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VEC-101 Application Notes

RealProbe

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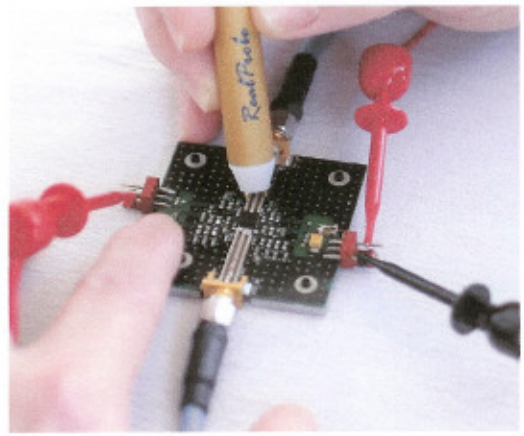
RealProbe

Vectria ltd. developed an easy to use high impedance passive probe, with broadband flat, consistent and accurate coupling factor for use with any 50 ohm matched measurement equipment, enabling accurate in-circuit frequency and time domain measurements within the real environment.



Invention Background

We have identified a growing requirement for trusty and accurate in-circuit measurement equipment among RF and Microwave hardware and system developers, this is especially true for complicated system on a board type of circuits which are very common. A real solution will enable substantial decrease in development cycle time and complete insight in the early stages to decrease the number of development cycles.
Board level repair is another important application of such a probe Which can be highly accelerated, especially in the missing last DB type of malfunctions.

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Contents:

RealProbe applications

RealProbe is the ultimate tool for in circuit measurements of RF and Microwave signals without disconnecting the load (or the next stage), for example:

- Accurate sub channels gain measurements.
- Accurate transmit stages in/out power within the lineup, identify compressed stages etc.
- Low to high power measurements over the board, up to 25W peak and 2W average power.
- Accurate local oscillator power measurement.
- Internal mid channel spurious detection
- LO leakage that is masked by filters later on in the chain and can saturate earlier stages.
- IF/RF/Microwave subchannels performance measurement
- Real Filters rejection within the chain
- In channel time domain measurements for analog and fast digital signals under real source/load conditions.
- The ultimate tool for "finding" the last missing DBs in a long chain.
- Fast repair of multifunction RF & Microwave boards.
- In circuit delay, compression, and EVM measurements using signal and network analyzers.

And much more.

Product Description

RealProbe VEC-101 is the first product in a family of new concept in-circuit passive probes. The VEC-101 covers 10-4000MHz with nominal reading accuracy of less than +/-0.5 db. It does not require special feeding and can be connected via a proper SMA Cable to any relevant measurements equipment such as spectrum analyzer, network analyzer, power meter, frequency counter etc.

- Flat response 10MHz to 4GHz (Typical 1dB Point at 6 GHz)
- Integrated matched ground returns
- Self aligning independent height contacts
- Negligible effect on circuitry
- Input/Output DC blocked

Available Optional Accessories

There are several optional accessories available for the RealProbe:

- VEC-104 – RealProbe calibration jig for best power measurements accuracy.
- VEC-105 – 1meter RealProbe adapted flexible RF cable for accurate, reliable and convenient measurements.

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Electrical Specification

Frequency Range:	10MHz – 4GHz
	(Typical 1dB Point at 6 GHz)
Max average input (probed) power:	2 watt
Max Peak (probed) power:	25 watt
Max Input Voltage:	30V DC
Residual Insertion Loss on probed line:	0.5dB nom.
Residual Return Loss on probed line:	18dBr nom.
Probing factor (Coupling):	25dB (±0.5dB) nom.
1dB Probing factor frequency:	6GHz typ.
Coupling output Return Loss:	18dBr nom.
Equipment output Impedance:	50 ohm
Input/Output DC blocked	

Note: All Electrical performances are related to 50ohm microstrip or back grounded coplanar, with proper side grounds and matched source/load impedance.

