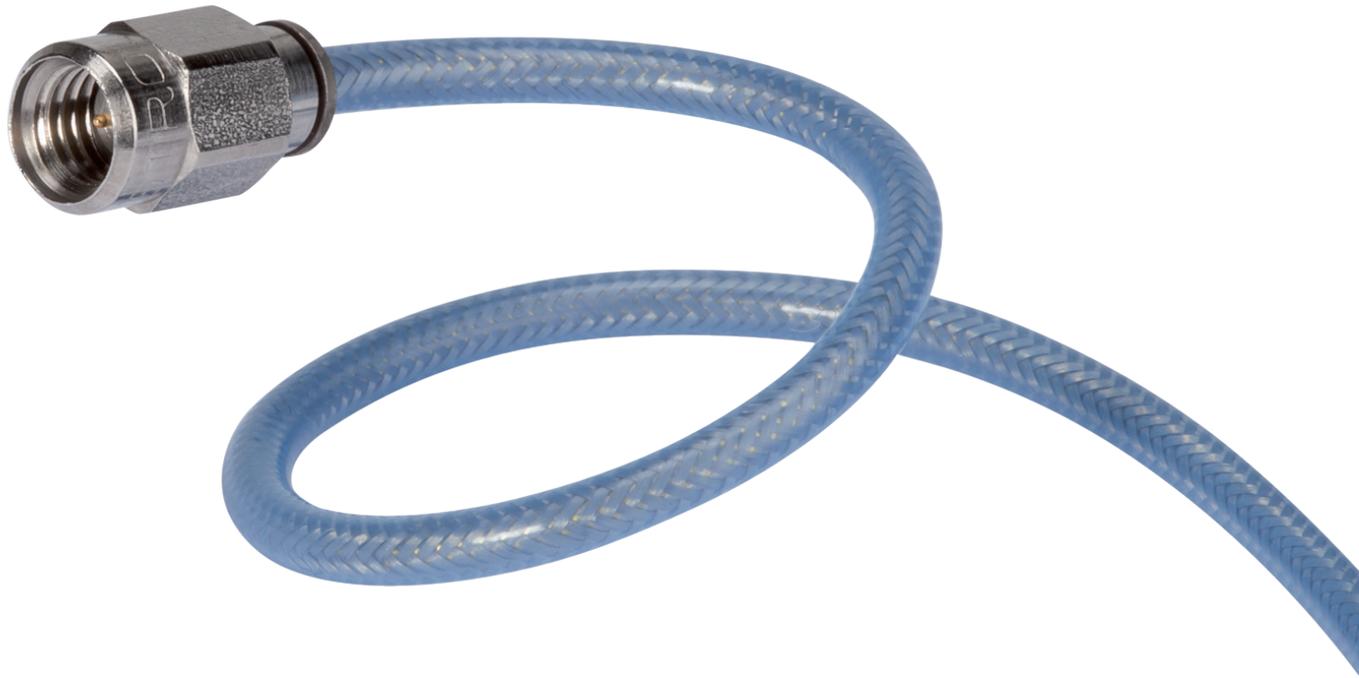
TL-P	716, N, 4.3-10 (screw version)
	Other connectors available on request.

## Specifications

Key values				
Frequency	up to 4 GHz			
Return loss (up to length = 3.0 m)	1 GHz	2 GHz	3 GHz	4 GHz
	$\leq -29$ dB	$\leq -26$ dB	$\leq -23$ dB	$\leq -20$ dB
Power (at 40 °C, sea level)	$\leq 560$ W	$\leq 390$ W	$\leq 320$ W	$\leq 280$ W
	0.75 dB/m at 2 GHz, 0.90 dB/m at 3 GHz			
PIM	$\geq -117$ dBm (160 dBc), tested according IEC 62037-2			
Waterproof	IP 67			
Shielding effectiveness	$> -120$ dB			
Temperature range	$-15$ to $+65$ °C (operating)			
	$-10$ to $+55$ °C (installation)			
Durability (matings)	$> 2000$ cycles			
Bending radius repeated	min. 50 mm (15 ×)			
Bending radius dynamic	$\geq 110$ mm (4.3 in), flex-life 10 000 bendings $\pm 90^\circ$			

## Standard assemblies

Item no.	Type	Length	Frequency	Max. insertion loss	Max. VSWR	Min. PIM	ROHS compliant
		mm	GHz	at 25 °C		dBc	
85027448	TL-P-11716-11716-01500-51	1500	4	1.54	1.22	160	yes
85027254	TL-P-11716-11716-03000-51	3000	4	2.97	1.22	160	yes
85027450	TL-P-11716-11N-01500-51	1500	4	1.54	1.22	160	yes
85027453	TL-P-11716-11N-03000-51	3000	4	2.97	1.22	160	yes
85029279	TL-P-11431X-11716-01500-51	1500	4	1.54	1.22	160	yes
85029280	TL-P-11431X-11716-03000-51	3000	4	2.97	1.22	160	yes

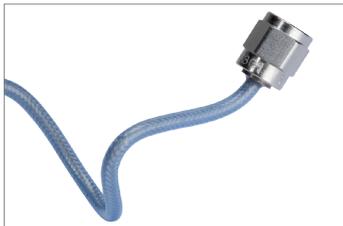


## Bend-to-end assemblies

Minibend is a truly flexible coaxial cable assembly which is designed for use in low profile, internal, point-to-point interconnections between RF modules within communications systems. Minibend replaces 0.086 inch custom semi-rigid cables with standard flexible cables, eliminating the need for predefined custom lengths and bend configurations. Minibend provides you with a preassembled and tested high performance, cost-effective alternative in a variety of standard lengths and connector configurations.

Minibend R is designed for use in complex, congested environments where higher cable retention force is required. Minibend R's pull strength is more than 70 % greater than a standard Minibend. When installed and bent at the minimum bend radius, Minibend R will tolerate multiple 90° rotations at the cable/connector junction. The "R" ruggedisation can be added to any Minibend connector style. All materials used in Minibend R assemblies meet or exceed NASA TML and CVCM requirements for use in spacecraft applications.

## Minibend



Low profile, high performance microwave coaxial cable assemblies

- Frequency range up to 65 GHz
- Triple shielded for high isolation
- Eliminates need for costly right angle connectors
- Direct replacement for 0.086 inch semi-rigid cables

## Minibend L



Low profile, high performance low loss microwave coaxial cable assemblies

- Frequency range up to 50 GHz
- Triple shielded for high isolation
- Microporous dielectric for 30 % lower insertion
- Direct replacement for 0.086 inch semi-rigid cables

## Microbend



Ultra low profile, high performance, microwave coaxial cable assemblies

- Frequency range up to 90 GHz
- Triple shielded for high isolation
- Direct replacement for 0.047 inch semi-rigid cables
- Guaranteed 10 lbs (45 N) pull force

## Mini141



Low profile, high performance ultra low loss microwave cable assemblies

- Frequency range up to 40 GHz
- Triple shielded for high isolation
- Eliminates need for costly right angle connectors
- Direct replacement for 0.141 inch semi-rigid cables

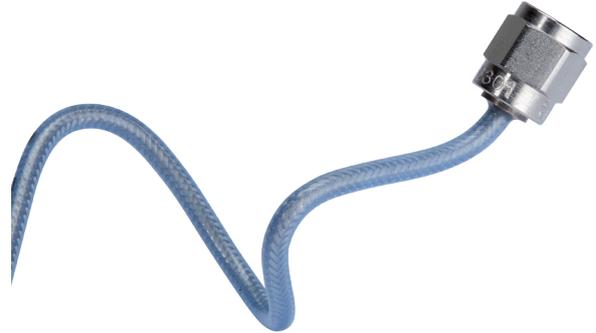
## Minibend CTR



Combines the industry-renowned flexibility of HUBER+SUHNER Astrolab's bend-to-the-end connector termination technology with industry leading phase vs. temperature performance.

# Minibend

Minibend is a truly flexible coaxial cable assembly which is designed for use in low profile, internal, point-to-point interconnections between RF modules within communications systems. Minibend replaces 0.086 inch custom semi-rigid cables with standard flexible cables, eliminating the need for predefined custom lengths and bend configurations. Minibend provides you with a preassembled and tested high performance, cost-effective alternative in a variety of standard lengths and connector configurations.



## Product features

- Impedance 50 Ω
- Applicable up to 65 GHz
- Direct replacement for 0.086 inch semi-rigid cables
- Stock delivery on standard lengths

## Recommended connectors

Minibend	SMA, SSMA, SK, SMP, 2.4 mm, 1.85 mm
	Other connectors available on request

## Specifications

Cable	Operating frequency	Velocity	Weight	Min. bending radius for ± 180°	Temperature range
	GHz	%	g/m	mm	°C
32081/32081S	65	70.3	14.9	5.08	-55 to +200

Assembly	Minibend R	Minibend AR	Minibend E	Minibend KR	Minibend KSR	Minibend KV
Connector A	SMA (m)	SSMA (m)	SMA (m), fully captivated	SK (m)	SK (m)	2.4 mm (m)/ 1.85 mm (m)
Connector B	SMA (m)	SSMA (m)	SMA (m), fully captivated	SK (m)	SMP (f)	SK (m)

Assembly	Minibend QG	Minibend PR	Minibend SR	Minibend 2SR	Minibend V
Connector A	2.4 mm (m) gold plated BeCu	SMA (m)	SMA (m)	SMP (f)	2.4 mm/1.85 mm (m)
Connector B	2.4 mm (m) gold plated BeCu	MMPX (m)	SMP (f)	SMP (f)	2.4 mm/1.85 mm (m)

Assembly	Minibend VG	Minibend WR	Minibend 2PR
Connector A	1.85 mm (m) gold plated BeCu	SMA (m)	MMPX (m)
Connector B	1.85 mm (m) gold plated BeCu	SMA (m)	MMPX (m)

Standard lengths	76.2 mm	(3 inch)	254 mm	(10 inch)
	101.6 mm	(4 inch)	279.4 mm	(11 inch)
	127 mm	(5 inch)	304.8 mm	(12 inch)
	152.4 mm	(6 inch)	330.2 mm	(13 inch)
	177.8 mm	(7 inch)	355.6 mm	(14 inch)
	203.2 mm	(8 inch)	381 mm	(15 inch)
	228.6 mm	(9 inch)	406.4 mm	(16 inch)

# Minibend L

Minibend L is an enhanced, low loss version of the Minibend flexible coaxial cable assembly with increased phase stability and power handling capacity which is designed for use in low profile, internal, point-to-point interconnections between RF modules within communications systems. Minibend L replaces 0.086 inch custom semi-rigid cables with standard flexible cables providing 30 % lower attenuation and eliminating the need for predefined custom lengths and bend configurations. Minibend L provides you with a preassembled and tested high performance, cost-effective alternative in a variety of standard lengths.



## Product features

- Impedance 50 Ω
- Applicable up to 50 GHz
- Direct replacement for 0.086 inch semi-rigid cables
- Stock delivery on standard lengths
- Microporous dielectric for 30 % lower insertion loss, improved phase stability and higher power handling

## Recommended connectors

Minibend L	SMA, SSMA, SMP, MMPX
	Other connectors available on request

## Specifications

Cable	Operating frequency	Velocity	Weight	Min. bending radius for ± 180°	Temperature range
	GHz	%	g/m	mm	°C
32024	50	76.0	16.4	6.4	-55 to +200

Assembly	Minibend LR	Minibend LSR	Minibend L2SR	Minibend LAR	Minibend LMTR	Minibend 2LMTR	Minibend L2PR
Connector A	SMA (m)	SMA (m)	SMP (f)	SSMA (m)	SMA (m)	SMPM-T (f)	MMPX (m)
Connector B	SMA (m)	SMP (f)	SMP (f)	SSMA (m)	SMPM-T (f)	SMPM-T (f)	MMPX (m)

Assembly	Minibend LPR	Minibend LMR	Minibend L2MR
Connector A	SMA (m)	SMA (m)	SMPM (f)
Connector B	MMPX (m)	SMPM (f)	SMPM (F)

Standard lengths	76.2 mm	(3 inch)	203.2 mm	(8 inch)
	101.6 mm	(4 inch)	228.6 mm	(9 inch)
	127 mm	(5 inch)	254 mm	(10 inch)
	152.4 mm	(6 inch)	279.4 mm	(11 inch)
	177.8 mm	(7 inch)	304.8 mm	(12 inch)

# Minibend CTR

The minibend CTR family of cable assemblies combines the industry-renowned flexibility of HUBER+SUHNER Astrolab's bend-to-the-end connector termination technology with industry leading phase vs. temperature performance to create a stable, reliable, MIL-DTL-17 qualified interconnect solution to satisfy an endless range of customer applications where phase stability is key. The broad selection of connector interfaces offered on minibend CTR cable assemblies ensures that we are able to meet the unique requirements of our customers.

## Features

- Flat phase change over temperature
- Bend-to-the-end technology
- Outstanding return loss performance

## Benefits

- Increased system accuracy over temperature change
- Higher reliability due to solderless junctions



## Recommended connectors

Minibend CTR	SMA, SK, SMP, MMPX
	Other connectors available on request

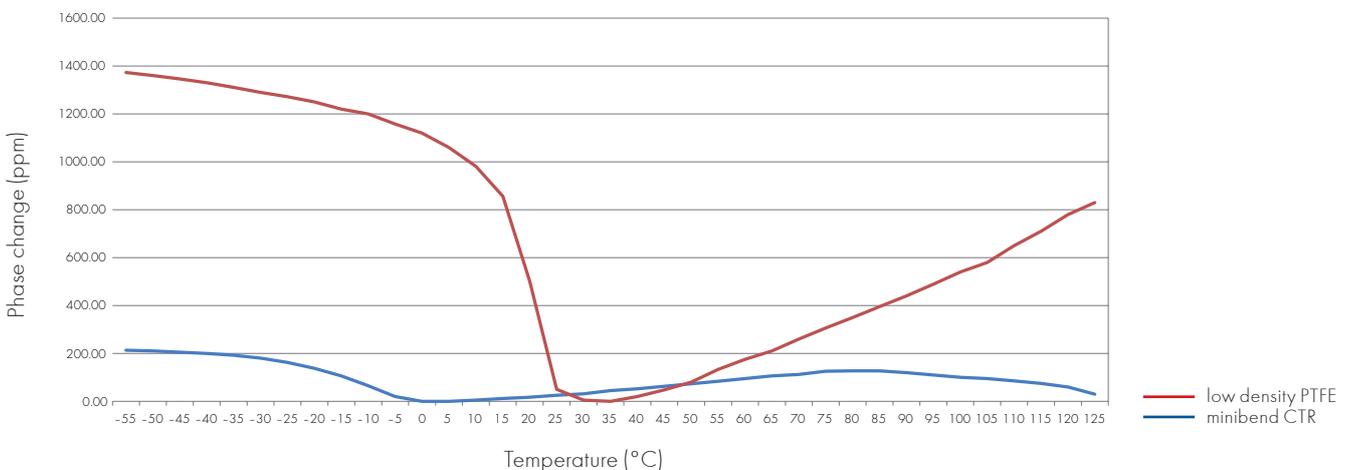
## Phase stability versus bending

Frequency	Test one*		Test two**	
	minibend CTR	minibend	minibend CTR	minibend
24.0 GHz	1.0°	1.4°	3.7°	3.9°
1.0 GHz	0.1°	0.1°	0.1°	0.2°

\* Test one: 152 mm long assemblies were flexed 90 degrees in a 6.35 mm radius directly behind the connector.

\*\* Test two: 406 mm long assemblies were flexed 180 degrees with a 10.16 mm radius in the middle.

## Phase stability versus temperature



Standard lengths	76.2 mm (3 inch)	203.2 mm (8 inch)
	101.6 mm (4 inch)	228.6 mm (9 inch)
	127 mm (5 inch)	254 mm (10 inch)
	152.4 mm (6 inch)	279.4 mm (11 inch)
	177.8 mm (7 inch)	304.8 mm (12 inch)

# Microbend

Microbend assemblies provide you with a standard preassembled and tested high performance, cost-effective truly flexible alternative to 0.047 inch custom semi-rigid cable assemblies, eliminating the need for predefined custom lengths and bend configurations. Microbend features include 35 % lower loss than 0.047 inch semi-rigid cable, a minimum bend radius of 1.52 mm (0.060 inch) and triple shielding for high isolation. Microbend assemblies are available with a wide range of connector interfaces. All Microbend assemblies are available only in a ruggedised version.



## Product features

- Impedance 50 Ω
- Applicable up to 65 GHz
- Stock delivery on standard lengths
- 35 % lower insertion loss than 0.047 inch semi-rigid cables

## Recommended connectors

Microbend	SMA, SSMA, SK, SMP, SMPM, SMPM-T, 1.85 mm, MMPX, 1.00 mm
	Other connectors available on request

## Specifications

Cable	Operating frequency	Velocity	Weight	Min. bending radius for ± 180°	Temperature range
	GHz	%	g/m	mm	°C
32041	90	70.3	11.9	1.50	-55 to +200

Assembly	Microbend R	Microbend AR	Microbend KR	Microbend KMR	Microbend KMTR	Microbend MR
Connector A	SMA (m)	SSMA (m)	SK (m)	SK (m)	SK (m)	SMA (m)
Connector B	SMA (m)	SSMA (m)	SK (m)	SMPM (f)	SMPM-T(f)	SMPM (f)

Assembly	Microbend KV	Microbend 2MR	Microbend MTR	Microbend 2MTR	Microbend MVR
Connector A	SK (m)	SMPM (f)	SMA (m)	SMPM-T(f)	SMPM (f)
Connector B	1.85 mm (m) gold plated BeCu	SMPM (f)	SMPM-T(f)	SMPM-T(f)	1.85 mm (m) gold plated BeCu

Assembly	Microbend SR	Microbend 2SR	Microbend V	Microbend 1R	Microbend PR	Microbend 2PR
Connector A	SMA (m)	SMP (f)	1.85 mm (m) gold plated BeCu	1.00mm (m)	SMA (m)	MMPX (m)
Connector B	SMP (f)	SMP (f)	1.85 mm (m) gold plated BeCu	1.00mm (m)	MMPX (m)	MMPX (m)

Standard lengths	76.2 mm	(3 inch)	203.2 mm	(8 inch)
	101.6 mm	(4 inch)	228.6 mm	(9 inch)
	127 mm	(5 inch)	254 mm	(10 inch)
	152.4 mm	(6 inch)	279.4 mm	(11 inch)
	177.8 mm	(7 inch)	304.8 mm	(12 inch)

# Microbend 1R

The Microbend 1R cable assembly is a true DC to 85 GHz solution that uses PC 1.0 connectors for microwave frequency applications. This assembly achieves high mechanical pull strength from a stainless steel outer braid, yet remains light-weight and flexible. Solderless, ruggedized PC 1.0 bend-to-the-end connector junctions allow the minimum bend radius to be applied at the connectors when spatial constraints are a concern, eliminating the need for signal attenuating right angle connectors. The flat wire inner braid of the cable decreases insertion losses and increases signal stability during flexure. Triple shielding in the cable increases RF signal isolation in high density situations.



