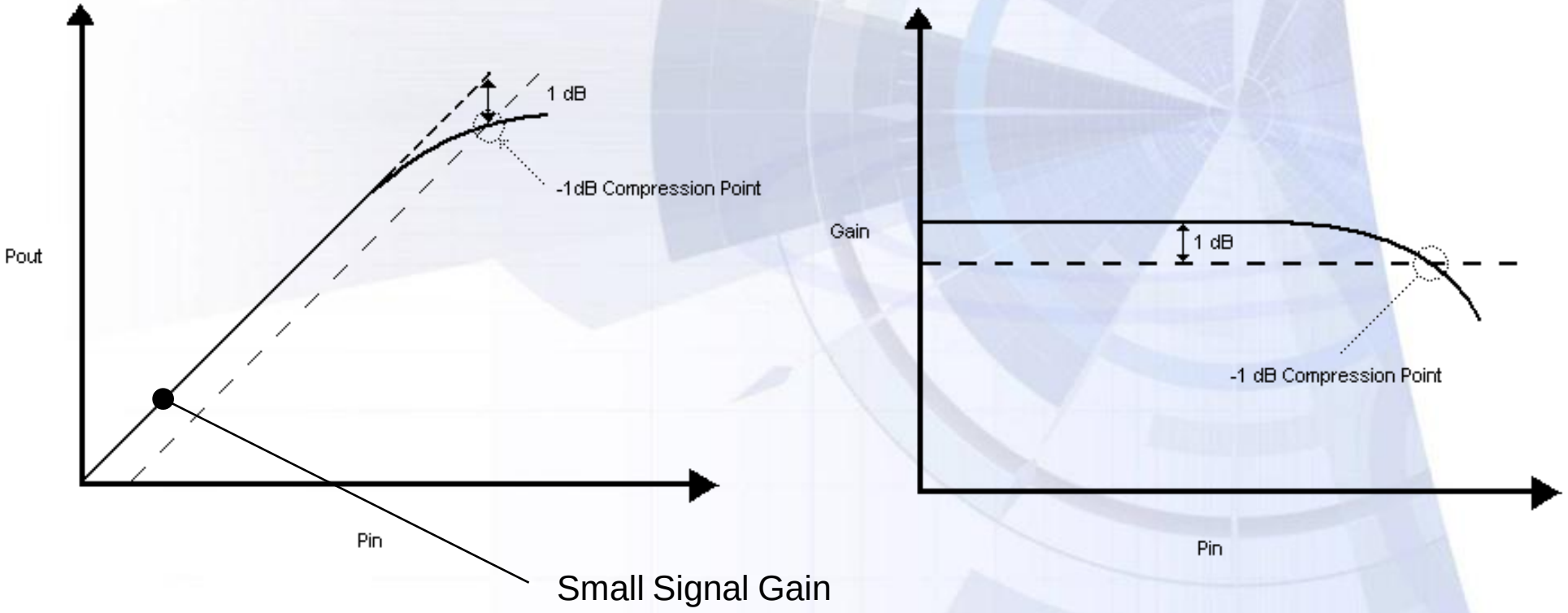
Implementing IEEE 1641 – Amplifier Characterisation on Multiple Test Platforms

Matt Cornish *EADS TES UK*

Johannes Ganzert *Rohde & Schwarz*

Malcolm Brown *DES SE TLS-SP-ATS, UK MoD*

Review of 1 dB Compression Test



Instrumentation

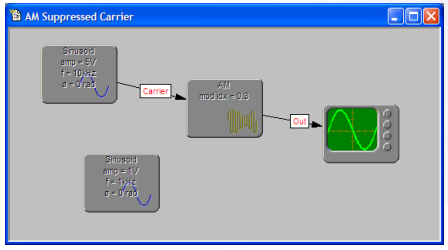
- Rohde & Schwarz **Vector Signal Generator R&S® SMJ 100A**
- Rohde & Schwarz **Spectrum Analyser FSG**
- Rohde & Schwarz **Vector Network Analyser ZVB 8**

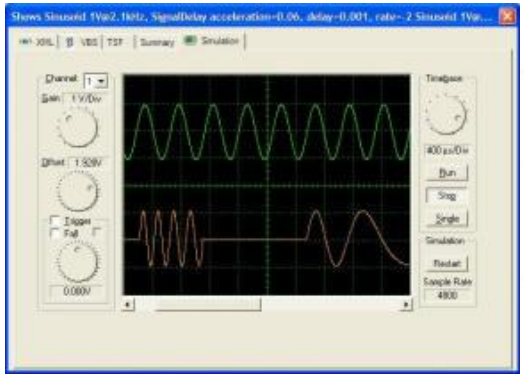
Set 1

Set 2

Software

- IEEE 1641 Signal Modelling with newWaveX™
  - Two key products:
    - **Signal Development** – *Signal and TSF modelling*
    - **Platform Development** – Resource *management* and *description*
  - Features:
    - *Graphical, signal-based modelling environment*
    - *Supports:*
      - *IEEE Std. 1641 Signal & Test Definition.*
      - *IEEE Std. 1671 ATML Test Description.*
      - *IEEE Std.1671 ATML Instrument and Test Station Description.*
    - *Simulation*
    - *Export XML, XSD & IDL*





Approach

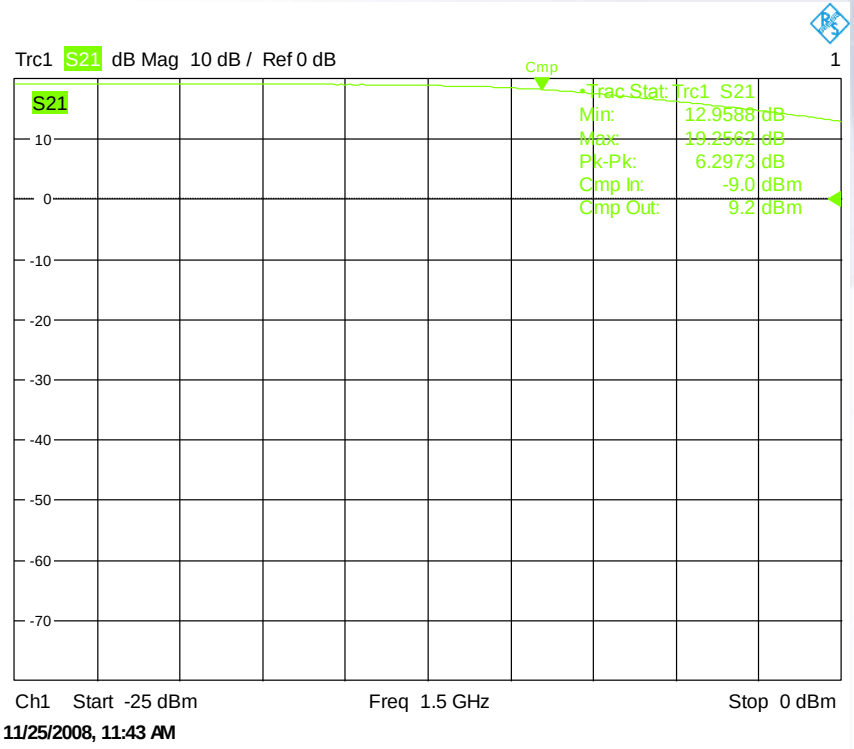
- Benchmark demonstration of all tests, by R&S.
  - Traditionally written C# test program, using IVI.
  - Results collected for later comparison with test results obtained under IEEE1641 test conditions.
- Generation of a TSF Library for 1 dB compression.
  - Demonstration of simulations.
  - Comparison with the benchmark results.
- Generation of a TSF Library for gain.
  - Demonstration of simulations
  - Comparison with the gain test implemented in a previous phase of study
  - Comparison with the benchmark results.
- Generation of an IEEE 1641 compliant test program.
  - Using the above TSF libraries.
  - Through the IVI interfaces provided by the test resources.
  - Comparison with the benchmark results.

