Vectria
Technologies

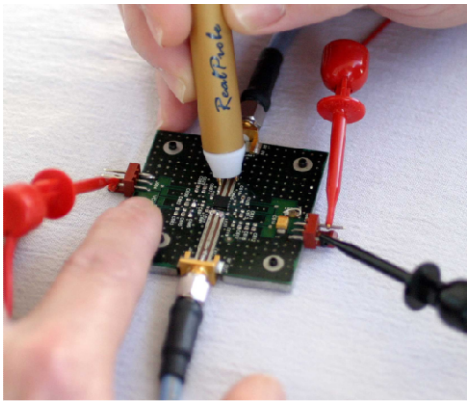
VEC-102 Application Notes

RealProbe

Vectria Technologies

RealProbe

Vectria Technologies ltd. developed an easy to use high impedance passive probes family, 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. VEC-102 is the third member of the RealProbe family covering the 10MHz to 7GHz frequency range.

Vectria
Technologies

Contents:

Vectria
Technologies

1. 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.

Vectria
Technologies

2. Product Description

RealProbe VEC-102 is the third product in a family of new concept in-circuit passive probes. The VEC-102 covers 10-7000MHz with nominal reading accuracy of less than +/-1 db to 6GHz. 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.

- High accuracy and broadband flat frequency response.
- Integrated matched ground returns.
- Self aligning independent height contacts.
- Negligible effect on circuitry.
- Input / Output DC blocked.

3. 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 relative measurements.
- VEC-105A – 1meter RealProbe low loss RF cable for accurate and reliable absolute high frequency measurements

Vectria
Technologies

4. Electrical Specification

Frequency Range:	10MHz – 7GHz
Max average input (probed) power:	2 watt
Max Peak (probed) power:	25 watt
Max Input Voltage:	30V DC
Residual Insertion Loss on probed line:	0.6dB nom. *
Residual Return Loss on probed line:	16dBr nom. *
Probing factor (Coupling):	25dB (±1dB) nom. *
1dB Probing factor frequency:	7GHz 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. Residual and coupling parameters relates to the band 10MHz - 6GHz.

