Simple Antenna Measurements Using DAMs5.0 Advanced Software

Diamond Engineering

Gain And Arbitrary Beamwidth Measurement For Identical Test Antennas

This note demonstrates the measurement proceeder using two identical AUTs (Antennas Under Test) in a lab environment (no anechoic chamber).

Statement Of The Measurement

Determine the Antenna Gain And Beamwidth for a microstrip 802.11 printed antenna subject to the following conditions:

Freq :	2.4GHz to 2.5GHz 101 points
Azimuth:	0 to 360deg 5 deg resolution
Elevation:	-30 to +30deg 5 deg resolution
Gain:	Max Gain dBi & dBd
Beamwidth:	3dB down from peak

Compare to ideal Isotropic link

Generate an ideal ½ wave dipole measurement data container and compare to the measurements above.

Compare results to a commercial80211 set of dipoles

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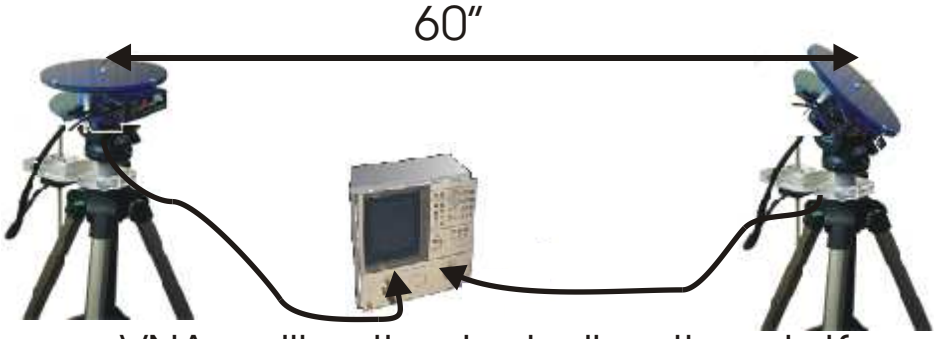
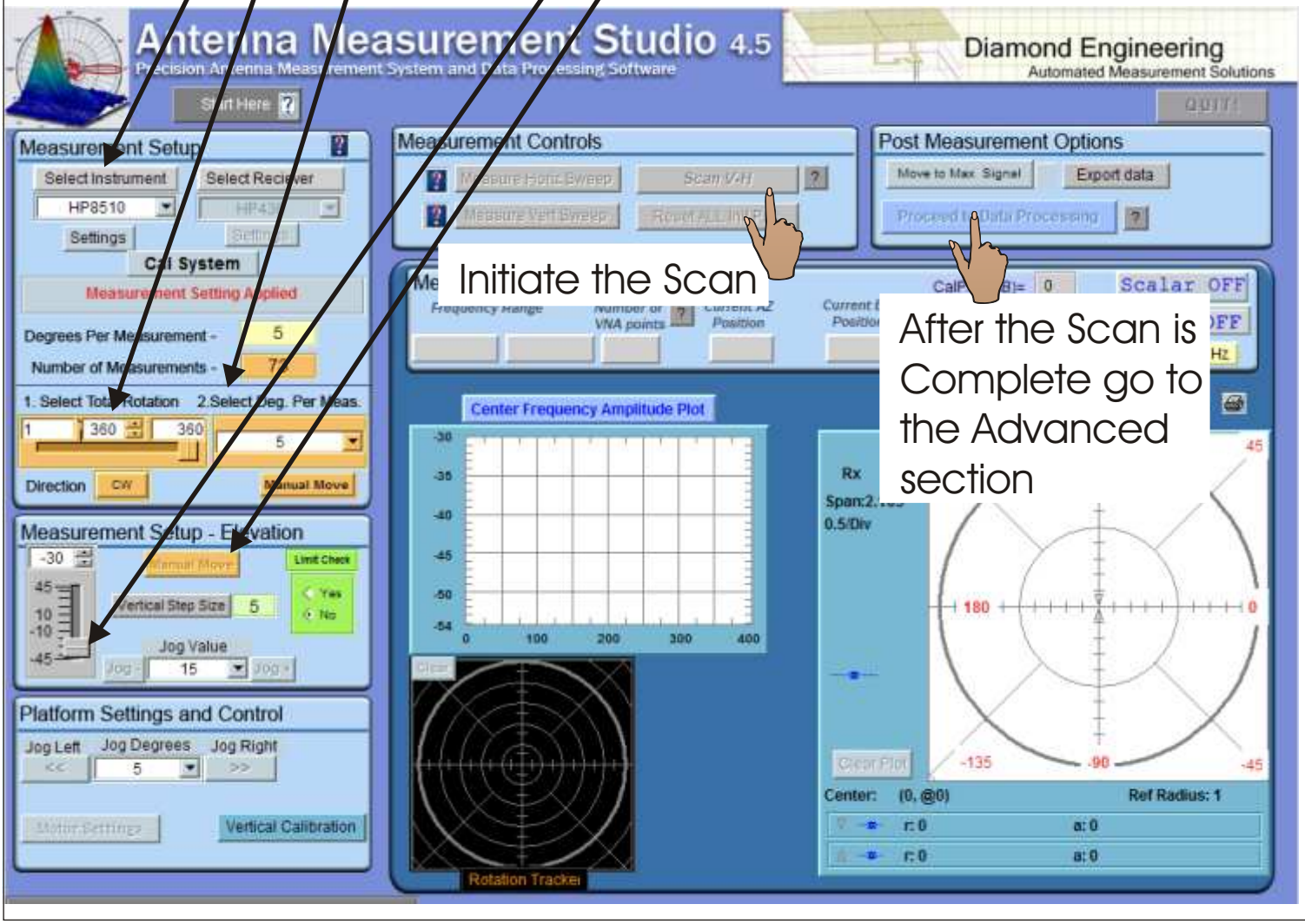
Direct Measurement Using Two Identical Antennas