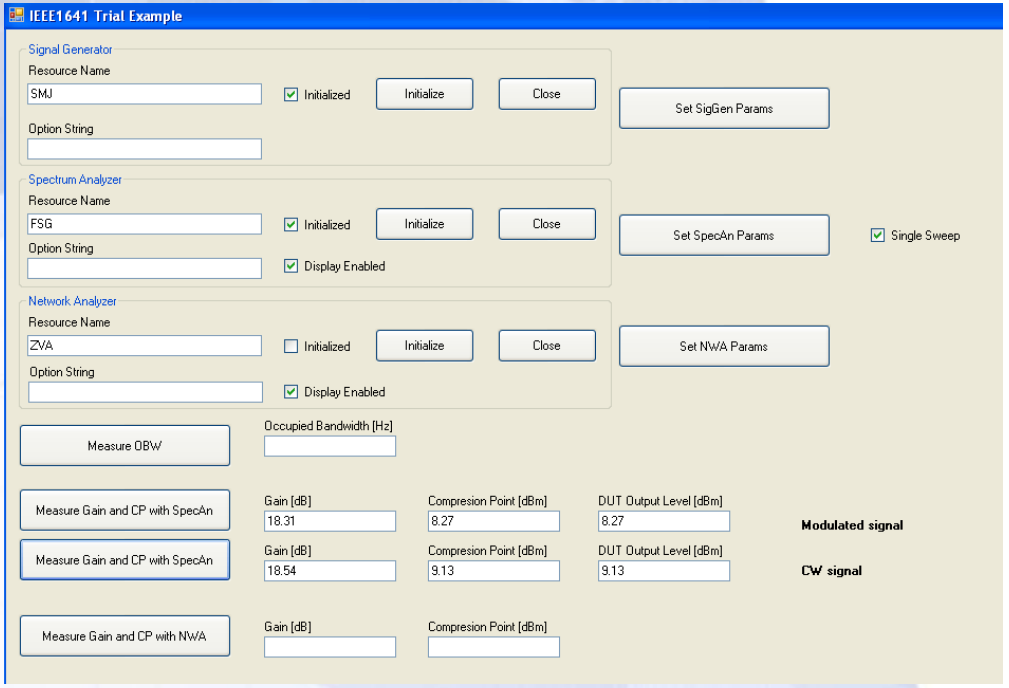
Benchmark Test Results

Baseline :

Cmp In:	-9.0 dBm
Cmp Out:	9.2 dBm

Gain [dB]	Compresion Point [dBm]	DUT Output Level [dBm]
18.54	9.13	9.13



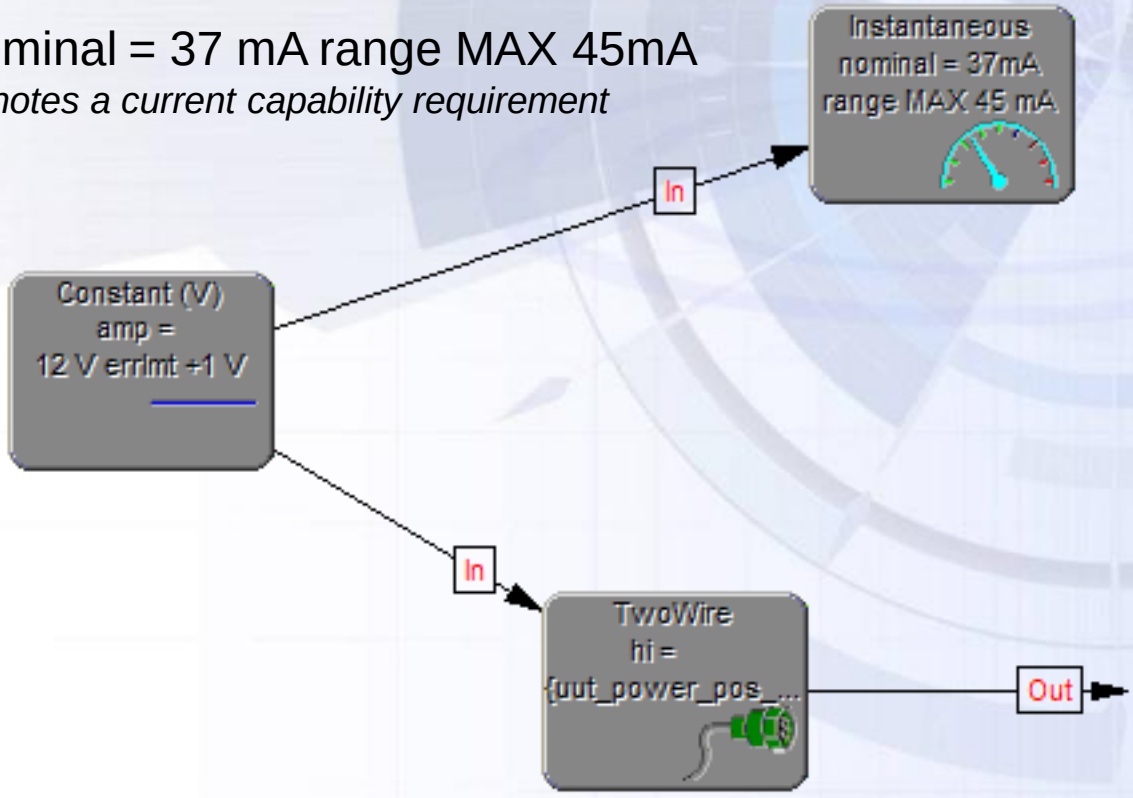


TSF Design – UUT Power Supply

A power supply for the Mini-Circuits ZJL-3G amplifier, to power the unit during the associated tests.

