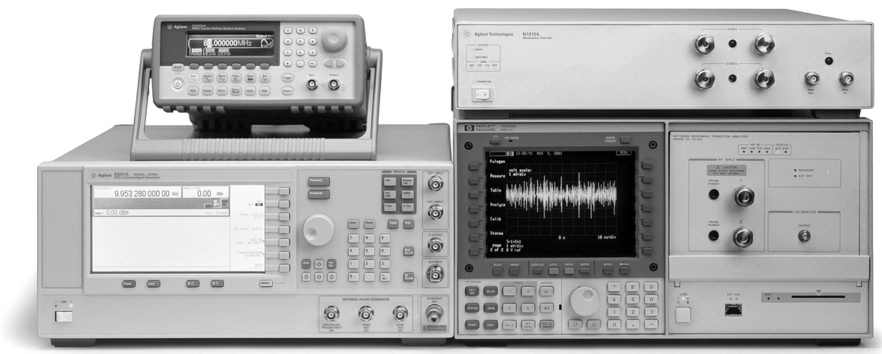
Agilent 71501D Jitter Analysis System

Product Overview

A flexible, wide bandwidth jitter analysis system



- System can be configured for compliance testing at 155 Mb/s, 622 Mb/s, 2488 Mb/s, or 9953 Mb/s
- Compliant measurements to the 20 MHz and 80 MHz bandwidth requirements of ITU-T 0.172 and Bellcore GR-1377-CORE standards
- The 0.002 UI rms intrinsic jitter noise floor is less than half the limit allowed in the standards
- Jitter characterization at any rate from below 50 Mb/s through 12.5 Gb/s
- Measure jitter transfer, jitter tolerance, and jitter generation/ output
- Built-in standard test templates for SDH/SONET compliance test, or customize your own test templates
- Diagnostic testing to view demodulated jitter spectrum and waveform or clock spectrum and waveform
- Upgrade the Agilent 71501B/C to 71501D with the addition of the new Agilent N1015A modulation test set and 70874D jitter analysis system software

High-speed digital transmission systems are often required to receive or regenerate data using a clock signal that is recovered or extracted from the data waveform. Variation in the data rate, commonly known as jitter can complicate the clock recovery and data regeneration process. To guarantee a high level of performance in the presence of jitter, components and systems are typically required to adhere to a rigorous set of jitter performance standards.

The Agilent 71501D jitter analysis system helps you perform a thorough jitter characterization of your devices from the chip or component level through complete transmission systems. Coupled with either an Agilent 86130A or 71612C error performance analyzer[1], SDH/SONET standard tests for jitter transfer, jitter tolerance, and jitter generation/output can be performed at STM-4/OC-12 (622 Mb/s), STM-16/OC-48 (2488 Mb/s) rates, and STM-64/ OC-192 (9953 Mb/s).

The Agilent N1015A modulation test set enables the expanded modulation bandwidths to 20 and 80 MHz at 2.5 and 10 Gb/s respectively. It also enables the 0.002 UI rms intrinsic jitter noise floor. Although the system is frequency agile, the 20 MHz expanded modulation range is limited to between 2.4 and 3.2 Gb/s. The 80 MHz expanded modulation range is limited to between 9.8 and 12.5 Gb/s.

Because the system is completely frequency agile, these tests can also be performed at any rate from below 50 Mb/s to above 12.5 Gb/s, such as the Fibre Channel 1063 Mb/s rate. Some utility for the STM-1/OC-3 (155 Mb/s) rate may be obtained. For 622 Mb/s (STM-4/ OC-12) or 155 Mb/s (STM-1/OC-3), the Agilent N1015A modulation test set is not necessary for SDH/SONET standards tests.

The Agilent 71501D is designed to be used as a separate, stand-alone measurement solution when combined with an Agilent 86130A or 71612C[2].

1. Only Agilent error performance analyzers can be used in the 71501D system.
2. Although remote commands for the main measurements are available, the Agilent 71501D is not recommended as part of an automated test system.

Agilent Technologies

The Agilent 71501D jitter analysis system gives basic parametric information without requiring functional performance such as data headers, framing, or alarms. This makes it an attractive solution for semiconductor and component manufacturers as well as more complex modules and systems.

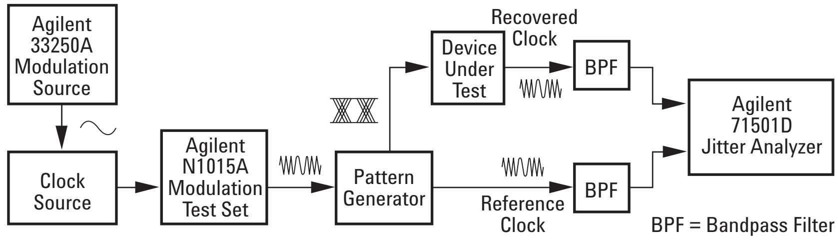


Figure 2. Block diagram for jitter transfer measurements

Jitter transfer

Jitter transfer is typically used to describe how a clock recovery module or repeater locks and tracks data as jitter is placed upon it. In simple terms, it is the ratio of the jitter on the output of the device or system compared to the jitter on the data going into the device. Jitter transfer is typically measured as a function of jitter frequency.