Scan Ready position

Establish your VNA calibration including the platform and cables.

Set the total Az movement. Tilt the platform to a starting elevation and set the slider to the end El.



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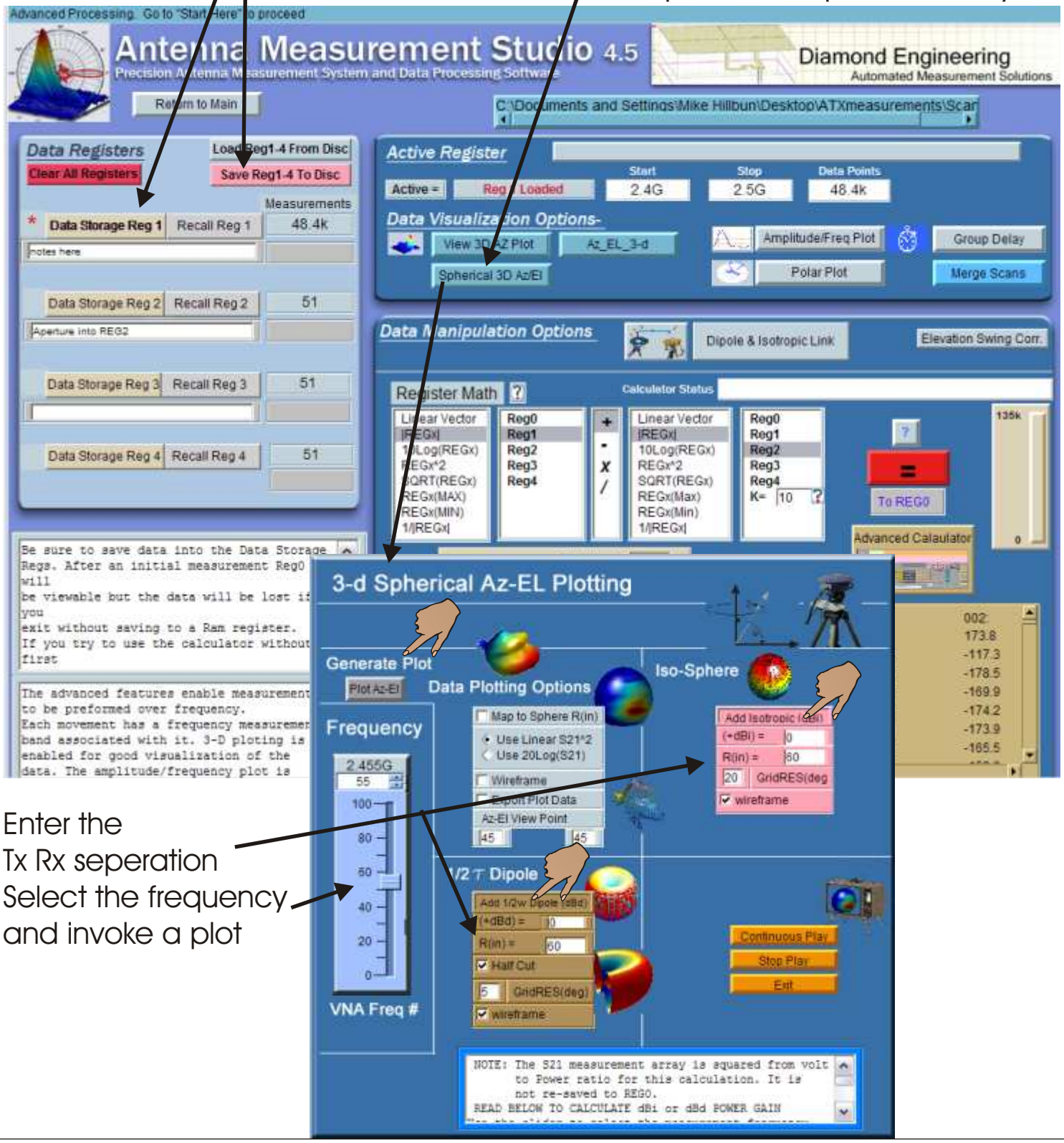
Save your data

