



SPINNER || MEASUREMENT & CALIBRATION EQUIPMENT FOR NETWORK ANALYZERS



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High Frequency Performance Worldwide
www.spinner-group.com

SPINNER test & calibration equipment for best measurement results

Today any development, production, test or quality assurance department that works with RF signals on coaxial lines can not function without latest measurement equipment.

In high frequency technology vector network analyzers (VNA) are often used to determine the characteristics of RF and microwave devices.

The components of a VNA as well as the test assembly connected to the instrument have their own frequency and phase responses. This may cause false readings.

System errors can be adjusted by calibration of the VNA. During the calibration procedure, different calibration standards with defined and known electrical characteristics are connected to a VNA. These values and the measured values are compared to identify error coefficients. In a system error correction procedure the VNA adjusts the measured data of the DUT by the error coefficients. Thus the measurement accuracy increases.

The calibration of a VNA can be done in different ways depending on the required measurement accuracy. The calibration methods differ both in the number and form of the calibration standards used for the procedure.

The most commonly used calibration method is OSL (Open, Short, Load) for 1-port measurements and OSLT (Open, Short, Load, Through) for multiple-port measurements. The names OSL and OSLT for the calibration methods can vary with other manufacturers.

For these two calibration methods SPINNER offers an appropriate selection of calibration equipment ranging from the high-precision calibration kit for laboratory use to the compact designed calibration combinations for field use. Kits are available with 7-16, N, 3.5 mm, 2.92 mm, 2.4 mm and 1.85 mm.

In manufacturing such components, SPINNER has reached a level of precision that sets new standards which many desire.

SPINNER also offers a broad line of coaxial measurement equipment with excellent electrical and mechanical performance for use in laboratory and production environments at frequencies up to 67 GHz.

Radio frequency measurement and test equipment from one source!

With a view of completing the product range in the field of radio frequency measurement and test equipment SPINNER has signed a cross-selling agreement with HUBER+SUHNER AG for selected parts of the measurement product portfolio.

In addition to our previous high-quality products we therefore distribute a specific assortment of SUCOFLEX® and SUCOTEST® measurement cables, which are ideally suited for test and measurement applications.

You will find further information about the collaboration between SPINNER and HUBER+SUHNER AG at **www.rfmeasuring.com**.

Compact calibration kits (3-in-1 and 4-in-1)

The combination of all calibration standards in one handy unit is the optimum solution for simple and comfortable handling during the calibration of network analyzers with the methods OSL and OSLT. The excellent handling, ergonomic arrangement of the components, small size and low weight are appreciated by in-field users as well.

Our 4-in-1 calibration kits include open, short, load and through-line for the complete calibration of a network analyzer with two or more ports with the OSLT method.

Our 3-in-1 calibration kits include all necessary standards for a complete OSL calibration of single port network analyzers, used for field testing of wireless network installations.



3-in-1 calibration kits with 50 Ohm impedance

Part number	BN 53 38 65 R000	BN 53 38 66 R000	BN 53 38 63 R000	BN 53 38 64 R000
Frequency range	0 - 6 GHz			
Connectors	7-16 socket	7-16 plug	N socket	N plug
Impedance	50 Ω $\pm$ 0.5			

4-in-1 calibration kits with 50 Ohm impedance

Part number	BN 53 38 45	BN 53 38 46	BN 53 38 43	BN 53 38 44	BN 53 38 28	BN 53 38 29
Frequency range	0 - 6 GHz		0 - 9 GHz		0 - 13 GHz	
Connectors	7-16 socket	7-16 plug	N socket	N plug	3.5 mm socket	3.5 mm plug
Impedance	50 Ω $\pm$ 0.5					

4-in-1 calibration kits with 75 Ohm impedance

Part number	BN 53 38 57 R000	BN 53 38 58 R000
Frequency range	0 - 3 GHz	
Connectors	N socket	N plug
Impedance	75 Ω $\pm$ 0.75	



High-precision calibration kits up to the cut-off frequencies of the connector series

In order to achieve the best possible measurement results over the whole frequency range of a connector series the VNA is calibrated with one of several high-precision SPINNER calibration kits.

