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# RFID Tag Antenna Measurement Using the DAMs6000 System And A Calibrated Reference Horn

This note demonstrates a measurement procedure using a calibrated reference horn to determine the Gain and Beam pattern of an RFID Tag antenna

## Statement Of The Measurement

Determine the Antenna Gain And Beamwidth properties for an RF ID tag antenna of unknown Tx Rx frequency bands.

| | |
|---|---|
| Test Freq : | .8GHz to 2GHz 201 points |
| Azimuth: | 0 to 360deg 5 deg resolution |
| Elevation: | -45 to +45deg 5 deg resolution |
| Gain: | Max Gain dBi & dBd |
| Beamwidth: | NA |

Find the front to back and Max to Min Gain at Fmax

Generate the spherical profile compared to Isotropic

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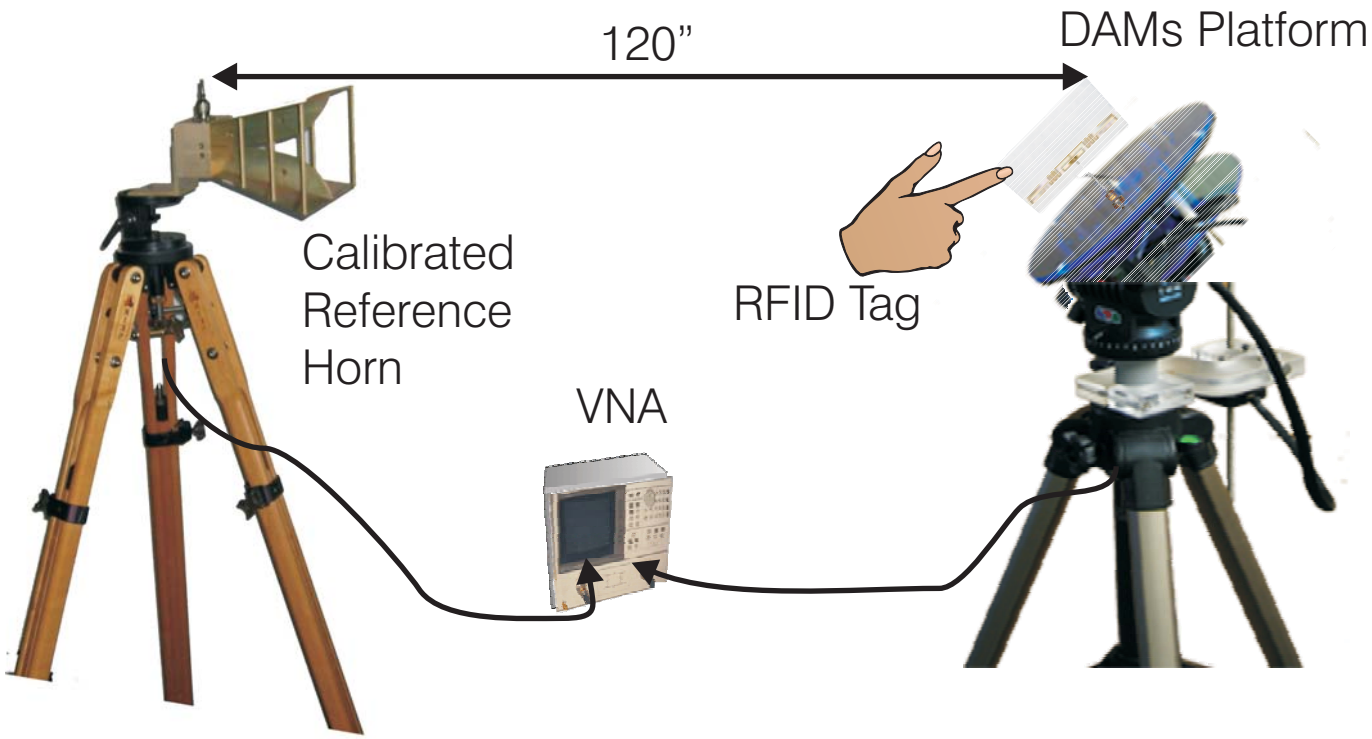


**Typical RFID Tag with .026 Micro-coax attached in place of chip transponder**

# Set Up The Measurement Equipment

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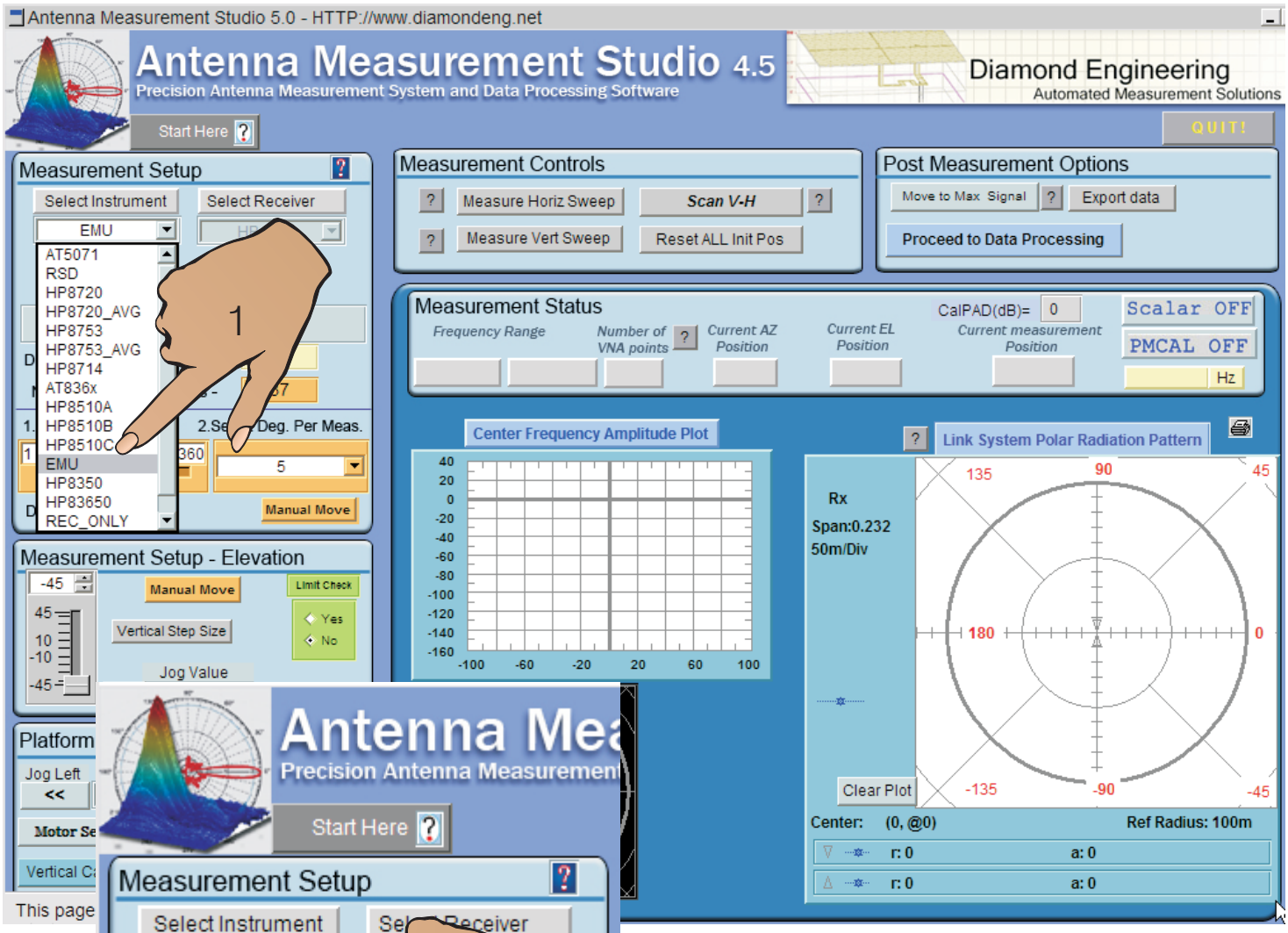
1. First Use the Pull Down to select the VNA

