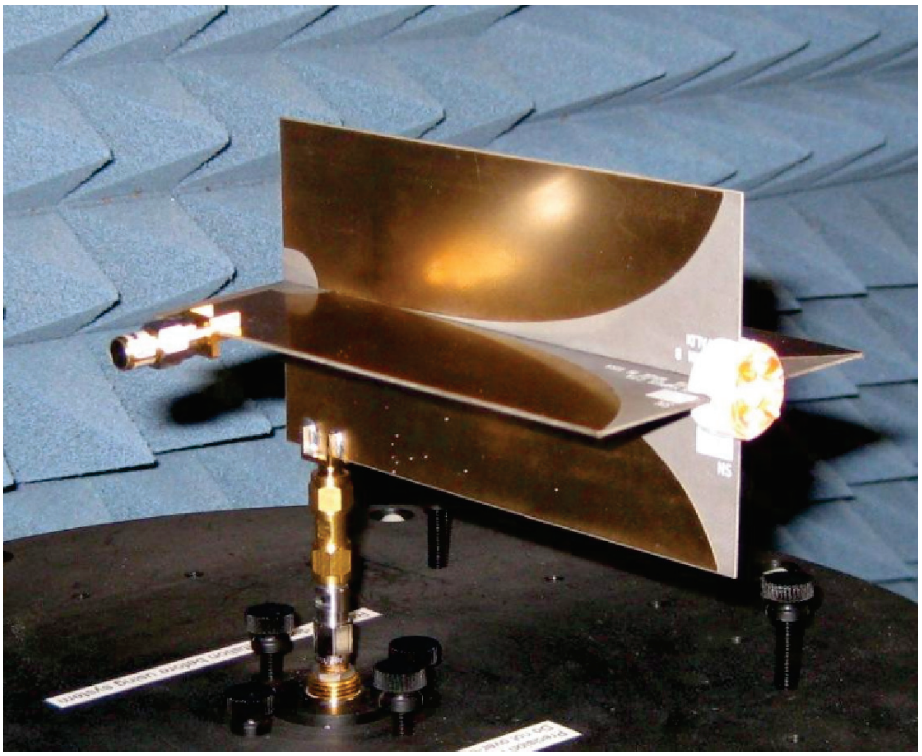
Diamond Engineering
Automated Measurement Systems

Application Note #0428
May 2012
Revised:

Processing Circular with ideal quadrature feed

Application Note



A circularly polarized antenna consisting of two identical antennas mounted at right angles with separate feeds are to be measured. The quadrature feed system is not included. Therefore an ideal 90 degree phase shift is to be added to one of the antennas.

Determine the LHC and RHC gain and axial ratio by measuring each antenna with constant Tx polarization. Interchange each aut feed and terminate the cross polarized feed.

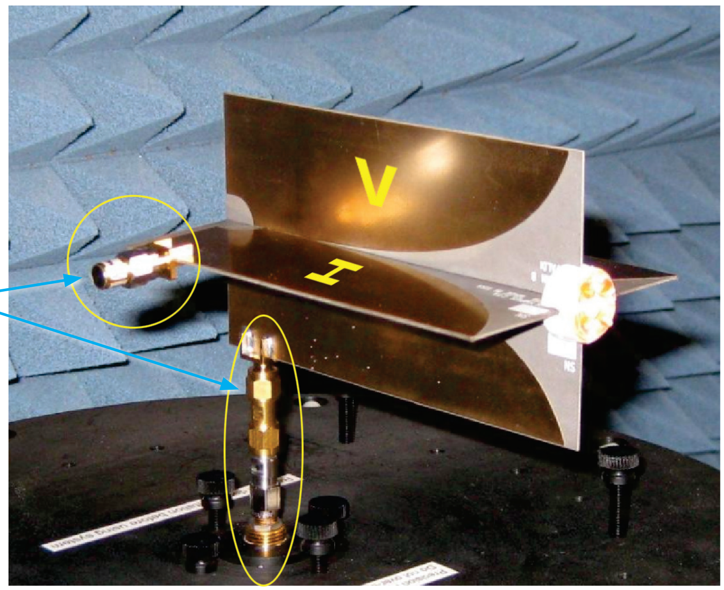
Problem

A circularly polarized antenna consisting of two identical antennas mounted at right angles with separate feeds are to be measured. The quadrature feed system is not included. Therefore an ideal 90 degree phase shift is to be added to one of the antennas.

Determine the LHC and RHC gain and axial ratio by measuring each antenna with constant Tx polarization. Interchange each aut feed and terminate the cross polarized feed.