## Product features

- Impedance 50 Ω
- Applicable up to 85 GHz
- Solderless bend-to-the-end technology
- Uses PC 1.0mm connectors
- High strength, high flexibility
- Excellent loss stability over flexure
- Triple shielded for RF isolation
- Rugged and reliable
- Wide temperature range (-55 to +125 °C\*)
- Direct replacement for 0.047 inch semi-rigid cables

## Recommended connectors

Microbend 1R	PC 1.0 mm
	Other connectors available on request

## Specifications

Cable	Operating frequency GHz	Velocity %	Weight g /m	Min. bending radius for ± 180°		Temperature range °C
				static mm	repeated mm	
32041	85	70	11.9	1.50	4.6	-55 to +125*

\* Extended temperature ranges available upon request

Standard lengths	76.2 mm	(3 inch)
	152.4 mm	(6 inch)
	304.8 mm	(12 inch)

# 110 GHz frequency cable (32061)

The 32061 Steel-flex cable is constructed to be a flexible and high strength for true 110 GHz solution for laboratory research and high-speed digital measurements when paired with precision PC 1.0 mm connectors. Triple shielding provides superb RF isolation for minimizing signal leakage and attenuation. The flat wire inner braid reduces insertion loss and increases signal stability during flexure. A stainless steel outer braid provides high pull strength as well as additional shielding. Solid extruded PTFE dielectric gives the cable added durability for physically demanding applications.



## Product features

- Impedance 50 Ω
- Applicable up to 110 GHz
- High pull strength
- Triple shielded for RF isolation
- Low phase loss vs. flexure
- Rugged and reliable
- Wide temperature range (-55 to +125 °C\*)

## Recommended connectors

Microbend	PC 1.0 mm
	Other connectors available on request

## Specifications

Cable	Operating frequency	Velocity	Weight	Min. bending radius for ± 180°		Temperature range
	GHz			%	g /m	
32061	110	70	7.4	5.08	15.2	-55* to +200

\* Extended temperature ranges available upon request

Standard lengths	76.2 mm	(3 inch)
	152.4 mm	(6 inch)
	304.8 mm	(12 inch)

# Mini141

Mini141 is an enhanced, low loss version of the Minibend flexible coaxial cable assembly with increased phase stability and power handling capacity which is designed for use in low profile, internal, point-to-point interconnections between RF modules within communications systems. Mini141 replaces 0.141 inch custom semi-rigid cables with standard flexible cables providing 20 % lower attenuation and eliminating the need for predefined custom lengths and bend configurations. Mini141 provides you with a preassembled and tested high performance, cost-effective alternative in a variety of standard lengths.



## Product features

- Impedance 50 Ω
- Applicable up to 40 GHz
- Direct replacement for 0.141 inch semi-rigid cables
- Stock delivery on standard lengths
- Microporous dielectric for 20 % lower insertion loss, improved phase stability and higher power handling

## Recommended connectors

Mini141	SMA, N, TNCA, SK, SMP
	Other connectors available on request

## Specifications

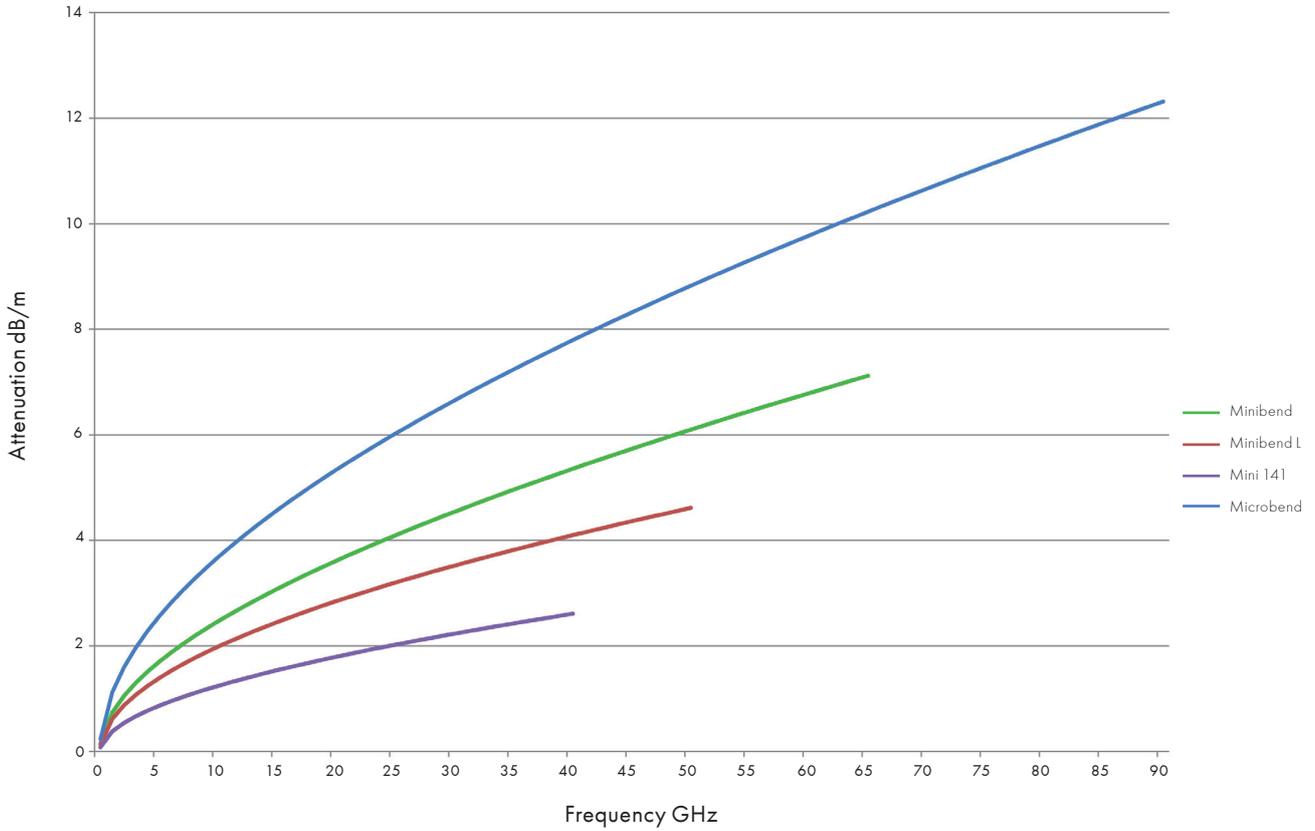
Cable	Operating frequency	Velocity	Weight	Min. bending radius for ± 180°	Temperature range
	GHz	%	g /m	mm	°C
32022	40	76.3	31.3	8.40	-55 to +200

Assembly	Mini141	Mini141 K	Mini141 N	Mini141 T	Mini141 W	Mini141 S
Connector A	SMA (m)	SK (m)	N (m)	ATNC (m)	SMA (m)	SMA (m)
Connector B	SMA (m)	SK (m)	N (m)	ATNC (m)	SMA (m)	SMP (f)

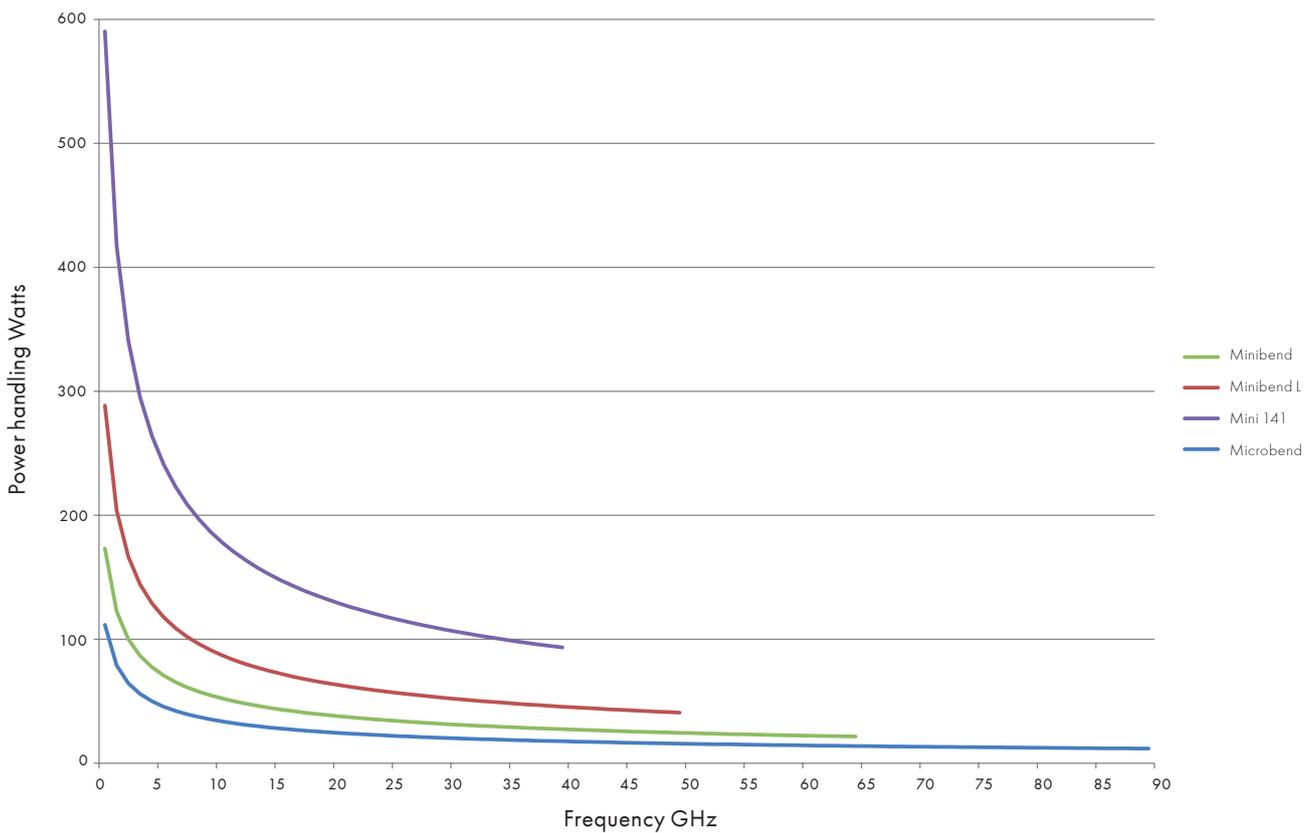
Standard lengths	127 mm	(5 inch)	228.6 mm	(9 inch)
	152.4 mm	(6 inch)	254 mm	(10 inch)
	177.8 mm	(7 inch)	279.4 mm	(11 inch)
	203.2 mm	(8 inch)	304.8 mm	(12 inch)

# Minibend series - Attenuation/power handling

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)





## High flexible and rigid cable assemblies

HUBER+SUHNER develops and produces coaxial cables for a wide range of applications all over the world according to international standards. Many years of experience and in-house manufacturing combine to produce a portfolio of components adapted perfectly to one another. Continuous further development ensures that the products are perfectly aligned with market requirements and incorporate the latest technology. An innovative development department with in-house test laboratories can react quickly to changing market trends and even develop customer-specific solutions.

Sucoform microwave coaxial cables offer distinct mechanical advantages over semi-rigid cables. They are based on the same design as the standard PTFE insulated semi-rigid cables, but have a tin-soaked copper braid for the outer conductor, giving them outstanding hand-formability. These cables combine the excellent characteristics of semi-rigid cables with those of flexible coaxial cables. Thanks to their small bending radii, they allow spacesaving routing and packaging.

The semi-rigid cable is unique in that it is easily bent to finished shape and still maintains its set after bending. This property makes it ideal for use with automated bending equipment as well as hand forming by bending tools. The semi-rigid cables provide greatly extended environmental parameters. The cables exhibit highly favourable electrical characteristics, particularly an impedance tolerance as low as 0.5 Ohm for a 0.0141" diameter cable with nominal impedance of 50 Ohm.

## Multiflex 86/141



The flexible alternative to semi-rigid

- Frequency range up to 65 GHz
- High screening
- High flexibility
- Resistant to chemicals, oils, lubricants, humidity

## Sucoform



The handformable alternative to semi-rigid

- Frequency range up to 40 GHz
- High phase stability
- Good flexibility
- Quick and easy assembling

## Cobra-flex



The flexible semi-rigid microwave coaxial cable assemblies

- Frequency range up to 40 GHz
- Minimal dielectric migration
- Standard semi-rigid size
- Optional extended temperature range  $-269$  to  $+250$  °C

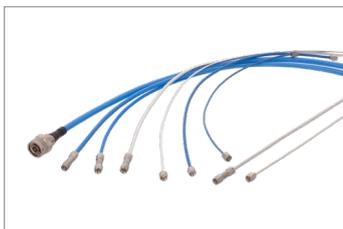
## Semi-rigid



The form stable microwave cable

- Frequency range up to 65 GHz
- Excellent VSWR performance
- Easy to form, strip and solder
- Small sizes permit use in high-density areas

## CT product family



Phase invariant cable assemblies

- Excellent phase and insertion loss stability over temperature
- Superior phase stability versus bending
- Outstanding return loss and shielding effectiveness performance

# Multiflex 86/141

Multiflex microwave cables are the flexible alternative to semi-rigid cables. They are used in commercial and military RF and microwave airborne systems, communication systems, cellular base stations, satellite, ground systems - in brief: anywhere a "flexible semi-rigid cable" is required.

## Product features

- Impedance 50 Ω
- Applicable up to 65 GHz
- Comparable electrical performance as corresponding semi-rigid cable types, high screening
- High flexibility: no 3D drawings required for design and manufacture
- Semi-rigid connectors can be used; quick and easy assembly
- Resistant to chemicals, oils, lubricants, humidity, etc.



## Recommended connectors

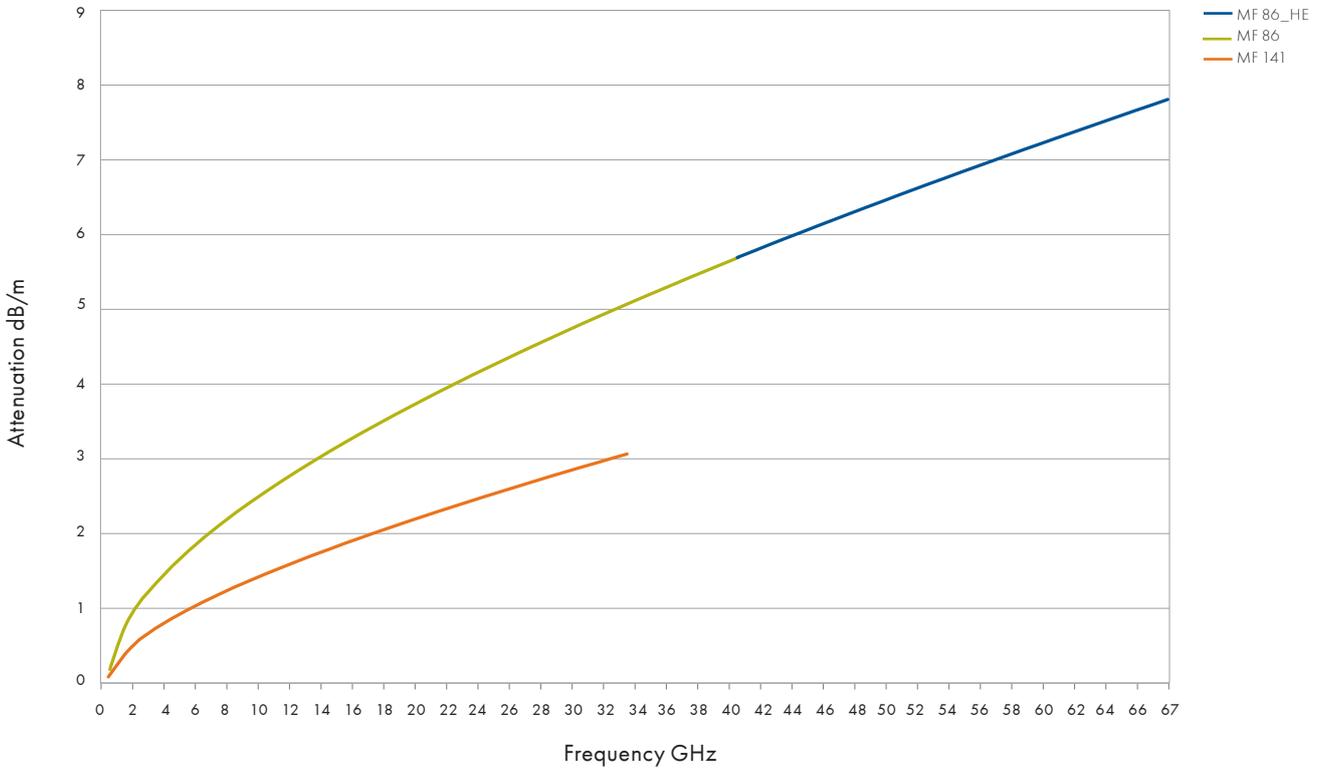
MF_86 MF_86_HE	MCX, MMBX, MMCX, MMPX, SMA, PC3.5, SK, PC1.85, BMA, QMA
MF_141	SMA, PC3.5, BMA, QMA, BNC, TNC, N
	Other connectors available on request.

