SPINNER
Test and Measurement

RF Test & Measurement Solutions

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HIGH FREQUENCY PERFORMANCE WORLDWIDE
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Content

Vector Network Analyzer Calibration

Today any development, production, test or quality assurance department that works with RF signals on coaxial lines cannot 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.

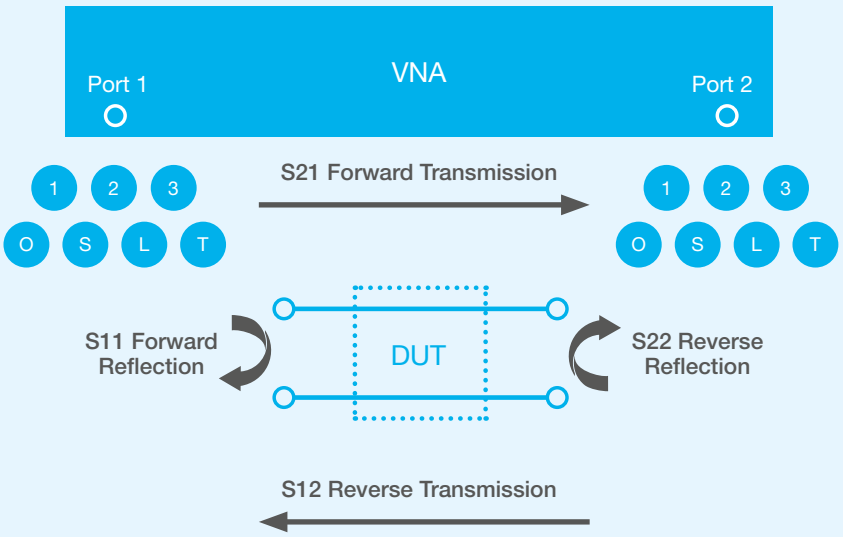
The names OSL and OSLT for the calibration methods can vary with other manufacturers.

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, 4.3-10, N, 2.2-5, NEX10®, 3.5 mm, 2.92 mm, 2.4 mm, 1.85 and 1.35 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 110 GHz.

S-Parameter Measurement (VNA)



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Testing of 75 Ω Line Systems

Not only broadcasting systems, but also new communications applications use 75 ohm interfaces for high frequencies up to 18 or 20 GHz.

This has created a need for precise, reliable calibration and testing equipment that can be connected to 50-ohm vector network analyzers. SPINNER 75-ohm test adapters with type N connectors are now available in different versions to fill this gap.

SPINNER offers them in two forms: as a practical calibration kit with customized calibration coefficients and as a compact calibration tool with global coefficients. Both are characterized by outstanding accuracy and electrical specifications.

A typical application is testing of SDI 12G-compliant cables and interfaces, all of which have a resistance of 75 ohms. 12G supports a data rate of 12 Gbps. This SDI standard was developed to support greater resolution, frame rates, and color fidelity.

75-ohm systems can be measured with a 50-ohm vector network analyzer using a 75-ohm calibration kit and a proper unmatched mechanical adapter from 75-ohm to 50-ohm to avoid any damage on the inner conductor system.

For frequencies up to 20 GHz, which need be measured on a 26.5 GHz VNA with a ruggedized 3.5 mm test port, SPINNER provides a unique adapter from N 75 Ohm to ruggedized 3.5 mm male and female.

Application Note
https://www.spinner-group.com/images/download/technical_documents/SPINNER_TD00178.pdf

75 Ohm Testing Product Range

Broadcast Video Applications

Terrestrial Broadcasting

Type N 75 Ohm line system/devices

Unmatched Inter-Type-Adapters

75 Ohm OSLT High Precision Calibration Kit

75 Ohm OSLT Compact Calibration Kit

Type N 50 Ohm line system/devices

Ruggedized Adapters

50 Ohm VNA

Minimizing PIM for over 25 Years

SPINNER understands how PIM performance can affect the growth of cellular networks and for decades has been devoting a huge R&D effort to offer a comprehensive portfolio of low-PIM products.

Passive intermodulation (PIM) is a form of intermodulation caused by the (generally very small) nonlinearities present in all passive components. When two or more frequencies are applied simultaneously, new and typically unwanted frequencies are generated. I

f these frequencies are of sufficient power and fall into the frequency range of the receiving signal, they can significantly disturb the receivers of mobile base stations and negatively impact the quality of service. Symptoms include reduced bandwidth and even dropped calls.

Fixing the problem involves additional and often repeated investments for locating and replacing components with bad PIM behavior. At SPINNER we believe in avoiding these issues from the start.

We also set extraordinarily high standards with our definition of „low PIM“. Even most of our standard products such as connectors and jumpers feature a value of -160 dBc or better. Measuring the PIM properties of a component or system requires a measuring environment of sufficiently higher precision than the device under test.

Praxis

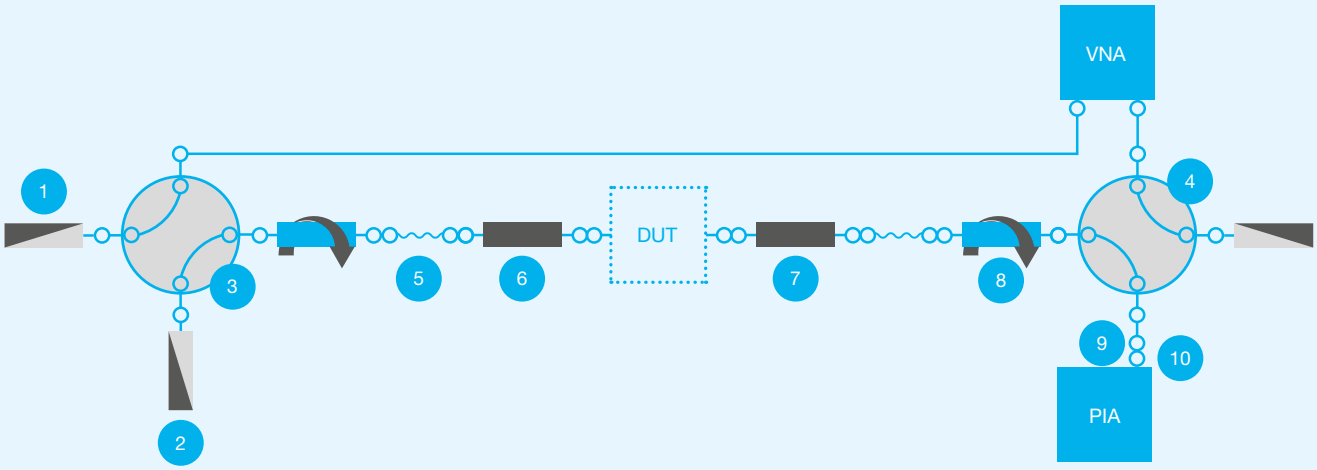
- Avoid all damage and contamination that may affect PIM values and make make sure that all RF-relevant electrical connections used for PIM measurement of free of metal particles dust, oxides and other contamination.
- All interseries adapters used for measurement should be designed as “PIM free” solutions with a single-piece inner conductor and a single-piece outer conductor.
- It is strongly recommended to use a dial gauge to ensure the right pin depths on each connector, otherwise there is a risk of damage and/or deformation.
- When a bad connection is discovered, sometimes the first reaction is to overtighten it. Instead, all coupling nuts and cable inputs should be tightened using a torque wrench that is adjusted. This will help minimize PIM.

Preparation of Test Equipment

The following requirements must be met to obtain comparable PIM measurements:

- PIM measurement must always be done by experienced and skilled staff, otherwise there is a risk that results will be misinterpreted
- Measurement equipment (frequency sources, spectrum analyzers and power meters) must be regularly calibrated based on the applicable national or international calibration standard.

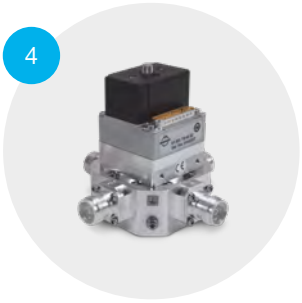
Low PIM Testing Product Range



1 Portable Low PIM Load

2 Laboratory Loads

3 Switches



4 Switches-Matrices

5 Test Cables

6 EasyDocks

7 Push-Pull-Adapters

8 Rotary Joints

9 PIM Standards

10 Port Savers

Optimize Your Test Chamber Setup

Photo by: Jet Fabara

One of the problems that crop up when testing RF devices, machines, or vehicles in open-air environments is the large number of potentially interfering RF signals from radars, cellphones etc.

Mobile applications such as smartphones and tablets use high-speed connections, for example, to display or save steady high-resolution videos. The antennas that let these devices connect to a base station are increasingly broadband, which makes them more sensitive to electromagnetic interference.

The best way to test these devices is to place them in an isolated space called a low-reflection or anechoic chamber. Then intrinsic interference or interference radiation can be measured, coexistence tests can be carried out, or antenna characteristics can be verified.

RF test chambers are also used to measure radiated spurious emissions (RSEs) or antenna characteristics in an over-the-air (OTA) space.

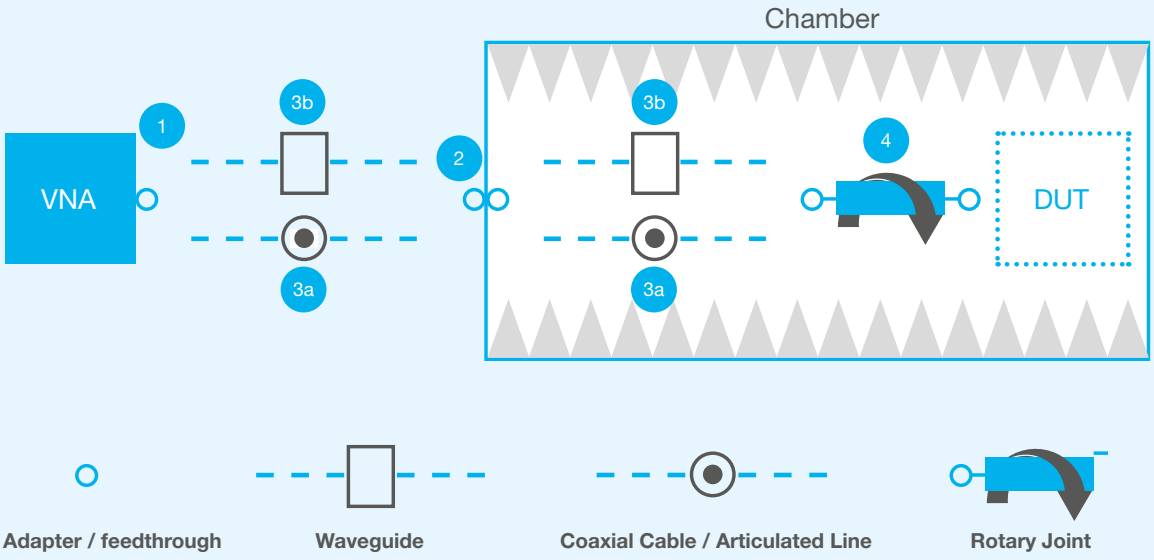
Equipment development is usually concluded with measurements for certification known as the “first-time pass”.

But what about RF signals when the test equipment is outside a chamber? How can signals be routed in and out without large losses and additional interference?

SPINNER offers a whole line of highly suitable components for optimizing signal transmission between the test equipment and the device being tested in an RF anechoic chamber.

They range from precision-manufactured test port adapters across special flexible test cables and flexible waveguides to panel feedthroughs and both single- and multi-channel coaxial and waveguide rotary joints for frequency ranges from DC to 210 GHz.

Anechoic Chambers Testing Product Range



Test Port / Adapter

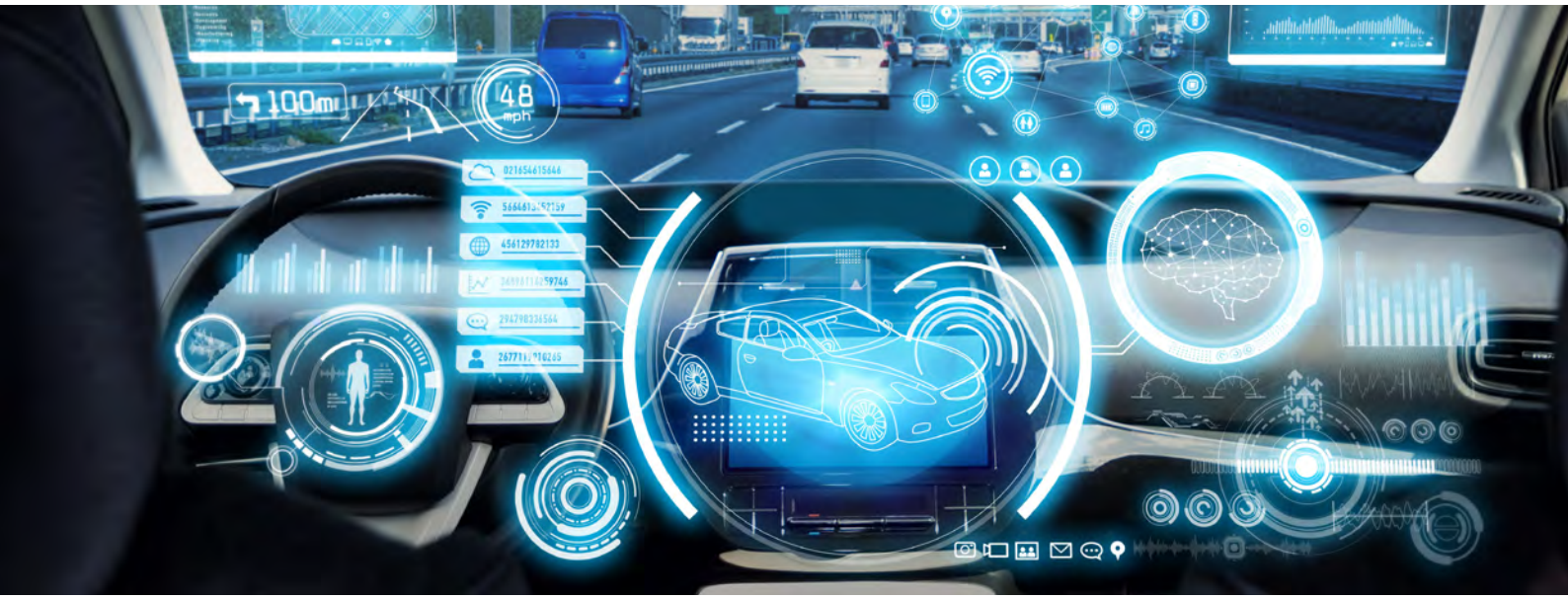
Panel /
Feedthrough Connector

Articulated Line

Flex. Waveguide Assembly

Rotary Joint

Precision Connectivity for Millimeter Wave



As the market for millimeter wave sensors for self-driving vehicles expands, the demand for proper RF connections in testing environments is also growing.

Reliable coaxial interface connections are crucial for achieving good RF performance, especially in E-band applications. A common frustration in RF laboratories is unwanted unlocking of the 1.00 mm coaxial thread after performing time-consuming calibrations. This spawned the idea of a 1.35 mm connector the “E Connector” with a precise metric thread like the 1.85 mm connector plus an integrated time saving push-pull capability.

The E Connector is ideal for making high-performance RF measurements in the E-band without being held up by fragile 1.00 mm coaxial connector or wasting time reassembling WR 10 waveguides.

SPINNER designed the new 1.35 mm E Connector to close the gap between the 1.85 mm and the 1.00 mm coaxial connectors.

The 1.35 mm E Connector interface has been accepted for IEEE precision connector standard P287 now.

A manufacturer-independent supply of the new 1.35 mm E Connector is therefore ensured.

Creating a Suitable Environment

Rotary Joints

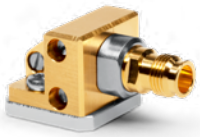
mmWave Waveguide to Coax-Adapters

Calibration Kits

Dial Gauges

Inter-Type Adapters

90 GHz E Connector 1.35 mm



PCB Launch Connectors

Cable Connectors

EasyDock

Panel Connectors

Air Lines bead-supported

Offset Shorts

Ruggedized Adapters

High Precision Calibration Kits

To ensure that a VNA delivers accurate amplitude and phase measurements without any drift, it is typically calibrated prior to each measurement. To do this, first the characteristic data of the various calibration standards are communicated to the VNA.

These characteristic data describe deviations from the ideal model. The calibration standards are then connected one after the other to the end of the test cable attached to the network analyzer.

The VNA then compares the measured values with the defined and known electrical properties of the calibration standard to calculate error terms. With their aid, all subsequently measured values are corrected to yield the actual values. If any change whatsoever is made to the test setup, no matter how small (slightly moving one of the test cables is enough), calibration is repeated before performing any additional measurements.

In fact, calibration is key for ensuring precise measurements. A VNA can be calibrated in various ways depending on the required degree of accuracy. The most frequently used calibration methods are OSL (open-short-load) for single-port measurements and OSLT (open-short-load-through) for two-port measurements.

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.

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.

Calibration Kits, OSL, Compact 3-in-1, 50 Ω

- The all-in-one compact calibration kit for one port calibration
- Open, short and load (OSL) in one compact handy device
- Applicable to all VNA
- For frequencies from DC to 6 GHz

Part Number	Interface	Frequency Range	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.
BN 533866R000 BN 533865R000	7-16 male 7-16 female	DC to 6 GHz	≤ 1.5°	≤ 1.0°	≥ 40 dB
			Phase shift	Phase shift	
BN 533864R000 BN 533863R000	Type N male Type N female	DC to 6 GHz	180° +/-	180° +/-	≥ 42 dB

Calibration data in formats for the common VNAs are included in the kit.

Calibration Kits, OSLT, Compact 4-in-1, 50 Ω

- Open, short, load (OSL) and through (OSLT) in one compact handy device
- Simplified calibration of more-port VNAs
- Applicable to all VNA
- Color coding for displaying interface size information
- For frequencies from DC to 6 GHz up to DC to 13 GHz

Part Number	Interface	Frequency Range	Open Phase deviation, max	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.	Through Insertion loss, max.
BN 533846 BN 533845	7-16 male 7-16 female	DC to 6 GHz	≤ 1.5°	≤ 1.50°	≥ 40 dB	≥ 34 dB	≤ 0.10 dB
BN 533844 BN 533843	Type N male Type N female	DC to 4 GHz 4 to 6 GHz 6 to 8 GHz 8 to 9 GHz	≤ 2.0° ≤ 3.0° ≤ 3.0° ≤ 3.0°	≤ 1.25° ≤ 1.25° ≤ 1.25° ≤ 1.25°	≥ 42 dB ≥ 42 dB ≥ 35 dB ≥ 35 dB	≥ 36 dB ≥ 31 dB ≥ 31 dB ≥ 28 dB	≤ 0.05 dB ≤ 0.10 dB ≤ 0.10 dB ≤ 0.10 dB
BN 533829 BN 533828	3.5 mm male 3.5 mm female	DC to 4 GHz 4 to 8 GHz 8 to 13 GHz	≤ 1.5° ≤ 3.0° ≤ 4.5°	≤ 1.0° ≤ 2.0° ≤ 3.5°	≥ 40 dB ≥ 34 dB ≥ 28 dB	≥ 34 dB ≥ 28 dB ≥ 25 dB	≤ 0.10 dB ≤ 0.10 dB ≤ 0.15 dB

Calibration data in formats for the common VNAs are included in the kit.

