

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

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.

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

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

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

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

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

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

Directions

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

	Data Registers			Load Reg1-4 From Disc		
	Save R				eg1-4 To Disc	
		EGISTER UTILITIES	# Measurements			
	CLR	Data Storage Reg 1	Reca	l Reg 1	289.2k	
<	Vert	tical H terminated 12/	2009	4:53:17		
	CLR	Data Storage Reg 2	Reca	I Reg 2	289.2k	
<	Hor	izantal V terminated 1	2/1/20	09 5:18:		

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

Az/El 🗻 🛶	Az	:_EL_F 3-d	Pola	r & Amplitude		
/s. Freq.	AUT	Compliance				
tion Options Generate Path Loss Gai				Gair		
it EL Swing	Corr.	Import REF /	Antenna	3-Poir		
Calculator Status						
Daw0						

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

Pł	nase offset = 90						
	Active Register Phase				Active Register Phase		
	000:	001:	002:		000:	001:	002: 🔄 🛓
	000: -160.3	170.8	141		000: -70.33	260.8	231
	001: -160.2	170.5	141.3	6	001:-70.18	260.5	231.3
	002: -160.8	170.4	140.4	H	002:-70.75	260.4	230.4
	003: -160.9	170.1	140.4		03:-70.89	260.1	230.4
	004: -161.3	169.7	140.2		004:-71.34	259.7	230.2
	005: -161.7	169.3	139.6		005: -71.66	259.3	229.6
Ŧ	006: -162.4	168.8	139.3	-	006: -72.38	258.8	229.3
					11 To Fo		_

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

Calculate Linear AUT Gain = REG4&0 Calculate Circular Gain using H & V Linear Tx Calculate Circular Gain using Fixed Linear Tx Cancel

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

Data Registers Load Reg	eg1-4 From Disc				
Save Re	eg1-4 To Disc				
	# Measurements				
CLR Data Storage Reg 1 Recall Reg 1	289.2k				
REG1 is V (ALIT) Linear Gain					
CLR Data Storage Reg 2 Recall Reg 2	289.2k				
REG2 is H(AUT) Linear Gain					
CLR Data Storage Reg 3 Recall Reg 3					
REG3 is LHC Linear Gain					
CLR Data Storage Reg 4 Recall Reg 4	289.2k				
Pata Storage Neg 4 Recall Neg 4					
REG4 is RHC Linear Gain					

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.