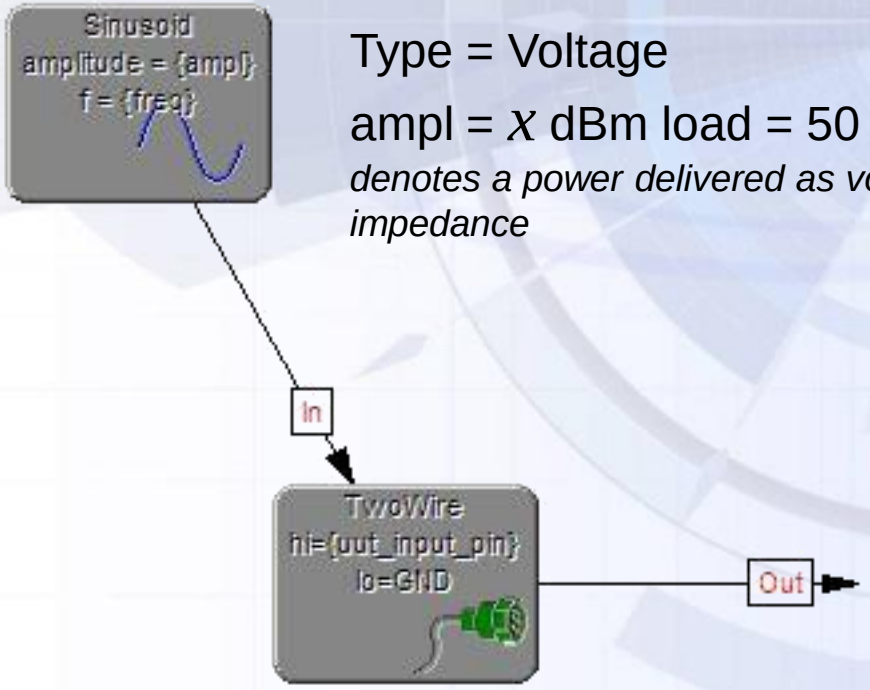
nominal = 37 mA range MAX 45mA

denotes a current capability requirement



TSF Design – RF CW Stimulus

A CW stimulus signal for Mini-Circuits ZJL-3G amplifier.

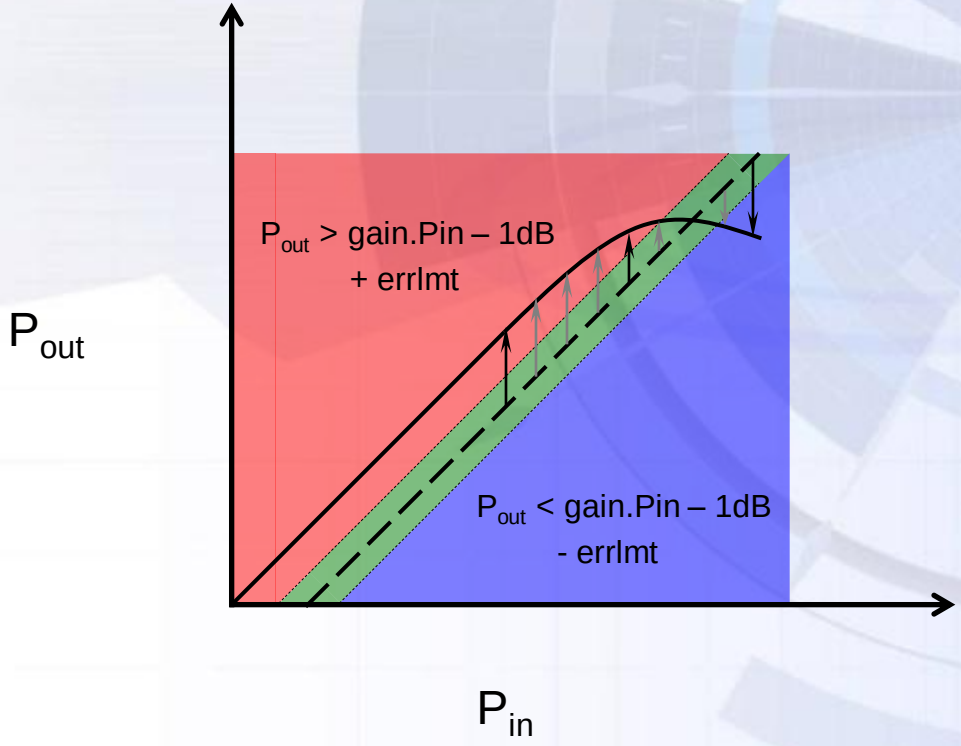


Type = Voltage

ampl = *X* dBm load = 50 Ohm

denotes a power delivered as voltage into an impedance

TSF Design - 1 dB Compression

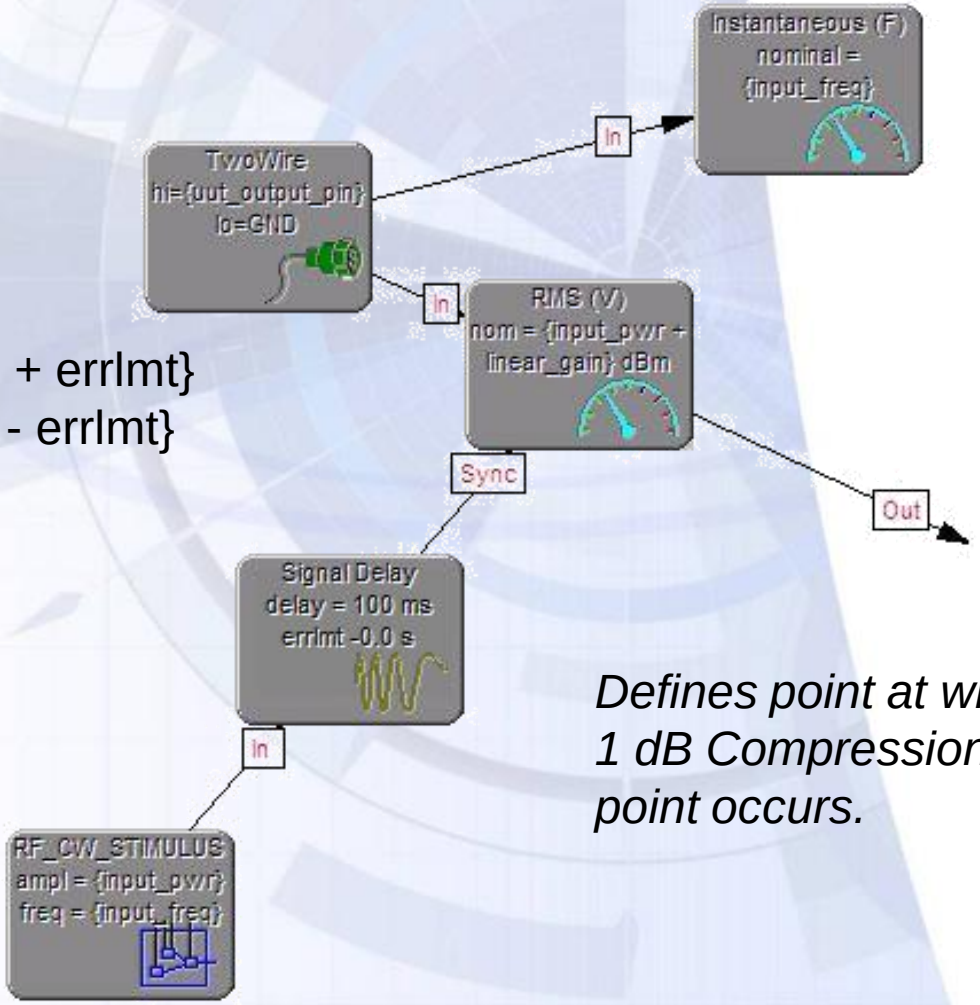


TSF Design - 1 dB Compression

RMS UL = {linear_gain + input_pwr - 1 dB + errlmt}
RMS LL = {linear_gain + input_pwr - 1 dB - errlmt}
denotes -1 dB region