Calibration Kits, OSLT, Compact 4-in-1, 50 Ω

- Open, short, load (OSL) and through (OSLT) in one compact handy device
- Simplified calibration of more-port VNAs
- Applicable to all VNA
- Color coding for displaying interface size information
- For frequencies from DC to 6 GHz up to DC to 70 GHz

Part Number	Interface	Frequency Range	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.	Through Insertion loss, max.
BN 533807 BN 533808	4.1-9.5 male 4.1-9.5 female	DC to 4 GHz 4 to 6 GHz			≥ 40 dB ≥ 40 dB	≥ 35 dB ≥ 30 dB	≤ 0.04 dB
BN 533301 BN 533302	4.3-10 male 4.3-10 female	DC to 4 GHz 4 to 6 GHz	≤ 1.5° ≤ 2.5°	≤ 1.0° ≤ 2.0°	≥ 40 dB ≥ 35 dB	≥ 35 dB ≥ 30 dB	≤ 0.04 dB
BN 533313 BN 533314	4.3-10 male screw 4.3-10 female	DC to 4 GHz 4 to 6 GHz 6 to 12 GHz	≤ 1.5° ≤ 2.5° ≤ 3.0°	≤ 1.0° ≤ 2.0° ≤ 2.5°	≥ 40 dB ≥ 35 dB ≥ 30 dB	≥ 35 dB ≥ 30 dB ≥ 25 dB	≤ 0.04 dB
BN 533879 BN 533880	Type N male Type N female	DC to 4 GHz 4 to 6 GHz 6 to 8 GHz 8 to 9 GHz 9 to 18 GHz	≤ 2.0° ≤ 2.0° ≤ 3.0° ≤ 3.0° ≤ 4.0°	≤ 1.5° ≤ 1.5° ≤ 2.5° ≤ 2.5° ≤ 3.0°	≥ 38 dB ≥ 34 dB ≥ 34 dB ≥ 28 dB ≥ 28 dB	≥ 38 dB ≥ 34 dB ≥ 34 dB ≥ 28 dB ≥ 28 dB	≤ 0.035 dB
BN 355101 BN 355102	NEX10® male screw NEX10® female	DC to 2 GHz 2 to 6 GHz	≤ 1.5° ≤ 2.5°	≤ 1.5° ≤ 2.5°	≥ 38 dB ≥ 34 dB	≥ 38 dB ≥ 34 dB	≤ 0.035 dB
BN 225301 BN 225302	2.2-5 male screw 2.2-5 female	DC to 4 GHz 4 to 6 GHz	≤ 3.0° ≤ 4.0°	≤ 3.5° ≤ 4.5°	≥ 40 dB ≥ 34 dB	≥ 34 dB ≥ 28 dB	≤ 0.07 dB
BN 533881 BN 533882	3.5 mm male 3.5 mm female	DC to 5 GHz 5 to 15 GHz 15 to 26.5 GHz	≤ 1.5° ≤ 3.0° ≤ 4.5°	≤ 1.5° ≤ 3.0° ≤ 4.5°	≥ 34 dB ≥ 30 dB ≥ 30 dB	≥ 42 dB ≥ 36 dB ≥ 32 dB	≤ 0.035 dB
BN 533897 BN 533898	2.92 mm male 2.92 mm female	DC to 4 GHz 4 to 10 GHz 10 to 26.5 GHz 26.5 to 40 GHz	≤ 1.5° ≤ 2.5° ≤ 4.5° ≤ 5.0°	≤ 1.5° ≤ 2.0° ≤ 3.5° ≤ 4.5°	≥ 39 dB ≥ 33 dB ≥ 28 dB ≥ 24 dB	≥ 30 dB ≥ 26 dB ≥ 26 dB ≥ 21 dB	≤ 0.04 dB
BN 534913 BN 534914	2.92 mm male 2.92 mm female	DC to 4 GHz 4 to 10 GHz 10 to 26.5 GHz 26.5 to 40 GHz 40 to 44 GHz	≤ 1.5° ≤ 2.5° ≤ 4.5° ≤ 5.0° ≤ 5.0°	≤ 1.5° ≤ 2.0° ≤ 3.5° ≤ 4.5° ≤ 4.5°	≥ 39 dB ≥ 33 dB ≥ 28 dB ≥ 24 dB ≥ 22 dB	≥ 30 dB ≥ 26 dB ≥ 26 dB ≥ 21 dB ≥ 19 dB	≤ 0.04 dB
BN 533760 BN 533759	2.4 mm male 2.4 mm female	DC to 4 GHz 4 to 10 GHz 10 to 26.5 GHz 26.5 to 40 GHz 40 to 50 GHz	≤ 2.5° ≤ 2.5° ≤ 4.5° ≤ 5.0° ≤ 5.0°	≤ 2.0° ≤ 3.5° ≤ 3.5° ≤ 4.5° ≤ 4.5°	≥ 38 dB ≥ 32 dB ≥ 27 dB ≥ 23 dB ≥ 23 dB	≥ 30 dB ≥ 26 dB ≥ 26 dB ≥ 23 dB ≥ 21 dB	≤ 0.04 dB
BN 533755 BN 533754	1.85 mm male 1.85 mm female	DC to 4 GHz 4 to 10 GHz 10 to 26.5 GHz 26.5 to 50 GHz 50 to 67 GHz	≤ 3.0° ≤ 3.0° ≤ 4.0° ≤ 6.0° ≤ 7.0°	≤ 2.0° ≤ 3.0° ≤ 3.0° ≤ 5.0° ≤ 6.5°	≥ 36 dB ≥ 31 dB ≥ 25 dB ≥ 22 dB ≥ 20 dB	≥ 30 dB ≥ 26 dB ≥ 26 dB ≥ 23 dB ≥ 21 dB	≤ 0.06 dB
BN 533431 **BN 533430**	1.85 mm male 1.85 mm female	DC to 4 GHz 4 to 10 GHz 10 to 26.5 GHz 26.5 to 40 GHz 40 to 50 GHz 50 to 67 GHz 67 to 70 GHz	≤ 3.0° ≤ 3.0° ≤ 4.0° ≤ 6.0° ≤ 6.0° ≤ 7.0° ≤ 7.0°	≤ 2.0° ≤ 3.0° ≤ 3.0° ≤ 5.0° ≤ 5.0° ≤ 6.5° ≤ 6.5°	≥ 36 dB ≥ 31 dB ≥ 25 dB ≥ 22 dB ≥ 22 dB ≥ 20 dB ≥ 18 dB	≥ 30 dB ≥ 26 dB ≥ 26 dB ≥ 23 dB ≥ 21 dB ≥ 21 dB ≥ 19 dB	≤ 0.06 dB

Calibration data in formats for the common VNAs are included in the kit.

High Precision Compact 4-in-1 Calibration Kits, OSLT, 75 Ω

75 Ω

- Open, short, load (OSL) and through (OSLT) in one compact handy device
- Simplified calibration of more-port VNAs
- Applicable to all VNA
- Characteristic golden color in contrast to 50 Ohm kits
- For frequency's from DC to 3 GHz up to DC to 20 GHz
- N 75 is a 75 Ω interface not intermateable with Type N (50 Ω) versions

Part Number	Interface	Frequency Range	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.	Through Insertion loss, max.
BN 533857R000 BN 533858R000	Type N 75 female Type N 75 male	DC to 3 GHz	≤ 2.0°	≤ 1.5°	≥ 36 dB	≥ 34 dB	≤ 0.05 dB
BN 534029 BN 534030	Type N 75 female Type N 75 male	DC to 4 GHz 4 to 8 GHz 8 to 12 GHz	≤ 2.5° ≤ 3.5° ≤ 4.5°	≤ 2.0° ≤ 3.0° ≤ 4.0°	≥ 38 dB ≥ 31 dB ≥ 27 dB	≥ 31 dB ≥ 28 dB ≥ 23 dB	≤ 0.04 dB ≤ 0.04 dB ≤ 0.04 dB
BN 534050 BN 534051	Type N 75 female Type N 75 male	DC to 4 GHz 4 to 8 GHz 8 to 12 GHz 12 to 20 GHz	≤ 1.5° ≤ 2.5° ≤ 4.5° ≤ 5.0°	≤ 1.0° ≤ 2.0° ≤ 3.5° ≤ 4.5°	≥ 38 dB ≥ 34 dB ≥ 30 dB ≥ 25 dB	≥ 35 dB ≥ 34 dB ≥ 30 dB ≥ 25 dB	≤ 0.06 dB ≤ 0.06 dB ≤ 0.06 dB ≤ 0.06 dB

Calibration data in formats for the common VNAs are included in the kit.

OSL High Precision Calibration Kits, 50 Ω

- High-end S-parameter measurements
- Open, short and load (OSL): each one in male and female version
- For frequencies from DC to 7.5 GHz up to DC to 18 GHz

7-16, DC to 7.5 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.
BN 533810*	7-16	DC to 3 GHz ≤ 0.5° 3 to 6 GHz ≤ 1.0° 6 to 7.5 GHz ≤ 1.5°		DC to 7.5 GHz ≥ 44 dB
Set Components				
	male	BN 806405R000	BN 806404R000	BN 533732R000
	female	BN 806505R000	BN 806504R000	BN 533733R000

4.1-9.5, DC to 12.5 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.
BN 533832*	4.1-9.5	DC to 12.5 GHz, see calibration data		DC to 6 GHz ≥ 40 dB 6 to 12.5 GHz ≥ 32 dB
Set components				
	male	**BN 533747**	**BN 533745**	BN 987297
	female	**BN 533746**	**BN 533744**	BN 987397

Type N, DC to 18 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.
BN 533831*	Type N	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.25° 8 to 12 GHz ≤ 1.5° 12 to 18 GHz ≤ 2.0°		DC to 6 GHz ≥ 42 dB 6 to 8 GHz ≥ 38 dB 8 to 12 GHz ≥ 35 dB 12 to 18 GHz ≥ 33 dB
Set components				
	male	BN 533914R000	BN 533912R000	BN 533910R000
	female	BN 533915R000	BN 533913R000	BN 533911R000

* Calibration data in formats for the common VNAs are included in the kit.
It includes individual calibration coefficients for every kit to achieve the best possible performance.

OSLT High Precision Calibration Kits, 50 Ω

- High-end S-parameter measurements
- Open, short, load and through (OSLT): each one in male and female version including through adapters, one with male-to-male and one with female-to-female connections
- Optionally a male-to-female through is available
- For frequencies from DC to 7.5 GHz up to DC to 12.5 GHz

7-16, DC to 7.5 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 533840*	7-16	DC to 3 GHz ≤ 0.5° 3 to 6 GHz ≤ 1.0° 6 to 7.5 GHz ≤ 1.5°		DC to 7.5 GHz ≥ 44 dB	DC to 4 GHz ≥ 40 dB 4 to 7.5 GHz ≥ 36 dB
Set components					
	male	BN 806405R000	BN 806404R000	BN 533732R000	BN 393307R000
	female	BN 806505R000	BN 806504R000	BN 533733R000	BN 196404R000
Option	male-female				BN 756301R000

4.3-10, DC to 12 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 533312*	4.3-10	DC to 4 GHz ≤ 1.5° 4 to 6 GHz ≤ 2.5° 6 to 12 GHz ≤ 3.0°	DC to 4 GHz ≤ 1.0° 4 to 6 GHz ≤ 2.0° 6 to 12 GHz ≤ 2.5°	DC to 4 GHz ≥ 40 dB 4 to 6 GHz ≥ 35 dB 6 to 12 GHz ≥ 30 dB	DC to 4 GHz ≥ 35 dB 4 to 6 GHz ≥ 30 dB 6 to 12 GHz ≥ 25 dB
Set components					
	male screw	BN 533303R000	BN 533305R000	BN 533307R000	BN 533309R000
	female	BN 533304R000	BN 533306R000	BN 533308R000	BN 533310R000
Option	male screw-female				BN 533311R000

4.1-9.5, DC to 12.5 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 533827*	4.1-9.5	DC to 12.5 GHz see calibration data 3 to 6 GHz ≤ 1.0° 6 to 7.5 GHz ≤ 1.5°		DC to 6 GHz ≥ 40 dB 6 to 12.5 GHz ≥ 32 dB	DC to 4 GHz ≥ 35 dB 4 to 6 GHz ≥ 30 dB 6 to 12.5 GHz ≥ 25 dB
Set components					
	male	**BN 533747**	**BN 533745**	BN 987297	BN 983719
	female	**BN 533746**	**BN 533744**	BN 987397	BN 983720
Option	male-female				**BN 983721**

* Calibration data in formats for the common VNAs are included in the kit.
It includes individual calibration coefficients for every kit to achieve the best possible performance.

OSLT High Precision Calibration Kits, 50 Ω

- High-end S-parameter measurements
- Open, short, load and through (OSLT): each one in male and female version including through adapters, one with male-to-male and one with female-to-female connections
- Optionally a male-to-female through is available
- For frequencies from DC to 18 GHz up to DC to 20 GHz

Type N, DC to 18 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 533861*	Type N	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.25° 8 to 12 GHz ≤ 1.5° 12 to 18 GHz ≤ 2.0°		DC to 4 GHz ≥ 42 dB 4 to 8 GHz ≥ 38 dB 8 to 12 GHz ≥ 35 dB 12 to 18 GHz ≥ 33 dB	DC to 4 GHz ≥ 38 dB 4 to 8 GHz ≥ 34 dB 8 to 12 GHz ≥ 32 dB 12 to 18 GHz ≥ 28 dB
Set components					
	male	BN 533914R000	BN 533912R000	BN 533910R000	BN 533916R000
	female	BN 533915R000	BN 533913R000	BN 533911R000	BN 533917R000
Option	male-female				BN 533918R000

NEX10®, DC to 20 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 355112*	NEX10®	DC to 4 GHz ≤ 2.0° 4 to 8 GHz ≤ 2.5° 8 to 12 GHz ≤ 3.5° 12 to 20 GHz ≤ 4.5°		DC to 2 GHz ≥ 40 dB 2 to 6 GHz ≥ 34 dB 6 to 12 GHz ≥ 28 dB 12 to 20 GHz ≥ 25 dB	DC to 2 GHz ≥ 34 dB 2 to 6 GHz ≥ 28 dB 6 to 12 GHz ≥ 24 dB 12 to 20 GHz ≥ 20 dB
Set components					
	male screw	BN 355103R000	BN 355105R000	BN 355107R000	BN 355109R000
	female	BN 355104R000	BN 355106R000	BN 355108R000	BN 355110R000
Option	male screw-female				BN 355111R000

2.2-5, DC to 20 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 225312*	2.2-5	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.5° 8 to 12 GHz ≤ 2.0° 12 to 20 GHz ≤ 3.0°		DC to 4 GHz ≥ 40 dB 4 to 8 GHz ≥ 37 dB 8 to 12 GHz ≥ 32 dB 12 to 18 GHz ≥ 30 dB 18 to 20 GHz ≥ 27 dB	DC to 4 GHz ≥ 34 dB 4 to 8 GHz ≥ 31 dB 8 to 12 GHz ≥ 28 dB 12 to 20 GHz ≥ 25 dB
Set components					
	male screw	BN 225303R000	BN 225305R000	BN 225307R000	BN 225309R000
	female	BN 225304R000	BN 225306R000	BN 225308R000	BN 225310R000
Option	male screw-female				BN 225311R000

* Calibration data in formats for the common VNAs are included in the kit.
It includes individual calibration coefficients for every kit to achieve the best possible performance.

OSLT High Precision Calibration Kits, 50 Ω

- High-end S-parameter measurements
- Open, short, load and through (OSLT): each one in male and female version including through adapters, one with male-to-male and one with female-to-female connections
- Optionally a male-to-female through is available
- For frequencies from DC to 32 GHz up to DC to 50 GHz

3.5 mm, DC to 32 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 533854*	3.5 mm	DC to 4 GHz ≤ 0.65° 4 to 10 GHz ≤ 1.0° 10 to 26.5 GHz ≤ 2.5° 26.5 to 32 GHz ≤ 3.0°	DC to 4 GHz ≤ 0.5° 4 to 10 GHz ≤ 1.0° 10 to 26.5 GHz ≤ 2.0° 26.5 to 32 GHz ≤ 3.0°	DC to 4 GHz ≥ 35 dB 4 to 10 GHz ≥ 35 dB 10 to 26.5 GHz ≥ 35 dB 26.5 to 32 GHz ≥ 35 dB	DC to 4 GHz ≥ 34 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 32 GHz ≥ 32 dB
Set components					
	male	BN 533303R000	BN 533305R000	BN 533307R000	BN 533309R000
	female	BN 533304R000	BN 533306R000	BN 533308R000	BN 533310R000
Option	male-female				BN 533311R000

2.92 mm, DC to 44 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 534912*	2.92 mm	DC to 4 GHz ≤ 0.75° 4 to 10 GHz ≤ 1.5° 10 to 26.5 GHz ≤ 2.5° 26.5 to 44 GHz ≤ 3.5°	DC to 4 GHz ≤ 0.5° 4 to 10 GHz ≤ 1.0° 10 to 26.5 GHz ≤ 2.0° 26.5 to 44 GHz ≤ 3.0°	DC to 4 GHz ≥ 40 dB 4 to 10 GHz ≥ 34 dB 10 to 26.5 GHz ≥ 30 dB 26.5 to 32 GHz ≥ 28 dB 32 to 40 GHz ≥ 25 dB 40 to 44 GHz ≥ 23 dB	DC to 4 GHz ≥ 33 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 40 GHz ≥ 25 dB 40 to 44 GHz ≥ 23 dB
Set components					
	male	BN 534905R000	BN 534903R000	BN 534901R000	BN 534907R000
	female	BN 534906R000	BN 534904R000	BN 534902R000	BN 534908R000
Option	male-female				BN 534909R000

2.4 mm, DC to 50 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 533842*	2.4 mm	DC to 26.5 GHz ≤ 1.5° 26.5 to 50 GHz ≤ 2.5°		DC to 4 GHz ≥ 40 dB 4 to 10 GHz ≥ 34 dB 10 to 26.5 GHz ≥ 30 dB 26.5 to 50 GHz ≥ 24 dB	DC to 4 GHz ≥ 32 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 40 GHz ≥ 25 dB 40 to 50 GHz ≥ 23 dB
Set components					
	male	BN 533774R000	BN 533772R000	BN 533770R000	BN 533776R000
	female	BN 533775R000	BN 533773R000	BN 533771R000	BN 533777R000
Option	male-female				BN 533778R000

* Calibration data in formats for the common VNAs are included in the kit.
It includes individual calibration coefficients for every kit to achieve the best possible performance.

OSLT High Precision Calibration Kits, 50 Ω

- High-end S-parameter measurements
- Open, short, load and through (OSLT): each one in male and female version including through adapters, one with male-to-male and one with female-to-female connections
- Optionally a male-to-female through is available
- For frequencies from DC to 70 GHz up to DC to 90 GHz

1.85 mm, DC to 70 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 533420*	1.85 mm	DC to 26.5 GHz ≤ 2.0° 26.5 to 50 GHz ≤ 3.5° 50 to 70 GHz ≤ 4.5°	DC to 26.5 GHz ≤ 2.0° 26.5 to 50 GHz ≤ 3.0° 50 to 70 GHz ≤ 4.0°	DC to 4 GHz ≥ 36 dB 4 to 10 GHz ≥ 31 dB 10 to 26.5 GHz ≥ 25 dB 26.5 to 50 GHz ≥ 22 dB 50 to 67 GHz ≥ 20 dB 67 to 70 GHz ≥ 18 dB	DC to 4 GHz ≥ 32 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 40 GHz ≥ 25 dB 40 to 67 GHz ≥ 23 dB 67 to 70 GHz ≥ 21 dB
Set components					
	male	BN 533425R000	BN 533423R000	BN 533421R000	BN 533427R000
	female	BN 533426R000	BN 533424R000	BN 533422R000	BN 533428R000
Option	male-female				BN 533429R000

1.35 mm, DC to 90 GHz

Part Number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 534936*	1.35 mm	DC to 26.5 GHz ≤ 2.0° 26.5 to 50 GHz ≤ 3.5° 50 to 70 GHz ≤ 5.0° 70 to 90 GHz ≤ 7.0°	DC to 26.5 GHz ≤ 2.0° 26.5 to 50 GHz ≤ 3.0° 50 to 70 GHz ≤ 4.5° 70 to 90 GHz ≤ 6.0°	DC to 4 GHz ≥ 36 dB 4 to 10 GHz ≥ 31 dB 10 to 26.5 GHz ≥ 25 dB 26.5 to 70 GHz ≥ 22 dB 70 to 90 GHz ≥ 20 dB	DC to 4 GHz ≥ 32 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 40 GHz ≥ 25 dB 40 to 70 GHz ≥ 23 dB 70 to 90 GHz ≥ 21 dB
Set components					
	male	BN 534931R000	BN 534929R000	BN 534927R000	BN 534933R000
	female	BN 534932R000	BN 534930R000	BN 534928R000	BN 534934R000
Option	male-female				BN 534935R000

* Calibration data in formats for the common VNAs are included in the kit.
It includes individual calibration coefficients for every kit to achieve the best possible performance.

OSLT High Precision Calibration Kit, 75 Ω

75 Ω

- High-end S-parameter measurements
- Open, short, load and through (OSLT): each one in male and female version including through adapters, one with male-to-male and one with female-to-female connections
- Optionally a male-to-female through is available
- For frequencies from DC to 20 GHz
- N 75 is a 75 Ohm interface not intermateable with Type N (50 Ohm) versions

Part number	Interface	Open Phase deviation, max.	Short Phase deviation, max.	Load Return loss, min.	Through Return loss, min.
BN 534046*	Type N-75	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.5° 8 to 12 GHz ≤ 2.0° 12 to 20 GHz ≤ 3.0°		DC to 4 GHz ≥ 38 dB 4 to 8 GHz ≥ 34 dB 8 to 12 GHz ≥ 30 dB 12 to 20 GHz ≥ 25 dB	DC to 4 GHz ≥ 35 dB 4 to 8 GHz ≥ 31 dB 8 to 12 GHz ≥ 28 dB 12 to 20 GHz ≥ 23 dB
Set components					
	male	**BN 534061R000**	**BN 534063R000**	BN 534065R000	**BN 534067R000**
	female	**BN 534062R000**	**BN 534064R000**	BN 534066R000	**BN 534068R000**
Option	male-female				BN 534069R000

* Calibration data in formats for the common VNAs are included in the kit.
It includes individual calibration coefficients for every kit to achieve the best possible performance.