The calibration comparison standards open circuit (Open), short circuit (Short) and fixed load (Load), each as a plug or socket, are included in our OSL calibration kits.

Additionally, our OSLT calibration kits include through adapters (Through), one with plug-to-plug and one with socket-to-socket connections. Optionally, a plug-to-socket adapter is available. All necessary data for the calibration are included.



Part number	OSL	BN 53 38 10	BN 53 38 31	—	—	—	—
	OSLT	BN 53 38 40	BN 53 38 61	BN 53 38 54	BN 53 38 56	BN 53 38 42	BN 53 38 55
Frequency range		0 - 7.5 GHz	0 - 18 GHz	0 - 32 GHz	0 - 40 GHz	0 - 50 GHz	0 - 67 GHz
Connectors		7-16	N	3.5 mm	2.92 mm	2.4 mm	1.85 mm
Impedance		50 Ω $\pm$ 0.5					

Part number	BN 74 16 51 R000	BN 74 16 50 R000
Frequency range	4 - 50 GHz	
Connectors	2.4 mm socket	2.4 mm plug
Impedance	50 Ω	
Line accuracy	$\geq$ 44 dB	
Return loss	$\geq$ 28 dB	
Directivity after calibration	$\geq$ 30 dB	

Sliding loads

Sliding loads are used to improve the measurement accuracy of vector network analyzers at frequencies above 4 GHz. The improvement results from the separation of the load mismatch and the impedance error of the transmission line. SPINNER sliding loads are available in the 2.4mm plug and socket versions.



Articulated lines

SPINNER developed articulated lines to replace the measurement cables between the test port of a vector network analyzer (VNA) and the device under test (DUT). Other than conventional cables they have an excellent phase and amplitude stability, even in motion and at very high signal frequencies. The use of several joints between rigid line sections allows the end of the line to be easily moved to all points within a sphere of approx. 0.5 m in radius (without restrictions such as the limited bending radius of a cable). The choice of materials ensures high reliability and a long life time of the lines. Articulated lines are available in connector types 3.5 mm and N.



Push-pull adapters

SPINNER push-pull adapters provide excellent mechanical stability and a fast and accurate method for continuous connects and disconnects without the time-consuming tightening of the connector with a torque wrench. The adapter is quickly and easily mated and de-mated by pulling its coupling nut backwards, pushing it onto the corresponding connector and loosening the nut.

Our technology is compatible with any standard socket in the corresponding connector series. The use of high-quality materials ensures the adapter's ability to produce precise connections and maximize its life time.



Part number	BN 53 36 45	BN 53 36 38
Frequency range	0 - 18 GHz	0 - 26.5 GHz
Connectors	N plug	3.5 mm plug
Impedance	50 Ω $\pm$ 0.5	
VSWR	≤ 1.1 @ 0 - 4 GHz ≤ 1.3 @ 4 - 9 GHz ≤ 1.4 @ 9 - 18 GHz	≤ 1.1 @ 0 - 4 GHz ≤ 1.3 @ 4 - 9 GHz ≤ 1.4 @ 9 - 18 GHz ≤ 1.6 @ 18 - 26.5 GHz
Phase stability S11/S22	$\pm 1.9^\circ$	$\pm 2.6^\circ$
Amplitude stability S11/S22	± 0.07 dB	± 0.12 dB
Phase stability S12/S21	$\pm 0.5^\circ$	$\pm 1.0^\circ$
Amplitude stability S12/S21	± 0.05 dB	± 0.10 dB

Part number	BN 19 44 72	BN 95 08 70	BN 64 05 70
Frequency range	0 - 7.5 GHz	0 - 18 GHz	0 - 26.5 GHz
Connectors	7-16 plug - N socket	N plug - socket	3.5 mm plug - socket
Impedance	50 Ω $\pm$ 0.5		
VSWR	≤ 1.02 @ 0 - 2 GHz ≤ 1.06 @ 2 - 7.5 GHz	≤ 1.02 @ 0 - 2 GHz ≤ 1.04 @ 2 - 10 GHz ≤ 1.06 @ 10 - 18 GHz	≤ 1.02 @ 0 - 6 GHz ≤ 1.06 @ 6 - 12 GHz ≤ 1.12 @ 12 - 26.5 GHz
Matings	5,000	10,000 ¹⁾	

¹⁾ Silicone ring of the coupling mechanism has to be changed after 5,000 matings

Gauges

To prevent damage to the precision connectors and to assure precise measurement data, the connector interface dimensions of all components used for the test assembly must be tested with a suitable gauge before mating.