## Specifications

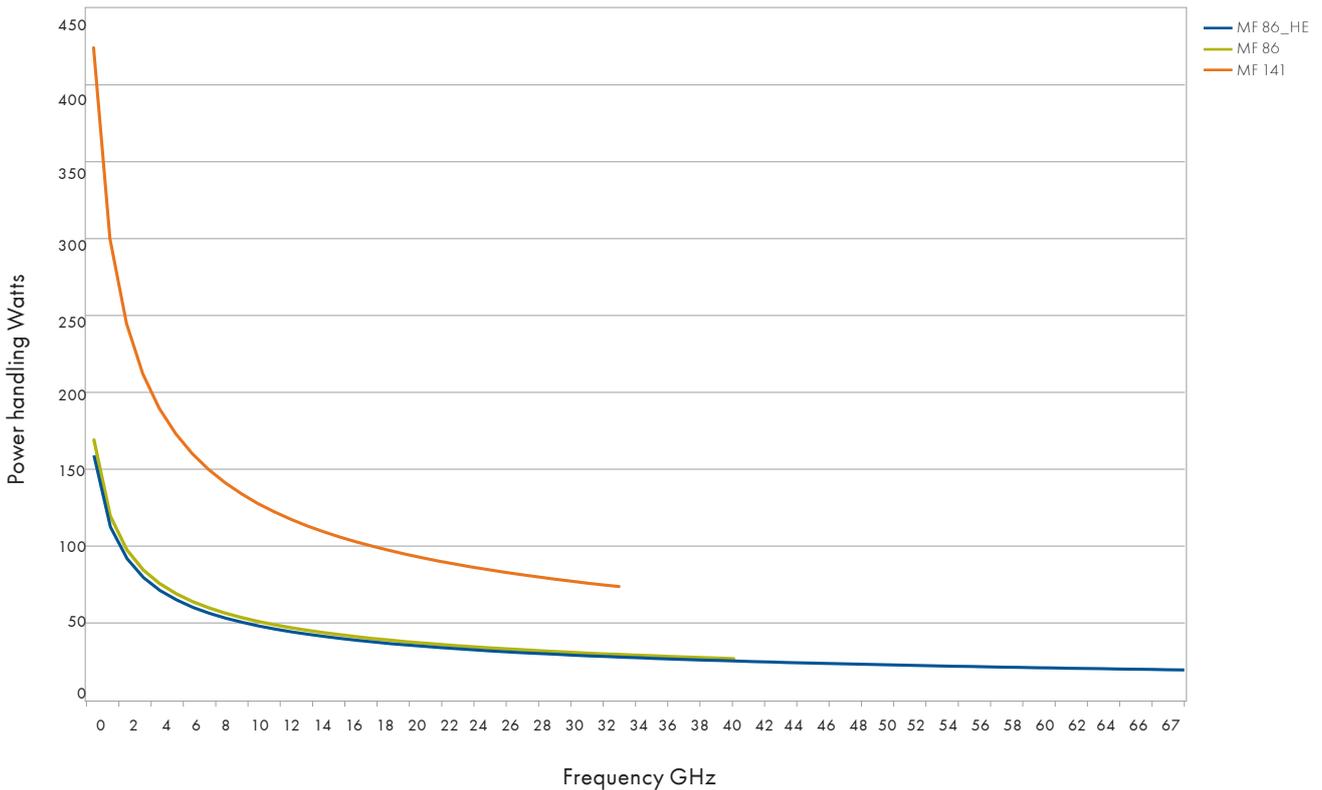
Cable	Item no.	Max. operating frequency	Velocity of propagation	Weight	Min. bending radius		Temperature range
					static mm	repeated mm	
Multiflex_86	22511965	40 GHz	71 %	21 g/m	6	20	-65 to +165 °C
Multiflex_86_HE	84129072	65 GHz	71 %	21 g/m	10	20	-65 to +165 °C
Multiflex_141	22511964	33 GHz	71 %	45 g/m	10	40	-65 to +165 °C

# Multiflex 86/141

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



# Sucoform

Sucoform microwave coaxial cables offer distinct mechanical advantages over semi-rigid cables. They are based on the same design as the standard PTFE insulated semi-rigid cables, but have a tin-soaked copper braid for the outer conductor, giving them outstanding hand-formability. These cables combine the excellent characteristics of semi-rigid cables with those of flexible coaxial cables. Thanks to their small bending radii, they allow space saving routing and packaging.



## Product features

- Impedance 50 Ω
- Applicable up to 40 GHz
- Due to the high phase stability over every production run, Sucoform is especially suitable for delay lines
- Good flexibility: easy hand forming without tooling; fits into the smallest systems
- Quick and easy assembly for design and manufacture

## Recommended connectors

SM_47_CU	MMCX, MCX, SMA, SK
SM_86	MCX, MMCX, SMA, SMB, SMC, PC3.5, SK, QMA, TNC, N
SM_141	SMA, PC3.5, QMA, TNC, N, QN
SM_250-01	SMA, N, 716
	Other connectors available on request

## Specifications

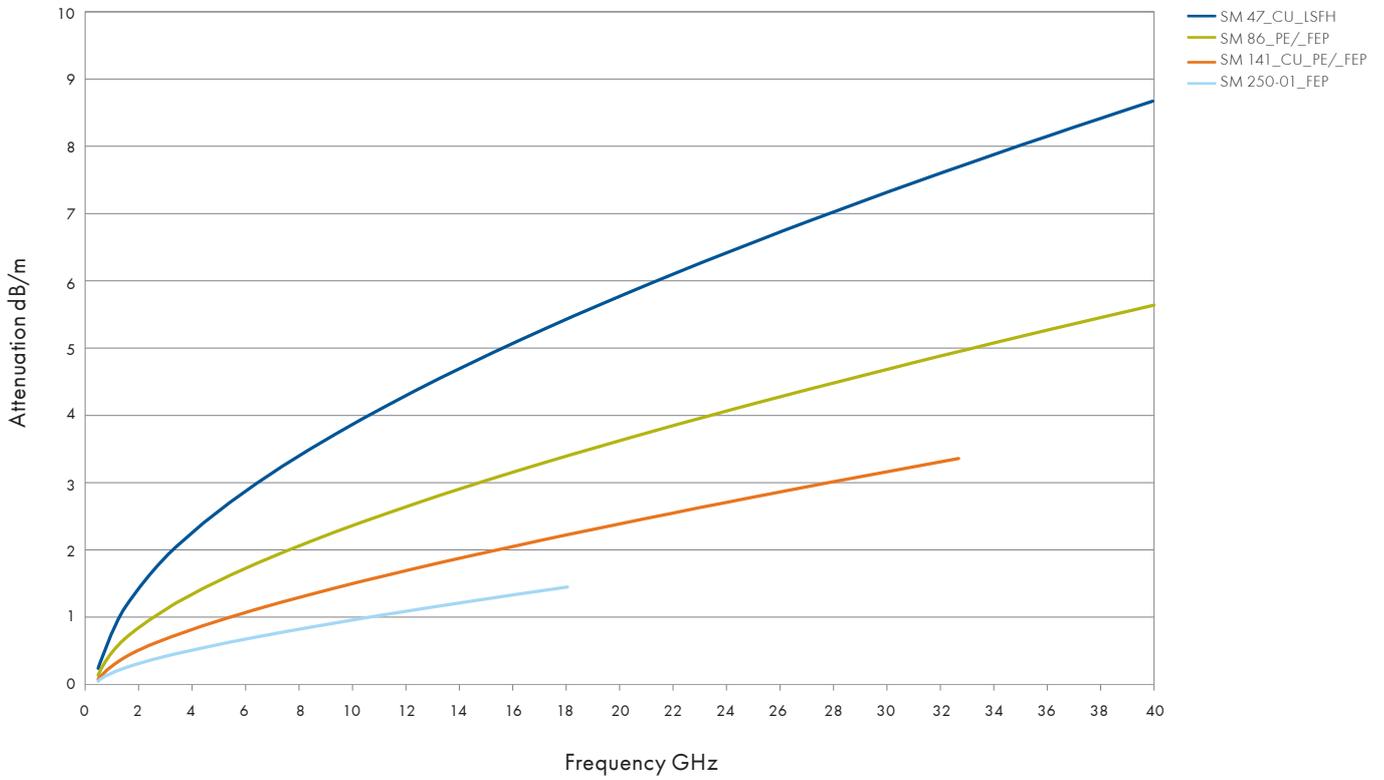
Cable	Item no.	Max. operating frequency	Velocity of propagation	Weight	Min. bending radii		Temperature range
					GHz	%	
SM_47_CU	23033515	40	71	6	3.18	n/a	-65 to +165
SM_86	22511613	40	71	15	6	20	-65 to +165
SM_141	22511925	33	71	38	8	40	-65 to +165
SM_250-01	84007938	18	71	130	30	120	-65 to +165

## Specifications – Sucoform with protective jacket

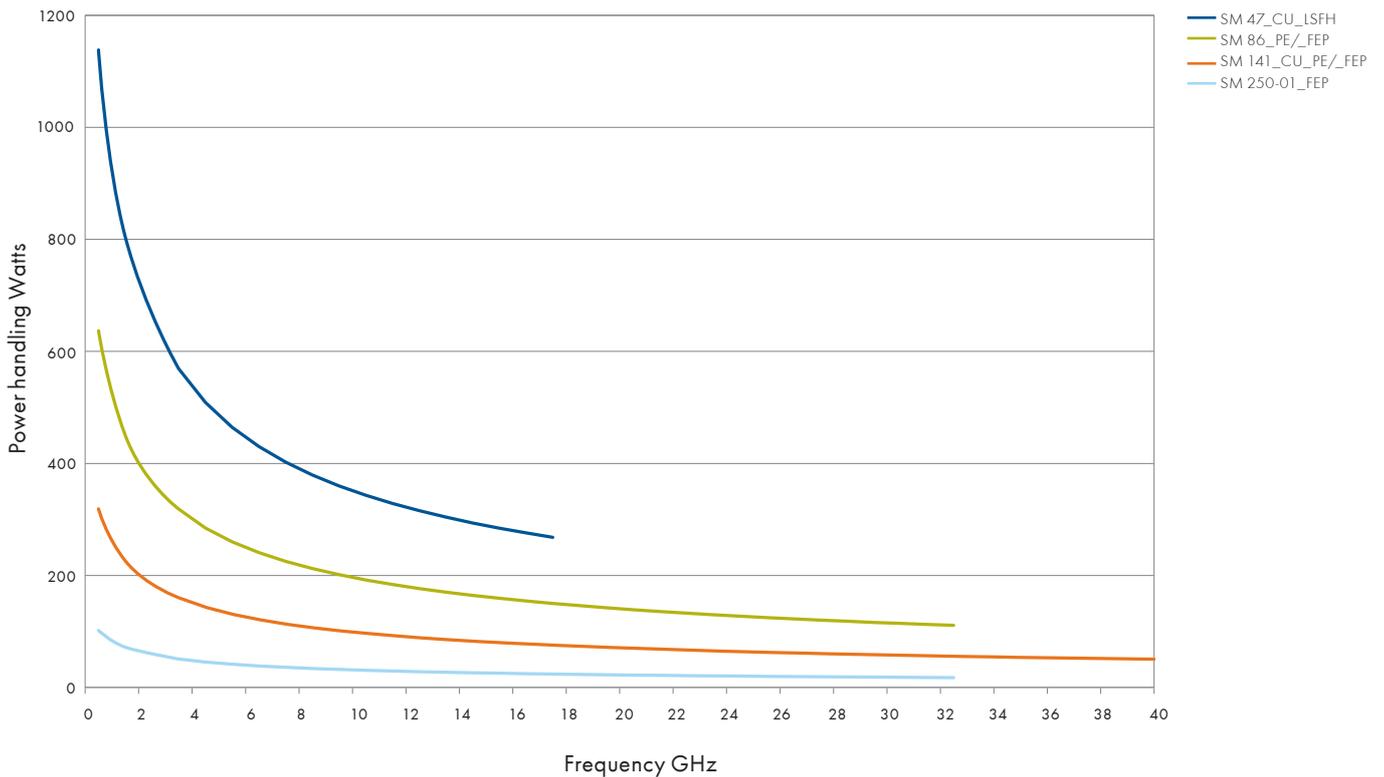
Cable	Item no.	Max. operating frequency	Velocity of propagation	Weight	Min. bending radii		Temperature range
					GHz	%	
SM_47_CU_LSFH	23035506	40	71	7	4	n/a	-40 to +85
SM_86_PE	22511631	40	71	19	6	20	-40 to +85
SM_86_FEP	22511942	40	71	18	6	20	-65 to +165
SM_141_CU_PE	22511639	33	71	47	8	40	-40 to +85
SM_141_CU_FEP	22512256	33	71	47	8	40	-65 to +165
SM_250-01_FEP	84007941	18	71	138	30	120	-65 to +165

# Sucoform

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



# Cobra-flex

Cobra-flex are high performance semi-rigid cables, which utilise a seamless outer conductor to provide excellent RF shielding. The convoluted design gives this cable excellent phase tracking characteristics over temperature due to minimal dielectric migration. These cables are offered with many options including tin-plated outer conductor, copper clad steel center conductor for low thermal conductivity in cryogenic applications.



## Product features

- Impedance 50 Ω
- Applicable up to 40 GHz
- Minimal dielectric migration
- Higher flexibility without outer conductor fatiguing
- Standard semi-rigid sizes
- Optional extended temperature range -269 to +250 °C for cryogenic applications

## Recommended connectors

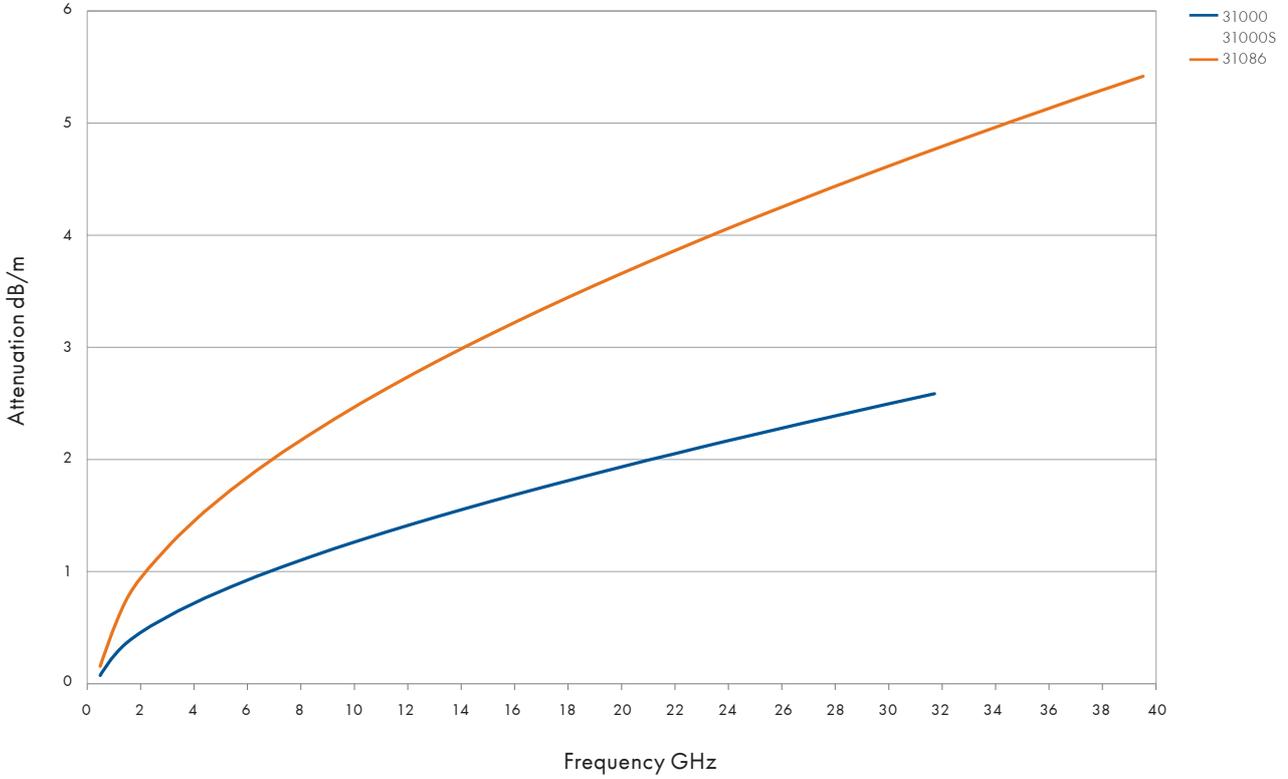
31086	SMA, SK, 3.5 mm, TNC, N
31000	SMA, TNC, N, 3.5 mm
31000S	SMA, TNC, N, 3.5 mm