Operating Temperature +5º C to +40º C

Vectria
Technologies

5. Mechanical Specification

Center spring probe

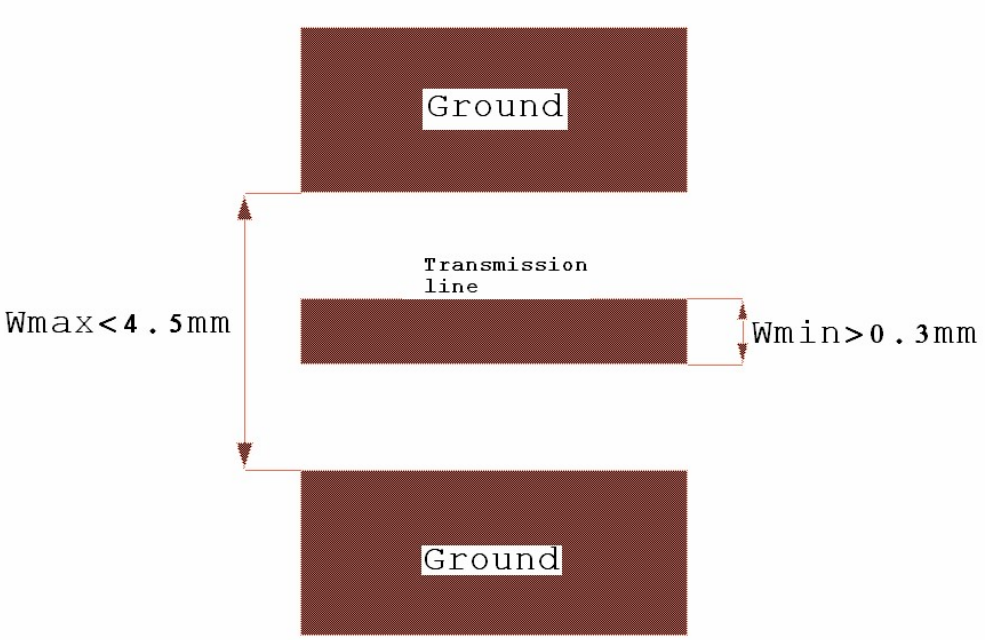
- diameter 0.4mm
- max travel 0.5mm

Side spring (ground) probe

- diameter 1mm
- max travel 1.4mm

Spacing between center and side spring 2.5mm

6. Recommendations for new layout

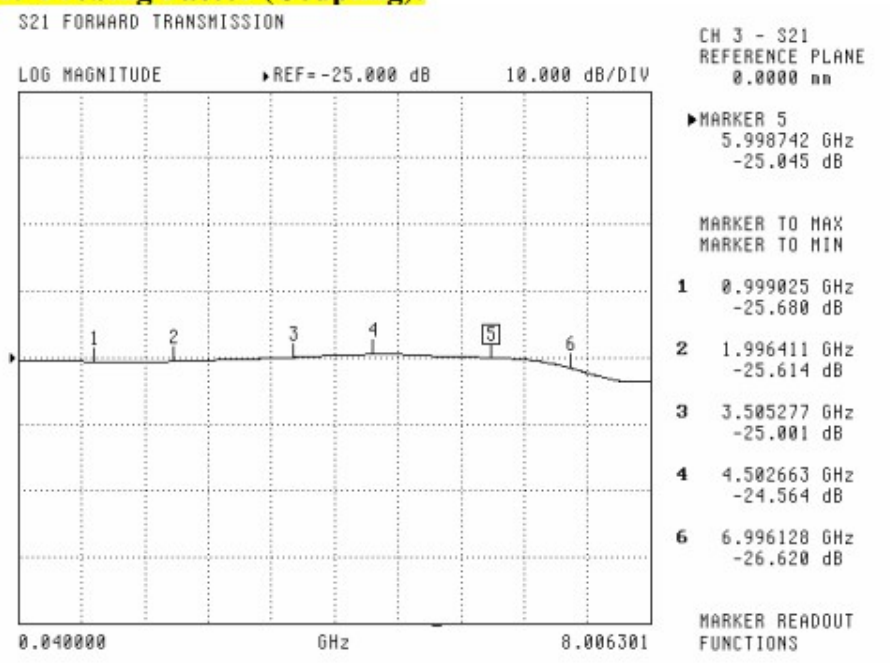


Vectria
Technologies

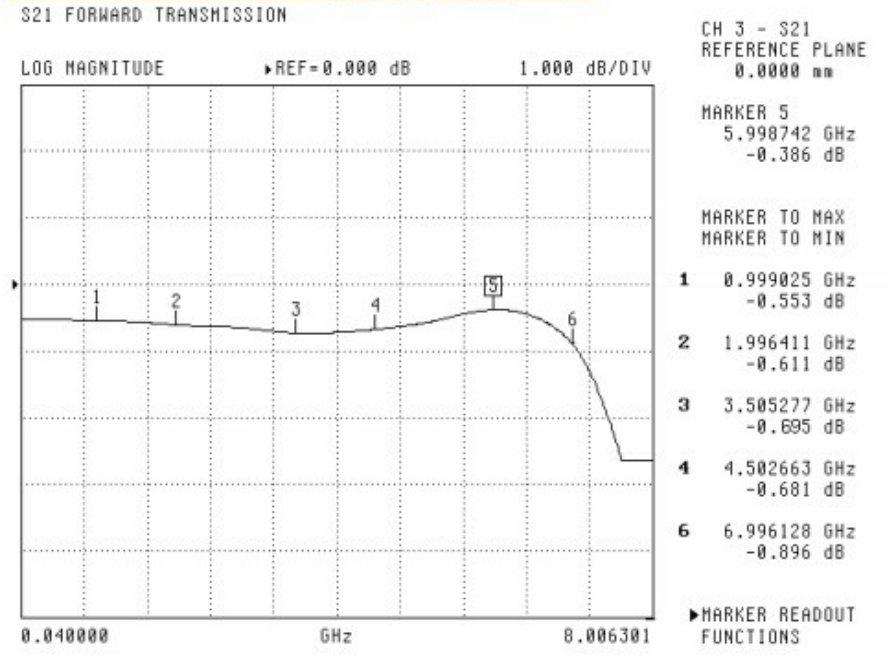
7. VEC-102 Performance Measurements

