



# TestWave – Test and Measurement Integration Software for the Cadence-AWR Design Environment

## Introduction

TestWave is a software product from Aphena that tightly integrates the Cadence-AWR Design Environment (Microwave Office and Visual System Simulator) with external test and measurement hardware such as modulation analyzers, signal generators, and network analyzers. (See Figure 1)

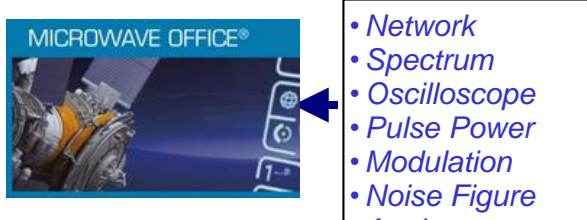


Figure 1 : TestWave instrument data transfers

## TestWave Components

TestWave Instrument Interface	Snapshot instrument traces into current project, to use as measured blocks in all types of simulation
TestWave Blocks for VSS	IQ data flows between system simulation and test equipment
SoftPlot for TestWave	Capture trace data from instruments to paste formatted graphs into documentation
RemoteControl	Automated measurements using GPIB scripts

## TestWave Instrument Interface

A TestWave instrument interface wizard, easily accessible from the AWR Design Environment, enables dynamic interchange of data between executing simulations and test hardware. Industry standard data formats for S-parameters, I-V data, amplifier compression curves and many other characteristics are supported. (See Figure 2)

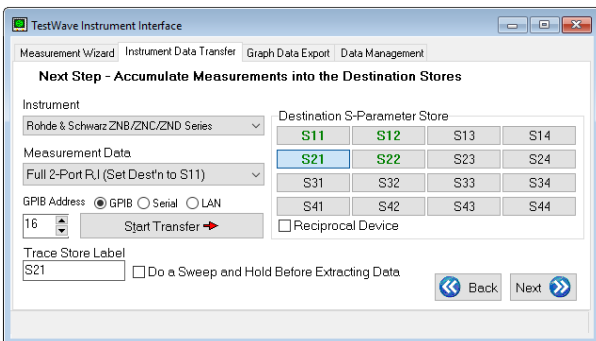


Figure 2 : TestWave Wizard

## TestWave Blocks for VSS

TestWave interacts with test and measurement equipment from dedicated “add-in” system diagram blocks within VSS projects to automate data transfers between the real world and the simulation. (See Figure 3)

One TestWave usage scenario starts with I/Q baseband waveform data generated by the VSS simulation, and sent to an external RF vector signal generator. The resulting output signal is used to drive a DUT (Device Under Test) whose output is measured with a vector signal analyzer and sent back to VSS for comparison with the simulation. (See Figure 4)

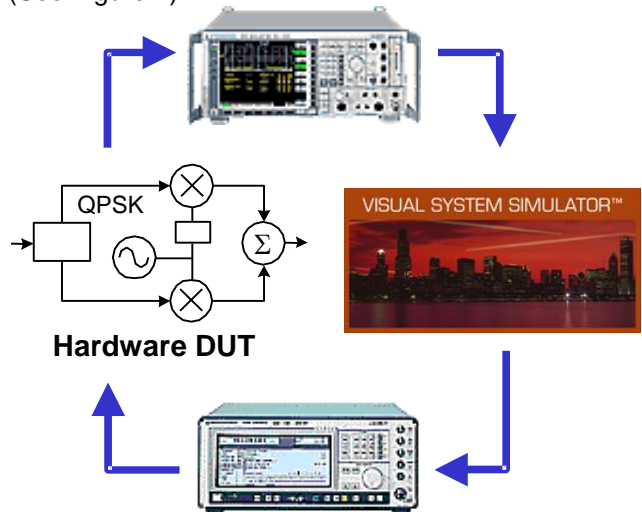


Figure 3 : Hardware links to VSS through TestWave

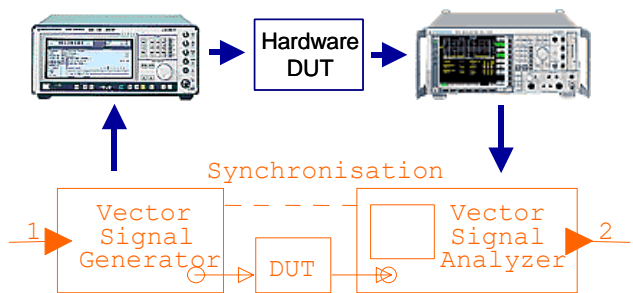


Figure 4 : Synchronized VSS to hardware to VSS

A second TestWave VSS method imports vector signal analyzer measured data into VSS as stimulus for system simulation, and then exports the simulated data to a vector signal generator. Driving



