



SYSTEM
DESIGN
and
INTEGRATION

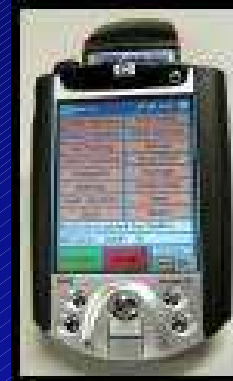
Overview

- **Founded 1991 to address Defence Project opportunities**
- **Projects now span industrial and military sectors**
- **Specialist in RF, vision, test, measurement and control systems**
- **System Analysis, Design, Build, Install and Support activities**
- **www.niksar.com.au**

Overview - Technology Areas



Electronically-Steered
Phased Array Antenna



PDA
Applications



Automotive
Component
Testing



Specialised
Electronics



Electromagnetic
Modeling

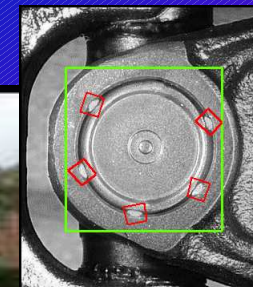
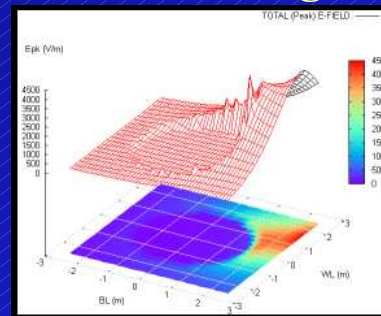


Image Analysis
&
Vision Inspection

RF MEASUREMENTS

USING NATIONAL INSTRUMENTS' TECHNOLOGY

- **GAIN**
- **PHASE**
- **INPUT REFLECTION (RETURN LOSS)**
- **HARMONICS**
- **PHASE NOISE (SPECTRAL PURITY)**

User Requirement Overview # 1

High Powered RF Amplifier Tests

(1.6kW and 400W units):

- Frequency Range : 5 - 200 MHz (up to 5th harmonics)
- Output Power : up to 2kW
- Gain : up to 50 dB
- Phase (absolute and differential) : $\pm 360^\circ$
- Input Match : -25 dB
- Harmonics : 2nd to 5th and -40 dBc
- Phase Noise : to -100 dBc @ 1Hz
- Voltages : up to 60V DC, 140V p-p RF
- Currents : up to 25 Amp

User Requirement Overview # 2

1600W RF combiner (4 X 400 Watt):

- Frequency Range : 5 - 40 MHz
- Output Power : small signal
- Insertion Loss : up to 10 dB
- Phase (absolute and differential) : 0 - 360°
- Input Match : -21 dB
- Input Port Isolation : to -28 dB
- Sampling Port Coupling : to -53 dB
- Harmonics : up to 5th and -40 dBc

Niksar Solution Overview - Software

System functionality based on National Instruments' software:

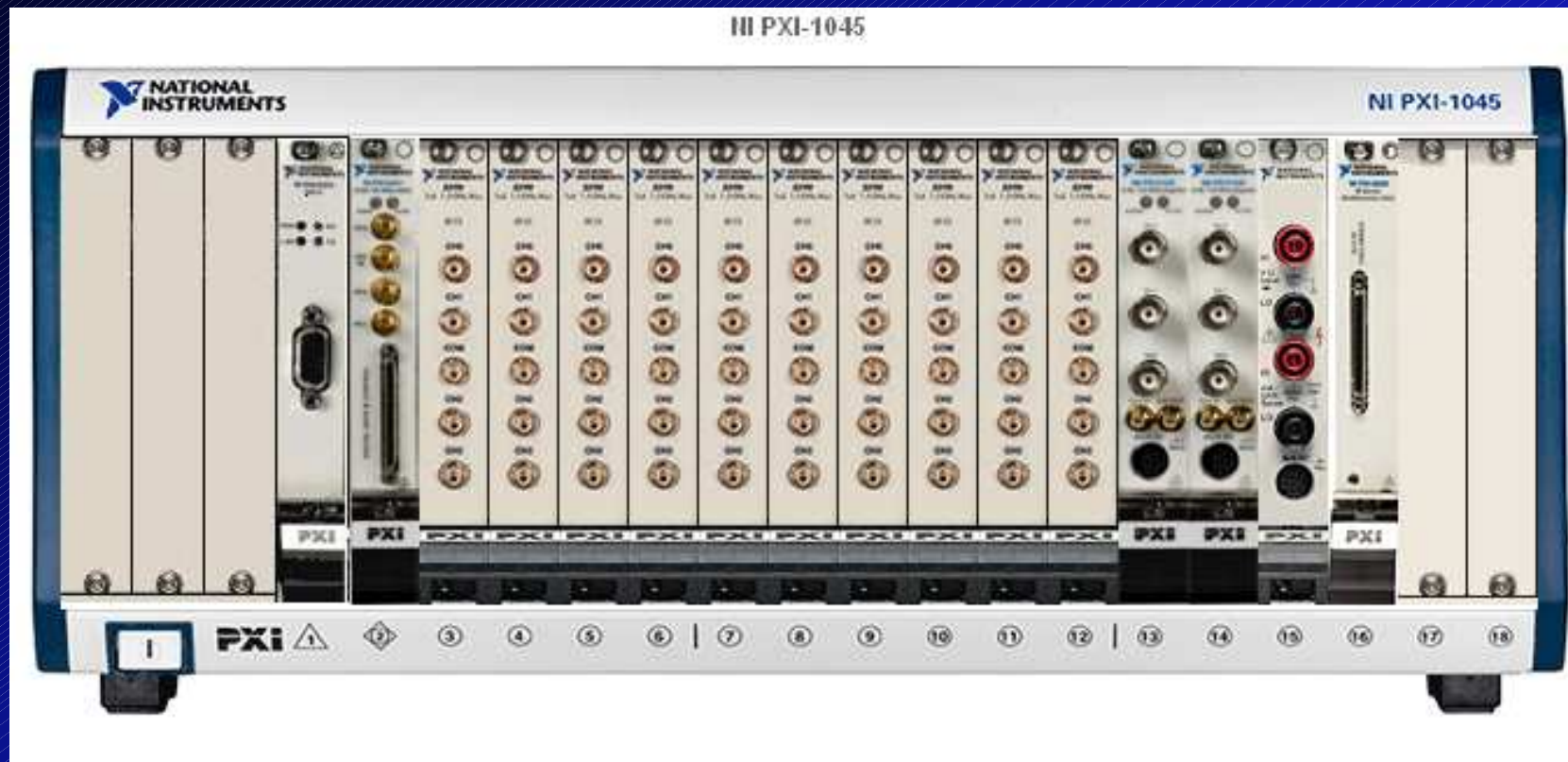
- NI TestStand
- NI LabVIEW
- Switch Executive, Signal Processing and Modulation Toolkits