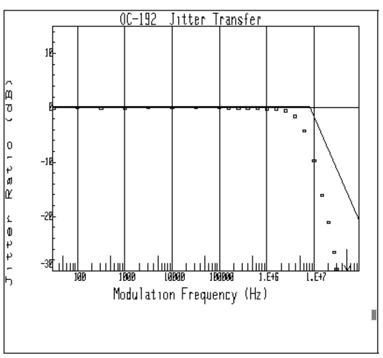


Figure 1. Jitter transfer measurement of a device operating at 9953 Mb/s

Figure 1 shows a jitter transfer measurement of a device operating at 9953 Mb/s (STM-64/OC-192). Because the measurement is a ratio, the results are unitless, and expressed in decibels. In this measurement, the jitter modulation, at a specific modulation rate or frequency, is impressed upon the data. The magnitude of the jitter is typically set at levels specified for a jitter tolerance test (discussed later). The jitter at the input to the device-under-test (DUT), as well as the jitter at the output of the DUT are measured simultaneously. The jitter transfer at this jitter rate is then computed. The jitter frequency is incremented and the measurement repeated. This process continues until the device has been characterized over the full 80 MHz bandwidth required by ITU-T 0.172

The test system block diagram for a jitter transfer measurement is shown in Figure 2. The Agilent 33250A is used as a source of jitter modulation from as low as 20 Hz to as high as 80 MHz. The 33250A signal is routed to the phase/ frequency modulation input of the system clock source. The 33250A output is automatically set to generate the desired jitter level and frequency. The N1015A modulation test set allows STM-16/OC-48 (2488 Mb/s) and STM-64/OC-192 (9953 Mb/s) compliant jitter measurements by providing an 80 MHz modulation bandwidth and 0.002 UI rms intrinsic jitter noise floor. The signal is routed to the Agilent 86130A or 71612C pattern generator, thus producing data with the desired jitter. This data signal is then fed to the DUT. The recovered clock signal is routed to Channel 1 of the Agilent 71501D. The clock signal from the pattern generator is used as a reference signal and is routed to Channel 2 of the 71501D. Jitter transfer measurement accuracy is enhanced if signal harmonic content is suppressed. Thus low pass or band-pass filters are typically used in the measurement paths.

The results of the jitter transfer measurement can be displayed in one of three ways. Figure 1 shows the jitter transfer function in the "transfer plot" mode. In this mode, the jitter transfer function is displayed on a 10 dB/ division scale, usually against the SDH/SONET specification line.

A second method for displaying the jitter transfer performance is with the "delta plot". In this mode the results are displayed as the difference between actual performance and specified performance. For example, if the maximum allowable value of the jitter transfer is 0.1 dB, and the actual performance is 0 dB, the delta plot will show this as being a value of –0.1 dB, as it is 0.1 dB below or within specification. A delta plot is shown in Figure 3.

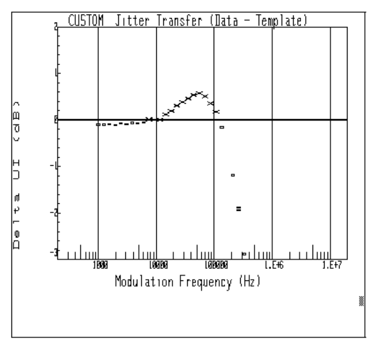


Figure 3. Delta plot jitter transfer test results

Note also that in the delta plot, the vertical scale is 2 dB/division, presenting a much higher resolution display than the transfer plot.

A third technique for displaying the jitter transfer function is a numerical listing. Figure 4 shows a listing of the jitter transfer measurement results. The measured response, the maximum allowed response, the difference

JITTER TRANSFER RESULTS

Pt#	Freq	Meas(dB)	Max(dB)	Delta(dB)	Status
1.	10.00 Hz	0.000	0.000	0.000	PASS
2.	31.60 Hz	.010	0.000	.010	FAIL
3.	100.00 Hz	0.000	0.000	0.000	PASS
4.	316.00 Hz	0.000	0.000	0.000	PASS
5.	1.00 kHz	.010	0.000	.010	FAIL
6.	3.16 kHz	.010	0.000	.010	FAIL
7.	10.00 kHz	.020	0.000	.020	FAIL
8.	31.60 kHz	.070	0.000	.070	FAIL
9.	100.00 kHz	.090	0.000	.090	FAIL
10.	158.00 kHz	.080	0.000	.080	FAIL
11.	251.00 kHz	.080	0.000	.080	FAIL
12.	398.00 kHz	.090	0.000	.090	FAIL
13.	631.00 kHz	-.030	0.000	-.030	PASS
14.	1.00 MHz	-.154	0.000	-.154	PASS