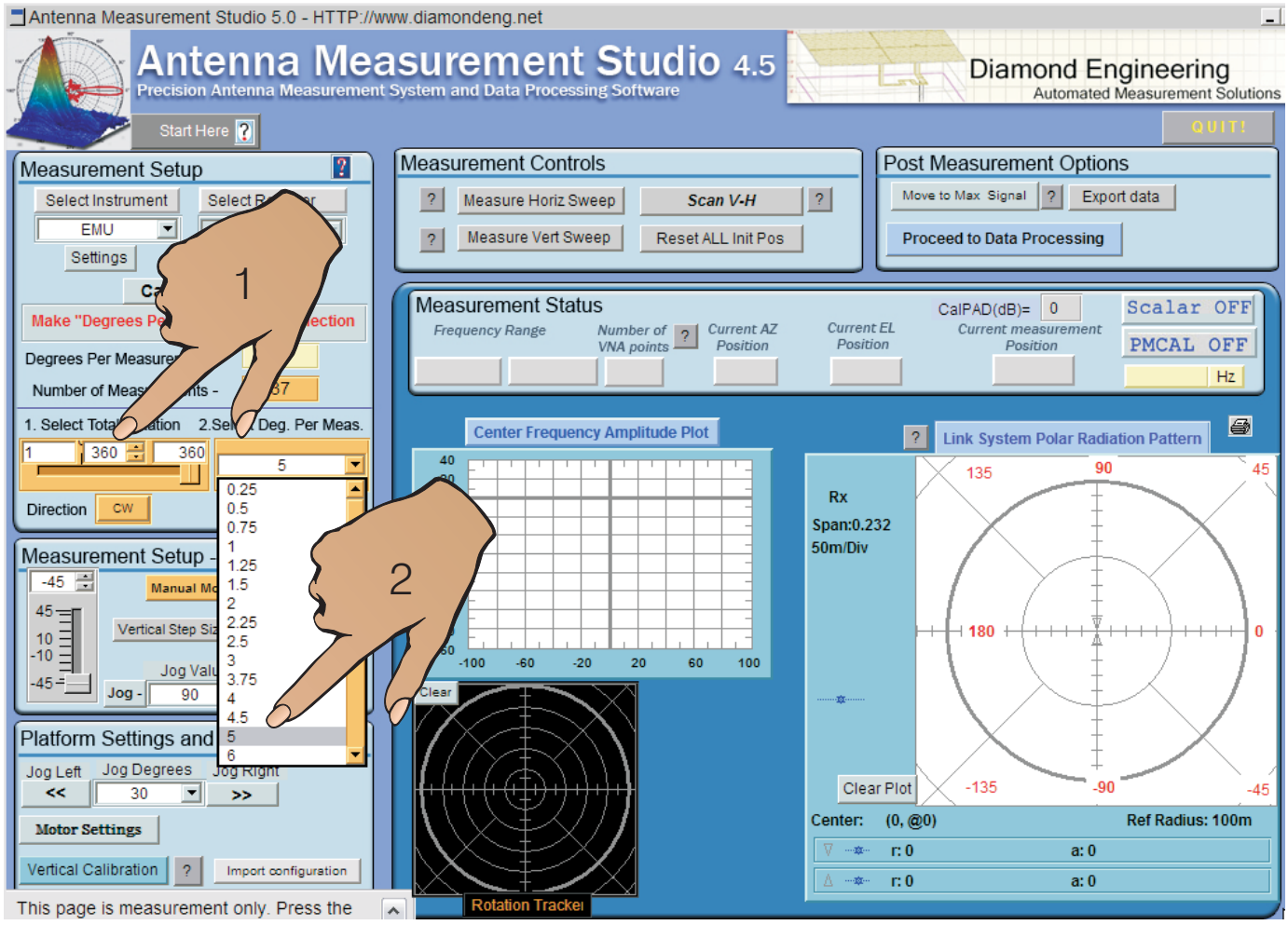



2. Use the Settings Menu to set the properties or you equipment

# Set The DAMs For Scan Mode

1. Slide the Azimuth rotation to the rotation value
2. Select the Azimuth movement resolution degrees

Note: If you wanted to scan about the main beam of an antenna from say +10deg to -10deg then first use the Manual Move to +10deg. Then slide the total rotation slider to 20deg and the Direction to CW or opposite. Scan will move from 20 deg from current position to -10deg. **During Scan Mode the DAMs always scans back and forth.**



# Set The DAMs For Scan Mode

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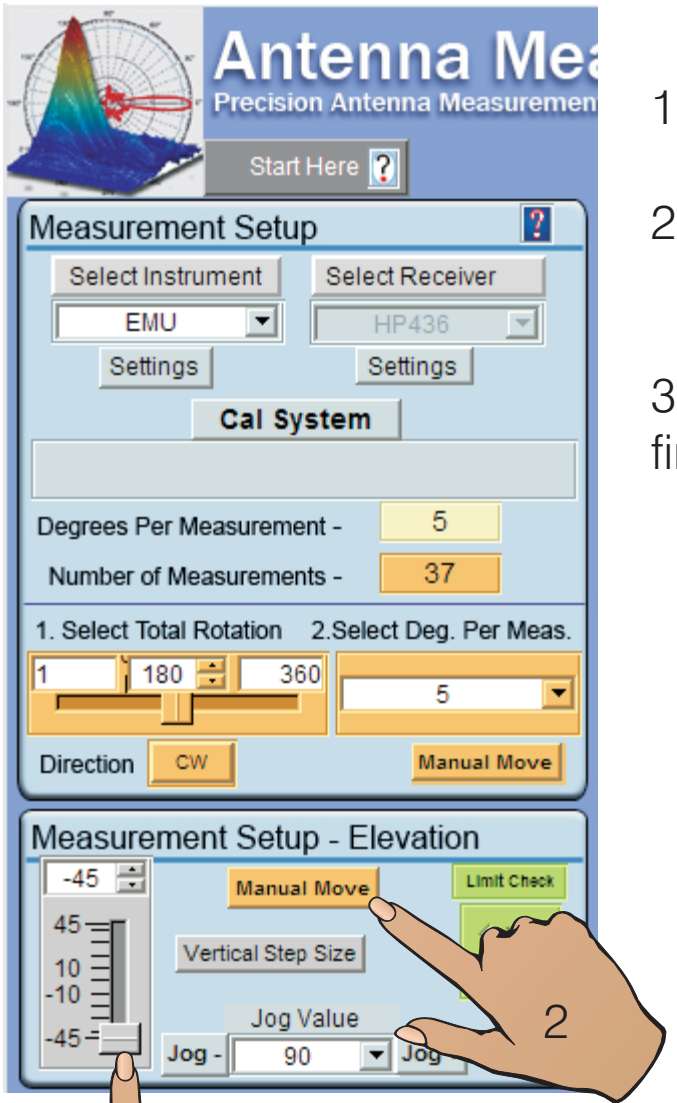
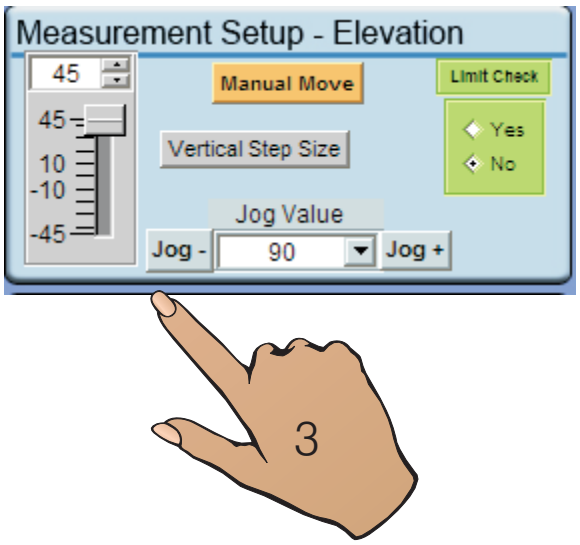



1. Set the Elevation Slider to -45deg

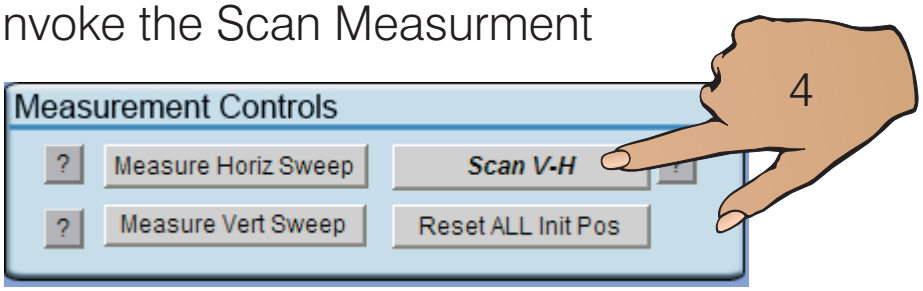
2. Use Manual Move to position the platform to -45deg.