Review your scan using Spherical with Isotropic and Dipole overlay



Enter the
Tx Rx seperation
Select the frequency
and invoke a plot

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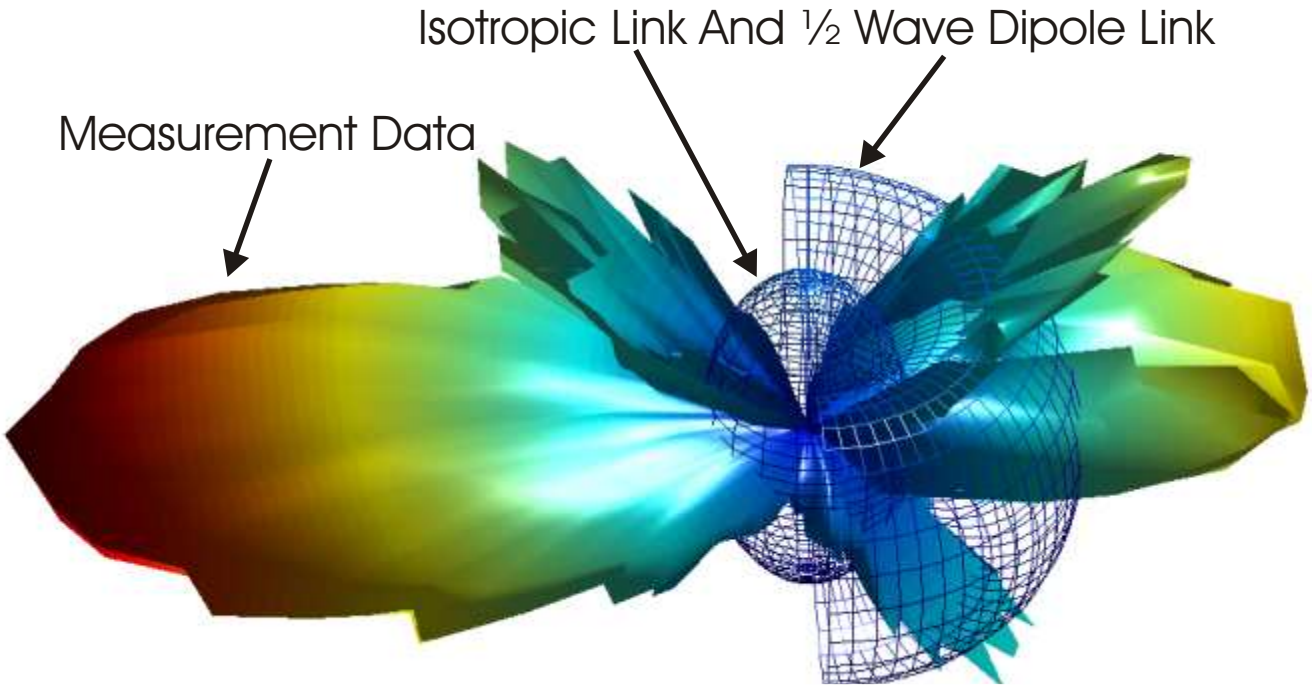
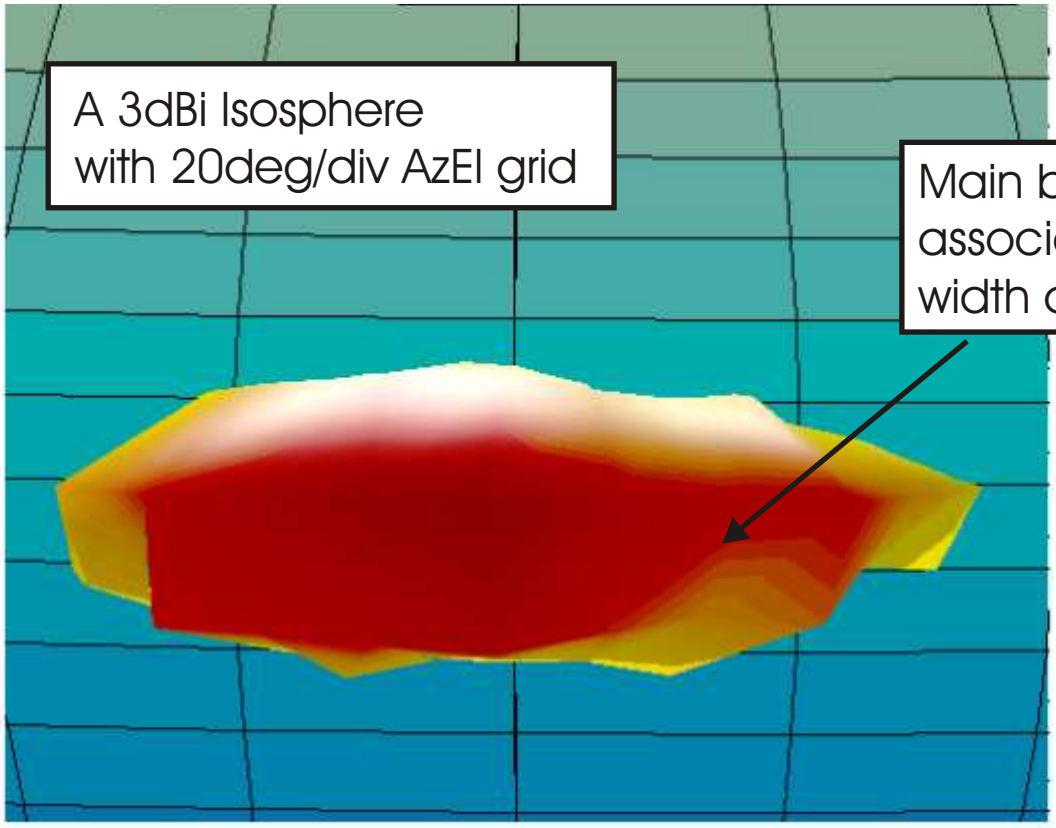
Spherical Profile. Rho,Az,El(0,0,0) is center of plot