## Specifications

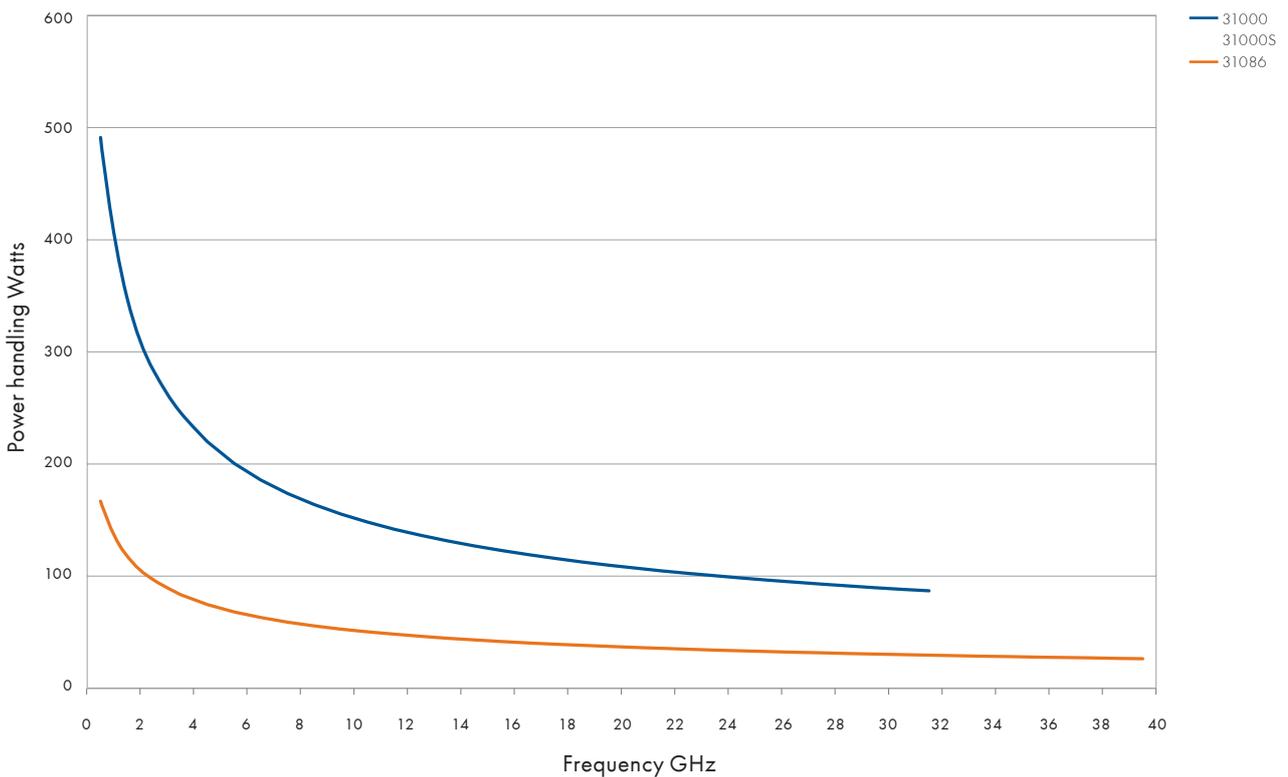
Cable	Item no.	Replacement for	Max. operating frequency	Velocity of propagation	Weight	Min. bending radii		Temperature range
			GHz	%		g/m	static mm	
31000	80310897	RG_402	32	70.3	35.7	19.1	57.2	-55 to +200
31000S	80320630		32	70.3	35.7	19.1	57.2	
31086	80310901	RG_405	40	70.3	20.8	8.9	26.7	

# Cobra-flex

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



# Semi-rigid

The semi-rigid cable is unique in that it is easily bent to finished shape and still maintains its set after bending. This property makes it ideal for use with automated bending equipment as well as hand forming by bending tools.

## Product features

- Impedance 50 Ω
- Applicable up to 65 GHz
- Excellent VSWR performance
- Easy to form, strip and solder, making for convenient installation
- Small sizes permit use in high-density areas



## Recommended connectors

EZ_47	MMCX, MCX, SMA, SK
EZ_86	MCX, MMCX, SMA, PC3.5, SK, QMA, TNC, N
EZ_118	SK
EZ_141	SMA, PC3.5, QMA, TNC, N, QN
EZ_250	SMA, N, 7/16
Other connectors available on request.	

## Specifications - Copper

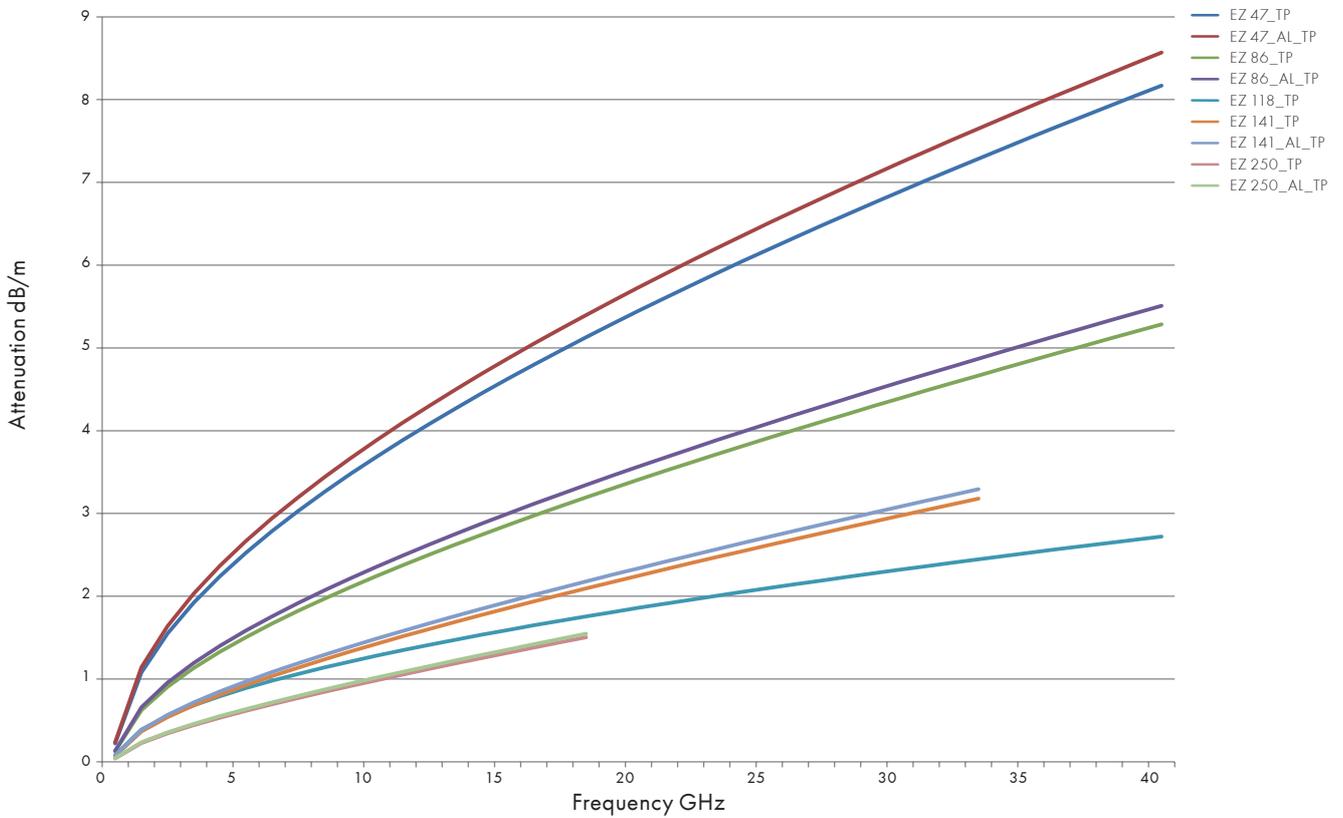
Cable	Item no.	Max. operating frequency	Velocity of propagation	Weight	Min. bending radius		Temperature range
		GHz	%		static mm	repeated mm	
EZ_47_TP_M17	22810504	65	69.5	7.1	3.18	n/a	-40 to +100
EZ_86_TP_M17	22810175	65	69.5	24	3.18	n/a	-40 to +125
EZ_118_TP	22810073	40	80.0	34	9.53	n/a	-40 to +125
EZ_141_TP_M17	22810043	33	69.5	52	6.35	n/a	-40 to +125
EZ_250_TP_M17	22810705	18	69.5	158	19.0	n/a	-40 to +90

## Specifications - Aluminium

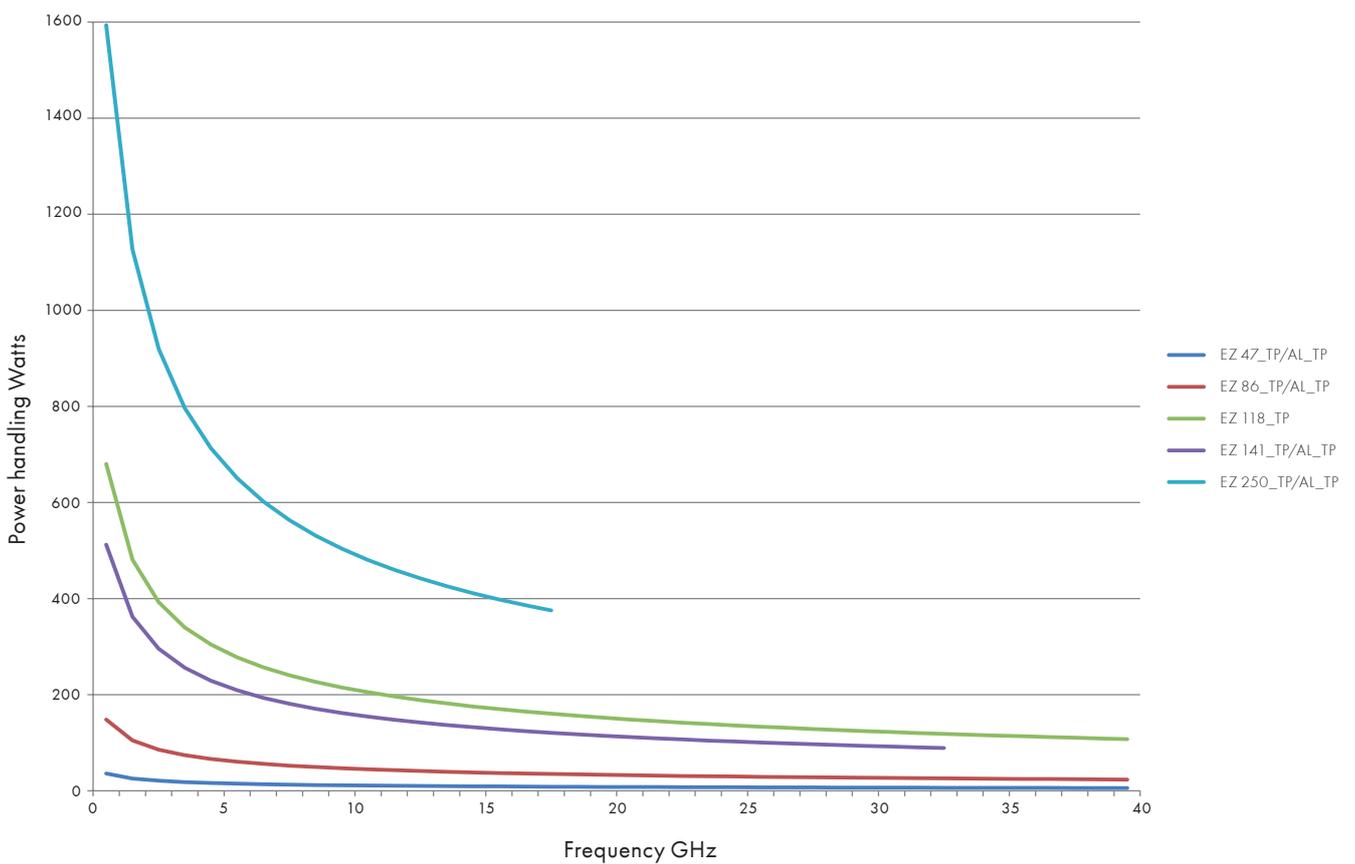
Cable	Item no.	Max. operating frequency	Velocity of propagation	Weight	Min. bending radius		Temperature range
		GHz	%		static mm	repeated mm	
EZ_47_AL_TP_M17	22810510	65	69.5	3.1	1.27	n/a	-40 to +100
EZ_86_AL_TP_M17	22810167	65	69.5	11.9	1.78	n/a	-40 to +125
EZ_141_AL_TP_M17	22810015	33	69.5	30.5	3.18	n/a	-40 to +125
EZ_250_AL_TP_M17	22810708	18	69.5	88.6	19.0	n/a	-40 to +90

# Semi-rigid

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



# CT product family

The HUBER+SUHNER CT product family is developed for phase critical applications requiring precision electrical length connectivity. Thus, it creates a stable and reliable interconnect solution to satisfy a huge range of customer applications where phase stability is key.

These products provide the industry leading phase vs. temperature performance, as well as a unique range of cable constructions to fulfil any customer demands.

Depending on the application, there is a broad variety of products lines available:

- Sucoform CT      Hand formable, form stable cable with tin soaked braid outer conductor
- Semi-rigid CT      Form stable cable with tubular, tin plated outer conductor
- Minibend CT      Flexible cable assembly with bend-to-the-end connector termination
- Multiflex CT      Flexible alternative to Semi-Rigid microwave cables

## CT Portfolio Overview

	0.086"	0.141"	0.210"	0.318"
Semi-rigid	✓	✓		
Sucoform	✓	✓		
Minibend	✓	✓		
Multiflex		✓	✓	✓

# CT product family

## Features

- Excellent phase and insertion loss stability over temperature
- Superior phase stability versus bending
- Outstanding return loss and shielding effectiveness performance
- Easy installation
- Small bending radii

## Benefits

- Increased system accuracy over temperature change
- Stable system performance over multiple temperature cycles
- Product reliability - meeting the specified values not only at one single temperature



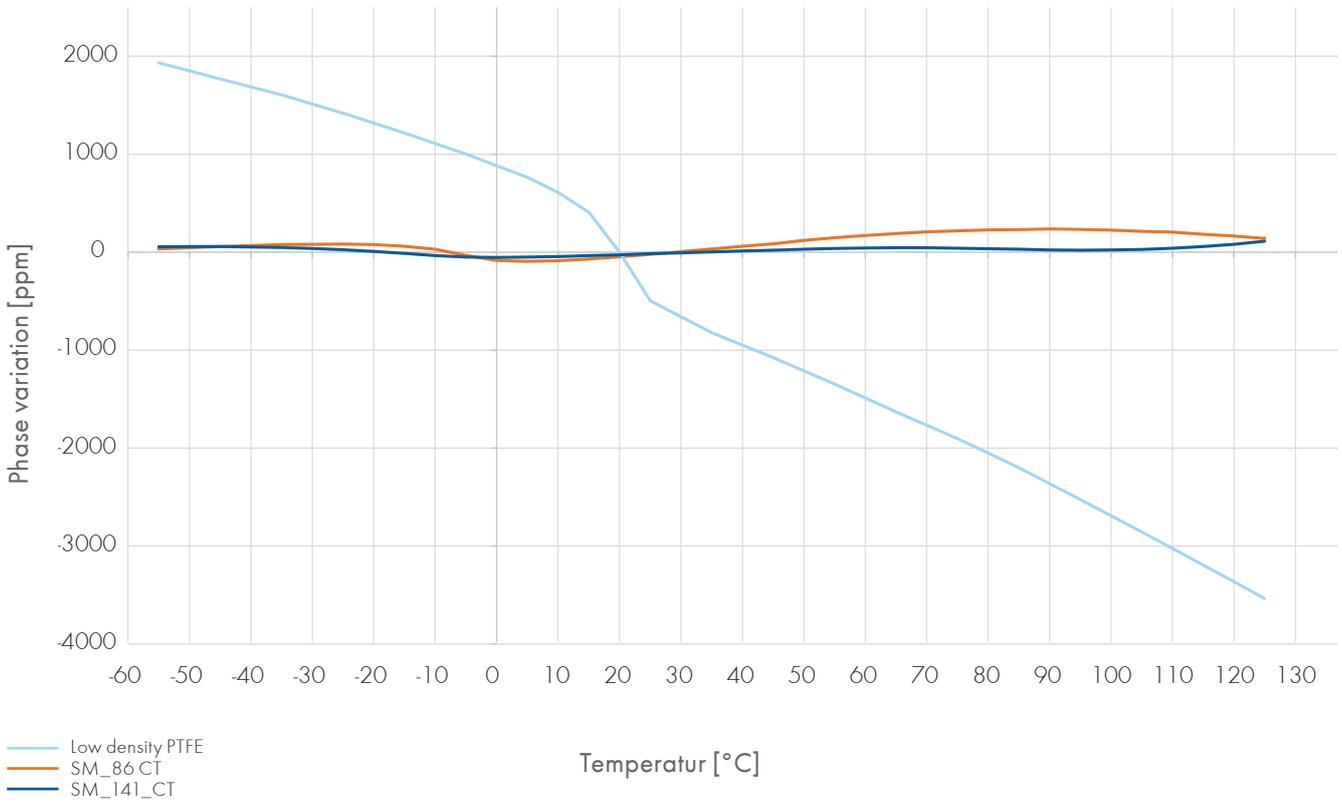
# Sucoform CT



## Benefits

- Static applications
- Frequency range up to 40GHz
- Space and time saving routing
- Quick and easy assembling

Phase variation vs. temperature



## Product Overview

Description	Frequency range	Insertion loss @18GHz	Outer diameter	Connectors
Sucoform_86_CT	40 GHz	3.18 dB/m	2.15 mm	SK, SMA, MMPX
Sucoform_141_CT	30 GHz	1.93 dB/m	3.58 mm	SK, SMA, BMA

