Cheetah PNA RCS and Antenna Measurement System

System Planning Corporation

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Agenda

- Why the Cheetah System
- What is the Cheetah System
- The Agilent PNA Network Analyzer
- Cheetah Noise Figure Measurements
- Cheetah NERCS
- Cheetah Dynamic Range
- Cheetah System Measurement Timing
- Cheetah Control and Processing Software
- Reliability
- Summary

Why the Cheetah System

- Agilent introduced its new line of network analyzers in 2001 – the PNA (Performance Network Analyzer)
  - Now on revision B
  - New features in the PNA allow the PNA to outperform older VNA's such as the HP8510 and HP8530.

Why the Cheetah System

- With the PNA, the following specifications are able to be improved upon:
  - Noise Figure
  - Sensitivity
  - Dynamic Range
  - Measurement Speed
  - Built-in Synthesizer

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Why the Cheetah System

- With the PNA, a low-cost system can be configured for either RCS or Antenna Measurements.
- Direct RF measurements can be made without having to add external synthesizers and/or remote mixers

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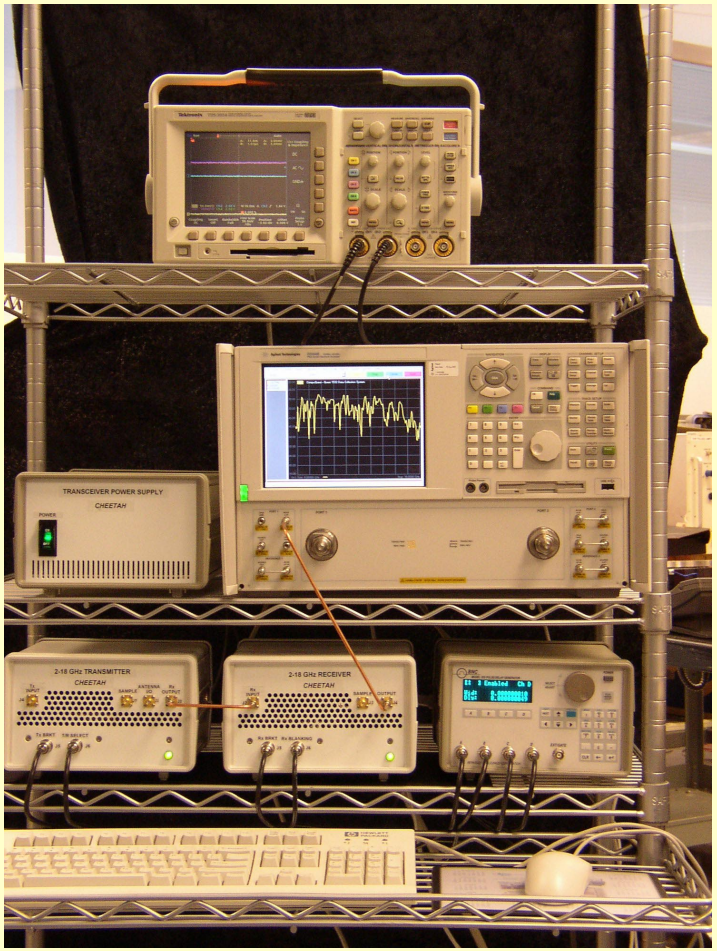
What is the Cheetah System



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What is the Cheetah System

- The Cheetah is a gated CW or CW RCS and Antenna Measurement System
- It utilizes the following major components:
  - Agilent PNA
  - SPC RF Gating Boxes, SPC Phase Modulator, SPC Power Amplifiers
  - CompuQuest 1541/1532 RCS and Antenna Data Acquisition and Data Analysis Processing Software