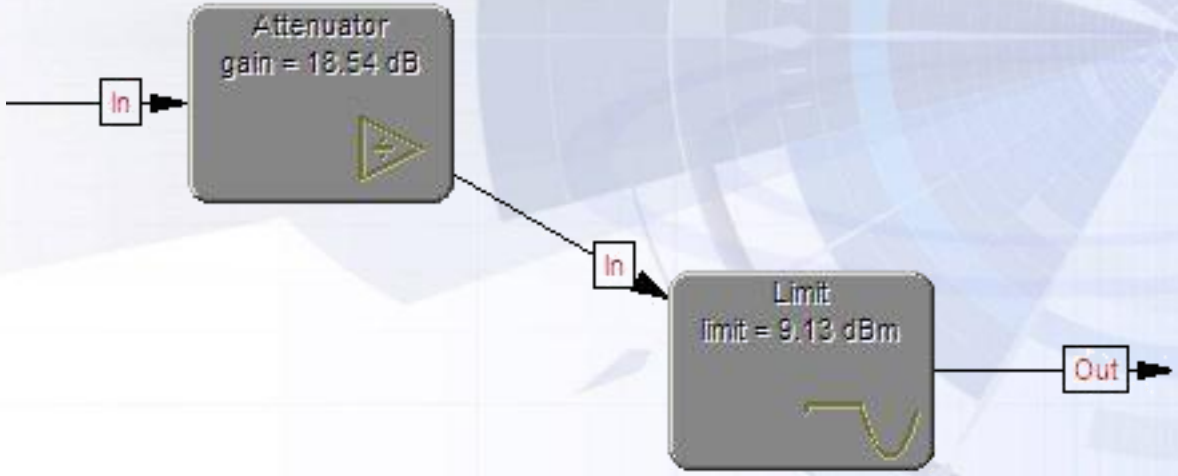
RMS Type = Voltage

nominal = x dBm load = 50 Ohm
denotes a voltage measurement converted to power into an impedance

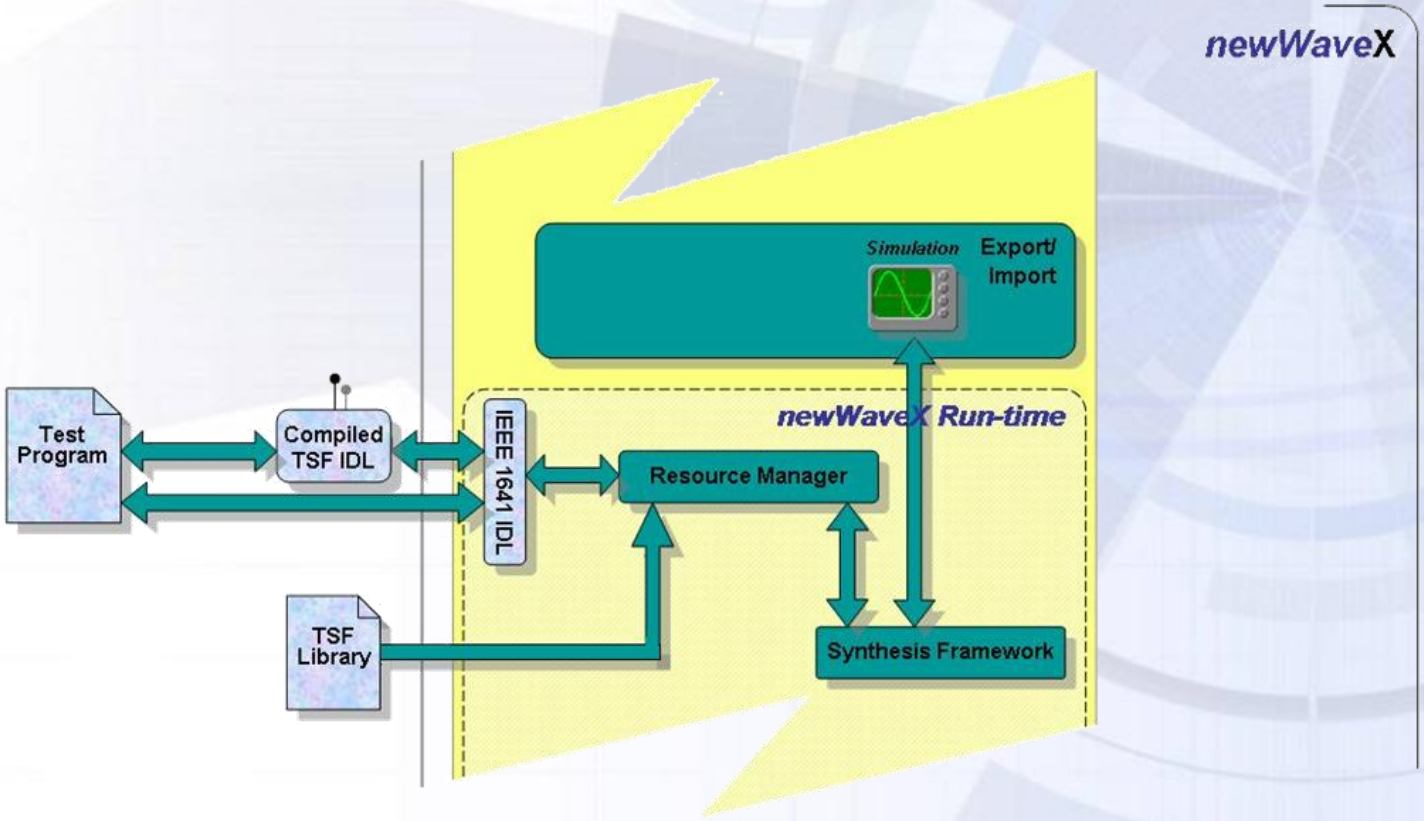


Defines point at which 1 dB Compression point occurs.

