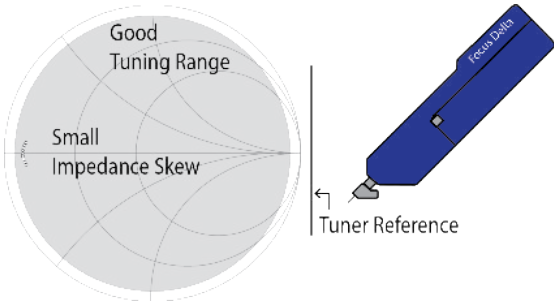
Focus Tech Tips Featuring MPI CORPORATION

Issues we are trying to solve:

Tuning range and impedance skew

Load pull users are far too familiar with the effects of cable and probe loss on tuning range when using passive tuners. The more modern communications standards now require much more modulation bandwidth adding reduced impedance skew as a new technical challenge to overcome. Luckily Focus Microwaves has addressed both these issues with the DELTA tuners.

Focus Microwaves' DELTA series of electro-mechanical tuners is designed specifically for high frequency on wafer measurements. The tuner's low profile allows it to be placed within the wafer perimeter and allows for a direct connection between the probe tip and the tuner, eliminating most insertion loss between the DUT and the tuner. This revolutionary new tuner design enables the engineer to achieve optimum tuning range and minimal impedance skew, with a tuner whose footprint and weight has been dramatically reduced.



Contribution from key partner: MPI CORPORATION

TITAN™ probes realize a unique combination of the micro-coaxial cable based probe technology and MEMS fabricated probe tip. A perfectly matched characteristic impedance of the coplanar probe tips and optimized signal transmission across the entire probe down to the pads of the device utnder test (DUT) result in excellent probe electrical characteristics.

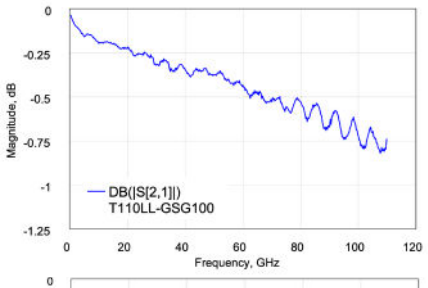
At the same time, the unique design of the probe tip provides minimal probe forward skate on any type of pad metallization material, therefore achieving accurate and repeatable measurement up to 110 GHz.

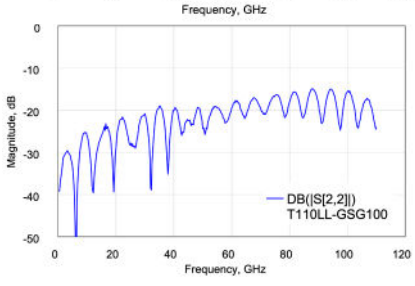
MPI T110LL
110GHz Low Loss Probe

Importance of Insertion Loss and Return Loss

Insertion loss has a direct effect on tuning range and user try to find the lowest loss probe to address this issue as the tuning range will be directly proportional to the loss introduced between the tuner and the measurement reference plane.

Return loss is also a very important parameter as it is deceptive in a sense because you can have a very low loss probe, but if the return loss is poor the the impedance plane will be shifted as if the poor return loss acts as a prematch and shift the tuning coverage to one side of the smith chart. In the case of the TITAN Probes 110 GHz Low Loss model we see best in class insertion loss as well as return loss making it ideal for load pull and noise measurements.





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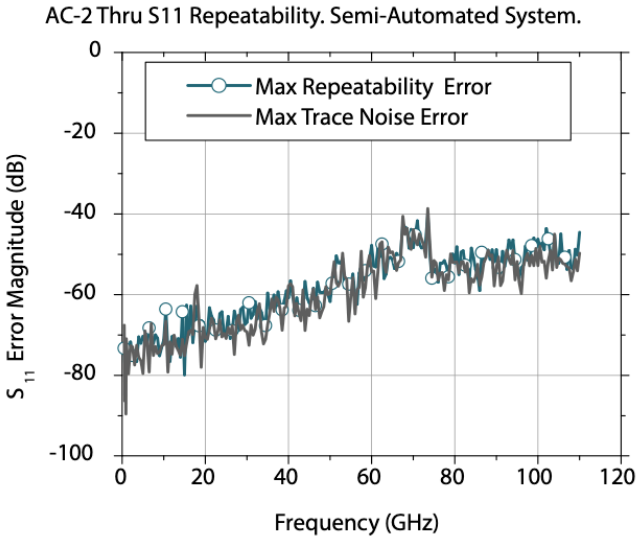
Stable and Repeatable Contact

