Agilent Modular Instrumentation

New PXI Vector Signal Analyzer
Technical Presentation
PXI Microwave Vector Signal Analyzer

- Product Overview
- Software
- Demo
- Supplemental Information
  - Performance data
  - Applications
  - Software / SFPs
  - Field Cal
  - Module Level Operation
Modular Product Summary

Introducing a broad and powerful modular product offering

• Providing of a comprehensive set of PXI products
• Leading the industry in adoption of AXIe standard
• Adopting PCIe as a standard controller I/O interface
• Delivering the software needed for effective modular solutions, that will work in any development environment
• Bring its wide measurement expertise to modular form factors
M9392A PXI Microwave Vector Signal Analyzer

First Single-Vendor PXI Microwave Vector Signal Analyzer

- Modular RF Design:
  - 4 or 5 module (7 or 8 slot) PXI Vector Signal Analyzer
  - 50 MHz to 26.5 GHz
  - Frequency Range and Capability to Optimize Cost
  - Combine with PXI uWave switches to create Test System

- Integration to Agilent Measurement Science Software:
  - 89600 VSA Program for Modulation Analysis

- Wide Bandwidth (250 MHz):
  - Measure Broadband Communications and Radar Signals

- Reduce test time for lower cost of test
  - PCIe Data Bus for 1 GB/S transfer Rate

- Flexible
  - Easy integration to: Visual Basic, C++, C#, LabView, LabWindows, Matlab, and VEE -- with examples

M9392A Includes:
- M9202A PXIe IF Digitizer
- M9302A PXI LO
- M9360A PXI Attenuator/Preselector
- M9361A PXI Downconverter
- M9351A PXI Downconverter (Option)
M9392A Block Diagram
Displayed Average Noise Performance

Measurement data is for two units, on a lab benchtop during development, and is not intended to represent guaranteed performance.
Observed Power Accuracy

Measurement data is for one unit, on a lab benchtop during development, and is not intended to represent guaranteed performance.
PXI Microwave Vector Signal Analyzer

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Typical Module Software Structure

Interactive Interface

Module Soft Front Panels

Matlab Driver

Programming Interfaces

Matlab

Visual Studio (VB, C#, C++) VEE

LabVIEW Driver

LabVIEW

LabWindows/ CVI

IVI-COM and IVI-C Drivers

Agilent I/O Libraries (AgVisa32.dll) Release 16

M9360A.dll
Typical Module Programming
API and Soft Front Panel

- Agilent 9360 PXI Attenuator/Preselector
  - Primary Settings
    - Input Frequency: 8 GHz
    - Input Level: 20 dBm
    - Presel. Enabled: Off
    - Presel. Frequency: 8.15 GHz
    - Step Attenuator: 40 dB
    - RF/LC Out: 1
      - 1 (Low-band)
      - 2 (High-band)
  - Custom Settings
    - Step Attenuator: 40 dB
    - Preselector: On
      - Frequency: 8.15 GHz
      - RF Path: 2 (High-band)
  - Hardware Status
    - Temperature: 37.8°C
    - Voltage: +12, +5, +3.3, -12
    - Self Test: Pass
    - Serial #: 12345678
  - Estimated Loss
    - Port Loss: 0.30 dB
    - Preselector Loss: N/A dB
    - Attenuator Loss: 42.10 dB
    - Total Loss: 42.40 dB
**M9392A Signal Analyzer Software Overview**

### Interactive Interfaces

<table>
<thead>
<tr>
<th>M9392A Soft Front Panel</th>
<th>89601A VSA Program</th>
<th>Matlab Driver</th>
<th>Matlab</th>
<th>Visual Studio (VB.Net, C#, C/C++)</th>
<th>VEE</th>
<th>LabVIEW Driver</th>
<th>LabVIEW</th>
<th>LabWindows/ CVI</th>
</tr>
</thead>
</table>