Operating Temperature +5˚C to +40˚C

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Mechanical Specification

Center spring probe

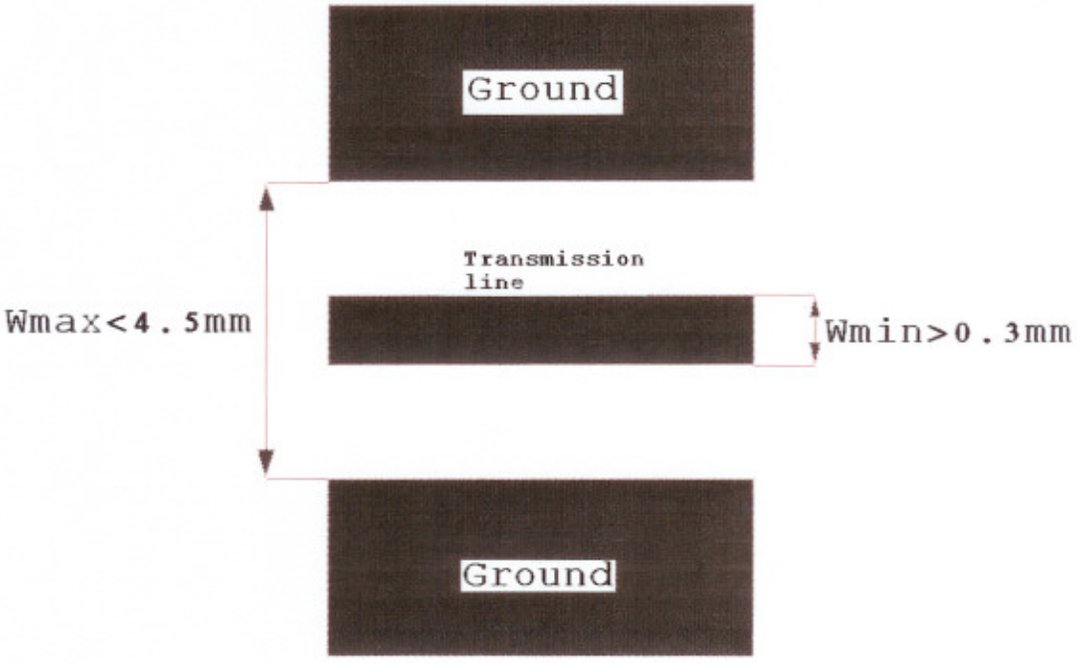
- diameter 0.4mm
- max travel 0.5mm

Side spring (ground) probe

- diameter 1mm
- max travel 1.4mm