Identical antennas at right angles

In phase individual feeds



Solution

The circular equations solved in the Gain Xfer module assume the antennas are quadrature fed. By adding 90 deg to one of the antenna phase an ideal quadrature is established. This separates the inherent leakage from the feed system leakage.

$$RE(LHC) = \frac{1}{\sqrt{2}}(E_{+1}\cos(\theta) + E_{+2}\sin(\phi))$$

$$IM(LHC) = \frac{1}{\sqrt{2}}(E_{+1}\sin(\theta) - E_{+2}\cos(\phi))$$

$$RE(RHC) = \frac{1}{\sqrt{2}}(E_{+1}\cos(\theta) - E_{+2}\sin(\phi))$$

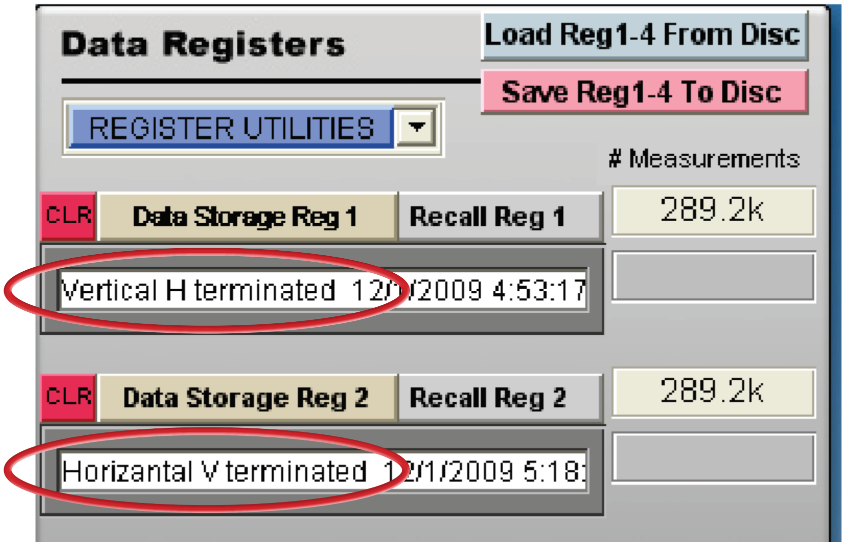
$$IM(RHC) = \frac{1}{\sqrt{2}}(E_{+1}\sin(\theta) + E_{+2}\cos(\phi))$$

$$\theta' = \tan^{-1}\left(\frac{E_{+1}\sin(\theta) - E_{+2}\cos(\phi)}{E_{+1}\cos(\theta) + E_{+2}\sin(\phi)}\right)$$

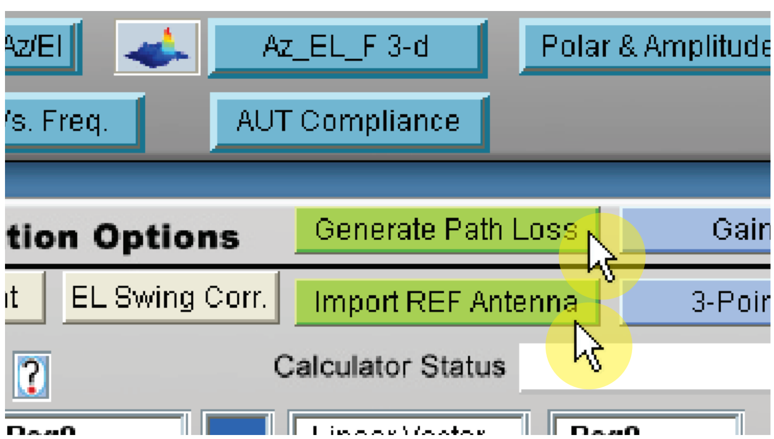
$$\theta' = \tan^{-1}\left(\frac{E_{+1}\sin(\theta) + E_{+2}\cos(\phi)}{E_{+1}\cos(\theta) - E_{+2}\sin(\phi)}\right)$$