### Programming Interfaces

**IVI-COM and IVI-C Drivers**

**VSA “Instrument” Library**

- M9202A.dll
- M9302A.dll
- M9360A.dll
- M9361A.dll
- M9351A.dll

**Agilent I/O Libraries (AgVisa32.dll) Release 16**
M9392A User Interface Programs

M9392A Soft Front Panel

89600A VSA Measuring 800 MHz Radar Chirp
89600 VSA Software Automation

89600A (v12.0):
• COM API

89600B (v13.0):
• Backwards-compatible COM API
  – Compatible with \( \leq v12.0 \) only
  – Exception: LTE \( \leq v13.0 \) only
• SCPI programming (\( \geq v13.0 \))
• .NET programming interface
• New macro languages
  – C# and Visual Basic.NET
  – Internal editor or Visual Studio

```vbnet
Option Explicit
' This is a demonstration of a complete measurement
'
' This routine creates, sets up, starts a measurement, reads
' frequency and voltage data, dumps the data to the debug screen,
' and exits the application.
'
' It would not normally combine all these steps into one routine.
' In particular, the creation of the 89600 app would normally be done
' only once at main form load time and kept around until the VB app
' is done.
Private Declare Sub Sleep Lib "kernel32" (ByVal dwMilliseconds As Long)

Public Sub MessTest()
    Dim oApp As AgtVsaVector.Application
    Dim oMes As AgtVsaVector.Measurement
    Dim oDisp As AgtVsaVector.Display
    Dim vTime As Variant
    Dim vHRx As Variant  ' Will be filled with an array of doubles
    Dim vHRy As Variant  ' Will be filled with an array of doubles
    Dim bMeasDone As Boolean
    Dim bCreated As Boolean
    Dim i As Long

    ' First, try getting a reference to an already running 89600 VSA
    bCreated = False
    On Error Resume Next
    Set oApp = GetObject(, "AgtVsaVector.Application")
    If oApp Is Nothing Then
        ' There is no running 89600 VSA, try to create a new one
        Set oApp = CreateObject("AgtVsaVector.Application")
        bCreated = True
    End If
    On Error GoTo 0

    If oApp Is Nothing Then
        MsgBox "Unable to create 89600 VSA object", vbCritical
        Exit Sub
    End If

    ' Make it visible
    oApp.Visible = True
```
M9392A Signal Analyzer
Programming API
Examples in many different programming languages

Basic measurement examples in all supported languages, with extended examples in LabView and C#.

```c
void acquireMeasurement(IAgM9392Ptr driver, int timeout)
{
    SAFEARRAY* complexdata = NULL;
    printf("\n");
    printf("Initiate measurement...\n");
    driver->Measurements->Initiate();
    driver->Measurements->WaitForInitiateComplete(timeout);
    printf("Arming...\n");
    driver->Measurements->Arm();
    driver->Measurements->WaitForData(timeout);
    printf("RMS Power = %lf dBm.\n", driver->Measurements->RmsPower);
    printf("Peak Power = %lf dBm.\n", driver->Measurements->PeakPower);
}
```

Sample Programs included with the driver installation
Basic Control Sequence

1) Set settings

M9392A

Acq Time → Power
BW → Frequency
Trigger →

2) Initiate HW Changes

M9392A

Initiate

M9392A

Digitizer → LO → Attn/Pre → Downconverters

3) Wait for Initiate Complete

M9392A

Initiate Complete

M9392A

Digitizer → LO → Attn/Pre → Downconverters

Setup DUT and other HW
Basic Control Sequence

4) Arm

Wait for DUT and other HW

M9392A

Arm

Digitizer

5) Get Data

Trigger happens, Data is acquired

32 bit complex pairs

Get Data

Cal and post process

Digitizer
Advanced Control Sequence for ATE

Settings

Initiate()

Wait for Initiate Complete()

ARM()

Wait for Data Available()

Get Data()

Abort()

Actual sample rate, BW, and number of Samples available

If no settings changed
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M9392A / M9362A-D01 Demo Setup