Precision Open Circuit Terminations, 50 Ω, Instrument Grade

- Contoured end cap fits to spanner SW 8 as well
- Calibration certificate included

Part Number	Interface	Frequency Range	Phase Deviation, max.
BN 806405R000 BN 806505R000	7-16 male 7-16 female	DC to 7.5 GHz	DC to 3 GHz ≤ 0.5° 3 to 6 GHz ≤ 1.0° 6 to 7.5 GHz ≤ 1.5°
BN 533303R000 BN 533304R000	4.3-10 male screw 4.3-10 female	DC to 12 GHz	DC to 3 GHz ≤ 0.5° DC to 4 GHz ≤ 1.5° 4 to 6 GHz ≤ 2.5° 6 to 12 GHz ≤ 3.0°
BN 533747 **BN 533746**	4.1-9.5 male 4.1-9.5 female	DC to 12.5 GHz	see calibration data
BN 533914R000 BN 533915R000	Type N male Type N female	DC to 18 GHz	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.25° 8 to 12 GHz ≤ 1.5° 12 to 18 GHz ≤ 2.0°
BN 355103R000 BN 355104R000	NEX10® male screw NEX10® female	DC to 20 GHz	DC to 4 GHz ≤ 2.0° 4 to 8 GHz ≤ 2.5° 8 to 12 GHz ≤ 3.5° 12 to 20 GHz ≤ 4.5°
BN 225303R000 BN 225304R000	2.2-5 male screw 2.2-5 female	DC to 20 GHz	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.5° 8 to 12 GHz ≤ 2.0° 12 to 20 GHz ≤ 3.0°
BN 533764R000 BN 533763R000	3.5 mm male 3.5 mm female	DC to 32 GHz	DC to 4 GHz ≤ 0.65° 4 to 10 GHz ≤ 1.0° 10 to 26.5 GHz ≤ 2.5° 26.5 to 32 GHz ≤ 3.0°
BN 534905R000 BN 534906R000	2.92 mm male 2.92 mm female	DC to 44 GHz	DC to 4 GHz ≤ 0.75° 4 to 10 GHz ≤ 1.5° 10 to 26.5 GHz ≤ 2.5° 26.5 to 44 GHz ≤ 3.5°
BN 533774R000 BN 533775R000	2.4 mm male 2.4 mm female	DC to 50 GHz	DC to 26.5 GHz ≤ 1.5° 26.5 to 50 GHz ≤ 2.5°
BN 533425R000 BN 533426R000	1.85 mm male 1.85 mm female	DC to 70 GHz	DC to 26.5 GHz ≤ 2.0° 26.5 to 50 GHz ≤ 3.5° 50 to 70 GHz ≤ 4.5°
BN 534931R000 BN 534932R000	1.35 mm male 1.35 mm female	DC to 90 GHz	DC to 26.5 GHz ≤ 2.0° 26.5 to 50 GHz ≤ 3.5° 50 to 70 GHz ≤ 5.0° 70 to 90 GHz ≤ 7.0°

Precision Short Circuit Terminations, 50 Ω, Instrument Grade

- Contoured end cap fits to spanner SW 8 as well
- Calibration certificate included

Part Number	Interface	Frequency Range	Phase Deviation, max.
BN 806404R000 BN 806504R000	7-16 male 7-16 female	DC to 7.5 GH	DC to 3 GHz ≤ 0.5° 3 to 6 GHz ≤ 1.0° 6 to 7.5 GHz ≤ 1.5°
BN 533305R000 BN 533306R000	4.3-10 male screw 4.3-10 female	DC to 12 GHz	DC to 4 GHz ≤ 1.0° 4 to 6 GHz ≤ 2.0° 6 to 12 GHz ≤ 2.5°
BN 533745 **BN 533744**	4.1-9.5 male 4.1-9.5 female	DC to 12.5 GHz	see calibration data
BN 533912R000 BN 533913R000	Type N male Type N female	DC to 18 GHz	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.25° 8 to 12 GHz ≤ 1.5° 12 to 18 GHz ≤ 2.0°
BN 355105R000 BN 355106R000	NEX10® male screw NEX10® female	DC to 20 GHz	DC to 4 GHz ≤ 2.0° 4 to 8 GHz ≤ 2.5° 8 to 12 GHz ≤ 3.5° 12 to 20 GHz ≤ 4.5°
BN 225305R000 BN 225306R000	2.2-5 male screw 2.2-5 female	DC to 20 GHz	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.25° 8 to 12 GHz ≤ 2.0° 12 to 20 GHz ≤ 3.0°
BN 533762R000 BN 533761R000	3.5 mm male 3.5 mm female	DC to 32 GHz	DC to 4 GHz ≤ 0.5° 4 to 10 GHz ≤ 1.0° 10 to 26.5 GHz ≤ 2.0° 26.5 to 32 GHz ≤ 3.0°
BN 534903R000 BN 534904R000	2.92 mm male 2.92 mm female	DC to 44 GHz	DC to 4 GHz ≤ 0.5° 4 to 10 GHz ≤ 1.0° 10 to 26.5 GHz ≤ 2.0° 26.5 to 44 GHz ≤ 3.0°
BN 533772R000 BN 533773R000	2.4 mm male 2.4 mm female	DC to 50 GHz	DC to 26.5 GHz ≤ 1.5° 26.5 to 50 GHz ≤ 2.5°
BN 533423R000 BN 533424R000	1.85 mm male 1.85 mm female	DC to 70 GHz	DC to 26.5 GHz ≤ 2.0° 26.5 to 50 GHz ≤ 3.0° 50 to 70 GHz ≤ 4.0°
BN 534929R000 BN 534930R000	1.35 mm male 1.35 mm female	DC to 90 GHz	DC to 26.5 GHz ≤ 2.0° 26.5 to 50 GHz ≤ 3.5° 50 to 70 GHz ≤ 4.5° 70 to 90 GHz ≤ 6.0°

Precision Offset Short Circuit Terminations, 50 Ω

- Contoured end cap fits to spanner SW 8 as well
- Calibration certificate included

Part Number	Interface Type	Frequency Range	Phase Deviation, max.
BN 534925R000	1.35 mm male	DC to 90 GHz	DC to 40 GHz ≤ 2.5° 40 to 90 GHz ≤ 3.5°
BN 534926R000	1.35 mm female		

Precision Fixed Loads, 50 Ω, Instrument Grade

- Contoured end cap fits to spanner SW 8 as well
- Calibration certificate included

Part Number	Interface	Frequency Range	Return Loss, min.
BN 533732R000 BN 533733R000	7-16 male 7 - 16 female	DC to 7.5 GHz	DC to 7.5 GHz ≥ 44 dB
BN 533307R000 BN 533308R000	4.3-10 male screw 4.3-10 female	DC to 12 GHz	DC to 4 GHz ≥ 40 dB 4 to 6 GHz ≥ 35 dB 6 to 12 GHz ≥ 30 dB
BN 987297 BN 987397	4.1-9.5 male 4.1-9.5 female	DC to 12.5 GHz	DC to 6 GHz ≥ 40 dB 6 to 12.5 GHz ≥ 32 dB
BN 533910R000 BN 533911R000	Type N male Type N female	DC to 18 GHz	DC to 4 GHz ≥ 42 dB 4 to 8 GHz ≥ 38 dB 8 to 12 GHz ≥ 35 dB 12 to 18 GHz ≥ 33 dB
BN 355107R000 BN 355108R000	NEX10® male screw NEX10® female	DC to 20 GHz	DC to 2 GHz ≥ 40 dB 2 to 6 GHz ≥ 34 dB 6 to 12 GHz ≥ 28 dB 12 to 20 GHz ≥ 25 dB
BN 225307R000 BN 225308R000	2.2-5 male screw 2.2-5 female	DC to 20 GHz	DC to 4 GHz ≥ 40 dB 4 to 8 GHz ≥ 37 dB 8 to 12 GHz ≥ 32 dB 12 to 18 GHz ≥ 30 dB 18 to 20 GHz ≥ 27 dB
BN 533766R000 BN 533765R000	3.5 mm male 3.5 mm female	DC to 32 GHz	DC to 4 GHz ≥ 40 dB 4 to 10 GHz ≥ 34 dB 10 to 26.5 GHz ≥ 30 dB 26.5 to 32 GHz ≥ 28 dB
BN 534903R000 BN 534904R000	2.92 mm male 2.92 mm female	DC to 44 GHz	DC to 4 GHz ≥ 40 dB 4 to 10 GHz ≥ 34 dB 10 to 26.5 GHz ≥ 30 dB 26.5 to 32 GHz ≥ 28 dB 32 to 40 GHz ≥ 25 dB 40 to 44 GHz ≥ 23 dB
BN 533770R000 BN 533771R000	2.4 mm male 2.4 mm female	DC to 50 GHz	DC to 4 GHz ≥ 40 dB 4 to 10 GHz ≥ 34 dB 10 to 26.5 GHz ≥ 30 dB 26.5 to 50 GHz ≥ 24 dB
BN 533421R000 BN 533422R000	1.85 mm male 1.85 mm female	DC to 70 GHz	DC to 4 GHz ≥ 36 dB 4 to 10 GHz ≥ 31 dB 10 to 26.5 GHz ≥ 25 dB 26.5 to 50 GHz ≥ 22 dB 50 to 67 GHz ≥ 20 dB 67 to 70 GHz ≥ 18 dB
BN 534927R000 BN 534928R000	1.35 mm male 1.35 mm female	DC to 90 GHz	DC to 4 GHz ≥ 36 dB 4 to 10 GHz ≥ 31 dB 10 to 26.5 GHz ≥ 25 dB 26.5 to 70 GHz ≥ 22 dB 70 to 90 GHz ≥ 20 dB

Precision Through Adapters, 50 Ω, Instrument Grade

- Contoured end cap fits to spanner SW 8 as well
- Calibration certificate included

Part number	Interface	Frequency Range	Return loss, min.
BN 393307R000 BN 196404R000 BN 756301R000	7-16 male 7-16 female 7-16 male-female	DC to 7.5 GHz	DC to 4 GHz ≥ 40 dB 4 to 7.5 GHz ≥ 36 dB
BN 533309R000 BN 533310R000 BN 533311R000	4.3-10 male screw 4.3-10 female 4.3-10 male screw-female	DC to 12 GHz	DC to 4 GHz ≥ 35 dB 4 to 6 GHz ≥ 30 dB 6 to 12 GHz ≥ 25 dB
BN 983719 BN 983720 BN 983721	4.1-9.5 male 4.1-9.5 female 4.1-9.5 male-female	DC to 12.5 GHz	DC to 4 GHz ≥ 35 dB 4 to 6 GHz ≥ 30 dB 6 to 12.5 GHz ≥ 25 dB
BN 533916R000 BN 533917R000 BN 533918R000	Type N male Type N female Type N male-female	DC to 18 GHz	DC to 4 GHz ≥ 38 dB 4 to 8 GHz ≥ 34 dB 8 to 12 GHz ≥ 32 dB 12 to 18 GHz ≥ 28 dB
BN 355109R000 BN 355110R000 BN 355111R000	NEX10® male screw NEX10® female NEX10® male screw-female	DC to 20 GHz	DC to 2 GHz ≥ 34 dB 2 to 6 GHz ≥ 28 dB 6 to 12 GHz ≥ 24 dB 12 to 20 GHz ≥ 20 dB
BN 225309R000 BN 225310R000 BN 225311R000	2.2-5 male screw 2.2-5 female 2.2-5 male screw-female	DC to 20 GHz	DC to 4 GHz ≥ 34 dB 4 to 8 GHz ≥ 31 dB 8 to 12 GHz ≥ 28 dB 12 to 20 GHz ≥ 25 dB
BN 533767R000 BN 533768R000 BN 533769R000	3.5 mm male 3.5 mm female 3.5 mm male-female	DC to 32 GHz	DC to 4 GHz ≥ 34 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 32 GHz ≥ 32 dB
BN 534907R000 BN 534908R000 BN 534909R000	2.92 mm male 2.92 mm female 2.92 mm male-female	DC to 44 GHz	DC to 4 GHz ≥ 33 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 40 GHz ≥ 25 dB 40 to 44 GHz ≥ 23 dB
BN 533776R000 BN 533777R000 BN 533778R000	2.4 mm male 2.4 mm female 2.4 mm male-female	DC to 50 GHz	DC to 4 GHz ≥ 32 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 40 GHz ≥ 25 dB 40 to 50 GHz ≥ 23 dB
BN 533427R000 BN 533428R000 BN 533429R000	1.85 mm male 1.85 mm female 1.85 mm male-female	DC to 70 GHz	DC to 4 GHz ≥ 32 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 40 GHz ≥ 25 dB 40 to 67 GHz ≥ 23 dB 67 to 70 GHz ≥ 21 dB
BN 534933R000 BN 534934R000 BN 534935R000	1.35 mm male 1.35 mm female 1.35 mm male-female	DC to 90 GHz	DC to 4 GHz ≥ 32 dB 4 to 26.5 GHz ≥ 30 dB 26.5 to 40 GHz ≥ 25 dB 40 to 70 GHz ≥ 23 dB 70 to 90 GHz ≥ 21 dB

Precision Open Circuit Terminations, 75 Ω, Instrument Grade

75 Ω

Part Number	Interface	Frequency Range	Phase Deviation, max.
BN 534061R000 **BN 534062R000**	Type N 75 Ohm male Type N 75 Ohm female	DC to 20 GHz	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.5° 8 to 12 GHz ≤ 2.0° 12 to 20 GHz ≤ 3.0°

Precision Short Circuit Termination, 75 Ω, Production Grade

75 Ω

Part number	Interface	Frequency Range	Phase Deviation, max.
BN 876785	Type N 75 Ohm male	DC to 3 GHz	DC to 3 GHz ≤ 1.5°

Precision Short Circuit Terminations, 75 Ω, Instrument Grade

75 Ω

Part Number	Interface	Frequency Range	Phase Deviation, max.
BN 534063R000 **BN 534064R000**	Type N male Type N female	DC to 20 GHz	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.5° 8 to 12 GHz ≤ 2.0° 12 to 20 GHz ≤ 3.0°

Precision Fixed Load, 75 Ω, Production Grade

75 Ω

Part Number	Interface	Frequency Range	Return Loss, min.
BN 876784	Type N male	DC to 3 GHz	DC to 3 GHz ≤ 1.5°

Precision Fixed Loads, 75 Ω, Instrument Grade

75 Ω

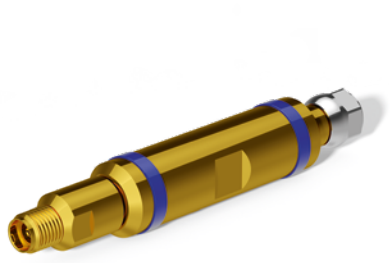
Part Number	Interface	Frequency Range	Return Loss, min.
BN 534065R000	Type N 75 Ohm male	DC to 20 GHz	DC to 4 GHz ≤ 35 dB 4 to 8 GHz ≤ 31 dB 8 to 12 GHz ≤ 28 dB 12 to 20 GHz ≤ 23 dB
BN 534066R000	Type N 75 Ohm female		

Precision Through Adapters, 75 Ω, Instrument Grade

75 Ω

Part Number	Interface	Frequency Range	Phase Deviation, max.
BN 534067R000	Type N 75 Ohm male	DC to 20 GHz	DC to 4 GHz ≤ 1.0° 4 to 8 GHz ≤ 1.5° 8 to 12 GHz ≤ 2.0° 12 to 20 GHz ≤ 3.0°
BN 534068R000	Type N 75 Ohm female		
BN 534069R000	Type N 75 Ohm male-female		

Precision Air Lines – Bead-Supported



Part Number	Interface	Frequency Range
BN 533692	7-16 male-female	DC to 7.5 GHz
BN 533693	7-16 female-female	
BN 533690	Type N male-female	DC to 18 GHz
BN 533691	Type N female-female	
BN 533694	3.5 mm male-female	DC to 34 GHz
BN 533695	3.5 mm female-female	

Precision Air Lines – Partially Bead-Supported

- Full bandwidth
- Traceable to national standards (PTB)
- Interface according to Grade "0" (respectively to LPC specifications)
- Due to very small impedance tolerances usable as traceable impedance reference airline for TDR-measurements
- Inner and outer conductor made of materials with the same coefficient of thermal expansion
- Outer conductor profile prevents airline from rolling across the desk

Part Number	Interface Type A	Interface Type B	Lenght	Frequency Range	Phase Deviation, max.
BN 533696C1630	1.35 mm male	1.35 mm female	17.8 mm	DC to 90 GHz	46 dB - (0.13 dB x f [GHz])
BN 533696C1780	1.35 mm male	1.35 mm female	17.8 mm		
BN 533697C1630	1.35 mm female	1.35 mm female	16.3 mm		
BN 533697C1780	1.35 mm female	1.35 mm female	17.8 mm		

Verification Kit

- Applicable to all VNAs
- 25 Ω mismatch center conductor incl. guiding device

Part Number	Interface	Air line 50 Ω, beadless	Mismatch Air Line 25 Ω Center Conductor	Attenuator 20 dB Return loss, min.	Attenuator 40 dB Return loss, min.
BN 533480	Type N male-female	Outer conductor Ø 7 mm ± 0.005 mm L 125 mm nom. Center conductor Ø 3.04 mm ± 0.004 mm L 125 mm nom.	Ø 50 Ω section 3.04 mm ± 0.007 mm Ø 25 Ω section 4.613 mm ± 0.005 mm L (total) 125 mm nom. L 25 Ω section 75 mm nom.	DC to 4 GHz ≥ 34 dB 4 to 18 GHz ≥ 28 dB	DC to 4 GHz ≥ 34 dB 4 to 18 GHz ≥ 26 dB

Other interfaces on request.

LRL Calibration Kit

- High-end S-parameter measurements
- Very accurate for phase measurements
- Very good effective directivity and testport-match => uncertainty is smaller compared to OSLT- (TOSM-) calibration
- Center- and outer conductor are matched in their lengths to avoid gaps during calibration

Part number	Interface	Frequency Range	Insertion Loss
BN 533319	4.3-10 male-female	DC to 12 GHz	44 dB
Set components			
Beadless reference air lines	B21446	male-male	50 mm
	B27870	female-female	50 mm
	B21445	male-male	60 mm
	B27869	female-female	60 mm
	B21383	male-male	126.6 mm
	B27868	female-female	126.6 mm
Shorts	533305R000	male	31.1 mm
	533306R000	female	31.1 mm
Inter-type adapters	194440	4.3-10 female - Type N male	Return loss, min. 44 dB - (1 dB x f [GHz])
	194442	4.3-10 male - Type N male	

Other interfaces on request.

Measurement Accessory Kit for 75 Ω Direct Access Units

75 Ω

Part Number	BN 876794		
Scope of Supply			
		Connectors	**Impedance**
4-in-1 OSLT-kit	BN 533857R000	N female	75 Ω
Short	BN 876785	N male	75 Ω
Load	BN 876784	N male	75 Ω
Cable, 30 cm	**BN A77368**	N male / N male	75 Ω
Adapter	BN 876780	N male / N female	75 Ω / 50 Ω

Adapters

Whenever the connector system of the VNA and the object to be measured do not match, special transitions, so called adapters, are required.

Adapters are used to connect line elements of different connection sizes (so-called inter-type or between-line adapters) or within one size but of different connection genders (so-called within-type or in-line adapters). The term transition connector is also used as another common term for adapters.

For example, the object to be measured has connections of type 4.3-10 plug and all measuring ports have the connector system 3.5 mm plug.

As a result, the available maximum frequency of the test ports is usually limited by the use of a different connector system. For example, when using a 4.3-10 connector system on a VNA with a 3.5 mm connector system, the frequency is limited to 12 GHz instead of 26.5 GHz.

Some connector systems do not require an adapter, as they are at least mechanically compatible with each other: 3.5 mm with SMA, 2.92 mm and vice versa, 2.4 mm with 1.85 mm and vice versa.

Push Pull Adapters

SPINNER push-pull adapters provide excellent mechanicalstability 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 ensure the adapter's ability to produce precise connections and maximize its lifetime.

Precision Inter-Type Adapters, 50 Ω

- For frequencies from DC to 90 GHz

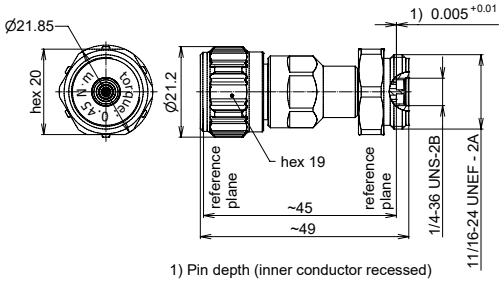
Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 194403	7-16 male	Type N female	DC to 7.5 GHz	40 dB @ DC to 3 GHz 36 dB @ 3 to 7.5 GHz
BN 293803	7-16 male	Type N male		
BN 293903	7-16 female	Type N male		
BN 294003	7-16 female	Type N female		
BN 194440	4.3-10 female	Type N male	DC to 12 GHz	40 dB @ DC to 2 GHz 36 dB @ 2 to 6 GHz 30 dB @ 6 to 12 GHz
BN 194441	4.3-10 female	Type N female		
BN 194442	4.3-10 male screw	Type N male		
BN 194443	4.3-10 male screw	Type N female		
BN 432042	4.3-10 female	3.5 mm male	DC to 12 GHz	35 dB @ DC to 4 GHz 30 dB @ 4 to 6 GHz 25 dB @ 6 to 12 GHz
BN 432043	4.3-10 female	3.5 mm female		
BN 533724	4.1-9.5 male	Type N female	DC to 12.5 GHz	40 dB @ DC to 4 GHz 30 dB @ 4 to 12.5 GHz
BN 533725	4.1-9.5 female	Type N female		
BN 640625	Type N female	3.5 mm male	DC to 18 GHz	42 dB @ DC to 2 GHz 38 dB @ 2 to 6 GHz 32 dB @ 6 to 12 GHz 30 dB @ 12 to 18 GHz
BN 640627	Type N male	3.5 mm female		
BN 640628	Type N male	3.5 mm male		
BN 640643	Type N female	3.5 mm female		
BN 355144	NEX10 ® male screw	3.5 mm male	DC to 20 GHz	40 dB @ DC to 2 GHz 34 dB @ 2 to 6 GHz 28 dB @ 6 to 12 GHz 25 dB @ 12 to 20 GHz
BN 355145	NEX10 ® male screw	3.5 mm female		
BN 355146	NEX10 ® female	3.5 mm male		
BN 355147	NEX10 ® female	3.5 mm female		
BN 225344	2.2-5 male screw	3.5 mm male	DC to 20 GHz	40 dB @ DC to 4 GHz 35 dB @ 4 to 6 GHz 30 dB @ 6 to 12 GHz 25 dB @ 12 to 20 GHz
BN 225345	2.2-5 male screw	3.5 mm female		
BN 225346	2.2-5 female	3.5 mm male		
BN 225347	2.2-5 female	3.5 mm female		
BN 534921R000	1.85 mm male	1.35 mm male	DC to 70 GHz	28 dB @ DC to 20 GHz 20 dB @ 20 to 50 GHz 17 dB @ 50 to 70 GHz
BN 534922R000	1.85 mm male	1.35 mm female		
BN 534923R000	1.85 mm female	1.35 mm male		
BN 534924R000	1.85 mm female	1.35 mm female		
BN 534917R000	1.35 mm male	1.0 mm male	DC to 90 GHz	28 dB @ DC to 20 GHz 20 dB @ 20 to 50 GHz 17 dB @ 50 to 90 GHz
BN 534918R000	1.35 mm male	1.0 mm female		
BN 534919R000	1.35 mm female	1.0 mm male		
BN 534920R000	1.35 mm female	1.0 mm female		

Precision Inter-Type Adapters 50 Ω to 75 Ω (Mechanically Only)

- For frequencies from DC to 20 GHz
- N 75 is a 75 Ohm interface not intermateable with Type N (50 ohms) versions
- Unmatched version

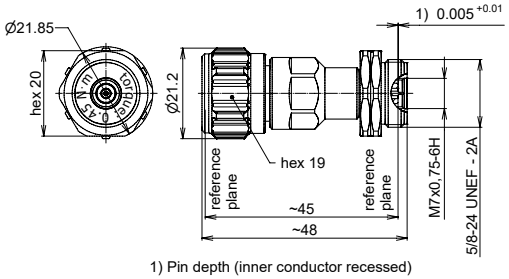
Part Number	Interface Type A	Interface Type B	Frequency Range
BN 876786	Type N 75 Ohm male	3.5 mm female	DC to 20 GHz
BN 876789	Type N 75 Ohm female	3.5 mm female	
BN 876780	Type N 75 Ohm male	Type N female 50 Ω	DC to 18 GHz
BN 876781	Type N 75 Ohm female	Type N male 50 Ω	
BN 876782	Type N 75 Ohm male	Type N male 50 Ω	
BN 876783	Type N 75 Ohm female	Type N female 50 Ω	