3. Set the Elevation slider to the final scan destination ie. 45 deg.

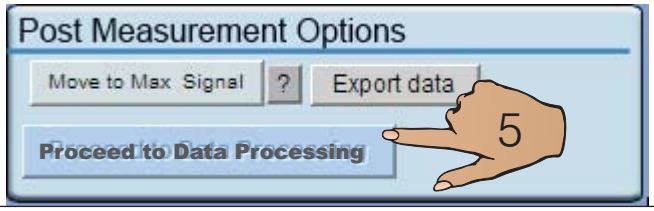



The system is now ready for Scan

4. Invoke the Scan Measurment



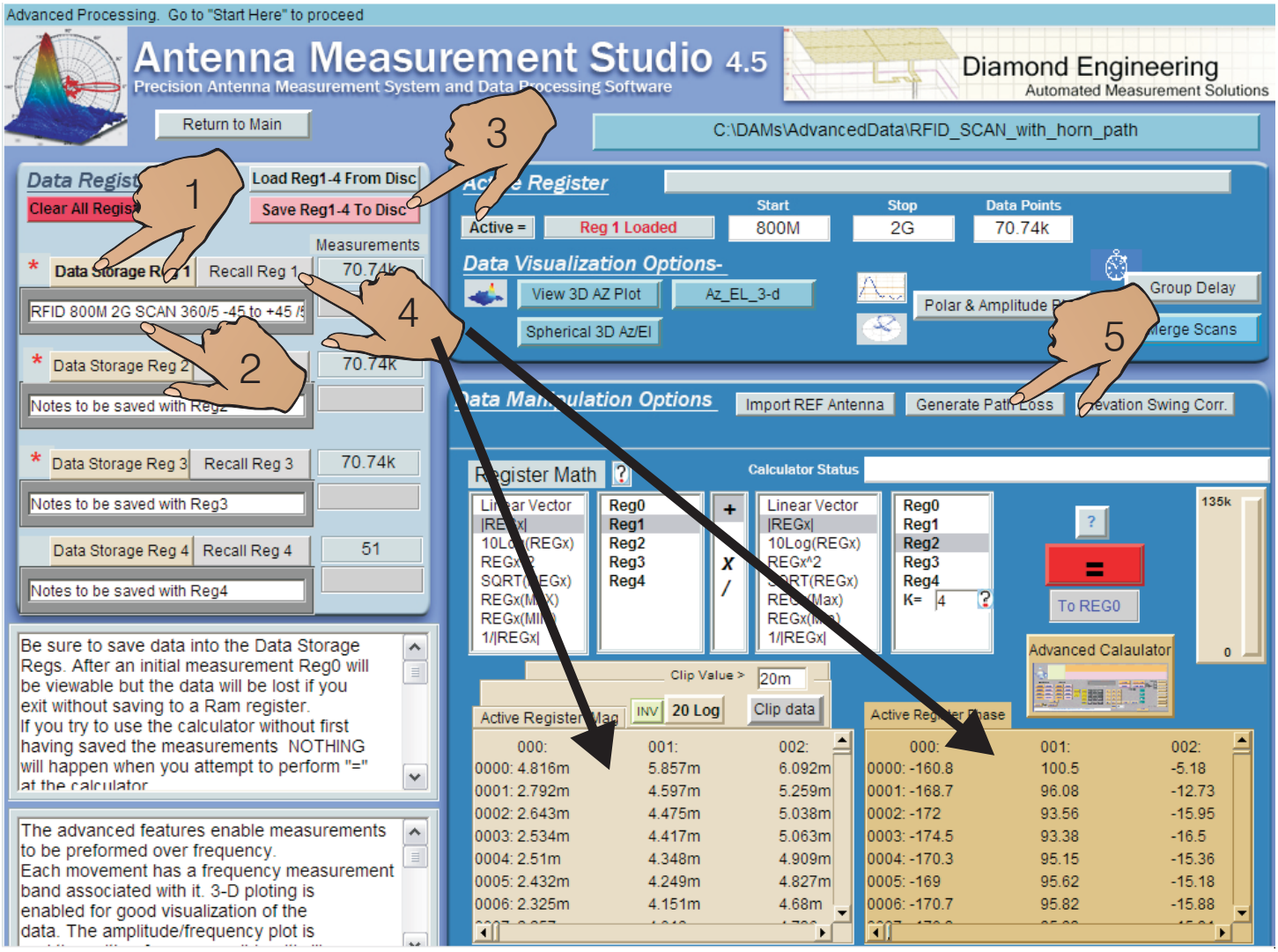

When Scan is complete the button will depress




5.Enter the Advanced Menu

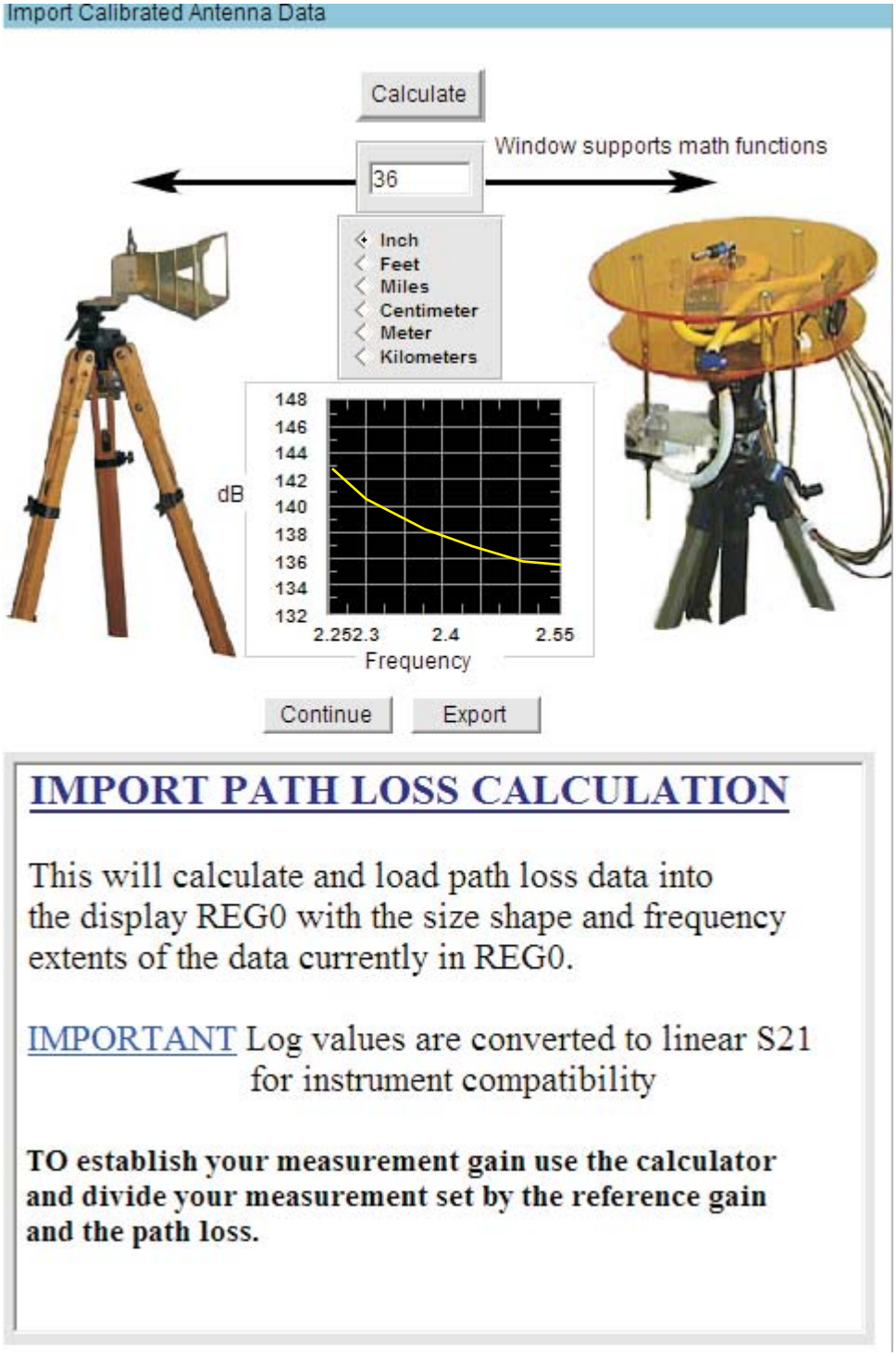
# Advanced Processing Module

1. Save data to a register
2. Add notes to be saved with reg
3. Save Regs to disc
4. Recall Reg to load display Reg0




5. Generate the path loss with the same shape and frequency extent as the display register reg0

# Generating A path loss array




Save the path loss data into a storage reg2(in this case)

# Input Horn Calibration Data

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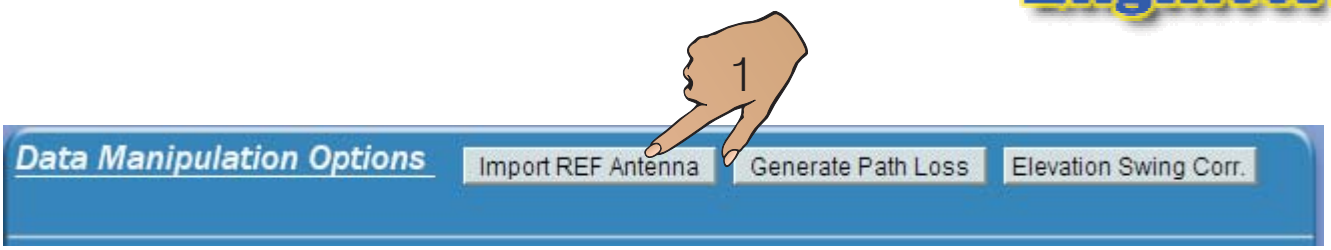