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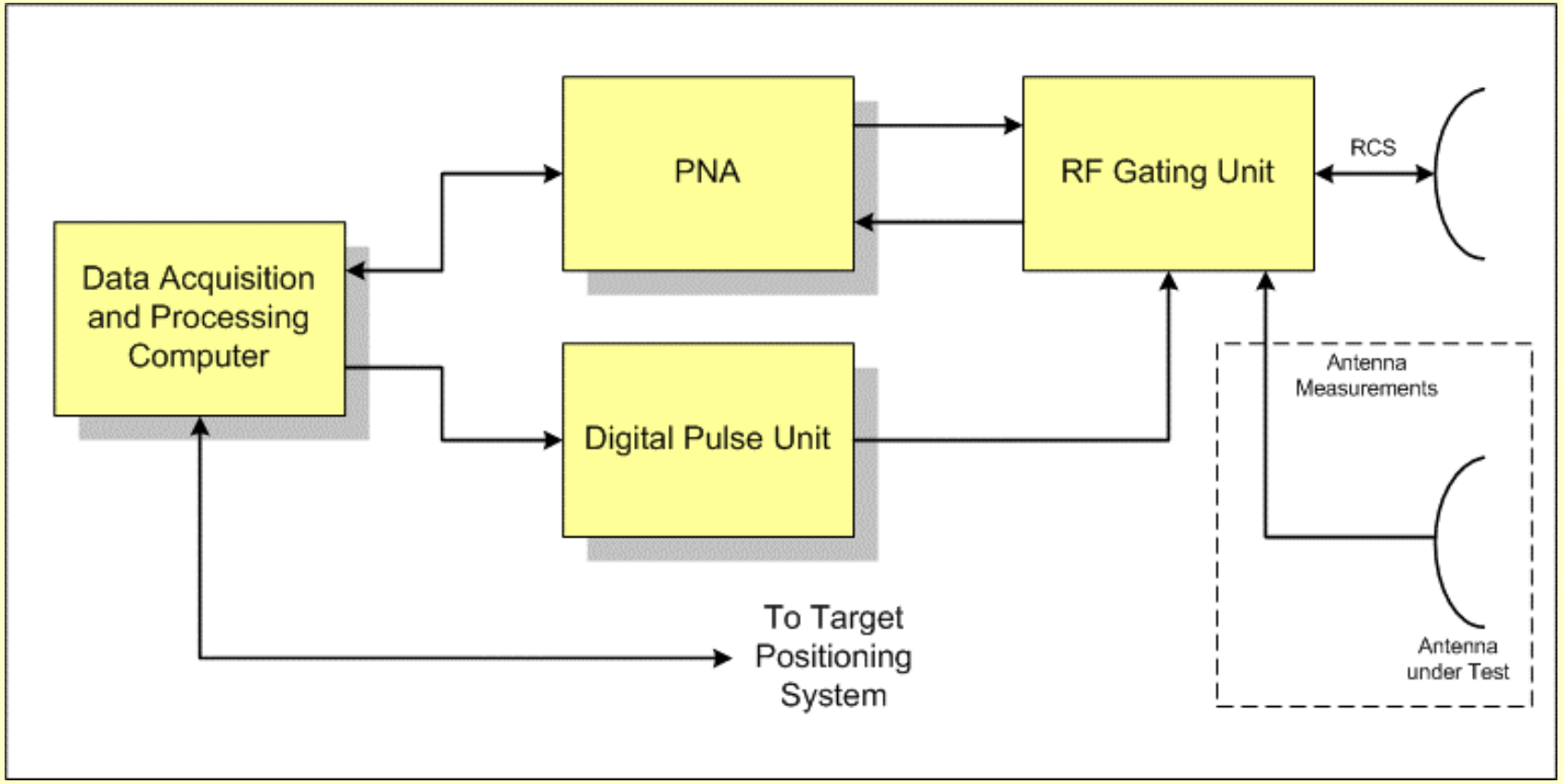
Cheetah Block Diagram



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What is the Cheetah System

- Frequency Coverage
  - Standard 2-18 GHz
  - Low band 0.1-2.0 GHz
  - High bands to 67 GHz
- Transmit Power
  - Standard 2-18 GHz - +23 dBm
  - Medium Power - 10 watts
  - High Power – 1-2 kW

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Cheetah Noise Figures

- The PNA has an inherently high noise figure
- In order to minimize the system noise figure, low noise preamplifiers and a receive gate switch are added in front of the PNA
- Theoretical and measured performance were then performed

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Cheetah Noise Figures

- The “Y” factor method was used to then compute the noise figure of the system.
- Utilizing high bandwidth (2-18 GHz) low noise preamps the noise figure was measured at approximately 2 dB.
- Next setting the duty factor to 14%, we measured a drop in the noise floor of 8.5 dB compared to the theoretical value of 8.54 dB.