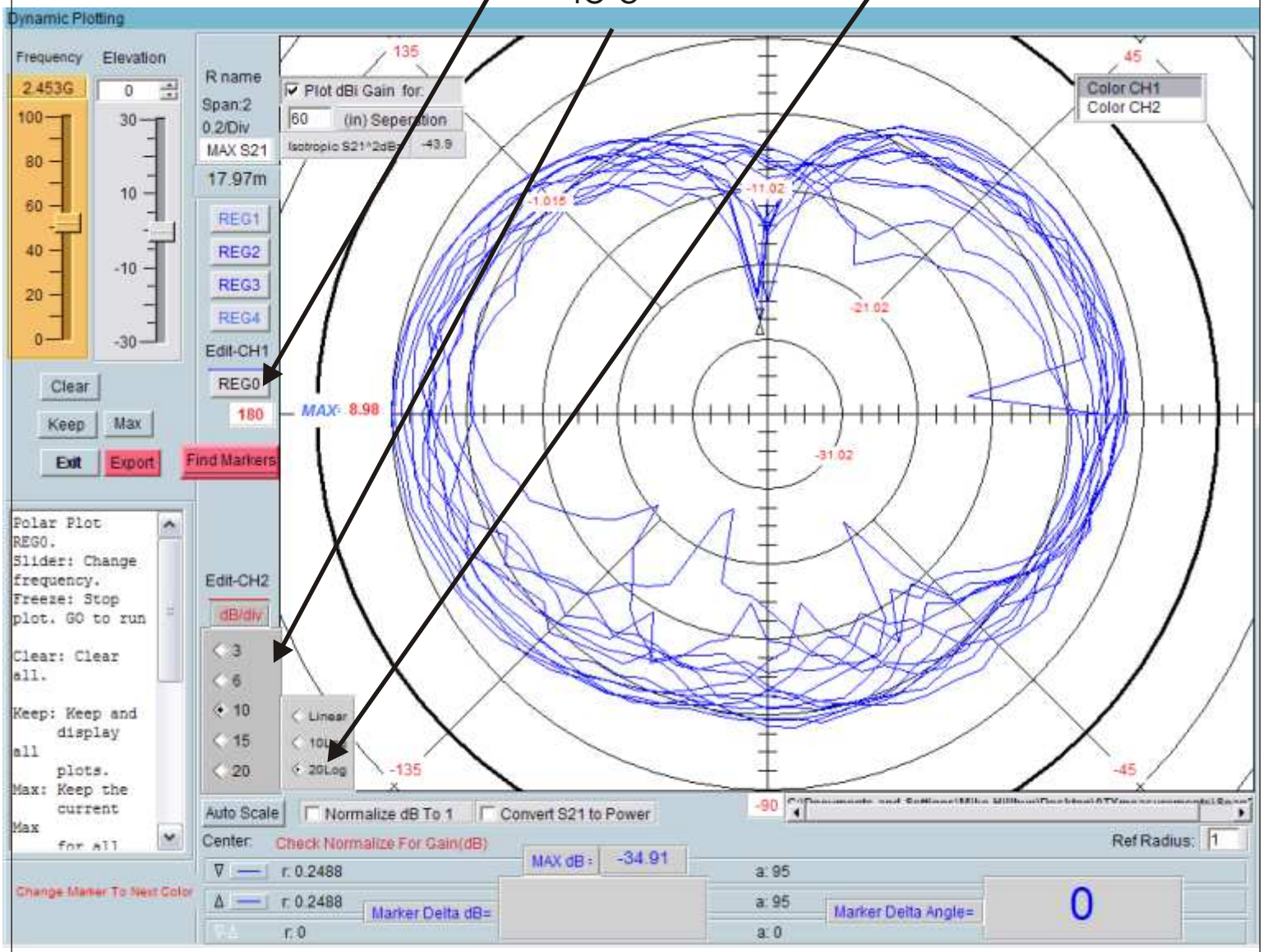
Replot using a solid IsoSphere with desired wire grid deg.
Rotate to main beam to see associated beamwidth