SystemVue Radar Model Library

LabVIEW Automation Program

89601A VSA Software

M9210A 2 Channel Software

SCI/LAN

IVI-C LabVIEW

Signal Generator

PXI Microwave Vector Signal Analyzer

IVI-C LabVIEW

COM

IVI-C LabVIEW

IVI-C COM

IVI-C LabVIEW
M9362A-D01 Downconverter Hardware Overview

<table>
<thead>
<tr>
<th>Port</th>
<th>Frequency Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Port</td>
<td>0.01 to 26.5 GHz</td>
</tr>
<tr>
<td>LO Port</td>
<td>0.01 to 26.5 GHz</td>
</tr>
<tr>
<td>IF Port</td>
<td>0.007 to 20 MHz</td>
</tr>
<tr>
<td></td>
<td>0.007 to 1.5 GHz (without jumper, Max BW)</td>
</tr>
</tbody>
</table>

RF Input Power Damage Levels:

<table>
<thead>
<tr>
<th>Port</th>
<th>Power Damage Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Port</td>
<td>+18 dBm</td>
</tr>
<tr>
<td>LO Port</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>Optimum LO Power</td>
<td>0 dBm (±1 dB)</td>
</tr>
</tbody>
</table>

RF Input @ 0.1 dB Typical Compression:

<table>
<thead>
<tr>
<th>Port</th>
<th>Compression Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-D Receiver</td>
<td>-10 dBm</td>
</tr>
<tr>
<td>IF Output Level</td>
<td>-10 dBm</td>
</tr>
</tbody>
</table>
Combined M9392A / M9362A-D01 Demo
M9392A / M9362A-D01 Demo Software Control

M9360A Attenuator/Preselector

M9361A Downconverter: 2.75 GHz to 26.5 GHz

LO IN, 3 GHz to 26.5 GHz

IF OUT

Video OUT

M9351A Downconverter: 50 MHz to 2.9 GHz

Upconvert to 3.5 GHz

Downconvert to IF

LO IN, 3.5 GHz to 6.4 GHz

IF OUT

Video OUT

M9362A-D01 Downconverter

M9202A IF Digitizer

Input 1

ADC

DDR 3 Memory

PCIe bus

89600A

M9202A IF Digitizer

M9210A Digitizing Scope

M9155C Switch

M9210A 2 Channel.exe

Demo Control.exe
Running VSA with M9202A Digitizer

89601A can be run with just the M9202A Digitizer using the M9392A role, providing Decimated, Zoomed IQ Data

Range of Operation:
- Maximum BW 800 MHz
- Minimum BW 1 MHz
- Frequency Range from 50 MHz to 1 GHz

Connection Procedure:
- Open M9392A SFP selecting M9202A digitizer only
- Save Connection as M92902A
- Open 89601A
- Select M9392 hardware and press “configure hardware” button
- Change Connection Name to M92902A
- Restart 89601A
M9362A-D01 Demo Signal
800 MHZ BW FM Linear Chirp
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## Demodulation Performance

<table>
<thead>
<tr>
<th>Modulation Type</th>
<th>Best Case EVM @ 3 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 MHz 802.11n, 64 QAM OFDM</td>
<td>-40 dB</td>
</tr>
<tr>
<td>20 MHz 802.11g, 64 QAM OFDM</td>
<td>-45 dB</td>
</tr>
<tr>
<td>EDGE</td>
<td>0.18 %</td>
</tr>
<tr>
<td>QAM 256, 3 MHz</td>
<td>0.66 %</td>
</tr>
<tr>
<td>QAM 32, 3 MHz</td>
<td>0.18 %</td>
</tr>
</tbody>
</table>

Measurement data is for one unit, on a lab benchtop during development, and is not intended to represent guaranteed performance.
## M9392A LO and IF Frequencies

