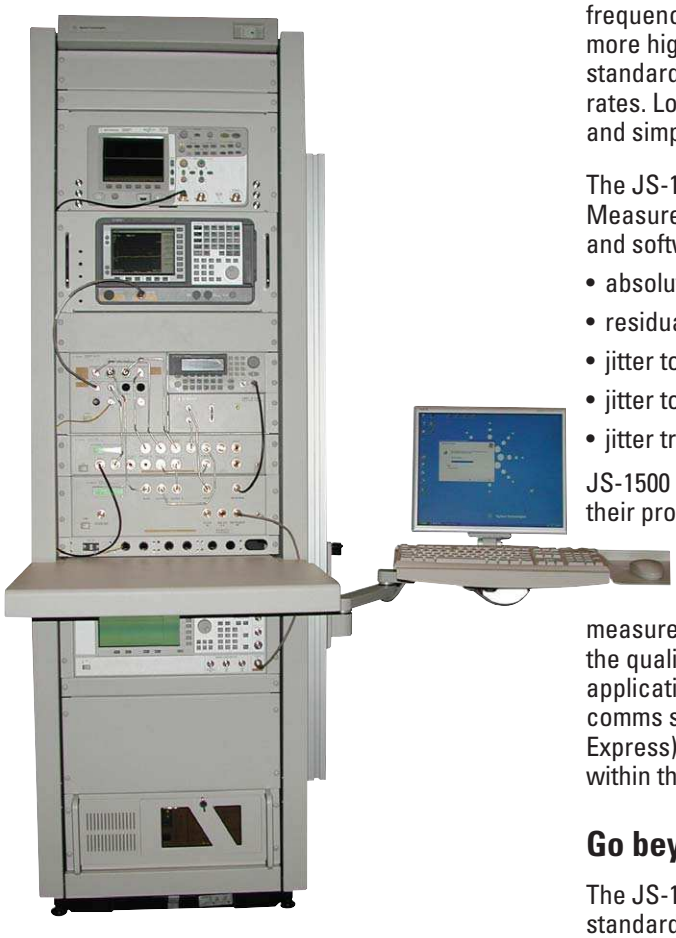
Agilent JS-1500

Clock/Data Jitter Solution

In-depth jitter characterization of clock and data devices from 50 kHz to 20 GHz



A fully integrated, turnkey solution

The Agilent JS-1500 is a high-performance characterization and verification solution for testing electrical timing generators or timing recovery devices such as VCOs, clock multipliers (CMUs), PLLs, clock recovery units (CRUs), serializer/deserializers (SERDES) or instrument-grade signal generators. Wide frequency coverage supports testing of everything from low-frequency oscillators for general-purpose electronics to more highly-integrated digitally-controlled timing circuits for standard electrical and optical communications system data rates. Low system intrinsic jitter, automated jitter test sets, and simplified GUIs ensure high accuracy and repeatability.

The JS-1500 solution is an extension of the Phase Noise Measurement System with both automated test hardware and software to enable the following measurements:

- absolute jitter generation
- residual jitter generation
- jitter tolerance (BERT-based)
- jitter tolerance for PLLs (non-BERT based)
- jitter transfer

JS-1500 was created for designers who want to differentiate their products on performance, time to market, or price. Using an ultrawideband hardware architecture (500 MHz to 13 GHz for most measurements), it allows for characterization of products to SONET/SDH jitter measurement standards as well as IEC standards governing the quality of crystal-controlled oscillators while supporting application of these jitter measurement methods to emerging comms standards at 1.5 and 3 Gb/s (serial ATA), 5 Gb/s (PCI Express), 6.25 Gb/s (double-XAUI), and any other data rate within the 500 MHz to 13 GHz range.

Go beyond compliance testing

The JS-1500 goes beyond compliance testing to a particular standard or standards to offer ongoing competitive advantage in two areas:

- Maximum design insight through very low intrinsic jitter, narrowband jitter spectral information, and spur identification and separation
- Broad application support for current and future telecom/datacom standards through continuously-variable frequency of test

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Maximum frequency coverage means maximum ROA as you can reuse the same hardware set to test your devices at Ethernet, FibreChannel, and FEC rates today as well as any new standard rates that appear tomorrow.