Initially all Scan contours appear. The "Plot dBi Gain" is used to scale the plot to dBi. The frequency slider can slide through the Scan realtime.

Exit the Spherical overview and invoke the Polar Plot from the Advanced Menu. Recall REG0 so all Scan contours for the Slider Frequency appear.

Set the Scale to 20LOG and dB/div to 6



When the Elevation slider is moved only the single contour associated with that frequency and elevation will be plotted.

In the above plot the red labels are the dBi gains. The MAX gain (8.9dBi) is indicated at 180 deg (in this case) at 2.453GHz

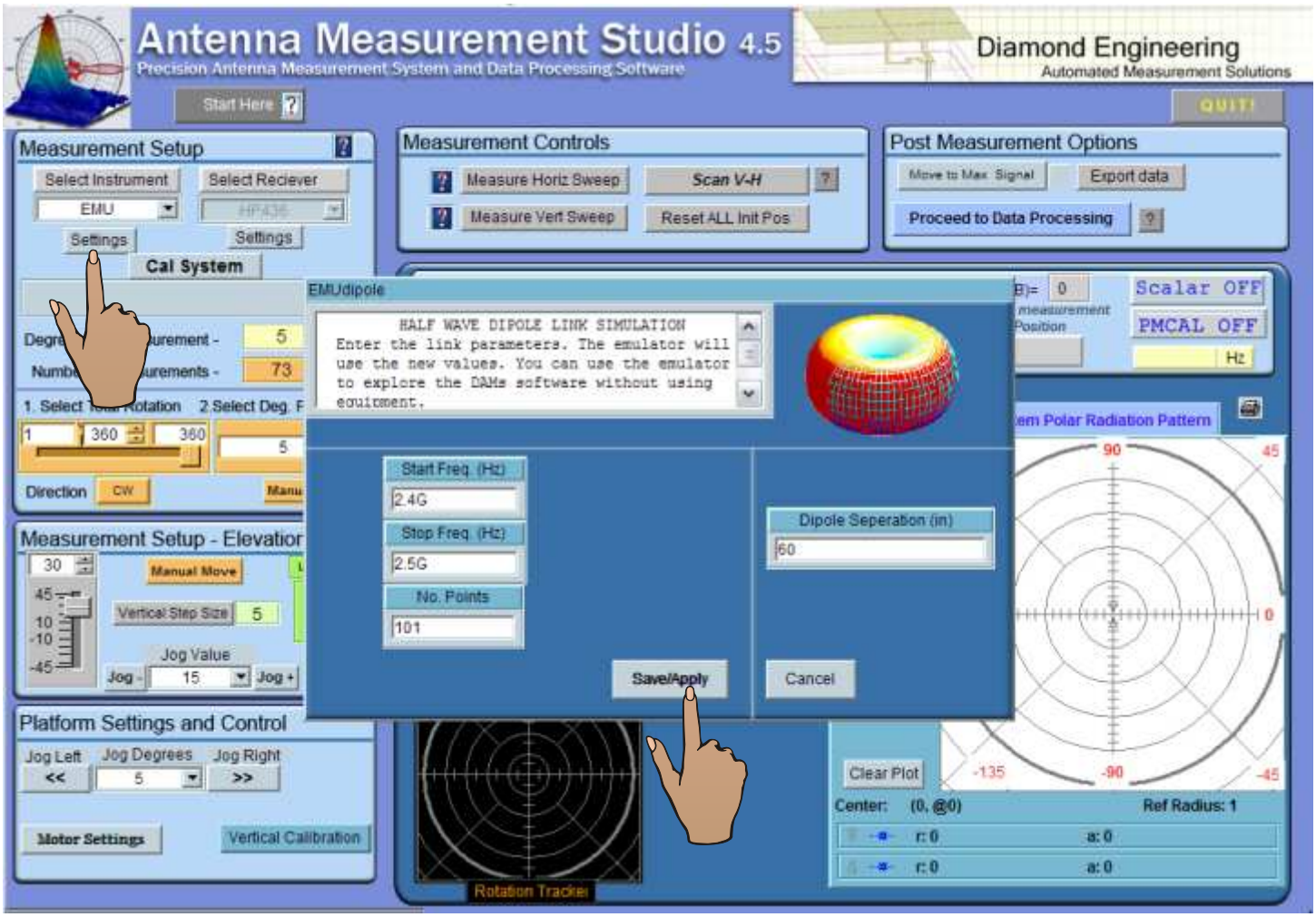
