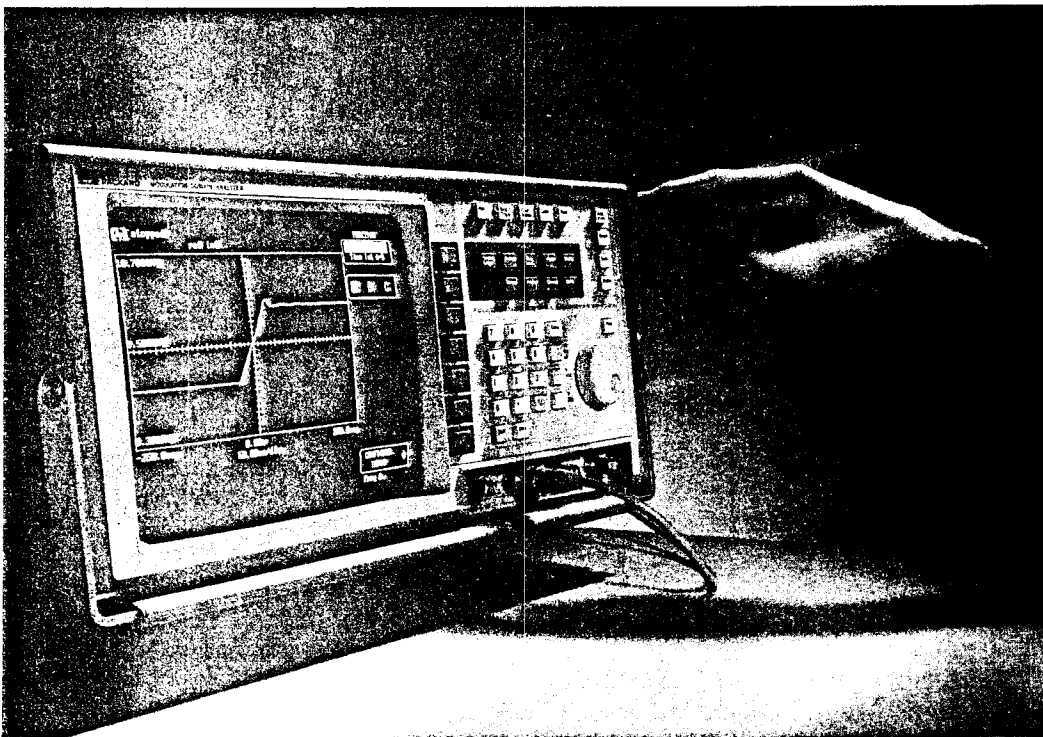


---

# A Quick Introduction to the HP 53310A Modulation Domain Analyzer

---

**Self - Paced Training  
in Less Than an Hour**



Internal Use Only

# Contents

This workbook contains the following learning modules:

Getting Started .....	1
Product Overview.....	5
Demonstrating the HP 53310A.....	9
Applications.....	13
Positioning the HP 53310A.....	19
The Competition .....	25
Typical Customer Questions and Objections.....	27
Answer Key.....	30

## Getting Started

### Welcome

Thanks for taking the time to go through these self-paced materials. We believe that the time and effort you put into this encounter will be well spent, and will help you sell more in a shorter period of time.

### Time

You should expect to spend less than an hour going through the exercises in this book. If there are areas you wish to pursue further, please contact your Santa Clara Division RSE, or call the Modulation Domain Applications Hotline.