<table>
<thead>
<tr>
<th>Path</th>
<th>BW</th>
<th>IF Freq</th>
<th>LO Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>uWave Fundamental, 3 to 9.75 GHz, no preselector</td>
<td>250MHz</td>
<td>468.75 MHz BW ( \leq ) 50 MHz, 500 MHz otherwise</td>
<td>( LO = RF + IF )</td>
</tr>
<tr>
<td>uWave 3(^{rd}) Harm, 9.75 to 26.5 GHz</td>
<td>250MHz</td>
<td>468.75 MHz BW ( \leq ) 50 MHz, 500 MHz otherwise</td>
<td>( LO = (RF + IF) / 3 )</td>
</tr>
<tr>
<td>RF Preselected</td>
<td>40MHz</td>
<td>492.1875 MHz BW ( \leq ) 10 MHz, 500 MHz otherwise</td>
<td>( LO = (RF + 3.0 \text{ GHz} + IF ) )</td>
</tr>
<tr>
<td>RF Straight-through</td>
<td>400 MHz or distance to band edge.</td>
<td>Same as RF Freq, 100 MHz to 625 MHz</td>
<td>No LO used</td>
</tr>
<tr>
<td>Preselected uWave Fundamental, 3 to 9.75 GHz,</td>
<td>40 MHz</td>
<td>468.75 MHz BW</td>
<td>( LO = RF + IF )</td>
</tr>
<tr>
<td>Preselected uWave 3(^{rd}) Harm, 9.75 to 26.5 GHz</td>
<td>40 MHz</td>
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</tr>
</tbody>
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Ways to Use M9392A

Soft Front Panel
- Debug
- Calibrate
- Learn

89601/System Vue
- Benchtop Analysis
- Demodulation

System Control App
- ATE

Small Footprint SA
- Field Repair
PXI Microwave Vector Signal Analyzer

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For the advanced user: Hints

<table>
<thead>
<tr>
<th>Hints</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ShiftIFFrequency</td>
<td>For spur dodging, specify IF shift in Hz. Causes a non-fpga (aka slow) IF frequency correction.</td>
</tr>
<tr>
<td>SwitchHighLowSideMixing</td>
<td>For images and spurs, change from high side to low side mixing</td>
</tr>
<tr>
<td>PreferUWaveDownconverter</td>
<td>For overlapping configurations, prefer the uWave converter (2.75 to 2.9 GHz)</td>
</tr>
<tr>
<td>PreferRFDownconverter</td>
<td>For overlapping configurations, prefer the RF converter (2.75 to 2.9 GHz)</td>
</tr>
<tr>
<td>PreferDirectPath</td>
<td>For overlapping configurations prefer the Direct path over the RF Downconverter (125 to 625 MHz)</td>
</tr>
<tr>
<td>OffsetIFAtten</td>
<td>Offset the IF attenuation by some amount in dB.</td>
</tr>
<tr>
<td>ForceFrontEndAttenTo</td>
<td>Force the Front End Attenuation to specified value, in dB.</td>
</tr>
<tr>
<td>IgnoreReceiverBandwidth</td>
<td>When choosing a receiver, allow BW requests greater than HW can pass (for system characterization)</td>
</tr>
<tr>
<td>ShiftPreselectorCenterFrequency</td>
<td>Shift the preselector center frequency if the YIG filter is active, to correct for drift.</td>
</tr>
<tr>
<td>ADCDitherLevel</td>
<td>Set a variable ADC Dither Level from 2.19 to 40 dB from full scale (6 dB default)</td>
</tr>
</tbody>
</table>

For example, to ask the M9392 to shift the IF frequency +3.4 MHz next measurement:

M9392.Acquistioin.Hints.Add(AgM9392HintTypeShiftIfFrequency, 3.4e6)

Hints are erased every Initiate(), so they don’t leak. You can query to see if a hint was used.
When to use the Soft Front Panel

• When running for the first time – check out the hardware
• To save a particular configuration in the IVI store, so can use a name for the VISA string.
• To do a Field Cal
• When something is broken, and you want to figure out which module or cable is the problem.
Setting up 89601A Connection: Setting up from M9392A SFP

Steps to Connect M9392A to 89601A VSA Software:

1. Open M9392A Soft Front Panel and connect with the PXI modules
2. Select File | Save Connection from the M9392A SFP
3. Save Connection Name as “89601”
4. Exit M9392A Soft Front Panel

• Note: These steps do not need to be repeated unless the configuration of M9392A modules is changed
Steps to Connect M9392A to 89601A VSA Software:

1. Start 89601A VSA Software
2. During initialization you should see a message “Identify TCPIP Hardware at localhost” and not see an error after this line. This process will take about 30 seconds
3. If the M9392 is not already selected as the hardware choice, select Utility | Hardware from the 89601A menu and then select the TCPIP::localhost Agilent M9392 resource from the ADC1 tab and then press OK
4. The M9392A will then initialize (~30 seconds)
Configuring 89601A VSA: Configuring Hardware

The M9392A Hints can be modified through the 89601A VSA Configure Hardware menu:

1. Select Utility | Hardware from the 89601A menu
2. Select M9392 hardware
3. Press Configure… button
4. Select Hardware option and press Edit…
5. Set new value for hardware option
6. Exit and restart 89601A VSA Software

• Note: You can save several connection names from the M9392A soft front panel and use this configuration to switch between them
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Field Calibration From Soft Front Panel

1) Cal the Source

2) Cal the M9392A

Perform a Field Calibration:
- When first delivered
- When cables changed
- When modules pulled for repair
- When reconfigured
- Every 3 months
- Major environmental change
Field Calibration Internal Operation

1. Asks M9392A what frequencies to cal.

2. User calibrates the source. Maybe measure source output, maybe calibrate splitter.

3. Tune source, tell M9392A to measure what it needs.

4. Save

User program

M9392A

What frequencies?

Sorted list of frequencies

Good Accuracy

Better Accuracy

Adjust source for -8 dBm at M9360A Input

To measure source

to cal splitter

To measure source
What is Calibrated?

- Power accuracy for CW tone at specified input level
- IF Power level for optimal dynamic range.

Not Calibrated:
- IF Flatness
- Preselector filter placement

Layered over the module level calibrations:
- Module level calibrations provide the offset calibration if an attenuator is set to a different level.
- The temperature compensation is applied as a module level correction, and trickles up to the field calibration.
Fixture Compensation Data

• User can specify with SetFixtureLoss(loss_table), where the loss table is a set of frequency(Hz), Loss(dB) pairs.

• Modest fixture loss (2-3 dB) can be included in Field Cal

• Expect that advanced users will do their own.
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M9392A Signal Analyzer PXI Modules

- **Digitizer: M9202A**
  - Digital IF operation, Programming, Soft Front Panel

- **Microwave Downconverter: M9361A**
  - Block Diagram, Soft Front Panel (SFP) and programming example in Lab Windows CVI

- **RF Downconverter: M9351A**
  - Block Diagram, SFP and programming example in LabVIEW

- **Attenuator/Preselector: M9360A**
  - Block Diagram, SFP and programming example in Visual Studio C++

- **LO Module: M9302A**
  - Block Diagram, SFP and programming example in Visual Studio C#
M9202A PXIe Wideband IF Digitizer

**New M9202A PXIe wideband IF Digitizer with on-board processing**

Key features:
- 1 channel, 12-bit, 2 GS/s
- 1 GHz analog bandwidth
- AC-coupled 50 Ω input
- Dither function
- +4/-2 dBm full scale (dither disabled/enabled)
- DDC algorithm to improve SNR and reduce data upload time
- 512 MB memory
- PCIe x4 connectivity (Gen 1 = 1 GB/s data throughput)
- Soft Front Panel GUI
- Designed to particularly fit in M9392A uWave Vector Signal Analyzer
Digitizer Programming API