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

1. Probing Factor (Coupling):

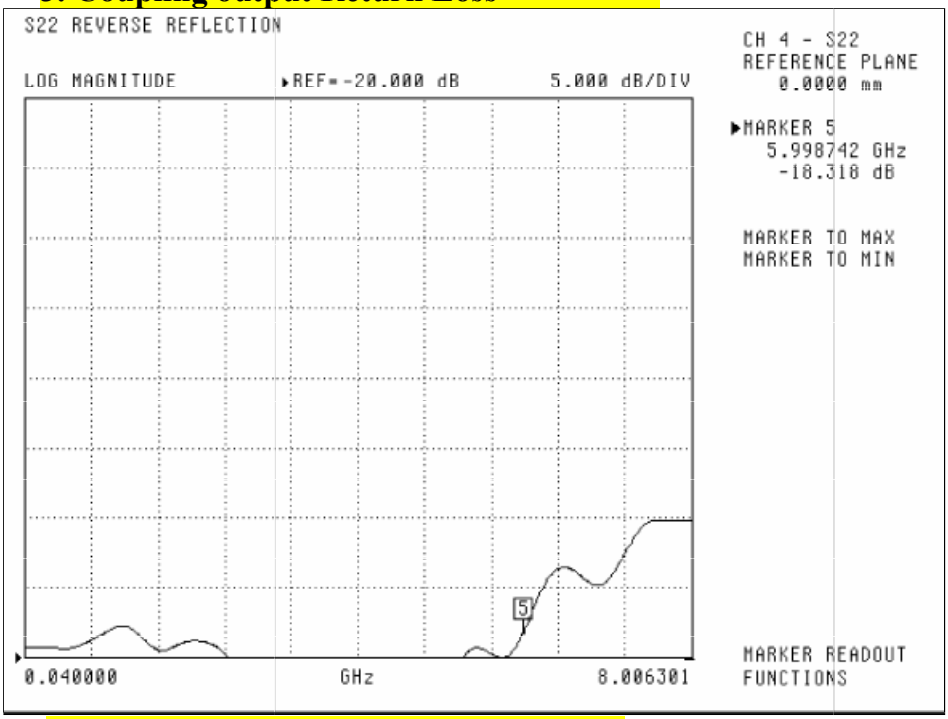


2. Residual Insertion Loss on probed line:

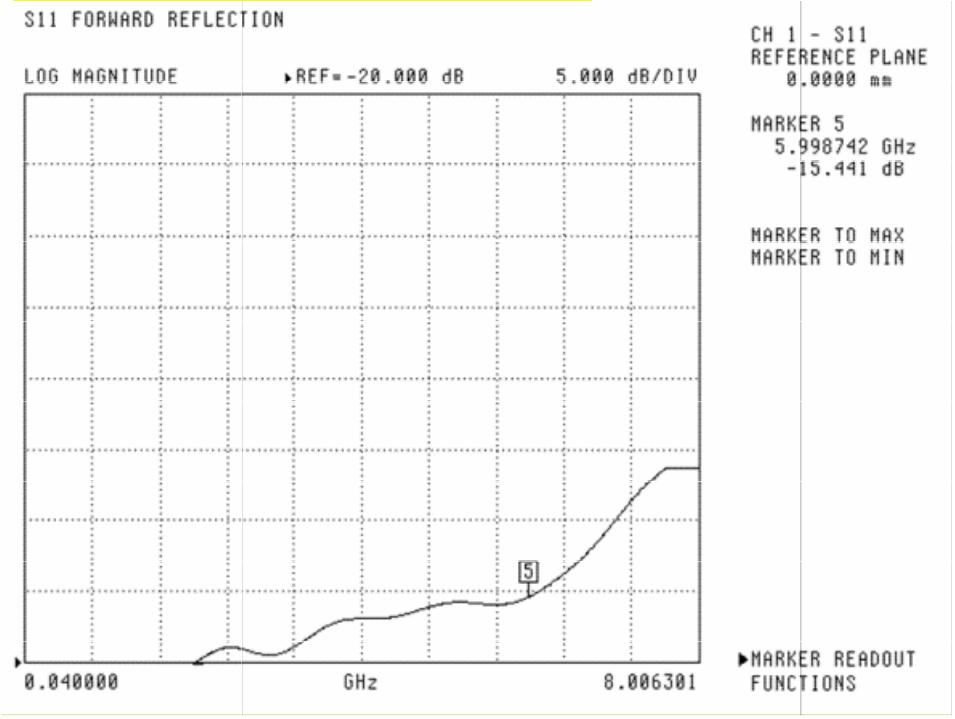


Vectria
Technologies

3. Coupling output Return Loss

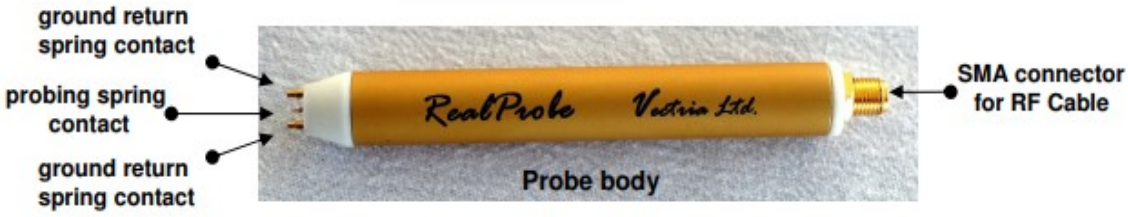


4. Residual Return Loss on probed line



Vectria
Technologies

8. How to use Vectria's RealProbe



Basic Measurements

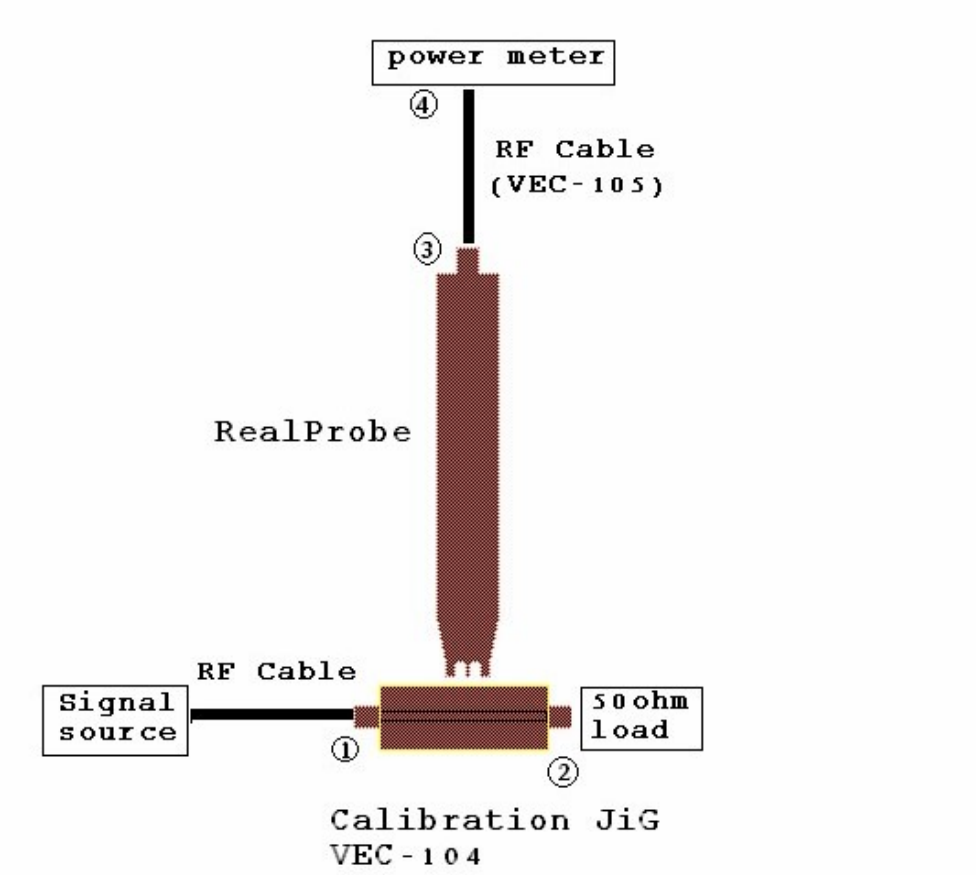
1. Carefully connect the SMA connector of the probe to an RF cable.
2. Connect the other side of the RF cable to the measurement Instrument, such as, spectrum analyzer, network analyzer, power meter etc.
3. Use light force to make gentle contact at all points of the bottom pins to the probed line and 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 Setup Drawing 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-105A (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)**.