Figure 4. Jitter transfer tabular test results

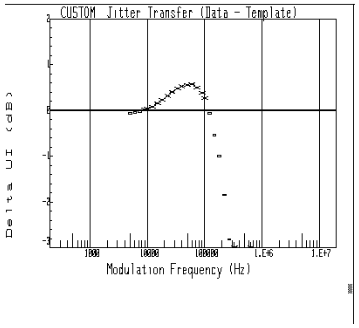


Figure 5. "Zoomed in" transfer results

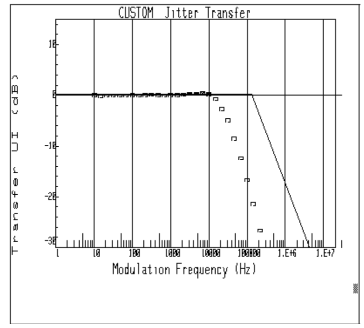


Figure 6. Jitter transfer measurement of a multiplexer

between actual and specified performance, and a pass/fail status are all listed.

For margin testing, or to create a custom specification, the magnitude and the location of the corner frequency of the specification limit can be set by the user.

To accurately characterize the jitter transfer function, it may be necessary to perform an analysis over a frequency range that is narrower than that provided by the default test setup. This is achieved by generating a custom template to define the test over the region of interest. For example, the test can easily be altered to zoom in on the region of interest, as is shown in Figure 5.

Multiplexers and demultiplexers: Jitter analysis for devices where the output rate is different than the input rate

A unique feature of the Agilent 71501D jitter analysis system is the ability to measure jitter transfer through a device where the input and output rates are not the same. Typical examples include devices where several data channels are multiplexed together. A higher rate clock signal may be derived from the lower data rate input. Or, characterization of jitter transfer from a low frequency reference clock (such as 19.44 MHz) to a standard rate output (such as 622.08 Mb/s) may be required[3]. The input and output rates do not need to be harmonically related because of the frequency agility of the Agilent 71501D jitter analysis system.

Figure 6 shows a jitter transfer measurement of a 155.52 Mb/s to 4.977 Gb/s multiplexer. Note that the measurement is automatically scaled such that 0 dB represents no jitter "gain" or "loss" through the multiplexing process.

The architecture of the 71501D jitter analysis system is sampler based, which is the key to this frequency agile system. The tradeoff is that the jitter transfer measurements are performed by analyzing the recovered clock signal, as the test system is not capable of measuring jitter on a true data signal. There are devices where clock recovery and data regeneration take place, yet no external clock signal is produced. Unfortunately, the 71501D jitter analysis system requires a clock signal from the DUT for jitter transfer measurements. In these cases, the pattern from the Agilent 86130A or 71612C is set to produce data with a high clock content, such as a 10101010 pattern. This will provide a valid jitter transfer measurement when the transfer response of the DUT is dominated by the loop bandwidth of the phase-locked loop in the clock recovery system and PLL bandwidth is not dependent upon data patterns. Also, because the apparent clock rate from a 10101010 pattern is one-half of a true clock signal, the measurement is made in the multiplex mode.

Note that the intent of the jitter transfer measurement is not to see how much jitter a component or device adds to a data signal. This is better measured using the jitter generation/output measurement which is discussed later. Instead, jitter transfer is intended to show the performance of clock recovery as a function of jitter frequency.

Jitter transfer measurement uncertainties

An important feature of the Agilent 71501D jitter analysis system measurement technique is that it is a two channel "simultaneous" measurement technique. Thus system drift is common to both channels and is not a significant factor in the measurement. Jitter transfer measurement uncertainty is then a function of the inherent ability of the 71501D jitter analysis system to measure jitter. The uncertainty of a jitter transfer measurement is ±0.05 dB. It is assumed that both measurement channels are filtered to reject harmonic signal content[4].

3. When using signals below 100 MHz, the quality of the clock outputs of the pattern generator may be degraded. The signal from the clock source may need to be used as the reference as opposed to the clock output of the pattern generator.
4. Typically, filtering is achieved using the bandpass filters supplied as part of the system for jitter generation measurements.

Jitter tolerance

Jitter tolerance is used to describe the ability of a device or system to maintain communication quality in the presence of jitter. The test can be viewed in two ways. A standards based compliance test would require the equipment to maintain a specific bit-error-ratio (BER) level at pre-defined jitter levels and jitter frequencies. Another form of testing would determine the actual jitter levels where the DUT can no longer maintain a desired BER. Both test methods are available with the Agilent 71501D jitter analysis system.

Similar to a jitter transfer test, a jitter tolerance test is performed at several jitter frequencies. The jitter magnitudes are normally defined by the standard against which the test is being performed. For SONET-based tests, the jitter magnitude is 15 unit intervals (UI, one bit period of jitter) for low jitter rates, 1.5 UI for medium jitter rates, and 0.15 UI for high jitter rates. For SDH-based tests, the jitter level is 1.5 UI at low and mid jitter rates, and 0.15 UI at high jitter rates. Both SDH and SONET test templates are built into the system. If jitter levels and frequencies other than those defined by the standard based tests are desired, a straightforward procedure is available to develop custom templates. For example, proposed jitter tolerance tests for Fibre Channel 1062.5 Mb/s systems can be performed using the Agilent 71501D.