On a SPINNER gauge the tolerance limits for the different connector standards are marked in colour on the dial. The connector interface dimensions can easily be checked without any specific knowledge of standards.

A reference gauge, used to check and to adjust the gauge, is part of the kit. SPINNER offers gauges for a wide variety of connector types.



Gauges for connectors 7-16, N and 3.5 mm

Part number	BN 53 70 37	BN 53 70 15	BN 53 70 13	BN 53 70 11	BN 53 70 75	BN 53 70 74
Connectors	7-16 socket	7-16 plug	N socket	N plug	3.5 mm socket	3.5 mm plug

Gauges for connectors 2.92 mm, 2.4 mm and 1.85 mm

Part number	BN 53 70 82	BN 53 70 81	BN 53 70 79	BN 53 70 78	BN 53 70 84	BN 53 70 83
Connectors	2.92 mm socket	2.92 mm plug	2.4 mm socket	2.4 mm plug	1.85 mm socket	1.85 mm plug

Part number	BN 53 70 91 R000	BN 15 41 41 R000
For use with connector types	N	3.5 mm, 2.92 mm, 2.4 mm, 1.85 mm
Wrench size	19 mm	8 mm
Preset torque	90 Ncm ±9	
Material	Steel / brass	
Surface	Nickel plated with black plastic cover on the end of the handle	

Torque wrenches

For precise measurement results, the connectors must be coupled according to specific standards. Furthermore, the use of torque wrenches can prevent overstraining of connectors and ensure maximum product life time. SPINNER supplies the appropriate torque wrenches.



Test port adapters

Every connection event puts stress on the test port of the measurement instrument, causing wear over time. Therefore, the test port must be replaced when the maximum number of matings allowed by the manufacturer has been completed.

SPINNER test port adapters can be mounted on the test ports of a vector network analyzer, absorbing the wear and tear that would otherwise affect the instrument. Thus, the life time of the measurement instrument can be extended until the test ports are worn out.

The use of test port adapters can help avoid the costs of an extensive test port replacement on the measurement instrument, as well as the longer downtime for having the instrument repaired by the manufacturer.



Part number	BN 75 64 04	BN 95 08 90
Frequency range	0 - 7.5 GHz	0 - 18 GHz
Connectors	7-16 plug - socket	N plug - socket
Impedance	50 Ω	
VSWR	≤ 1.01 @ 0 - 1 GHz ≤ 1.04 @ 1 - 3 GHz ≤ 1.06 @ 3 - 7.5 GHz	≤ 1.02 @ 0 - 1 GHz ≤ 1.04 @ 1 - 3 GHz ≤ 1.06 @ 3 - 6 GHz ≤ 1.12 @ 6 - 12 GHz ≤ 1.27 @ 12 - 18 GHz
Intermodulation (IM3) 2 x 20 W	≤ -165 dBc	
Matings	max. 5,000	
Length	29 mm	29.7 mm

Precision air lines

Air lines work as a reference impedance for the DUT and the VNA and are used for precision time domain reflectometry measurements (TDR-measurements) in particular of connectors, inter-series adapters and loads. For a more convenient handling at the VNA side of the air line, the inner conductor is supported by one low-loss dielectric bead and is aligned in this way.

Besides that the bead also keeps the inner conductor fixed at the beadless end in terms of concentricity and in compliance with the defined pin depth (DUT side of the air line).

SPINNER precision air lines are made of high quality with most accurate dimensions.

Therefore, our air lines feature lowest return loss for the area on the DUT side of the air line and best possible impedance values from mating area DUT side up to the bead.