Spacing between center and side spring 2.5mm

Recommendations for new layout



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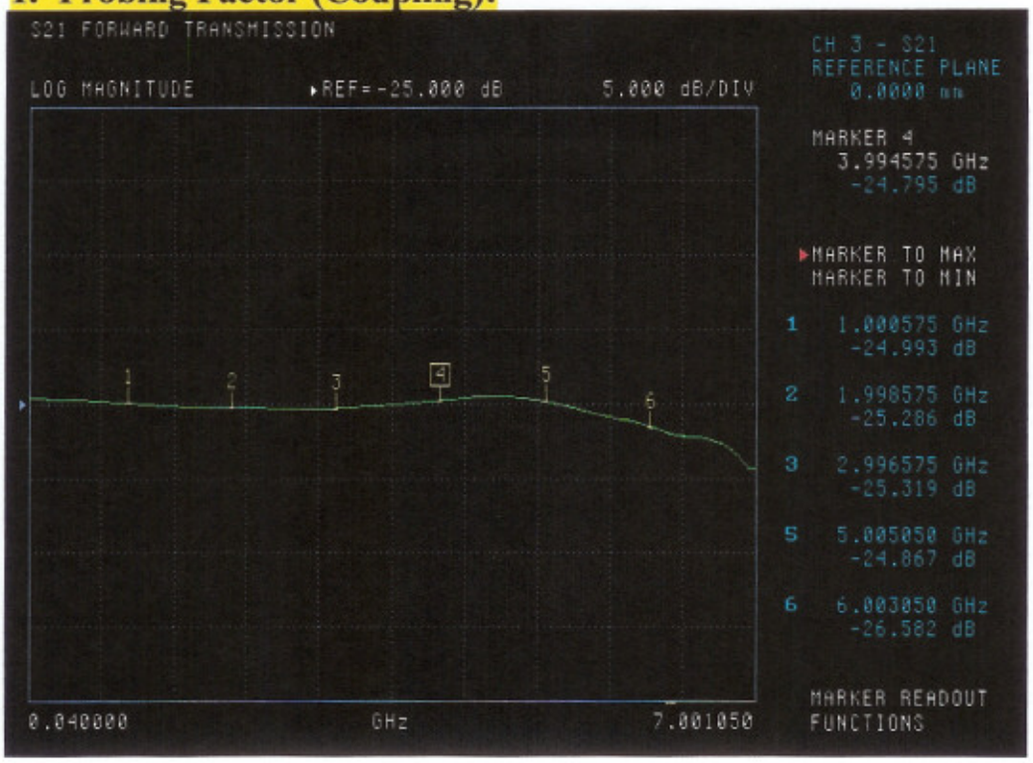
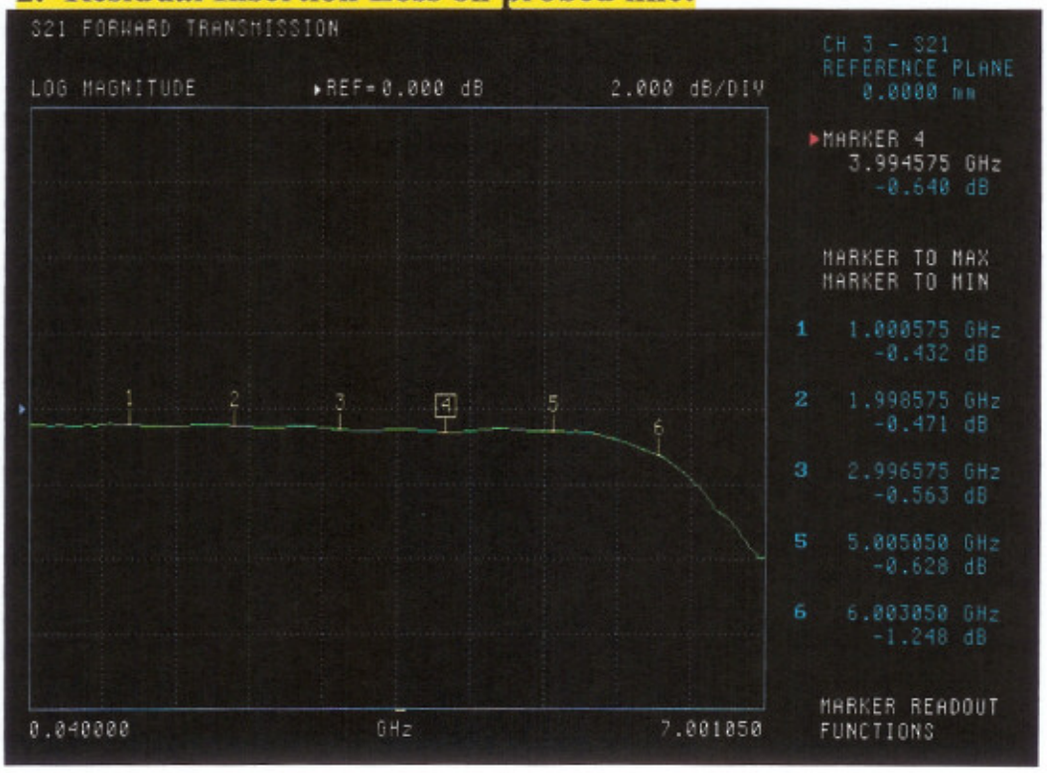
VEC-101 Performance Measurements

All measurements have been done using ANRITSU 37347C Network Analyzer.

