

# RF Accessories



For Complete Measurement Solutions

# RF Accessories

In an effort to provide complete measurement solutions to our customers, Focus Microwaves has developed, over time, customized accessories, which will make sure a load pull or noise test system will operate as expected.

Tuner based measurements differ fundamentally from other microwave testing, because the devices operate under non-50 Ohm environment.

VNA calibrations are therefore extremely important and, to our experience, TRL (Thru-Reflect-Line) is the best method to use, at least above 3GHz. We have therefore developed a family of TRL calibration kits.

Since load pull is a lengthy test procedure, on the same device, we opted for a manual, instead of an automatic probe station (LPPS).

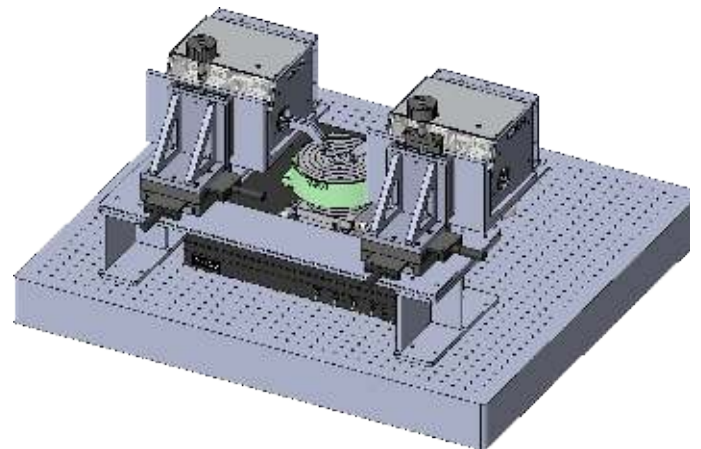


Power Test Jig

## Load Pull Probe Station Solutions (LPPS)

Conventional wafer probe stations are not designed to support large and heavy (up to 50kg) mechanical tuners. Focus has, therefore developed manual probe stations, designed to support tuners. A number of customized designs are available under the brand name LPPS (Load Pull Probe Station). The stations comprise an optical table, operation platen, microscope and video-feed and heavy duty customized high precision 3 axis tuner positioners.

LPPS can be customized for all Focus tuners and its components can be adapted to existing commercial probe stations to allow tuner operations. Balancing kits, external or integrated in the tuners, allow for extreme mechanical stability during tuner wafer probing operation, even if the tuners are connected with the wafer probes using low loss rigid airlines (bend-lines) instead of lossy flexible cables.



LPPS



## VNA Calkits

Tuner calibration is a difficult task for Network Analyzers. Due to high reflection and low loss, tuner S-parameter measurements represent a challenge for VNA's, because of error term determination and coupler directivity. Long experience has taught us not to rely on other calibration techniques than TRL (Thru-Reflect-Line). The popular SOLT technique is conditionally useable. The much convenient ECal method has provided questionable and inconsistent results. Our customers are advised to be very careful with VNA calibrations, because the whole measured data depends on that.



Because of this, and to save our customers time and doubt, Focus has developed and offers a set of precision and reliable TRL calibration kits from 0.03 to 110 GHz with the following connector types: 7/16, N, APC-7, 3.5mm, 2.9mm, 2.4mm, 1.9mm, WR-15, WR-10. Our calibration kits are compatible with all commercial network analyzers.

## Bias-Tees

Auriga Bias Tees balance impressive RF performance with heavy-duty power handling across multiple frequency bands ranging from 100 MHz to 40 GHz. They are designed for rigorous usage without sacrificing RF performance. Only the highest-quality materials are used to minimize signal loss and enable efficient heat removal.



The highest-power bias tees include a fast-acting fuse to protect DUTs against current spikes. A DC sense port is provided for accurately measuring the incident DC voltage. Bias tees requiring external heat sinking include pre-tapped holes for easy mounting.