Part number	BN 53 36 92	BN 53 36 93	BN 53 36 90	BN 53 36 91	BN 53 36 94	BN 53 36 95
Frequency range	0 - 7.5 GHz		0 - 18 GHz		0 - 34 GHz	
Connectors*	7-16 plug - socket	7-16 socket - socket	N plug - socket	N socket - socket	3.5 mm plug - socket	3.5 mm socket - socket
Impedance	50 Ω ± 0.07		50 Ω ± 0.15		50 Ω ± 0.25	
VSWR	1.004 + 0.0016 x f [GHz]		1.004 + 0.002 x f [GHz]		1.006 + 0.002 x f [GHz]	

* First gender is the test port connector at the DUT's side, second gender is the beaded port connector

Calibration, maintenance and repair services

To retain the best performance and to prolong the life time of SPINNER's high quality measurement and calibration equipment, it is recommended to have the following items maintained and/or recalibrated in a periodic cycle:

- Calibration kits
- Articulated lines
- Precision air lines
- Torque wrenches
- Gauges
- Other coaxial components used in your laboratory

SPINNER offers excellent calibration, maintenance and repair services worldwide so that you will continue to take much pleasure in the daily use of our equipment. If a refurbishment of your equipment has to be done or it has to be repaired, for example in case a pin had been broken, SPINNER will provide you with the best and the most cost-effective options for repair and the needed original spare parts.

Please contact us by sending an e-mail to is@spinner-group.com and we will give you all information for your specific calibration, maintenance and repair services required for your situation.

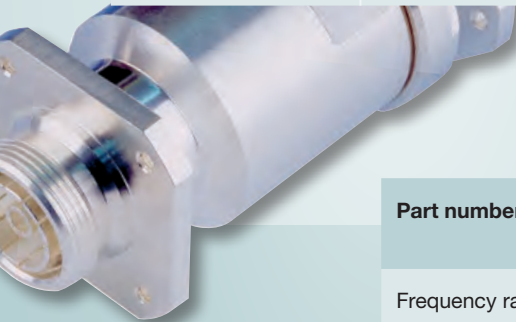
Single channel coax rotary joints

SPINNER's contacting single channel rotary joints stand out for their extremely large bandwidth up to 50 GHz. Excellent VSWR and insertion loss values with very little variation in rotation throughout the complete frequency range make these rotary joints suitable for a broad range of applications in measurement technology.

The typical life time of rotary joints is about 10 million revolutions. The use of rotary joints can help to significantly extend the life time of other components, especially expensive measurement cables, because the cables are not exposed to torsion which can damage them.



Part number	BN 94 54 36	BN 83 50 27	BN 83 50 47
Frequency range	0 - 5 GHz	0 - 15 GHz	0 - 18 GHz
Average power	600 W	70 W	40 W @ 15 GHz 30 W @ 18 GHz
VSWR	≤ 1.01	≤ 1.06 @ 0 - 2 GHz ≤ 1.15 @ 2 - 8 GHz ≤ 1.20 @ 8 - 15 GHz	≤ 1.3 @ 0 - 10 GHz ≤ 1.4 @ 10 - 18 GHz
Insertion loss (dB)	≤ 0.02	≤ 0.03 @ 0 - 2 GHz ≤ 0.10 @ 2 - 8 GHz ≤ 0.20 @ 8 - 15 GHz	≤ 0.25 @ 0 - 10 GHz ≤ 0.30 @ 10 - 18 GHz
Phase variation - WOW	$< 1^\circ$	$< 2^\circ$	$< 1^\circ$
Impedance	50 Ω	50 Ω	50 Ω
Connections	7-16 socket	N socket	SMA socket