Vectria Technologies

Calibration Setup Drawing



8. Prepare a table with accurate probing factor =CF (Calibration Factor)
   Use the following equation to calculate CF.
   CF = P in – Pmeasured + HWJL
   HWJL = Half way Jig Loss , see attached data.

10. Determine the accurate absolute power at the point of probing using:
    Pprobed = Pmeasured + CF

HWJL Data 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
7000	0.15

Vectria
Technologies

Gain Measurements using a Network Analyzer:

1. Use existing network calibration for the required frequency band or perform a normal new calibration.

2. Connect the Calibration Jig VEC-104 to network port 1. output (or signal generator output for SNA, at output of the cable used for the network calibration). Connect 50ohm termination to the other side of the VEC-104.

3. Connect the probe output to the network port 2. input (or detector input for SNA) directly, or preferably through the flexible cable VEC-105/105A.

4. Place the probing pin of the RealProbe between the markers on the Calibration Jig for sampling the RF signal on the VEC-104 Calibration Jig.

5. Use averaging factor of 100, Save S21 or transmission data to memory, display DATA/MEMORY, Check for transmission S21 ~0db using the marker readout across the band.

6. Disconnect network port 1. from the calibration Jig VEC-104, connect the network port 1. to your device under test input and use the RealProbe to measure the gain from input to the each sampled point along the circuit.

Notes: 1. Use terminations at the DUT outputs.
2. If VEC-104 calibration jig was not purchased, use the above procedure on a reference point at the circuit's input.

Vectria
Technologies

9. RealProbe Accessories Performance

VEC-104 Calibration Jig :

Return Loss 10MHz –7GHz	:	20 dbr nom.
Insertion Loss @ 10MHz	:	0.02db
500MHz	:	0.046 db
800MHz	:	0.068 db
1GHz	:	0.1 db
2GHz	:	0.14 db
3GHz	:	0.16 db
4GHz	:	0.18 db
5GHz	:	0.22 db
6GHz	:	0.26 db
7GHz	:	0.30 db

Vectria
Technologies

VEC-105 Flexible Cable : (Highly flexible)

Return Loss 10MHz – 6Hz	:	20 dbr nom.
Insertion Loss @ 10MHz	:	0.25 db
500MHz	:	0.60 db
800MHz	:	0.75 db
1GHz	:	0.85 db
2GHz	:	1.20 db
3GHz	:	1.50 db
4GHz	:	1.75 db
5GHz	:	2.05 db
6GHz	:	2.30 db

VEC-105A Flexible Cable : (Low Loss)

Return Loss 10MHz – 7GHz	:	20 dbr nom.
Insertion Loss @ 10MHz	:	0.04db
500MHz	:	0.34db
800MHz	:	0.42db
1GHz	:	0.47db
2GHz	:	0.67db
3GHz	:	0.85db
4GHz	:	1.00db
5GHz	:	1.10db
6GHz	:	1.22db
7GHz	:	1.31db