Niksar Solution Overview- Hardware

Test functionality based on National Instruments' virtual instrumentation:

- NI PXI - 5421 Arbitrary Waveform Generator (AWG)
- NI PXI - 5122/256MB High Performance Digitiser
- NI PXI - 5124/8MB High Speed Digitiser
- NI PXI - 6221 M-Series Multifunction DAQ
- NI PXI - 2590 Series 1.3 GHz 4x1 RF Switches
- NI PXI - 4060 Digital Multimeter
- NI PXI - 1045 Chassis and 8350 Controller with MXI-4 PCI bus link

Niksar Solution Overview



View of PXI Chassis Configuration

Niksar Solution Overview

**Front View of
the Tester suite
in a 19" rack**



Interface Unit

PXI Rack

UUT Table

Fixture Drawer

NI-8350 Controller

3kW DC Power Supply

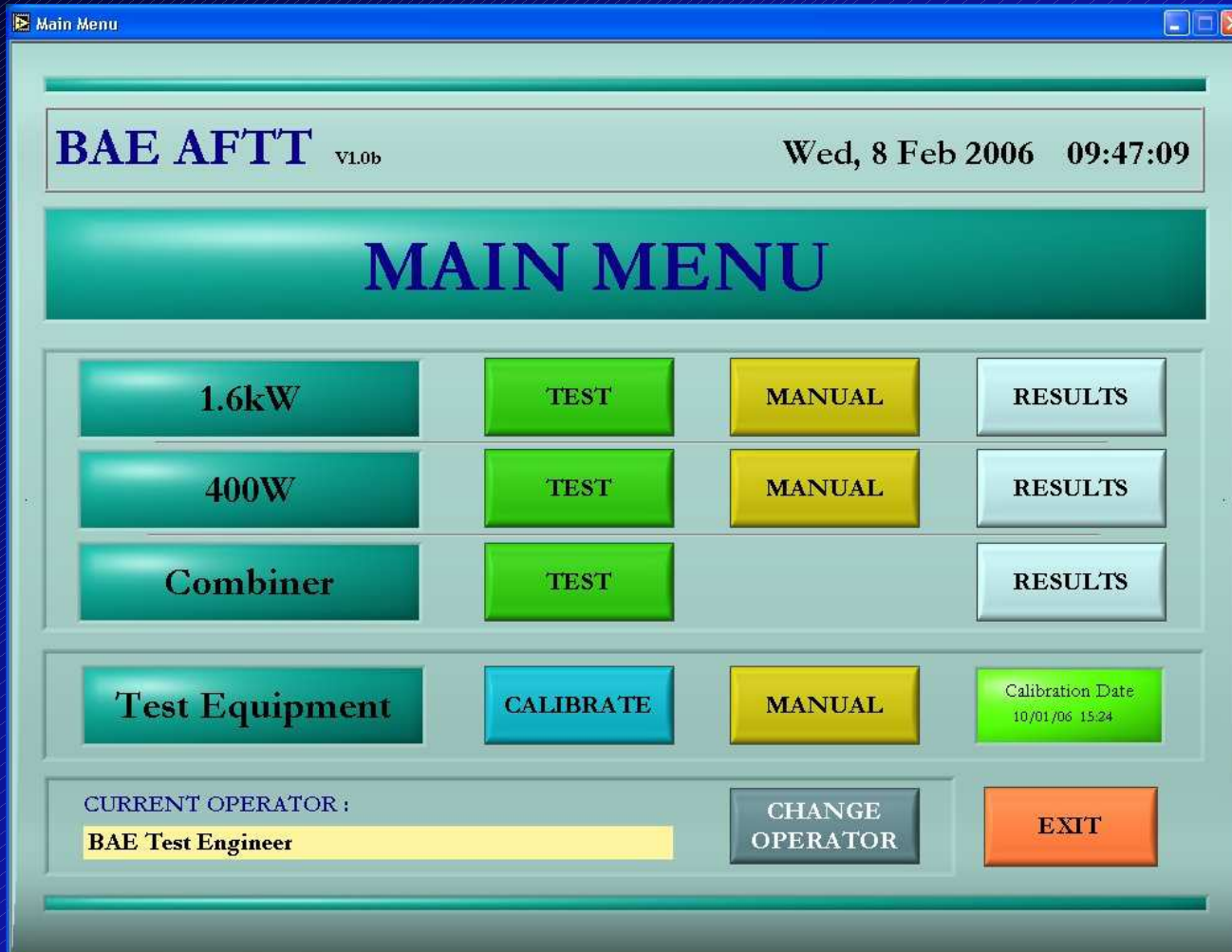
UPS

Medium Power RF Amp

Niksar Solution Overview


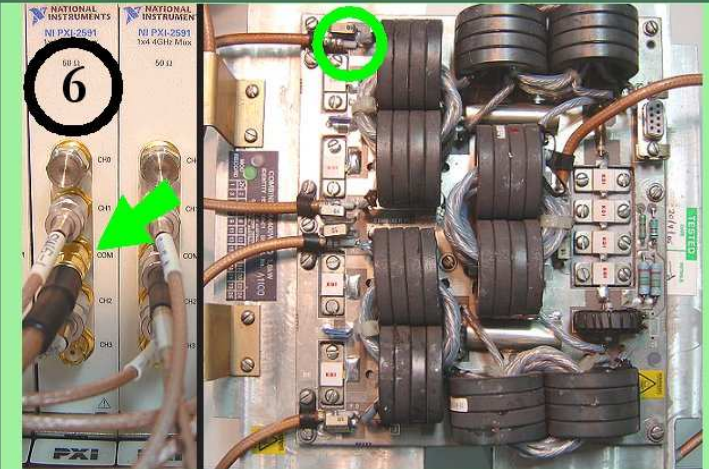


Niksar Solution Overview



Niksar Solution Overview

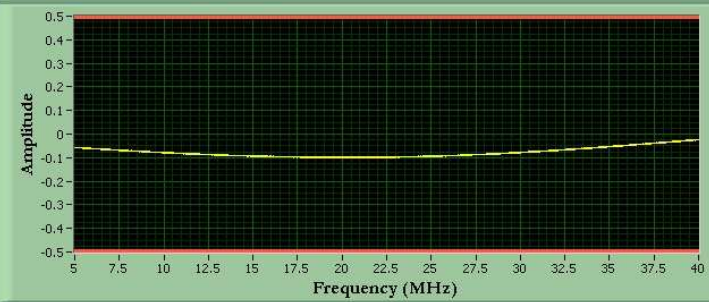
COMBINER IN & OUT NETWORK CALIBRATION CANCEL