Part number	BN 83 50 68	BN 83 50 45	BN 83 50 77
Frequency range	0 - 26.5 GHz	0 - 40 GHz	0 - 50 GHz
Average power	25 W	1 W	50 W @ 1 GHz 1 W @ 50 GHz
VSWR	≤ 1.3 @ 0 - 10 GHz ≤ 1.4 @ 10 - 18 GHz ≤ 1.7 @ 18 - 26.5 GHz	≤ 1.3 @ 0 - 10 GHz ≤ 1.4 @ 10 - 18 GHz ≤ 1.7 @ 18 - 26.5 GHz ≤ 2.0 @ 26.5 - 40 GHz	≤ 1.3 @ 0 - 10 GHz ≤ 1.4 @ 10 - 26.5 GHz ≤ 1.7 @ 26.5 - 50 GHz
Insertion loss (dB)	≤ 0.30 @ 0 - 10 GHz ≤ 0.35 @ 10 - 18 GHz ≤ 0.70 @ 18 - 26.5 GHz	≤ 0.5 @ 0 - 18 GHz ≤ 1.0 @ 18 - 26.5 GHz ≤ 1.2 @ 26.5 - 40 GHz	≤ 0.3 @ 0 - 10 GHz ≤ 0.5 @ 10 - 26.5 GHz ≤ 0.9 @ 26.5 - 50 GHz
Phase variation - WOW	$< 1^\circ$	$< 3^\circ$	$\leq 1^\circ$ @ 0 - 26.5 GHz $\leq 2^\circ$ @ 26.5 - 50.0 GHz
Impedance	50 Ω	50 Ω	50 Ω
Connections	3.5 mm	2.92 mm	2.4 mm

Test cable assemblies

SPINNER and HUBER+SUHNER AG have signed a mutual cross-selling agreement for measurement and calibration equipment. Therefore we have now expand our product portfolio and offer a specific portfolio of test cable assemblies which allows you to buy all your RF measurement and test equipment from one source.

The SUCOTEST®18 cable assemblies feature excellent electrical performance and are ideal for daily use in component and assembly shops, test labs and automatic test equipment applications. For heavy-duty, outdoor and harsh environment measurements the SUCOTEST®18A cable assemblies have beyond the excellent electrical performance a ruggedisation which offers perfect protection against mechanical forces

acting upon the cable. They are ideal for testing wireless communication infrastructures, defence and ground systems as well as for daily use in component and assembly shops.

As high-end products with optimal performance the SUCOFLEX® 102 and SUCOFLEX®104 cable assemblies are perfectly suited for static and dynamic measurements. SUCOFLEX®104P/PE/PEA assemblies have to be applied for applications in which flexibility is the critical factor. SUCOFLEX®104P and SUCOFLEX®104PE differ in the material of the cable jacket. SUCOFLEX®104PEA assemblies have a ruggedisation for measurements in a heavy-duty, outdoor and harsh environment.

The assortment of HUBER+SUHNER measurement cables is only available through selected sales channels.

SUCOTEST®18 – Measurement cables up to 18 GHz



Connectors	Length	Return loss min. ¹⁾	Loss ¹⁾	Operating frequency	Part number HUBER+SUHNER	Part number SPINNER
SMA plug / SMA plug	36 inch (approx. 900 mm)	≥ 19 dB	< 1.51 dB	0 - 18 GHz	84 00 20 61	BN A7 36 02
N plug / N plug	36 inch (approx. 900 mm)	≥ 19 dB	< 1.51 dB	0 - 18 GHz	84 00 20 60	BN A7 36 03
SMA plug / N plug	36 inch (approx. 900 mm)	≥ 19 dB	< 1.51 dB	0 - 18 GHz	84 00 45 94	BN A7 36 04
SMA plug / SMA plug	48 inch (approx. 1200 mm)	≥ 19 dB	< 1.95 dB	0 - 18 GHz	84 00 33 73	BN A7 36 05
N plug / N plug	48 inch (approx. 1200 mm)	≥ 19 dB	< 1.95 dB	0 - 18 GHz	84 00 33 72	BN A7 36 06
SMA plug / N plug	48 inch (approx. 1200 mm)	≥ 19 dB	< 1.95 dB	0 - 18 GHz	84 00 40 06	BN A7 36 07
SMA plug / SMA plug	72 inch (approx. 1800 mm)	≥ 19 dB	< 2.85 dB	0 - 18 GHz	84 00 40 07	BN A7 36 08
N plug / N plug	72 inch (approx. 1800 mm)	≥ 19 dB	< 2.85 dB	0 - 18 GHz	84 00 40 70	BN A7 36 09
SMA plug / N plug	72 inch (approx. 1800 mm)	≥ 19 dB	< 2.85 dB	0 - 18 GHz	84 00 45 95	BN A7 36 10