To determine the 3dB beamwidth position one marker to the peak and the second marker to the nearest -3dB point. The marker difference windows show the associated magnitude and angle difference. In this case the ½ beamwidth is 30 deg. The markers can be used to measure front to back and lobe ratios.

Log scale set to 3dB/div

Since "Plot dBi gain" is checked the red labels are dBi values

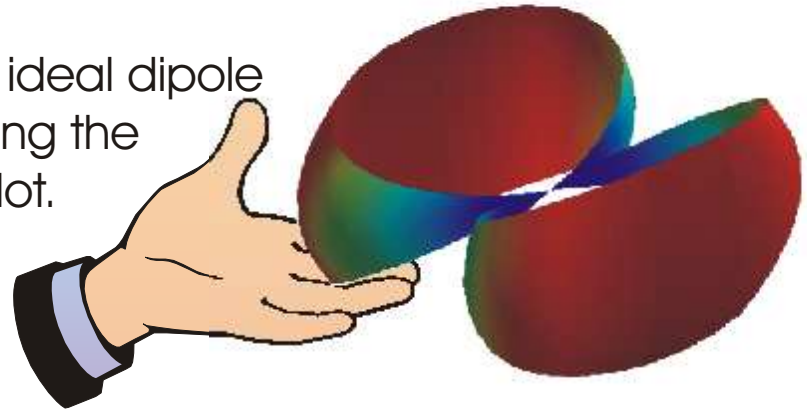
Compare this beamwidth to the previous Spherical Beamwidth

Generate the ideal ½ wave dipole by using the EMU (emulate) in the "select Instrument" menu of the measurement page. Use the "Settings menu to establish the identical measurement sequence as your measurement data.