Figure 7 shows the results of a SONET OC-192 jitter tolerance test displaying the test points with their associated jitter magnitudes and frequencies in a graphical display (tabular display is also available). Jitter transfer tests are also performed with these jitter levels and frequencies applied to the data. The measurement

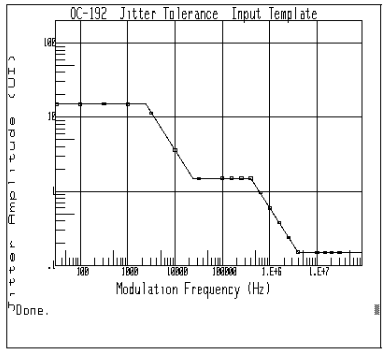


Figure 7. Jitter tolerance compliance test

process is as follows: A BER measurement of the DUT is performed with jitter-free data. The signal power is attenuated until the onset of errors or a specific BER is achieved. The attenuation is then reduced 1 dB. The jitter modulation source, the Agilent 33250A, is routed to the FM port of the clock source. The 33250A is also controlled by the Agilent 71501D to yield the required jitter frequency and magnitude on the clock signal, which in turn will translate this jitter to the pattern generator data output. This data is then sent to the DUT. The recovered clock and data from the DUT is then routed to the Agilent 86130A or 71612C error detector where a BER measurement is performed. Pattern lengths, data levels, gating times and so forth are set by the Agilent 86130A or 71612C.

The results of the BER test are monitored by the Agilent 71501D. The 71501D compares the actual BER performance to the desired level (defined by the user) to determine the pass or fail status. If the desired BER limit is maintained, a green box is placed at that test point on the results plot. If the BER limit is exceeded, a red X is placed on the results plot. This process is repeated for each test point as defined by the test template.

The above method is used to verify compliance to a given test standard. If the DUT passes the test, it is still unknown just what level of tolerance is achievable. A simple margin test can be performed by selecting a percentage margin by which to increase the jitter magnitude at each test point. Figure 9 shows a test performed at 50% above the compliance level.

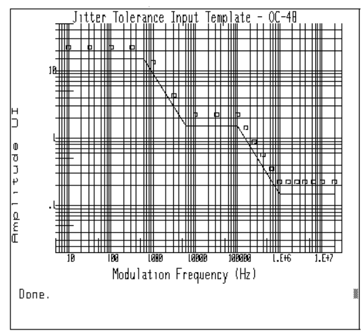


Figure 9. Jitter tolerance test with a 50% margin

Another available technique is to perform a tolerance search. In this mode the Agilent 71501D will initially perform the BER test with the jitter level set to that of the template. The jitter will then be systematically increased by a user-defined factor and a BER test performed until the desired BER limit is exceeded, or the test system generation capability is

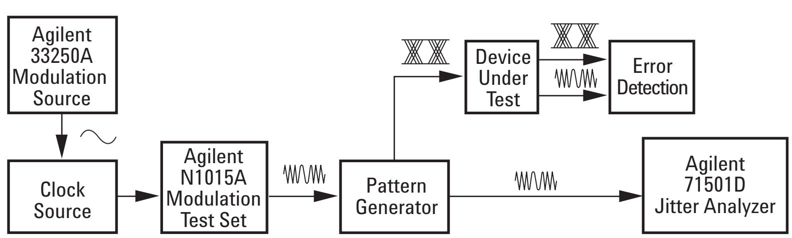


Figure 8. System block diagram for jitter tolerance measurements

exceeded. If the DUT is not capable of achieving basic compliance levels, the search factor can be set to a negative level. In this mode, the jitter level will be decreased until a level is reached where the DUT can maintain the desired BER. Figure 10 shows the results of a tolerance search test.

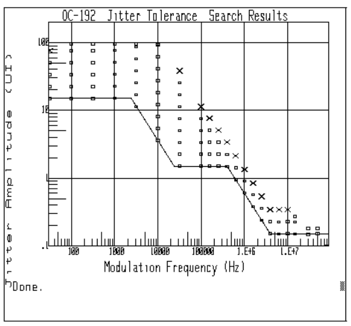


Figure 10. Jitter tolerance search results

For single point testing, the jitter frequency and magnitude can be arbitrarily selected and a BER test performed.

All of the above jitter tolerance tests may also be performed on multiplexing and de-multiplexing devices. The Agilent 71501D jitter analysis system simply sets the desired jitter levels at the input side of the DUT, and the appropriate BER test is performed at the output rate by the Agilent 86130A or 71612C.

Jitter tolerance measurements on devices with no clock output signal

If the DUT has no recovered clock output, the source of the clock signal for the Agilent 86130A or 71612C BERT would be the same as what would be used for a conventional BER test (as if no jitter were applied to the data). For example, the clock output of the pattern generator might be used as an input to the error detector.