1. Probing Factor (Coupling):



2. Residual Insertion Loss on probed line:



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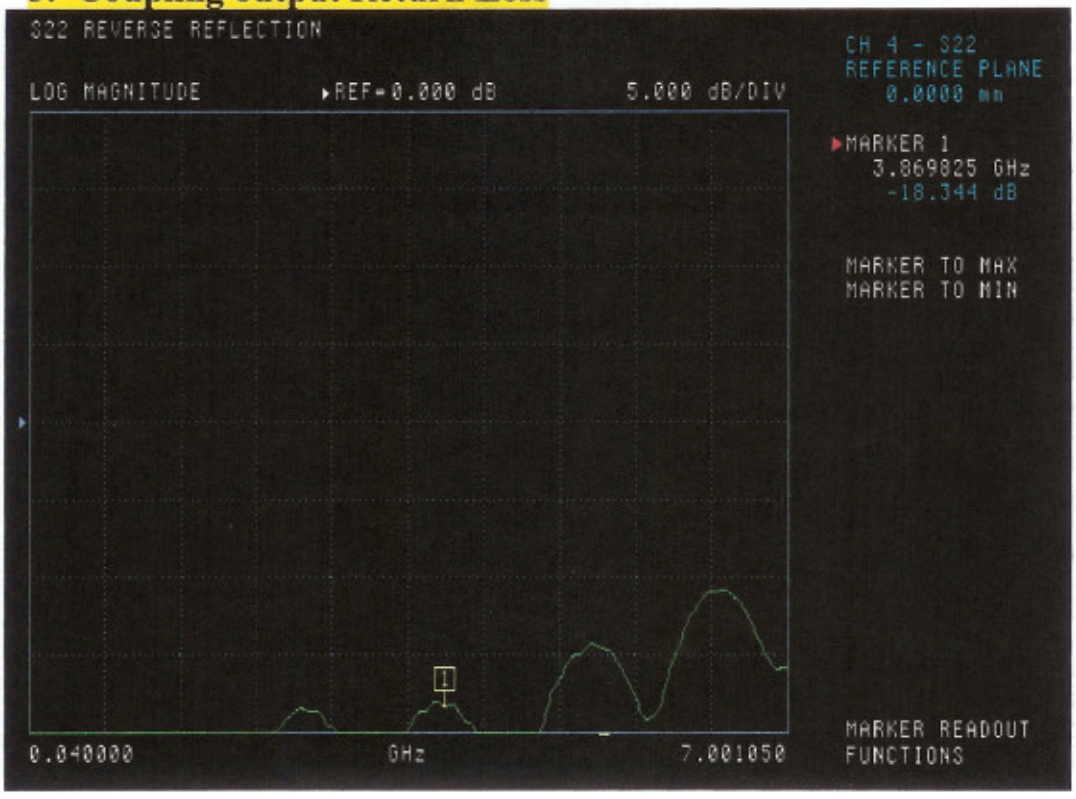
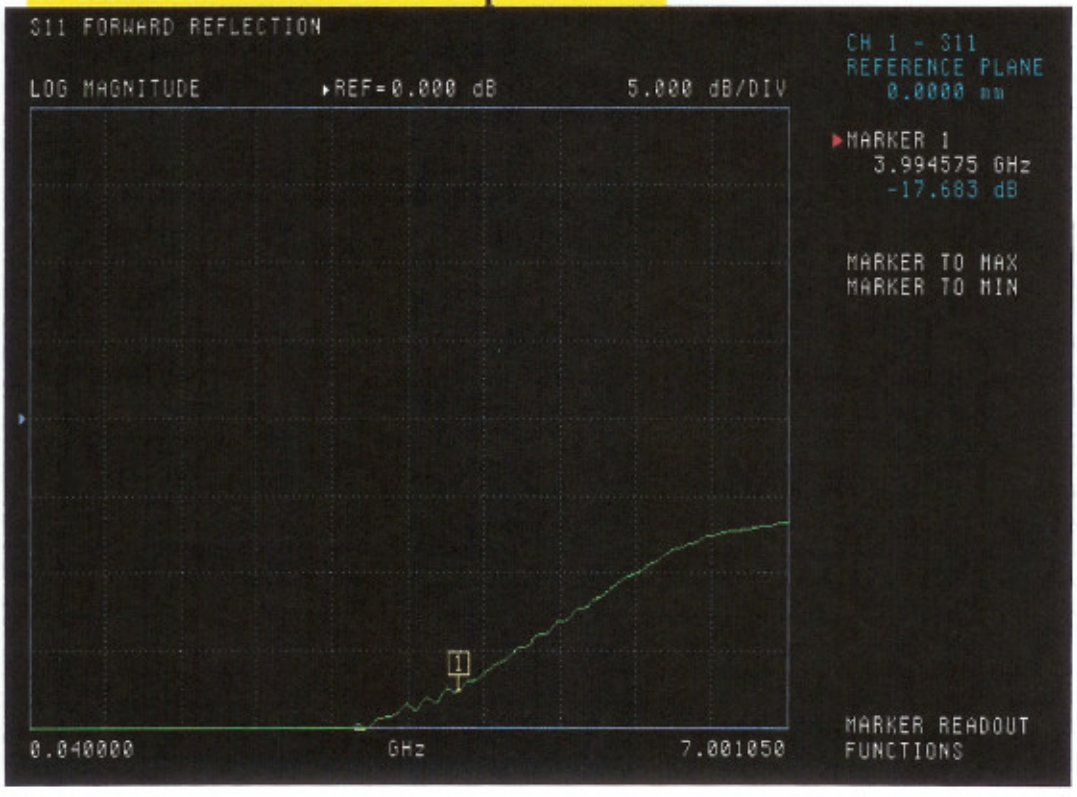
3. Coupling output Return Loss