Directions

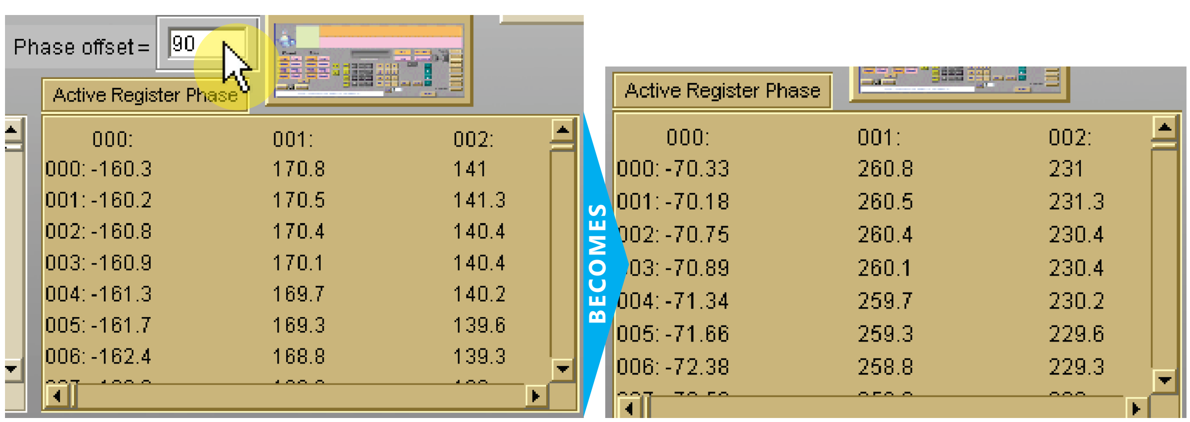
Measure link data with V antenna terminated and vice versa as highlighted below.



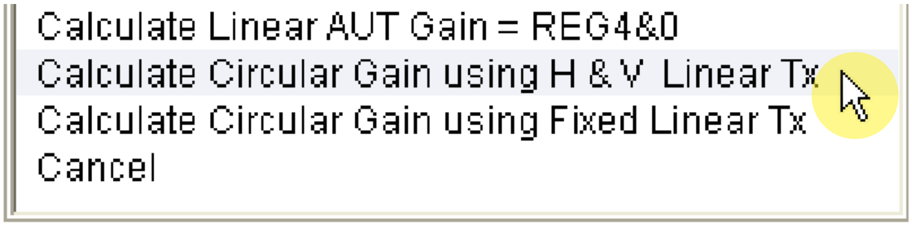
Generate Path Loss and import the appropriate Tx Ref Antenna. The buttons will turn green upon completion as shown below:



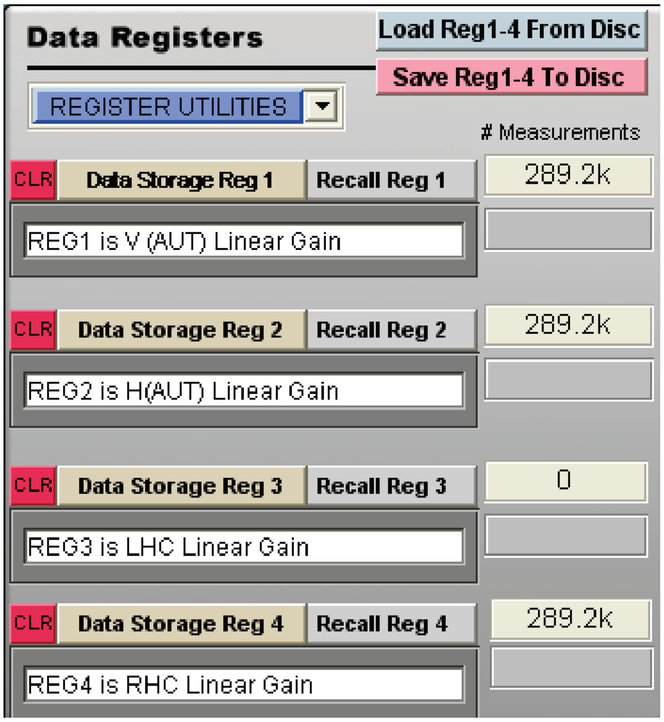
Next, enter 90 degree offset to REG0 and recall REG2 to initiate. Re-save quadrature data to REG2.