Jitter tolerance measurement uncertainties and accuracies

The key measurement in a jitter tolerance test is BER. The uncertainty of a BER measurement is dictated by the Agilent 86130A or 71612C and how they are configured. Accuracy of the Agilent 71501D jitter analysis system involves precision in setting a specific jitter level.

Jitter generation and output jitter

Jitter generation and output jitter are measurements which determine the amount of jitter a component or system adds to an input data signal. In this measurement the Agilent 33250A jitter modulation source is disabled, thus no jitter modulation is applied to the data. The jitter-free data from the Agilent 86130A or 71612C is routed to the DUT, and the DUT output clock signal is received and measured by the Agilent 71501D.

Because this is essentially a noise measurement, it is defined over a specific bandwidth. For example, a jitter generation measurement at the STM-64/OC-192 rate of 9953 Mb/s examines only the demodulated jitter spectrum from 50 kHz to 80 MHz. The band limiting process is achieved in two stages. First, the signal is sent through a hardware bandpass filter centered at the data rate frequency. The bandwidth of the filter is dependent upon the data rate and in the 9953 Mb/s case is + 80 MHz centered at 9953.28 MHz. Filter bandwidth and center frequency are unique to each data rate. By passing the signal through the hardware filter, the high end of the jitter spectrum is determined. The signal is then demodulated to extract the jitter modulation. The baseband jitter is passed through a software filter to reject the low frequency spectrum. In the case of the 9953.28 Mb/s jitter generation measurement the default filter cutoff is 50 kHz. The software filter is user selectable. Several “traces” of the intrinsic jitter are recorded. The peak-to-peak extremes of the signal are monitored to yield the required measurement of peak-to-peak jitter. The RMS jitter is also determined. Figures 11 and 12 show the measurement configuration and a measurement of jitter generation on a 9953 Mb/s regenerator.

These measurements can only be made on clock signals and not on data signals. If only a data signal is available from the DUT, it would first need to pass through a clock recovery scheme which would not add a significant amount of jitter while extracting a clock signal. This clock recovery scheme would also need to have a jitter transfer function that was flat over the spectrum of interest so as not to degrade the measurement results.

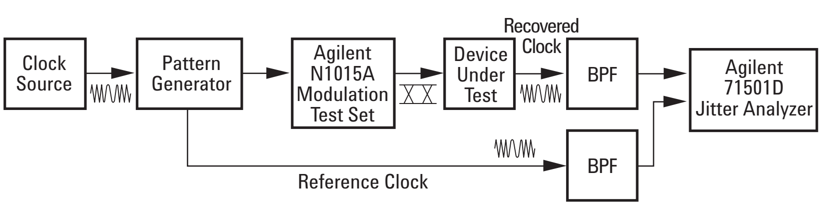


Figure 11. Measurement configuration for jitter generation

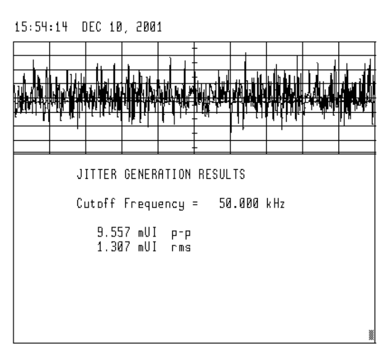


Figure 12. Jitter generation measurement of a 9953 Mb/s regenerator

Output jitter

Output jitter measurements are almost identical to jitter generation measurements. The only difference from a measurement perspective is that the frequency position of the software highpass filter is set for two values. In the case of a 622 Mb/s signal, instead of a 12 kHz cutoff, measurements are made with both a 1 kHz and a 250 kHz cutoff. The hardware filter is identical to that used in the jitter generation measurement, yielding an approximate 5 MHz jitter spectrum.

Hardware filters for 155, 622, 2488, and 9953 Mb/s are supplied as standard equipment with the Agilent 71501D system. Optional filters are available at other standard SONET/SDH rates, as well as other popular rates.

Jitter generation and output jitter measurement accuracy

The factors which dominate intrinsic jitter measurement accuracy are the jitter of the test system itself and its ability to accurately characterize jitter “noise” signals. Test system jitter is dictated to a large extent by the Agilent 70820A microwave transition analyzer. This then sets a minimum or baseline level of jitter that can be measured. The uncertainty in making intrinsic jitter measurements, not accounting for the baseline jitter is ±10% of the measured value. Thus measurement uncertainty is ±10% + baseline. Table 1 (page 7) shows the baseline limitations for various system configurations.

Diagnostic capabilities of Agilent 71501D system

For diagnostic purposes, the Agilent 71501D has the ability to display the demodulated or “baseband” jitter spectrum and waveform of a phase modulated clock signal. Also, similar to using a high-frequency spectrum analyzer and high-speed oscilloscope, the clock spectrum and waveform can be displayed. Examples are shown in Figure 13.

For troubleshooting purposes, the system can provide data signals with arbitrary jitter magnitudes and frequencies. For example, if a data stream with 2 UI of jitter at 15 kHz is desired, simply enter in these values and the system will automatically produce the desired signal.