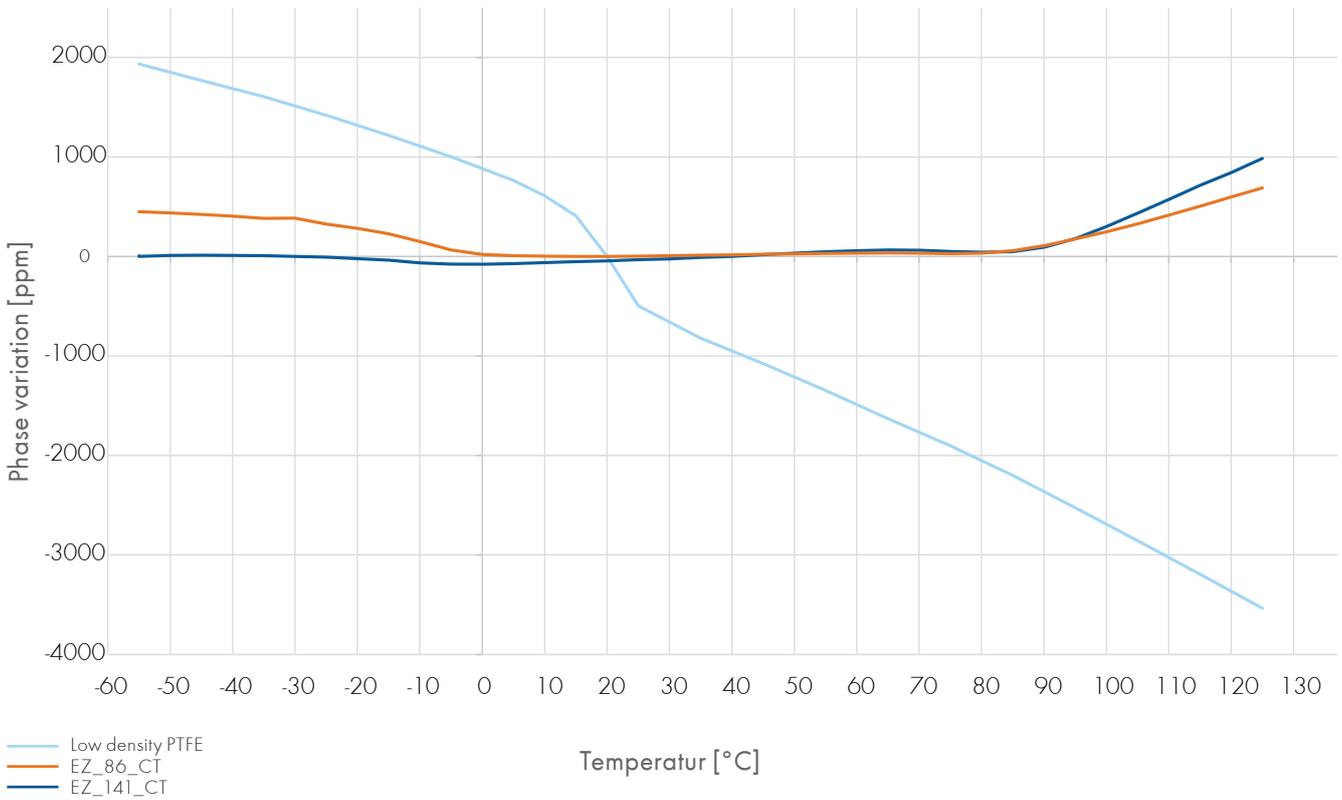
# Semi-rigid CT



## Benefits

- Static applications
- Frequency range up to 40GHz
- Easy to form, strip and solder
- Space and time saving installation

Phase variation vs. temperature



## Product Overview

Description	Frequency range	Insertion loss @18GHz	Outer diameter	Connectors
EZ_86_CT	40 GHz	3.18 dB/m	2.2 mm	SK, SMA, MMPX
EZ_141_CT	33 GHz	1.8 dB/m	3.58 mm	SK, SMA

# Minibend CT

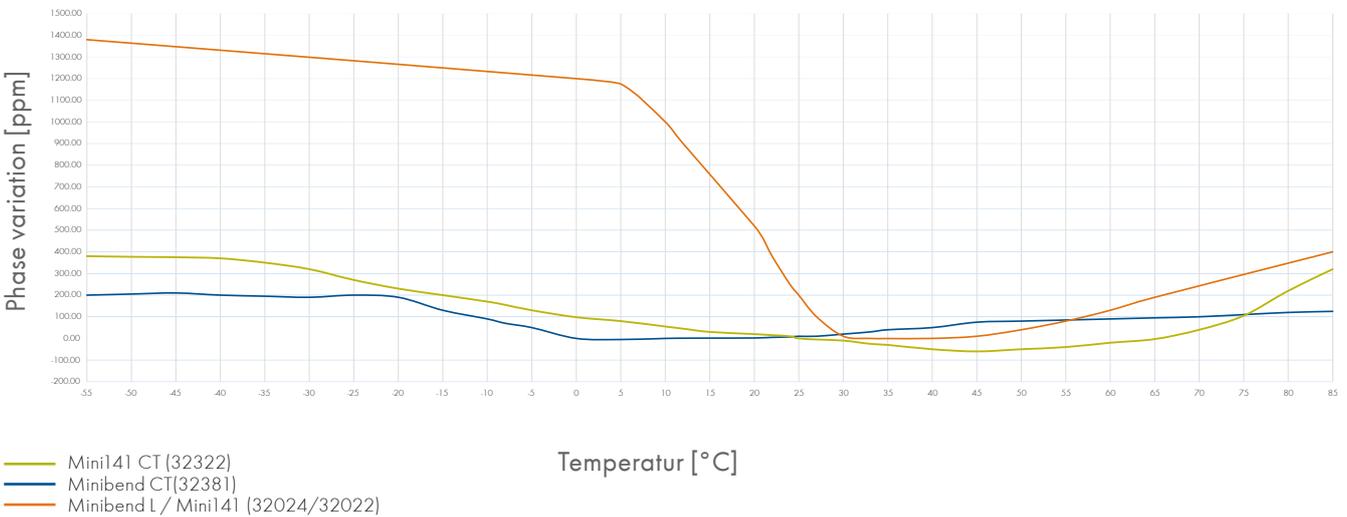


## Benefits

- Flexible applications
- Bend-to-the-end technology
- Higher reliability due to solderless junctions
- MIL/DTL qualified

- Excellent phase and insertion loss stability over temperature  
 minibend CTR: < 300 ppm absolute phase changeover -55 to +85 °C temperature range  
 mini141 CT: < 500 ppm absolute phase changeover -55 to +85 °C temperature range
- Outstanding phase stability versus bending  
 Phase vs flexure of 1.0° at 24 GHz
- Revolutionary minibend bend-to-the-end flexibility  
 minibend CTR: 5 mm minimum bend radius applicable right behind the connector  
 mini141 CT: 8.4 mm minimum bend radius applicable right behind the connector

## Phase variation vs. temperature



## Product Overview

Description	Frequency range	Insertion loss @18GHz	Outer diameter	Connectors
Minibend CT (32381)	70 GHz	3.94 dB/m	2.54 mm	SMA, K, SMP, SMPM, SMPM-T, 1.85 mm
Mini141 CT (32322)	40 GHz	2.12 dB/m	3.66 mm	SMA, K, SMP

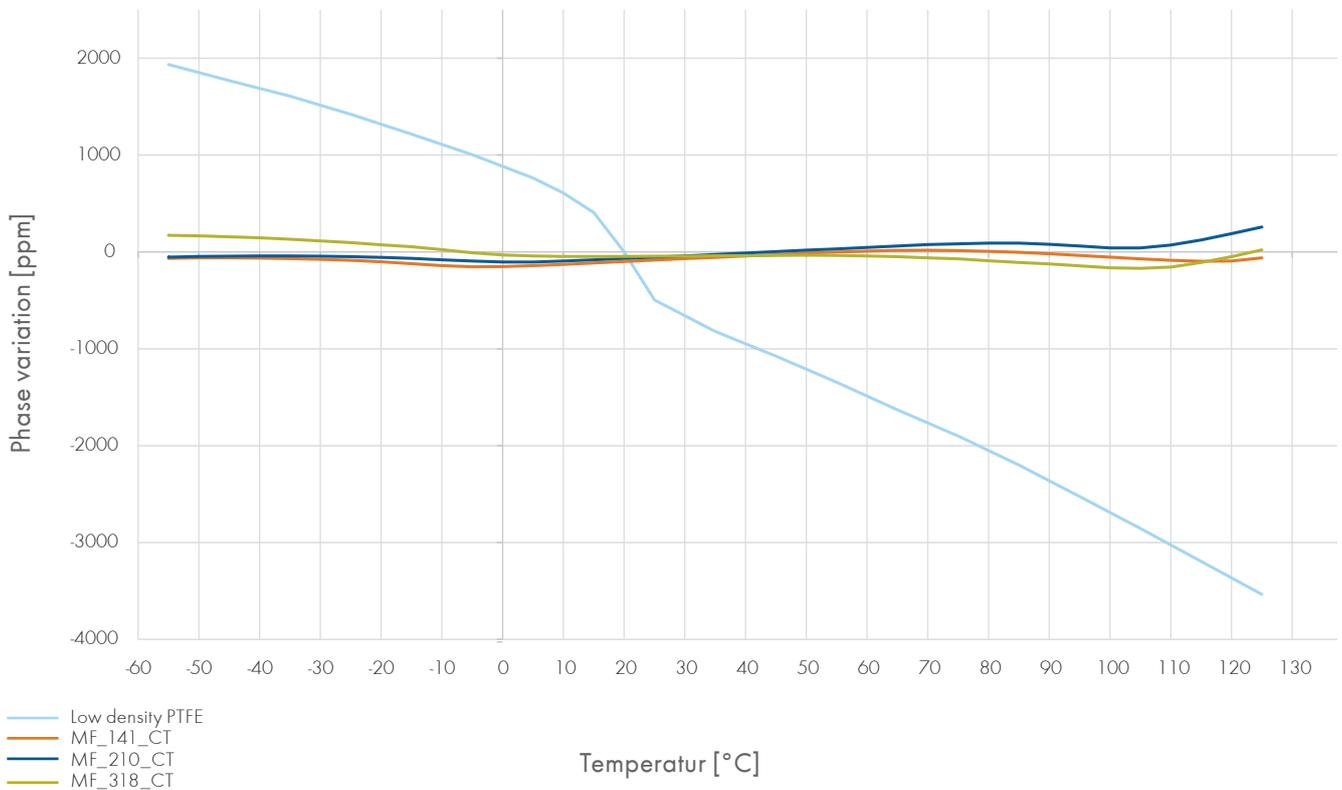
# Multiflex CT



## Benefits

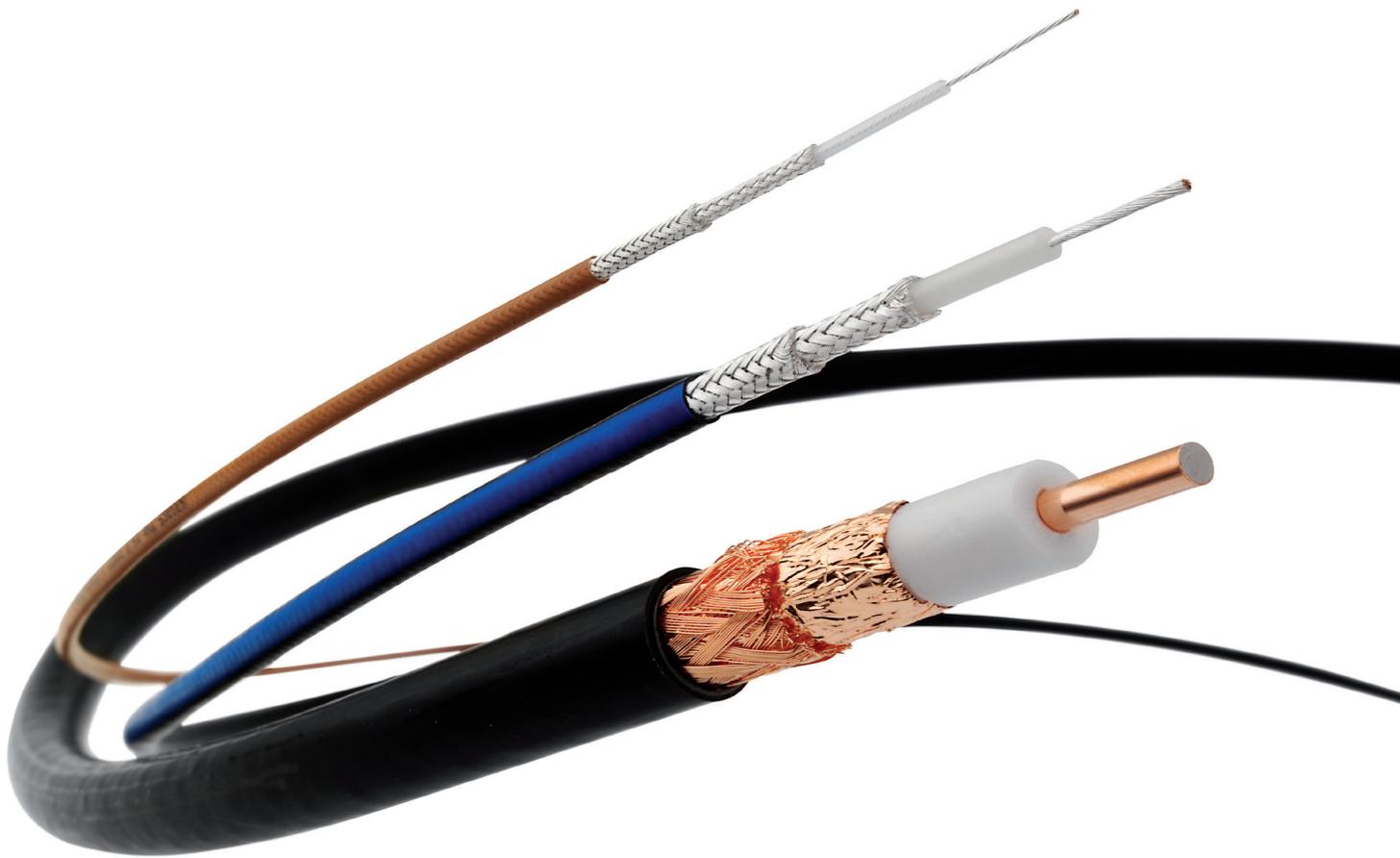
- Flexible applications
- Frequency range up to 33GHz
- Low loss
- Low weight

## Phase variation vs. temperature



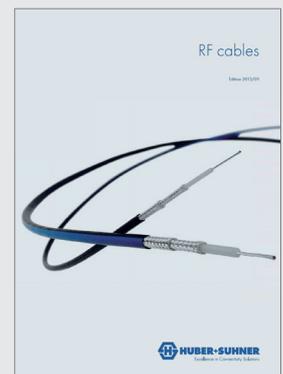
## Product Overview

Description	Frequency range	Insertion loss @18GHz	Outer diameter	Connectors
Multiflex_141_CT	33GHz	1.6 dB/m	4.2 mm	SK, SMA, BMA
Multiflex_210_CT	30GHz	1.4 dB/m	5.0 mm	SK, SMA, TNC
Multiflex_318_CT	18GHz	0.99 dB/m	7.5 mm	N, TNC



## RF cables

HUBER+SUHNER offers a wide range of coaxial cables, developed to meet the highest standards. A balanced range of flexible coaxial cables provides the best performance for demanding applications. Our premium quality cables have excellent electrical and mechanical properties and are used globally in various applications to meet the highest demands. Comprehensive, professional support in conjunction with our comprehensive product range makes HUBER+SUHNER a leading provider of radio frequency solutions in defense applications.



### Performance line: high-temperature coaxial cable

- Temperature range
- High performance
- RG standard

### Foam line: flexible, low-loss cable

- High precision
- Excellent shielding
- Halogen-free options



## Performance line – high-temperature coaxial cable



### Product description

The PTFE/FEP cables from our RG series are designed for applications up to 200 °C and are characterised by low losses, especially at high frequencies. The cables in the Enviroflex family do not contain fluorine plastics in the dielectric or in the jacket and thus provide a robust and environmentally friendly option.

	RG	Enviroflex
Dielectric material	PTFE	SPEX
Jacket material	FEP	RADOX®
Halogen free	-	✓
low smoke	✓	✓
Flame retardancy	Not flammable	✓✓
Temperature range	✓✓✓	✓✓
Weather resistance	✓✓✓	✓✓

Outer diameter (in mm)	RG	G
2	RG_178_B/U	EF_178 EF_178_D
3	RG_316_/U K_02252_D	EF_316 EF_316_D
5	RG_400_/U	EF_400
5	RG_142_B/U	EF_142
10	RG_393_/U	EF_393

## Foam line – flexible, low-attenuation cable



### Product description

The Spuma, S and SX cable families provide lowest attenuation, high flexibility and optimal shielding. The S series with LSFH jacket material and the radiation cross-linked SX series with the RADOX® jacket also offer extremely high flame protection.