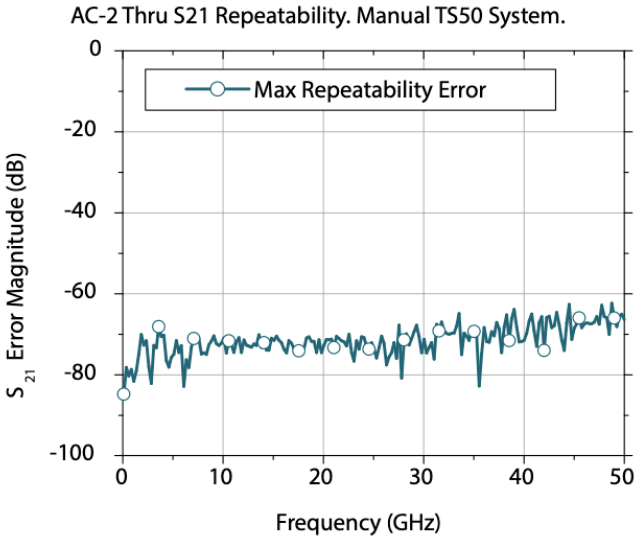
Load Pull requires very reliable and stable contact as the user needs to calibrate the tuners, perform many measurements for a great number of impedances. If the contact changes or degrades in time this will greatly affect the overall performance of the system. The accuracy of the calibration and measurement is directly associated to the quality of the contact throughout the calibration and measurement

A poor contact will result in the following:

- Inaccuracies in the on-wafer s-parameter calibration
- Errors in the tuner characterization
- False optimums for key RF parameters
- Expensive additional iteration in the final design stage
- Damaged probes caused by overdriven contact

Another advantage of the TITAN Probes is its superior contact repeatability, which is comparable with the entire system trace noise when measured on the semi-automated system and on gold contact pads.



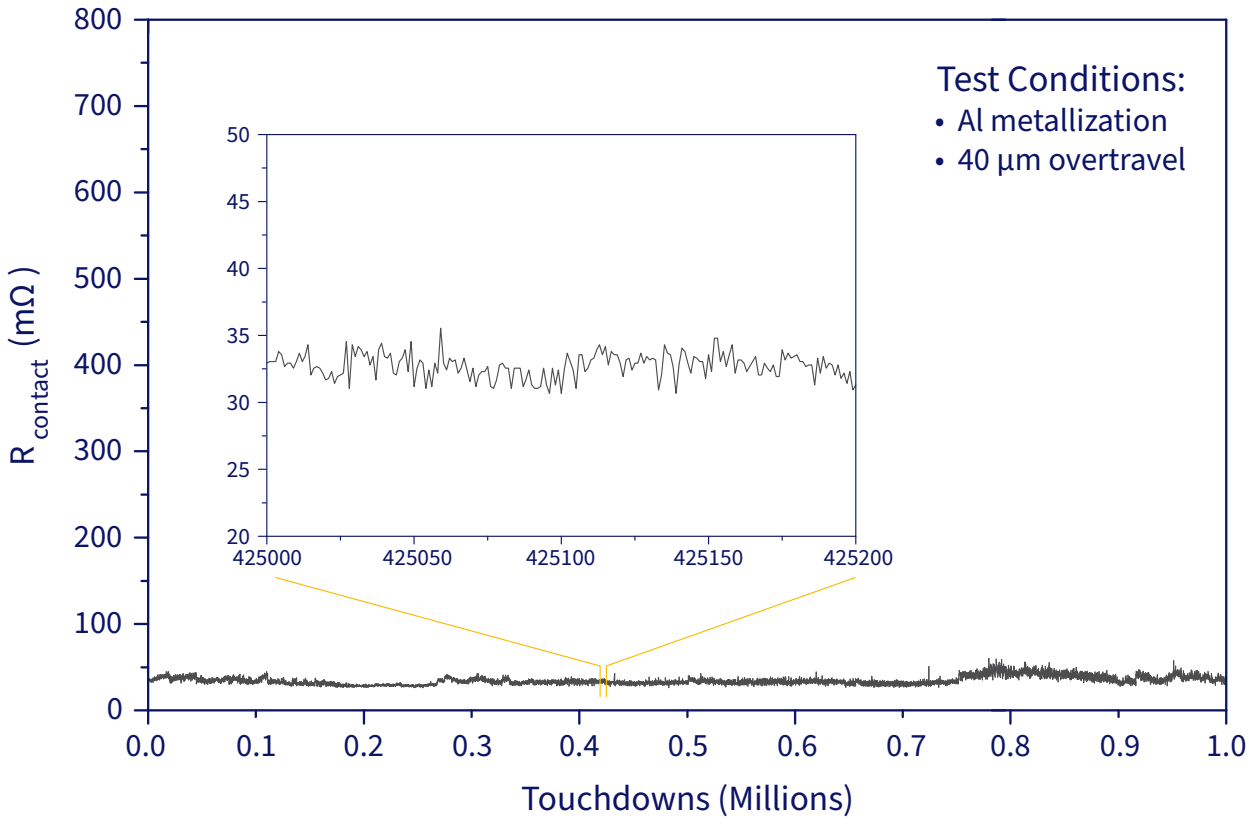


The maximal probe contact repeatability error of the calibrate S11 and S21 of the AC-2 thru standard by T110 and T50 probes.