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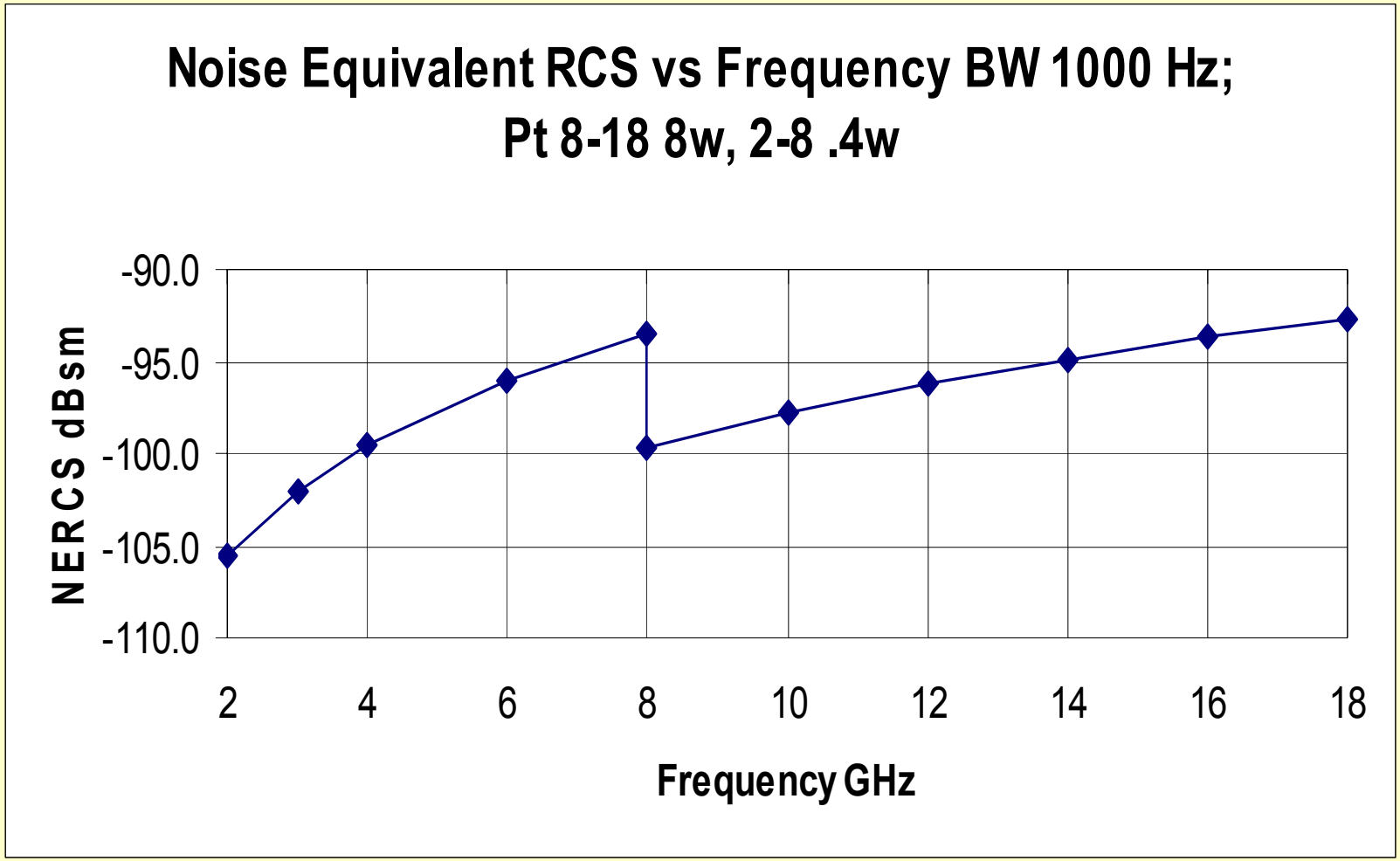
Cheetah Noise Equivalent RCS