ATTACH SHORT CIRCUIT TERMINATION TO BNC CONNECTOR

Ch0 OK Ch1 OK

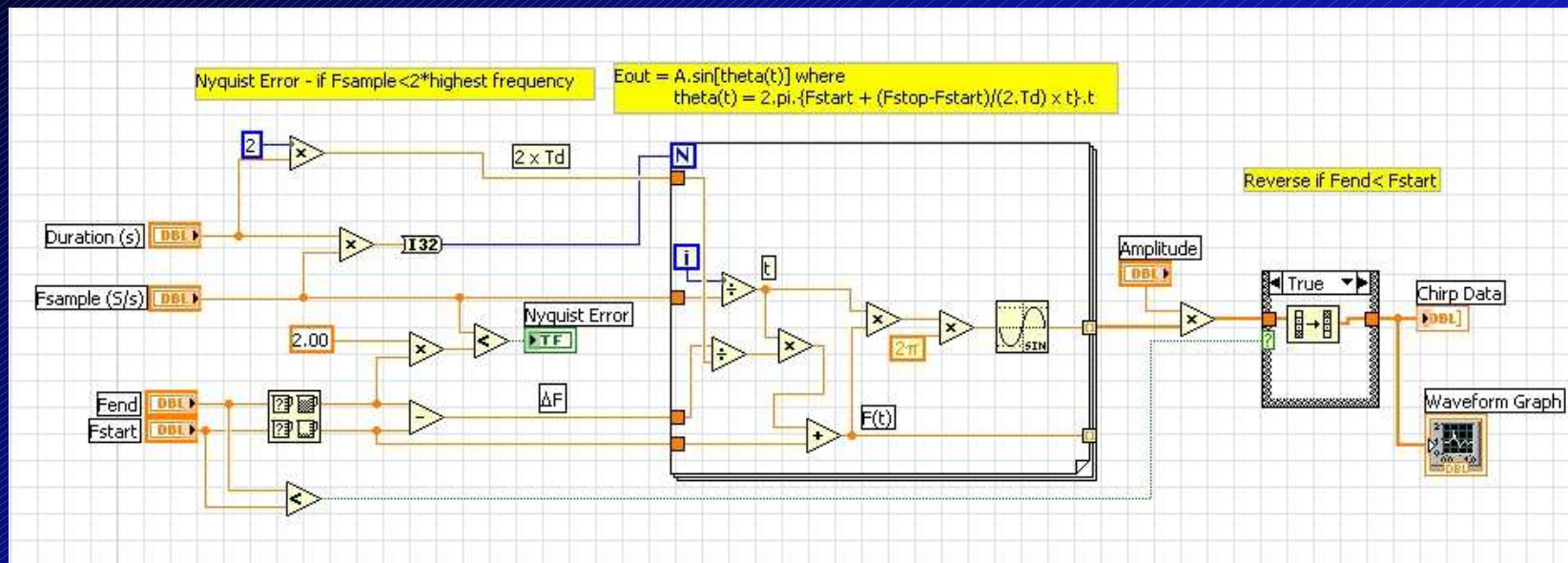
CALIBRATION RESULT



PASSED

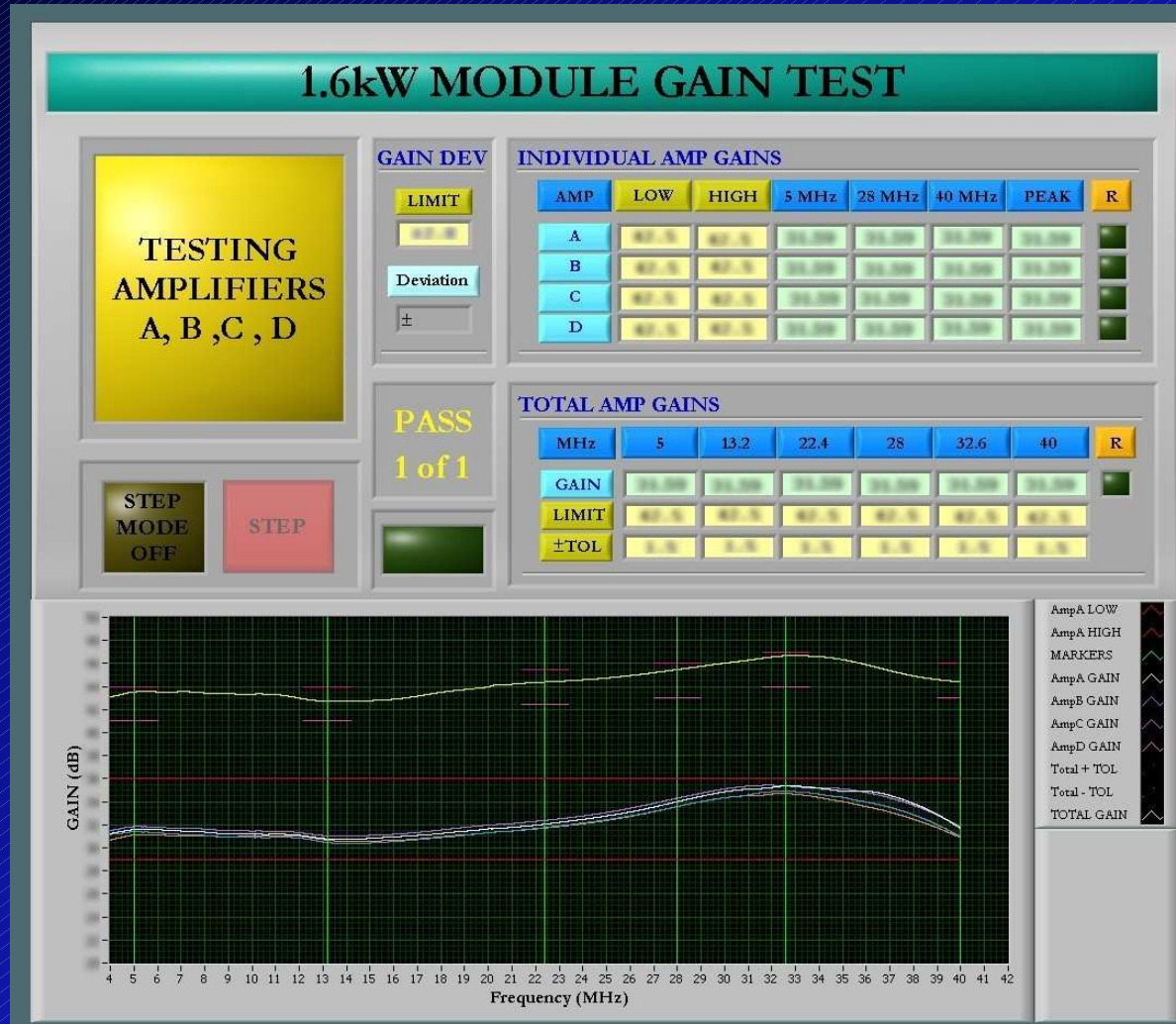
REPEAT STEP NEXT STEP

Niksar Solution Overview

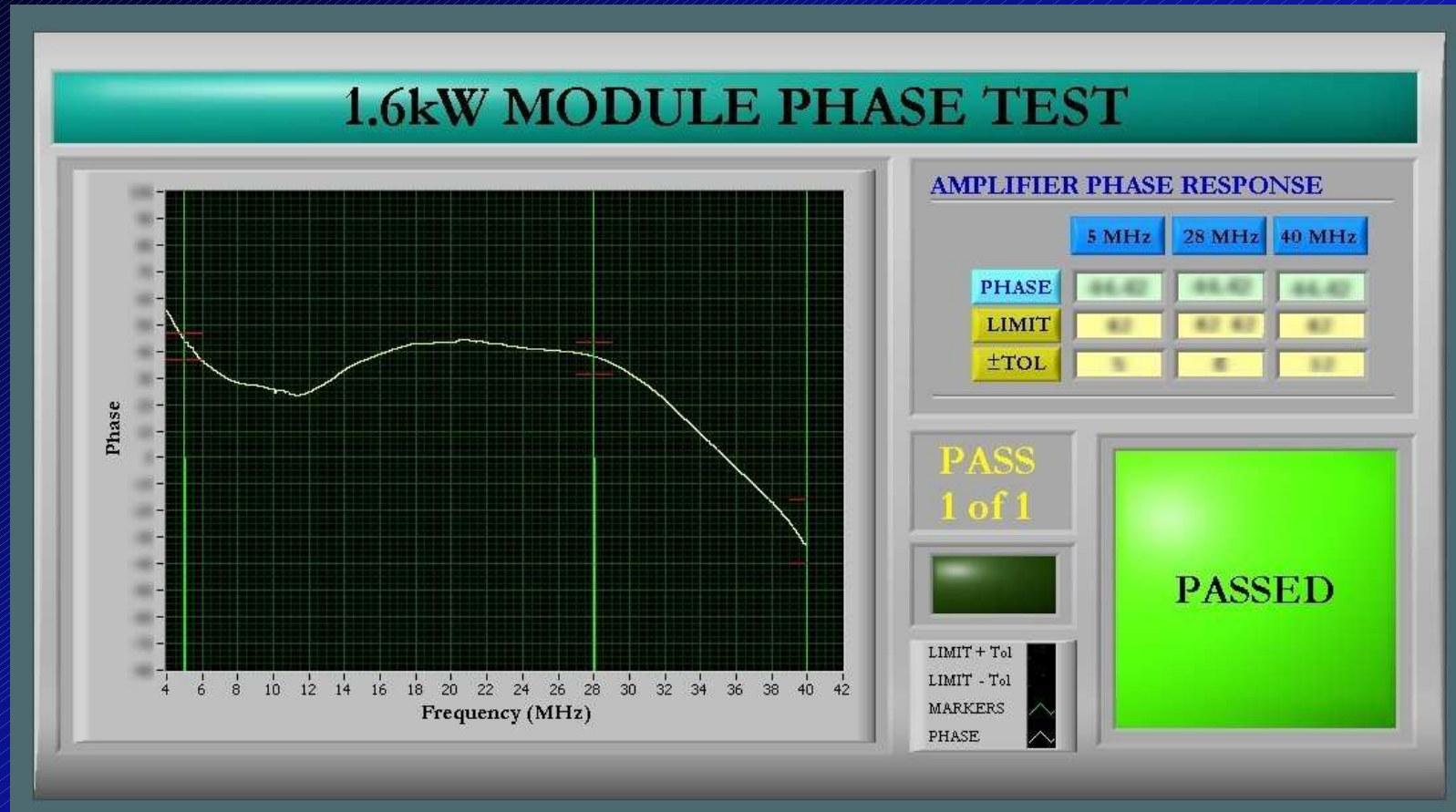


WIDE BAND Timed Linear Sweep

