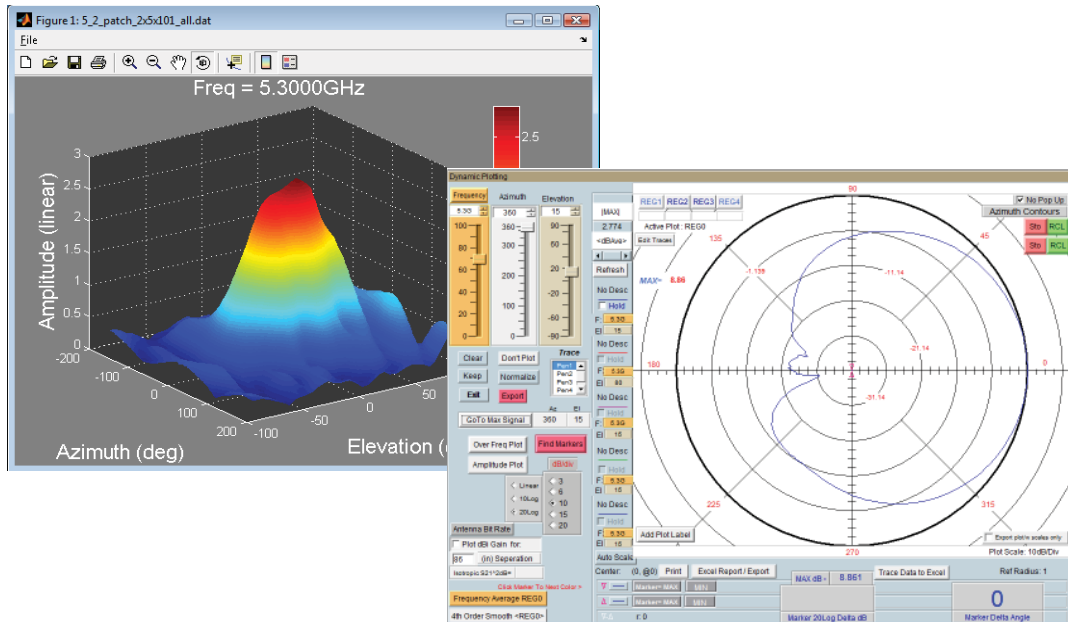


Antenna Gain Measurements - Gain Transfer Method



When measuring antennas, the initial measurement is for the entire link including any uncorrected losses/gains such as path loss and reference antenna gain. These factors can be corrected using the gain transfer function. This application note will illustrate the proper procedure for making the initial measurement and performing gain transfer using the DAMS antenna measurement software.

Process Outline

1. Define and perform initial measurement
2. Generate path loss data
3. Import and generate reference antenna data.
4. Perform Gain Transfer

Measurement Parameters.

Antenna Type: Patch
 Measured Frequency: 4.6– 5.6 GHz @ 101 points
 Measured Angle: Az. 0-360 Deg. @ 2 Deg./Meas. El. -90 +90 @ 5 Deg./Meas.
 Path Distance: 36 Inches
 Reference Antenna: 1-18 GHz dual ridge horn.
 Cable Correction: VNA calibration.

Measuring the Antenna

Before you begin: Recall or perform a vector cal (OSLT) on your network analyzer for the cable loss using the DAMS measurement system as port 2 and the reference antenna cable as port 1.

1. Configure extents for the measurement: 0-360 Deg. x 5 Deg. /meas.

2. Press “Measure Azimuth Cut” to begin the measurement.

3. Once the measurement has completed, press proceed to data processing.

Antenna Measurement Studio v5.3
Precision Antenna Measurement System and Data Processing Software

Pro License Enter License QUIT! DE Diamond Engineering Automated Measurement Systems

Import configuration

Select VNA or Source: HP.8753D/E Settings

Select Receiver: Settings

Cal System: Scalar Offset Settings

CalPAD(dB)= 0 PMCAL OFF

Az Extents
Az Start: 0
Az Stop: 360
Az Resolution: 2
Configure Extents

EL Extents
El Start: -90
El Stop: 90
El Resolution: 5

Azimuth Jog delta: Jog Left, Jog Right (2, 2)
Elevation Jog delta: Jog -, Jog + (2, 2)
Az Jog to: 0 El Jog to: 0
MOVE TO DIRECT POSITION ZERO POSITIONER

MEASURE AZIMUTH CUT SCAN Az/EI Proceed to Data Processing
MEASURE ELEVATION CUT Reset ALL Init Pos Position Platform to peak
PAUSE MEASUREMENT STOP MEASUREMENT

STATUS: 0h:0m:0s Remaining
Measurement Complete - Proceed to Data Processing

Start Freq	Stop Freq	No. Points	Az Pos.	El Pos.
4.6G	5.6G	101	360	90

Center Frequency Amplitude / Polar Preview 5.1G Hz

AZ Progress S21 Averaging: <<S21(f)> OFF, <<S21(f)> ON, # Avg's: 3, Use ALL, ALL-Min/Max, Meas. Delay: 0

EL Progress

Display Settings

This page is collection only - after making measurements, proceed to data processing to work with your measured data. Press any ? for help.