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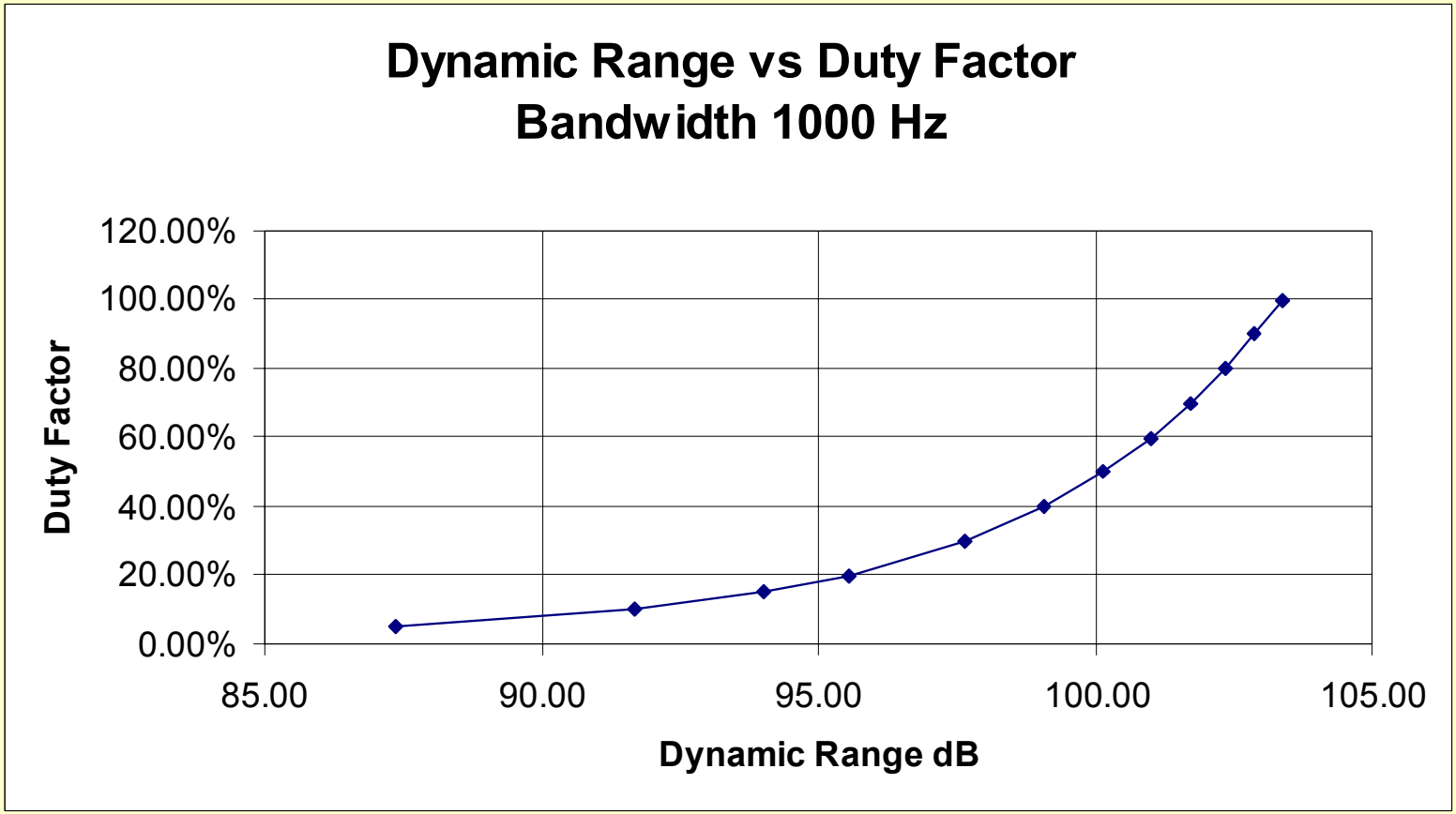
Cheetah Dynamic Range



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Cheetah System Measurement Timing

- The PNA timing is dependent on the following factors
  - Frequency Span → Number of Band Crossings
  - Frequency Steps
  - Frequency Settling
  - Retrace
  - IF Bandwidth
- Measurement Time
  - Number of polarizations
  - Rotator Angle Extent
  - Angle Increment

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Cheetah System Measurement Timing

- As an example
  - Frequency Span → 2-18 GHz
  - Frequency Step → 50 MHz
  - Angle Extent → 360 degrees
  - Angle Increment → 0.1 degrees
  - Number of polarizations → 2
  - IF Bandwidth → 1 kHz
- Recorded measurement time
  - **66 minutes**

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Cheetah Control and Processing Software

- CompuQuest evolved Quest 1541/1532 RCS and Antenna Data Acquisition and Processing Software Package
- The 1541 has been used for other systems such as the HP-8510, -8530, -8720, -8757, and –8566, the SA2090 and SA1790
- Interface to the PNA is via DCOM (Ethernet), which provides extremely fast data communications.