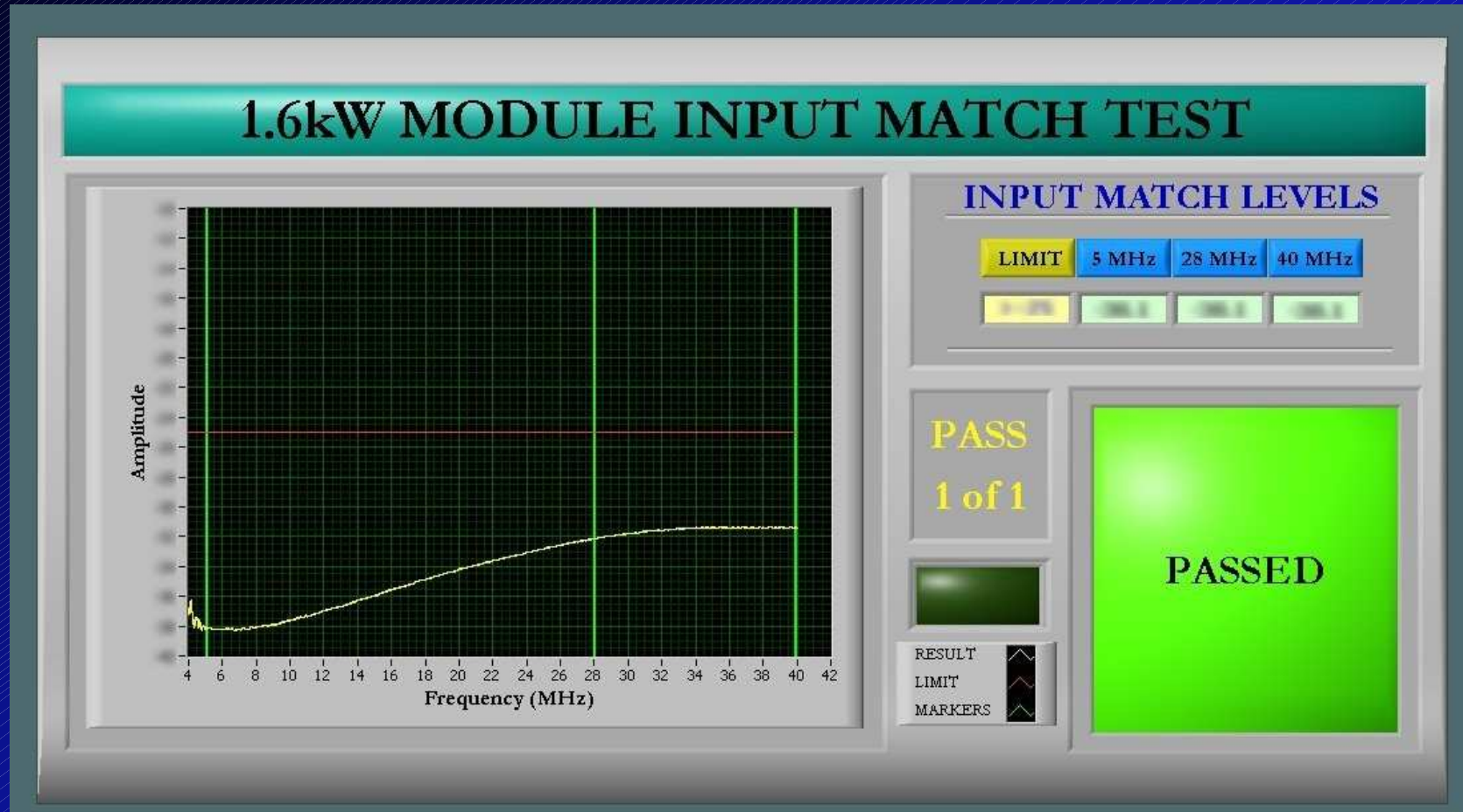
Niksar Solution Overview



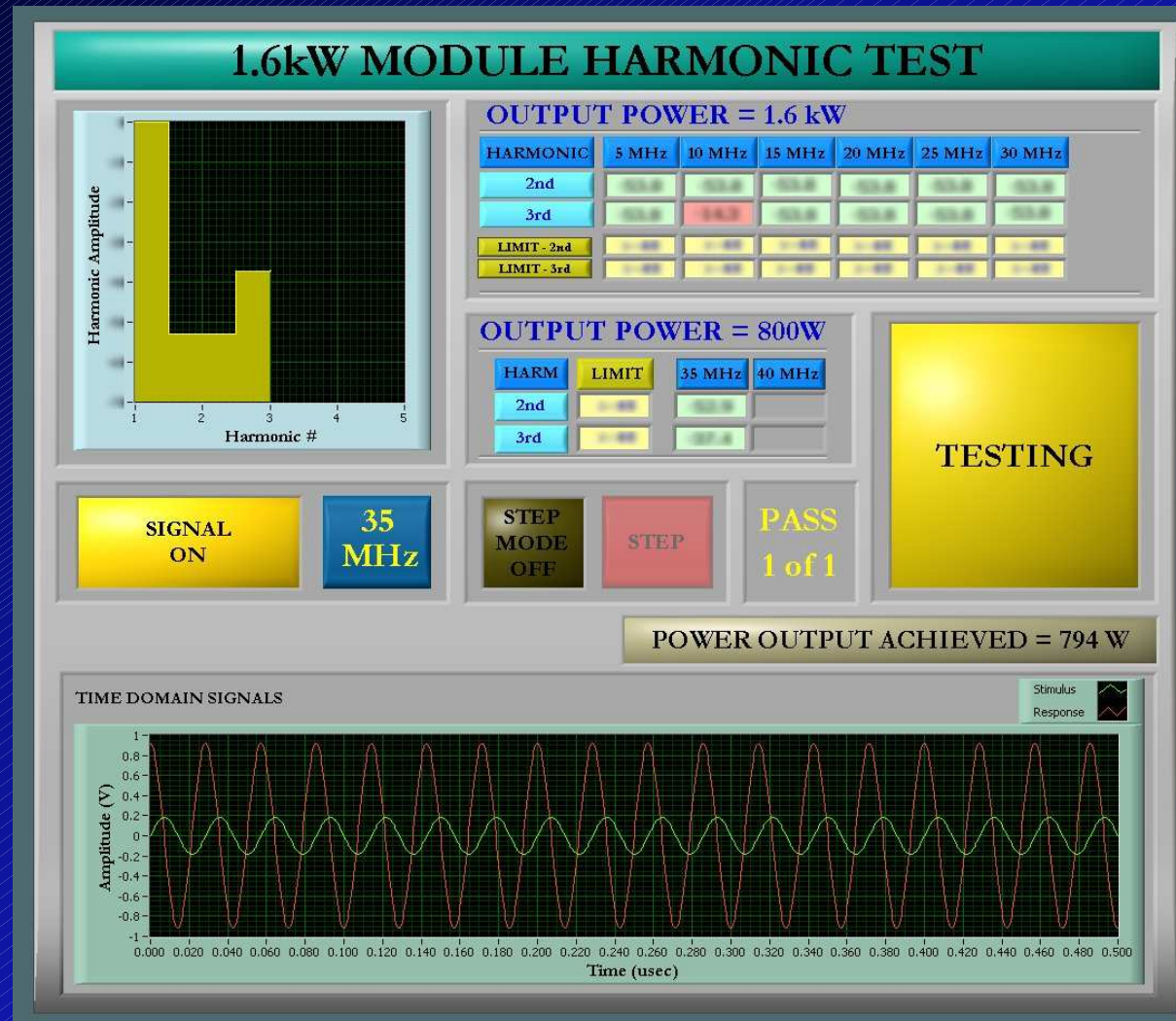
Niksar Solution Overview



Niksar Solution Overview



Niksar Solution Overview



An Instrumentation Challenge

Measurement of RF an amplifier's spectral characteristics:

- carrier frequencies to 40 MHz