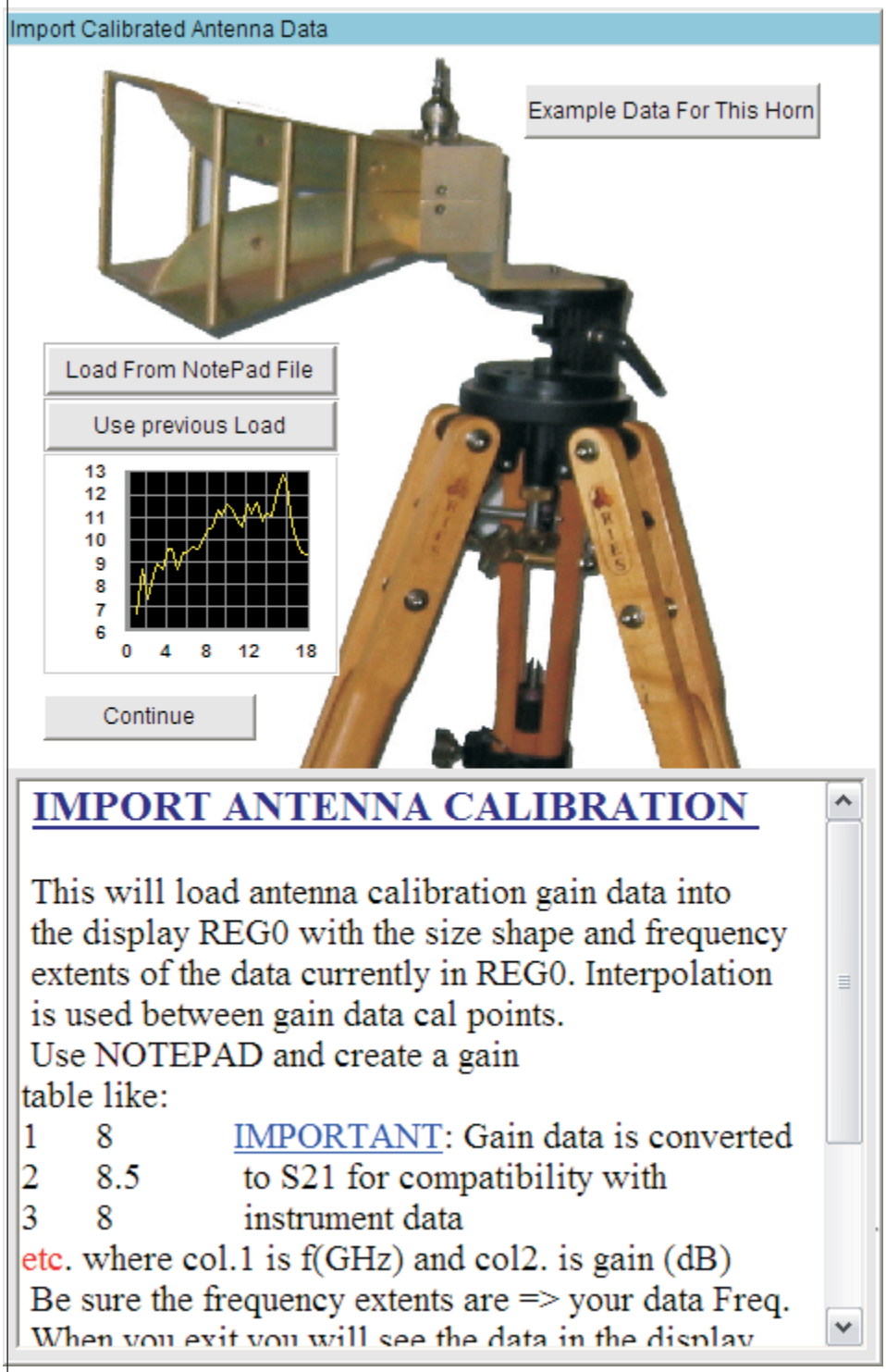


Horn calibration data files can be generated using Notepad or entered directly. The DAMs software will interpolate between frequency calibration points as required.

Re-save the calibration array to a reg

# Calculate the AUT(antenna under test) Gain

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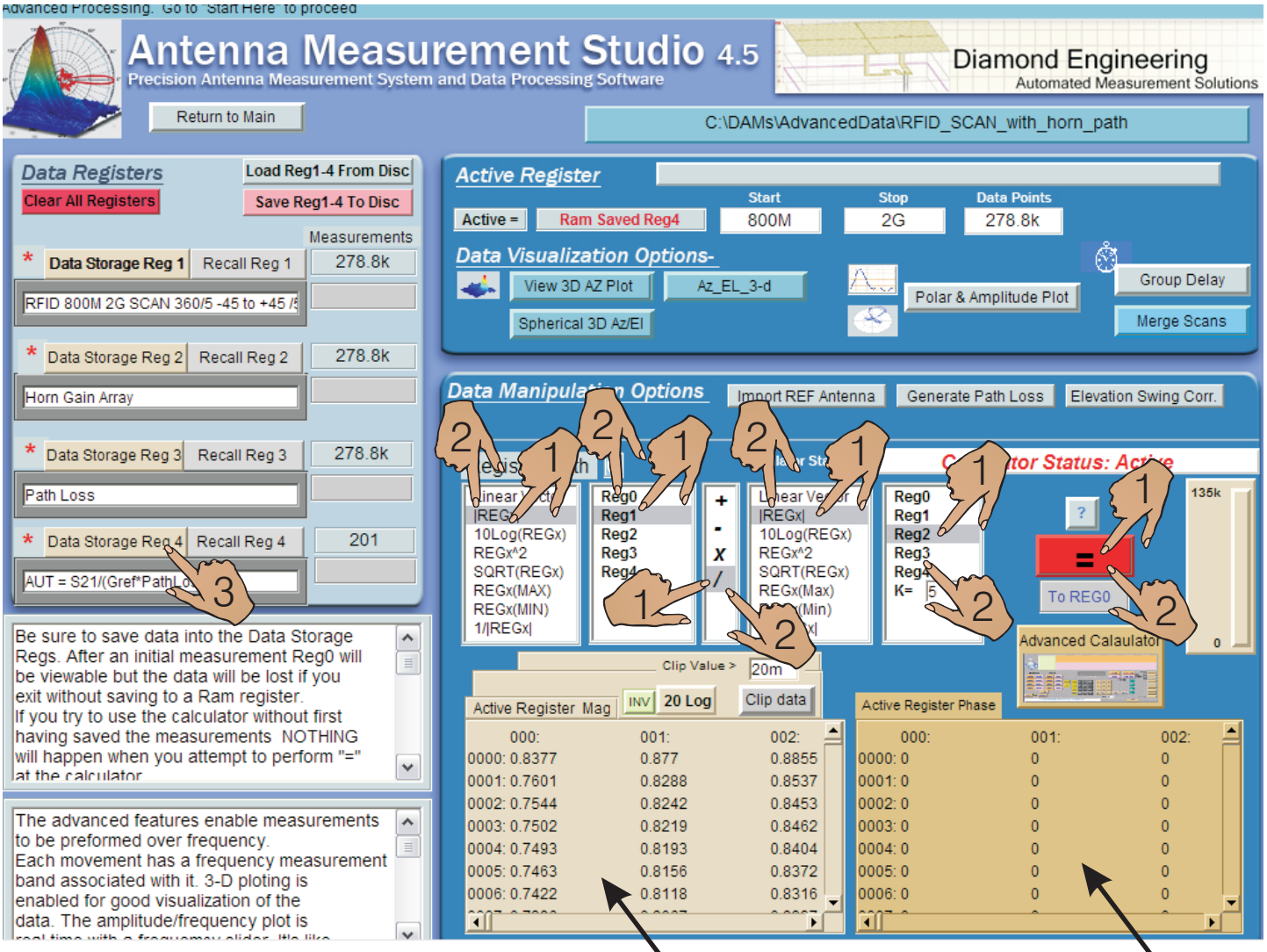
1. Perform the gain calculation Reg1/Reg2 → Reg0 (display)
2. Remove the path loss Reg0/Reg3 → Reg0 (display)
3. Save the gain data to Reg4