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a hardware DUT with the results of a system simulation allows system design ideas to drive real hardware. (See Figure 5)

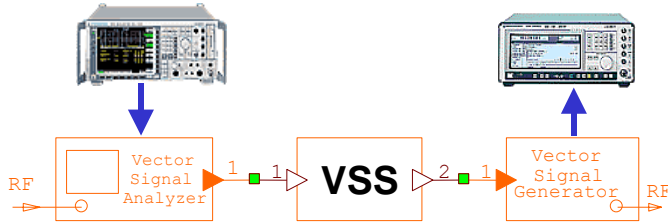
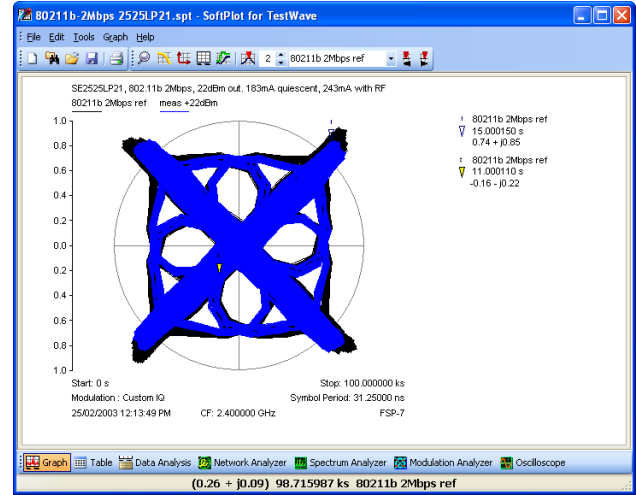
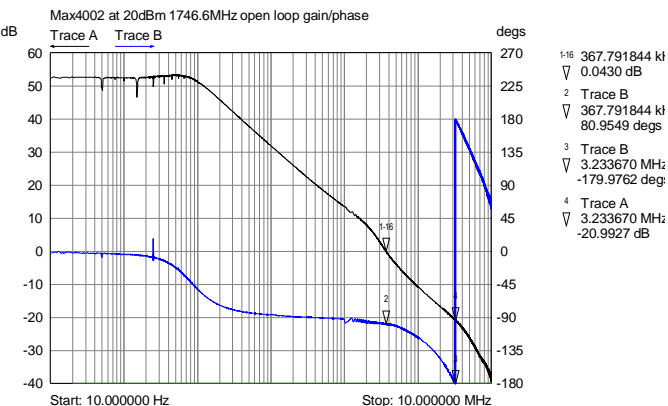
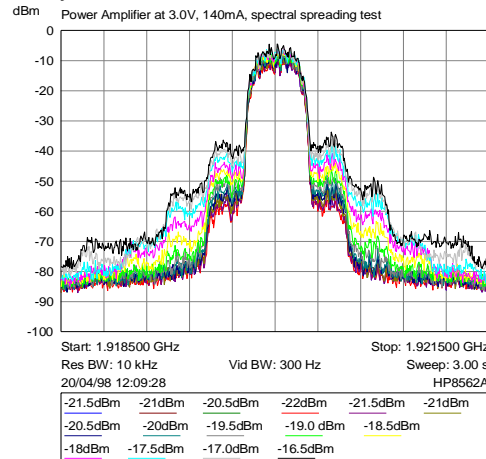


Figure 5 : Hardware to VSS to hardware

## SoftPlot for TestWave

Designed for putting measurement traces as high quality graphics into documents and presentations. Measurements can be formatted from complex data and graphed on Cartesian or Smith charts, etc. All common display charts are supported including log-frequency, IQ diagrams, antenna polar plots and many more.