- analysis bandwidth to 300 Hz
- high resolution (1Hz)
- high dynamic range (spectral levels to -110 dBc)
- single-sided noise sidebands (phase and amplitude noise)
- mains frequency related components (hum)

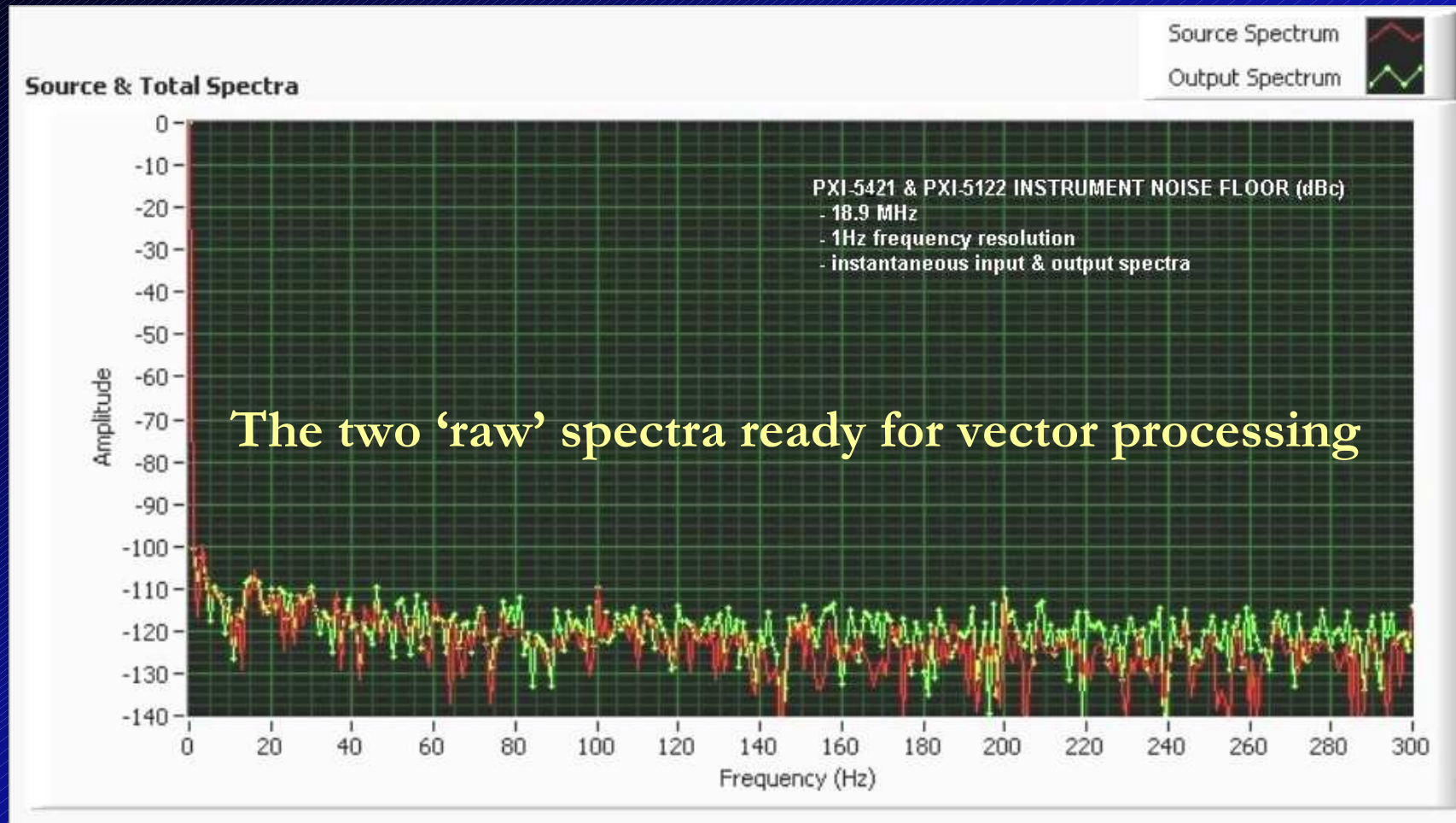
Raw PXI Instrument Performance

- based on inherent noise levels (SFDR & THD) in the PXI modules, ~ 75 dBc would apparently be the best performance achievable
- the application of synchronous and coherent techniques allows better performance to be achieved
- sound signal processing practices available within LabVIEW allowed the challenge to be met