Reg0 will contain the linear AUT gain data

# Plot the contours and find Max Gain

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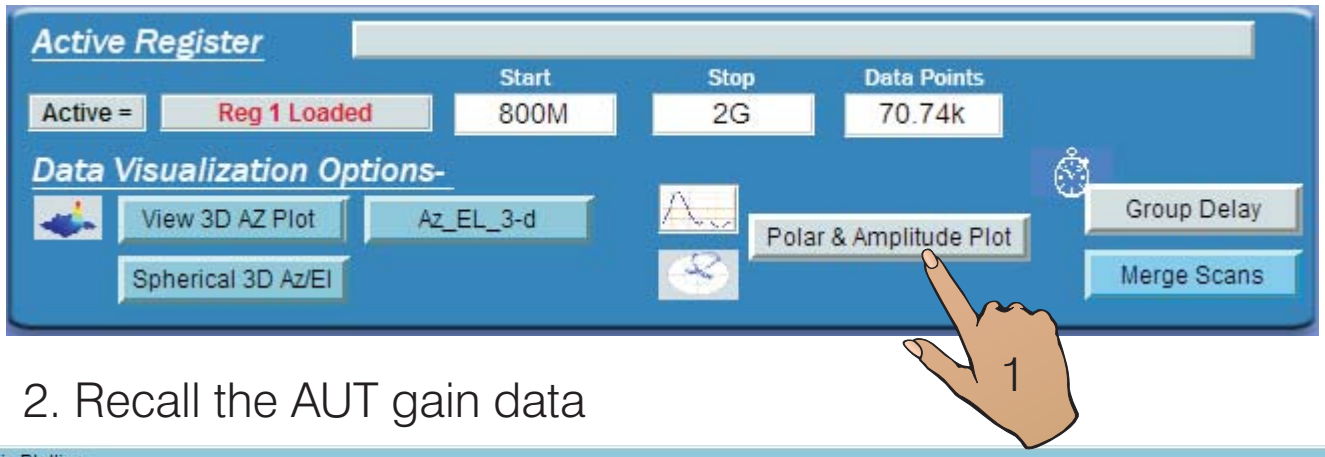
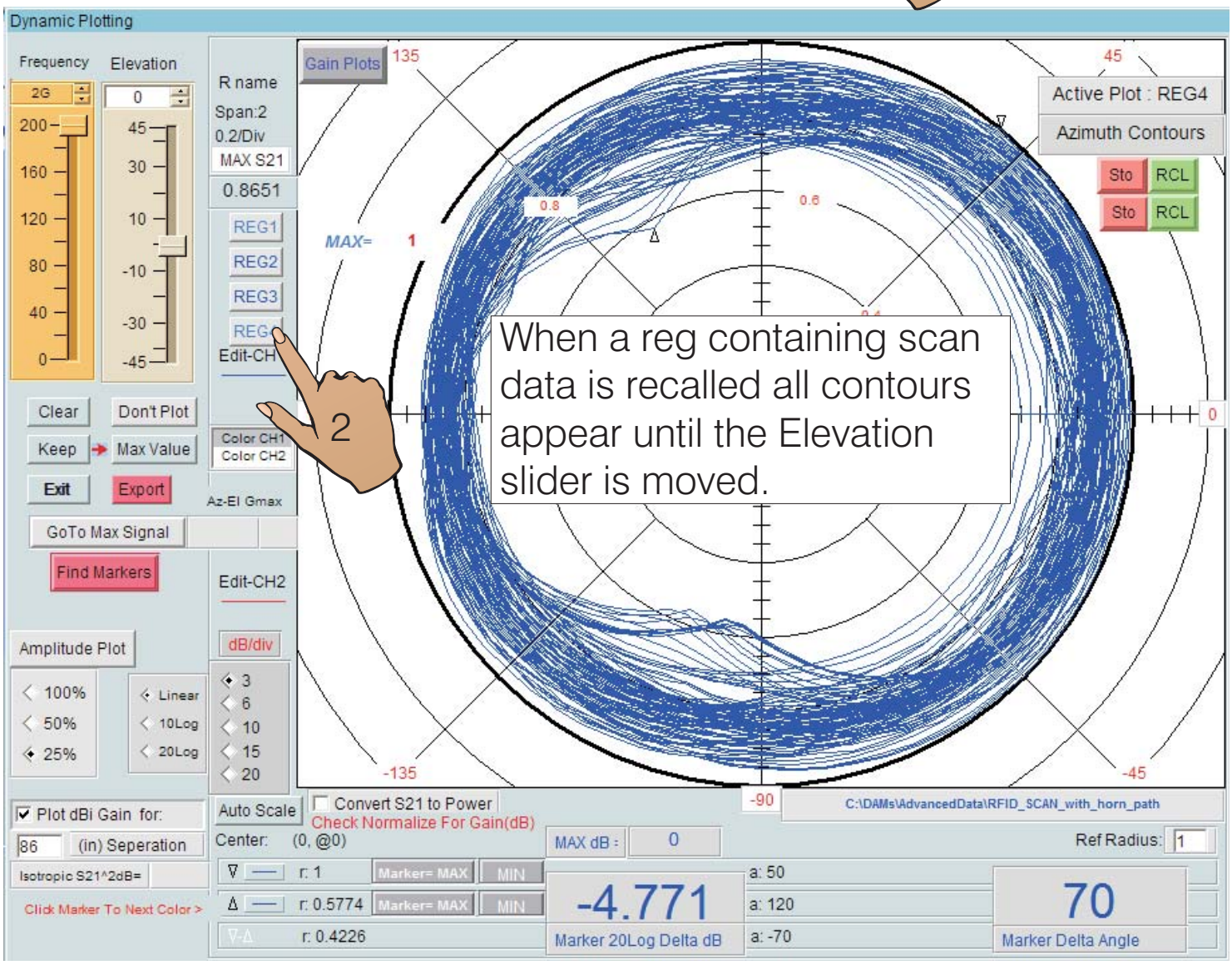
1. Invoke the Polar/Amplitude Plot Module