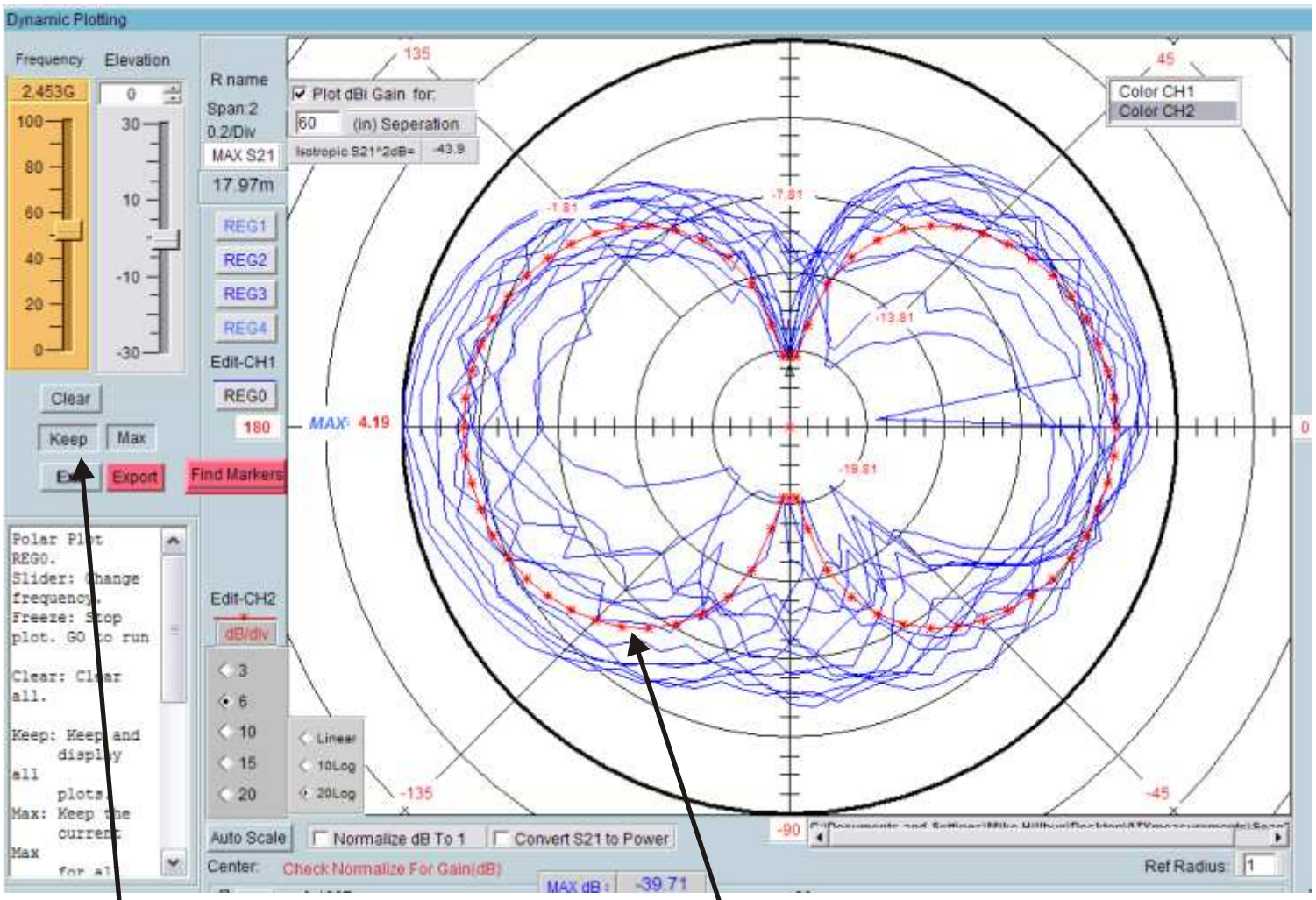
Spherical Profile. Rho,Az,El(0,0,0) is center of plot

Inspect the ideal dipole data set using the Spherical plot.



Reload your original measurements into the Regs from the disc. Reg0 data (ideal dipole) will remain. In the polar plot recall your measurements in Reg1 and invoke "Keep Max". The recall the ideal dipole data in Reg0 and change the line type for better visibility.