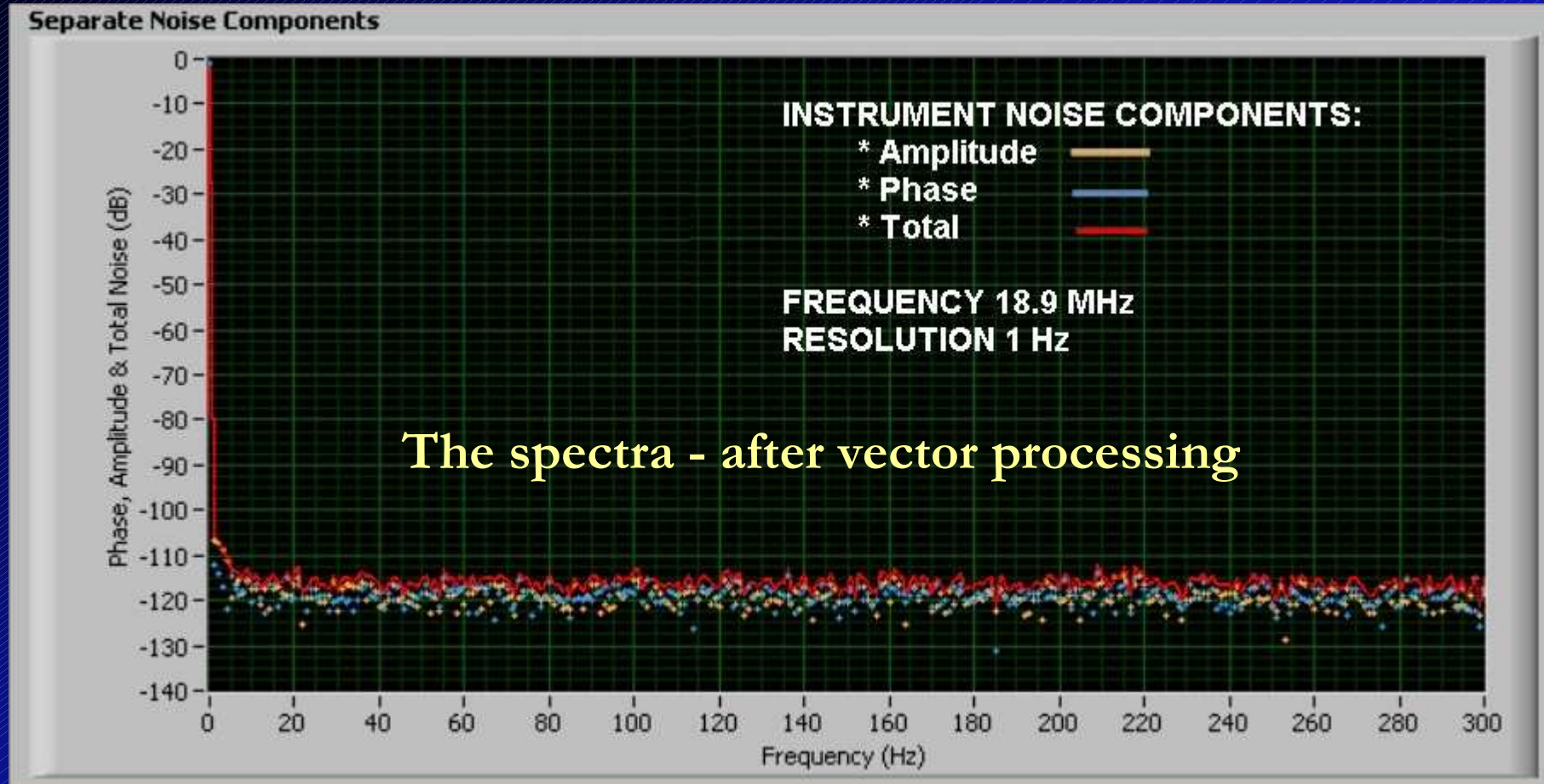
Approach to Signal Processing

- 1 second of data capture at up to 100 Ms/s
- coherent generation, capture and processing signals
- block by block processing of captured data
- signal down conversion, filtering and decimation
- ensemble averaging to arrive at a smoothed (average) spectrum
- during processing, relative gain and phase stability of PXI units (AWG and digitiser) is computed
- analysis bandwidth of 7,500 Hz with respect to carrier was obtained