2. Recall the AUT gain data

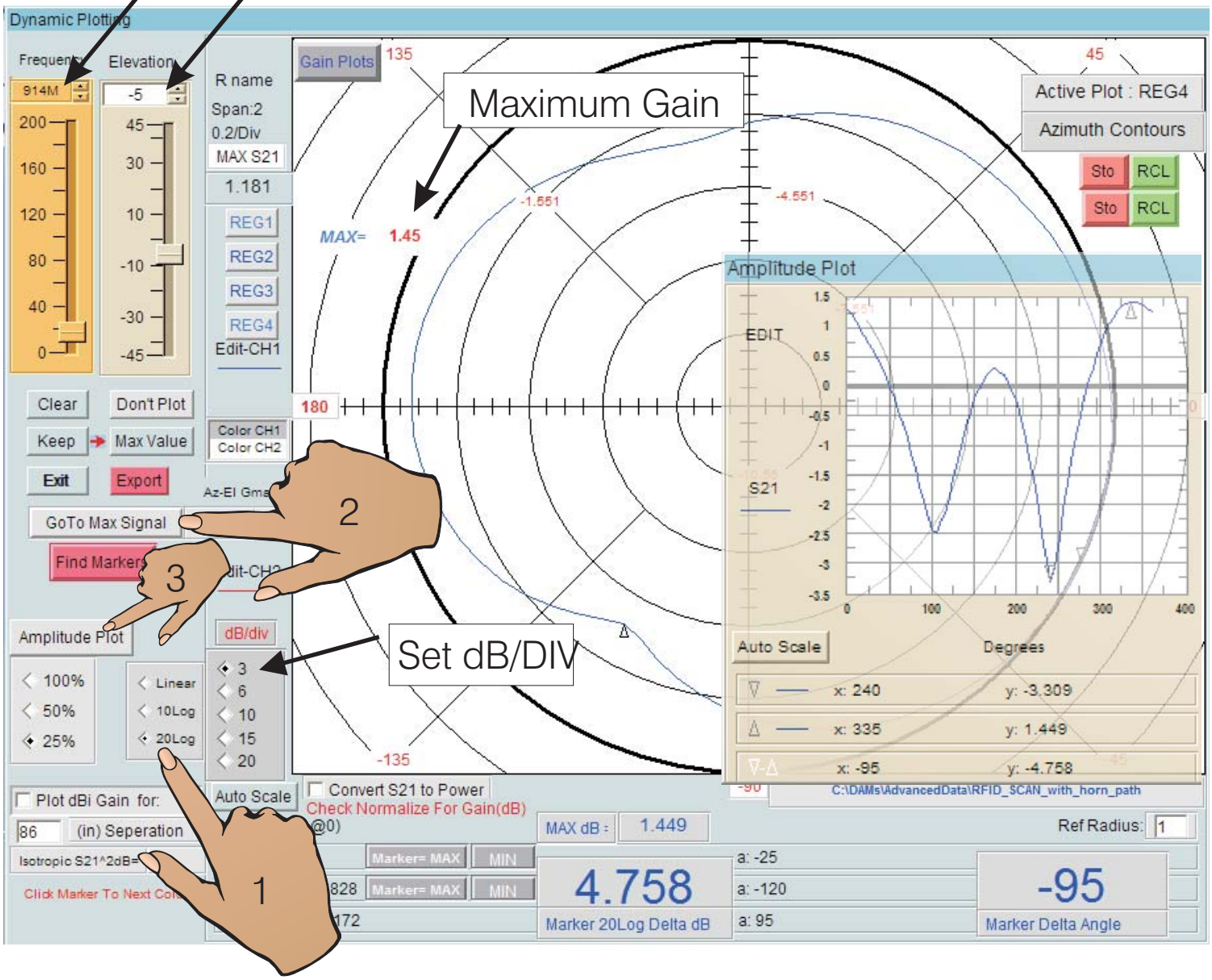


# Plot the contours and find Max Gain

1. Change the scale from linear to 20Log

2. Invoke GoTo Max Signal. The frequency slider and the Elevation slider will move to the max signal contour.

Maximum Gain Frequency (914MHz) Elevation -5deg

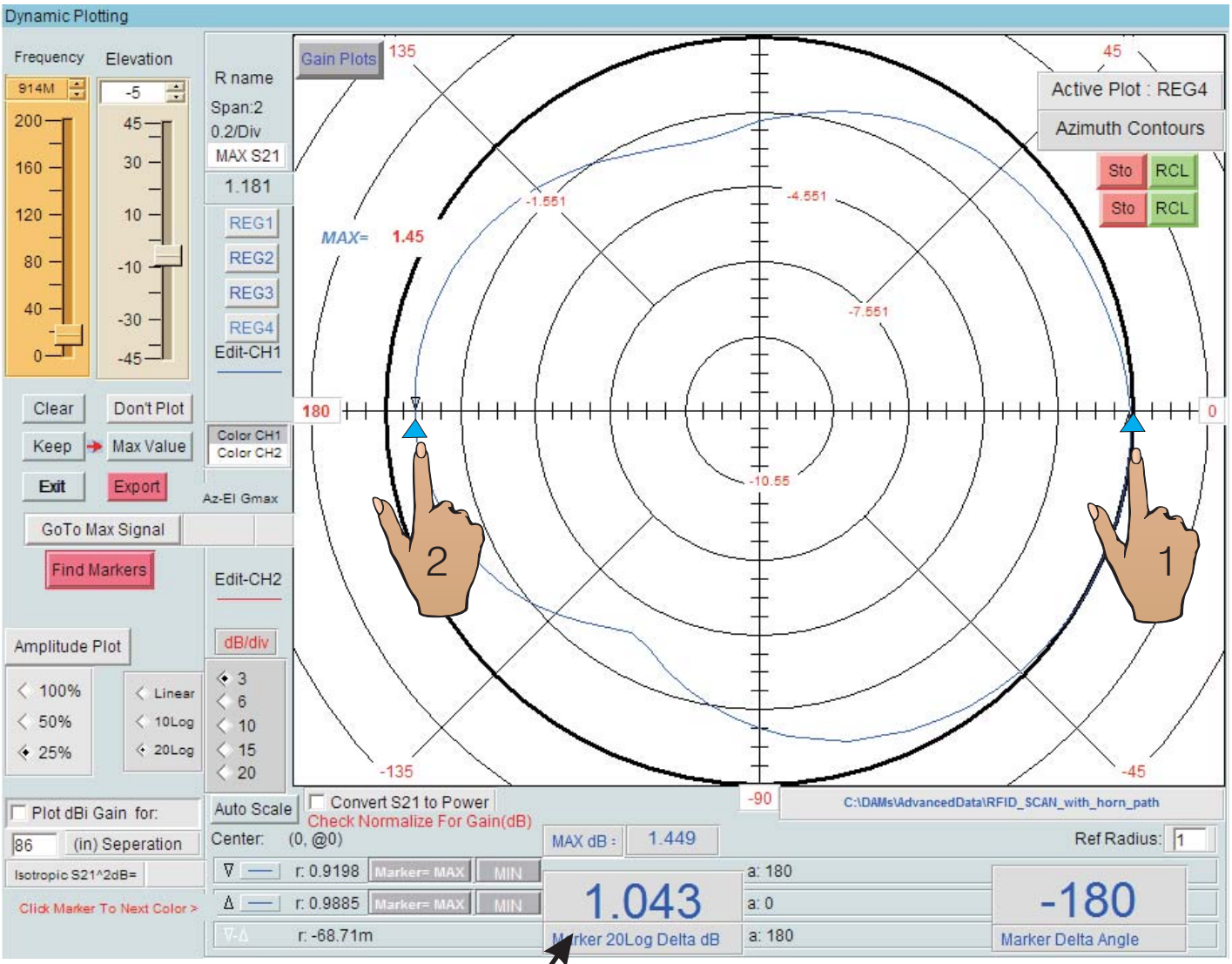



3. Invoke the Amplitude Plot for reference

Note: For absolute data log mode must be used. Linear mode normalizes all data to 1 unless KEEP MAX is invoked

## Find the front to back and Max to Min G

1. Position Marker1 to front (0 deg)
2. Position Marker2 to back (180 deg)
3. Read Marker delta dB = 1.043dB

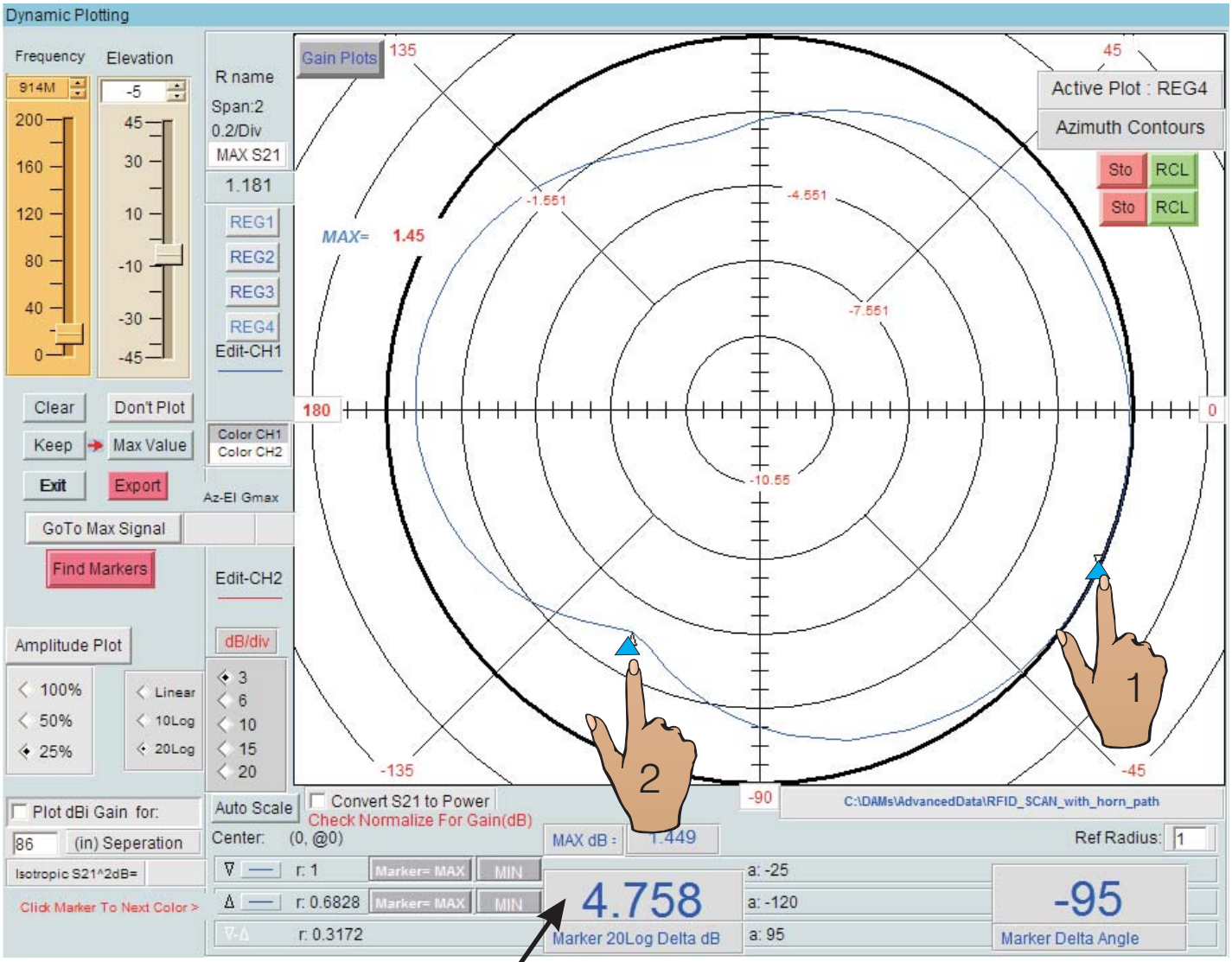



Front to back ratio

## Find the front to back and Max to Min G

1. Use Marker1=Max to locate marker1 on the maximum

2. Use Marker2=Min to locate marker2 on the minimum




Max to min ratio

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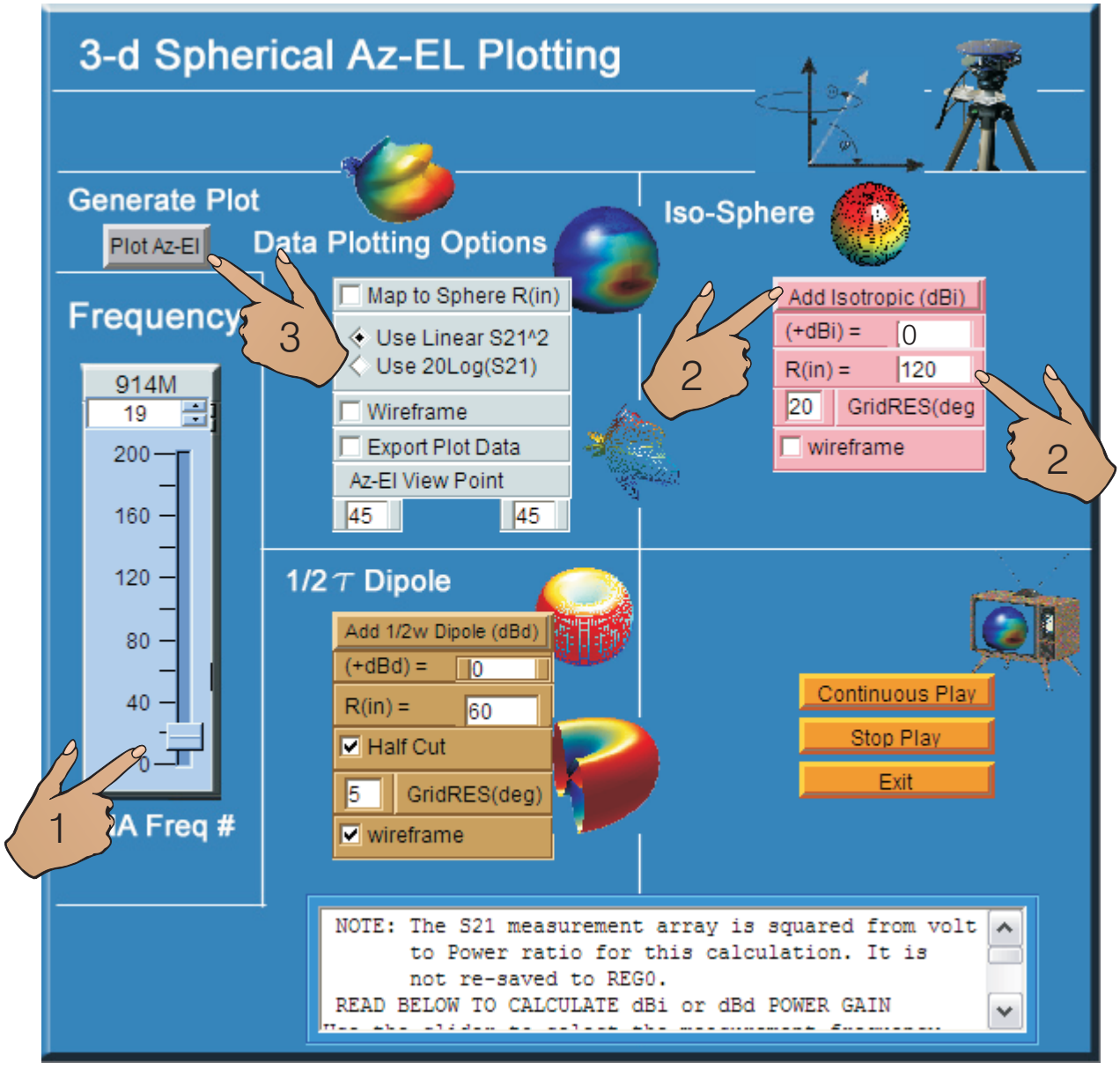
## Generate the spherical profile compared to Isotrophic