Long term minimal and consistant resistive contact

As mentioned above both load pull and noise parameter extraction measurements require stable probe contact as the calibration and measurement process requires multiple touches and long term continuous connections.

The quality of the contact must be very high over time and number of cycles. The graphs below show how stable the contact of the TITAN Probes are over time and contact cycles. This is key for noise parameter extraction as some devices have very small current flowing while being measured and and very sensitive to any varions in current. Any fluctuation in resistive contact could lead to erroneous data as the users require very stable current when measuring low noise devices.



Precisely manufactured, the TITAN Probes include matched 50 ohm MEMS contact tips with improved probe electrical characteristics which allow the realization of unmatched calibration results over a wide frequency range. The patented protrusion tip design enables small passivation window bond pad probing, while significantly reducing probe skate thus providing the outstanding contact repeatability required in today's extreme measurement environments.

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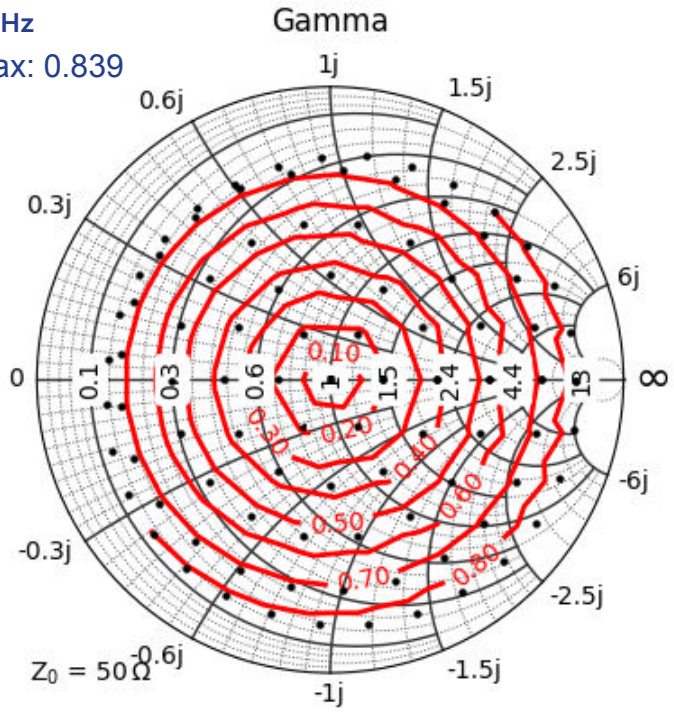
Sample Data

The sample data below is a good representation of the tuning range the user can expect at the following frequencies. 28GHz, 50GHz, and 96GHz.

NOTE: this specific tuner is a broadband tuner which provide good tuning range from 24-110GHz, The tuner performance can be optimized for given frequencies.

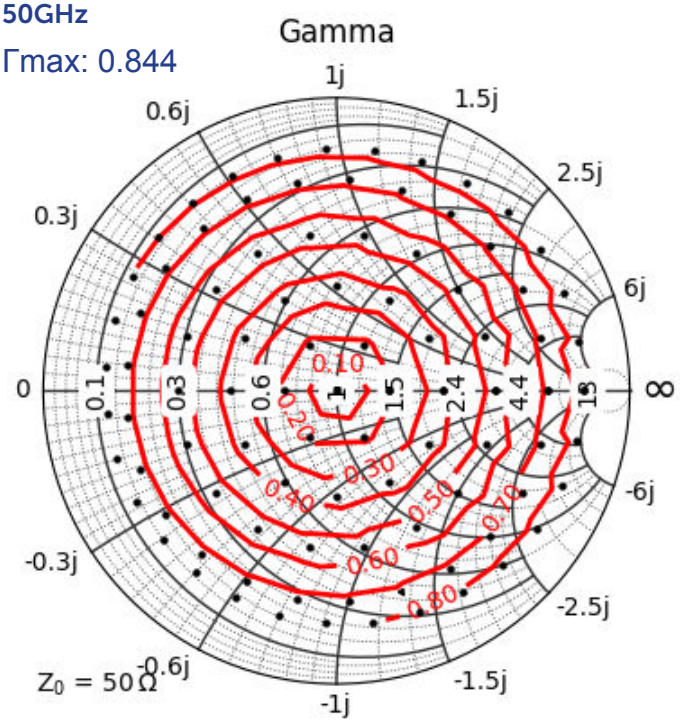
28GHz

Γmax: 0.839



50GHz

Γmax: 0.844



96GHz

Γmax: 0.839