- Hierarchy
  - Attribute Accessors
    - GetAttributeVBoolean
    - GetAttributeVInt32
    - GetAttributeVInt64
    - GetAttributeVReal64
    - GetAttributeVSession
    - GetAttributeVString
    - SetAttributeVBoolean
    - SetAttributeVInt32
    - SetAttributeVInt64
    - SetAttributeVReal64
    - SetAttributeVSession
    - SetAttributeVString
  - Calibration
    - Self Calibrate
  - Channel
    - Channel Count
    - Channel Enabled
    - Filter
      - Input Filter Bypass
      - Input Filter Max Frequency
      - Input Connector Selection
      - Input Impedance
      - Time Interleaved Channel List
      - Vertical Coupling
      - Vertical Offset
      - Vertical Range
    - Close
  - Configuration
    - Configure Acquisition Record
    - Configure Sample Mode
  - Acquisition
    - Configure Channel
    - Get Channel Name
  - Reference Oscillator
    - Configure Reference Oscillator Output
  - Trigger
    - Configure Edge Trigger Source
    - Configure Multi Trigger
    - Configure Trigger Modifier
    - Configure TV Trigger Source
    - Get Trigger Source Name
  - Inherent VI Attributes
    - Advanced Session Information
      - Driver Setup
      - I/O Resource Descriptor
      - Logical Name
    - Driver Capabilities
      - Class Group Capabilities
      - Supported Instrument Models
    - Driver Identification
      - Specific Driver Class Spec Major Veri
      - Specific Driver Class Spec Minor Veri
      - Specific Driver Description
      - Specific Driver Prefix
      - Specific Driver Revision
      - Specific Driver Vendor
    - Instrument Identification
      - Instrument Firmware Revision
      - Instrument Manufacturer
      - Instrument Model
    - User Options
      - Cache
      - Interchange Check
Agilent MD1 SFP for High-Speed Digitizers

Control panel

Acquired waveform display

Zoom on Acquired waveform
M9361A Downconverter
2.75 GHz to 26.5 GHz

Key Features:
• Frequency Range = 2.75-26.5GHz
• IF center freq = 500 MHz
• IF BW = 250 MHz
• Detector output for video triggering
• Pre-amp enables very low signal measurements
• Built-in calibration simplifies system power budget calculations by providing a constant output power
M9361A uW Downconverter Module

- Frequency Range: 2.75-26.5GHz
- IF center freq = 500MHz
- IF BW = 250MHz
- Optimal RF Input Level: -40 dBm
- Optimal LO Input Level: +15 dBm
- Aux input / switch for routing RF Downconverter Output to Digitizer
- Video Detector Output for IF Trigger of Digitizer
- DANL: ~-160 dBm/Hz fundamental Conversion
  ~-146 dBm/Hz Third Harmonic Conversion
Conversion Gain Plot: Fundamental and Third Harmonic Mixing

Measurement data is for one unit, on a lab benchtop during development, and is not intended to represent guaranteed performance.
Measurement data is for one unit, on a lab benchtop during development, and is not intended to represent guaranteed performance.
M9361A uW Downconverter Module

M9361A SFP and LabWindows example program.
M9351A Downconverter: 50MHz to 2.9 GHz

Key Features:
• Frequency Range = 50 MHz to 2.9 GHz
• IF center freq = 500 MHz
• IF BW = 40 MHz
• Pre-amp enables very low signal measurements
• Built-in calibration simplifies system power budget calculations by providing a constant output power
M9351A RF Downconverter Module

- Frequency Range = 50 MHz to 2.9 GHz
- IF center freq = 500 MHz
- IF BW = 40 MHz
- Optimal RF Input Level: -40 dBm
- Optimal LO Input Level: +15 dBm
- Up/Down Conversion for Image Removal
- DANL ~ -160 dBm/Hz
Measurement data is for one unit, on a lab benchtop during development, and is not intended to represent guaranteed performance.
Measurement data is for one unit, on a lab benchtop during development, and is not intended to represent guaranteed performance.
M9351A RF Downconverter Module

M9351A Soft Front Panel (SFP) and LabView programming example.
M9360A Attenuator / Preselector: 100 kHz to 26.5 GHz

Key Features:
- YIG Tuned Filter Path BW 40MHz, 3-26.5GHz
- Through path 100 kHz-26.5GHz
- 70dB step attenuator
- Switches for signal routing to RF and μWave downconverters
M9360A Attenuator / Preselector Module

#include "src/str.h"
#include <string.h>

#include "Preselector.h"

int main(int argc, char* argv[])
{
    Initialize( NULL );

    // Pass in a command line argument as the resource descriptor, if none, will default
    char* defaultResource = "PXI20::1::INSTR";
    char* options = "QueryInstrStatus=true, Simulate=true, DriverSetup= Model=, Trace=false"
    if (argc > 1)
    {
        defaultResource = argv[1];
        options = "QueryInstrStatus=true, Simulate=false, DriverSetup= Model=, Trace=false"
    }

    Preselector module( defaultResource, options );

    // Input parameters
    double inputFrequency = 5.0e+9; // in Hz
    double inputPower = -10; // in dBm

    // Print results
    cout << "Preselector module setup completed.