Simulation – UUT Model

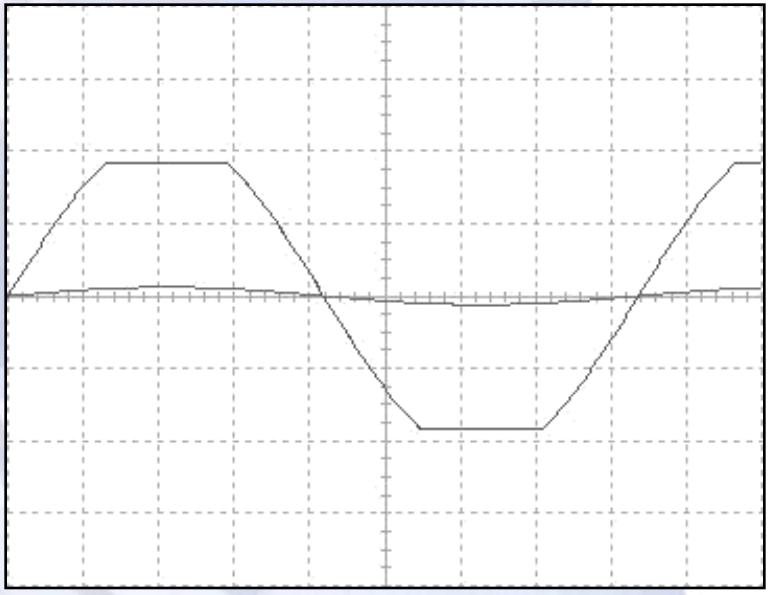


Simulation - newWaveX

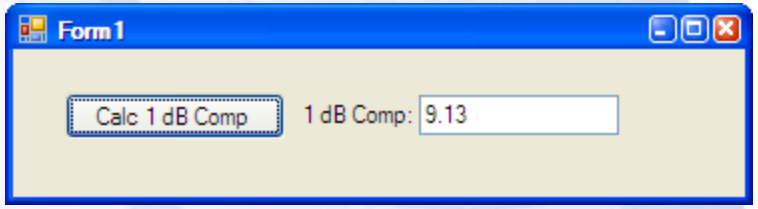


Simulation - Results

Simulation of a single step of the 1 dB compression point test



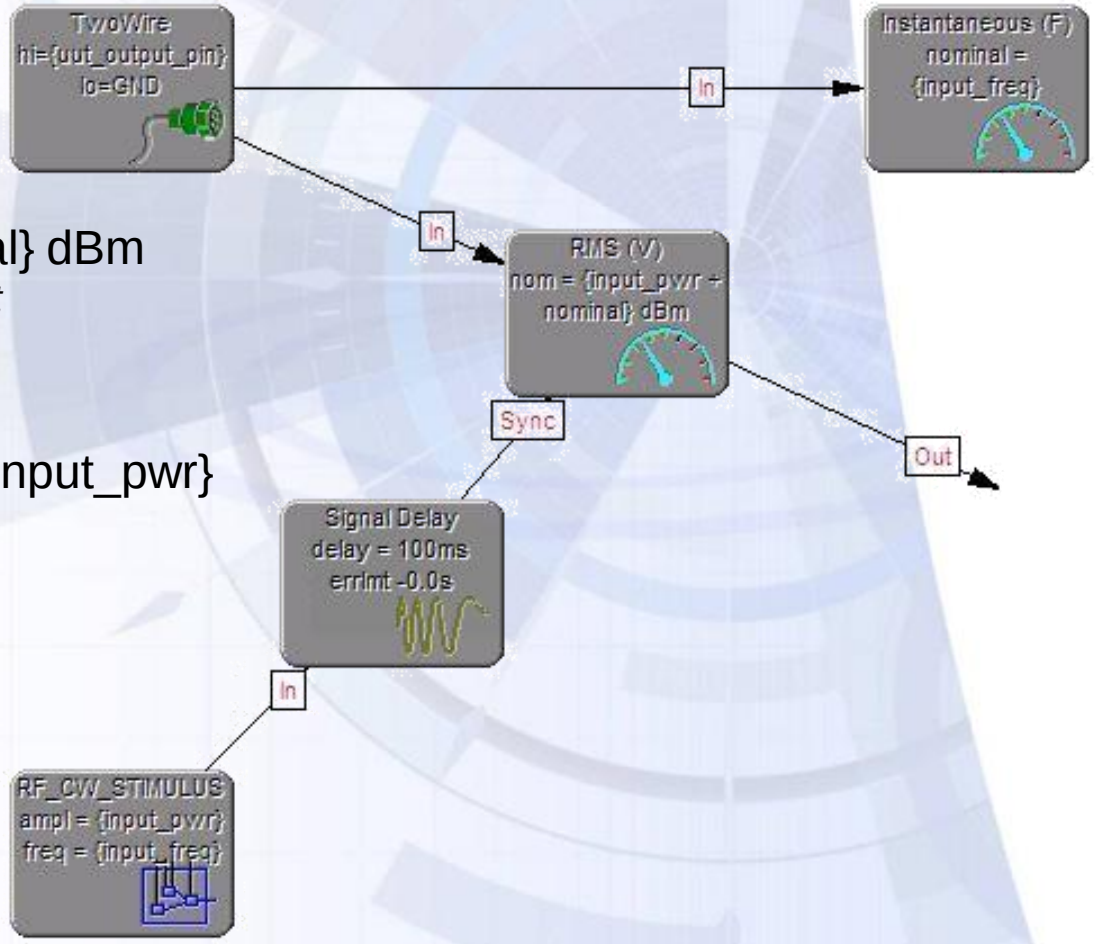
Calling test program results



TSF Design - Gain

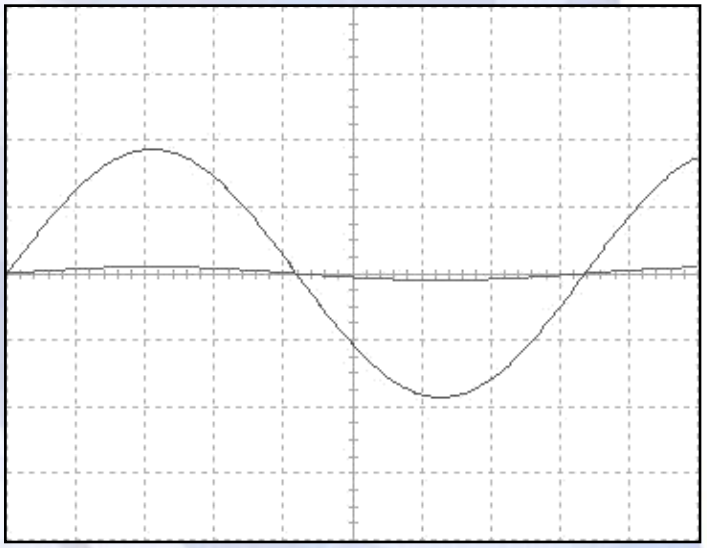
RMS nominal = {input_pwr + nominal} dBm
denotes a measurement capability requirement

TSF gain =
{MeasOutputPower.measurement - input_pwr}
TSF attribute calculates gain