Instrument Performance



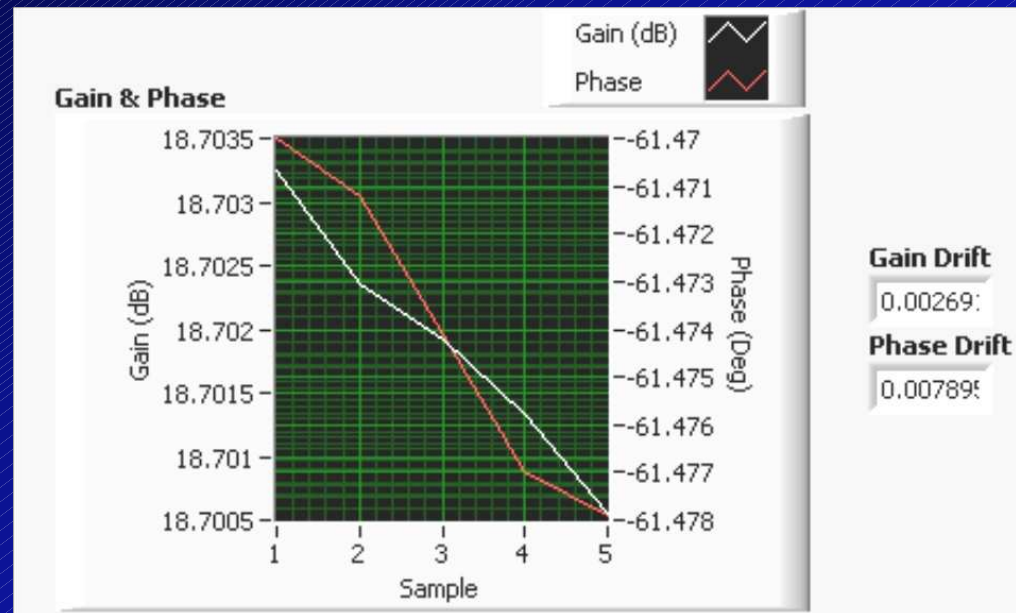
Instrument Performance



The spectra - after vector processing

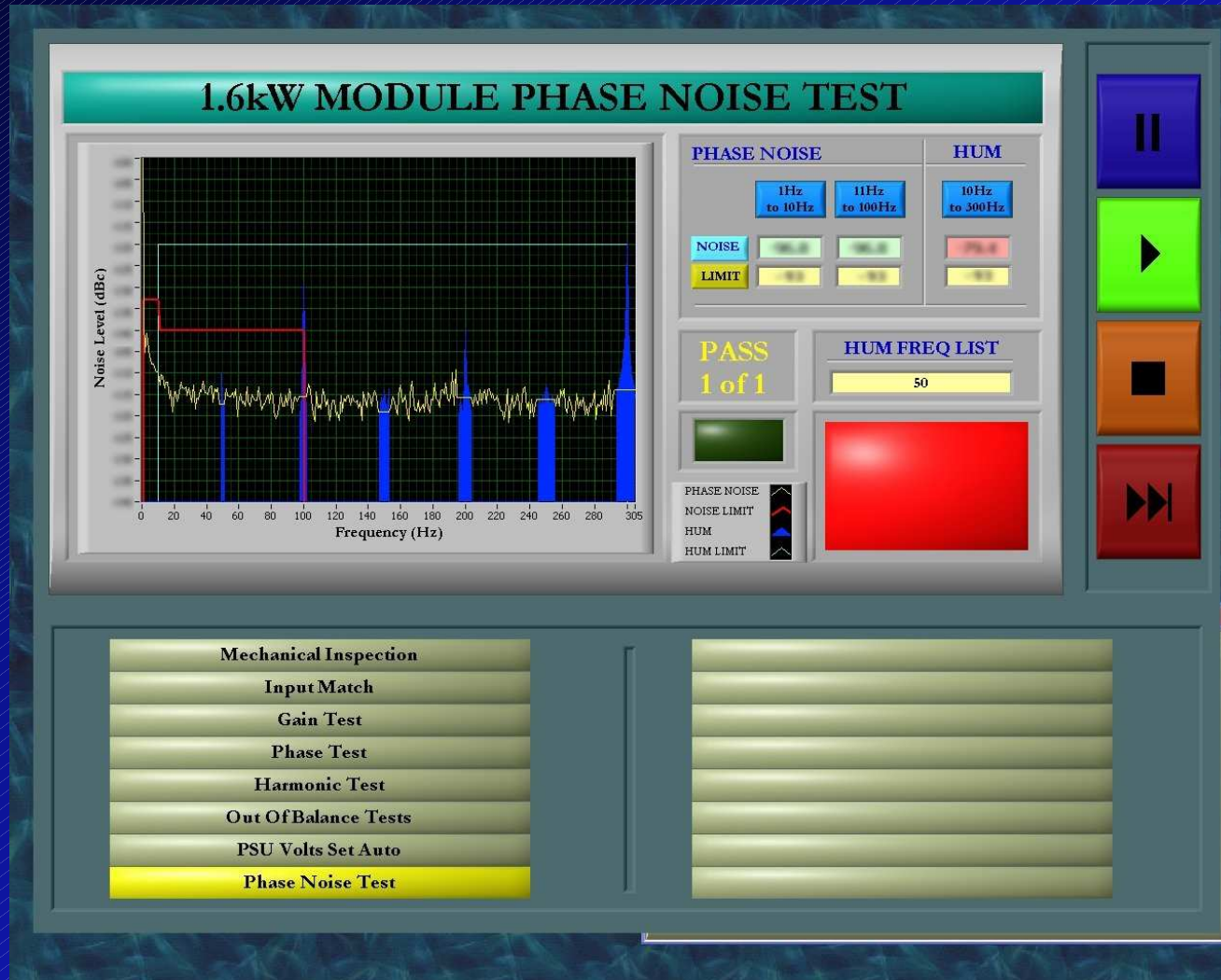
Instrument Performance

Over a 5 minute acquisition period, the tracking performance of the two instrument channels was:



- **Differential Phase Drift : -0.008° (equivalent to ~ 1 picosecond)**
- **Differential Amplitude Drift : -0.003dB (equivalent to 0.03%)**

Niksar Solution Overview



The Result

- **A tester performing a comprehensive and detailed set of RF, DC, AC and data tests**
- **On-screen graphical and textual operator instructions - minimises separate operator manuals**
- **Acceptance testing against demanding procedures**
- **High quality GPTE used as the measurement standard for verification & validation**

The Result (cont.)

- **Test time significantly reduced**
- **Instrumentation cost reduced**
- **Inherent flexibility - functionality can be added as required**
- **Instrument in service**
- **Niksar nominated as the design authority and support agent**
- **Most important - A HAPPY CUSTOMER**

Questions?



FIN