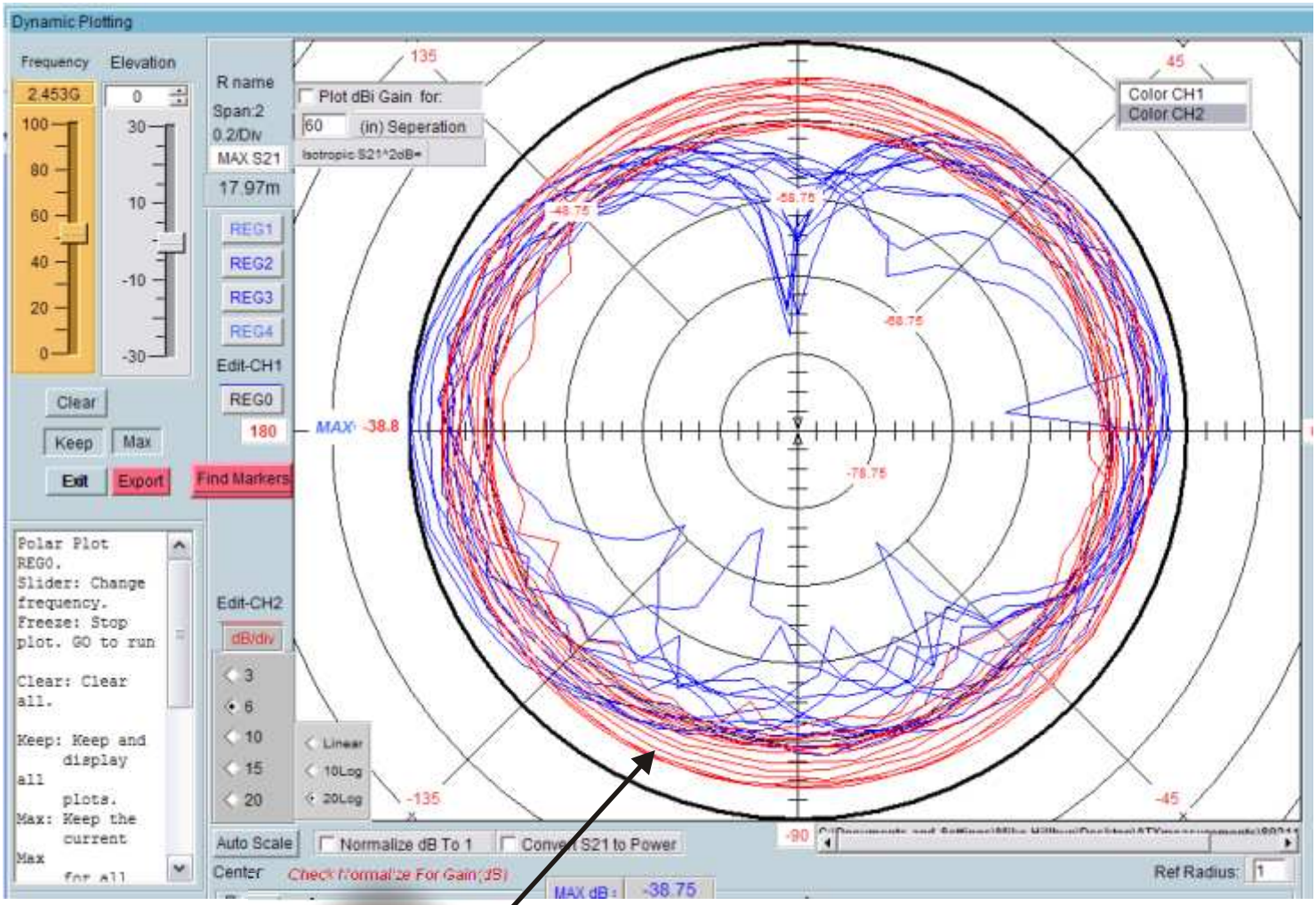
Scale set to 6dBi/Div



"Keep Max" will lock the plot diameter to existing data set.

The next data set will plot against the previous data set. The markers can jump from one contour to another for measurement.

To compare two antenna measurement sets load both sets into the registers. Recall the reference set (Reg1 our previous data) and invoke "Keep Max". Then load the second set (commercial dipole) from Reg2 so both overlay. You can then use the markers for measurement.



Scale : 6dB/div

This comparision could also have been done by using the array calculator to perform REG1/REG2. The resulting single data set would represent the gain relative to the commercial dipole.

Commercial 802.11 dipole (red) plotted against the 802.11 microstrip antenna