    Primary Settings
    Input Frequency:
    8 GHz
    Input Level:
    20 dBm

    Step Attenuator:
    40 dB

    Preselector Frequency:
    8.15 GHz

    Hardware Status
    Temperature: 37.8
    Voltage: +12 +5 +3.3 +12
    Self Test: Pass
    Serial #: 12345678

    Estimated Loss
    Port Loss: 0.30 dB
    Preselector Loss: N/A dB
    Attenuator Loss: 42.10 dB
    Total Loss: 42.40 dB

    Simulation Mode
    No Error

M9360A SFP with C++ .NET programming example
M9302A Local Oscillator: 3 to 10 GHz

Key Features:

• Supplies LO to downconverters
• Supplies 100 MHz reference to digitizer for sampling clock generation
• Output Level 0 dBm
• 1 mS switching time
• 0.1 Hz tuning resolution
M9302A LO Module

- 3 to 10 GHz, +15 dBm Output
- Supplies LO to downconverters
- Supplies 100MHz reference to digitizer for sample clock generation
Phase Noise Plot:
3 GHz, 6 GHz, 9 GHz

Measurement data is for one unit, on a lab benchtop during development, and is not intended to represent guaranteed performance.
using System;
using AgilentM9302Lib;

namespace CS_SimpleSetup
{
    /// <summary>
    /// Agilent IVI-C Driver Example Program
    /// Initializes the driver, reads a few Identity interface
    /// properties, and initiates instrument specific functionality.
    /// Runs in simulation mode without an instrument.
    /// Requires a COM reference to the driver's type library.
    ///
    /// </summary>
    public class App
    {
        [STAThread]
        static void Main(string[] args)
        {
            Console.WriteLine("CS_SimpleSetup");
            Console.WriteLine();

            // Pass in a command line argument as the resource descriptor, if none, will default
            string resource = "PXI10::18::INSTR";
            string options = "QueryInstrStatus=true, Simulate=true, DriverSetup= Model", Trace=false";
            if (args.Length > 0)
            {
                resource = args[0];
                options = "QueryInstrStatus=true, Simulate=false, DriverSetup= Model", Trace=false";
            }

            AgilentM9302 driver = null;
            try
            {  
M9302A SFP with C# .NET programming example.
4 Channel Downconverter & M9210A Digitizer
M9362A-D01 Downconverter

- Same downconverter module as N5280A box instrument
- 4-channel synchronous downconversion
- Can be combined with digitizer modules, LO, and/or external attenuation to form a multi-channel receiver

M9362AD01
4-channel, 1.5 GHz instantaneous bandwidth
10 MHz – 26.5 GHz input
M9362A-D01 Downconverter block diagram

<table>
<thead>
<tr>
<th>Port</th>
<th>Frequency Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Port</td>
<td>0.01 to 26.5 GHz</td>
</tr>
<tr>
<td>LO Port</td>
<td>0.01 to 26.5 GHz</td>
</tr>
<tr>
<td>IF Port</td>
<td>0.007 to 1.5 GHz</td>
</tr>
</tbody>
</table>

RF Input Power Damage Levels:

<table>
<thead>
<tr>
<th>Port</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Port</td>
<td>+18 dBm</td>
</tr>
<tr>
<td>LO Port</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>Optimum LO Power</td>
<td>0 dBm (±1 dB)</td>
</tr>
</tbody>
</table>

RF Input @ 0.1 dB Typical Compression:

<table>
<thead>
<tr>
<th>Port</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-D Receiver</td>
<td>-10 dBm</td>
</tr>
</tbody>
</table>

IF Output Level:\n
<table>
<thead>
<tr>
<th>Ports A-D</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-10 dBm</td>
</tr>
</tbody>
</table>
Conversion Gain Plots with Fundamental (MXG or PSG to 26.5 GHz) and Third Harmonic (LO Module)
M9210A PXI-H High-Speed Digitizing Scope