## Transistor Fixtures

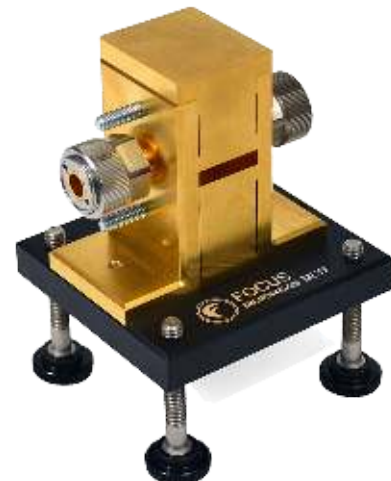
Focus' modular microstrip, high power and ultra low loss coaxial fixtures are designed mainly for load pull testing of packaged transistors. All Focus test fixtures come with TRL calibration standards and support most transistor packages sized from less than 0.1" and up to 1" wide.

Special designs include:

- Decade wide (Fmax:Fmin ~10:1) Klopfenstein transformers
- Water and Air cooling and on-substrate bias networks.
- Microstrip fixtures (PTJ-x\*; Packaged Test Jig) are available with 50Ω lines or built-in  $\lambda/4$  or taper (Klopfenstein) transformers, harmonic traps and DC bias networks
- Minimum Loss coaxial Test Fixtures (MLTF-x\*) (insertion loss < 0.03 dB at 2 GHz) are available with 7mm, N and 7/16 connectors in frequency ranges up to 18 GHz. (US patent 6,464,513).

Both fixture types can be fitted with water cooling for RF power up to several hundred Watts.

(\*) '-x' indicates the frequency range: DC-4GHz, -6GHz, -12GHz and -18GHz.



MLTF

# Accessories Specifications

## VNA TRL Calkits

| Model             | Connector   | Description   |
|-------------------|-------------|---------------|
| GPC-7/16-TRL-CV   | 7/16        | up to 6.5 GHz |
| GPC-7-TRL-CV      | 7mm         | up to 18 GHz  |
| GPC-N-TRL-CV      | N Type      | up to 18 GHz  |
| GPC-3.5-TRL-CV    | 3.5 mm      | 0.1 to 35 GHz |
| GPC-2.9-TRL-CV    | 2.9 mm (K®) | 0.1 to 40 GHz |
| GPC-2.4-TRL-CV    | 2.4 mm      | 0.1 to 50 GHz |
| GPC-1.85-V-TRL-CV | 1.85 mm (V) | 0.1 to 65 GHz |
| GPC-WR22-TRL-CV   | WR-22       | 33 - 50 GHz   |
| GPC-WR15-TRL-CV   | WR-15       | 50 - 75 GHz   |
| GPC-WR10-TRL-CV   | WR-10       | 75 - 110 GHz  |

## Mesuro Phase Reference

| Model | Frequency        | Connector |
|-------|------------------|-----------|
| PR67  | 100 MHz - 67 GHz | 1.85 mm   |
| PR50  | 100 MHz - 50 GHz | 2.4 mm    |
| PR30  | 100 MHz - 30 GHz | 3.5 mm    |
| PR18  | 100 MHz - 18 GHz | 3.5 mm    |
| PR8   | 100 MHz - 8 GHz  | 3.5 mm    |



## Test Fixtures

### Modular RF Power Transistor Test Fixture

| Model    | Connector                                   | Description                          |
|----------|---|--------------------------------------|
| PTJ-S    | 7/16, N, 7mm, SMA, (2.9,3.5 adapter option) | DC-4 GHz, TRL Calibration standards  |
| PTJ-C    | 7/16, N, 7mm, SMA, (2.9,3.5 adapter option) | DC-6 GHz, TRL Calibration standards  |
| PTJ-X    | 7/16, N, 7mm, SMA, (2.9,3.5 adapter option) | DC-12 GHz, TRL Calibration standards |
| PTJ-Ku   | 7/16, N, 7mm, SMA, (2.9,3.5 adapter option) | DC-18 GHz, TRL Calibration standards |
| PTJ-Ka   | 7/16, N, 7mm, SMA, (2.9,3.5 adapter option) | DC-26 GHz, TRL Calibration standards |
| PTJ-Klop | 7/16, N, 7mm, SMA, (2.9,3.5 adapter option) | Klopfenstein, custom design          |