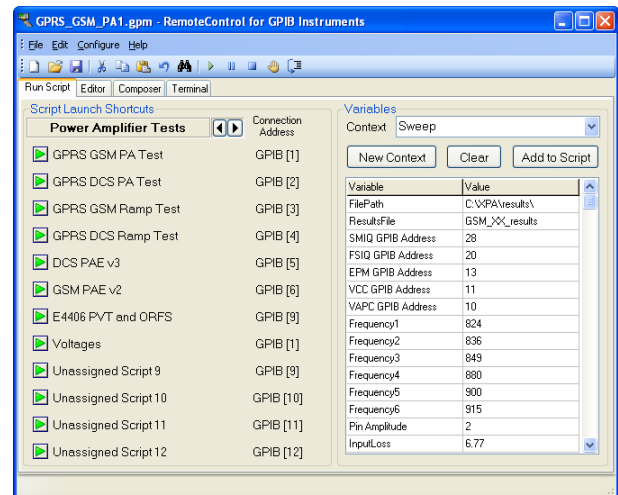


## RemoteControl

RemoteControl allows you to easily program RF test equipment using GPIB instructions, without the usual overhead of having to write a suitable computer program first. RemoteControl can create and run a GPIB instruction sequence (or "script") to configure an instrument for a particular measurement. More advanced scripts can automate measurements involving several instruments, logging results in a convenient format.

The advantage of a GPIB script file is that it is very powerful without being too complicated to use. Re-creating a test bench to repeat an experiment can normally involve a lot of setup time, but downloading a GPIB script takes just a few seconds.

A VSS block is also provided to allow RemoteControl scripts to be initiated as part of a system simulation.





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## Instruments Supported by TestWave