Phone: (408) 553-2587  
(8:00 am - 5:00 pm PST)

Fax: (408) 244-4698

### Materials Required

Materials required to complete this training:

- This self-paced workbook
- HP 53310A Literature Package which includes:
  - Technical Data Sheet
  - Application Briefs
  - Audio tape (for review)
- HP 53310A Modulation Domain Analyzer
- HP 53310A Quick Start Guide and Quick Start Signal Source (supplied with each instrument)

## Organization

Each of the learning modules in this workbook contains the following parts:

### **Purpose**

An explanation of why the module is being presented to you, and what areas will be discussed

### **Objectives**

Specific knowledge and/or behavior goals that you will attain by completing the module

### **Text**

Information and/or guidance that gives you access to the important information you need to complete the module

### **Summary**

A brief recap of what you have learned in the module

### **Review Quiz**

A few questions aimed at ensuring that the key points have been understood. The review quizzes follow most of the learning modules.

At the end of the workbook you will find an Answer Key that provides sample answers to the questions from the modules.

**The  
Literature Package**

Your Literature Package contains technical and applications information about the HP 53310A. It is meant to provide you with the technical and positioning tools you need to sell the HP 53310A.

The Applications Briefs are an important part of the Literature Package. The Application Briefs show the ease-of-use and utility of the HP 53310A in a variety of applications.

**Program  
Objectives**

After completing this self-paced program, you will be able to:

- Identify potential customers for the HP 53310A
- Identify the key capabilities of the HP 53310A for solving your customers' needs
- Position the HP 53310A relative to the HP 5372A in terms of features, performance, and price
- Effectively use the Application Briefs to open a dialogue with the customer
- Demonstrate the ease-of-use, general purpose applicability, and value of the HP 53310A
- Respond to typical customer objections and questions.

## Product Overview

### Purpose

To concentrate on the features, advantages, and benefits of the HP 53310A that will enhance your customer's testing.

### Objectives

After completing this module, you will be able to:

- Identify the key benefits of the HP 53310A for your customers
- Link the technical aspects of the box to how it helps your customer's business.

### Introduction

**Product Positioning Statement:**  
**The HP 53310A makes modulation and jitter analysis easy.**

Modulation Domain Analysis was introduced with the HP 5371A and HP 5372A Frequency and Time Interval Analyzers. This new measurement technology has been a great success. Many of you have sold benefits of the Modulation Domain into a wide range of applications.

The HP 53310A will allow you to introduce the Modulation Domain to an even broader range of customers by lowering two key entry barriers: complexity-of-operation, and cost. The HP 53310A gives you an easy-to-use, low-cost, entry-level Modulation Domain Analyzer. You can introduce/prospect with the HP 53310A, and sell up to the HP 5372A depending on your customer's needs.

## Key Specifications

Functions:	Frequency and Time Interval displayed versus time, or as a histogram
Range:	10 Hz to 200 MHz (2.5 GHz optional)
Resolution:	200 ps rms
Maximum Sample Rate:	2 million measurements per second
Price:	\$9,500 US List (\$9,462 FBP)

## Action

Take out the HP 53310A Data Sheet. The inside front cover gives an excellent overview of the HP 53310A. The key features are listed on pages 12 - 13. Briefly review these two areas of the data sheet to familiarize yourself with the HP 53310A. Complete the Worksheet on the next page stating the advantages and benefits in your customers' terms. (Answers to the worksheet can be found in the Answer Key in the back of this workbook.)

## Summary

As you have seen in the Features, Advantages, Benefits section, the HP 53310A Modulation Domain Analyzer is a powerful, versatile, and easy-to-use instrument. All of its functions are uniquely designed to save the user time and provide them with detailed, accurate measurements.

### HP 53310A Work Sheet

**Directions:** In the chart below, suggest an advantage and benefit for each of the HP 53310A features listed. Suggested answers appear in the Answer Key.

