SPINNER
Test & Measurement

PIM Testing Portfolio

LOW PIM

HIGH FREQUENCY PERFORMANCE WORLDWIDE
www.spinner-group.com

SPINNER

Content

Content 2

Minimizing PIM for Over 25 Years 3

Low PIM Product Range 4
Passive Intermodulation Reference Standards 5
Low PIM Cable Assemblies 7
Low PIM Measurement Cable Assemblies – Sales Article Number 8
Rotary Joints 9
SPINNER EasyDock 10
SPINNER EasyDock 11
Coaxial 2-Way Switch up to 3.8 GHz 12
Coaxial 2-Way Switch up to 6 GHz 13
Switching Matrix: Low IM, 8 In / 8 Out up to 3.8 GHz 14
Switching Matrix: Low IM, 8 In / 8 Out up to 6 GHz 15
Laboratory Loads, Hand-Held 16
Laboratory Loads, Panel Mount 17
Portable Load for site & in-building testing 18
Push-Pull Adapters 19
Port Savers 20
Within-Type Adapters 21
Inter-Type Adapters 7-16 to 4.3-10 22
Inter-Type Adapters 7-16 to 2.2-5 23
Inter-Type Adapters 7-16 to NEX10® 24
Inter-Type Adapters 4.3-10 to 2.2-5 25
Inter-Type Adapters 4.3-10 to NEX10® 25
Preventing PIM – Precise Mating 26
Dial Gauges 27
Torque Wrenches 27

Index 28

Minimizing PIM for over 25 Years

SPINNER has been optimizing infrastructure components for mobile communication applications since the advent of the mobile communication industry. As a technology leader in this field, we know that one of the most important and challenging goals is to achieve extremely low 3rd order intermodulation 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. If 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.

SPINNER was the first vendor to recognize the potential risks of PIM, and has been warning customers of them since the early days of mobile communication systems. Current mobile networks based on different technologies utilize multiple frequency bands in parallel to maximize the use of available spectrum. However, this makes it more important than ever to minimize PIM. Today's carriers are aware of the impact that PIM has on the performance of their networks and insist that it be as low as possible.

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. 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. Of course, while this is enough for many applications, some situation require even better performance. And accurately measuring PIM is one of the greatest challenges.

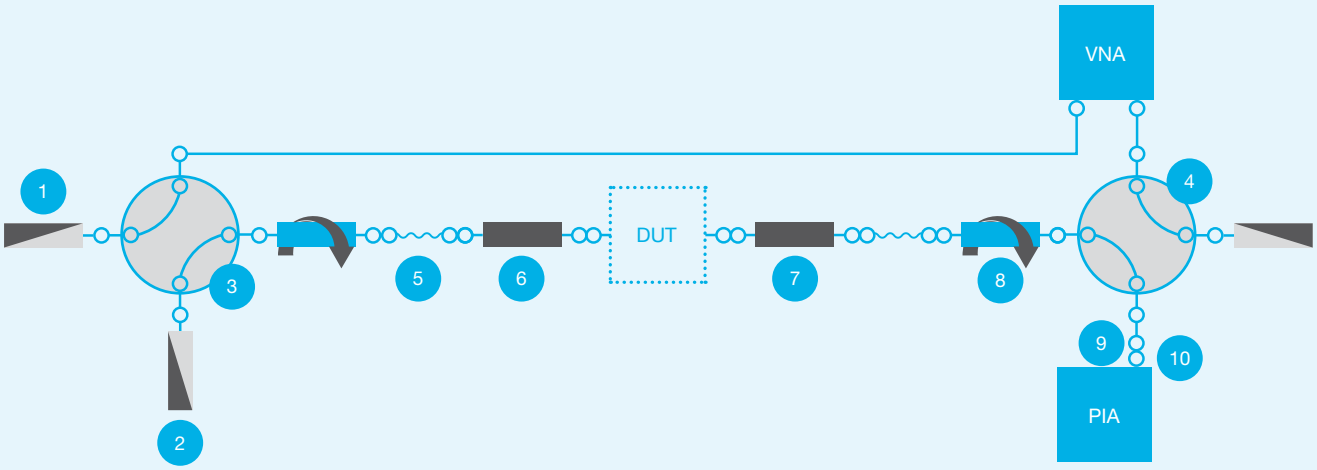
Measuring the PIM properties of a component or system requires a measuring environment of sufficiently higher precision than the device under test. When we discovered that no equipment was available with the high precision we wanted, we decided to develop our own.