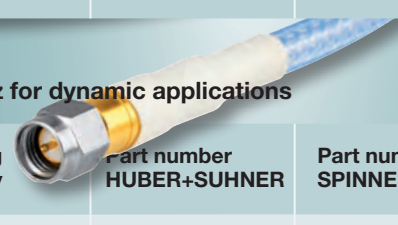
¹⁾ Attenuation values specified at + 25°C ambient temperature and maximum operating frequency

SUCOTEST®18A – Measurement cables up to 18 GHz for harsh environment

Connectors	Length	Return loss min. ¹⁾	Loss ¹⁾	Operating frequency	Part number HUBER+SUHNER	Part number SPINNER
N plug / N plug	1500 mm	≥ 19 dB	< 2.74 dB	0 - 18 GHz	84 01 30 29	BN A7 36 20
N plug / N socket	1500 mm	≥ 19 dB	< 2.74 dB	0 - 18 GHz	84 01 30 30	BN A7 36 21
N plug / N plug	3000 mm	≥ 19 dB	< 5.30 dB	0 - 18 GHz	84 01 30 31	BN A7 36 22

SUCOFLEX®104 – Flexible measurement cables up to 26.5 GHz for static applications

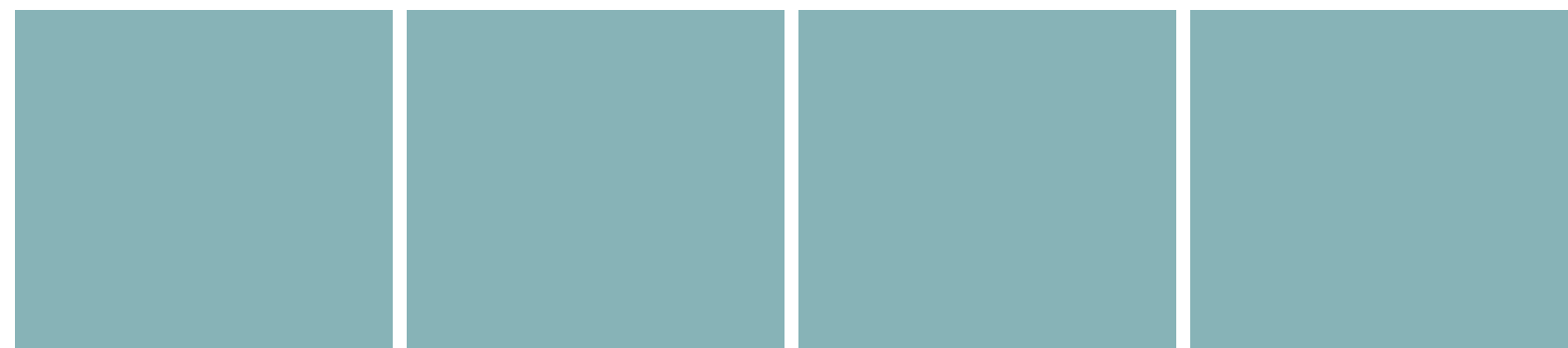
Connectors	Length	Return loss min. ¹⁾	Loss ¹⁾	Operating frequency	Part number HUBER+SUHNER	Part number SPINNER
SMA plug / SMA plug	500 mm	≥ 19 dB	< 0.82 dB	0 - 18 GHz	22 64 26 42	BN A7 36 30
N plug / N plug	500 mm	≥ 17 dB	< 0.82 dB	0 - 18 GHz	22 64 89 12	BN A7 36 31
SMA plug / SMA plug	1000 mm	≥ 19 dB	< 1.39 dB	0 - 18 GHz	84 01 67 55	BN A7 36 32
N plug / N plug	1000 mm	≥ 19 dB	< 1.39 dB	0 - 18 GHz	22 64 26 45	BN A7 36 33
SMA plug / N plug	1000 mm	≥ 18 dB	< 1.39 dB	0 - 18 GHz	22 64 89 16	BN A7 36 34
SMA plug / SMA plug	1500 mm	≥ 19 dB	< 1.99 dB	0 - 18 GHz	84 01 67 56	BN A7 36 35
N plug / N plug	1500 mm	≥ 17 dB	< 1.99 dB	0 - 18 GHz	84 01 70 67	BN A7 36 36
N plug / N socket	1500 mm	≥ 19 dB	< 1.99 dB	0 - 18 GHz	84 01 71 92	BN A7 36 37
SMA plug / SMA plug	2000 mm	≥ 19 dB	< 2.59 dB	0 - 18 GHz	84 01 67 57	BN A7 36 38
N plug / N plug	2000 mm	≥ 17 dB	< 2.59 dB	0 - 18 GHz	22 64 89 14	BN A7 36 39
SMA plug / N plug	2000 mm	≥ 18 dB	< 2.59 dB	0 - 18 GHz	22 64 89 17	BN A7 36 40
N plug / N plug	3000 mm	≥ 17 dB	< 3.80 dB	0 - 18 GHz	84 01 71 61	BN A7 36 41
SMA plug / SMA plug	5000 mm	≥ 19 dB	< 6.22 dB	0 - 18 GHz	23 03 23 36	BN A7 36 42
N plug / N plug	5000 mm	≥ 17 dB	< 6.22 dB	0 - 18 GHz	22 65 40 52	BN A7 36 43
3.5 mm plug / 3.5 mm plug	500 mm	≥ 17 dB	< 1.01 dB	0 - 26.5 GHz	22 64 89 10	BN A7 36 50
3.5 mm plug / 3.5 mm plug	1000 mm	≥ 17 dB	< 1.73 dB	0 - 26.5 GHz	84 01 71 58	BN A7 36 51