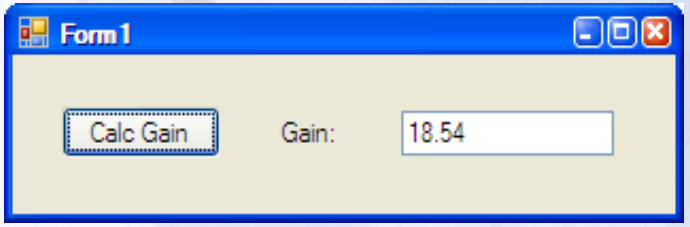


Simulation – Gain

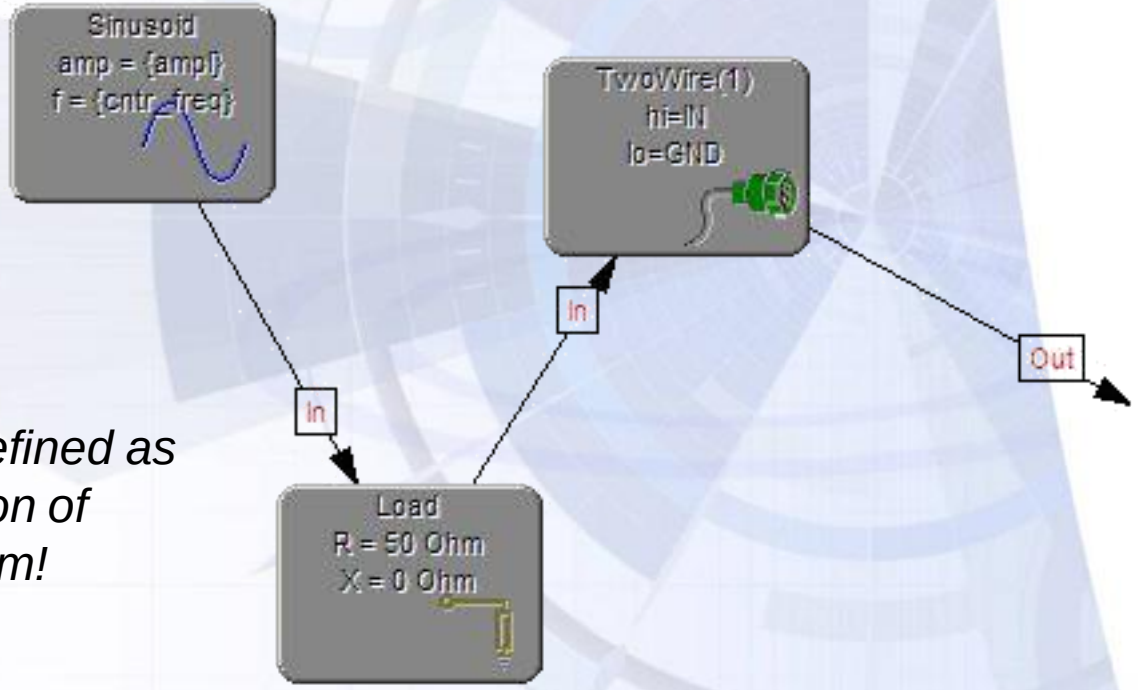
Simulation of gain step



Calling test program results



TSF Design – Phase 2, CW Signal

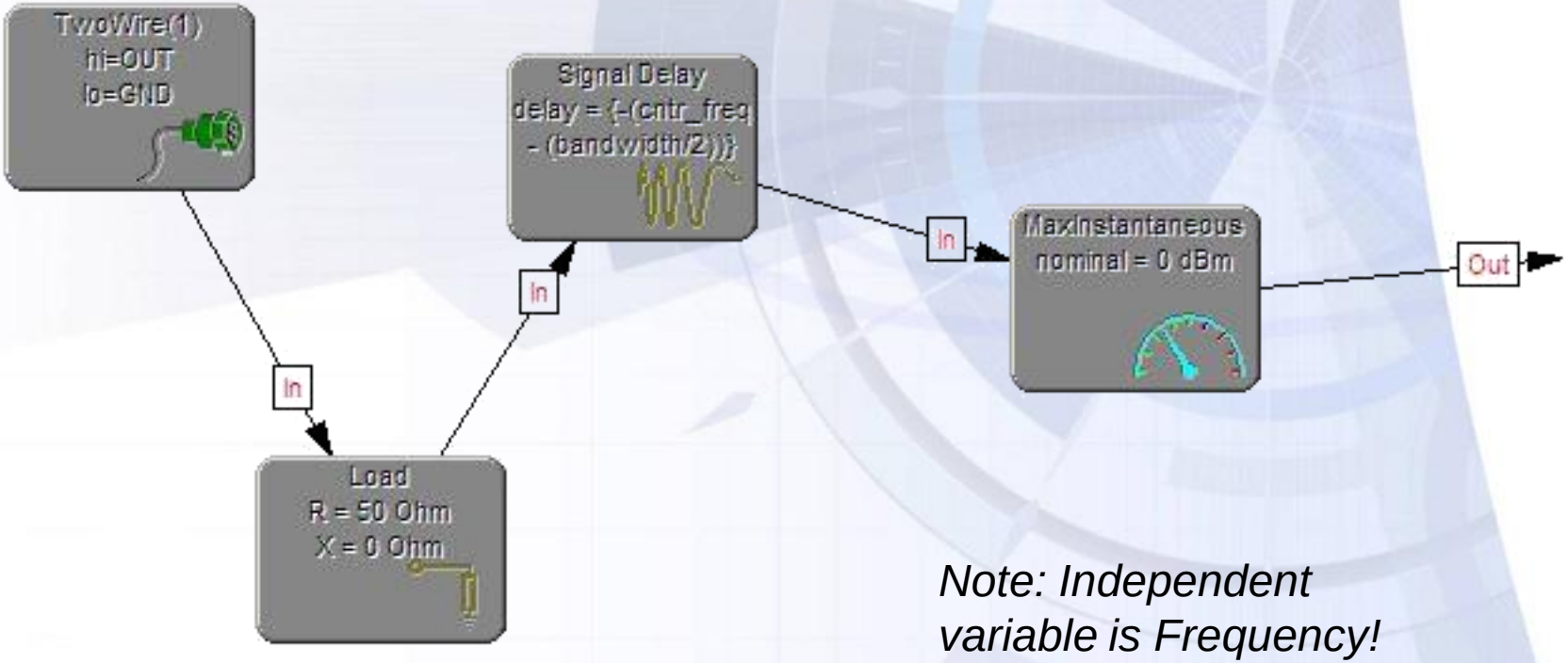


Tone Power calculation is defined as two TSFs, with the calculation of gain being in the test program!