### Add-On Options

| Model     | Description                                 |
|-----------|---|
| TRINW     | Transistor Insert with water cooling option |
| WCP       | Water cooling pump for water cooling option |
| XDEL      | Extra delay line, standard                  |
| XTRIN     | Extra Transistor Insert, Standard           |
| XTRFS     | Extra Transistor Substrate, Custom          |
| XTRFS-CUS | Extra Transformer Substrate, Custom         |
| XTRCLP    | Extra Transistor Clamp, flush mount         |

## Bias-Tees

| Model        | Min Freq | Max Freq | Max Current (A) | RF Power (W) | Voltage (V) | Typ. Ins. Loss (dB) | Connector Type |
|--------------|----------|----------|-----------------|--------------|-------------|---------------------|----------------|
| BT0480-50-P  | 0.4 GHz  | 8.0 GHz  | 2               | 50           | 50          | 1.2                 | 2.92 mm (m-f)  |
| BT0780-150-P | 0.7 GHz  | 8.0 GHz  | 3               | 150          | 200         | 1.5                 | Type N (m-f)   |
| BT2080-100-P | 2.0 GHz  | 8.0 GHz  | 10              | 100          | 100         | 1.7                 | Type N (m-f)   |
| BT0110-50-P  | 0.1 GHz  | 10 GHz   | 3               | 50           | 100         | 1.8                 | 2.92 mm (m-f)  |
| BT0710-50-P  | 0.7 GHz  | 10 GHz   | 3               | 50           | 100         | 1.8                 | 2.92 mm (m-f)  |
| BT0118-10-P  | 0.1 GHz  | 18 GHz   | 2               | 10           | 50          | 1.5                 | 2.92 mm (m-f)  |
| BT1018-50-P  | 1.0 GHz  | 18 GHz   | 1               | 50           | 50          | 2                   | 2.92 mm (m-f)  |
| BT2018-50-P  | 2.0 GHz  | 18 GHz   | 2               | 50           | 50          | 1.8                 | 2.92 mm (m-f)  |
| BT0118-1-N   | 0.1 GHz  | 18 GHz   | 1               | 1            | 50          | 1.5                 | 2.92 mm (m-f)  |
| BT0126-1-N   | 0.1 GHz  | 26.5 GHz | 1               | 1            | 50          | 2.2                 | 2.92 mm (m-f)  |
| BT1026-10-P  | 1.0 GHz  | 26.5 GHz | 2               | 10           | 50          | 2                   | 2.92 mm (m-f)  |
| BT1026-1-P   | 1.0 GHz  | 26.5 GHz | 2               | 1            | 150         | 2.2                 | 2.92 mm (m-f)  |
| BT0140-1-N   | 0.1 GHz  | 40 GHz   | 1               | 1            | 50          | 2.5                 | 2.92 mm (m-f)  |
| BT1040-12-P  | 1.0 GHz  | 40 GHz   | 2               | 12           | 50          | 2.5                 | 2.92 mm (m-f)  |
| BT0150-1-N   | 0.1 GHz  | 50 GHz   | 1               | 1            | 50          | 2                   | 2.4mm (m-f)    |
| BT0150-12-P  | 0.1 GHz  | 50 GHz   | 1               | 12           | 50          | 2                   | 2.4mm (m-f)    |
| BT0167-1-N   | 0.1 GHz  | 67 GHz   | 1               | 1            | 50          | 3.2                 | 1.85mm (m-f)   |
| BT0167-12-P  | 0.1 GHz  | 67 GHz   | 1               | 12           | 50          | 3.2                 | 1.85mm (m-f)   |

P for Pulsed Applications      N for Noise Measurements