Test system features & benefits

Agilent's JS-1500 is a flexible platform designed to help you quickly respond to ever-changing manufacturing needs, such as the need to test diverse jitter frequencies. In addition, the JS-1500 was designed to support devices with a variety of input/output frequency ratio characteristics: many of the measurements allow the user to specify output/input frequency ratios of 2^n from 1/4 to 64.

Agilent's test system derives much of its accuracy and advanced diagnostic capability from using the E5505 series Phase Noise Solution, which allows you to examine clock jitter in the frequency domain as well as the time domain. Measuring jitter in the frequency domain offers many advantages including:

Frequency domain RMS noise measurements have very low intrinsic jitter; flexibility in the frequencies you measure beyond SONET/SDH data rates; diagnostic insight by viewing random and non-random (spur) components; and the capability to measure every zero-crossing on the incoming signal within 100 MHz of bandwidth.

The JS-1500 incorporates automated jitter test sets including a variety of standards-compliant peak-peak filters and a "true" continuous peak detection system. This test set enables the user to easily setup band-limited peak-peak measurements for up to 500 seconds in which there is no processing "dead time" (as with sampling oscilloscope measurements) in which a rare peak "event" may be missed. Continuous peak detection over larger time scales is available as an option.

The jitter test sets also incorporate signal conditioning and autoranging hardware to maximize the dynamic range of the measurement system both in terms of signal power and jitter deviation. Along with both single-ended and differential inputs, this allows the system to measure a variety of very low-jitter devices as well as clock signals that have been impaired with intentional noise, sinusoidal, or other jitter.

Testing of devices with data inputs or outputs is enabled via the incorporation of an N490x-series Bit Error Rate Tester (BERT) into the solution. The necessary conversion of a customer device's data output to a measurable clock signal is achieved using either the BERT's own clock recovery capabilities or optional 8760C-K82 or 8760C-K83 Wideband Clock Recovery Units. In addition, if the customer elects to use the N4903A J-BERT, he has the option of choosing a tunable bandwidth clock recovery option (UTR).

Tailored to your specific needs

Applications vary, so the Agilent JS-1500 was designed to meet specific testing needs by offering flexible, tailored solutions for software, data acquisition, external switching, DUT power, DUT comms, facility interface, and power supplies. Agilent provides the expertise to incorporate additional measurement capabilities, such as calibrated impairments and wideband total jitter characterization using high-speed scopes as well as custom fixturing with RF enclosures specifically for your product. All JS platform and tailored solutions offer consulting and uptime support as well.

Typical Characteristics

Absolute Jitter Generation

	Min	Value	Max	Units	Notes
DUT Output Clock Rate	50 kHz		20 GHz		
DUT Output Level					50 ohm
Single-Ended:					
50 kHz to 10 MHz	0.63		20	V_{pp}	
10 MHz to 13 GHz	0.1		3.56	V_{pp}	
13 GHz to 20 GHz	0.63		20	V_{pp}	
Differential:					
10 MHz to 13 GHz	0.1		1	V_{pp}	
Jitter Frequencies	10 Hz		100 MHz		
Jitter Measurement Ranges		0.03		UI_{pp}	
		0.06		UI_{pp}	
		0.12		UI_{pp}	
		0.24		UI_{pp}	
		0.48		UI_{pp}	
System Intrinsic Jitter					
600 MHz:					
1 kHz to 5 MHz			26	µUIrms	
20 kHz to 80 MHz			70	µUIrms	
10 GHz:					
20 kHz to 80 MHz			200	µUirms	
Pk-Pk Jitter Accuracy	-10%		10%		measured value >10× intrinsic over pp bandpass
Pk-Pk Measurement Duration	2		500	s	