Network Analyzers	<p><b>Advantest</b> R3753H, R3764/65/66/67H, R3765/67G, R3860A, R3770, R3768 series</p> <p><b>Anritsu Wiltron</b> 360, 371xx/372xx/373xx, MS20XXC VNA Master, MS3401A/B, MS462XX, MS4630B, VectorStar MS4640A, ME7838, Site Master SxxxA/B series, S820E Microwave Site Master, ShockLine MS46122A/B, MS46322A/B, MS4652XA/B</p> <p>54xxA/541xxA/56100A series scalar analyzers</p> <p><b>Ceyear</b> 3661/3672 Series</p> <p><b>CMT Planar</b> PC-based network analyzers 304/1, 804/1, 1300/1, S5048, S7530 (COM svr). R60, S5048, 808/1, Cx409, Cx420 (SxVNA, RVNA).</p> <p><b>Hewlett - Packard</b> 3577A, 3589A, 8510, 8711-14B/C, ES, ET, 8751/52/53, 8720 series, E5100A/B; 4195, 4395A, 4396A/B</p> <p>Network/Spectrum Analyzer 4192A, 4194A, 4284A, 4291A/B, 4294A, E4991</p> <p>Impedance Analyzer 8756, 8757</p> <p>Scalar Analyzer, 8903A/B</p> <p>Audio Analyzer 4145A/B, 4155/56</p> <p>Semiconductor Param. Analyzers 4280</p> <p>Capacitance Meter; 4352B</p> <p>VCO / PLL Signal Analyzer</p> <p><b>Keysight/Agilent</b> E5061/62/63/70/71A/B/C, E5080A ENA, E835XA/B/C, E836XA/B/C, N522XA, N523XA, N524XA PNA, PNA-X Series, FieldFox (N9912A..N9962A) PXIe/USB VNA : M9485A, M937xA</p> <p><b>Hioki</b> IM3570</p> <p><b>Marconi Instruments / IFR / Aeroflex</b> 6210 reflection analyzer 6200, 6800 series Microwave Test Sets</p> <p><b>Pico Technology</b> PicoVNA 106</p> <p><b>Rohde &amp; Schwarz</b> ZVA/ZVB/ZVT series, ZVH, ZVL, ZVR/ZVC/ZVM/ZVK series, ZNA/ZNB/ ZNBT/ ZNC/ZND series; ZNL/ZNLE</p> <p><b>Wayne Kerr</b> 6500B Impedance Analyzer</p> <p><b>Wiltron</b> 560A / 6600 Scalar Analyzer system</p>
Spectrum Analyzers	<p><b>Advantest</b> R3131/3132/3162, R3261/3361, R3265/3271, R3267/3273, R3463/3465, R3671/81, U3641, U3751, U3771, U3772, U4941, R4131 series, TR4135</p> <p><b>Ando</b> AQ6317 Optical Spectrum Analyzer</p> <p><b>Anritsu</b> MS2602, MS2650/60, MS2665C, MS2667C, MS2668C, MS2702, MS2802, MS2830/40/50A, MS612A, MS2711A/B/D, MS2721A/B, MS272XC/T</p> <p>MT8801B Radio Comms Analyzer, MT8220</p> <p>UMTS Master</p> <p>MS9030A (MV02) Optical Spectrum Analyzer</p> <p><b>Hewlett - Packard</b> 3561A, 3562A, 35660, 35665, 35670A, 3582, 3585, 3588/89A, 4195, 4395A, 4396A/B , 8542E / 8546A, 8560/1/2/3/4/5, 8566A/B, 8568A/B, 8569B, 8590 series, HP8594EM EMI Receiver; 70000 series8920/22</p> <p>Wireless Comms Test Set</p> <p><b>Keysight/Agilent/ HP</b> CSA, E44XXA/B ESA-E, ESA-L, PSA, E7400, CXA, EXA, MXA, MXE, PXA, UXA series, L1500A, N9912A-N9938A</p> <p>E5052A Signal Source Analyzer</p> <p>8960 Wireless Comms Test Set (GSM), 89600 series, N9340 Series</p> <p><b>IFR/Aeroflex</b> AN940 series, IFR2394, 2395, 2397, 2398, 2399, 2399A/B/C, 3250, 3280, 6800, 8800S</p> <p><b>LG Precision</b> SA-9270 / SA-7270</p> <p><b>Marconi Instruments</b> 2380 and 2390 series 2945 series (spectrum analyzer display only) 2965 series (graphical displays only)</p> <p><b>Rigol</b> DSA800 series</p> <p><b>Rohde &amp; Schwarz</b> ESCI, ESML, ESPI, ESCS, ESIB, ESRP, ESL, ESU, ETL, FPS, FSA/B/M, FSE, FSG, FSH (opt K1), FSIQ, FSL, FSP, FSQ, FSU, FSUP,FSV, FSW, FSWP; FS-K40 phase noise option</p> <p>ZVL/ZNL/ZNLE</p> <p>CMS50 series (spectrum analyzer display only)</p> <p>CMD55/65, CMU200 (3GPP</p> <p>FDD/GSM/EDGE/Btooth), CMU300 (GSM/EDGE)</p> <p><b>Scientific Atlanta</b> SD385</p> <p><b>Tektronix</b> 2711/2712, 2714/2715, 492P/ AP/BP, 494P, RSA3303A/08A, RSA5100B, RSA6106A/RSA6114A, RSA306 (via SignalVu-PC)</p> <p><b>Willtek</b> 9100 Series</p>