Over the years, we have developed a large portfolio of specialized equipment with outstandingly low PIM for testing and measurement. Nothing comparable is available anywhere else. It includes self-aligning connectors, diplexers, rotary joints, loads, switch matrices, reference standards and more. We provide these products for hand-operated on-site testers and fully automated test systems in manufacturing environments to boost productivity while ensuring the highest standards of quality.

The following pages present a sampling of our large low PIM test and measurement portfolio, concentrating on the 7-16, 4.3-10, 2.2-5 and NEX10® connector systems.

Please let us know your requirements!

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 Reference Standards

10 Port Savers

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.					
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 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.						
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 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

Low PIM Measurement Cable Assemblies

Spinner Flex® TopFit SF 3/8” and SF 1/2“

- 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 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 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

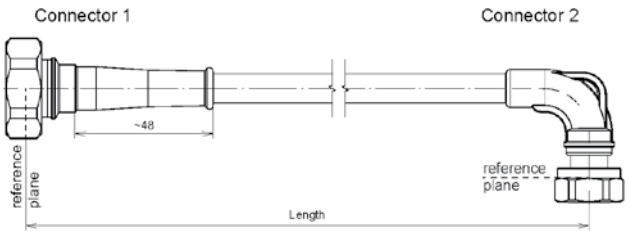
[1)] The provided VSWR values are maintained within all global cellular frequency bands.

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-I3: 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.

Rotary Joints

Eliminating Torsional Forces

- No torsion on test cables
- Lowest intermodulation
- Contactless
- Guaranteed service life

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	

More information:

BN 835089

BN 835103

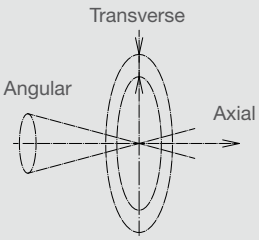
View Video
PIM Test at SPINNER with Low PIM rotary joints

SPINNER EasyDocks

Jig Operated Test Applications in Production Lines

- For jig automated coupling movements to multiple DUT ports
- Lowest intermodulation
- Self-aligning
- Non-locking
- Enables top productivity in large-volume production
- Quick & reliable connection
- 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.

More information:

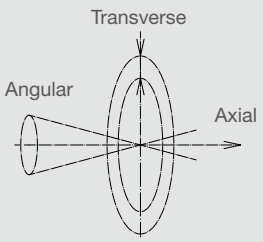
BN 293809 | BN 293810 | BN 194476 | BN 432014

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

SPINNER EasyDocks

Robotic Operated Test Applications in Production Lines

- For robotic based coupling movements to DUT
- Pick & connect – suitable for 2-jaw gripper
- Lowest intermodulation
- 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 Axial Angular (at minimum stroke of 1.5 mm)	 ±1.5 mm 6 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

More information:

BN 293820 | BN 194482C0002 | BN 432047C0002

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	

More information:

BN 754081

BN 754082

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		

More information:

BN 754100

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

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

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 180 mm	
Weight	≈ 3.0 kg	
Maximum surface temperature	50°C	

More information:

BN 157157

BN 157151

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	

BN 157157C0001

BN 157151C0001

Portable Load for site & in-building testing

- For conventional mobile communic. 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 mm x 65 mm	
Weight	≈ 1.0 kg	

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

More information:

BN 157165

Push-Pull-Adapters

Quick Connector as Cable Port Saver

- For port or connector saving tasks
- Lowest intermodulation
- Lockable
- Unlockable in jig via automated handling
- Quick & reliable connection
- Extremely compact
- Save time – easy latching
- 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.