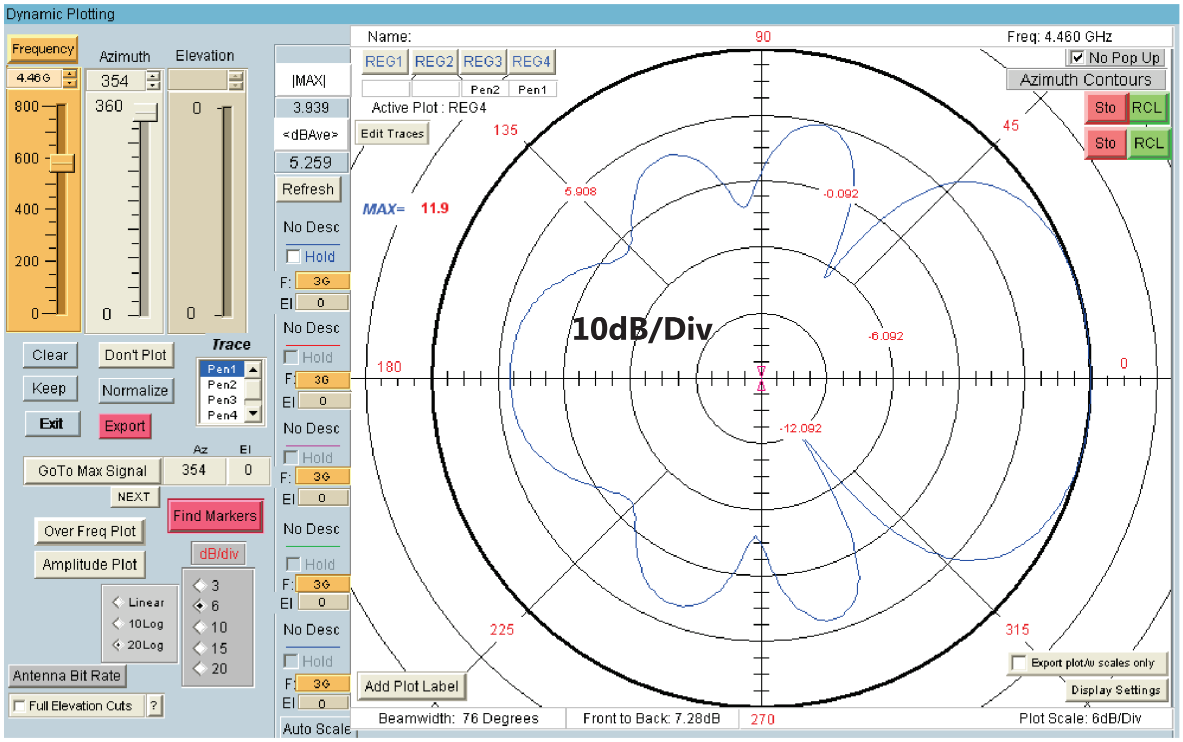
Invoke Gain Xfer module and select Circular Gain using H & V Linear Tx:



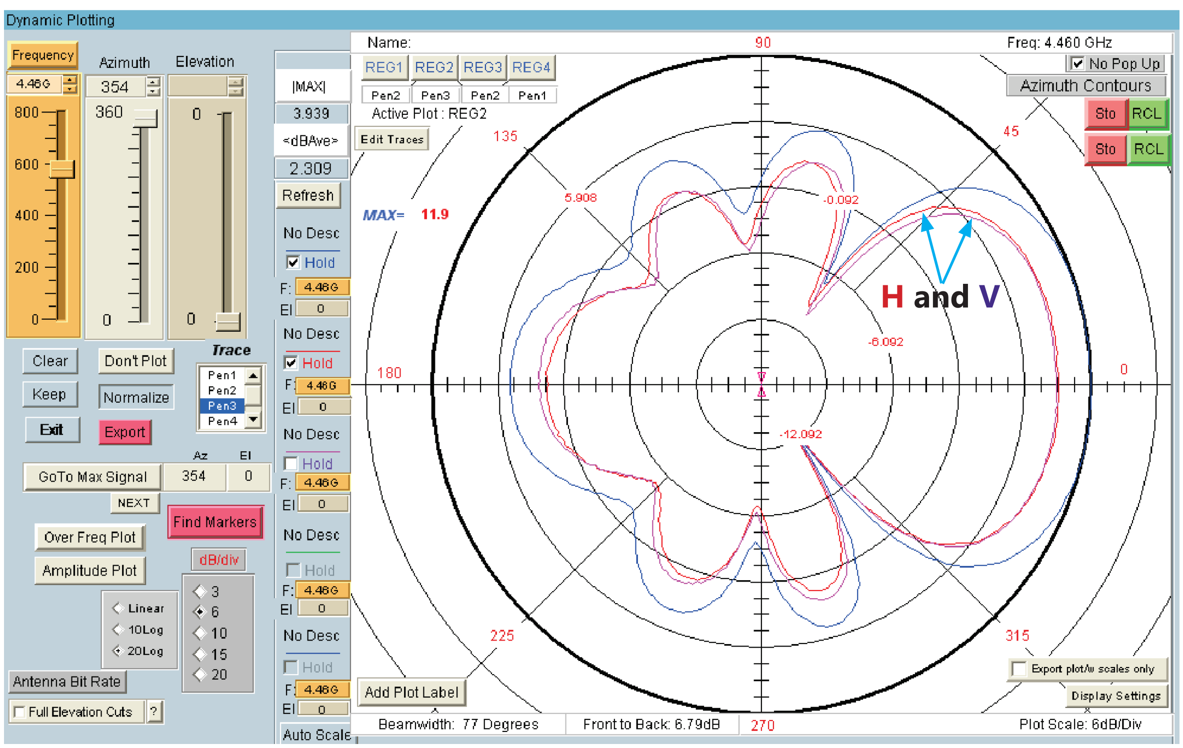
Data registers 1-4 are rewritten as linear and circular gain as shown below:



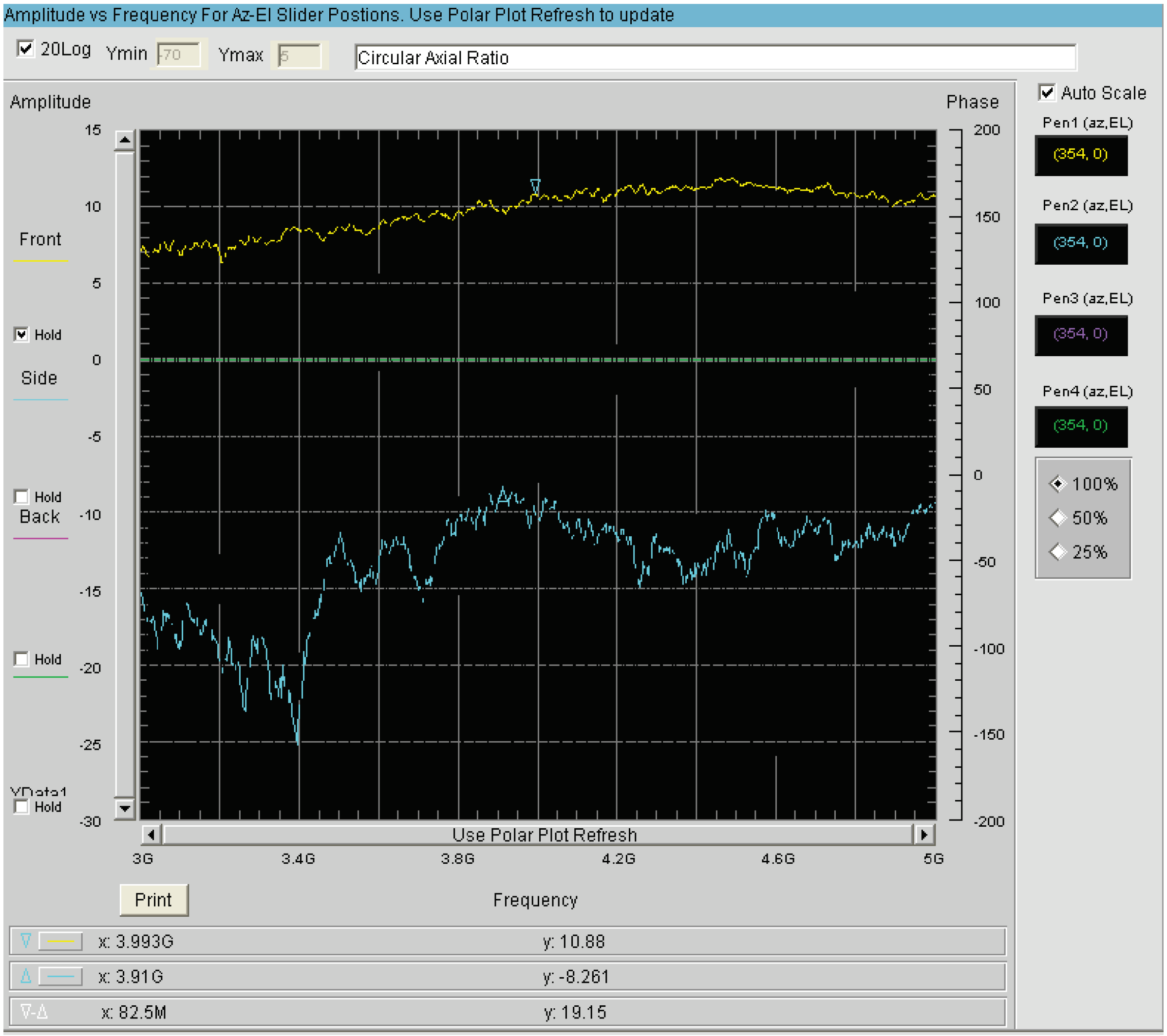
Recall RHC and Invoke Go To Max(11.9dBi) in dB mode:



Use the hold and Normalize to over lay the H V linear data:



RHC LHC Axial ratio over frequency(REG3 and REG4).



This represents the minimum possible Axial Ratio. A quadrature feed system will degrade the ratio.