	Spuma	Spuma-FR and S
Dielectric material	SPE	SPE
Jacket material	PE	LSFH™
Halogen free	✓	✓
Low smoke	-	✓
Flame retardancy	-	✓✓
Temperature range	✓	✓
Weather resistance	✓✓	✓✓

Outer diameter (in mm)	Spuma	Spuma-FR and S
3	-	S_02162_B
4.5	Spuma_195	Spuma_195-FR-01
6	Spuma_240	Spuma_240-FR-01
13	Spuma_400	Spuma_400-FR-01
10	-	Spuma_500-FR-01
15	Spuma_600	-

# Performance line – high temperature coaxial cable

## RG series

Cable type	Item no.	Impedance (Ω)	Freq. (GHz)	Inner conductor	Dielectric	Braid construction	Jacket	Diameter (mm)
RG_178_B/U	22510043	50	1	strand-07	PTFE	single screen	FEP	1.80
RG_316_/U	22510079	50	3	strand-07	PTFE	single screen	FEP	2.50
K_02252_D	22510218	50	6	strand-07	PTFE	double screen	FEP	3.00
RG_400_/U	22510080	50	6	strand-19	PTFE	double screen	FEP	4.95
RG_142_B/U	22510037	50	6	wire	PTFE	double screen	FEP	4.95
RG_393_/U	22511430	50	6	strand-07	PFA	double screen	FEP	9.90

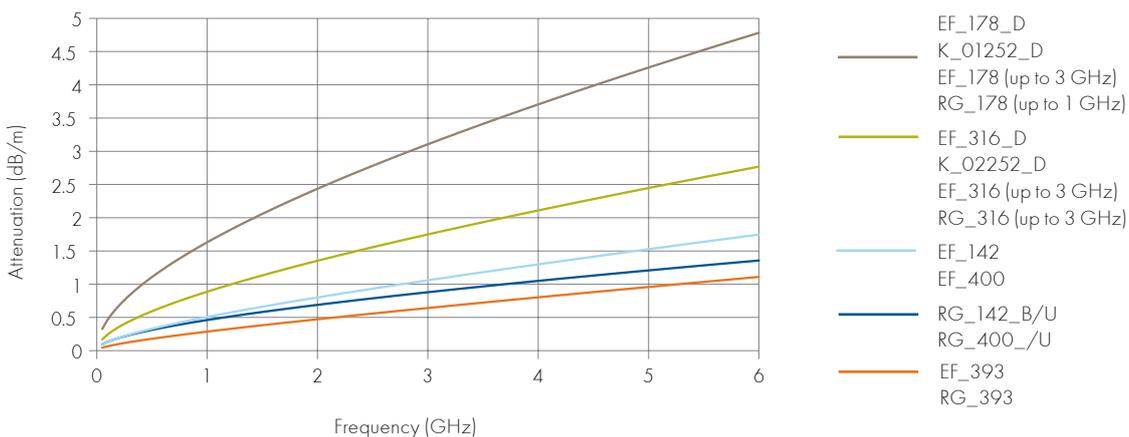
## Enviroflex

Cable type	Item no.	Impedance (Ω)	Freq. (GHz)	Inner conductor	Dielectric	Braid construction	Jacket	Diameter (mm)
EF_178	23010656	50	3	strand-07	SPEX	single screen	RADOX®	1.84
EF_178_D	23030426	50	6	strand-07	SPEX	double screen	RADOX®	2.45
EF_316	23009565	50	3	strand-07	SPEX	single screen	RADOX®	2.54
EF_316_D	22512281	50	6	strand-07	SPEX	double screen	RADOX®	3.16
EF_400	22512280	50	6	strand-19	SPEX	double screen	RADOX®	5.00
EF_142	22512168	50	6	wire	SPEX	double screen	RADOX®	5.00
EF_393	22512282	50	6	strand-07	SPEX	double screen	RADOX®	10.05

# Foam line – flexible, low-attenuation cable

## Spuma series

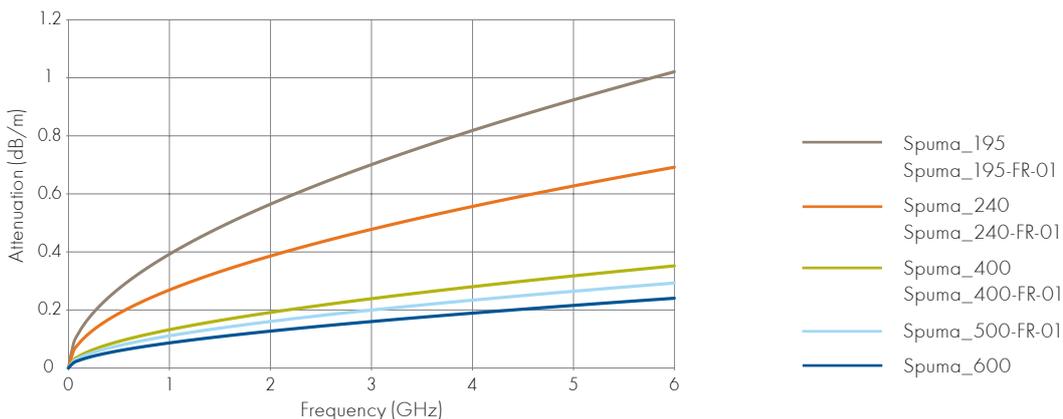
Cable type	Item no.	Impedance (Ω)	Freq. (GHz)	Inner conductor	Dielectric	Braid construction	Jacket	Diameter (mm)
Spuma_195	84151727	50	6	wire	SPE	tape/braid	PE	4.95
Spuma_195-FR-01	85021562	50	6	wire	SPE	tape/braid	LSFH	4.98
Spuma_240	84151737	50	6	wire	SPE	tape/braid	PE	6.15
Spuma_240-FR-01	85021563	50	6	wire	SPE	tape/braid	LSFH	6.17
Spuma_400	84102703	50	6	wire	SPE	tape/braid	PE	10.3
Spuma_400-FR-01	84132035	50	6	wire	SPE	tape/braid	LSFH	10.3
Spuma_500-FR-01	85021564	50	6	wire	SPE	tape/braid	LSFH	12.8
Spuma_600	84151738	50	6	wire	SPE	tape/braid	PE	15.0

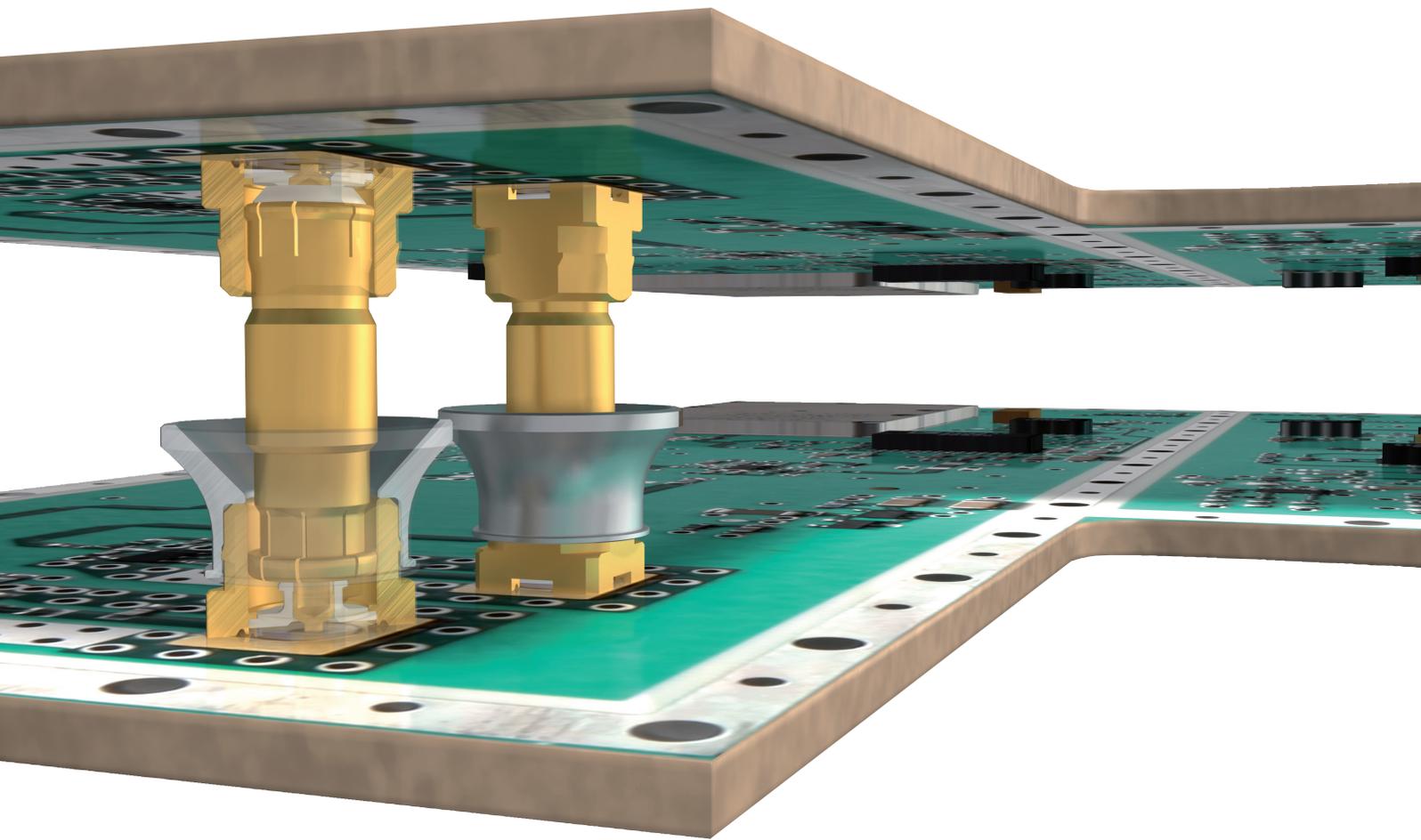


Temperature range (°C)	Attenuation @ 1 GHz (dB/m)	Attenuation @ 3 GHz (dB/m)	Attenuation @ 6 GHz (dB/m)	Screening effectiveness (dB)	Bending static (mm)	Bending repeated (mm)	Cable group
-65 to +165	1.62	-	-	> 40 (up to 1 GHz)	10	18	U1
-65 to +165	0.87	1.63	-	> 38 (up to 1 GHz)	15	25	U2
-65 to +165	0.91	1.73	2.65	> 80 (up to 6 GHz)	18	30	U4
-65 to +165	0.48	0.95	1.51	> 81 (up to 6 GHz)	30	50	U11
-65 to +165	0.46	0.88	1.36	> 85 (up to 6 GHz)	30	50	U9
-65 to +165	0.3	0.69	1.20	> 81 (up to 6 GHz)	60	100	U33

Temperature range (°C)	Attenuation @ 1 GHz (dB/m)	Attenuation @ 3 GHz (dB/m)	Attenuation @ 6 GHz (dB/m)	Screening effectiveness (dB)	Bending static (mm)	Bending repeated (mm)	Cable group
-40 to +105	1.63	3.11	-	> 40 (up to 3 GHz)	5	20	U1
-40 to +105	1.63	3.08	4.72	> 60 (up to 6 GHz)	5	20	X1
-40 to +105	0.97	1.86	-	> 38 (up to 1 GHz)	5	30	U2
-40 to +105	0.90	1.72	2.65	> 80 (up to 6 GHz)	5	30	U4
-40 to +105	0.57	1.08	1.65	> 70 (up to 6 GHz)	10	40	U11
-40 to +105	0.54	1.07	1.7	> 75 (up to 5 GHz)	25	50	U9
-40 to +105	0.29	0.65	1.11	> 78 (up to 3 GHz)	30	100	U33

Temperature range (°C)	Attenuation @ 1 GHz (dB/m)	Attenuation @ 3 GHz (dB/m)	Attenuation @ 6 GHz (dB/m)	Screening effectiveness (dB)	Bending static (mm)	Bending repeated (mm)	Cable group
-40 to +85	0.39	0.70	1.00	> 90 (up to 6 GHz)	12.5	50	X27
-40 to +85	0.39	0.70	1.02	> 90 (up to 6 GHz)	10.0	40	X27
-40 to +85	0.26	0.48	0.69	> 90 (up to 6 GHz)	19.0	60	X28
-40 to +85	0.26	0.48	0.69	> 90 (up to 6 GHz)	14.0	53	X28
-40 to +85	0.13	0.24	0.35	> 90 (up to 6 GHz)	25.0	100	U30
-40 to +85	0.13	0.24	0.35	> 90 (up to 6 GHz)	25.0	100	U30
-40 to +85	0.11	0.20	0.29	> 90 (up to 6 GHz)	34.0	130	X31
-40 to +85	0.09	0.16	0.24	> 90 (up to 6 GHz)	38.0	152	X29



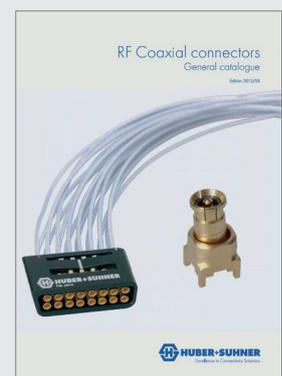


## RF connectors, adaptors and resistive components

HUBER+SUHNER is a leading global provider of RF connectors, adaptors, and resistive components. We offer a wide range of standard connectors and application specific solutions. With our experience, product knowledge and application know-how we support customers with application specific solutions.

Within the standard connector series like SMP, SMA, BNC, TNC, N and others, we provide a comprehensive range of connectors for different applications. We constantly refine our product portfolio with new and innovative solutions. HUBER+SUHNER has set market standards with board-to-board connectivity solutions like MMBX and MBX and with connectors with quick-lock mating mechanisms like QMA and QN.

Additionally HUBER+SUHNER supports its customers worldwide with application engineers to help customers select the right product for each specific application. The success of HUBER+SUHNER is based on high quality products, design-in support, and expertise in RF technology. We are your partner for RF connectivity solutions. Please find more product details on our website or in our RF coaxial connectors general catalogue or in our Resistive components catalogue.



## Connector overview



HUBER+SUHNER is a leading global provider of radio-frequency connectors for the transmission of analogue and digital signals and has many years of experience in the engineering and production of coaxial connectors. In addition to a broad selection of standard connectors for a wide range of different applications, customer-specific solutions for the following connections are also developed and manufactured

## Microminiature connectors



Ultra low profile, high performance, microwave coaxial cable assemblies

- Frequency range up to 90 GHz
- Triple shielded for high isolation
- Direct replacement for 0.047 inch semi-rigid cables
- Guaranteed 10 lbs (45 N) pull force

## Precision multicoax connectors



Low profile, high performance ultra low loss microwave cable assemblies

- Frequency range up to 50 GHz
- Triple shielded for high isolation
- Eliminates need for costly right angle connectors
- Direct replacement for 0.141 inch semi-rigid cables

## Board-to-board connectors



HUBER+SUHNER connectors are especially developed for board-to-board and board-to-module RF interconnections. In addition to the board-to-board portfolio, HUBER+SUHNER provides the highest flexibility for current and future radio module applications.

## Adaptors



The RF adaptor assortment covers all commercially available RF interfaces and configurations, frequency, and return loss specification. Any RF coaxial adaptor can be modified to fit specific applications.

## Attenuators, terminations and DC blocks



The comprehensive range of high-quality radio frequency attenuators, terminations, and DC blocks is based around the varying needs of test and measurement applications.

# Connectors – Overview

Series	Coupling mechanism	Frequency range	
BNC	bayonet	4 GHz	
MCX	snap-on	6 GHz	
MMCX	snap-on	6 GHz	
7/16	screw-on	7.5 GHz	
QN	quick-lock	11 GHz	
TNC	screw-on	11 GHz	
4.3-10	screw-on/quick-lock	12 GHz	
MMBX	snap-on	12.4GHz	
N	screw-on	18 GHz	
QMA	quick-lock	18 GHz	
SMA	screw-on	26.5 GHz	
PC 3.5 (3.5 mm)	screw-on	26.5 GHz	
SK (2.92 mm)	screw-on	40 GHz	
SMP	snap-on	40 GHz	
PC 2.4 (2.4 mm)	screw-on	50 GHz	
PC 1.85 (1.85 mm)	screw-on	65 GHz	
MMPX	snap-on	65 GHz	
SMPM/SMPM-T	screw-on/snap-on	65 GHz	

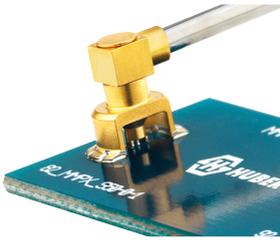
# Precision multicoax connectors



Typical electrical data	Testing condition	MXP 50 performance	MXP 40 performance	MXP 18 performance	
Operating range/ data rate		up to 50 Gbps	up to 40 Gbps	up to 18 Gbps	
Frequency range		DC up to 50 GHz	DC up to 40 GHz	DC up to 18 GHz	
Impedance		50 Ω	50 Ω	50 Ω	
Return loss	mated condition	≥ 20 dB up to 22.5 GHz ≥ 15 dB up to 50 GHz	≥ 20 dB up to 22.5 GHz ≥ 12 dB up to 40 GHz	≥ 20 dB up to 18 GHz	
Insertion loss	Multiflex 53-02				
Cross-talk	at PCB transition	≤ -40 dB up to 40 GHz ≤ -35 dB up to 50 GHz	≤ -40 dB up to 40 GHz	≤ -40 dB at 18 GHz	
Typical mechanical data	Testing condition	MXP 50 performance	MXP 40 performance	MXP 18 performance	
Mating force (per single channel)		max. 3.4 N (typical 1.1 N)	max. 3.4 N (typical 1.1 N)	max. 3.4 N (typical 1.1 N)	
Demating force (per single channel)		max. 3.4 N (typical 1.1 N)	max. 3.4 N (typical 1.1 N)	max. 3.4 N (typical 1.1 N)	
Durability (matings)	MIL-PRF-39012, paragraph 4.7.12	> 500	> 500	> 500	
Material data cable connector	Testing condition	MXP 50 performance	MXP 40 performance	MXP 18 performance	
Center contact	copper beryllium	SUCOPRO® gold plating	SUCOPRO® gold plating	SUCOPRO® gold plating	
Outer contact	brass	SUCOPRO® gold plating	SUCOPRO® gold plating	SUCOPRO® gold plating	
Insulator	PTFE	n/a	n/a	n/a	
Body	aluminium	gold anodised	black anodised	green anodised	
Material data PCB connector	Testing condition	Typical environmental data	MXP 50 performance	MXP 40 performance	MXP 18 performance
Center contact	copper beryllium		SUCOPRO® gold plating	SUCOPRO® gold plating	SUCOPRO® gold plating
Outer contact	BZ4		SUCOPRO® gold plating	SUCOPRO® gold plating	SUCOPRO® gold plating
Body	brass		SUCOPRO® gold plating	SUCOPRO® gold plating	SUCOPRO® gold plating
Insulator	PEEK		n/a	n/a	n/a
Typical environmental data	Testing condition	MXP 50 performance	MXP 40 performance	MXP 18 performance	
Temperature range		-55 to +85 °C	-55 to +85 °C	-55 to +85 °C	
Thermal aging (mated condition)	IEC 60068-2-2, test B	120 °C/260 h	120 °C/260 h	120 °C/260 h	
Change of temperature	IEC 60068-2-14, test na	assembly: -55 to +85 °C PCB: -55 to +85 °C	assembly: -55 to +85 °C PCB: -55 to +85 °C	assembly: -55 to +85 °C PCB: -55 to +85 °C	
Vibration	IEC 60068-2-6	on request	on request	on request	
Mechanical shock (transport)	MIL-STD-202, method 213, condition I	100 g/6 ms	100 g/6 ms	100 g/6 ms	
Damp heat steady state	IEC 60068-2-78, test ca.	40 °C/humidity 93 %/ 96 h	40 °C/humidity 93 %/ 96 h	40 °C/humidity 93 %/ 96 h	