**SUCOFLEX®104P/PE/PEA – Flexible measurement cables up to 26.5 GHz for dynamic applications**

Connectors	Length	Return loss min. ¹⁾	Loss ¹⁾	Operating frequency	Part number HUBER+SUHNER	Part number SPINNER
SMA plug / SMA plug	500 mm	≥ 19 dB	< 1.07 dB	0 - 18 GHz	23 01 57 97	BN A7 36 64
SMA plug / SMA plug	1000 mm	≥ 19 dB	< 1.39 dB	0 - 18 GHz	22 64 41 34	BN A7 36 65
SMA plug / SMA plug	2000 mm	≥ 19 dB	< 3.60 dB	0 - 18 GHz	22 64 41 35	BN A7 36 66
SMA plug / SMA plug	1000 mm	≥ 19 dB	< 1.90 dB	0 - 18 GHz	84 01 72 58	BN A7 36 67
3.5 mm plug / 3.5 mm plug	1000 mm	≥ 17 dB	< 2.39 dB	0 - 26.5 GHz	23 00 50 64	BN A7 36 52
N plug / N plug	1000 mm	≥ 17 dB	< 1.90 dB	0 - 18 GHz	23 00 50 59	BN A7 36 68
N plug / N socket	1500 mm	≥ 17 dB	< 1.99 dB	0 - 18 GHz	23 00 50 77	BN A7 36 69

SUCOFLEX®102 – Flexible measurement cables up to 40 GHz for static applications

Connectors	Length	Return loss min. ¹⁾	Loss ¹⁾	Operating frequency	Part number HUBER+SUHNER	Part number SPINNER
2.92 mm plug / 2.92 mm plug	500 mm	≥ 15 dB	< 1.76 dB	0 - 40 GHz	84 01 71 46	BN A7 36 60
2.92 mm plug / 2.92 mm plug	1000 mm	≥ 15 dB	< 3.16 dB	0 - 40 GHz	22 64 98 03	BN A7 36 61



Figures not binding | Designs subject to modification

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