Load BSC vs. Physical *load*

denotes input impedance of UUT

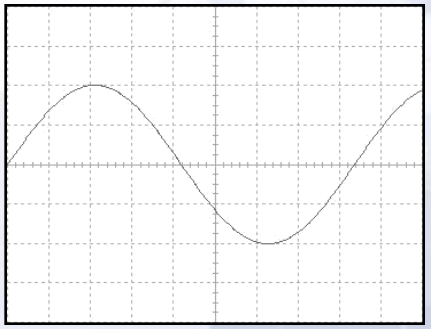
TSF Design – Phase 2, Tone Power



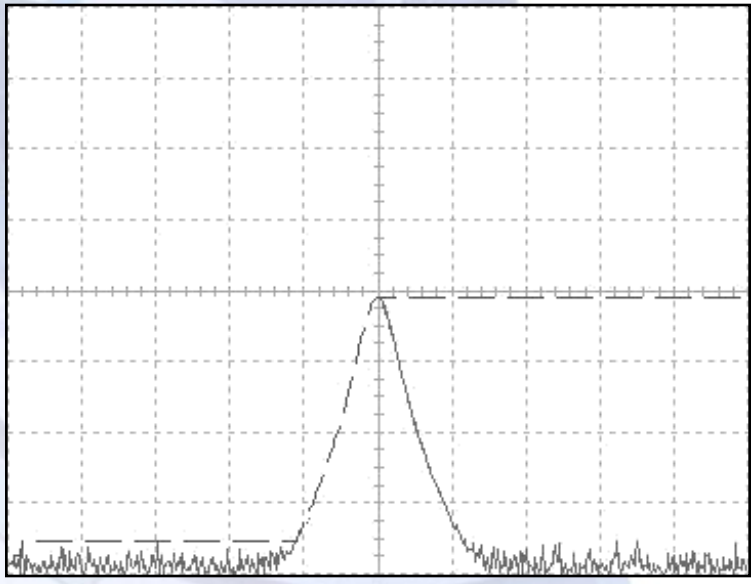
Note: Independent variable is Frequency!

Simulation – Phase 2 Tone Power

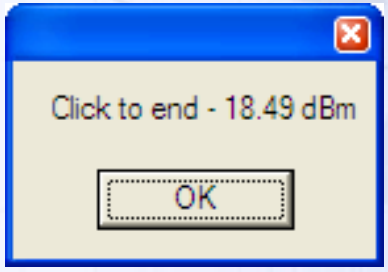
- Stimulus …



- Measurement made on Spectrum Analyser buffer data ……



- Calling test program results ……



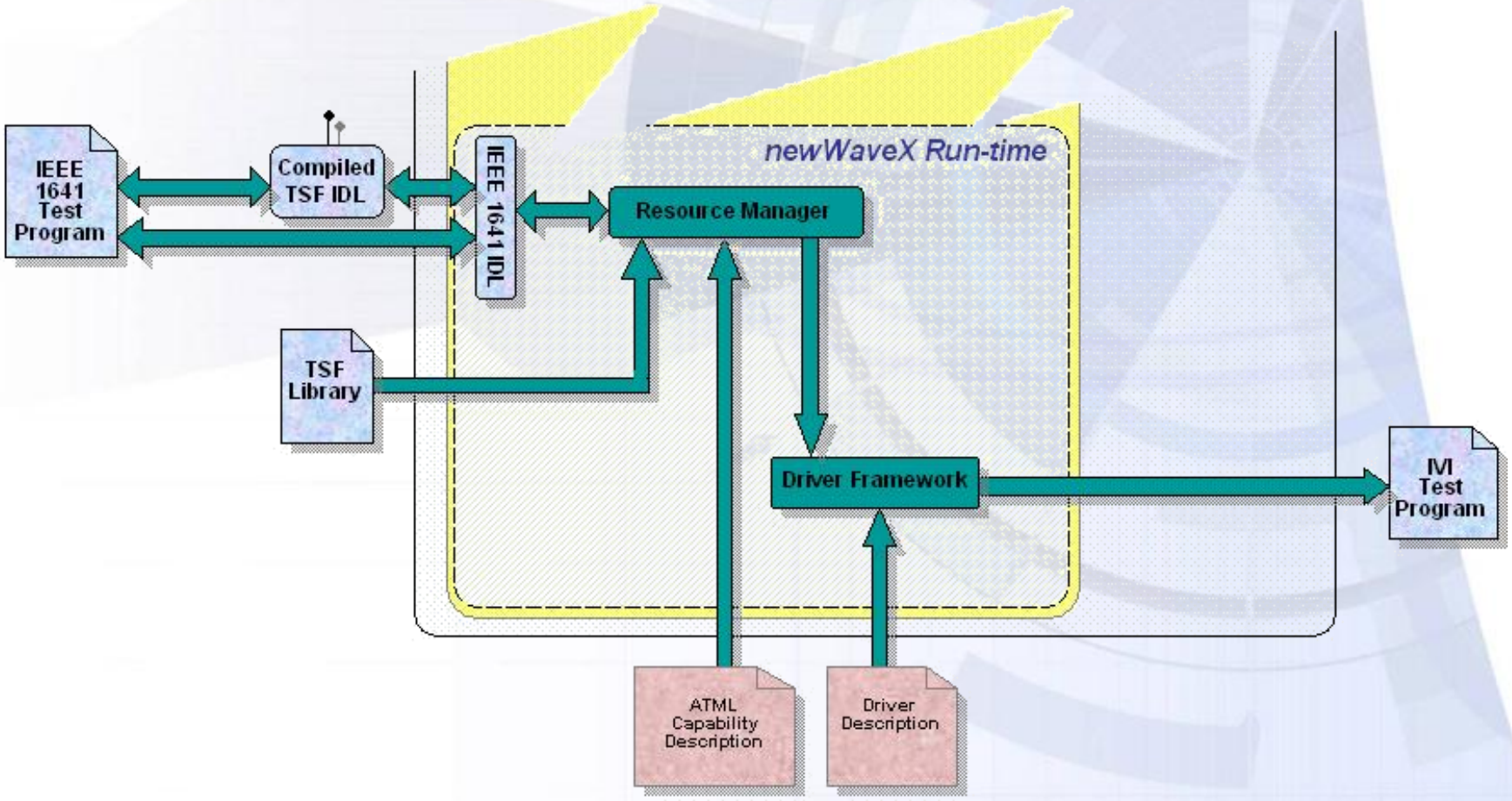
IVI Test Program – *IEEE ATML Capability Description*

- ATML includes:
  - Instrument Description
  - Test Station Description (multi-instrument capability)
- Test Station Calibration (not in this study)