4. Residual Return Loss on probed line



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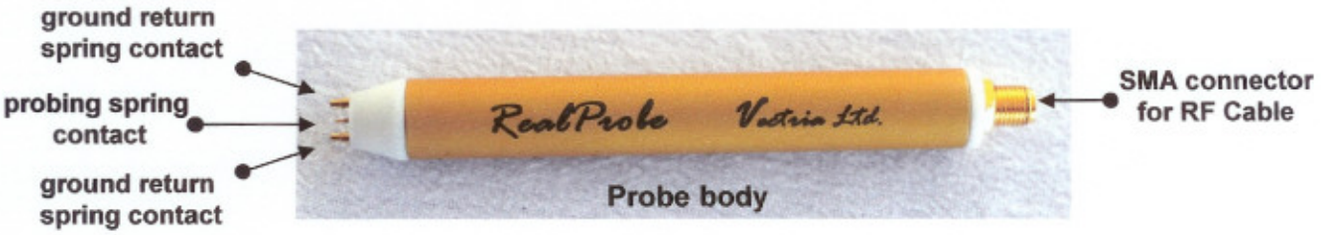
How to use Vectria's RealProbe



Basic Measurements

1. Carefully connect the SMA connector of the probe to an RF cable.
2. Connect the other side of the RF cable to the measurement Instrument, such as, spectrum analyzer, network analyzer, power meter etc.
3. Use light force to make gentle contact at all points of the bottom pins to the probed line and its side grounds.
4. Hold the probe above the probed transmission which is under test and perform the measurement.
5. In case of absolute power measurements add 25dB to the measurement (the coupling factor of the probe).