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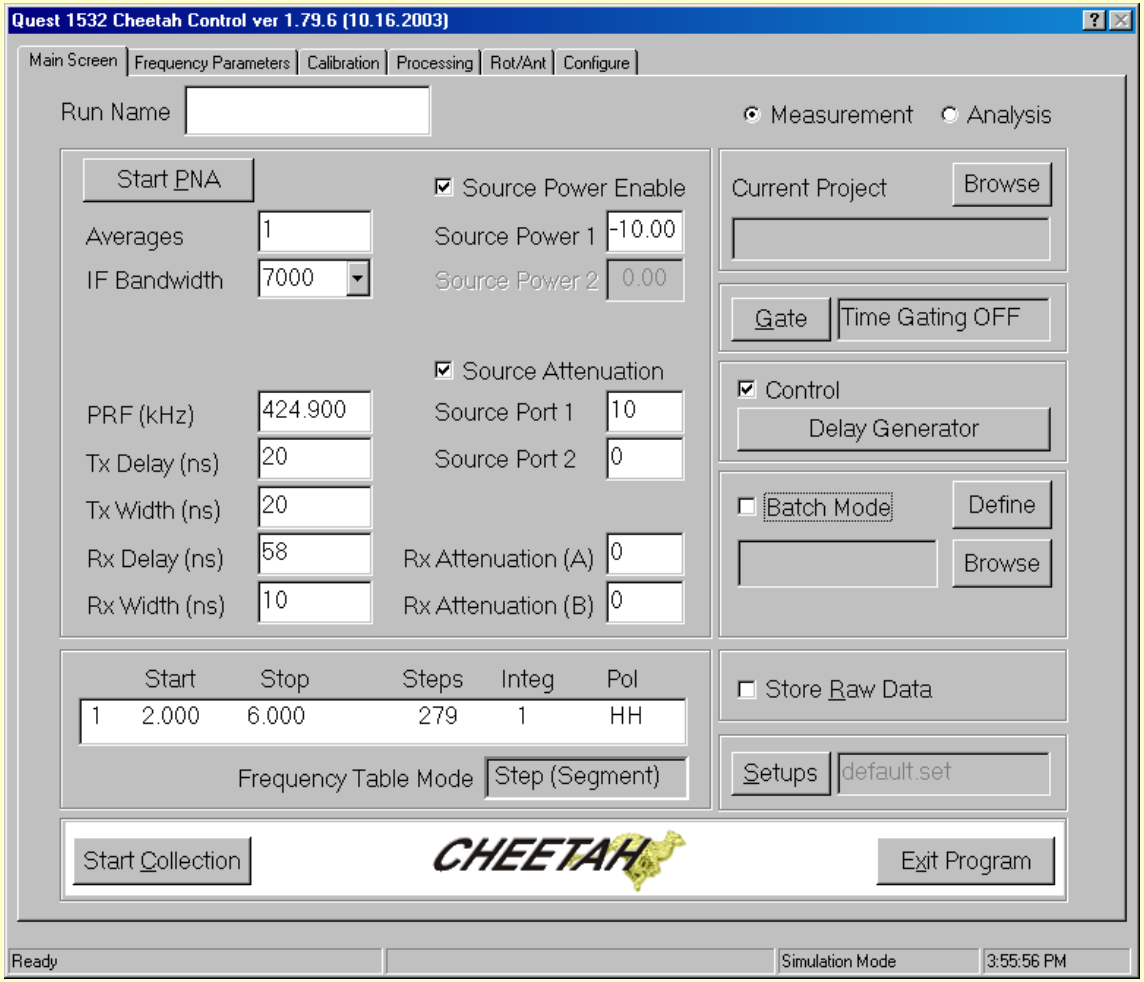
Cheetah GUI