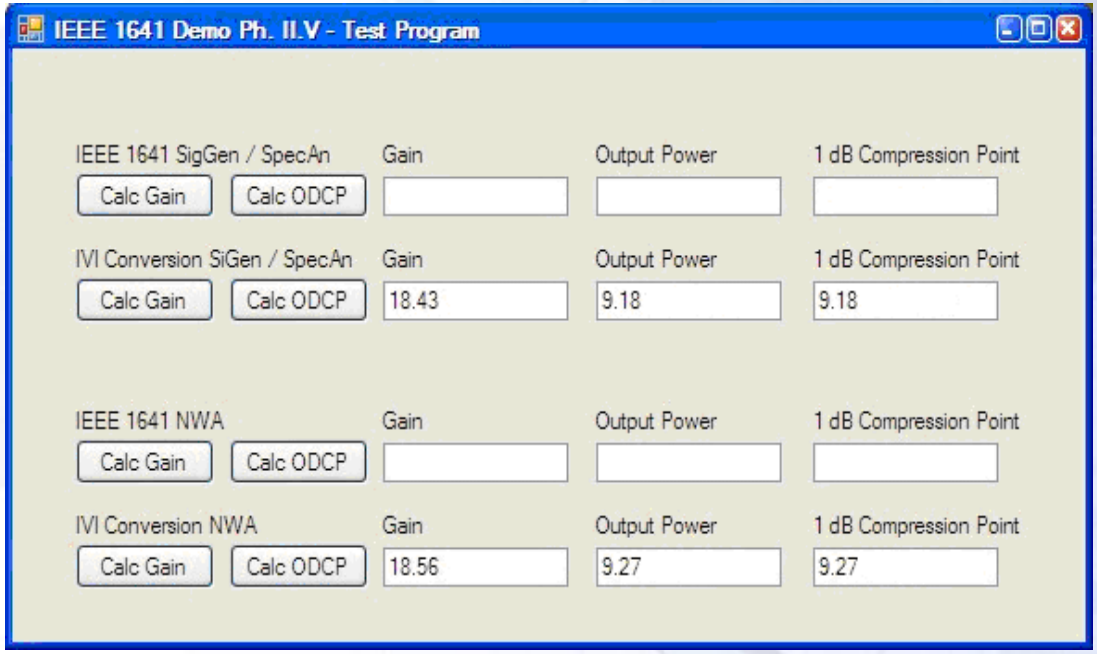
IVI Test Program – *IEEE 1641 Defined Interface for Test Programs*

- Functions defined by IEEE 1641 directly include:
  - Require <Signal>, [AllocationInformation]
  - Run [timeout]
  - Change [timeout]
  - Stop [timeout]
- Further, each Basic Signal Component has its property interface defined by the Standard.
- Additionally, a programmer interface may be defined, in terms of the Standard, for each of the attributes of a TSF.

IVI Test Program – *IEEE 1641 to IVI Translation*



IVI Test Program – *Execution*



'Rohde & Schwarz – Booth 806'

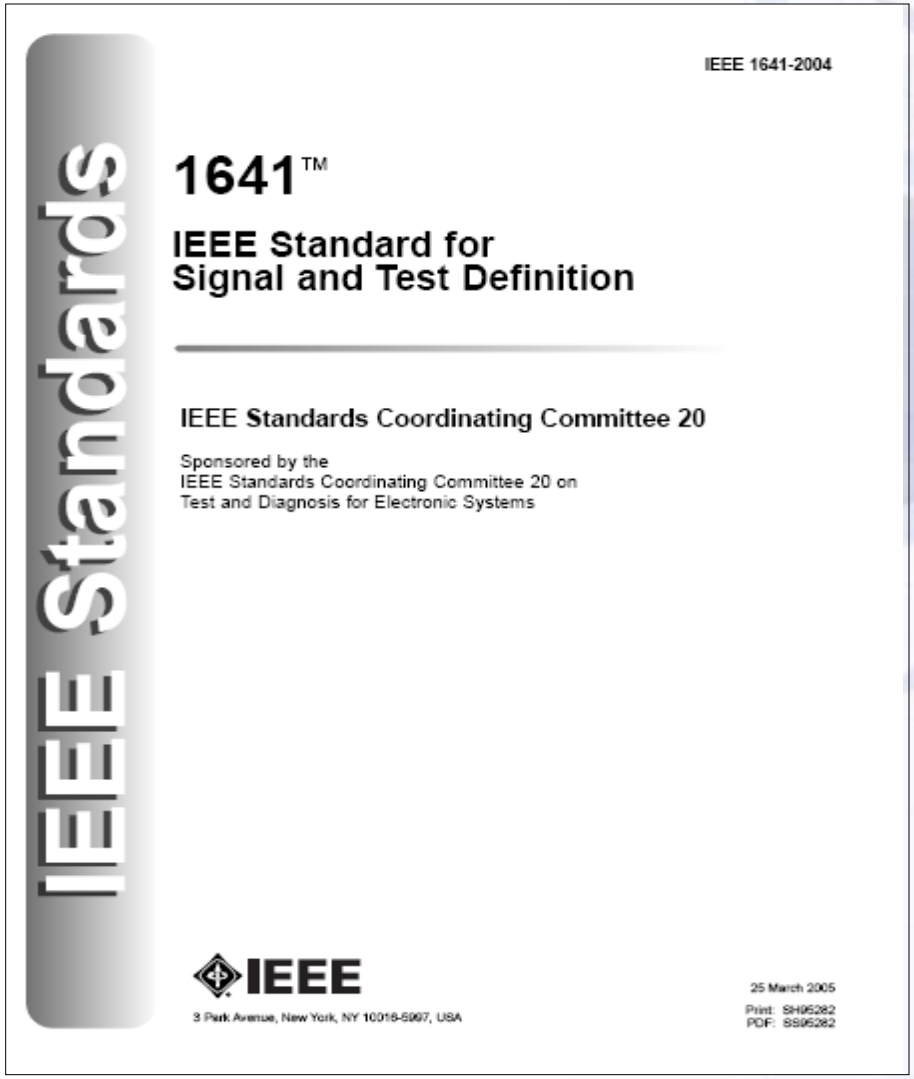
Conclusions

- Resolution has been provided on the use of IEEE 1641 to define input and output ***impedances***
- ***Power (W)*** may be better represented ***as a voltage (V)***, when applied through a matched impedance.
- ***Sync*** can been used to define a sequence of ***test steps, without a test program***.
- ***TSFs*** can be implemented in ***different programmatic sequence***, while retaining the ***same test definition***.
- '***Capability requirements***' capture information ***essential to resource allocation***.

Conclusions Contd.

- Comparison with the ***Phase 2 TSFs*** has ***shown equivalence*** of signal definitions between ***time & frequency***.
- ***Automated software tools*** shown ***generating and exchanging the XML, XSD & IDL*** signal definition formats.
- ***IDL*** has be shown used ***to develop programming interfaces*** for the TSFs, to enable their ***use in C#*** test programs.

IEEE 1641 – Signal & Test Definition



- **Available from IEEE**
  in paper or PDF format
- **Paper –** Product No: SH95282 ISBN 0-7381-4500-9 Price $105 or $85 (IEEE members)
- **PDF –** Product No: SS95282 ISBN 0-7381-4501-7 Price $90 or $70 (IEEE members)
- **Website**
  http://shop.ieee.org/ieeestore
  Search for **1641**; type **Standards**

- **Also now available:**
  IEEE Std 1641.1™-2006
  IEEE Guide for the Use of IEEE Std 1641, Standard for Signal and Test Definition