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Modulation Analyzers	<p><b>Advantest</b> R3264/3267/3273 + Opt62 3GPP, R3671/81</p> <p><b>Anritsu</b> MS269XA, MS2830A, MS8604A, MS8608A/MS8609A Transmitter Tester</p> <p>MT8820A Radio Comms Analyzer, MT8852A Bluetooth Analyzer</p> <p><b>Hewlett Packard</b> 53310 modulation domain analyzer</p> <p>5372A Frequency / Time Interval Analyzer</p> <p>71500/70820A Microwave transition analyzer</p> <p>5361B Counter</p> <p><b>IFR</b> 2310 Tetra modulation analyzer, 2319E RF Digitiser</p> <p><b>Keysight/Agilent / HP</b> 89400, 8981B, E4406, ESA, EXA, MXA, PSA, PXA, UXA, 89600A/B VSA</p> <p><b>Pendulum</b> CNT-80 / 81 / 85; CNT-90 / 91 / 91R / 91XL Counter</p> <p><b>Rohde &amp; Schwarz</b> AMIQ ARB (Memory Buffer), FSE series with Digital Demodulation option B7, FSIQ, FSIQ-B70, FSP-B70, FSG/FSP/FSQ/FSU/FSV/FSW IQ Capture, FSIQ-K72 WCDMA Analysis, FS-K70, FS-K40 options</p> <p>FS-K96 OFDM analysis</p> <p>RTO-K11 (IQ decimation option)</p> <p><b>Tektronix</b> WCA230A/280A, RSA5100B</p> <p>RSA6106A/RSA6114A</p> <p><b>Wandel &amp; Goltermann</b> PCM-4 PCM channel test set</p>	Oscilloscopes	<p><b>Fluke/Philips</b> PM3350/55/65/75; PM338XA/PM339XA</p> <p><b>Hameg</b> HMO352x, HMO2524, HMO72x .. HMO202x</p> <p><b>Keysight/Agilent / HP</b> DSO3000, DSO5000, MSO6000, DSO7000, MSO7000, MSO8000, DSO9000, 90000 Series, 54111/12D, 54120 Series, 54200, 54502A, 54520/40C, 54600/1/2/3, 54610/15/16, 54621/22/24A/D, 54641/2/4A/D, 54645A/D, 54750, 548XXA, 80000 Infiniium, 83480, InfiniiVision 2000 X-Series, 3000 X-Series, 4000 X-Series, S Series DSO/MSO, V Series DSO/MSO</p> <p><b>LeCroy</b> LC300/LC500/9300, WaveRunner/WaveMaster/WavePro, SDA, DDA Series</p> <p><b>Rigol</b> DS6000 series</p> <p><b>Rohde &amp; Schwarz</b> RTB , RTO, RTE, RTM2000/RTM3000</p> <p><b>Tektronix</b> 11000 / DSA60x / CSA Digitiser, TDS 200 to 800 series, TBS 2000, TDS1000/2000/3000/4000/5000/8000, TDS3000B, DPO/MSO2000B, DPO/MSO3000, MDO 3000, DPO 4000, MSO/DPO 5000, DPO7000, DPO70000, DSA70000, 2220, 2230, 2232, 2432A, 2440, 7D20, 7854</p> <p>SCD1000 / SCD5000 Transient Recorder</p> <p><b>Yokogawa</b> DL1520/DL1540, DL1740 / DL7100 / DL7200, DL750 / DL750P / DL850 / DL850V Series</p>
Signal Generators	<p><b>Anritsu</b> MG3700A, MS269XA opt 020</p> <p><b>IFR</b> 3410 ARB Memory (Opt 005)</p> <p><b>Keysight / Agilent / HP</b> ESG-B (4433-4437B) Option UND ARB Memory</p> <p>ESG-C (4438C), PSG ARB Memory, EXG N517XB</p> <p>MXG N5182A with Option 651/652/654, MXG N518XB, M8190A Arb</p> <p>N8241/2A Arb</p> <p><b>Keithley</b> 2910 Vector Signal Generator</p> <p><b>Rohde &amp; Schwarz</b> AMIQ / SMIQ / SMJ / SMBV / SMU / SMW ARB Memory</p> <p><b>Tektronix</b> AWG2021 Arb (Opt 02 dual channel), AWG400/500/600/710, AFG3000, AWG5000/7000/B series, TSG4100</p> <p><b>Thurlby Thandar</b> TGA12100 Arb</p>	Others	<p><b>Boonton</b> 4400 / 4500 Peak Power Meter</p> <p><b>Keysight/Agilent</b> EPM-P Series Power Meter, 8990A/8991A, 8990B</p> <p><b>Keysight/Agilent</b> N8972/3/4/5A NFA Series Noise Figure Meter</p> <p>66319B/D, 66321B/D Series PSU</p> <p><b>Hewlett Packard</b> HP8970A/B Noise Figure Meter</p> <p>HP 8990/8991 Peak Power Analyzer</p> <p>HP 85719A Noise Figure Card in HP859XE</p> <p>HP 85671A Phase Noise Card in HP8560/90</p> <p><b>Rohde &amp; Schwarz</b> NRP xxS(N) sensor family</p>