Feature	Advantage	Benefit
AUTOSCALE		
Value triggering: Triggers on a frequency or time interval value		
One button Jitter and Modulation Analysis		
Fast display updates: 20 updates/second		
Fast histograms of frequency & time interval @ full 2MHz rate		



## Review Quiz - Product Overview

*Read each statement or question. Circle or write your answer. To verify the quiz, refer to the Answer Key.*

1. The HP 53310A is designed to make modulation and jitter analysis easy.
  - A. True
  - B. False
  
2. What is the frequency range of the HP 53310A?
  
  
  
  
  
  
  
  
  
  
3. What barriers to selling/introducing the Modulation Domain to your customers have been reduced by the HP 53310A?
  - A. Cost
  - B. Complexity
  - C. Simplified Triggering
  - D. All of the above
  
  
  
  
  
  
  
  
  
  
4. What is the maximum sample rate for the HP 53310A?

## Demonstrating the HP 53310A

### Purpose

To demonstrate how easy the HP 53310A is to use, and how it can be used to educate prospects about Modulation Domain Analysis.

### Objectives

After completing this module, you will be able to:

- Use the HP 53310A and its demonstration tools
- Demonstrate the HP 53310A's ease-of-use and general purpose nature to your customer.

The best way to learn the HP 53310A is to sit down and use one. This exercise is designed to guide you through a brief hands-on session with the HP 53310A. You will need a demo instrument and the accompanying Quick Start Guide and Quick Start Signal Source to complete this section.

If a demo unit is not available to you at this time, skip ahead to the next section. Please complete this section when a demo unit is available. You really need to go through a hands-on session to fully appreciate the benefits of the HP 53310A.

### Demonstration Tools

The HP 53310A Quick Start Guide and Quick Start Signal Source are your demonstration tools for the HP 53310A. This "Quick Start Kit" ships with every instrument. The pocket-sized source outputs four signals for training and demonstration purposes:

1. VCO Step Analysis
2. Data-To-Clock Jitter
3. Pulse Width Modulation
4. Simple FM

**Hands-on Exercise**

Select the signal of most interest to you, and use the Quick Start Guide to go through the demonstration. For the demonstration(s) you've selected, fill in the information below :

1. VCO Step Analysis

Start Frequency \_\_\_\_\_

Stop Frequency \_\_\_\_\_

Switching Time \_\_\_\_\_

Overshoot \_\_\_\_\_

2. Data-To-Clock Jitter

Versus Time Display:

Mean Value \_\_\_\_\_

Jitter Rate \_\_\_\_\_

Peak-To-Peak Jitter \_\_\_\_\_

Histogram Display:

Mean \_\_\_\_\_

Min \_\_\_\_\_

Max \_\_\_\_\_

Std Dev \_\_\_\_\_

3. Pulse Width Modulation

Number of different  
PW States \_\_\_\_\_

Mean Value  
of one State \_\_\_\_\_

Probability of  
one PW State \_\_\_\_\_

4. Simple FM

Carrier Frequency \_\_\_\_\_

Modulation Rate \_\_\_\_\_

Peak-To-Peak  
Modulation \_\_\_\_\_

**Exercise**

*Read the question below, and write your answer in the space provided. To verify the exercise, refer to the Answer Key.*

From the "Measure Your Signal" section of the Quick Start Guide, what are the four steps that must be taken to set the instrument up to measure the customer's signal?

1.

2.

3.

4.

**Summary**

You now have a good idea about how easy the HP 53310A is to use. It completes detailed analysis in seconds that other methods take significantly longer to accomplish. And, learning to operate it takes only a few minutes.

## Applications

### Purpose

To become familiar with the general purpose applicability of the HP 53310A, and to practice using the Application Briefs as sales tools for the HP 53310A.

### Objectives

After completing this module, you will be able to:

- Identify applications for the HP 53310A
- Effectively use the Application Briefs to open a dialogue with the customer.

### A General Purpose Product

Applications for the HP 53310A are everywhere. The HP 53310A is a general purpose tool for design engineers concerned with frequency or time modulated signals. Quick qualitative views of intentional, as well as unintentional modulation give your customer valuable insight needed to bring their designs to market faster, and with more confidence than ever before.