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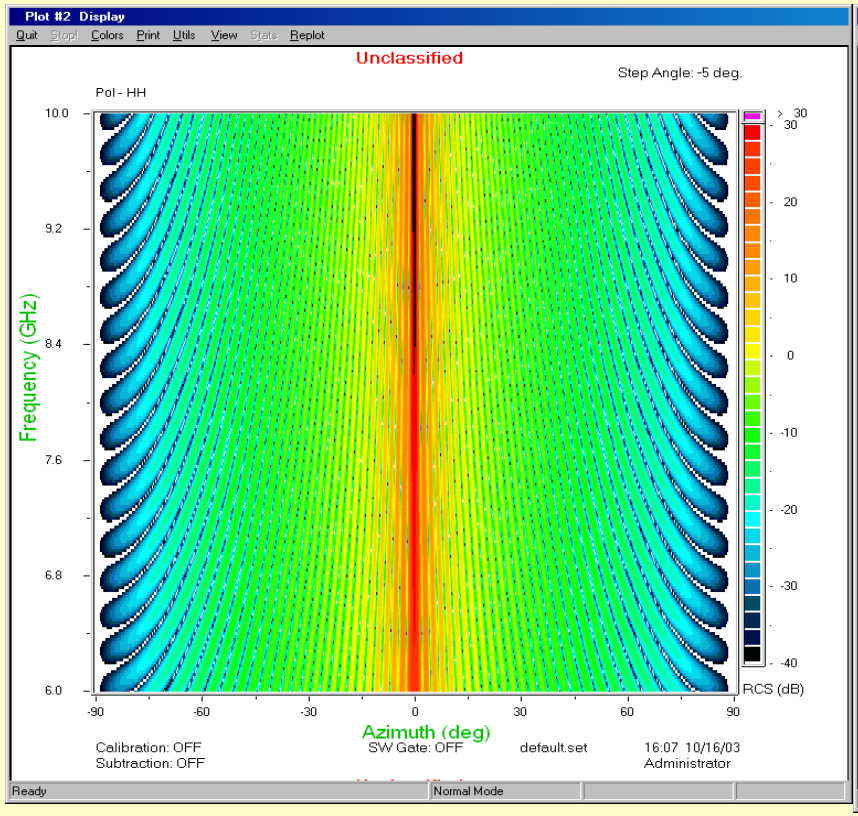
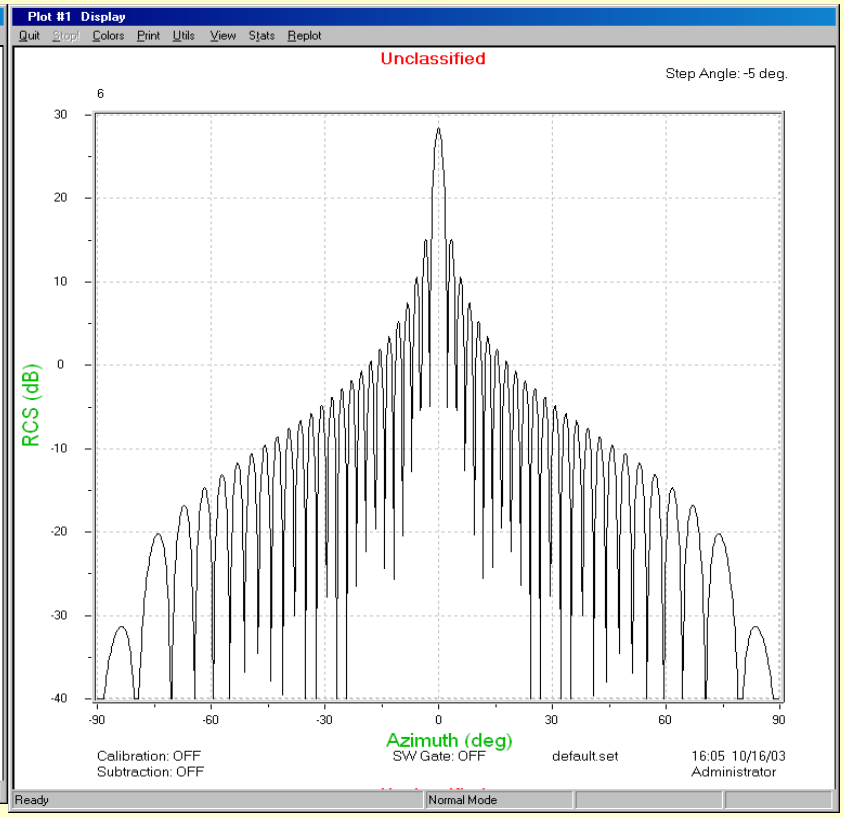
Typical Cheetah Presentation





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Cheetah Reliability

- The PNA has a predicted MTBF of 40,000 hours
- The Digital Pulse Unit is on the order of 50,000 hours
- The Transmit/Receive RF Gating Units have a total MTBF of 21,900 hours
- Thus the total MTBF is >14,000 hours

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Summary

- The Agilent PNA provides the following new capabilities
  - Flexible IF Bandwidth
  - Segmented Waveforms
  - High dynamic range, low noise floor
  - Built-in Synthesizer
- Coupled to the CompuQuest evolved 1541/1532 Data Acquisition and Analysis Package
  - Data Collection and Processing in a single package
  - Pioneer Compatible

Summary

- SPC designed Transmit and Receive RF Gating Units
  - Broad range of power options, frequency options, phase modulation and specialized implementations
- SPC is an Agilent Channel Partner
  - Allows direct access to Agilent engineering groups
  - Allows for a direct communications path back to Agilent for inclusion of customer feedback for upgrades and changes that may be required to better support this community.