Precision Inter-Type Test Port Adapters – One-Sided Ruggedized



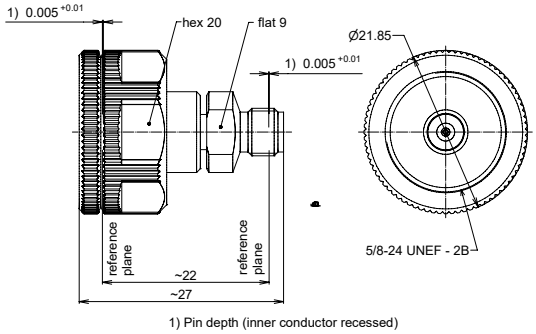
1) Pin depth (inner conductor recessed)

Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535116	N male	RUG-3.5 mm male	DC to 18 GHz	38 dB @ DC to 2 GHz 34 dB @ 2 to 6 GHz 28 dB @ 6 to 12 GHz 23 dB @ 12 to 18 GHz



1) Pin depth (inner conductor recessed)

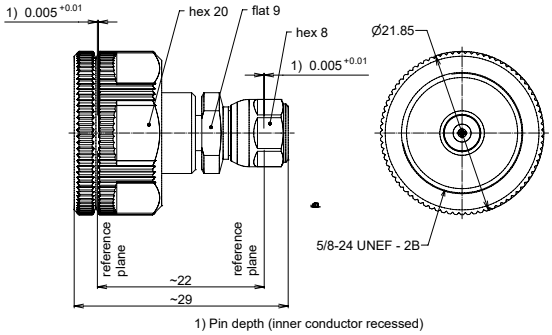
Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535115	N male	RUG-2.4 mm male	DC to 18 GHz	38 dB @ DC to 2 GHz 34 dB @ 2 to 6 GHz 28 dB @ 6 to 12 GHz 23 dB @ 12 to 18 GHz



1) Pin depth (inner conductor recessed)

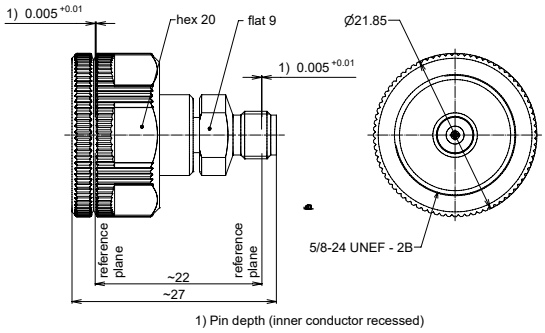
Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535103	2.92 mm female	RUG-2.4 mm female	DC to 44 GHz	32 dB @ DC to 4 GHz 28 dB @ 4 to 18 GHz 23 dB @ 18 to 32 GHz 20 dB @ 32 to 44 GHz

Precision Inter-Type Test Port Adapters – One-Sided Ruggedized



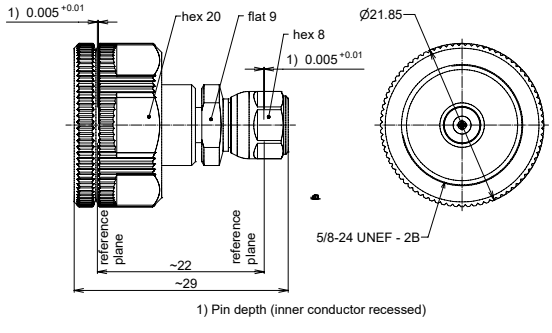
1) Pin depth (inner conductor recessed)

Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535105	2.92 mm male	RUG-2.4 mm female	DC to 44 GHz	32 dB @ DC to 4 GHz 28 dB @ 4 to 18 GHz 23 dB @ 18 to 32 GHz 20 dB @ 32 to 44 GHz



1) Pin depth (inner conductor recessed)

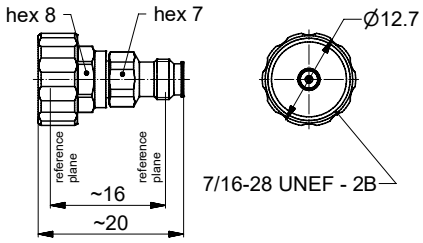
Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535104	3.5 mm female	RUG-2.4 mm female	DC to 33 GHz	33 dB @ DC to 4 GHz 30 dB @ 4 to 18 GHz 26 dB @ 18 to 26.5 GHz 23 dB @ 26.5 to 33 GHz



1) Pin depth (inner conductor recessed)

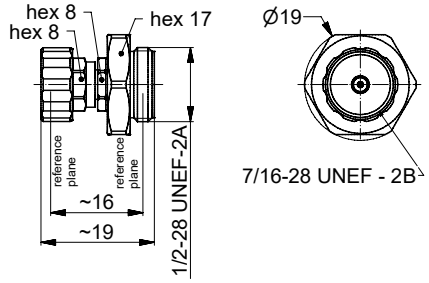
Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535106	3.5 mm male	RUG-2.4 mm female	DC to 33 GHz	33 dB @ DC to 4 GHz 30 dB @ 4 to 18 GHz 26 dB @ 18 to 26.5 GHz 23 dB @ 26.5 to 33 GHz

Precision Inter-Type Test Port Adapter – One-Sided Ruggedized



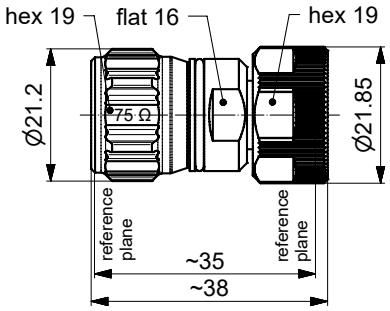
Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 534975	1.35 mm female	RUG-1.0 mm female	DC to 90 GHz	28 dB @ DC to 20 GHz 20 dB @ 20 to 50 GHz 17 dB @ 50 to 70 GHz 14 dB @ 70 to 90 GHz

Precision Inter-Type Test Port Adapter – Double-Sided Ruggedized

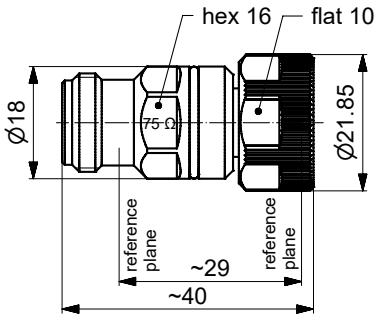


Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 534974	RUG-1.0 mm female	RUG-1.35 mm male	DC to 90 GHz	28 dB @ DC to 20 GHz 20 dB @ 20 to 50 GHz 17 dB @ 50 to 70 GHz 14 dB @ 70 to 90 GHz

Precision Inter-Type Test Port Adapter, 75 Ω to 50 Ω – One-Sided Ruggedized



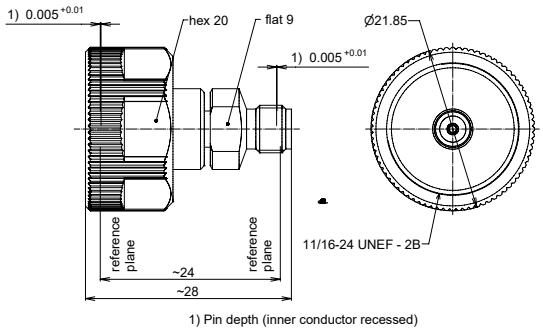
Part Number	Interface Type A	Interface Type B	Frequency Range
BN 876790*	Type N 75 Ohm male	RUG-3.5 mm female (50 Ohm)	DC to 20 GHz



Part Number	Interface Type A	Interface Type B	Frequency Range
BN 876793*	Type N 75 Ohm female	RUG-3.5 mm female (50 Ohm)	DC to 20 GHz

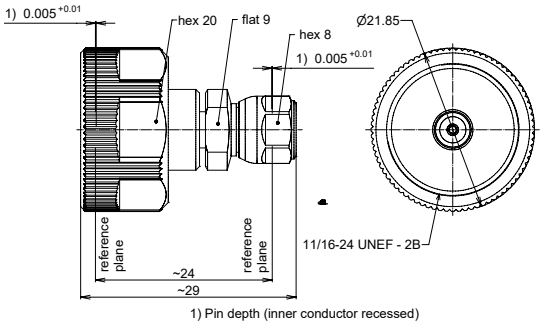
* Impedance 50 ohm / 75 ohm unmatched.
N 75 ohm is a 75 ohm interface not intermateable with type N 50 ohm versions.

Precision Within-Type Test Port Adapters – One-Sided Ruggedized



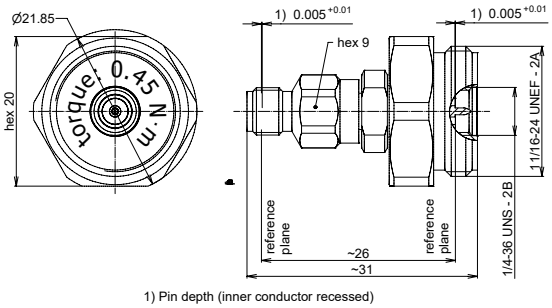
1) Pin depth (inner conductor recessed)

Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535119*	RUG-3.5 mm female	3.5 mm female	DC to 33 GHz	34 dB @ DC to 4 GHz 30 dB @ 4 to 26.5 GHz 26 dB @ 26.5 to 33 GHz



1) Pin depth (inner conductor recessed)

Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535120*	RUG-3.5 mm female	3.5 mm male	DC to 33 GHz	34 dB @ DC to 4 GHz 30 dB @ 4 to 26.5 GHz 26 dB @ 26.5 to 33 GHz

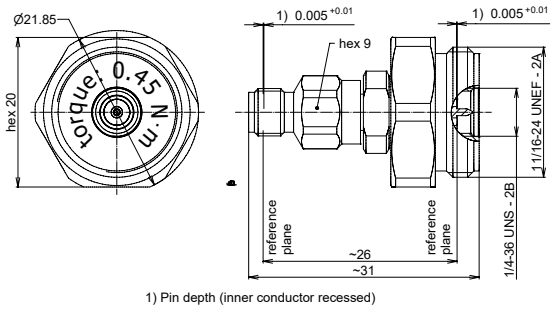


1) Pin depth (inner conductor recessed)

Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535124*	RUG-3.5 mm male	3.5 mm male	DC to 33 GHz	34 dB @ DC to 4 GHz 30 dB @ 4 to 26.5 GHz 26 dB @ 26.5 to 33 GHz

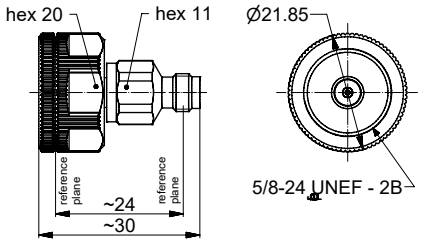
*Amongst others especially suitable to ANRITSU VNA broadband millimeter-wave module with “Adapter Mounting Bracket” to stabilize the sophisticated coaxial 1.00 mm test port.

Precision Within-Type Test Port Adapters – One-Sided Ruggedized

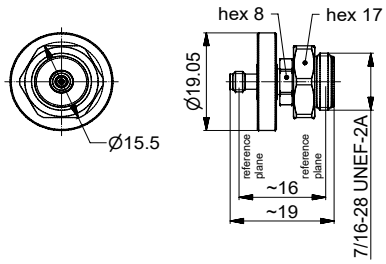


1) Pin depth (inner conductor recessed)

Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 535123*	RUG-3.5 mm male	3.5 mm female	DC to 33 GHz	34 dB @ DC to 4 GHz 30 dB @ 4 to 26.5 GHz 26 dB @ 26.5 to 33 GHz



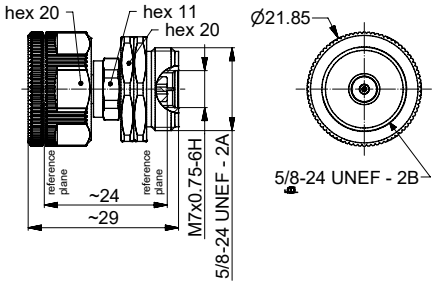
Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 534992*	RUG-1.85 mm female	1.85 mm female	DC to 70 GHz	32 dB @ DC to 4 GHz 30 dB @ 4 to 26.5 GHz 25 dB @ 26.5 to 40 GHz 23 dB @ 40 to 67 GHz 21 dB @ 67 to 70 GHz



Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 534976*	RUG-1.0 mm male	1.0 mm female	DC to 110 GHz	28 dB @ DC to 20 GHz 20 dB @ 20 to 50 GHz 17 dB @ 50 to 70 GHz 14 dB @ 70 to 110 GHz

*Amongst others especially suitable to ANRITSU VNA broadband millimeter-wave module with “Adapter Mounting Bracket” to stabilize the sophisticated coaxial 1.00 mm test port.

Precision Within-Type Test Port Adapter – Double-Sided Ruggedized



Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 534991	RUG-1.85 mm male	RUG-1.85 mm female	DC to 70 GHz	32 dB @ DC to 4 GHz 30 dB @ 4 to 26.5 GHz 25 dB @ 26.5 to 40 GHz 23 dB @ 40 to 67 GHz 21 dB @ 67 to 70 GHz

Inter-Type Adapters 7-16 to 4.3-10

- For sensitive testing and measurement applications
- Lowest intermodulation
- Abrasion-proof
- Tarnishing and corrosion proof
- Nickel-free
- RoHS-compliant

Part Number		BN 432008	BN 432005	BN 432001	BN 432016	BN 432002	BN 432011
Coaxial interface connector	Side A	7-16 male			7-16 female		
	Side B	4.3-10 male push-pull	4.3-10 male screw	4.3-10 female	4.3-10 male push-pull	4.3-10 male screw	4.3-10 female
Frequency range		DC to 6 GHz					
VSWR, max.		Max. 1.02 @ DC to 2 GHz Max. 1.04 @ 2 to 3 GHz Max. 1.06 @ 3 to 6 GHz					
Passive intermodulation (IM3) @ 2 x 20 W		Max. ≤-165 dBc					
Weight		≈ 95 g					

Inter-Type Adapters 7-16 to 2.2-5

- For sensitive testing and measurement applications
- Lowest intermodulation
- Abrasion-proof
- Tarnishing and corrosion proof
- Nickel-free
- RoHS-compliant

Part Number		BN 225002	BN 225003	BN 225006	BN 225008
Coaxial interface connector	Side A	7-16 male		7-16 female	
	Side B	2.2-5 male screw	2.2-5 female	2.2-5 male screw	2.2-5 female
Frequency range		DC to 6 GHz			
VSWR, max.		Max. 1.04 @ DC to 2 GHz Max. 1.06 @ 2 to 4 GHz Max. 1.10 @ 4 to 6 GHz			
Passive intermodulation (IM3) @ 2 x 20 W		Max. ≤-165 dBc			
Weight		≈ 70 g			

Inter-Type Adapters 7-16 to NEX10®

- For sensitive testing and measurement applications
- Lowest intermodulation
- Abrasion-proof
- Tarnishing and corrosion proof
- Nickel-free
- RoHS-compliant

Part Number		BN 227000	BN 227001	BN 227002	BN 227003
Coaxial interface connector	Side A	7-16 male		7-16 female	
	Side B	NEX10® male screw	NEX10® female	NEX10® male screw	NEX10® female
Frequency range		DC to 6 GHz			
VSWR, max.		Max. 1.12 @ 4 to 2 GHz			
Passive intermodulation (IM3) @ 2 x 20 W		Max. ≤-165 dBc			
Weight		≈ 70 g			

Inter-Type Adapters 4.3-10 to 2.2-5

- For sensitive testing and measurement applications
- Lowest intermodulation
- Abrasion-proof
- Tarnishing and corrosion proof
- Nickel-free
- RoHS-compliant

Part Number		BN 225009	BN 225010	BN 225012	BN 225013
Coaxial interface connector	Side A	4.3-10 male screw		4.3-10 female	
	Side B	2.2-5 male screw	2.2-5 female	2.2-5 male screw	2.2-5 female
Frequency range		DC to 6 GHz			
VSWR, max.		Max. 1.04 @ DC to 2 GHz Max. 1.06 @ 2 to 4 GHz Max. 1.10 @ 4 to 6 GHz			
Passive intermodulation (IM3) @ 2 x 20 W		Max. ≤-165 dBc			
Weight		≈ 40 g			

Inter-Type Adapters 4.3-10 to NEX10®

- For sensitive testing and measurement applications
- Lowest intermodulation
- Abrasion-proof
- Tarnishing and corrosion proof
- Nickel-free
- RoHS-compliant

Part Number		BN 432068	BN 432069	BN 432070	BN 432071
Coaxial interface connector	Side A	4.3-10 male screw		4.3-10 female	
	Side B	NEX10® male screw	NEX10® female	NEX10® male screw	NEX10® female
Frequency range		DC to 6 GHz			
VSWR, max.		Max. 1.04 @ DC to 2 GHz Max. 1.08 @ 2 to 4 GHz Max. 1.12 @ 4 to 6 GHz			
Passive intermodulation (IM3) @ 2 x 20 W		Max. ≤-165 dBc			
Weight		≈ 40 g			

Within-Type Adapters

- For sensitive testing and measurement applications
- Lowest intermodulation
- Abrasion-proof
- Tarnishing and corrosion proof
- Nickel-free
- RoHS-compliant

Part Number		BN 432029	BN 432049	BN 432019	BN 393370	BN 196400
Coaxial interface connector	Side A	4.3-10 male screw	4.3-10 female	4.3-10 female bulkhead	7-16 male	7-16 female
	Side B	4.3-10 male screw	4.3-10 female	4.3-10 female	7-16 male	7-16 female
Frequency range		DC to 6 GHz			DC to 8 GHz	DC to 7.5 GHz
VSWR		Max.1.02 @ DC to 2 GHz Max.1.04 @ 2 to 3 GHz Max.1.06 @ 3 to 6 GHz			Max.1.01 @ DC to 1 GHz Max.1.04 @ 1 to 3 GHz Max.1.06 @ 3 to 8 GHz	
Passive intermodulation (IM3) @ 2 x 20 W		Max. ≤-165 dBc				
Weight		55 g	60 g	70 g	95 g	95 g

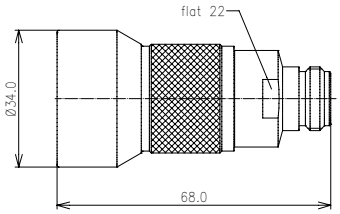
Push-Pull Adapters

- Quick connector
  for port or connector saving tasks
- Lowest intermodulation
- Lockable
- Unlockable in jig via automated handling
- Quick & reliable connection
- Extremely compact
- Guaranteed matings

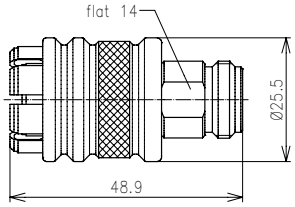
Part Number	BN 432051
Coaxial DUT port interface connector	4.3-10 male push-pull
Coaxial outgoing (Analyzer) port interface connector	4.3-10 female
Frequency range	DC to 2.7 GHz
VSWR, max.	Max. 1.08 @ DC to 2.7 GHz
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤-165 dBc; typ. ≤-168 dBc
Insertion loss	Max. 0.05 dB
Isolation	90 dBc
Matings	Min. 500[1)]
Weight	190 g

1) For optimal measurement results, cleaning must be regularly performed and assessed by expert staff.

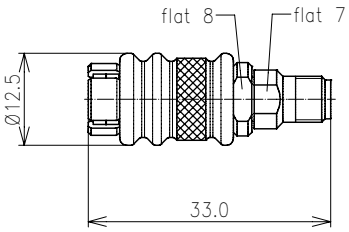
Push-Pull Adapters



Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 194472	7-16 male push-pull – Type N female	DC - 7.5 GHz	40 dB @ DC to 2 GHz 30 dB @ 2 to 7.5 GHz



Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 950870*	Type N male push-pull – female	DC - 18 GHz	40 dB @ DC to 2 GHz 34 dB @ 2 to 10 GHz 30 dB @ 10 to 18 GHz



Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 640570*	3.5 mm male push-pull – female	DC to 26.5 GHz	40 dB @ DC to 6 GHz 30 dB @ 6 to 12 GHz 25 dB @ 12 to 26.5 GHz

*The pressure-ring (green rubber) in the connector head included is a wearing part and should be replaced after approx. 5,000 mating cycles

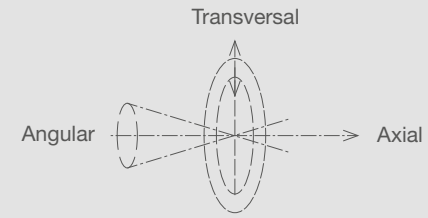
Accessories for Push-Pull Adapters

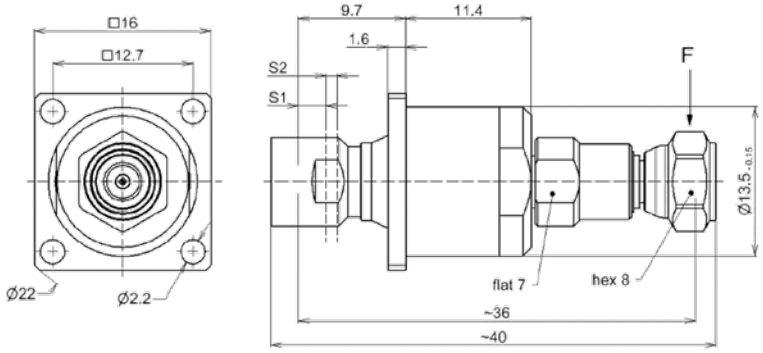
Part Number	Description
A09431	Pressure-Ring (green rubber) for BN 950870
A09636	Pressure-Ring (green rubber) for BN 640570

SPINNER EasyDock – 1.35 mm Blind Mate Adapters

- For jig operated test applications in production lines
- Unique smallest floating E-band connector DC-90 GHz
- Outstanding number of matings
- Design allows smallest cluster in multipole applications

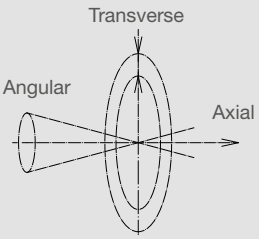
Part Number	BN 535301	BN 535302
Coaxial DUT port interface connector	1.35 mm male blind mate	
Coaxial outgoing (analyzer) port interface connector	1.35 mm male	1.35 mm female
Version	Blind mate, four-hole flange	
Frequency range	DC to 90 GHz	
Return loss, min.	25 dB @ DC - 26.5 GHz 20 dB @ 26.5 - 70 GHz 15 dB @ 70 - 90 GHz	
Maximum allowable misalignment corrections		
Transversal	±0.8 mm	
Axial		
S1: Stroke for centering	2.5 mm	
S2: Working range for measurement	1 mm	
Angular	±1°	





SPINNER EasyDock – Push-Pull Adapters

- For jig automated coupling movements to multiple DUT ports
- Self-aligning
- Non-locking
- Guaranteed matings

Part Number	BN 293809	BN 293810	BN 194476	BN 432014
Coaxial DUT port interface connector	7-16 male push-pull	7-16 male push-pull	7-16 male push-pull	4.3-10 male push-pull
Coaxial outgoing (analyzer) port interface connector	7-16 female	7-16 female	4.3-10 female	4.3-10 female
Mounting	Bulkhead[1)]			
Frequency range	DC to 6 GHz			
VSWR	Max. 1.02 @ DC to 2 GHz Max. 1.06 @ 2 to 6 GHz			
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤ -162 dBc (for first 5,000 matings)			
Insertion loss	Max. 0.05 dB			
Maximum allowable misalignment corrections				
Transverse	±2 mm			
Axial	6 mm			
Angular (at minimum stroke of 1.5 mm)	±1.5°			
Contact force during measurement	≈ 80 N			
Matings	Min. 5,000 at PIM / min. 10,000 at VSWR			
Special feature			Supports enhanced screening effectiveness	

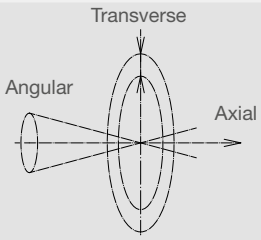
1) Please refer to data sheet for other mounting options.