Configuring a system

There are a variety of configurations allowable with the Agilent 71501D jitter analysis system. Selection of the correct configuration is dependent upon the range of data rates over which testing is to occur. The fundamental components of a complete system include:

1. **Agilent 71501D jitter receiver/system controller.** This is made up of the Agilent 70004A[5] display mainframe and the Agilent 70820A microwave transition analyzer.
2. **Agilent 33250A function/ arbitrary waveform generator** which acts as the jitter modulation source.
3. **Frequency/phase modulatable clock source[6]:** Agilent 83752A or E4422B
4. **Data pattern generator:** Agilent 86130A[7] error performance analyzer or the Agilent 71612C error performance analyzer (specific component is the Agilent 70843B option UHG pattern generator)
5. **Error detector** (for jitter tolerance test): Agilent 86130A error performance analyzer or the Agilent 71612C error performance analyzer (specific component is the Agilent 70843B option UHH error detector)

The Agilent 71501D and 33250A must be included in the system. Choosing a pattern generator and error detector is dictated by the highest data rate at which testing is to occur. The Agilent 86130A system normally operates from 50 Mb/s to 3.6 Mb/s. The Agilent 71612C system operates from 100 Mb/s to 12500 Mb/s. Choosing a clock source is based on the following criteria:

1. Range of data rates to be tested
2. Jitter modulation bandwidth requirements
3. Jitter magnitude requirements

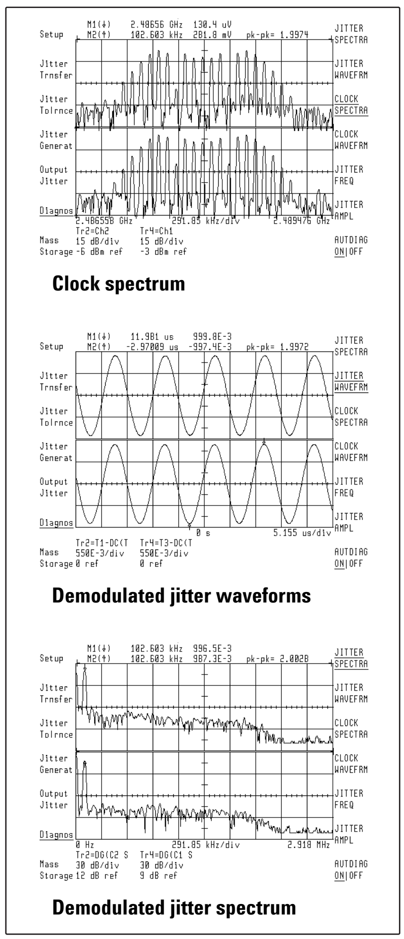


Figure 13. Diagnostic measurement capabilities

5. The Agilent 71501D or Agilent 71501D/71612C system can operate with one or two Agilent 70004A display mainframes.
6. Other clock sources that were supported by the 71501B/D will also be supported by, but not sold with the 71501D: Agilent 83752A, Agilent 83732B, and Agilent 70311A (obsolete).
7. Configuration requires external clock source.

Agilent 83752A clock source

(included as a standard part of the Agilent 71501C jitter analysis system, a delete option is available)

This clock source can operate from 10 Mb/s to 20 Gb/s. It is a general-purpose signal generator with frequency/phase modulation characteristics that are essentially independent of the selected clock frequency. That is, the modulation capabilities at 155 Mb/s are similar to the capabilities at 10 Gb/s. The jitter magnitude versus jitter frequency response is shown in Figure 14. Minimum jitter refers to the smallest jitter level that can be precisely set by the system. Modulation range is about 250 Hz to 80 MHz. SDH/ SONET jitter transfer measurements require operation beyond 2 MHz at 2488 Mb/s and beyond 1 MHz for jitter tolerance. Lower data rates require proportionally lower jitter modulation bandwidths. Thus the Agilent 83752A provides very good jitter capabilities over a broad range of data rates.

The Agilent 83752A clock source does not operate as part of the Agilent Technologies Modular Measurement System. When operating with either the Agilent 86130A or 71612A/B as a stand-alone BERT independent of the Agilent 71501C jitter analysis system, setting the clock frequency for the pattern generator is achieved directly at the 83752A either manually or over GPIB. (The Agilent 83752A is controlled automatically by the 71501C when performing jitter analysis).

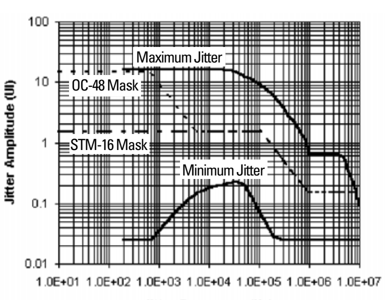


Figure 14. Modulation capabilities of the Agilent 83752A clock source

Agilent 83732B clock source

The Agilent 83732B clock source will operate from 10 Mb/s to 20 Gb/s. However, it can produce larger jitter levels at low frequencies in comparison to the Agilent 83752A.