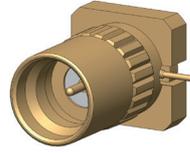
# Microminiature connectors

## MMPX



- Broadband characteristics from DC to 65 GHz
- Excellent return loss
- Excellent shielding, low cross-talk
- 5.08 mm pitch (0.2 inch)
- Mechanically robust design

## SMP



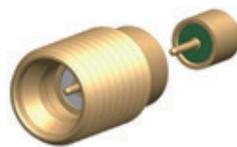
- Applications up to 40 GHz.
- MIL-SPEC qualified
- Provide true compatibility
- Guaranteed mechanical performance over the mating life of the connector

## SMMPM



- Applications up to 65 GHz.
- MIL-SPEC qualified
- Available as well for MMPX, SMMPM-T, and SMP
- Large portfolio of different PCB mount SMMPM

## SMMPM-T



- Applications up to 65 GHz
- Smallest threaded open source connector on the market
- Combination of a MIL-STD-348 SMMPM female interface together with a retractable threaded nut
- Centerline-to-centerline spacing of just 5 mm (0.20 in)

Electrical data	MMPX	SMP	SMMPM/SMMPM-T
Frequency range	DC to 65 GHz	DC to 40 GHz	DC to 65 GHz
Center conductor resistance	≤ 5 mΩ	6.0 milliohms max.	6.0 milliohms max.
Outer conductor resistance	≤ 2 mΩ	2.0 milliohms max.	2.0 milliohms max.
DWV		500 Vrms at sea level	335 Vrms at sea level
Insulation resistance	≥ 1 GΩ	5000 megaohms min.	5000 megaohms min.
Corona levels		190 Vrms at 70 000 ft	125 Vrms at 70 000 ft
RF high potential		325 Vrms at 5 MHz	200 Vrms at 5 MHz
RF leakage	40 dB max. at DC to 65 GHz	80 dB max. at 3 GHz 65 dB max. at 3 to 26.5 GHz	80 dB max. at 3 GHz 65 dB max. at 3 to 26.5 GHz
Magnetic permeability		< 2 Mu	< 2 Mu
VSWR		1.35:1 to 26.5 GHz 1.5:1 to 40 GHz	1.1:1 to 26.5 GHz 1.3:1 to 65 GHz
Insertion loss		0.06 √f in GHz (non-hermetic connectors) 0.12 √f in GHz (hermetic connectors)	0.05 + 0.04 √f in GHz (non-hermetic connectors) 0.12 √f in GHz (hermetic connectors)
Mechanical data		SMP	SMMPM
Center contact retention (captivated designs)		1.5 lbs (6.672 N) min.	1.5 lbs (6.672 N) min.
Durability - full dentent Durability - smooth bore		100 cycles min. 1 000 cycles min.	100 cycles min. 1 000 cycles min.
Force to engage - full detent Force to engage - smooth bore		15 lbs (66.723 N) max. 2 lbs (8.896 N) max.	3.5 lbs (15.569 N) typical 1.5 lbs (6.672 N) typical
Force to disengage - full detent Force to disengage - smooth bore		5 lbs (22.241 N) min. 0.5 lbs (2.224 N) min.	5 lbs (22.241 N) typical 1.5 lbs (6.672 N) typical
Environmental data		SMP	SMMPM
Temperature range	-65 to +155 °C	-65 to +165 °C	-65 to +165 °C

# Board-to-board connectors

## MBX



- Very high axial float – best in class
- High output power
- Excellent return loss values
- Smallest board-to-board distances in class

## MBX 2<sup>nd</sup> generation



- Very high axial float – best in class
- Excellent return loss values
- Smallest board-to-board distances in class

## MFBX



- Medium float
- Low cost
- Very good board-to-board shielding
- Small board-to-board distances

## MMBX



- Very high frequencies – best in class
- Very good return loss values
- Smallest board-to-board distances in class

## SMPM



- Ultra high frequency range (DC to 65 GHz)
- MIL-STD-348 qualified
- Various detent options
- Custom ganged connection options available
- Smallest pitch distance and envelope
- Smallest board-to-board distances
- True 65 GHz board-to-board solution

## SMP



- Ultra high frequency range (DC to 40 GHz)
- MIL-STD-348 qualified
- Various detent options
- Rugged and reliable
- Most widely used board-to-board connector in the market
- Small board-to-board distances

Characteristics	MBX and MBX <sup>2nd</sup>	MFBX	MMBX	SMP	SMPM
Frequency range	DC to 6 GHz	DC to 3.5 GHz	DC to 12.4 GHz	DC to 40 GHz	DC to 65 GHz
Axial float (misalignment)	± 1.2 mm	± 0.8 mm	± 0.3 mm	± 0.25 mm	± 0.25 mm
Radial float (misalignment)	± 0.6 mm (at 13 mm b-to-b distance) ± 1.0 mm (≥ 18 mm b-to-b distance)	± 0.8 mm	± 0.4 mm (at 6.7 mm b-to-b distance)	± 0.25 mm	± 0.25 mm
Min. board-to-board distance	13 mm	13 mm	6.7 mm	11.07 mm	8.93 mm
Min. panel-to-board distance	< 13 mm depending on connector	< 13 mm depending on connector	4.63 mm	5.97 mm	5.58 mm
Min. panel-to-panel distance	< 13 mm depending on connector	< 13 mm depending on connector	2.56 mm	0.87 mm	2.23 mm
Power at room temperature, at 2.4 GHz	typical 260 W (MBX) typical 240 W (MBX <sup>2nd</sup> )	typical 130 W	typical 260 W		

## PC 1.0 adaptors



HUBER+SUHNER PC 1.0-to-PC 1.0 adaptors are precision test components for use in microwave applications of up to 110 GHz.

The adaptors feature optimum return loss and insertion loss, excellent mechanical stability and extreme reliability. The HUBER+SUHNER PC 1.0 complies with the IEEE standard 287™-2007 (Annex J).

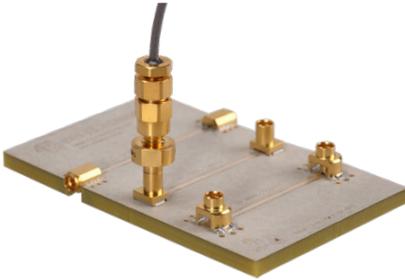
### Key characteristics

- Broadband characteristics from DC to 110 GHz
- Excellent return loss
- Very low insertion loss
- Robust design
- Phase matched within the series
- De-embedding data available on request

### Product portfolio within series (PC 1.0-to-PC 1.0)

- Adaptor jack/jack (31\_PC1-50-0-1/111\_UE, 85031727)
- Adaptor plug/plug (32\_PC1-50-0-1/11\_UE, 85031743)
- Adaptor plug/jack (33\_PC1-50-0-1/11\_UE, 85031288)

## 80 GHz coaxial-to-PCB all-in-one solution



The unique HUBER+SUHNER 80 GHz solution features a true 80 GHz coaxial-to-PCB transition with superb electrical performance combined with an easy snap connection mechanism to the PCB. The broadband characteristics, excellent electrical performance and easy handling facilitate high-end measurement setups for high-speed digital testing and RF testing.

The solution is composed of field-tested standard MMPX snap connectors on the PCB side coupled with an MMPX male-to-PC 1.0 female adaptor. The adaptor and test equipment are linked using a HUBER+SUHNER Astrolab 1 mm male-to-male cable assembly.

HUBER+SUHNER MMPX is a HUBER+SUHNER proprietary standard, the HUBER+SUHNER PC 1.0 complies with IEEE Standard 287™-2007 (Annex J).

### Key characteristics

- Broadband characteristics from DC to 80 GHz
- Excellent return loss
- Easy handling
- De-embedding data available on request

### Recommended PCB connectors

- 82\_MMPX-S50-0-2/111\_NM, 84096711 (blister tape, 10 pcs)
- 82\_MMPX-S50-0-2/111\_NM-1, 84096752 (reeled blister tape, 750 pcs)
- 92\_MMPX-50-0-1/111\_NM, 84009138 (blister tape, 10 pcs)
- 92\_MMPX-50-0-1/111\_NM-1, 84009140 (reeled blister tape, 500 pcs)
- 96\_MMPX-50-0-2/111\_NM-1, 84093961 (blister tape, 10 pcs)
- 96\_MMPX-50-0-2/111\_NM, 84093966 (reeled blister tape, 750 pcs)
- 96\_MMPX-50-0-3/111\_NM-1, 84099981 (blister tape, 10 pcs)
- 96\_MMPX-50-0-3/111\_NM, 84099988 (reeled blister tape, 450 pcs)

### Required adaptor

- 33\_MMPX-PC1-50-1/111\_NE, 85031764 (single packaging)

### Recommended assemblies

- Steel-flex, 32061E-29840-29840-6, 110 GHz (single packaging)
- Microbend 1R-6, 85 GHz (single packaging)

# Adaptors - Overview

HUBER+SUHNER is manufacturing a wide range of adaptors in various configurations such as within series or between series, straight or angled designs, and some with panel mount features. They are classified according to their typical intended applications, each of which requiring specific properties. There are four major groups: standard, precision, low passive intermodulation (PIM), and quick-mate adaptors.

## Standard adaptors



### Features

- Wide range of different configurations
- Appropriate materials

### Benefits

- Most common interfaces available
- Accurate transitions
- Effective and reliable interconnection solutions

## Precision adaptors



### Features

- Precision interfaces
- Excellent electrical performance
- Premium base materials and platings

### Benefits

- For precision laboratory measurements
- High repeatability and accuracy

## Low PIM adaptors



### Features

- Outstanding low intermodulation performance
- Excellent electrical contacts
- Non-magnetic materials

### Benefits

- High reliability
- Repeatable intermodulation measurements

## Hermetically sealed adaptors



### Features

- Glass-fired seal
- 100 % tested
- Wide temperature range

### Benefits

- Hermetically sealed feed-thru

## Custom adaptors



Adaptors can be custom designed according to your specific application requirements:

- Between/in-series adaptors
- Stainless steel, beryllium copper, brass materials
- Gold, passivated, SUCOPRO®, SUCOPLATE® platings

# Standard and precision adaptors

		SMPM-T		MMBX		MMCX		MCX		MMPX		SMPM		PC 1.85	
		Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack
SMPM-T	Plug														
	Jack														
MMBX	Plug														
	Jack														
MMCX	Plug					84047711									
	Jack						22645960								
MCX	Plug							22653002							
	Jack								22543558						
MMPX	Plug														84132754
	Jack												84132750		
SMPM	Plug											23021824			
	Jack														
PC 1.85	Plug										84132750			84132748	84019546
	Jack									84132754				84019546	84132746
SMP	Plug														
	Jack														
PC 2.4	Plug														
	Jack														
SK (2.92 mm standard)	Plug	80317870									84071696	80317861	23021753		
	Jack	80362561								84071648		23032847	23021816		
PC 3.5	Plug							22651600	22651599						
	Jack							22651594	22651593						
SMA	Plug			23004934	23004935	22645967	22645969	22645486	22645488						
	Jack					22658202	22658204								
QMA	Plug					22645970	22645961	22645487	22645485						
	Jack			23004937	23004933	84008370 <sup>pl</sup>	22658868 <sup>pl</sup>								
N	Plug					22658203	22658201								
	Jack				84076178 <sup>pl</sup>										

00000000 Standard adaptors

00000000 Precision adaptors for test+measurement high speed digital testing solutions

SMP		PC 2.4		SK (2.92 mm standard)		PC 3.5		SMA		QMA		N			
Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack
				80317870	80362561									Plug	SMPM-T
														Jack	
								23004934	23004937					Plug	MMBX
								23004935	23004933		84076178 <sup>6)</sup>			Jack	
								22658202	22658203					Plug	MMCX
								22645967	22645970					Jack	
								22658204	22658201						
								22645969	22645961						
									22658868 <sup>6)</sup>						
						22651600	22651594	22645486	22645487					Plug	MCX
						22651599	22651593	22645488	22645485					Jack	
							84071648							Plug	MMPX
				84071696										Jack	
					23032847									Plug	SMPM
				23021753	23021816									Jack	
				23021792	23021817 <sup>4)</sup>										
														Plug	PC 1.85
														Jack	
				80318037	80318038									Plug	SMP
				80363059	80363059									Jack	
				23004729	23004730								22650021	Plug	PC 2.4
				23004731	84008075							22649932		Jack	
80318037	80363059	23004729	23004731	23004727	23004728									Plug	SK (2.92 mm standard)
80318038	80318039	23004730	84008075	23004728	23004726									Jack	
								22644361	22644362			23017489	23017467	22643957	22643958
								22644362	22644360			23017488	23017468	22643959	22643960
										22648730	22648731		84012204	22543916	22660181
										22640151	22641119				
										22648731	22648729	84014876		22660180	22660178
														22543925	22645162 <sup>7)</sup>
										22641119	22640150				
						23017489	23017488		84014876			23023199	23023287		23023143
														84034347 <sup>7)</sup>	
						23017467	23017468	84012204				23023287	23023171	23024265	
												84034347 <sup>7)</sup>	84012029 <sup>6)</sup>		
			22649932			22643957	22643959	22543916	22660180	22543925			23024265		
		22650021				22643958	22643960	22660181	22660178	22645162 <sup>7)</sup>		23023143			
						22660363 <sup>7)</sup>								Jack	

<sup>1)</sup> NH = 100 pieces

<sup>2)</sup> 75 Ω

<sup>3)</sup> NY = variable industrial packing

<sup>4)</sup> Additional type item no. 23021818

<sup>5)</sup> Quick-Mate

<sup>6)</sup> Bulkhead adaptor

<sup>7)</sup> Panel adaptor, flange mount

# Attenuators

HUBER+SUHNER attenuators are passive resistive components used to reduce the input power. The attenuation can vary from 1 up to 40 dB and power range up to 300 W. In this selection guide only low power attenuators are listed. For more options regarding interface, frequency range, and power handling, please consult the electronically available Resistive components catalogue.



Power	0.5 to 300 W
Connectors 50 Ω	BNC, N, PC 2.4, SK (2.92 mm), QMA, SMA, TNC
Connectors 75 Ω	BNC, N
Frequency range	from DC up to 50 GHz
Attenuation range	1 to 40 dB

## 50 Ω attenuators up to 2 Watt, connector configuration plug to jack

Attenuation dB	Interface f max.	BNC	N	TNC	SMA	PC 3.5	SK (2.92 mm)	PC 2.4
		4 GHz	6 GHz*	12.4 GHz	6 GHz*	23 GHz*	46 GHz	50 GHz
1		22641542	84066765		84037361	84066837		
2		22641543	84066769		84034481	84066840		
3		22550177	84066770	22543746	84036311	84066841	84076856	84058353
4			84066772		84034272	84066842		
5			84066786		84037414	84066844		
6		22550178	84066798	22550194	84037343	84066845	84076855	84058358
7			84066801		84037410	84066847		
8			84066802		84037388	84066850		
9			84066808		84037381	84066851		
10		22550179	84066809	22550195	84036452	84066853	84076854	84058360
15			84066814		84037424	84066855		
18					84037420			
20		22550180	84066815	22550196	84037362	84066879	84076850	84058363
30		22550181	84066817	22550197	84037372	84066884		
40			84060559					84058370

\* For higher frequency versions, please consult electronic catalogue

## Power handling capability

The referenced average power is applicable at 25 °C ambient temperature. For higher ambient temperature a certain power derating may be required. Please see detailed product specification. Medium and high power products must be mounted in such a way that free air convection around heat sink is given to assure performance.

# Terminations

Terminations are used to terminate an open RF port with a specific RF interface. The terminations vary regarding power handling from 0.5 W up to 60 W. In this selection guide only low power terminations are listed. For more options regarding interface, frequency range, VSWR, and power handling please consult the electronically available Test+Measurement catalogue.



Power	0.5 to 60 W
Connectors 50 Ω	TNC, SMB, SMC, SMA, QN, QMA, QLA, SK (2.92 mm), PC 2.4, N, MMCX, MCX, BNC, BMA, 7/16
Connectors 75 Ω	TNC, N, BNC, MCX
Frequency range	from DC up to 50 GHz
VSWR	refer to datasheet

Power (W)	Configuration	BNC	N	TNC	SMA	SK (2.92 mm)	PC 2.4
0.5	plug			22659852			84066625
	jack			22659846			
0.75	plug				22645868		
	jack				22645869		
1	plug	22550141	23034002	84011017	22640162	84000377	
	jack	22648680		22640683	84141417		
2	plug	84059870	84066537	84011017			
	jack		84066538				
6	plug	22550260	22550258	22550255	22550257		
	jack	22550259	22550253		22550256		
1	plug		84066518		84066618		
	jack		84068982				
15	plug	22550273	22550264		22544579		
	jack		22550263		22544580		
25	plug		22642248		22643659		
	jack		22643786		22643655		
50/25 *	plug		22641938		84066590		
	jack		22643792				
60	plug		22643798				
	jack		22643800				

\* 50 Watt, if the termination is mounted on an additional heat sink with a max. thermal resistance (Rth) of 5 K/Watt. Without additional heat sink this termination is applicable up to 25 Watts only.

## DC blocks



A DC block separates or blocks DC voltage (galvanic isolation) but allows an RF signal to along the coaxial transmission line.

### Features and benefits

- Broadband
- RF signal passes with negligible loss
- Blocking of DC
- Galvanic isolation of centre conductor

### 50 Ω, connector configuration male to female

Interface characteristics	Frequency (GHz)	Voltage max. (V)	Block type	VSWR max.	Return loss min. (dB)	HUBER+SUHNER type	Item no.
BNC	5	250	centre conductor	1.22	20.1	1100.01.A	22550233
N	5	250	centre conductor	1.22	20.1	1100.17.A	22550232
SMA	18	200	centre conductor	1.35	16.5	1100.19.0001	84107082

## Resistive power dividers



Power dividers are designed to split an RF signal equally into two output signals with an insertion loss of 6 dB.