From the Advance page enter the Spherical Plot module

1. Set the frequency slider to the max contour (914MHz)
2. Invoke the Isotropic link and enter the separation
3. Plot the response



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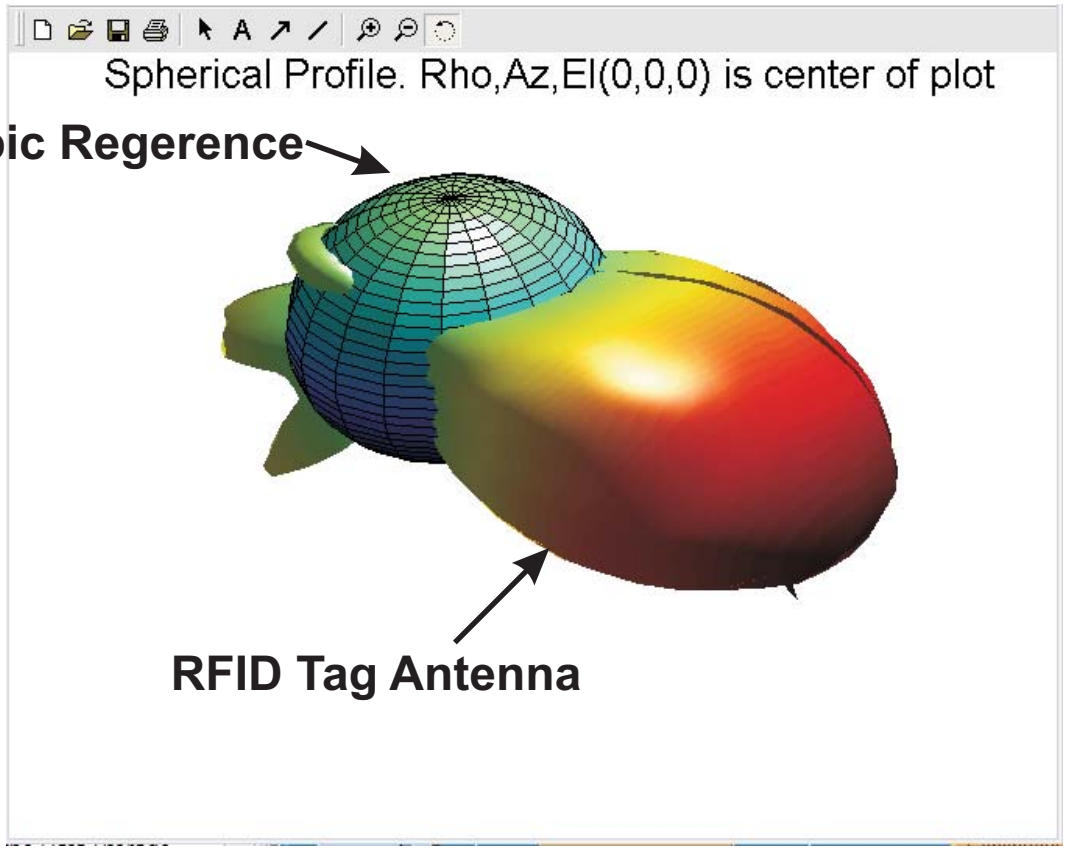
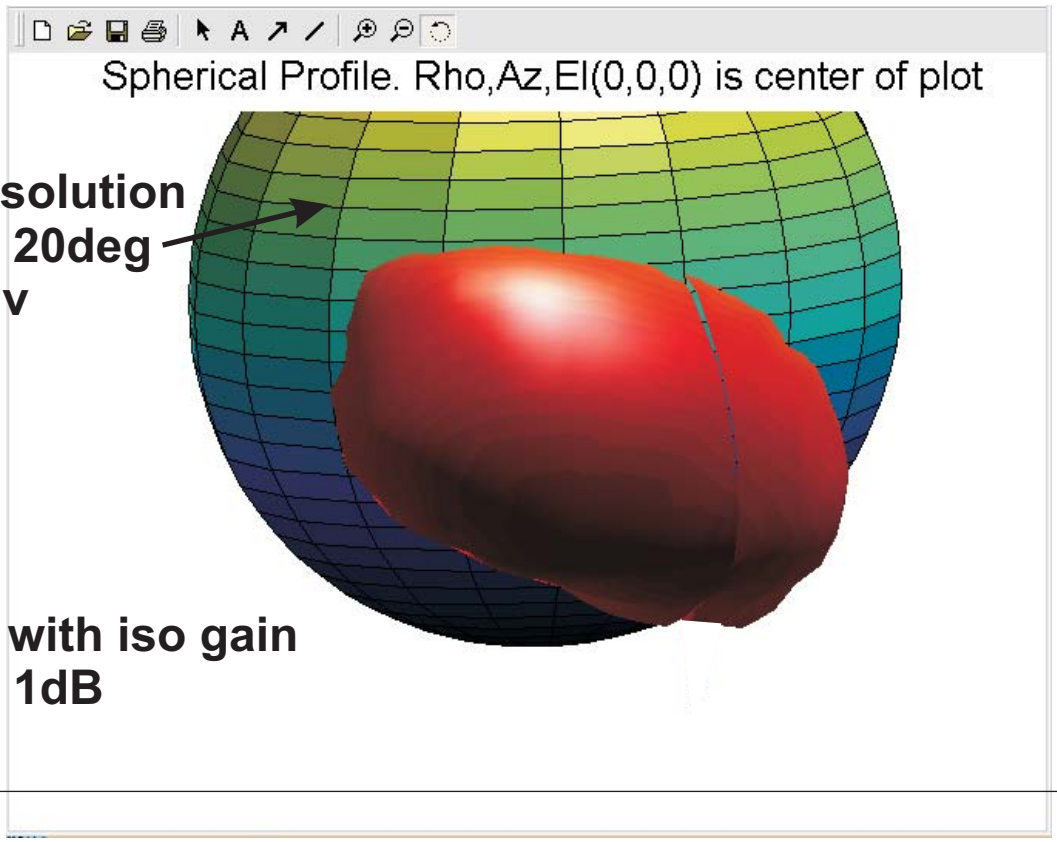
## Generate the spherical profile compared to Isotrophic



Max Gain with Isotropic and dipole link

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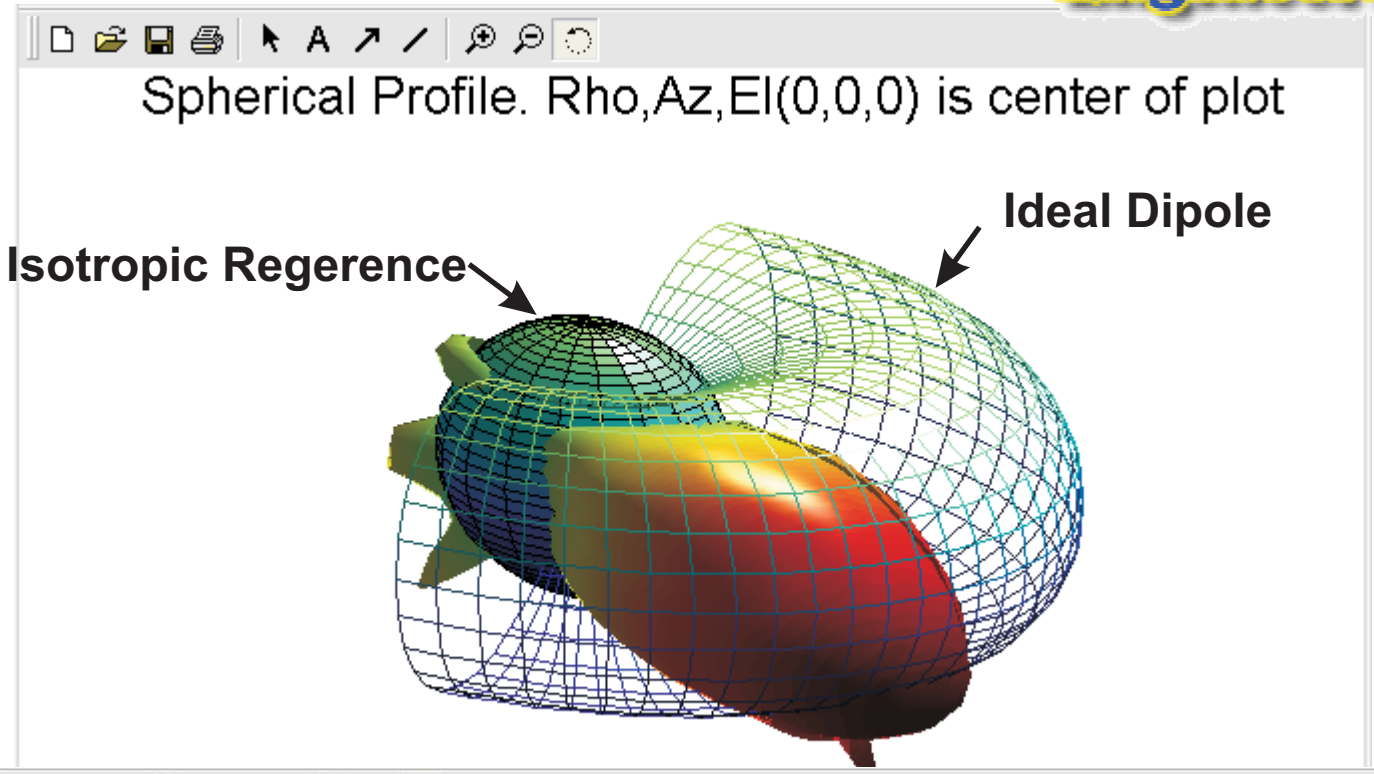