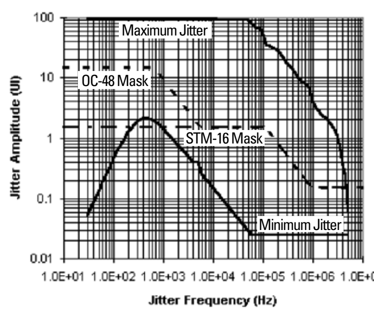


Figure 15. Jitter performance of the Agilent 83732B

Agilent E4422B clock source

The Agilent E4422B will operate at data rates from 1 Gb/s to 4 Gb/s. Its jitter modulation range is from 60 Hz to 20 MHz. Because it does not operate below 1 Gb/s, it cannot be used for 155 and 622 Mb/s testing. However, modulation performance exceeds 2488 Mb/s templates. Similar to the Agilent 83752A, modulation performance is independent of data rate. Jitter generation/output capabilities are discussed in Table 1.

Jitter testing at Fibre Channel and other non-SDH/SONET rates

Because the Agilent 71501D is frequency agile, jitter transfer, tolerance and generation/output testing at Fibre Channel or other rates is performed in the same fashion as SDH/SONET tests. The jitter levels for transfer and tolerance test could be default values used in a SONET or SDH test, or could be user defined. Once a test template has been defined, it can be easily saved and recalled for any subsequent testing.

Eye-diagram analysis

The Agilent 71501D jitter analysis system can also be configured as a high-speed eye-diagram analyzer using Option 005 eye-diagram analysis software. The Agilent 71501D eye-diagram analysis software allows the system to operate similar to a high-speed sampling oscilloscope such as the Agilent 86100 Infiniium DCA[8].

The Agilent 71501D can perform eye-diagram analysis such as extinction-ratio testing and mask testing.

Jitter Generation (noise)

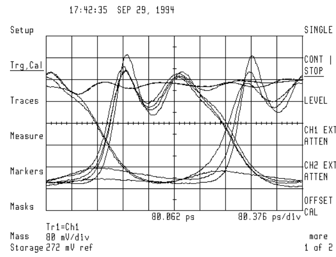
	OC-48/STM-16	OC-192/STM-64
Without Agilent N1015A test set (RMS/pp)	0.002/.02 UI	.006/.06 UI
With Agilent N1015A test set (RMS/pp)	0.002/.02 UI	.002/.02 UI

Table 1. Jitter generation characteristics

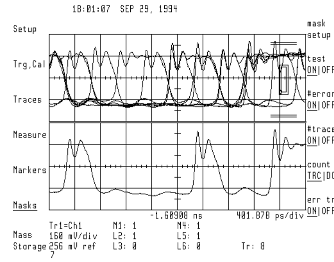
8. In terms of ease-of-use, measurement speed, accuracy, and configuration flexibility, the Agilent 86100 Infiniium DCA is a superior measurement tool for eye-diagram analysis in comparison to any other instrument, including the Agilent 71501D. A general recommendation is that the Agilent 71501D should not be selected for eye-diagram analysis alone, but as a jitter analysis system with incremental eye-diagram analysis capabilities.

In addition, the software allows the system to operate in Agilent eyeline mode only with the 71603 BERT or the 70841B pattern generator. In eyeline mode the eye-diagram display shows continuous traces instead of synchronous dots. This allows pattern dependent effects to be investigated. For example, the trace leading to a mask violation can be captured and displayed. The eyeline eye diagram can take advantage of trace averaging. Thus very small energy signals can be extracted from broadband noise. Finally, eye diagrams can be analyzed using software filters. Fourth-order Bessel-Thomson filters can be easily designed for virtually any data rate allowing analysis without having to actually construct a hardware filter.

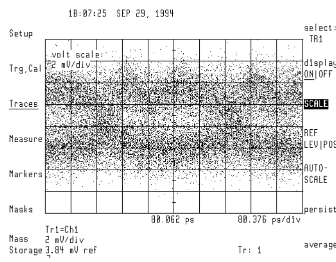
The eye-diagram analysis software is a separate application from the jitter analysis software. The applications cannot be run simultaneously. Switching from eye-diagram analysis to jitter analysis requires reloading of the jitter application program or vice-versa.



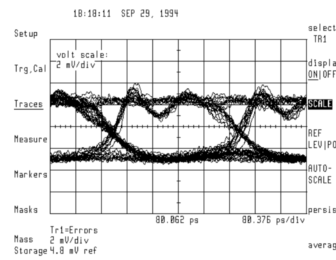
Eye-diagram using eyeline mode



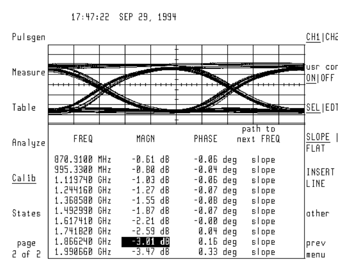
Capturing the trace causing a mask violation



Small power eye-diagram without using outline



Small power eye-diagram using eyeline mode



Creating a custom software eye filter

Ordering information

The following is a representative sample of common configurations. Other configurations are possible.