View Video
SPINNER EasyDock test cases featuring 4.3-10, 7-16 and PIM

SPINNER EasyDock – Self-Locking Adapters

- For robotic based coupling movements to DUT
- Pick & connect suitable for 2-jaw gripper
- Self-aligning
- Lockable
- Enables top productivity in large-volume production
- Quick & reliable connection
- Guaranteed matings

Part Number	BN 293820	**BN 194482C0002**	**BN 432047C0002**
Coaxial DUT port interface connector	7-16 male push-pull, lockable		4.3-10 male push-pull, lockable
Coaxial outgoing (analyzer) port interface connector	7-16 female	4.3-10 female	
Operation	2-jaw gripper, e.g. handled by robot		
Frequency range	DC to 6 GHz		
VSWR	Max. 1.02 @ DC to 2 GHz Max. 1.06 @ 2 to 6 GHz		
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤ -163 dBc (for first 5,000 matings)		
Insertion loss	Max. 0.05 dB		
Maximum allowable misalignment corrections			
Transverse	±1.5 mm		
Axial	6 mm		
Angular (at minimum stroke of 1.5 mm)	±1.5°		
Contact force	≈ 80 N		
Matings	Min. 5,000 at PIM / min. 10,000 at VSWR		
Weight	510 g	450 g	420 g



Port Savers

- Protects damageable PIM test equipment
- For sensitive testing and measurement applications
- Abrasion-proof
- Tarnishing and corrosion proof
- Nickel-free
- vRoHS-compliant

Part Number		BN 756404	BN 432017
Coaxial interface connector	Side A	7-16 male	4.3-10 male
	Side B	7-16 female	4.3-10 female
Frequency range		DC to 7.5 GHz	DC to 6 GHz
VSWR		Max.1.01 @ DC to 1 GHz Max.1.04 @ 1 to 3 GHz Max.1.06 @ 3 to 7.5 GHz	Max.1.02 @ DC to 2 GHz Max.1.04 @ 2 to 3 GHz Max.1.06 @ 3 to 6 GHz
Passive intermodulation (IM3) @ 2 x 20 W		Max. ≤-165 dBc	
Weight		≈ 95 g	

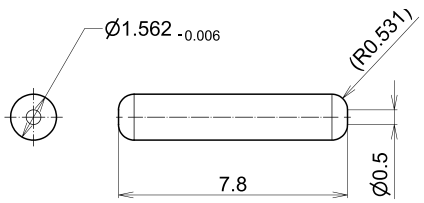
Precision Inter-Type Adapters Waveguide-to-Coaxial 1.00 mm and 1.35 mm Ruggedized

Part Number	Style	Description	Frequency Range	Return Loss
BN 533141	In-line	Precision adapter waveguide R 900 (WR 10) to 1.00 mm female ruggedized	75 - 110 GHz	≥ 16 dB
BN 533142	In-line	Precision adapter waveguide R 740 (WR 12) to 1.00 mm female ruggedized	60 - 90 GHz	≥ 16 dB
BN 533143	In-line	Precision adapter waveguide R 620 (WR 15) to 1.00 mm female ruggedized	50 - 75 GHz	≥ 16 dB
BN 533161	In-line	Precision adapter waveguide R 900 (WR 10) to 1.00 mm male ruggedized	75 - 110 GHz	≥ 16 dB
BN 533162	In-line	Precision adapter waveguide R 740 (WR 12) to 1.00 mm male ruggedized	60 - 90 GHz	≥ 16 dB
BN 533163	In-line	Precision adapter waveguide R 620 (WR 15) to 1.00 mm male ruggedized	50 - 75 GHz	≥ 16 dB
BN 533151	In-line	Precision adapter waveguide R 900 (WR 10) to 1.35 mm female ruggedized	75 - 90 GHz	≥ 16 dB
BN 533152	In-line	Precision adapter waveguide R 740 (WR 12) to 1.35 mm female ruggedized	60 - 90 GHz	≥ 16 dB
BN 533153	In-line	Precision adapter waveguide R 620 (WR 15) to 1.35 mm female ruggedized	50 - 75 GHz	≥ 16 dB

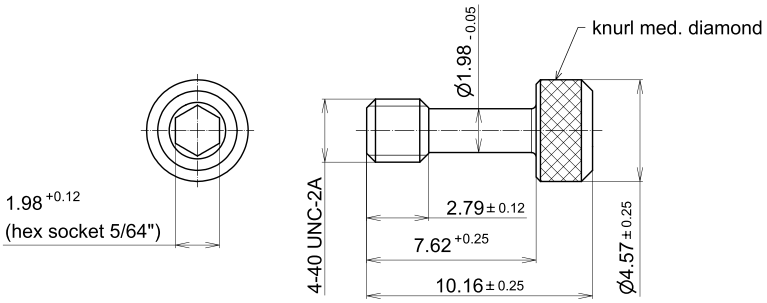
Precision Inter-Type Waveguide-to-Coaxial Adapters 1.00 mm and 1.35 mm

Part Number	Style	Description	Frequency Range	Return Loss
BN 533110	Right-angle	Precision adapter waveguide R 1.2k (WR 08) to 1.00 mm female	90 - 120 GHz	≥ 16 dB
BN 533112 BN 533114	In-line Right-angle	Precision adapter waveguide R 900 (WR 10) to 1.00 mm female	75 - 110 GHz	≥ 16 dB
BN 533116 BN 533118	In-line Right-angle	Precision adapter waveguide R 740 (WR 12) to 1.00 mm female	60 - 90 GHz	≥ 16 dB
BN 533120 BN 533122	In-line Right-angle	Precision adapter waveguide R 620 (WR 15) to 1.00 mm female	50 - 75 GHz	≥ 16 dB
BN 533124 **BN 533125**	In-line Right-angle	Precision adapter waveguide R 900 (WR 10) to 1.00 mm male	75 - 90 GHz	≥ 16 dB
BN 533126 **BN 533127**	In-line Right-angle	Precision adapter waveguide R 740 (WR 12) to 1.00 mm male	60 - 90 GHz	≥ 16 dB
BN 533128 **BN 533129**	In-line Right-angle	Precision adapter waveguide R 620 (WR 15) to 1.35 mm female	50 - 75 GHz	≥ 16 dB
BN 533134	In-line	Precision adapter waveguide R 900 (WR 10) to 1.35 mm male	75 - 90 GHz	≥ 16 dB
BN 533135	In-line	Precision adapter waveguide R 740 (WR 12) to 1.35 mm male	60 - 90 GHz	≥ 16 dB
BN 533136	In-line	Precision adapter waveguide R 620 (WR 15) to 1.35 mm male	50 - 75 GHz	≥ 16 dB
BN 533159	In-line	Panel connector R 740 (WR 12) to 1.35 female, D-hole mount	60 - 90 GHz	≥ 16 dB

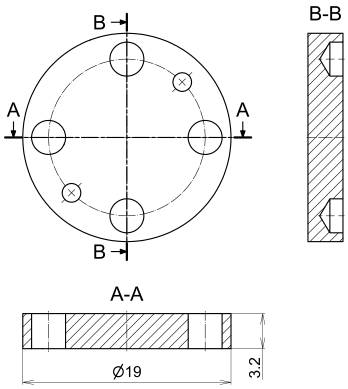
Accessories for mmWave Waveguide-to-Coaxial Adapters



Part Number	Description
A61785	Aligning pin



Part Number	Description
A61786	Socket-head cap screws 4-40 UNC



Part Number	Description
A62935	Protective cap

Passive Intermodulation Reference Standards

- Generates a defined intermodulation product for test purposes
- Guaranteed intermodulation
- High accuracy
- Excellent repeatability

General							
Frequency range		DC to 4 GHz					
Passive intermodulation level 3rd order* *±3 dB at 2 x 43 dBm / 2 x 20 W carrier		-70 dBm	-80 dBm	-90 dBm	-100 dBm	-110 dBm	-120 dBm
Coaxial interface connector		7-16 male - female (50 Ω)					
Frequency band		Part number starting with **BN 756616….** To specify a type, please add a suffix from the table below.					
GSM 900 fIM3: 890.3 MHz	f1: 925.1 MHz f2: 959.9 MHz	C0070	C0080	C0090	C0100	C0110	C0120
GSM 1800 fIM3:1730 MHz	f1: 1805 MHz f2: 1880 MHz	C1070	C1080	C1090	C1100	C1110	C1120
UMTS fIM3: 2050 MHz	f1: 2110 MHz f2: 2170 MHz	C2070	C2080	C2090	C2100	C2110	C2120
LTE 2.6 fIM3: 2550 MHz	f1: 2620 MHz f2: 2690 MHz	C3070	C3080	C3090	C3100	C3110	C3120

More information:

BN 756616Cxxxx

Coaxial interface connector	4.3-10 male - female (50 Ω)						
Frequency band	Part number starting with **BN 756617….** To specify a type, please add a suffix from the table below.						
GSM 900 fIM3: 890.3 MHz	f1: 925.1 MHz f2: 959.9 MHz	C0070	C0080	C0090	C0100	C0110	C0120
GSM 1800 fIM3:1730 MHz	f1: 1805 MHz f2: 1880 MHz	C1070	C1080	C1090	C1100	C1110	C1120
UMTS fIM3: 2050 MHz	f1: 2110 MHz f2: 2170 MHz	C2070	C2080	C2090	C2100	C2110	C2120
LTE 2.6 fIM3: 2550 MHz	f1: 2620 MHz f2: 2690 MHz	C3070	C3080	C3090	C3100	C3110	C3120

More information:

BN 756617Cxxxx

Example:
BN 756616C1090: Intermodulation standard with -90 dBm for band GSM 1800, interface 7-16 male-female

Passive Intermodulation Reference Standards

Generates a Defined Intermodulation Product for Test Purposes

- Guaranteed intermodulation
- High accuracy
- Excellent repeatability

General							
Frequency range		DC to 4 GHz					
Passive intermodulation level 3rd order* *±3 dB at 2 x 43 dBm / 2 x 20 W carrier		-70 dBm	-80 dBm	-90 dBm	-100 dBm	-110 dBm	-120 dBm
Coaxial interface connector		NEX10® male - female (50 Ω)					
Frequency band		Part number starting with **BN 756618….** To specify a type, please add a suffix from the table below.					
900 MHz fIM3: 890.3 MHz	f1: 925.1 MHz f2: 959.9 MHz	**C0070**	**C0080**	**C0090**	**C0100**	**C0110**	**C0120**
1800 MHz fIM3:1730 MHz	f1: 1805 MHz f2: 1880 MHz	**C1070**	**C1080**	**C1090**	**C1100**	**C1110**	**C1120**
2100 MHz fIM3: 2050 MHz	f1: 2110 MHz f2: 2170 MHz	**C2070**	**C2080**	**C2090**	**C2100**	**C2110**	**C2120**
2600 MHz fIM3: 2550 MHz	f1: 2620 MHz f2: 2690 MHz	**C3070**	**C3080**	**C3090**	**C3100**	**C3110**	**C3120**

More information:

BN 756618Cxxxx

Example:
BN 756618C1090: Intermodulation standard with -90 dBm for band GSM 1800, interface NEX10® male-female

Panel Connectors and Cables

RF panel mount and cable connectors are found in a wide range of applications such as communication infrastructure, medical, research, industrial, aerospace and defence, automotive and consumer products, and must operate reliably even under the most difficult conditions.

No matter where the application is, SPINNER guarantees the best transmission characteristics, enables high bandwidths and signal integrity and offers a robust design.

RF cable connectors from SPINNER are provided in standard or custom configurations with cable entries and soldering sleeves for the most common 50 Ohm RF cable types.

Connctors for RF cables are available for: 1.00 mm, 1.35 mm, 1.85 mm, 2.4 mm, 2.92 mm, 3.5 mm, 1.5-3.5 in male or female straight, male push-pull as well as a bulkhead, D-hole or 4-hole panel mount version.

Thru-male

For instrument wiring, we offer precision-manufactured cable connectors with the lowest insertion loss. The inner cable conductor is also the inner connector conductor. There is no need for time-consuming soldering to the connector ferrule.

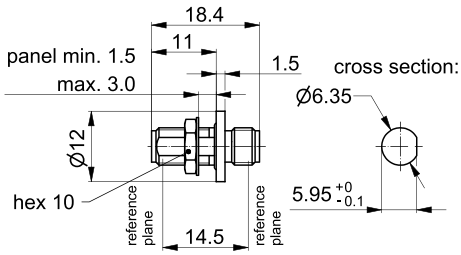
As the connections in the devices are only contacted once, the wear of the cable inner connector pin is negligible.

Sometimes it is also necessary for space reasons to connect a cable for higher frequencies to a cable connector for a low frequency. These cables are thinner and easier to bend and thus allow installation in the tightest of spaces. The somewhat higher attenuation values are neglected in this case.

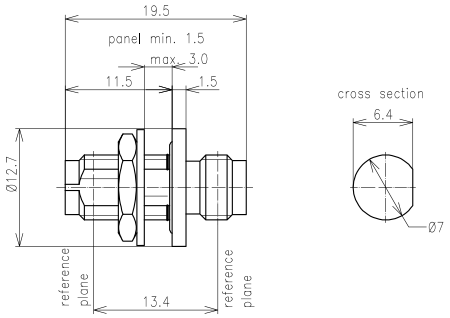
SPINNER cable connectors are all especially suitable for use with semi-rigid cables. 3.5 mm is intermatable with 2.92 mm (K) connectors, the 2.4 mm with the 1.85 mm connectors.

With the 1.35 mm E-connector standard, a coaxial connector system is on the market that enables applications up to 90 GHz. The E-connector offers a more reliable mechanical locking than the 1.0 mm coaxial connector system and is perfect suited for many test applications in the field of automotive radar.

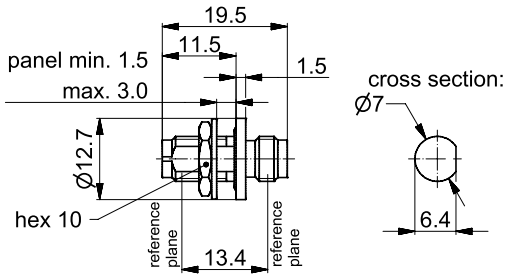
Coaxial Panel Connectors



Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 533168	2.92 mm female, bulkhead	2.92 mm female	DC - 44 GHz	27 dB @ DC to 10 GHz 24 dB @ 10 to 26.5 GHz 20 dB @ 26.5 to 44 GHz

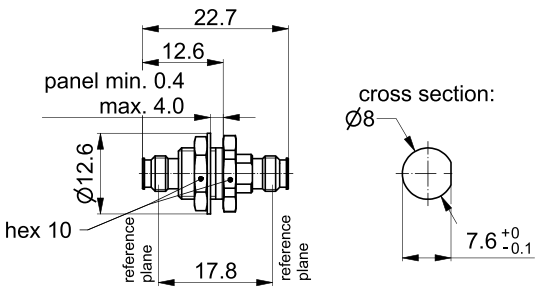


Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 533713	2.4 mm female, bulkhead	2.4 mm female	DC - 50 GHz	27 dB @ DC to 10 GHz 24 dB @ 10 to 26.5 GHz 20 dB @ 26.5 to 50 GHz

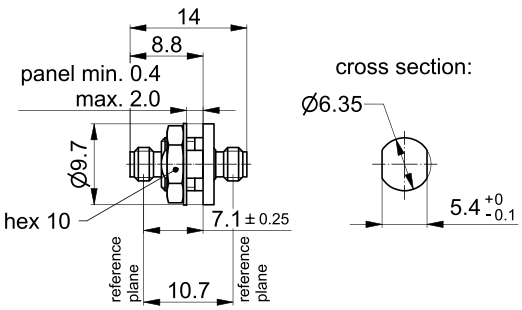


Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 533712	1.85 mm female, bulkhead	1.85 mm female	DC - 70 GHz	27 dB @ DC to 10 GHz 24 dB @ 10 to 26.5 GHz 20 dB @ 26.5 to 50 GHz 16 dB @ 50 to 70 GHz

Coaxial Panel Connectors

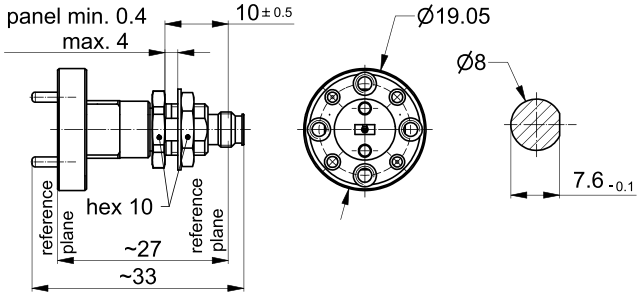


Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 534990	1.35 mm female, bulkhead	1.35 mm female	DC - 90 GHz	24 dB @ DC to 26.5 GHz 18 dB @ 26,5 to 70 GHz 15 dB @ 70 to 90 GHz



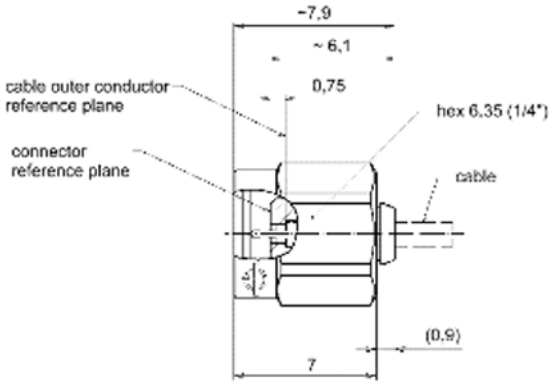
Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 534999	1.00 mm female, bulkhead	1.00 mm female	DC - 110 GHz	24 dB @ DC to 26.5 GHz 18 dB @ 26,5 to 70 GHz 15 dB @ 70 to 90 GHz 12 dB @ 90 to 110 GHz

Waveguide Panel Connector



Part Number	Interface Type A	Interface Type B	Frequency Range	Return Loss, min.
BN 533159	WR 12 bulkhead	1.35 mm female	DC - 90 GHz	16 dB @ DC to 90 GHz

Cable Connector



Part Number	Interface Type	Cable Type	Frequency Range	Return Loss, min.
BN c*	1.35 mm male	Semi-Rigid UT-047 (MIL-DTL-17/151)	DC - 90 GHz	17 dB @ DC to 90 GHz

* “Thru male” design: Pin diameter equals center conductor of MIL-DTL-17/151 and other standard cables – enables high-quality low-budget jumper cables

Low PIM Measurement Cable Assemblies

- Outstanding IM performance
- 100% PIM tested; with protocol
- Straight and right angle 7-16, 4.3-10, 2.2-5 or NEX10® connectors
- Lengths: min. 0.13 m; max. 30 m
- Optimized for repeated bending
- Reinforced cable ends
- For indoor use only (no O-ring in connector interface)

Article	Low PIM SpinnerFlex® TopFit Cable SF 3/8“			
Frequency range	≤ 0.96 GHz	≤ 2.2 GHz	≤ 2.7 GHz	≤ 3.8 GHz
VSWR (≤ 6 m)[1)]	1.2			
Insertion loss	13.8 dB/100 m	21.7 dB/100 m	25.8 dB/100 m	30.4 dB/100 m
Power rating, max. (40°C)	0.57 kW	0.36 kW	0.31 kW	0.26 kW

Article	Low PIM SpinnerFlex® TopFit Cable SF 1/2“			
Frequency range	≤ 0.96 GHz	≤ 2.2 GHz	≤ 2.7 GHz	≤ 3.8 GHz
VSWR (≤ 6 m)[1)]	1.07	1.10	1.14	1.16
Insertion loss	11.56 dB/100 m	18.64 dB/100 m	21.06 dB/100 m	25.90 dB/100 m
Power rating, max. (40°C)	0.91 kW	0.56 kW	0.49 kW	0.42 kW

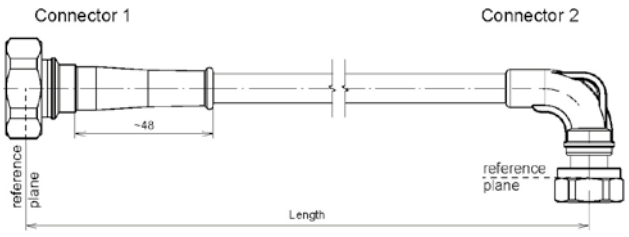
1) The provided VSWR values are maintained within all global cellular frequency bands.