The Amplitude(log), and Polar (linear) plot can be used during the measurement to verify the data being collected is correct or within tolerances.

Storing Measurement Data

When entering the Data Processing section after making a new measurement the data is stored and displayed in the active register (reg0). The default description is titled "New Measurement <completion date/time>". At this point we will store the data to a register then save reg 1-4 for a hard copy of the original measured data. The steps below illustrate this procedure.

Typical post-measurement procedure

1. Store data to Reg 1.
2. Change description if desired
3. Save Reg 1-4 to disk.

Active Register containing new measurement

1. Store to Reg1

2. Reg1 Description

3. Save Reg. 1-4

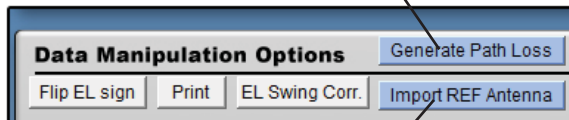
The screenshot displays the 'Antenna Measurement Studio v5.8' interface. The 'Data Registers' panel on the left lists four registers. Register 1 is selected and contains the text 'Patch Antenna 2/18/2009 2:17:45 AM' and a size of 676.4k. The 'Active Register' panel on the right shows 'New Measurement 2/18/2009 2:17:45 AM' with 'Stored to Reg1' selected. The 'Data Manipulation Options' panel shows a calculator with 'REG1' selected. The bottom section shows a table of data points for 'Active Register Mag' and 'Active Register Phase'.

Active Register Mag	Active Register Phase
000: 3.6m	000: 151.6
0001: 3.631m	0001: 151.9
0002: 3.679m	0002: 151.2
0003: 3.681m	0003: 150.8
0004: 3.724m	0004: 149.7
0005: 3.766m	0005: 150.1
0006: 3.742m	0006: 149.7

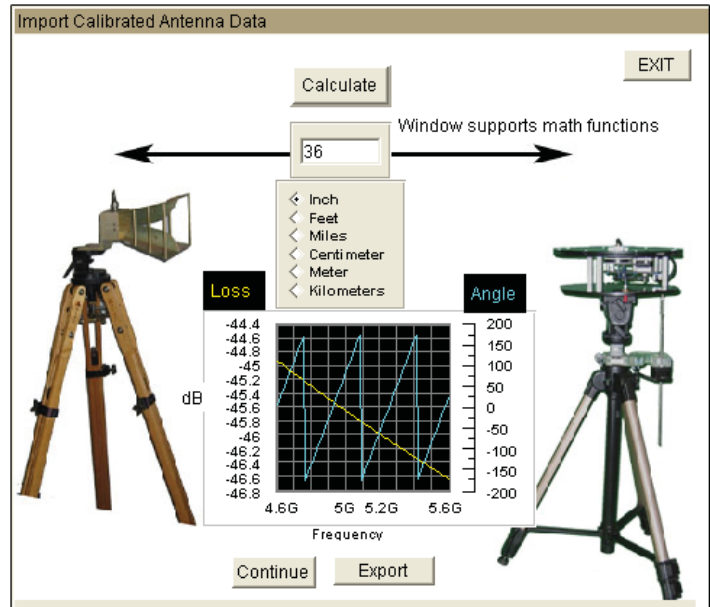
Path Loss and Reference Antenna Data

The Path Loss and Reference Antenna data is calculated based on the data that is currently in the Active Register (reg 0) When completed the data will be accessible to any functions that require it. The data can also be recalled into the active register for modification or copying to another file. a .RPL file will be generated along-side the original reg 1-4.dat file that you save, this .rpl file must be moved along with the .dat file to be viewed or accessed on another computer.

Generate the path loss for your measurement, Enter the correct distance, select the unit of measurement and press "Calculate", Press continue to return.