Designers are using more and more complex modulation schemes to enhance the information content in signals ranging from coded entry devices and compact disc players to motion control systems and cellular radios. Quick analysis of unintentional forms of modulation such as rotational nonlinearities in electromechanical systems, timing jitter in local area networks, or transients in phase-locked loops is an invaluable aid to designers in hunting down sources of errors in their systems.

**Here is a generic profile of our target customer, their measurement problem, and how the HP 53310A solves it.**

**Who Is The Customer?**

The primary customer for the HP 53310A is the design engineer working with frequency or time modulated signals, examining jitter, studying motion control systems, or controlling frequency switching.

**What Is Their Measurement Problem?**

Engineers need a quick, direct and easy way to view modulation while testing design ideas, building prototypes, and finalizing their circuits. They need a tool to easily quantify how much jitter or unintentional modulation they have, and to identify potential sources of these problems so they can be quickly eliminated. They need a tool to shorten design cycles so they can bring their products to market faster.

**How Does The HP 53310A Solve The Problems?**

The HP 53310A allows customers to view the frequency or time modulation of a signal directly on a real-time display. Built-in analysis quantifies modulation rate, peak-to-peak deviation, minimum, maximum, and mean carrier value all at the touch of a button. Histograms allow them to view the probability distribution of their measurements. Jitter characteristics are quickly quantified with the built-in analysis. Potential sources of jitter can be identified easily. For example, a jitter rate at 50 or 60 Hz might indicate a line shielding problem.

**How Does The HP 53310A Solve Their Problem Better Than Existing Techniques?**

The HP 53310A now allows your customer to easily make measurements that used to be difficult or impossible. It eliminates the need for custom hardware and software solutions such as a discriminator, digitizer, and computer to profile a single-shot VCO step. It gives a simpler and more complete characterization of jitter than the traditional "fuzzy trace" on an oscilloscope.

**In short, the HP 53310A will simplify your customer's analysis of modulation and jitter.**

## Application Briefs

A key element of this training is to provide you with application information so you know where to sell the HP 53310A.

Your Literature Package includes the following Application Briefs:

- Examine Channel Switching Characteristics of Cellular Radios
- VCO Step Response Analysis Made Easy
- Easy Analysis of Phase-Locked Loop Capture and Tracking Range
- Single Shot Frequency Profiling of Chirped Radars Made Easy
- Fast Characterization of Pulse Width Encoded Data
- Analysis of Motion Control Systems Made Easy
- Histograms Simplify Analysis of Random Jitter
- Simple Analysis of Frequency Modulation
- Quick Identification of Periodic Jitter Sources
- Simplified Motor Spin-Up Analysis

## Exercise

A Worksheet for the Application Briefs has been provided on the following page. Make as many copies of the worksheet as you need to work on the Application Briefs. (Suggestion: you may find it helpful to attach a worksheet to each Application Brief you use as a quick reference guide for yourself.)

Complete the worksheets for the application areas that you will be selling into first. As time and interest permit, study the other Application Briefs.

## Application Briefs - Field Engineer Worksheet

Application Brief:	Customer Type (Business, user title):	
Customer Needs (Concerns):	Test Equipment Currently Used:	
What Do You Want This Customer to Learn from the Presentation?		
Key Selling Points (Benefits):  1.  2.  3.	Key Application Brief Points (Features and Advantages):  1.  2.  3.	



**Exercise**

*Read the question below, and write your answer in the space provided. Answers are not provided in the Answer Key for this exercise.*

List your top three potential applications for the HP 53310A.

1.

2.

3.

**Summary**

Application Briefs can be used as an entry point into the sales process with your customers. They are designed to focus on typical customer needs, and to show how our product can benefit them in those areas. Use them to your greatest benefit by taking your customer through them in order to spur interest.