More information:

Low PIM coaxial cables

View Video
4.3-10 and 7-16 low PIM jumpers - PIM test at SPINNER

Low PIM Measurement Cable Assemblies - Sales Article Numbers



Jumper	Cable Type	Cable Size		Connector 1	Connector 2		Length	Unit	Length	Extra Features
J	Z	X	-	XZ	XZ	-	X	Z	X	-Z
	SF	S		Any combination of connectors below is possible. Please specify XZ combination for connectors 1 and 2.						Leave blank if N/A
	3/8“	38								
	1/2“	12								
	X = Connector System	Z = Connector Style		X	Z					
	7-16	Male		7	M					
		Male right angle			R					
		Female			F					
		Female bulkhead			B					
		Female four-hole			P					
	4.3-10	Male; screw		43	MS					
	2.2-5	Male right angle; screw		22	RS					
	NEX10®	Female		X	F					
		Female bulkhead			B					
		Female four-hole			P					
							Length in meters/feet (dependent on unit specified)			
							Meter	M		
							Feed	F		
							Length in decimeters/inch (dependent on unit specified)			
										Low PIM Measurement Cable (only available with PE jacket)
										- Passive intermodulation (IM3) @ 2 x 20 W ≤ -160 dBc[1], inspection certificate 3.1[2], per jumper -I0
										- Passive intermodulation (IM3) @ 2 x 20 W ≤ -160 dBc[1], inspection certificate 3.1[2], per order -I1
										- Passive intermodulation (IM3) @ 2 x 20 W ≤ -165 dBc[1], inspection certificate 3.1[2], per jumper -I2
										- Passive intermodulation (IM3) @ 2 x 20 W ≤ -165 dBc[1], inspection certificate 3.1[2], per order -I3
										- Passive intermodulation (IM3) @ 2 x 20 W ≤ -170 dBc[1], inspection certificate 3.1[2], per jumper -I4
										- Passive intermodulation (IM3) @ 2 x 20 W ≤ -170 dBc[1], inspection certificate 3.1[2], per order -I5

1) According to IEC 62037-2 and WN 20 000
2) According to EN 10204

Examples of sales article numbers:
JS38-7M7F-2M-I4: SF 3/8” jumper with 7-16 male and 7-16 female; length 2.0 meter; low PIM performance with ≤ -165 dBc; test protocol per order.

JS12-7M43RS-1M3-I5: SF 1/2” jumper with 7-16 male and 4.3-10 female right angle screw; length 1.3 meter; low PIM performance with ≤ -170 dBc; test protocol per jumper.

Coaxial Articulated Lines

Articulated lines boast excellent RF properties and an extremely long service life. They are considerably more robust than ordinary test cables, lasting several times as long.

Features

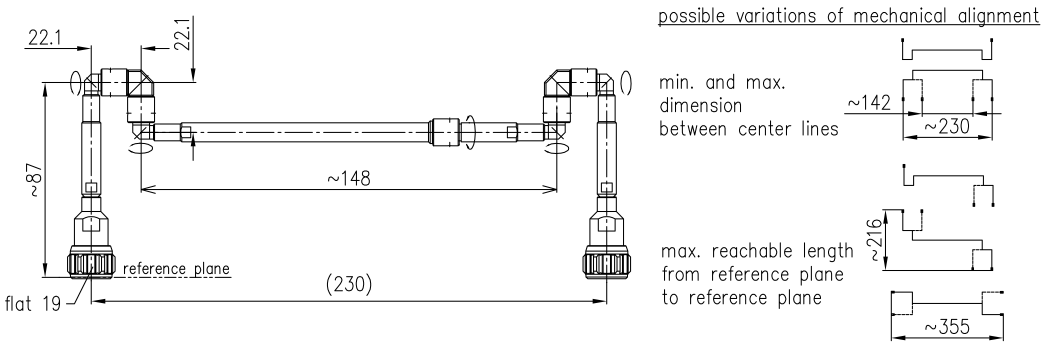
- Extremely long life
  - 1 Million flex cycles guaranteed for articulated line (The rotary joints allow movements without stressing of the material by strain or torsion)
  - Worn-out port saver connectors (5000 matings guaranteed) can be easily replaced by customer
- Excellent amplitude and phase stability
  - Also during movement
  - Also with temperature drift
- Accurate and reproducible RF measurements
  - No need for adapters because 3.5 and N connectors are available as male and female
  - VNA calibration is not affected by movements
- Highly flexible
  - DUT ports in any orientation can be connected within a sphere 1 m in diameter (0.5 m for short line)
  - Rotation allowed
  - No mechanical stress introduced to DUT
- Ecofriendly
  - Long life
  - Repair-friendly
  - Recyclable

Applications

- General test bench use
- Network analysis (S-parameter measurement)
- Robotic test setups
- Measurement of rotatable DUTs (e.g. rotary joints and rotating systems)

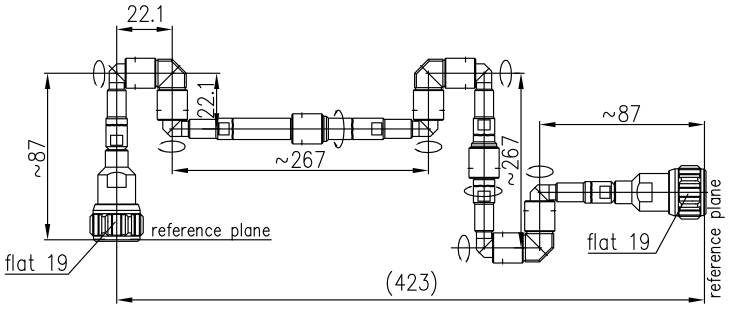
YouTube - Articulated Lines
SPINNER RF Articulated Lines contra RF test cables

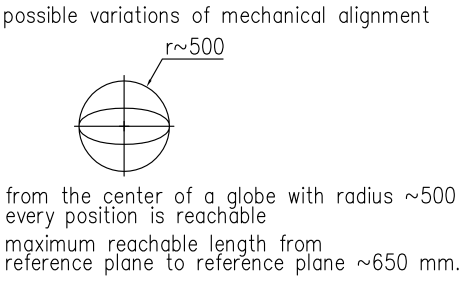
Coaxial Articulated Lines, DC to 18 GHz – 365 mm



Part Number	Interface	Return Loss, min.	Insertion Loss, max.	Length (mm)	Quantity per Set
BN 533626C1010	Type N male/male	DC to 4 GHz ≥ 26 dB 4 to 12 GHz ≥ 20 dB 12 to 18 GHz ≥ 15 dB	DC to 18 GHz ≤ 1.7 dB	365	1
BN 533626C2010	Type N male/female				
BN 533626C3010	Type N female/female				
BN 533626C1111	Type N male/male				2
BN 533626C2211	Type N male/female				
BN 533626C3311	Type N female/female				

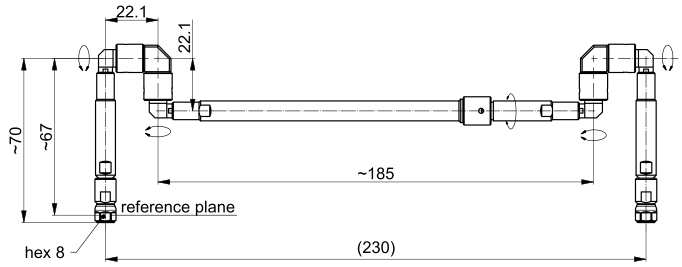
Coaxial Articulated Lines, DC to 18 GHz – 650 mm

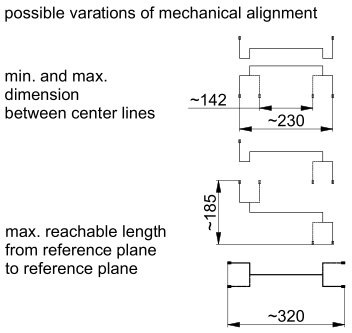




Part Number	Interface	Return Loss, min.	Insertion Loss, max.	Length (mm)	Quantity per Set
BN 533645C1010	Type N male/male	DC to 4 GHz ≥ 26 dB 4 to 9 GHz ≥ 17 dB 9 to 18 GHz ≥ 15 dB	DC to 18 GHz ≤ 2.7 dB	650	1
BN 533645C2010	Type N male/female				
BN 533645C3010	Type N female/female				
BN 533645C1111	Type N male/male				2
BN 533645C2211	Type N male/female				
BN 533645C3311	Type N female/female				

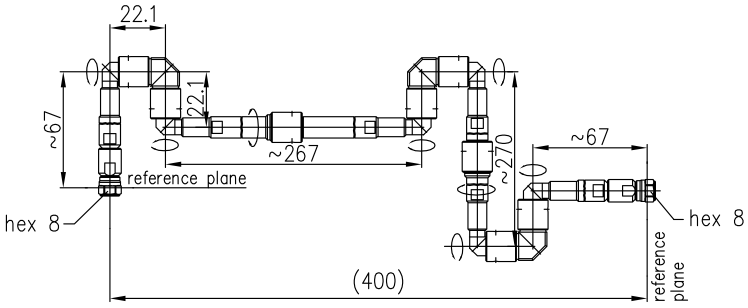
Coaxial Articulated Lines, DC to 32 GHz – 320 mm

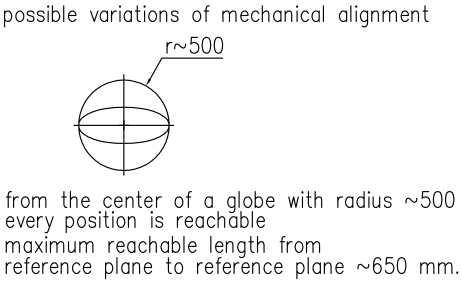




Part Number	Interface	Return Loss, min.	Insertion Loss, max.	Length (mm)	Quantity per Set
BN 533627C1010	3.5 mm male/male	DC to 4 GHz ≥ 26 dB 4 to 12 GHz ≥ 20 dB 12 to 18 GHz ≥ 15 dB	DC to 18 GHz ≤ 1.7 dB 18 to 26.5 GHz ≤ 2.2 dB 26.5 to 32 GHz ≤ 3.0 dB	320	1
BN 533627C2010	3.5 mm male/female				
BN 533627C3010	3.5 mm female/female				
BN 533627C1111	3.5 mm male/male				2
BN 533627C2211	3.5 mm male/female				
BN 533627C3311	3.5 mm female/female				

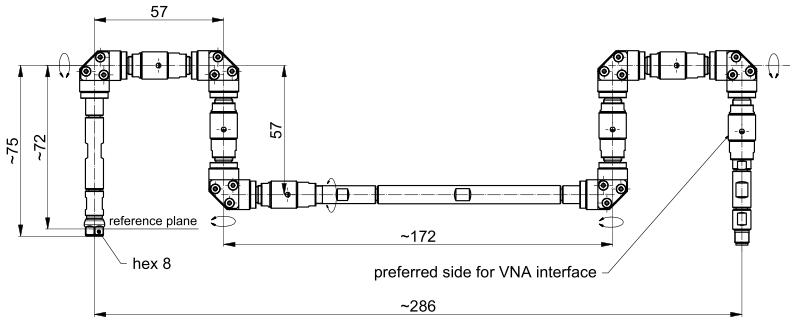
Coaxial Articulated Lines, DC to 32 GHz – 650 mm

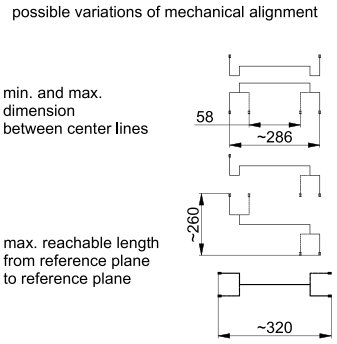




Part Number	Interface	Return Loss, min.	Insertion Loss, max.	Length (mm)	Quantity per Set
BN 533638C1010	3.5 mm male/male	DC to 4 GHz ≤ 26 dB 4 to 9 GHz ≤ 17 dB 9 to 18 GHz ≤ 15 dB 18 to 26.5 GHz ≤ 12 dB 26.5 to 32 GHz ≤ 9 dB	DC to 18 GHz ≤ 2.7 dB 18 to 26.5 GHz ≤ 3.2 dB 26.5 to 32 GHz ≤ 3.4 dB	650	1
BN 533638C2010	3.5 mm male/female				
BN 533638C3010	3.5 mm female/female				
BN 533638C1111	3.5 mm male/male				2
BN 533638C2211	3.5 mm male/female				
BN 533638C3311	3.5 mm female/female				

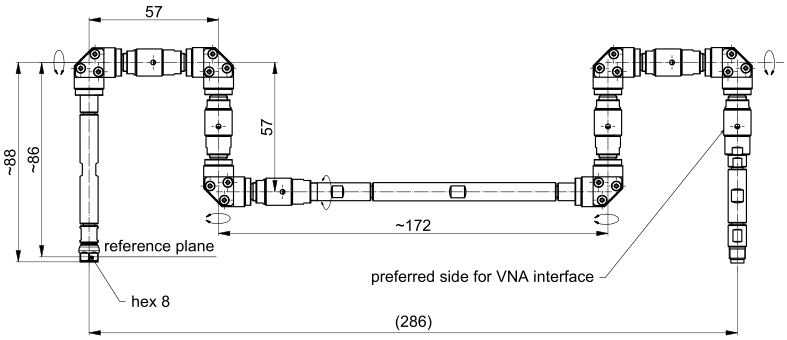
Coaxial Articulated Lines, DC to 40 GHz – 320 mm

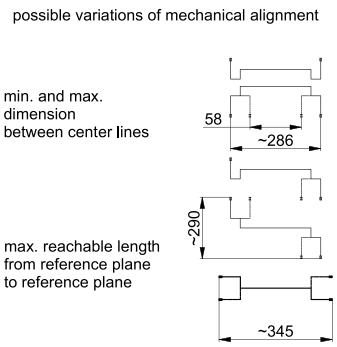




Part Number	Interface	Return Loss, min.	Insertion Loss, max.	Length (mm)	Quantity per Set
BN 533647C1010	2.92 mm male/male	DC to 4 GHz ≤ 26 dB 4 to 9 GHz ≤ 20 dB 9 to 18 GHz ≤ 15 dB 18 to 26.5 GHz ≤ 12 dB 26.5 to 40 GHz ≤ 10 dB	DC to 18 GHz ≤ 2.3 dB 18 to 26.5 GHz ≤ 3.0 dB 26.5 to 40 GHz ≤ 4.0 dB	320	
BN 533647C2010	2.92 mm male/female				1
BN 533647C3010	2.92 mm female/female				
BN 533647C1111	2.92 mm male/male				
BN 533647C2211	2.92 mm male/female				2
BN 533647C3311	2.92 mm female/female				

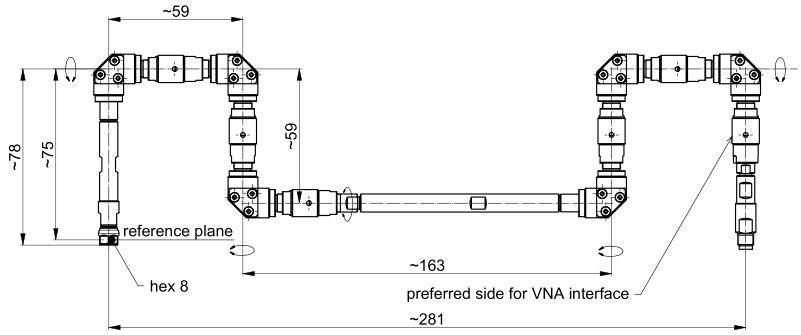
Coaxial Articulated Lines, DC to 50 GHz – 345 mm

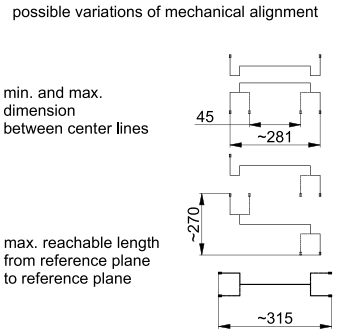




Part Number	Interface	Return Loss, min.	Insertion Loss, max.	Length (mm)	Quantity per Set
BN 533646C1010	2.4 mm male/male	DC to 4 GHz ≤ 26 dB 4 to 9 GHz ≤ 20 dB 9 to 18 GHz ≤ 15 dB 18 to 26.5 GHz ≤ 12 dB 26.5 to 40 GHz ≤ 10 dB 40 to 50 GHz ≤ 8 dB	DC to 18 GHz ≤ 2.5 dB 18 to 26.5 GHz ≤ 3.5 dB 26.5 to 40 GHz ≤ 4.5 dB 40 to 50 GHz ≤ 5.5 dB	345	
BN 533646C2010	2.4 mm male/female				1
BN 533646C3010	2.4 mm female/female				
BN 533646C1111	2.4 mm male/male				
BN 533646C2211	2.4 mm male/female				2
BN 533646C3311	2.4 mm female/female				

Coaxial Articulated Lines, DC to 67 GHz – 315 mm





Part Number	Interface	Return Loss, min.	Insertion Loss, max.	Length (mm)	Quantity per Set
BN 533652C1010	1.85 mm male/male	DC to 4 GHz ≤ 25 dB 4 to 6 GHz ≤ 20 dB 6 to 18 GHz ≤ 15 dB 18 to 26.5 GHz ≤ 12 dB 26.5 to 40 GHz ≤ 10 dB 40 to 67 GHz ≤ 8 dB	DC to 18 GHz ≤ 2.5 dB 18 to 26.5 GHz ≤ 3.5 dB 26.5 to 40 GHz ≤ 4.5 dB 40 to 50 GHz ≤ 5.5 dB 50 to 67 GHz ≤ 6.5 dB	315	1
BN 533652C2010	1.85 mm male/female				
BN 533652C3010	1.85 mm female/female				
BN 533652C1111	1.85 mm male/male				2
BN 533652C2211	1.85 mm male/female				
BN 533652C3311	1.85 mm female/female				

Port Savers for Coaxial Articulated Lines

- High-precision adapter in instrument quality
- Minimize wear at articulated line ports
- Male-male, female-female, or male-female available
- For frequencies up to 50 GHz

Part Number	Interface type	Frequency range	Return Loss, min.
BN 533916C0001	Type N male-male	DC to 18 GHz	38 dB @ DC to 4 GHz 34 dB @ 4 to 8 GHz 28 dB @ 8 to 18 GHz
BN 533917C0001	Type N female-female		
BN 533918C0001	Type N male-female		
BN 533767C0001	3.5 mm male-male	DC to 32 GHz	34 dB @ DC to 4 GHz 30 dB @ 4 to 26.5 GHz 26 dB @ 26.5 to 32 GHz
BN 533768C0001	3.5 mm female-female		
BN 533769C0001	3.5 mm male-female		
BN 533907C0001	2.92 mm male-male	DC to 40 GHz	33 dB @ DC to 4 GHz 30 dB @ 4 to 26.5 GHz 25 dB @ 26.5 to 40 GHz
BN 533908C0001	2.92 mm female-female		
BN 533909C0001	2.92 mm male-female		
BN 533776C0001	2.4 mm male-male	DC to 50 GHz	32 dB @ DC to 4 GHz 30 dB @ 4 to 26.5 GHz 25 dB @ 26.5 to 40 GHz 23 dB @ 40 to 50 GHz
BN 533777C0001	2.4 mm female-female		
BN 533778C0001	2.4 mm male-female		

SPINNER EasySnake – The Flexible Terahertz Waveguide Assembly

SPINNER EasySnake for E- and W-band performs the function of a **hollow metallic** waveguide but offers two degrees of freedom: flexible bending and twisting **in any direction** while delivering excellent measurement results at the same time. Even conventional flexible waveguides made of electrically conductive bellows are typically non-twistable i.e. resist torsion, which significantly limits the feasible test configurations.

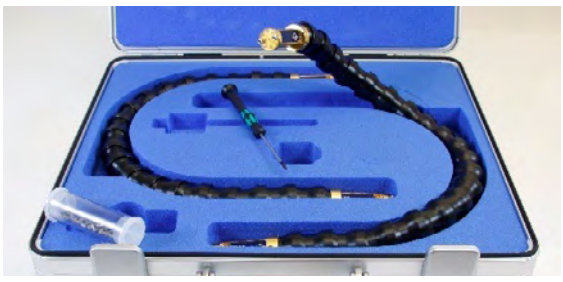
They are also completely intolerant of minimally misalign or twisted flanges. The SPINNER EasySnake overcomes this by combining the flexibility of a conventional RF measurement cable with the excellent low-loss transmission characteristics of a conventional non-flexible waveguide system.

Features

- Dielectric waveguide supported by unique tubular segments (patent pending)
- Flexible, i.e. bendable and twistable (eliminates installations problems caused by misalignment of flanges)
- Flex-stable, i.e. keeps chosen bending geometry
- Built-in transitions from dielectric to rectangular waveguide
- Insertion loss outperforms any coaxial cable and single-mode metallic waveguide
- Excellent amplitude stability with flexure and temperature change
- Length configurable in steps of 25 mm
- Mechanically protected and electrically shielded
- High-voltage decoupled waveguide transitions

Applications

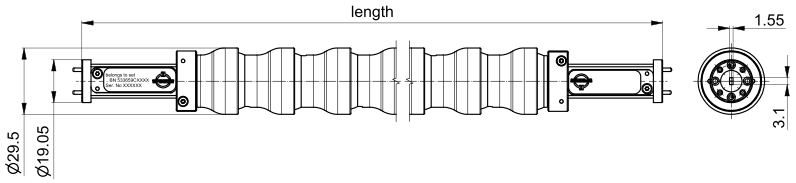
- General test bench use
- Network analysis (S-parameter measurement)
- Antenna testing (near field, far field)
- Environmental chamber and vibration testing



Conference Paper

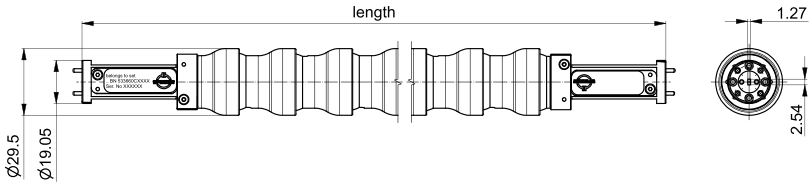
Nickel, H.-U. and Zovo, J., 2014, Novel flexible dielectric waveguide for millimeter and sub-millimeter frequencies – Design and characterization, 84th ARFTG Microwave Measurement Conference (ARFTG 84th), Boulder, Colorado, USA, Proceedings.