More information:

BN 432051

Port Savers

Protects Damageable PIM Test Equipment

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

More information:

BN 756404

BN 432017

Within-Type Adapters

- For test & 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

More information:

BN 432029 | BN 432049 | BN 432019 | BN 393370 | BN 196400

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		4.3-10 female	4.3-10 male		4.3-10 female
		push-pull	screw		push-pull	screw	
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					

More information:

BN 432008 | BN 432005 | BN 432001 | BN 432016 | BN 432002 | BN 432011

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			

More information:

BN 225002 BN 225003 BN 225006 BN 225008

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 6 GHz			
Passive intermodulation (IM3) @ 2 x 20 W		Max. ≤-165 dBc			
Weight		≈ 70 g			

More information:

BN 227000 | BN 227001 | BN 227002 | BN 227003

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			

More information:

BN 225009 | BN 225010 | BN 225012 | BN 225013

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. 1.12 @ 4 to 6 GHz			
Passive intermodulation (IM3) @ 2 x 20 W		Max. ≤-165 dBc			

More information:

BN 432068 | BN 432069 | BN 432070 | BN 432071

Preventing PIM – Precise Mating

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.

Best Practices

- Avoid all damage and contamination that may affect PIM values.
- Make sure that all RF-relevant electrical connections used for PIM measurement are 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 to the right torque as given in the installation instructions. This will help minimize PIM.

Dial Gauges

Ensures Precise Mating of Every PIM Test Setup Component

- Designed to properly gauge the contact pin locations and pin depth of the connectors used
- Marked tolerance limits for different connector grades
- Calibration standard for zero reset

Part Number	BN 537037	BN 533315	BN 533317	BN 533318
Coaxial interface connector	7-16 female	4.3-10 female inner conductor	4.3-10 female inner conductor	4.3-10 female outer conductor
Accuracy level	Grade 0			
Tolerance range	0.08 mm	0.1 mm		
Pin offset	5.28 to 5.36 mm	2.9 to 2.8 mm		3.1 to 3.2 mm
Gauge range	5 mm			
Scale marking	0.01 mm			
Measurement accuracy	0.005 mm			

More information:

BN 537037 | BN 533315 | BN 533317 | BN 533318

Torque Wrenches

Properly Tightening Connectors Improves the Reliability of PIM Measurements

- Preset to the precise torque needed for 4.3-10 and 7-16 connectors

Part Number	BN 238736	BN 238740C0001
Coaxial interface connector	7-16 male	4.3-10 male
Wrench size	32 mm	22 mm
Preset torque	30 Nm +2.71/-0	2.5 Nm +0.226/-0

More information:

BN 238736 | BN 2387430c0001

Index

Part Number	Page
BN 157151	16
BN 157151C0001	17
BN 157157	16
BN 157157C0001	17
BN 157165	18
BN 194476	10
BN 194482C0002	11
BN 196400	21
BN 225002	23
BN 225003	23
BN 225006	23
BN 225008	23
BN 225009	25
BN 225010	25
BN 225012	25
BN 225013	25
BN 227000	24
BN 227001	24
BN 227002	24
BN 227003	24
BN 238736	27
BN 238740C0001	27
BN 293809	10
BN 293810	10
BN 293820	11
BN 393370	21
BN 432001	22
BN 432002	22
BN 432005	22
BN 432008	22
BN 432011	22
BN 432014	10
BN 432016	22
BN 432017	20
BN 432019	21
BN 432029	21
BN 432047C0002	11
BN 432049	21
BN 432051	19
BN 533315	27
BN 533317	27
BN 533318	27
BN 537037	27
BN 754081	12
BN 754082	12
BN 754100	13
BN 756404	20
BN 756616C0070	5
BN 756616C0080	5
BN 756616C0090	5
BN 756616C0100	5
BN 756616C0110	5
BN 756616C0120	5
BN 756616C1070	5
BN 756616C1080	5
BN 756616C1090	5
BN 756616C1100	5
BN 756616C1110	5
BN 756616C1120	5
BN 756616C2070	5
BN 756616C2080	5
BN 756616C2090	5
BN 756616C2100	5