Typical Characteristics

Residual Jitter Generation

	Min	Value	Max	Units	Notes
DUT Output Clock Rate	500 MHz		13 GHz		
Output/Input Freq Ratios	1/4		64		not all ratios are supported at all frequencies
Jitter Frequencies	10 Hz		100 MHz		
Jitter Measurement Ranges		0.25 0.50 1.00 2.00 4.00		UI_{pp} UI_{pp} UI_{pp} UI_{pp} UI_{pp}	
Pk-Pk Jitter Accuracy	-10%		10%		measured value >10 × Intrinsic over pp bandpass

Peak-to-Peak Bandpass Filters

Pk-Pk Bandpass Filters	10 Hz, 10 kHz 20 Hz, 20 kHz 100 Hz, 50 kHz 1 kHz, 200 kHz 5 kHz, 500 kHz 5/12 kHz, 1 MHz 20 kHz, 50 kHz 2 MHz, 4 MHz		100 kHz 500 kHz 1.5 MHz 5 MHz 15 MHz 20 MHz 80 MHz 80 MHz		

Jitter Tolerance (BERT-based)

DUT Input Data Rate	150 Mb/s		12.5 Gb/s		assumes N4906B opt. 012/102
DUT Output Data Rate	150 Mb/s		12.5 Gb/s		assumes N4906B opt. 012/102
Output/Input Freq Ratios	TBD		TBD		not all ratios are supported at all frequencies
Jitter Frequencies	10 Hz		80 MHz		
Max Applied Jitter:					see page 4

Jitter Tolerance (for PLLs)

DUT Input Clock Rate	TBD		TBD		
DUT Output Clock Rate	TBD		TBD		
Output/Input Freq Ratios	1/4		64		not all ratios are supported at all frequencies
Jitter Frequencies	10 Hz		1 MHz		
Max Applied Jitter:	$31200/f_{mod}$ rad_{pp} from 10 Hz to PLL corner frequency 4.88 rad_{pp} from PLL corner frequency to 800 kHz				

Jitter Transfer

DUT Input Data Rate	10 MHz		13 GHz		
DUT Output Data Rate	500 MHz		13 GHz		
Output/Input Freq Ratios	1/4		64		not all ratios are supported at all frequncies
Jitter Frequencies	10 Hz		80 MHz		
Max Applied Jitter:					see page 4

Maximum Applied Jitter

Via Generator FM System

Clock	100 Hz to 10 MHz	10 Hz	10 MHz
10 to < 250 MHz	$636e^3/f_{mod}$ UI_{pp}	63.6 kUI_{pp}	63.6 μUI_{pp}
250 to 500 MHz	$318e^3/f_{mod}$ UI_{pp}	31.8 kUI_{pp}	31.8 μUI_{pp}
> 500 MHz to 1 GHz	$636e^3/f_{mod}$ UI_{pp}	63.6 kUI_{pp}	63.6 μUI_{pp}
> 1 to 2 GHz	$1.27e^6/f_{mod}$ UI_{pp}	127 kUI_{pp}	127 μUI_{pp}
> 2 to 3.2 GHz	$2.54e^6/f_{mod}$ UI_{pp}	254 kUI_{pp}	254 μUI_{pp}
> 3.2 to 10 GHz	$5.09e^6/f_{mod}$ UI_{pp}	509 kUI_{pp}	509 μUI_{pp}
> 10 to 20 GHz	$10.2e^6/f_{mod}$ UI_{pp}	1.02 MUI_{pp}	1.02 UI_{pp}

Via Phase Modulators

Clock	10 Hz to 20 MHz	20 MHz to 80 MHz
2.4 to 3.2 GHz	500 μUI_{pp}	Not applicable
9.5 to 12.5 GHz	500 μUI_{pp}	500 μUI_{pp}

Other features included:

Non-brickwall filter for RMS integration
Integrated peak event capture
Phase noise measurement GUI
Jitter generation measurement GUI
Jitter transfer measurement GUI
Jitter tolerance measurement GUI
Remote interface to jitter measurement server
Industrial PC, LCD panel monitor, Windows XP

Technical data subject to change.

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