## Positioning the HP 53310A

<b>Purpose</b>	To position the Modulation Domain Analyzer relative to oscilloscopes and spectrum analyzers, and to position the HP 53310A with respect to the HP 5372A.
<b>Objectives</b>	After completing this module, you will be able to: <ul style="list-style-type: none"><li>• Position the HP 53310A relative to the HP 5372A</li><li>• Discuss the upgrade path from the customer's current equipment through the HP 53310A, and up to the HP 5372A.</li></ul>
<b>Positioning</b>	<p>Modulation Domain Analysis is poised to take its place alongside oscilloscopes and spectrum analyzers on the common engineering bench. The HP 53310A does not replace oscilloscopes or spectrum analyzers, but acts as a complementary tool.</p> <p><b>An important positioning point to remember is that the HP 53310A is not a replacement for the HP 5372A.</b></p> <p>The HP 53310A is positioned as an easy-to-use, entry-level product, offering basic Modulation Domain Analysis performance at a low price. The HP 5372A is positioned at the high performance and higher price side of the market. It offers wider bandwidth, faster sampling, and detailed analysis for high end customers. Generally, you will introduce Modulation Domain Analysis to your customers with the HP 53310A, and sell up to the HP 5372A as required.</p> <p>The reference charts on the next two pages give you a comparison of the HP 53310A and the HP 5372A.</p>

## A Comparison of the HP 53310A versus the HP 5372A

	<b>Benefit</b>	<b>HP 53310A</b>	<b>HP 5372A</b>
Measurement Functions	Displays a variety of measurement functions	Frequency Time Interval	Frequency Time Interval Period Phase Phase Deviation Time Deviation Ratio Totalize & more
Display Modes	Completely characterizes modulation and jitter	Vs Time Histogram	Vs Time Histogram Event Timing Numeric
Frequency Range	Cover a wide frequency range	200 MHz (2.5 GHz optional)	500 MHz (2 GHz optional)
Sampling Rate	Capture fast modulation rates	2 MHz max.	13.3 MHz max.
Resolution	Resolve small timing deviations	200 ps rms	150 ps rms
Memory	Capture long sequences	8K (32K optional) Measurements	8K Measurements
Fast Histograms	Fast accumulation of measurements	Yes 2 MHz max rate	Yes 13.3 MHz max rate
Display Update Rate	Real-time feel	20 per second	2 per second
Autoscale	Ease-of-use	Yes	No
Value Trigger	Eliminates need for external trigger	Frequency and time interval	Time interval only
Triggering/ Arming	Capture a specific portion of the signal	Internal or External	Numerous Modes Very Flexible
Price (U.S. list)	Value to customer	\$9,500	\$30,000