SPINNER EasySnake - The Flexibel Dielectric Waveguide Assembly, 60 - 90 GHz (E-Band)



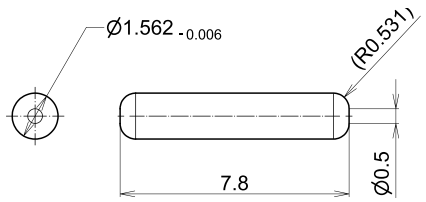
Part Number	Interface	Return Loss, min.	Insertion Loss, max.	Length (mm)	Quantity per Set
BN 533659C0107	WR 12 / R 740	16 dB	1.8 dB @ 60 to 65 GHz 1.4 dB @ 65 to 90 GHz	300	1
BN 533659C0207				300	2
BN 533659C0115			2.3 dB @ 60 to 65 GHz 1.8 dB @ 65 to 90 GHz	500	1
BN 533659C0215				500	2
BN 533659C0119			2.6 dB @ 60 to 65 GHz 2.1 dB @ 65 to 90 GHz	600	1
BN 533659C0219				600	2
BN 533659C0131		14 dB	3.5 dB @ 60 to 65 GHz 2.9 dB @ 65 to 90 GHz	900	1

SPINNER EasySnake - The Flexibel Dielectric Waveguide Assembly, 75 - 110 GHz (W-Band)

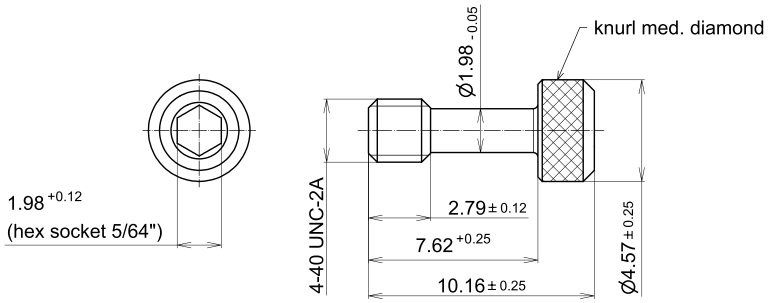


Part Number	Interface	Return Loss, min.	Insertion Loss, max.	Length (mm)	Quantity per Set
BN 533660C0107	WR 10 / R 900	16 dB	0.4 dB @ 75 to 80 GHz 0.2 dB @ 80 to 110 GHz	300	1
BN 533660C0207				300	2
BN 533660C0119			0.8 dB @ 75 to 80 GHz 0.4 dB @ 80 to 85 GHz 0.2 dB @ 85 to 110 GHz	600	1
BN 533660C0219				600	2
BN 533660C0131		14 dB	0.8 dB @ 75 to 80 GHz 0.6 dB @ 80 to 85 GHz 0.4 dB @ 85 to 90 GHz 0.2 dB @ 90 to 110 GHz	900	1

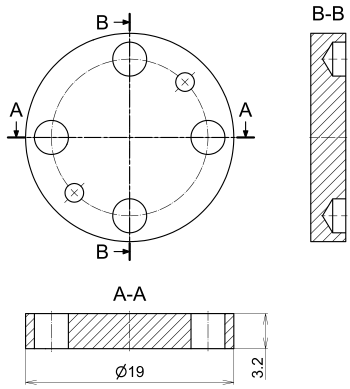
Accessories for SPINNER EasySnake



Part Number	Description
A61785	Aligning pin



Part Number	Description
A61786	Socket-head cap screws 4-40 UNC



Part Number	Description
A62935	Protective cap

SPINNER EasyLaunch – Solderless PCB Connectivity

The Challenge

There is an increasing demand for millimeter wave signal pickup on printed circuit boards (PCBs). However, existing solutions either limit the range of possible PCB layouts or reduce RF performance.

In most cases, layout designs are limited by the need to solder PCB adapters to the edge of the board. The worst case is when the board includes cavities for picking up RF signals somewhere in the middle.

Other solutions that involve taping RF signals in the middle of the board impair RF performance since the PCB Adapter's still inner conductor pricks the surface.

The Solution

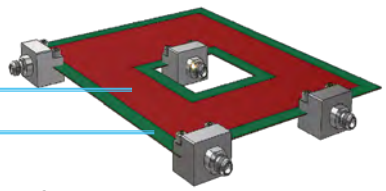
The flexible, soft-launch SPINNER EasyLaunch is mounted flush with the PCB surface and ensures excellent RF performance, even with multiple launches.

This technology permits **variable positioning** of the connectors and **maximizes flexibility** for placing RF contact.

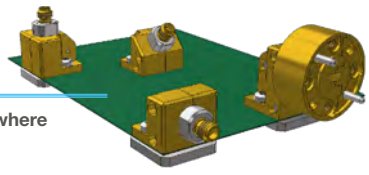
Advantages of SPINNER EasyLaunch

- Variable positioning for maximimum flexibility
- Excellent RF performance for the highest frequencies
- Compact board design

Conventional Solution



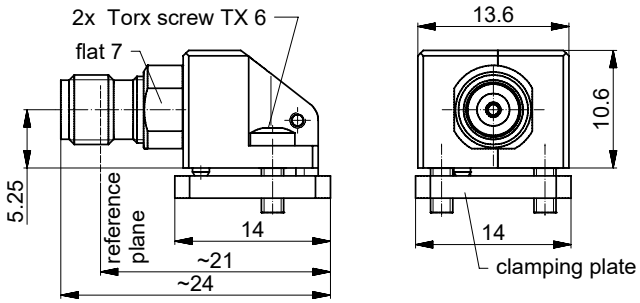
SPINNER EasyLaunch Solution



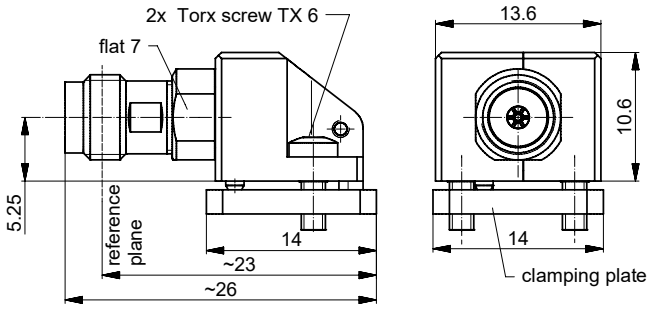
The Benefits

- Excellent RF performance:
  The soft-launch concept avoids compromising the PCB surface, even when there are multiple launches.
- Support for more compact PCB designs:
  The SPINNER EasyLaunch Adapter can be positioned anywhere.
- The SPINNER EasyLaunch Adapter and PCB board can be easily reused—no soldering required.
- Flush contact with the PCB
- Support for a wide range of PCB substrates
- The fixed connector interface can be ordered for any angle between 0° and 90°.

SPINNER EasyLaunch – Coaxial PCB Launch Connectors

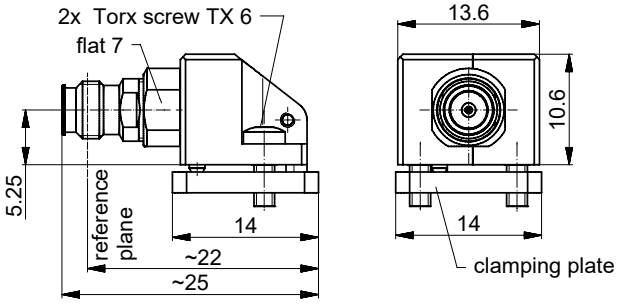


Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 533410	2.92 mm female	DC to 40 GHz	25 dB @ DC to 10 GHz 21 dB @ 10 to 26.5 GHz 19 dB @ 26.5 to 40 GHz

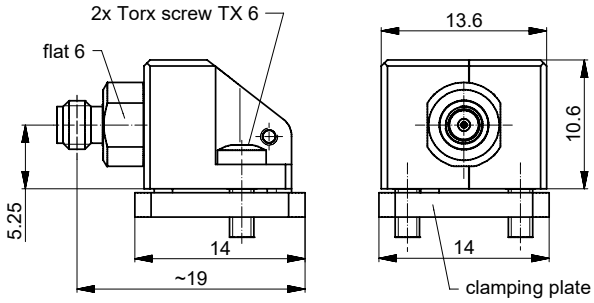


Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 533404	1.85 mm female	DC to 70 GHz	23 dB @ DC to 26.5 GHz 19 dB @ 26.5 to 40 GHz 17 dB @ 40 to 70 GHz

SPINNER EasyLaunch – Coaxial PCB Launch Connectors

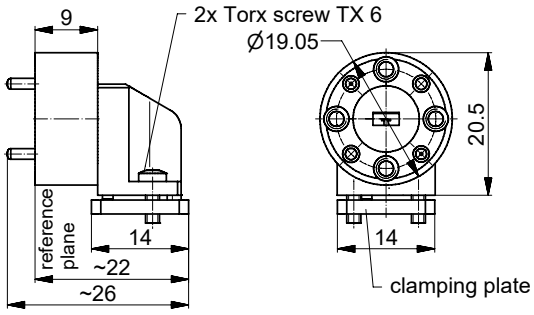


Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 533416	1.35 mm female	DC to 90 GHz	23 dB @ DC to 26.5 GHz 16 dB @ 26.5 to 50 GHz 10 dB @ 50 to 90 GHz

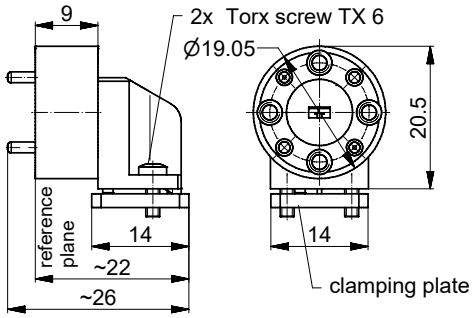


Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 533402	1.0 mm female	DC to 110 GHz	10 dB @ DC to 110 GHz

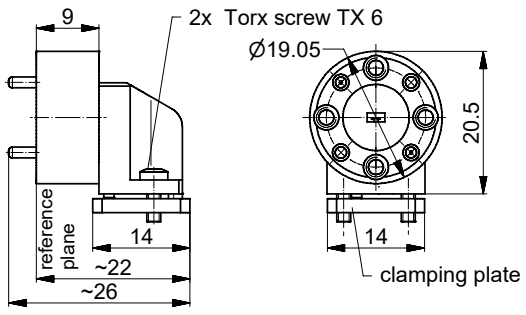
SPINNER EasyLaunch – Waveguide PCB Launch Connectors



Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 533413	R 620 (WR 15)	50 to 75 GHz	15 dB

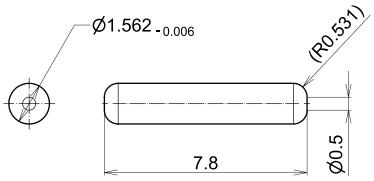


Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 533412	R 740 (WR 12)	60 to 90 GHz	12 dB

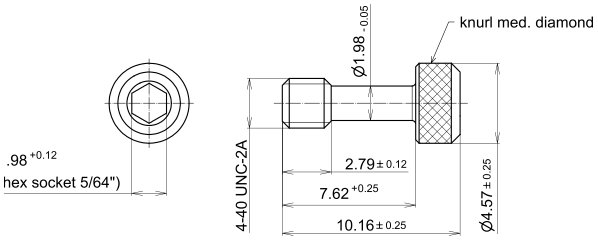


Part Number	Interface Type	Frequency Range	Return Loss, min.
BN 533411	R 900 (WR 15)	75 to 110 GHz	10 dB

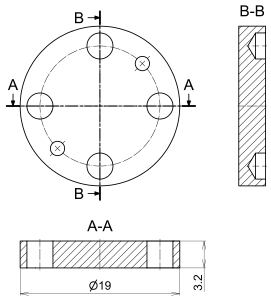
Accessories for Waveguide PCB Launch Connectors



Part Number	Description
A61785	Aligning pin



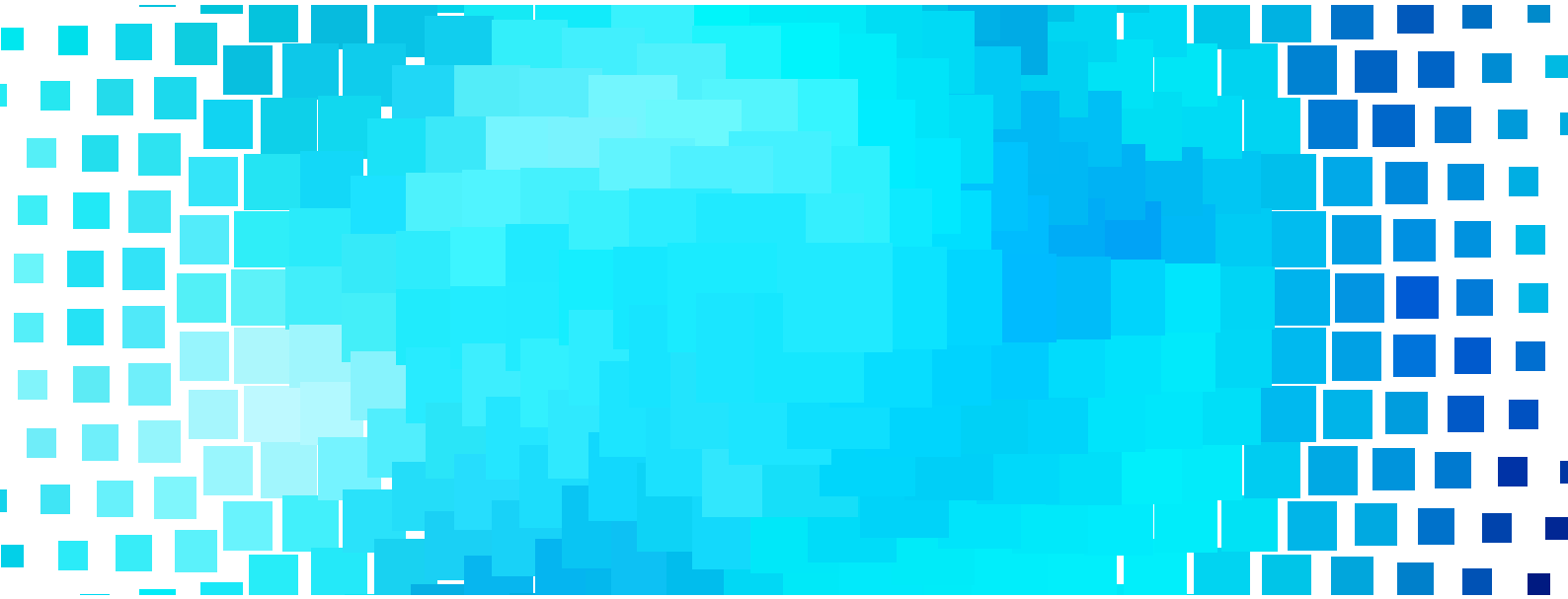
Part Number	Description
A61786	Socket-head cap screws 4-40 UNC



Part Number	Description
A62935	Protective cap

Part Number	Description
B25702	Panel fixture for PCB launch connector with waveguide interface

RF Rotary Joints for Measurement Tasks



SPINNER rotary joints excel with compact designs, excellent VSWR, low insertion losses, minimal fluctuation of transmission characteristics while rotating, and high crosstalk attenuation between individual channels across the entire range of frequencies used.

Noncontacting Rotary Joints

Noncontacting RF rotary joints (RJ) are available in **coaxial and waveguide designs for frequency ranges up to 100 GHz**. They are characterized by an especially long service life. Signal transmission is possible at a bandwidth of about 20% of the highest transmitted frequency.

Noncontacting rotary joints are used for **narrow-band transmission**. With special coupling structures, the same module can also be used to transmit two different frequency bands (e.g. the X and L bands).

Contacting Rotary Joints

In contacting rotary joints, the inner and outer conductors of the stator and rotor are DC-coupled.The maximum frequency depends on the diameter of the coaxial line. These coaxial rotary joints are used for **broadband applications**, allowing signal transmission in the frequency range from DC up to 120 GHz.

Interface Styles

The interfaces are available in I, U and L styles. These differ in the orientation of the input and output connections of a rotary joint (at the rotor and stator).

In the I style, both are aligned with the rotational axis, in the U style both are perpendicular to the rotational axis, and in the L style one is perpendicular to the axis while the other is aligned with it.

Application note:
Rotary Joints – Installations Guidelines

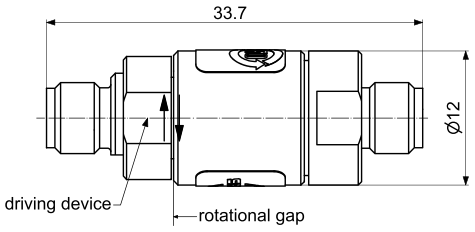
Low PIM Single-Channel Coaxial Rotary Joints

- No torsion on test cables
- Lowest intermodulation
- Contactless
- Guaranteed service life
- Enables top productivity in large-volume production
- Quick & reliable connection
- Guaranteed matings

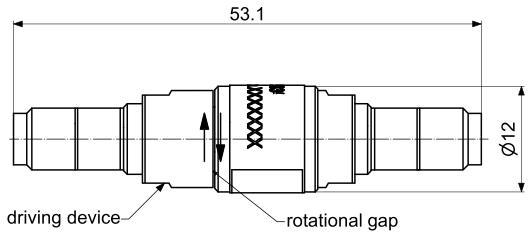
Part Number	BN 835089	BN 835103
Coaxial interface connector	7-16 male - female	4.3-10 screw male - female
Frequency range	0.69 to 0.96 GHz 1.71 to 2.69 GHz	
Peak power capability	6 kW	
Average power capability	300 W	
VSWR	Max. 1.16 @ 0.69 to 0.79 GHz Max. 1.10 @ 0.79 to 0.96 GHz Max. 1.10 @ 1.71 to 2.69 GHz	
VSWR variation over rotation	Max. 0.04 @ 0.69 to 0.79 GHz Max. 0.03 @ 0.79 to 0.96 GHz Max. 0.03 @ 1.71 to 2.69 GHz	
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤-165 dBc; typ. ≤-168 dBc	
Rotating speed	Max. 60 / nominal 30 rpm	
Life	Min. 5 x 10^6 revolutions	
Dimensions (L x D)	191.7 mm x 35 mm	
Weight	900 g	

View Video
PIM Test at SPINNER with Low PIM rotary joints

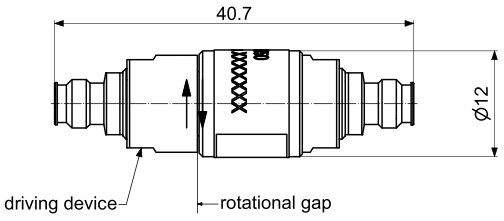
Single-Channel Coaxial Rotary Joints, I-Style



Part Number	Interface Type A	Interface Type B	Frequency Range	VSWR, max.
BN 835091	3.5 mm female	3.5 mm female	DC - 26.5 GHz	1.3 @ DC to 10 GHz 1.4 @ 10 to 18 GHz 1.7 @ 18 to 26.5 GHz

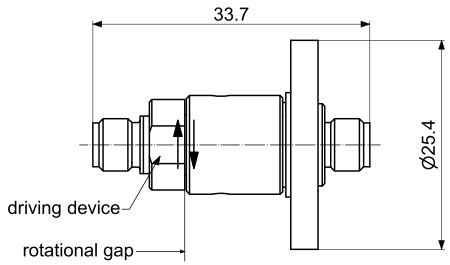


Part Number	Interface Type A	Interface Type B	Frequency Range	VSWR, max.
BN 835080	1.85 mm female	1.85 mm female	DC - 67 GHz	1.1 @ DC to 10 GHz 1.2 @ 10 to 26 GHz 1.3 @ 26 to 50 GHz 1.4 @ 50 to 67 GHz

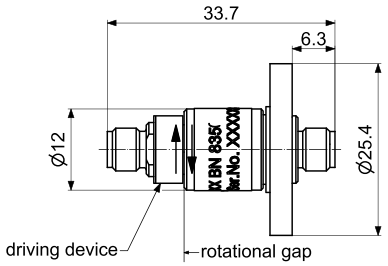


Part Number	Interface type A	Interface type B	Frequency Range	VSWR, max.
BN 835082	1.35 mm female	1.35 mm female	DC - 92 GHz	1.2 @ DC to 26.5 GHz 1.4 @ 26.5 to 70 GHz 1.6 @ 70 to 90 GHz

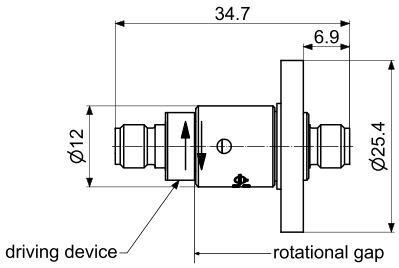
Single-Channel Coaxial Rotary Joints, I-Style, Flanged



Part Number	Interface Type A	Interface Type B	Frequency Range	VSWR, max.
BN 835047	SMA female	SMA female	DC - 18 GHz	1.3 @ DC to 10 GHz 1.4 @ 10 to 18 GHz

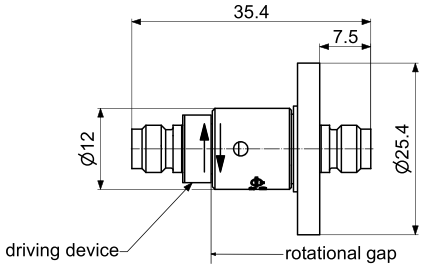


Part Number	Interface Type A	Interface Type B	Frequency Range	VSWR, max.
BN 835068	3.5 mm female	3.5 mm female	DC - 32 GHz	1.3 @ DC to 10 GHz 1.4 @ 10 to 18 GHz 1.7 @ 18 to 26.5 GHz