### Features and benefits

- Broadband down to DC
- Very low return loss
- Cost effective solution to tap off a signal
- Very compact

### 50 Ω

Interface characteristics	Frequency (GHz)	VSWR max.	Power (W)	Return loss min. (dB)	HUBER+SUHNER type	Item no.
BNC (f-f-f)	2	1.15	1	23.1	4901.01.A	22550077
BNC (m-f-f)	2	1.15	1	23.1	4901.01.B	22550078
N (f-f-f)	2	1.15	1	23.1	4901.17.A	22550252
N (m-f-f)	2	1.15	1	23.1	4901.17.B	22643830
TNC (f-f-f)	2	1.15	1	23.1	4901.26.A	22640656
TNC (m-f-f)	2	1.15	1	23.1	4901.26.B	22550165
SMA (f-f-f)	12.4	1.2	0.5	20.8	4901.19.A	22641657

m: refers to plug (male), f: refers to jack (female)

## Low passive intermodulation load



HUBER+SUHNER offers high performance intermodulation loads for Test+Measurement that are primarily used to close open parts in IM sensitive applications, such as an open port of a hybrid coupler. These intermodulation loads are made by using high performance cable and connectors, especially developed for IM sensitive applications, and are assembled by highly trained HUBER+SUHNER staff to obtain the best IM and VSWR results.

### Features and benefits

- High repeatability
- Outstanding IM, better than  $-160$  dBc
- Other power levels and customised designs available on request
- Currently HUBER+SUHNER offers these terminations as three standard types

## Low intermodulation load, $50 \Omega$

Interface	Frequency (GHz)	Power (W)	3rd order intermodulation* (dBc)	HUBER+SUHNER type	Item no.
DIN 7/16 female	2	50	$\leq -160$	6550.41.0001	22659656

\* at  $2 \times 43$  dBm/ $2 \times 20$  W carrier

## Phase shifters



HUBER+SUHNER phase shifters allow phase change while maintaining constant VSWR and insertion loss values. These passive devices have proven to be successful in aerospace, missile, and satellite programs. The construction of all phase shifters and trimming devices incorporate fine gauge threads for precise tuning. Phase shifters are terminated with precision interfaces per MIL-STD-348 including SMA, TNC, and N (in series and between series). However, custom devices can be manufactured using other interfaces.

### Available configurations

- SMA plug to SMA plug
- SMA plug to SMA jack
- SMA jack to SMA jack
- N plug to N plug
- N plug to N jack
- N jack to N jack
- N jack to SMA plug
- N plug to TNC jack
- TNC jack to TNC jack
- SMA jack to cable
- SMA plug to cable
- N plug to cable

# Services and support

## 3D files

For the exchange of CAD models between various CAD systems, HUBER+SUHNER is providing the customers with 3D files in IGS or STEP data format.

## Simulations/PCB layouts

HUBER+SUHNER has the ability and the tools for computer simulation of customer specific printed circuit board layouts.

## Customized connector solutions

While HUBER+SUHNER offers an extensive product line of connectors and adaptors, we also understand that some application needs are unique.

HUBER+SUHNER offers custom-engineered solutions through innovative design, using state-of-the-art development tools. These powerful tools allow us to demonstrate product feasibility, including prototyping, in a short amount of time. Our in-house type testing capabilities will further prove the design through intensive verification tests according to MIL standards or your specific requirements.

## Plating technology

We offer a broad range of different platings perfectly suited for your specific need. Besides the common gold and silver-platings, we have additional platings with superior performance:

- SUCOPRO - the gold plating of the future (minimizes gold-embrittlement)
- SUCOPLATE - the outdoor plating

## Optimized connector/PCB solutions

Only by using an optimized footprint can the performance of the connectors be unleashed. HUBER+SUHNER offers optimized connector/board solutions:

- 3D field simulation
- Optimized footprints (incl. connector) as gerber files

## Application engineering

HUBER+SUHNER has a team of specialists supporting your specific application. We have more than 25 years of experience within the industry and have successfully participated in many programs. Make use of our broad knowledge on connectors, cables, cable assemblies, and EMP's.

## Product selection guides

### Evaluate with our product finder

By using our "product finder" please choose the suitable cable, connector, adaptor, EMP, or antenna. You will find this utility on our homepage or with following link:

<http://products.hubersuhner.com>

### Calculate with the assembly calculator

Define the suitable assembly by using the "RF assembly calculator". You will find this utility on our homepage or with following link:

<http://rfcablecalc.hubersuhner.com>

# Attenuation of cable assemblies

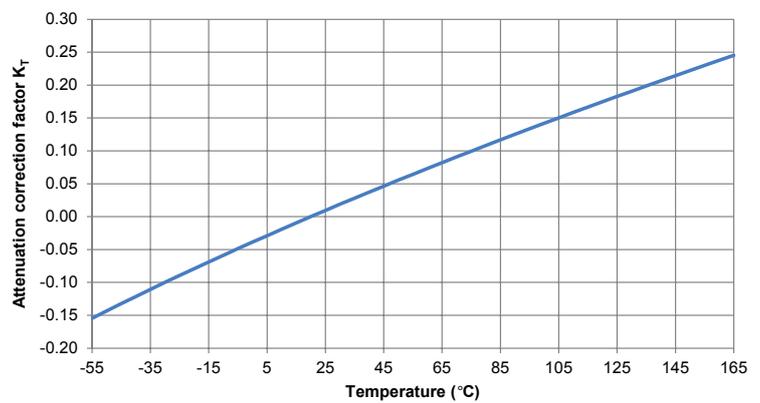
## Thermal influence

The attenuation shift occurring at temperatures other than the reference temperature (+20 °C or +25 °C) is attributed to the conductivity as the resistance of the inner conductor and screen changes. The relation for the temperature dependence of the electrical attenuation  $\alpha(T)$  is given according to IEC 60096-0-1 by

$$\alpha(T) = \alpha_{293K} \cdot \sqrt{1 + \sigma_p \cdot \left(\frac{T}{K} - 293\right)}$$

whereas  $\sigma_p$  is the temperature coefficient of resistivity and  $\alpha_{293K}$  is the resistivity at the temperature of 293 K. The parameter  $\sigma_p$  is empirical and related to the conductor material and plating. This leads to the following formula:

$$a(T) = a_{25} \cdot (1 + K_T)$$



# Phase stability of cable assemblies

## Definition

The term "phase change" refers to a change in the absolute electrical length as a result of thermal or mechanical influences.

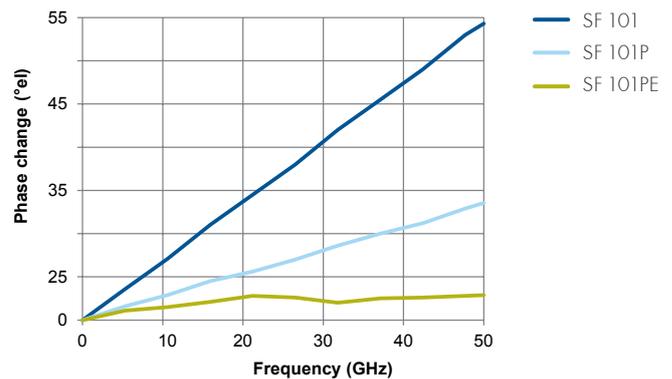
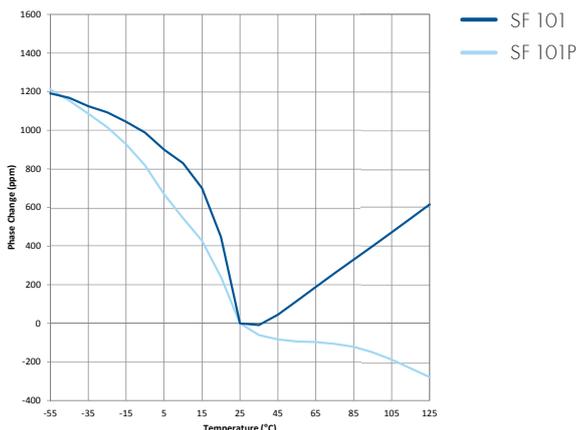
## Thermal influence

The phase will change as a result of changes in the mechanical length and electrical characteristics of the dielectric when subjected to temperature variations.

Because of the special material used for the dielectric (low-density PTFE), the measurable phase change over temperature extremes is minimal.

## Mechanical influence

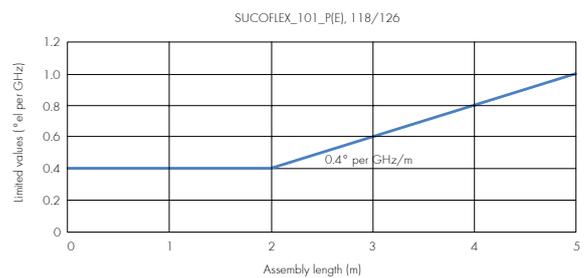
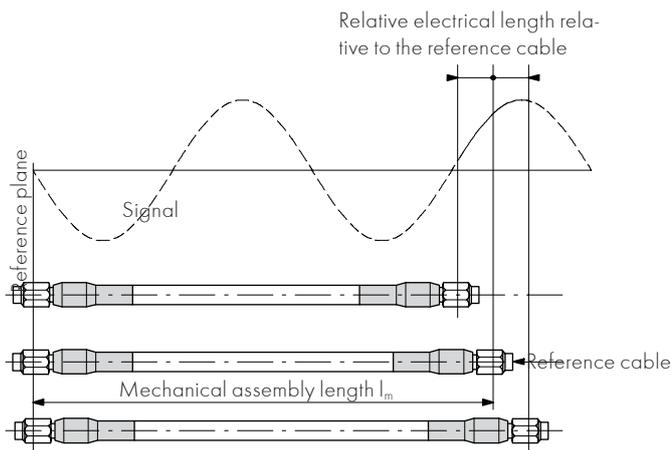
Bending or torsion of an assembly will also cause a phase change. The change is directly proportional to the angle of bending or torsion.



# Phase matching of cable assemblies

## Definition

The term "phase matching" refers to the relative electrical length of an assembly compared with a reference cable or a given electrical length.



## Availability

All SUCOFLEX 101P, 118 and 126 type microwave cable assemblies are available as phase-matched sets. Their outstanding thermal and mechanical phase stability makes them the ideal choice for applications requiring high stability. Any required matching values are available on request, although they are limited. The reproducibility of the electrical characteristics of the connectors in addition to thermal and mechanical influences limit the matching range attainable in practice to  $\pm 0.2^\circ$  per GHz/m, equivalent to a mechanical length of  $\pm 0.13$  mm. In long assemblies, the thermal and mechanical influencing factors have a greater impact, resulting in a rise of the lower limit of matchability as the length increases (see graph above). In day-to-day practice, we find that it is better to speak of a specification window than of a tolerance. As a consequence, a statement such as "within  $0.4^\circ$  per GHz/m" makes more sense than " $\pm 0.2^\circ$  per GHz/m". This applies in particular to assembly sets consisting of more than two individual assemblies.

## Guarantee of phase matching

HUBER+SUHNER guarantees phase matching ex-factory. The relevant measurement logs are included in the supply. It is essential during installation and service to ensure that all assemblies of a phase-matched set are exposed to the identical thermal and mechanical stresses.

## Reference cables

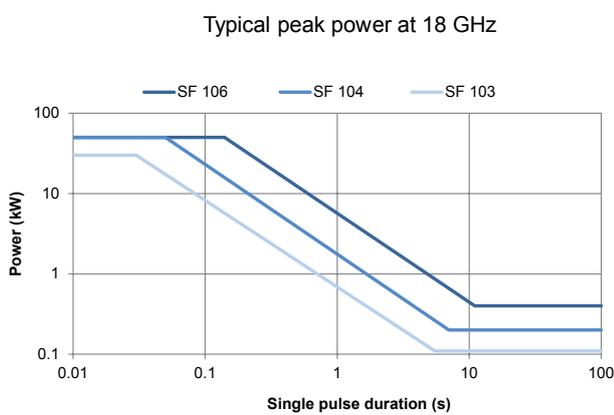
Usually, a reference cable is produced for each phase-matched assembly set when an initial production run takes place. The absolute electrical length measured is internally saved. The reference cables are stored during 10 to 20 years under controlled conditions (temperature, humidity) together with the order data to allow individual assemblies to be replaced whenever the need arises.

# Power handling capabilities of cable assemblies

## Peak power

The maximum power is limited by the weakest component in the assembly. A distinction is made between two types of power transmission: peak power by pulses and continuous wave (CW) power.

In applications involving power peaks, the main phenomenon encountered is a breakdown as a result of high voltage. Cables, cable-to-connector transitions or connectors break down and are irreversibly damaged. The transitions between the cable and the connectors are the most sensitive areas of an assembly. The correct selection of cables and connectors and the careful assembly process ensure that no damage will occur during operation. Also the keying ratio must be taken into account as shown in the figure below.



## CW power

A large number of factors determine the maximal continuous wave (cw) power that an assembly can transmit. A short discussion may help to make things clear. The most important factor in connection with cw power transmission is the generation of heat as a result of more power losses (attenuation) in the assembly.

## Influence of attenuation

The lower the attenuation, the lower evidently also the heat generated inside the cable by power loss. In other words, "thicker" cables can handle a bigger power load, and this in turn means that the SF 106 is the SUCOFLEX cable with the "highest power performance".

## The influence of connectors

Heat generation inside the connectors is determined by the diameter of the connector's inner conductor. As a general rule, it can be said that when the inner conductor of the connector roughly equals the inner conductor of the cable, also the surface temperature will be approximately the same. If a thinner connector is selected, the inner conductor of the connector will be heated more than that of the cable. The combination of SUCOFLEX 106 with SMA connectors may serve as an example.

Viewed from this aspect, connectors of type 7/16 or N have a considerably higher performance than connectors of type SMA.

## Influence of the maximum temperature

In any event, the maximum power handling capacity is reached when the highest surface temperature in the assembly (measured anywhere on or in the assembly) has reached the maximal allowed value. For most cable types, the maximum temperature Tmax is 165°C. This temperature is determined by the materials used, such as PTFE and FEP, and by the MIL requirements regarding explosive atmospheres according to MIL-E-5400.

The temperature Tmax is in most cases reached next to or on the connector closest to the signal source.

## Dissipation of heat generated

With a given cw power, the assembly reaches the maximum temperature at a given power level after about thirty minutes.

This maximum temperature is influenced, in addition to the above-mentioned parameters, also by numerous ambient influences such as ambient temperature, type of installation and altitude of application.

The more capable the assembly is of dissipating the heat by unobstructed convection and radiation at a low ambient temperature and a low altitude of application, the higher its maximum power handling capacity will be. Of the two types of heat dissipation – convection and radiation – convection is normally the more effective. At high altitudes with low air pressure it is the other way round. Cables with a larger surface dissipate heat more easily to their surroundings and therefore have a higher power handling capacity.

## Influences of ambient temperature and operating altitude

As mentioned above, the ambient temperature and altitude of application determine the maximum power handling capacity to a crucial extent.

It is calculated for a cable in the following way:

$$P_{\max} = P_{\max,0} \cdot K_R \cdot K_T \cdot K_A \cdot K_f$$

$P_{\max,0}$  is shown in the corresponding cable curves. The VSWR-dependent parameter  $K_R$ , the altitude-dependent parameter  $K_T$  and the frequency dependent parameter  $K_f$  are defined as follows (acc. IEC 60096-0-1):

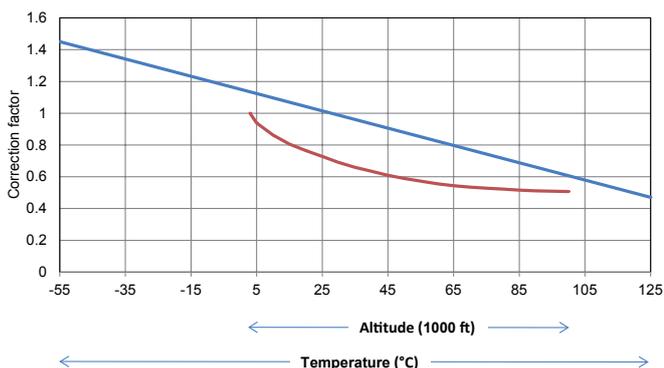
$$K_R = \frac{(VSWR + 1)^2}{4 \cdot (VSWR)^2}$$

$$K_T = 1 - \left( \frac{T - 40^\circ\text{C}}{T_{\max} - 40^\circ\text{C}} \right)^{0.8}$$

$$K_f = \frac{1}{\sqrt{f}}$$

The factor  $K_A$  strongly depends on the emissivity of the jacket material of the cable, i.e. the capability to dissipate heat by radiation.

## Correction factors $K_A$ and $K_T$



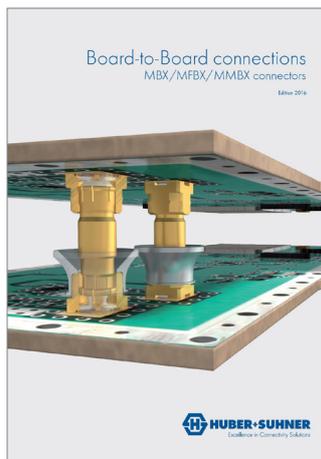
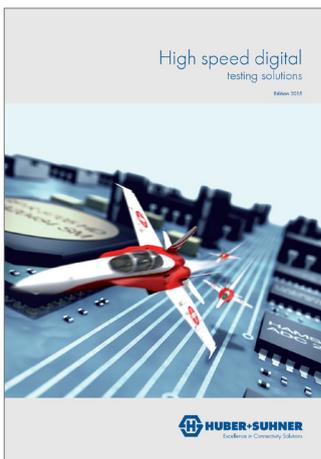
Note:  
All specifications are approximate values. In edge cases or critical applications, please contact your HUBER+SUHNER distributor.

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