Part Number	Page
BN 756616C2110	5
BN 756616C2120	5
BN 756616C3070	5
BN 756616C3080	5
BN 756616C3090	5
BN 756616C3100	5
BN 756616C3110	5
BN 756616C3120	5
BN 756617C0070	5
BN 756617C0080	5
BN 756617C0090	5
BN 756617C0100	5
BN 756617C0110	5
BN 756617C0120	5
BN 756617C1070	5
BN 756617C1080	5
BN 756617C1090	5
BN 756617C1100	5
BN 756617C1110	5
BN 756617C1120	5
BN 756617C2070	5
BN 756617C2080	5
BN 756617C2090	5
BN 756617C2100	5
BN 756617C2110	5
BN 756617C2120	5
BN 756617C3070	5
BN 756617C3080	5
BN 756617C3090	5
BN 756617C3100	5
BN 756617C3110	5
BN 756617C3120	5
BN 756618C0070	6
BN 756618C0080	6
BN 756618C0090	6
BN 756618C0100	6
BN 756618C0110	6
BN 756618C0120	6
BN 756618C1070	6
BN 756618C1080	6
BN 756618C1090	6
BN 756618C1100	6
BN 756618C1110	6
BN 756618C1120	6
BN 756618C2070	6
BN 756618C2080	6
BN 756618C2090	6
BN 756618C2100	6
BN 756618C2110	6
BN 756618C2120	6
BN 756618C3070	6
BN 756618C3080	6
BN 756618C3090	6
BN 756618C3100	6
BN 756618C3110	6
BN 756618C3120	6
BN 835089	9
BN 835103	9
Low PIM Cable SF 3/8“	7
Low PIM Cable SF 1/2“	7

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.

www.spinner-group.com

SPINNER GmbH
Headquarters
Erzgiessereistr. 33
80335 Munich
GERMANY
Phone: +49 89 12601-0
info@spinner-group.com

SPINNER Austria GmbH
Modecenterstraße 22/C38
1030 Vienna
AUSTRIA
Phone: +43 1 66277 51
info-austria@spinner-group.com

SPINNER Electrotécnica S.L.
c/ Perú, 4 – Local n° 15
28230 Las Rozas (Madrid)
SPAIN
Phone: +34 91 6305 842
info-iberia@spinner-group.com

OOO SPINNER Elektrotechnik
Kozhevnicheskaja str. 1, bld. 1
Office 420
115114 Moscow
RUSSIA
Phone: + 7 495 638 5321
info-russia@spinner-group.com

SPINNER France S.A.R.L.
24 Rue Albert Priolet
78100 St. Germain en Laye
FRANCE
Phone: +33 1 74 13 85 24
info-france@spinner-group.com

SPINNER ICT Inc.
2220 Northmont Parkway, 250
Duluth, GA 30096
USA
Phone: +1 770 2636 326
info@spinner-group.com

SPINNER Nordic AB
Kråketorpsgatan 20
43153 Mölndal
SWEDEN
Phone: +46 31 7061670
info-nordic@spinner-group.com

SPINNER Telecommunication
Devices (Shanghai) Co., Ltd.
351 Lian Yang Road
Songjiang Industrial Zone
Shanghai 201613
P.R. CHINA
Phone: +86 21 577 45377
info-china@spinner-group.com

SPINNER UK Ltd.
Suite 8 Phoenix House
Golborne Enterprise Park,
High Street
Golborne, Warrington
WA3 3DP
UNITED KINGDOM
Phone: +44 1942 275222
info-uk@spinner-group.com

2.5/TM/01.2022