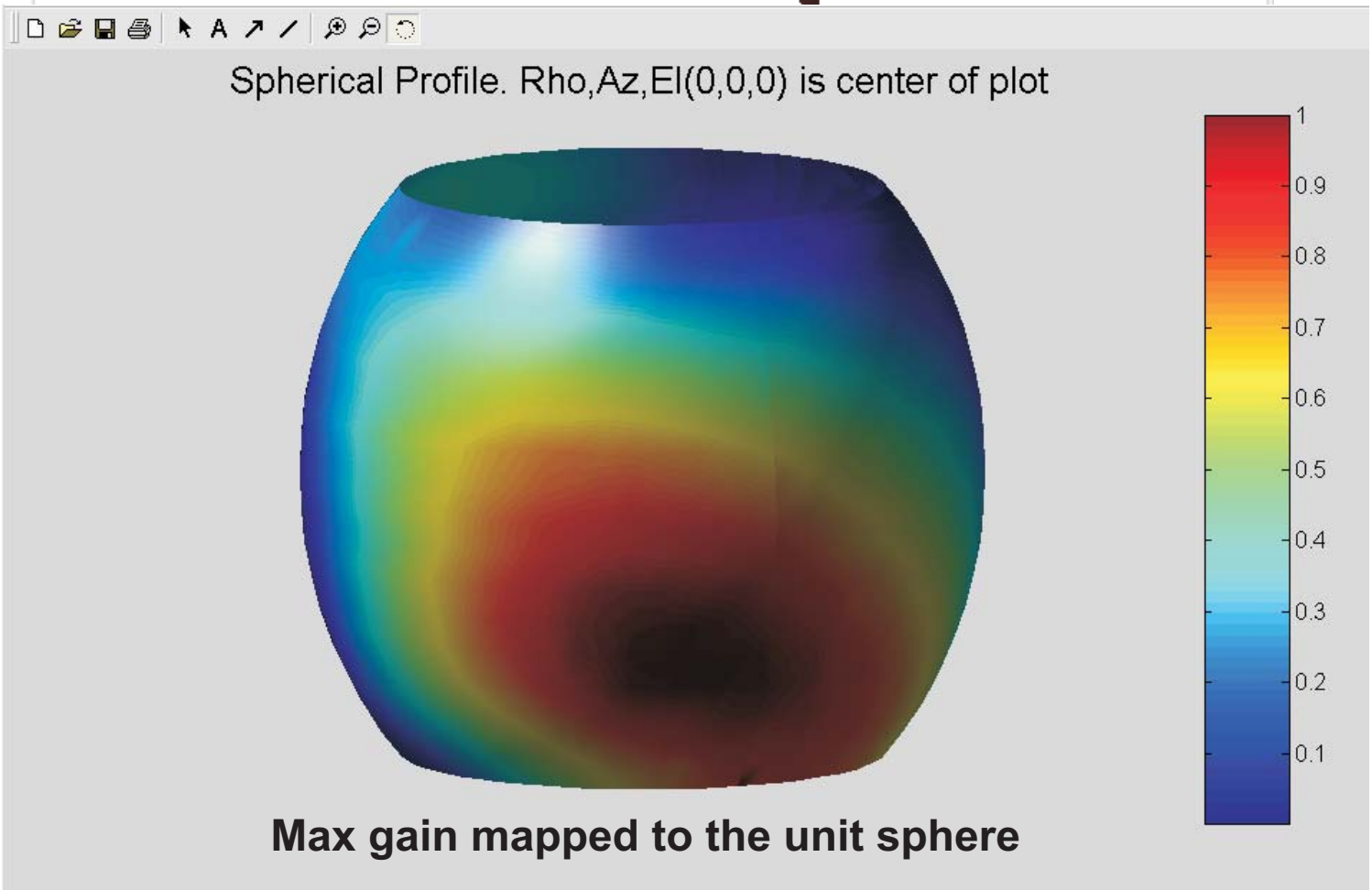


**Max gain mapped to the unit sphere**

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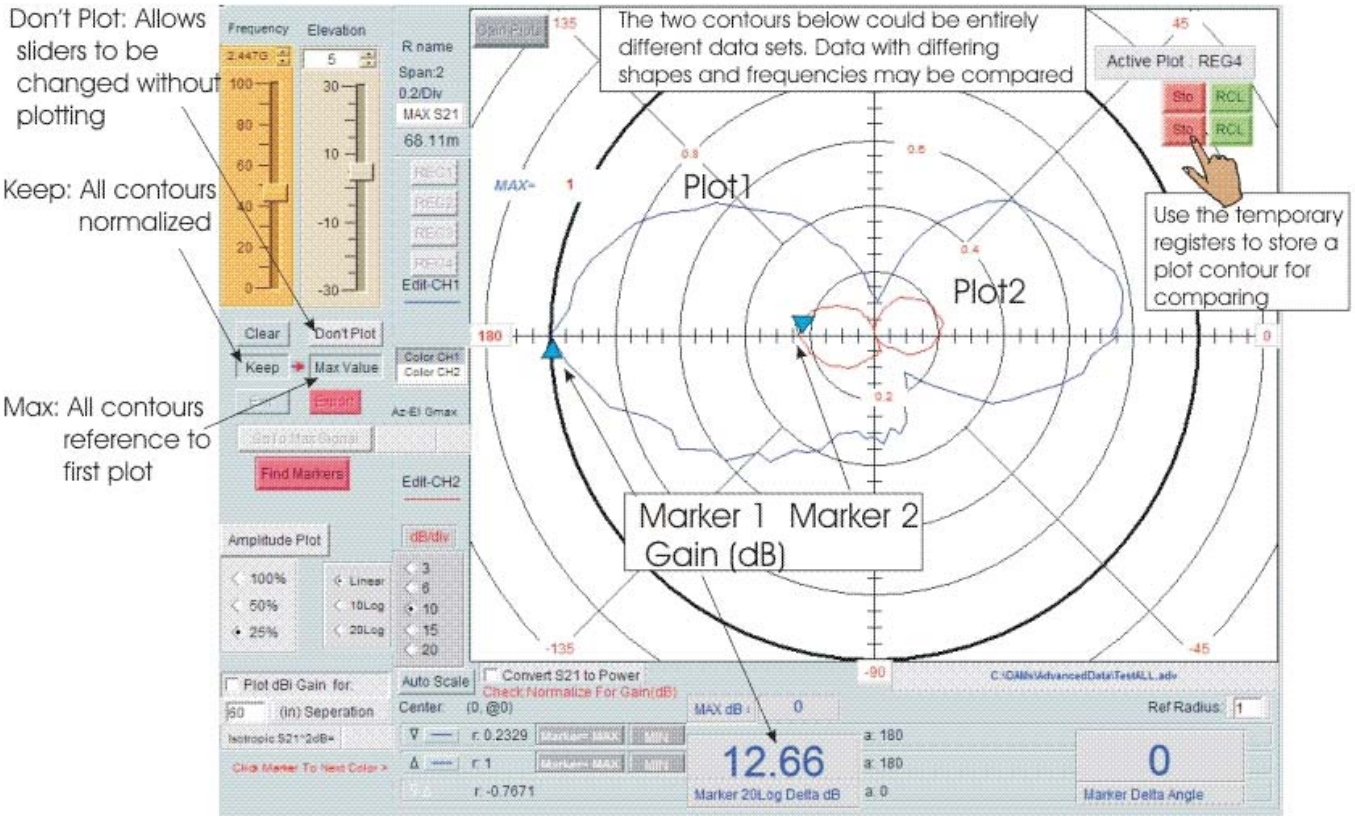
# Linear Plot Using Two Separate Measurements

Linear Plot is Always normalized to 1 unless Keep or Keep Max Value is invoked.
Use 20Log Marker Delta to compare two linear S21 plots



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# Linear Plot Using Single Measurement And Isotropic Link

Must be Log Plot. When Plot dBi Gain is checked the polar plot scale (red) is the difference between the isotropic link gain and the measurement link S21dB