## Key Advantages by Application

Application	HP 53310A Advantages	HP 5372A Advantages
VCO/PLL	<ul style="list-style-type: none"> <li>• Frequency trigger</li> <li>• Real-time display</li> <li>• 200 MHz/2.5 GHz</li> </ul>	<ul style="list-style-type: none"> <li>• Phase vs time display</li> <li>• 13.3 MHz sample rate</li> <li>• Superior single-shot performance</li> <li>• 500 MHz/2GHz</li> </ul>
Electromechanical	<ul style="list-style-type: none"> <li>• Frequency trigger</li> <li>• +/- 10 volt input range</li> <li>• 50 ohm/1 Mohm switchable input impedance</li> <li>• Sample by user specified number of input events</li> </ul>	<ul style="list-style-type: none"> <li>• Built-in math</li> <li>• Superior single-shot performance</li> </ul>
Communications Jitter	<ul style="list-style-type: none"> <li>• Infinite persistence</li> <li>• Real-time display</li> <li>• Probability analysis</li> <li>• 50 ohm/1 Mohm switchable input impedance</li> </ul>	<ul style="list-style-type: none"> <li>• Time deviation display for cumulative jitter</li> <li>• Supports Data Physics DP280/380 Phase Noise and Jitter Analysis Software</li> <li>• 150ps rms resolution</li> <li>• TI to 500 MHz</li> </ul>
Disk	<ul style="list-style-type: none"> <li>• Fast TI histogram and statistics for head mfg.</li> <li>• Frequency trigger for servo design</li> <li>• 50 ohm/1 Mohm switchable input impedance</li> </ul>	<ul style="list-style-type: none"> <li>• Window margin analysis</li> <li>• Inhibit mode/input</li> <li>• Randomizer</li> <li>• 13.3 MHz sample rate</li> <li>• Read/write noise per AN 358-3</li> </ul>
Radar/EW	<ul style="list-style-type: none"> <li>• Frequency trigger</li> <li>• Real-time display</li> <li>• 200 MHz/2.5 GHz</li> </ul>	<ul style="list-style-type: none"> <li>• Phase vs time display</li> <li>• 13.3 MHz sample rate</li> <li>• 500 MHz/2 GHz</li> <li>• Fastport option</li> </ul>
Agile Communications	<ul style="list-style-type: none"> <li>• Frequency trigger</li> <li>• Fast histogram for frequency</li> <li>• 200 MHz/2.5 GHz</li> </ul>	<ul style="list-style-type: none"> <li>• Phase vs time display</li> <li>• 13.3 MHz sample rate</li> <li>• 500 MHz/2 GHz</li> <li>• Fastport option</li> </ul>
Frequency Stability	<ul style="list-style-type: none"> <li>• Infinite persistence</li> <li>• Fast histogram for frequency</li> </ul>	<ul style="list-style-type: none"> <li>• Allan variance (AN 358-12 &amp; software available)</li> <li>• Long gate times</li> <li>• Superior post processing analysis</li> </ul>

## Summary

Introduce Modulation Domain Analysis with the HP 53310A, and sell up to the HP 5372A. Naturally, your selling points will vary with each customer. However, the ease-of-use, time savings, and affordability of the HP 53310A will be a part of every sale.

## Review Quiz - Positioning

*Read each statement or question. Circle or write your answer. To verify the quiz, refer to the Answer Key.*

1. Generally, you will introduce Modulation Domain Analysis with the HP 53310A and sell up to the HP 5372A as required.
  - A. True
  - B. False
  
2. Will the HP 53310A replace the HP 5372A?
  - A. Yes
  - B. No
  
3. Circle all of the following statements that are true in describing the HP 53310A.
  - A. Provides Autoscale
  - B. Provides Value Triggering
  - C. Faster Sampling Rate
  - D. Provides Phase Measurements
  - E. Provides Real-Time Display
  
4. When would you sell an HP 5372A versus an HP 53310A?

## The Competition

<b>Purpose</b>	To identify the competition for the HP 53310A, and be able to separate it from their offerings.
<b>Objectives</b>	After completing this module, you will be able to: <ul style="list-style-type: none"><li>• Identify competitive products that are being considered by the prospect</li><li>• Use the HP 53310A information to neutralize the competition.</li></ul>
<b>Maintaining Separation</b>	<p><b>The HP 53310A faces no direct competition.</b></p> <p>Competition for the HP 5372A is emerging from companies like Kode, and ITI offering specific analysis in areas such as disk testing. You should sell (and win) with the HP 5372A against them.</p> <p>With the HP 53310A, you will generally find yourself offering your customer a new tool against no direct competition. Your biggest obstacle may be in moving your customer away from an alternative solution, such as using a frequency discriminator, digitizer, and controller for VCO testing. The ease-of-use and low cost of the HP 53310A will help you penetrate these applications.</p>
<b>Summary</b>	The HP 53310A Modulation Domain Analyzer adds a new tool to the test equipment market. There is no direct competition for the HP 53310A.





## Typical Customer Questions and Objections

### Purpose

To give you practice in answering and overcoming customer questions/objections about the HP 53310A.

### Objectives

After completing this module, you will be able to:

- Respond to typical customer objections and questions.