Best Power Measurements Accuracy With calibration jig VEC-104
(Use Calibration Drawing Setup in the next page)

1. Connect one port of calibration jig VEC-104 to a signal source.
   P (input) = Output power of the signal source after the RF cable (point no. 1 at the Drawing).
2. Connect the other side of the calibration jig VEC-104 to a broadband 50 ohm load (point no. 2 at the Drawing).
3. Carefully connect the SMA connector of the probe to a proper RF cable, preferably VEC-105 (point no. 3 at the Drawing).
4. Connect the other side of the RF cable to a power meter, which is calibrated to the relevant frequency (point no. 4 at the Drawing).
5. Use light force to make contact between the bottom pins to the probed line and its side grounds.
6. Place the probing pin of the RealProbe between the markers on the calibration jig.
7. Hold the probe above the probed transmission line, which is under test, and perform set of measurements in the relevant frequencies that are of interest = **P (measured)**.

Continued on the next page…

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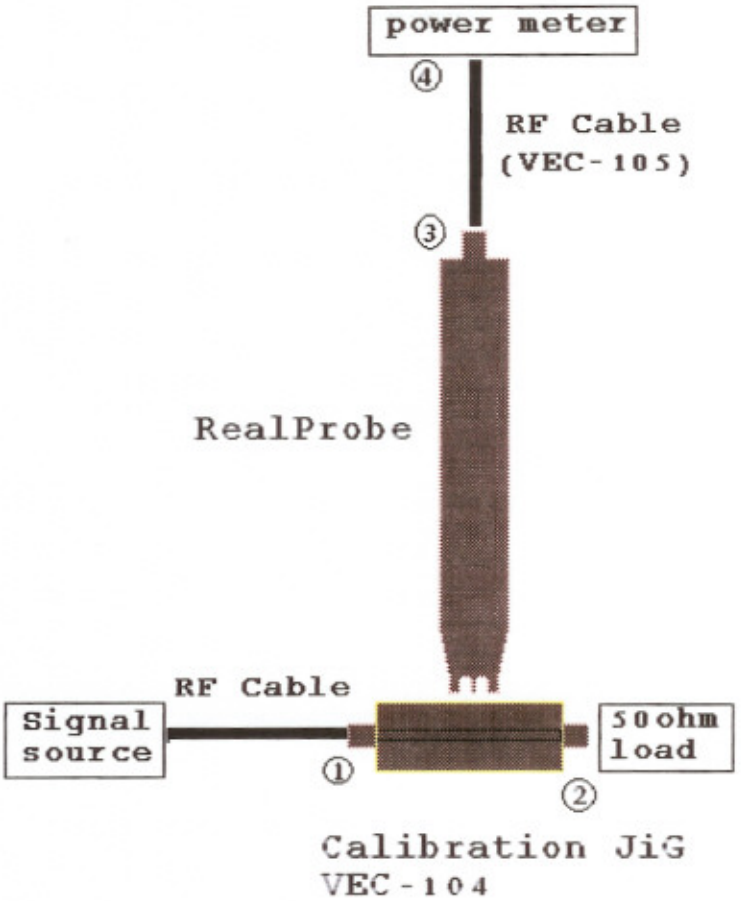
Calibration Setup Drawing



8. Prepare a table with accurate probing factor =CF (Calibrate Factor).
   Use the following equation to calculate CF:

   CF = P (input) - P (measured) + HWJL

   HWJL = half way jig loss ⟶

HWJL Table

Freq [MHz]	Loss [dB]
10	0.01
1000	0.05
2000	0.07
3000	0.08
4000	0.09
5000	0.11
6000	0.13

9. After you finished the calibration process you can perform very accurate power measurement by adding the calibration factor CF to the measureme
   Use the following equation:

   P (probed) = P (measured) + CF [dB]