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## Hardware Requirements

<b>Minimum system requirement</b>	See AWR Design Environment requirements
<b> GPIB card</b> Note: TestWave can also use RS-232 or LAN if the instrument supports it.	<b>National Instruments</b> , type PC-IIA, AT-GPIB/TNT, PCI-GPIB, PCMCIA-GPIB, GPIB-USB-A/B/HS <b>Keysight/Agilent / HP</b> 82335, 82340, 82341, 82350, 82357 <b>MCC (ComputerBoards Inc.)</b> , type ISA-GPIB, ISA-GPIB/LC, ISA-GPIB-PC2A, PCI-GPIB, PCM-GPIB. <b>ines GPIB-PCMCIA</b> , GPIB-PCI card <b>IC Select</b> 488-USB, 488-USB-2 <b>Prologix</b> GPIB-USB 4.2, GPIB-Ethernet 1.2 or higher

TestWave software is a third-party add-in for Cadence-AWR's Microwave Office and Visual System Simulator simulation software packages. TSW-100-XXX

TestWave integrates test and measurement equipment to computer simulation through data transfers over GPIB, RS-232, LAN sockets or VISA connections.

TestWave is developed, sold and supported by Aphena Ltd. Contact [enquiries@aphena.com](mailto:enquiries@aphena.com) for pricing and availability.

All enquiries: [enquiries@aphena.com](mailto:enquiries@aphena.com)

## SoftPlot for TestWave Capabilities

<b>Supports</b>	Network Analyzers, Spectrum Analyzers, Modulation Analyzers, Oscilloscopes
<b>Chart types</b>	Cartesian- linear and log, Polar, Smith, Admittance Smith, Eye Diagram, Vector Modulation (Cartesian, polar, rotated), Constellation, Nichols, Antenna Polar
<b>Graph Data Formats</b>	Linear magn, Log magn, re/im, VSWR, Phase, Group Delay, Unwrapped Phase, Inductance, Capacitance, Series Quality Factor, Parallel Quality Factor
<b>Data Storage</b>	16 complex trace stores, arbitrary number of points (limited by available system memory). Each store has a trace label, trace notes and data analysis table.
<b>Markers</b>	Up to 100 markers and/or delta markers
<b>Limit lines</b>	Up to 100 arbitrary line segments for limits testing
<b>Scaling</b>	Up to 2 independent vertical scales
<b>Numerical</b>	Electrical delay, Smoothing, Magnitude/ Phase offset, Magnitude slope
<b>Trace maths</b>	+, -, /, x, Log, Magn, Phase, Square-root, Anti-Log, Group Delay, Derivative, Mismatch loss factor, Rollet's Stability Factor K, Stability Factor B, Edwards-Sinsky Stability Mu, Max Unilateral power gain, Max Available Gain, Max Stable Gain, Z0 Renormalisation, No. of Bit Differences, Max Value, Min Value, Standard 3 or 4 port to Mixed Mode S-Parameters, Standard 2-port to Differential 1-port S-Parameters, Timebase Delay, Smoothing, Wraparound Smoothing, Complex Reflection to VSWR, Complex Refl to impedance, dB Reflection to VSWR, mW to dBm, dBm to mW, T-Check quotient, Sorting, 2-port de-embedding, Envelope of RF Signal
<b>Data editing</b>	Edit, cut, copy and paste traces in the Table view
<b>Measurement templates</b>	Copy attributes from previous measurements such as limits, markers, annotation, graticule
<b>Integrated interfaces</b>	OLE2 Linking and Embedding Server (for Word, PowerPoint, etc) :- double-click in the document to begin editing. COM (ActiveX Automation) and DDE Server (for automated operation with test system software)
<b>File formats: (all bi-directional except MAT)</b>	SoftPlot (*.SPT), MIPlot (*.MPT), AWR Design Environment (Touchstone) (*.SIP.. S4P), Spreadsheet (*.CSV), Tab Delimited (*.TXT), MathCad (*.PRN), Citifile (*.F??,D??), MatLab (*.MAT)

<http://www.aphena.com/>

Aphena Limited,  
 10, Teversham Road,  
 Fulbourn, Cambridge CB21 5EB, U.K.  
 +44 1223 700499