### Typical Customer Questions and Objections

*A list of some difficult customer questions or objections follow with suggested responses.*

1. The measurement capability looks interesting, but all my measurement needs are above the 200 MHz frequency range.

*Signals up to 2.5 GHz can be covered with the optional channel C. Signals above that range can be down -converted into the range of the HP 53310A and measured. In fact, downconverting is a common way of improving frequency resolution. The HP 5364A Microwave Mixer / Detector is a downconverter designed specifically for use with Modulation Domain Analyzers.*

2. We purchased the HP 5372A, and are satisfied with its performance. Now you are showing me this new instrument. What's the difference between the two machines? Did we waste our money on the other machine?

*You didn't waste the investment in the HP 5372A. It is still the best high-end solution to the sampling needs of sophisticated engineering challenges. The HP 5372A makes complex and specific calculations that the HP 53310A is not designed to do.*

3. I have heard that Modulation Domain Analyzers are difficult to understand and use.

*Our first generation analyzers were targeted at high-end, complex applications. They offer high performance analysis and flexible arming and sampling. This superior performance and flexibility does lead to greater complexity of operation.*

*Operation of the HP 53310A is modeled after a basic digital oscilloscope. Triggering on frequency values and Autoscale make it very easy to use. The HP 53310A is our low-cost, easy-to-use, entry-level analyzer. It is designed to make modulation and jitter analysis easy.*

4. I need to measure phase coded signals. The HP 53310A doesn't seem to measure phase.

*It is true that the HP 53310A does not provide Phase versus Time measurements. Phase versus Time is a complex measurement that the HP 5372A addresses directly. The HP 5372A is our solution for measuring phase.*

5. I have been evaluating the Kode and ITI analyzers. Your HP 53310A doesn't seem to offer the same feature set that those boxes do.

*The HP 53310A is our entry level Modulation Domain Analyzer. It is not positioned to compete with a high-end analyzer like the Kode or ITI boxes. The good news is that the HP 5372A offers superior performance over the Kode and ITI boxes. You should be considering our HP 5372A for your high-end measurement needs.*

## Summary

The HP 53310A Modulation Domain Analyzer offers you an opportunity to sell a new product into your accounts.

- It clearly satisfies the needs of a segment of the market in which there is little or no competition.
- It means time and money savings to your customer affording them the opportunity to make more detailed and accurate measurements than ever before.
- It gives you an entry level analyzer to use to introduce Modulation Domain Analysis to your customer.

We hope that you feel the time spent on this workbook has increased your knowledge of the HP 53310A.

**Be sure to listen to the audiotape to review the important points of the HP 53310A Modulation Domain Analyzer.**



## Answer Key

### Product Overview

1. A. True
2. 200 MHz (2.5 GHz optional)
3. D
4. 2 million measurements per second

### Demonstrating the HP 53310A

1. A. Start from Preset  
B. Select the measurement function (Frequency or Time Interval).  
C. Configure the input conditions (coupling and impedance).  
D. Press Autoscale

### Positioning the HP 53310A

1. A. True
2. B. No
3. A, B, & E
4. Sell the HP 5372A to the same high end customers that are typically buying it now - people who need higher-performance, detailed analysis.

## Answer Key

### The Competition

1. A. True
2. B is correct. These boxes are high end analyzers aimed at the disk test market. The HP 5372A will generally beat either of them.
3. The answer to this question will depend upon what type of alternative solutions your customers are using now to make their measurements. Generally, they fall into three categories:
  1. Custom hardware/software solutions
  2. Inferring/guessing from oscilloscopes or spectrum analyzer views
  3. No present solution
4. Your key selling points will also vary depending upon the situation. Here are several that generally apply:
  1. Direct views of modulation
  2. Eliminates the guesswork in finding sources of jitter
  3. Eliminates the need for expensive and hard to maintain custom hardware and software solutions
  4. Lowers test cost
  5. Easy to use
  6. Real-time display