Agilent 71501D standard configuration OC-48/STM-16 and OC-192/STM-64 compliance testing

The Agilent 71501D comes standard with the following equipment to form a complete jitter analyzer system when configured with the Agilent 71612C error performance analyzer.

Mainframes
Option-202 70004A display mainframe
Option-203 70820A microwave transition analyzer (jitter receiver/system controller)

Modulation test set
Option-300 N1015A with 20 MHz modulator (1.9 to 3.6 Gb/s data rates)
Option-310 N1015A with 80 MHz modulator (9.8 to 12.5 Gb/s data rates)
Option-305 N1015A with 20 and 80 MHz modulator

Clock source
Option-720 83752A performance signal generator (250 kHz to 20 GHz)

Modulation source
Option-250 33250A function/arbitrary waveform generator (1 μHz to 80 MHz jitter modulation source)

Hardware filters[9]
Option-420 Two 2488.32 MHz hardware bandpass filters
Option-440 Two 9953.28 MHz hardware bandpass filters

Software & applications support
Option-874 70874D jitter analysis system software

Documentation
Option-0B1 User's guide

For modifications to the standard system, the following configurations are available:

OC-192/STM-64 compliance testing

The Agilent 71501D can be configured with the following equipment for OC-192/STM-64 compliance testing when configured with the Agilent 71612C error performance analyzer.

Mainframes
Option-202 70004A display mainframe
Option-203 70820A microwave transition analyzer (jitter receiver/system controller)

Modulation test set
Option-310 N1015A with 80 MHz modulator (9.8 to 12.5 Gb/s data rates)

Clock source
Option-720 83752A performance signal generator (250 kHz to 20 GHz)

Modulation source
Option-250 33250A function/arbitrary waveform generator (20 Hz to 80 MHz jitter modulation source)

Hardware filters[9]
Option-440 Two 9953.28 MHz hardware bandpass filters

Software & applications support
Option-874 70874D jitter analysis system software

Documentation
Option-0B1 User's guide

OC-48/STM-16 compliance testing

The Agilent 71501D can be configured with the following equipment for OC-48/STM-16 compliance testing when configured with the Agilent 86130A error performance analyzer.

Mainframes
Option-202 70004A display mainframe
Option-203 70820A microwave transition analyzer (jitter receiver/system controller)

Modulation test set
Option-300 N1015A with 20 MHz modulator (1.9 to 3.6 Gb/s data rates)

Clock source
Option-722 E4422B analog RF signal generator (250 kHz - 4 GHz)

Modulation source
Option-250 33250A function/arbitrary waveform generator (1 μHz to 80 MHz jitter modulation source)

Hardware filters[9]
Option-420 Two 2488.32 MHz hardware bandpass filters

Software & applications support
Option-874 70874D jitter analysis system software

Documentation
Option-0B1 User's guide

Upgrading the 71501B/C to the 71501D

The Agilent 71501D can be configured with the following equipment for OC-48/STM-16 and OC-192/STM-64 compliance testing.

Mainframes
Option-200 No mainframe
Option-204 No 70820A microwave transition analyzer

Modulation test set
Option-300 N1015A 20 MHz modulator (1.9 to 3.6 Gb/s data rates)
Option-310 N1015A 80 MHz modulator (9.8 to 12.5 Gb/s data rates)
Option-305 N1015A with 20 and 80 MHz modulator

Clock source
Option-001 No clock source

Modulation source
Option-003 No modulation source

Hardware filters[9]
Option-405 No hardware filters

Software & applications support
Option-874 Agilent 70874D jitter analysis system software

Documentation
Option-0B1 User's guide

Other options

Other options available for the Agilent 71501D.

Modulation source
Option-003 No modulation source

Hardware filters
Option-004 No hardware filters
Option-400 Two 155 Mb/s band pass hardware filters
Option-410 Two 622 Mb/s band pass hardware filters
Option-412 Two 800 MHz low pass hardware filters
Option-417 Two 1.5 GHz low pass hardware filters
Option-420 Two 2488 Mb/s band pass hardware filters
Option-430 Two 2666 Mb/s band pass hardware filters
Option-435 4.0 GHz low pass hardware filters
Option-440 Two 9953 Mb/s band pass hardware filters
Option-450 Two 10.7092 Gb/s band pass hardware filters
Option-467 12.4 GHz low pass hardware filters
Option-470 10.7092 Gb/s band pass hardware filters
Option-460 Two 12.4416 Gb/s band pass hardware filters
Option-480 10.66423 Gb/s band pass hardware filters

Software & applications support
Option-005 Eye diagram analysis software

Accessories
Option-810 Rackmount slide kit for 70004A
Option-908 Rack flange kit for 70004A
Option-913 Rackmount flange kit (w/ handles) for 70004A

9. Hardware filters at other data rates are available.

Agilent Technologies'
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Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

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Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

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