Key features:
• 2 channels, 10-bit resolution, 2-4 GS/s
• Scope-like features:
  Selectable 50Ω/1MΩ input
  Selectable AC/DC coupling
  Different trigger functions
  ...
• 1.4 GHz in 50Ω and 300 MHz in 1MΩ Bandwidth
• Acquisition memory up to 256 MSamples/channel
• Multiple modules synchronization through front-panel connector
• Soft Front Panel GUI with scope-like measurements:
  RMS, min/max, etc…
Agilent MD1 SFP for High-Speed Digitizers

Control panel

Acquired waveform display

Zoom on Acquired waveform
## PXI High-Speed Digitizers Comparison

<table>
<thead>
<tr>
<th></th>
<th>M9210A</th>
<th>M9211A</th>
<th>M9202A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Digitizing Scope</td>
<td>UWB IF Digitizer</td>
<td>Wideband IF Digitizer</td>
</tr>
<tr>
<td><strong>Channels</strong></td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Max. Sampling Rate</strong></td>
<td>2-4 GS/s</td>
<td>4 GS/s</td>
<td>2 GS/s</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>10-bit</td>
<td>10-bit</td>
<td>12-bit</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>50 Ω 1 MΩ 1.4 GHz 300 MHz (min)</td>
<td>3 GHz N/A</td>
<td>1 GHz N/A</td>
</tr>
<tr>
<td><strong>Input Impedance</strong></td>
<td>Selectable 50 Ω/1 MΩ</td>
<td>50 Ω</td>
<td>50 Ω</td>
</tr>
</tbody>
</table>
| **Analog performance** | SFDR = ~-57dBc @100 MHz -43dBc @ 400 MHz  
ENOB = 7.1 @ 10 MHz  
6.5 @ 400 MHz | SFDR = ~-53dBc @100 MHz -46dBc @ 400 MHz  
ENOB = 7.3 @ 10 MHz  
6.8 @ 400 MHz | SFDR = -65dBc @ 500 MHz  
NSD = -144 dBm/Hz (TBC)  
ENOB = 9.2 @500 MHz |
| **Memory**           | 512 kS standard 64 MS or 512 MS options                                | 512 kS standard 64 MS or 512 MS options                                | 256 MS                                                                |
| **Input coupling**   | Selectable AC/DC                                                      | DC                                                                    | AC (30 MHz)                                                           |
| **On-board processing** | N/A                                                                  | N/A                                                                  | Virtex-6 FPGA with DDC algorithm                                      |
| **Back-plane**       | PXI-H                                                                  | PXI-H                                                                 | PXIe                                                                  |
| **Others**           | Multi-module sync with ASBus system (Up to 3 modules)                 | Multi-module sync with ASBus system (Up to 3 Modules)                 | Especially designed to fit in M9392A uW VSA                         |
PXI Switches
Agilent DC to 26.5 GHz PXI uW Switch Modules

Key Features:

• A readily scaled integrated switching solution to satisfy your unique application platform needs

• Guaranteed 0.03 dB insertion loss repeatability throughout the operating life of up to 5 million cycles, to reduce downtime for recalibration, improve testing efficiency and hence, maximizing throughput

• Unmatched isolation of >60 dB at 26.5 GHz, maximizing measurement accuracy and system flexibility

• Soft front panel is available for each switch module to ease the troubleshooting of your PXI systems

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M9155C</td>
<td>PXI Hybrid Dual SPDT Coaxial Switch, DC to 26.5 GHz, Untermiated</td>
</tr>
<tr>
<td>M9156C</td>
<td>PXI Hybrid Dual Transfer Coaxial Switch, DC to 26.5 GHz</td>
</tr>
<tr>
<td>M9157C</td>
<td>PXI Hybrid Single SP6T Coaxial Switch, DC to 26.5 GHz, Terminated</td>
</tr>
</tbody>
</table>
Soft Front Panel

Soft front panel is available to ease your troubleshooting and switch monitoring.

**Cycle count**

![Cycle count diagram]

**Refresh**

![Refresh diagram]
Soft Front Panel

Clear counter

Firmware Update

firmware update will be made downloadable from a.com drivers library