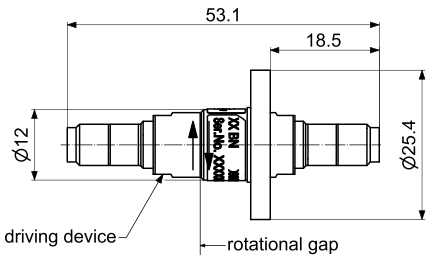


Part Number	Interface Type A	Interface Type B	Frequency Range	VSWR, max.
BN 835045	2.92 mm female	2.92 mm female	DC - 44 GHz	1.3 @ DC to 10 GHz 1.4 @ 10 to 18 GHz 1.7 @ 18 to 26.5 GHz 2.0 @ 26.5 to 44 GHz

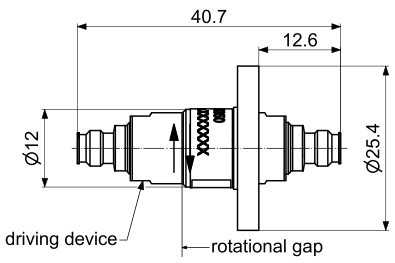
Single-Channel Coaxial Rotary Joints, I-Style, Flanged



Part Number	Interface Type A	Interface Type B	Frequency Range	VSWR, max.
BN 835077	2.4 mm female	2.4 mm female	DC - 50 GHz	1.3 @ DC to 10 GHz 1.4 @ 10 to 26.5 GHz 1.7 @ 26.5 to 50 GHz

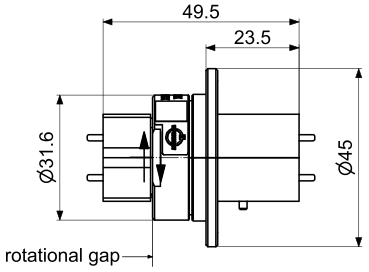


Part Number	Interface Type A	Interface Type B	Frequency Range	VSWR, max.
BN 835080C0001	1.85 mm female	1.85 mm female, with 3-hole flange	DC - 67 GHz	‘1.10 @ DC to 10 GHz ‘1.20 @ 10 to 26 GHz ‘1.30 @ 26 to 50 GHz ‘1.40 @ 50 to 67 GHz

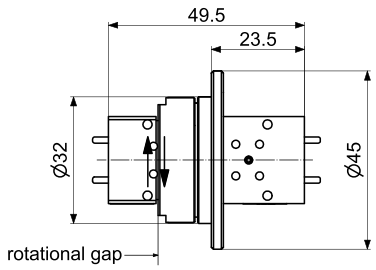


Part Number	Interface Type A	Interface Type B	Frequency Range	VSWR, max.
BN 835082C0001	1.35 mm female	1.35 mm female, with 3-hole flange	DC - 92 GHz	1.20 @ DC to 26.5 GHz 1.40 @ 26.5 to 70 GHz 1.60 @ 70 to 90 GHz

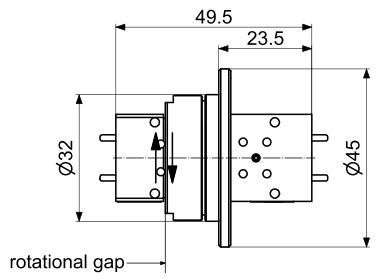
Single-Channel Rectangular Waveguide Rotary Joints, I-Style



Part Number	Interface type A	Interface type B	Frequency Range	VSWR, max.
BN 636281	WR 15 / R 620	WR 15 / R 620	50 – 75 GHz	1.8

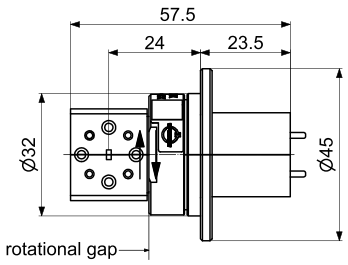


Part Number	Interface type A	Interface type B	Frequency Range	VSWR, max.
BN 636282	WR 12 / R 750	WR 12 / R 750	60 – 90 GHz	1.8



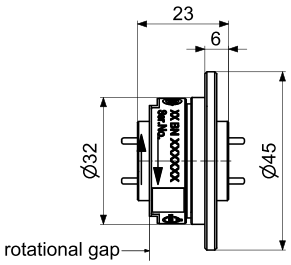
Part Number	Interface type A	Interface type B	Frequency Range	VSWR, max.
BN 636283	WR 10 / R 900	WR 10 / R 900	75 – 110 GHz	1.8

Single-Channel Rectangular Waveguide Rotary Joints, L-Style, Narrow Band

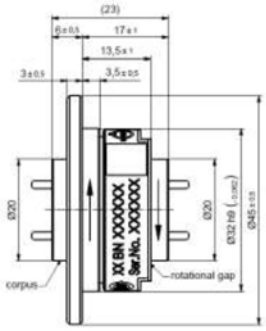


Part Number	Interface type A	Interface type B	Frequency Range	VSWR, max.
BN 636295	WR 10 / R 900	WR 10 / R 900	94 GHz	1.3 @ 94±1 GHz 1.5 @ 94±2 GHz 2.0 @ 94±3 GHz

Single-Channel Circular Waveguide Rotary Joints



Part Number	Interface type A	Interface type B	Frequency Range	VSWR, max.
BN 636214	WC 6.7	WC 6.7	73 - 110 GHz	1.2



Part Number	Interface type A	Interface type B	Frequency Range	VSWR, max.
BN 636210	WC 6.7	WC 6.7	110 - 210 GHz	1.2 @ 110 to 200 GHz 1.4 @ 200 to 210 GHz

Portable Load for Site & In-Building Testing

- For conventional mobile communication bands, new 5G bands, and PMR/TETRA
- 4.3-10 male and female ports
- 2 x 20 W
- -165 dBc typ.
- 380 – 3.800 MHz
- High mating cycles capability
- Convection cooled
- For indoor use
- Cylindrical, but can not roll away

Part Number	BN 157165
Coaxial interface connector	4.3-10 male & 4.3-10 female
Frequency range	0.38 to 3.8 GHz
VSWR	Max. 1.25
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤-160 dBc; typ. ≤-165 dBc
Average power capability	Max. 40 W (CW)*
Dimensions (L x W x H)	216 x 65 mm
Weight	≈ 1.0 kg

* Maximum surface temperature +90°C, test @ ambient temperature of +25°C

Laboratory Loads, Hand Held

- Lowest intermodulation
- Lead-free
- BeO-free
- Convection cooling
- For indoor use
- Hand held

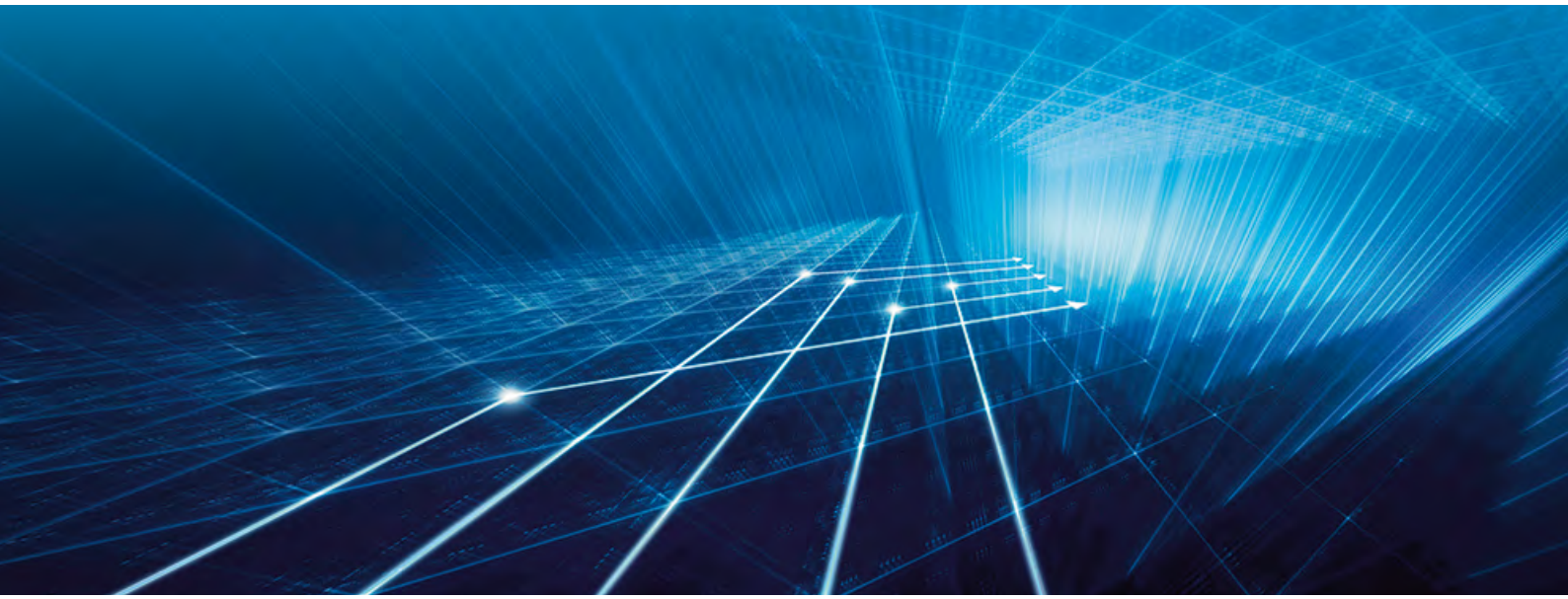
Part Number	BN 157157	BN 157151
Coaxial interface connector	7-16 female	4.3-10 female
Frequency range	0.25 to 3.8 GHz	
VSWR	Max. 1.20	
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤-165 dBc; typ. ≤-170 dBc	
Average power capability	Max. 50 W	
Dimensions (L x W x H)	150 mm x 91.5 mm x 219 mm	
Weight	≈ 3.0 kg	
Maximum surface temperature	50°C	

Laboratory Loads, Panel Mount

- Lowest intermodulation
- Lead-free
- BeO-free
- Convection cooling
- For indoor use
- Panel mount

Part Number	BN 157157C0001	BN 157151C0001
Coaxial interface connector	7-16 female	4.3-10 female
Frequency range	0.25 to 3.8 GHz	
VSWR	Max. 1.20	
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤-165 dBc; typ. ≤-170 dBc	
Average power capability	Max. 50 W	
Dimensions (L x W x H)	150 mm x 91.5 mm x 170 mm	
Weight	≈ 3.0 kg	
Maximum surface temperature	50°C	

Switches



Automate mobile radio antenna testing with SPINNER low-PIM switches for up to 6 GHz!

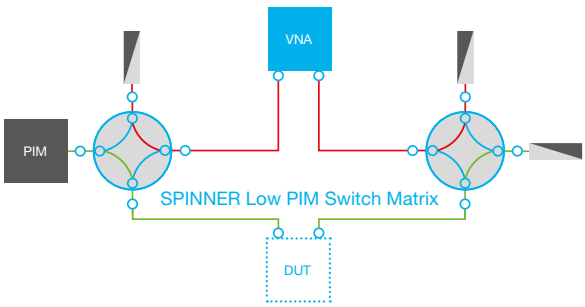
A surprisingly large share of low-PIM RF component testing is still done manually. But there is enormous potential for reducing both labor and costs.

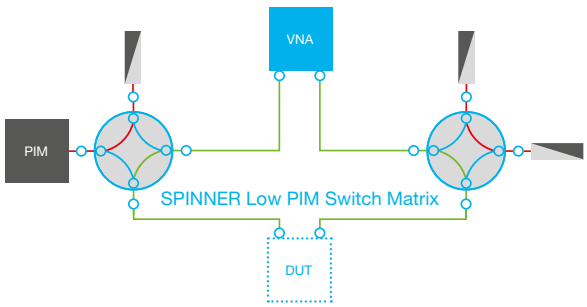
Although very similar approaches are taken for testing many products, many companies still aren't fully tapping the available possibilities for streamlining them. For example, almost all manufacturers still use mobile radio antennas and radio units to measure VSWR and PIM. The methods they work with are quite similar, but practically without exception they involve laboriously inserting individual devices and cables between the objects being tested and the measurement equipment.

The newly developed SPINNER low-PIM switch has great potential for boosting the efficiency of testing. Technically it's a double-pole, double-through (DPDT) crossover switch, also known as a switching matrix, with two inputs that are switched through to two outputs. It's excellently suited for measuring VSWR and PIM, since it eliminates the need to laboriously disconnect and reconnect the test setup for each object. Plus, if multiple adapters and lines have been used they can either be eliminated completely or deployed more efficiently elsewhere. After each measurement, it's only necessary to throw the switch to continue testing with different settings or devices. And if multiple tests need to be performed at the same time, a switching matrix can be assembled to operate several switches at once, depending on the required test path, and perform multiple measurements simultaneously.

These extremely low-PIM switches feature a service life of about 500,000 cycles and are specified for -165 dBc (typ. -170 dBc). They are available with 7-16 or 4.3-10 connectors for frequencies up to 3.8 GHz. We're now also offering a new version with 4.3-10 connectors for up to 6 GHz.

Tests have shown that costs can be slashed by up to 80% by using switches and switching matrices, depending on how they're configured.





Coaxial 2-Way Switch up to 3.8 GHz

- Lowest intermodulation
- Maximum phase and amplitude stability
- Fast switching
- Hot switching
- Guaranteed cycles
- Cascadable
- Suitable for calibrated setup

Part Number	BN 754081 7-16 female BN 754082 4.3-10 female	
Frequency range	0.69 to 2.69 GHz	3.4 to 3.8 GHz
Return loss	Min. 20 dB	Min. 20 dB
Isolation	Min. 55 dB	Min. 50 dB
Insertion loss	Max. 0.1 dB	Max. 0.1 dB
Average power capability	300 W	
Peak voltage	1 kV	
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤-165 dBc; typ. ≤-168 dBc	
Switching time	100 ms	
Switching frequency	Max. 30 operations per minute	
Service life	Min. 500,000 cycles	
Dimensions (L x W x H)	128.8 mm x 128.8 mm x 116.34 mm	
Weight	≈ 1.75 kg	

View Video
RF Test: Switching between VSWR and PIM using SPINNER‘s low PIM switch/EasyDock

Coaxial 2-Way Switch up to 6 GHz

- Lowest intermodulation
- Highest phase and amplitude stability
- Fast switching
- Hot switching
- Guaranteed cycles
- Cascadable
- Suitable for calibrated setup

Part Number	BN 754100 4.3-10 female		
Frequency range	0.617 to 2.69 GHz	3.4 to 4.2 GHz	5.15 to 5.925 GHz
Return loss	Min. 20 dB	Min. 20 dB	Min. 18 dB
Isolation	Min. 55 dB	Min. 35 dB	Min. 35 dB
Insertion loss	Max. 0.1 dB	Max. 0.1 dB	Max. 0.2 dB
Average power capability	300 W		
Peak voltage	1 kV		
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤-165 dBc; typ. ≤-168 dBc		
Switching time	100 ms		
Switching frequency	Max. 30 operations per minute		
Service life	Min. 500,000 cycles		
Dimensions (L x W x H)	128.8 mm x 128.8 mm x 116.34 mm		
Weight	≈ 1.75 kg		

Switching Matrix – Low IM, 8 In / 8 Out up to 3.8 GHz

Figure similar

- Contactless switching
- Lowest intermodulation
- Maximum phase and amplitude stability
- Fast switching
- Hot switching
- Guaranteed cycles
- Cascadable

Part Number	**On request**		
Interface type (16 connections)	4.3-10-f (50 Ω) per IEC 61169-54		
Characteristic impedance	50 Ω		
Frequency range	0.69 to 0.96 GHz	0.96 to 2.69 GHz	3.4 to 3.8 GHz
Return loss	Min. 13 dB	Min. 18 dB	Min. 16 dB
Return loss repeatability	Min. 40 dB		
Isolation	Min. 55 dB		
Insertion loss	Max. 0.7 dB	Max. 0.7 dB	Max. 0.9 dB
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤-155 dBc; typ. ≤-165 dBc		
Switching time	100 ms		
Switching frequency	Max. 30 operations per minute		
Life	Min. 500,000 cycles		
Dimensions (L x W x H)	666 mm x 482.6 mm x 443.7 mm		
Weight	≈ 40 kg		
Control interface	Controlled via USB Ethernet Other protocols on request		

More information available on request

Switching Matrix – Low IM, 8 In / 8 Out up to 6 GHz

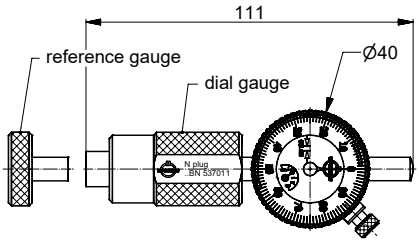
Figure similar

- Non-contact switching
- Lowest intermodulation
- Maximum phase- and amplitude stability
- Fast switching
- Hot switching
- Guaranteed cycles
- Cascadable

Part Number	**On request**		
Interface type (16 connections)	4.3-10-f (50 Ω) per IEC 61169-54		
Characteristic impedance	50 Ω		
Frequency range	0.671 to 2.69 GHz	3.4 to 4.2 GHz	5.15 to 5.925 GHz
Return loss	Min. 13 dB	Min. 18 dB	Min. 16 dB
Return loss repeatability	Min. 40 dB		
Isolation	Min. 55 dB		
Insertion loss	Max. 0.7 dB	Max. 0.7 dB	Max. 0.9 dB
Passive intermodulation (IM3) @ 2 x 20 W	Max. ≤-155 dBc; typ. ≤-165 dBc		
Switching time	100 ms		
Switching frequency	Max. 30 operations per minute		
Life	Min. 500,000 cycles		
Dimensions (L x W x H)	666 mm x 482.6 mm x 443.7 mm		
Weight	≈ 40 kg		
Control interface	Controlled via USB Ethernet Other protocols on request		

More information available on request

Dial Gauges



- Designed to properly gage the contact pin locations and pin depth of used Interfaces
- Marked tolerance limits for different connector grades
- Calibration standard to adjust to zero

Why use a gauge?

Proven RF measurement procedures require that all coaxial connectors on equipment, cables and terminations be routinely measured to detect mechanical tolerance variations that could affect electrical performance or damage the connector. When using coaxial cables, it is particularly important for them to be tested before use to ensure that the assembled connector conforms to the relevant mechanical specification limits. There is otherwise a risk of damage to the calibration components, which would in turn result in costly downtimes and repairs. Coaxial connectors should never be forced together when making a connection, since the apparent need to do so often indicates that they are defective, damaged, or incompatible.

Certain dimensions are critical for the mechanical integrity, non-destructive mating and electrical performance of the connector. The mating face is usually offset from the reference plane. This is done to reduce mechanical damage or isalignment when making connections.

On a SPINNER dial gauge, the tolerance limits for the various connector standards are color-coded on the dial. This makes a good/bad assessment of the gauge dimensions of precision connectors easy even without in-depth knowledge of the standard. A so-called reference gauge for monitoring and calibrating the dial gauge is included in the scope of delivery.

Part Number	Interface type	Gauge range	Scale marking	Measurement accuracy
BN 537015	7-16 male	5 mm	0.01 mm	0.005 mm
BN 537037	7-16 female			
BN 533315	4.3-10 male, inner conductor			
BN 533317	4.3-10 female, inner conductor			
BN 533318	4.3-10 female, outer conductor			
BN 537022	4.1-9.5 male			
BN 537023	4.1-9.5 female			
BN 537011	Type N 50 Ohm male			
BN 537013	Type N 50 Ohm female			
BN 537074	3.5 mm male	1 mm	0.001 mm	0.003 mm
BN 537075	3.5 mm female			
BN 537081	2.92 mm male			
BN 537082	2.92 mm female			
BN 537078	3.5 mm male			
BN 537079	3.5 mm female			
BN 537083	2.92 mm male	0.1 mm		
BN 537084	2.92 mm female			
BN 534940	1.35 mm male			
BN 534941	1.35 mm female			

Torque Wrenches

Properly tightening connectors improves every calibration and subsequent measurement.

- Preset with the precise torque needed for 1.35 mm, 1.85 mm, 2.4 mm, 2.92 mm, 3.5 mm and Type N Interfaces
- 8 mm version with soft pads on spanner flats avoiding scratches on precision connector surfaces
- Additional open-ended wrench included in set BN 238741

Why use a torque wrench?

RF torque wrenches are designed to help prevent excessive tightening of the coupling nut of the sensitive coaxial precision connectors. The international standards specify a maximum tightening torque for each precision connector size, which must not be exceeded. These torque values differ considerably from those of the standard connectors. The user must therefore ensure that the correct torque value is applied to the connector.

SPINNER torque wrenches for precision connectors are therefore already preset to the correct torque.
However, this alone is not enough for torque-controlled screwing with high accuracy. Even when using a torque wrench, both sides of the connector can be damaged if, for example, the connector covered by the coupling nut rotates unintentionally. To prevent this, the connector should be additionally held in its initial position with a simple open-ended wrench.

When the set torque value is reached, this is indicated by a clearly audible clicking of the torque wrench.
From this point on, no further force should be applied.
It is also not necessary to repeat the tightening process.
Torque wrenches for precision applications should be checked or calibrated regularly. An interval of 12 months is recommended. This service can be requested from our aftersales service center.

Part Number	Interface type	Frequency range	Return Loss, min.
BN 537091R000	Type N	19 mm	0.9 N·m
BN 154141R000	1.85 mm – 3.5 m	8 mm	0.9 N·m
BN 238741	1.35 mm, 1.85 mm, 2.4 mm, 2.92 mm, 3.5 mm	8 mm, softpads, storage box, with counterholder wrench	0.9 N·m
BN 238740C0001	4.3-10 – 4.1-9.5	22 mm	2.5 N·m
BN 238743C0001	NEX10®	11 mm	1.5 N·m

Accessories for Torque Wrenches

Part Number	Description
A45535	Spare soft pads for torque Wrench BN 238741

Notes

Index

HIGH FREQUENCY PERFORMANCE WORLDWIDE

SPINNER designs and builds cutting-edge radio frequency systems, setting performance and longevity standards for others to follow. The company's track record of innovation dates back to 1946, and many of today's mainstream products are rooted in SPINNER inventions.

Industry leaders continue to count on SPINNER's engineering excellence to drive down their costs of service and ownership with premium-quality, off-the-shelf products and custom solutions. Headquartered in Munich, Germany, the global frontrunner in RF components remains the first choice in simple-yet-smart RF solutions.

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