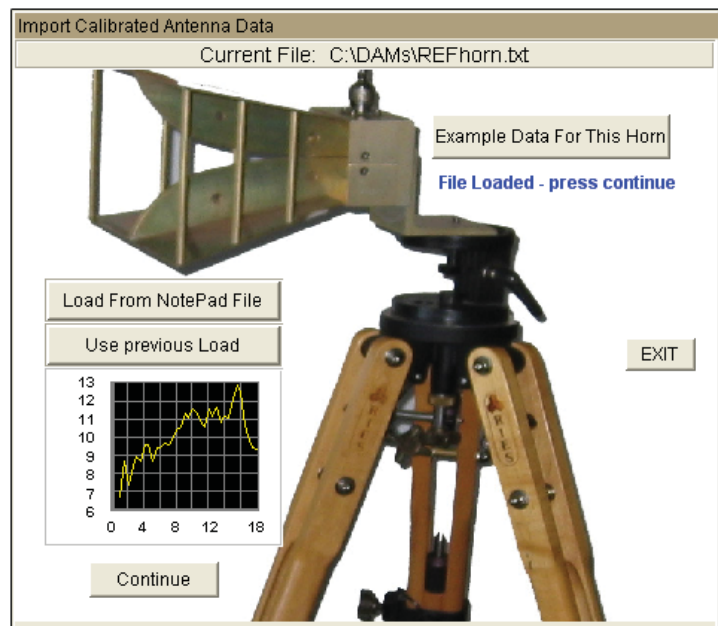
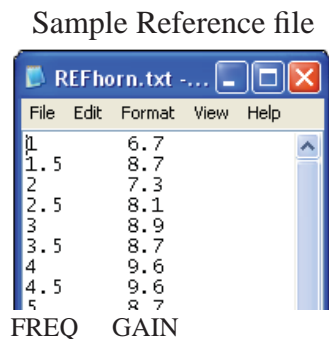


Path Loss Module



Reference Antenna Module

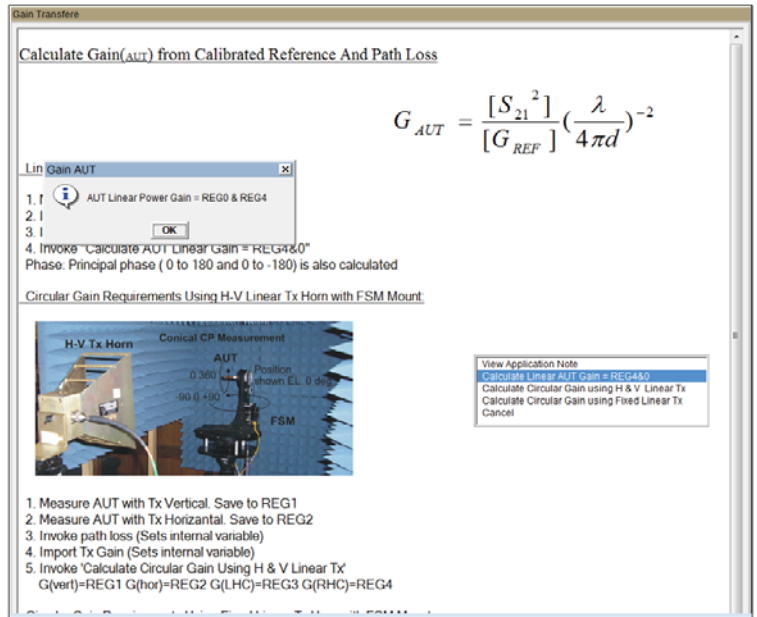
Import reference antenna data from .txt file. The format of the file is as follows:
 <freq in GHz> space <dBi gain> each line being a new frequency the frequencies of your measurement MUST fall within the limits of the imported reference file.



Gain Transfer

The gain transfer function will use the previously generated path loss and reference data to calculate the dBi gain of the measured antenna across all angles and frequencies. Corrected data will be stored into Reg4 and the Active Register (reg0).

After calculating, save reg-1-4 to the hard drive this file will contain original and calculated data including path and REF. data.



Gain Transfer Module

To Perform Gain Transfer:

1. Measurement data must be present in Reg 1
2. Path loss and REF buttons must be green indicating data is present.
3. Run Gain Transfer function

Resultant AUT Gain Data (Also in Reg0)

Active Register	Mag	Phase
000:	001:	002:
0000: 3.6m	3.521m	3.425m
0001: 3.631m	3.548m	3.434m
0002: 3.679m	3.584m	3.452m
0003: 3.681m	3.64m	3.516m
0004: 3.724m	3.623m	3.496m
0005: 3.766m	3.592m	3.562m
0006: 3.742m	3.611m	3.503m

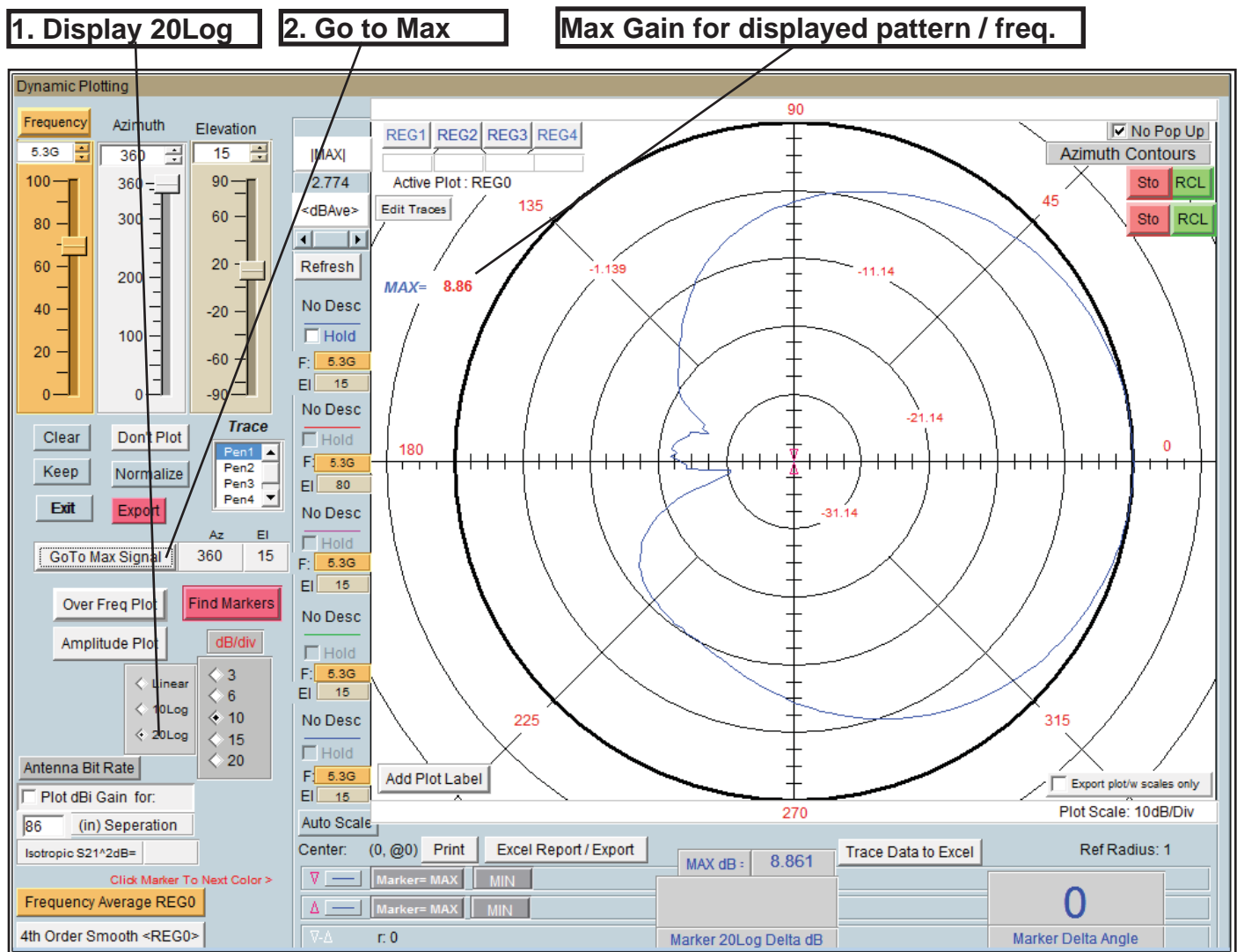
Data processing page after Gain Transfer has been completed

Antenna Gain Pattern

Once the gain transfer has been completed the antenna pattern can be plotted in a number of ways, the quickest way to analyze the max gain positions and frequencies is with the polar plot. Up to 4 antenna traces can be plotted at one time. The radiation pattern for any frequency or axis can be displayed simply by moving the sliders to the desired setting.

Locating maximum gain frequency / angle

1. Select 20Log to view the gain in dB.
2. Press "Go to Max signal", The plot will be changed to the plot with the maximum gain.
3. Max gain value for specified frequency/cut will be displayed to the left of the polar plot.



Antenna azimuth pattern showing a peak gain of 8.86 dBi at 15 Deg. elevation.