Introduction

Use the tests in this chapter if you want to check that the Agilent E8312A 330 MHz Pulse generator,VXI C-Size is working correctly. Before starting any testing allow all test equipment to warm up for at least 30 minutes.

The performance tests in this chapter verify the Agilent E8312A specified performance characteristics using remote commands.

The performance verification tests can **only** be done using a * VXI C-size Mainframe * PC stand alone + Comand Module or VXI PC

The instrument driver runs on the Windows NT platform. Furthermore the desired Interface (GPIB) should be installed and work well. Because the instrument driver is based on the functionallity of the VISA library, VISA has to be installed properly before the installation of the driver is started.

See the Instrument Driver User's Guide.

Automating Calibration Procedures

With computer controll you can automate the complete performance test outlined in this chapter if you have access to programmable test equipment. You can program the instrument configurations specified for each test over the remote interface. You can then enter readback verification data into a test program and compare the results to the appropriate test limit values. For further detailing on programming the pulse generator, see "Agilent E8312A SCPI Command Reference" in the Reference Guide.

Test Results Tables

Tables for entering the results of the tests are included at the end of this chapter. The tests are numbered and reference numbers for each Test Result (TR) are given in a small table at the end of each test. The reference number shows you where the actual results should be entered in the Test Results Tables.

The Test Results tables at the end of the chapter should be photocopied, and the Test Results entered on the copies. Then, if the tests need to be repeated, the tables can be copied again.

If Channel 2 has been fitted to your instrument, make an extra copy of the Test Results tables for entry of the results of tests on that channel. In this case, however, it is not necessary to repeat the Period tests, as these are common to both channels.

Recommended Test Equipment and Accessories

The following tables list the recommended test equipment you need to perform all the tests in this chapter. You can use alternative instruments if they meet the critical specifications given. The test set-ups and procedures assume you are using the recommended equipment.

Test Equipment	Model	Critical Specifications
Oscilloscope or	Agilent 54121T	20 GHz, 10 bit vertical resolution, Histogram
Oscilloscope	Agilent 54750A + Agilent 54751A	20 GHz, 15 bit vertical resolution, Histogram
Counter or	Agilent 5334B #010, 030	Period and Time Interval measurements Oven Osci, 1.3 GHz C-Channel
Counter	Agilent 53132A #001/010, 030	Frequency measurements > 150 MHz High-Stability Timebase, 3 GHz Channel
Digital Voltmeter	Agilent 3458A	DCV up to 20 V
Pulse Generator	Agilent 8110A	up to 150 MHz
Delay line	Agilent 54008A	22 ns

Accessories	Model	Critical Specifications
Digitizing Oscilloscopes Accessories Attenuators	33340C#020 33340C#006	20 dB 6 dB
Power Splitter SMA/SMA (m-m)Adapter SMA/BNC Adapter SMA Cable	11667B 1250-1159 1250-1700 8120-4948	

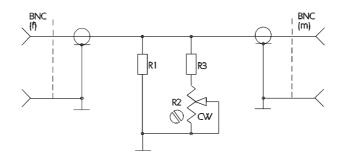
Accessories	Model	Critical Specifications
50 Ω Feedthrough Termination	10100C See Figure	2 W,1% 10 W,0.1%
Adapter	1251-2277	BNC to Banana
Cable Assemblies, BNC	8120-1839	
Torque Wrench	8710-1582	5/16 in, 5 lb-in (56 Ncm)

NOTE:

When you connect the test equipment for the first time, and whenever you change the setup during the course of these tests, use the 8710 - 1582 torque wrench to tighten and loosen SMA connectors. This will ensure that the connectors are at the correct tightness and give the best signal transfer.

50 Ohm, 0.1%, 10 W Feedthrough Termination

The following figure provides a schematic and a parts list except for the case. The case must provide shielding and maintain grounding integrity.



50 Ohm, 0.1%, 10 W Feedthrough Termination

The following parts are required:

- 1. $R1 = 53.6\Omega$, 1%, 10 W; Part Number: 0699-0146.
- 2. $R2 = 200 \Omega$, 10%, 0.5 W, Variable trimmer; Part Number: 2100-3350.
- 3. $R3 = 681 \Omega$; 1%, 0.5 W; Part Number: 0757-0816.
- 4. BNC (M): Part Number: 1250-0045.
- 5. BNC (F): Part Number: 1250-0083.

Getting Started

The performance verification tests use the pulse generator specifications listed in "Specifications" of the Reference Guide.

You can perform different levels of tests:

• Self-Test

A series of internal tests that give a high confidence that the pulse generator is operational.

- Quick Verification A combination of the internal self-test and selected verification tests.
- **Performance Verification Test** An extensive set of tests that are recommended as an acceptance test when you first receive the pulse generator or after repair.

Self-Test

A *power-on* self-test occurs automatically when you turn on the pulse generator. This limited test assures you that the pulse generator is operational.

A *complete* self-test runs a series of tests and takes approximately 10 seconds to execute. If all tests pass, you can have a high confidence that the pulse generator is fully operational.

Use the following command to perform a self-test:

*TST?

Self-test command

Returns "0" if the self-test passes or "1" if it fails. If the self-test fails, an error message is also generated with additional information on why the test failed.

Use the command to read the error queue:

:SYSTem:ERRor? Query for errors

See "Self-Test Errors" for more information

The error queue can store up to 30 error codes on a first-in-first-out basis. When you read the error queue, the error number and associated message are put into the the instrument's output buffer. Re-read the error queue till the error queue is empty, and the value 0 is returned, meaning No *more* ERROR.

Printer output example:

-222 "Data out of range" overlap at output 1: Width>Double Delay

Quick Verification

The quick performance check is a combination of internal self-test and an abbreviated performance test (specified by the letter \mathbf{Q} in the performance verification tests). This test provides a simple method to achieve high confidence in the pulse generator's ability to functionally operate and meet specifications. These tests represent the absolute minimum set of performance checks recommended following any service activity.

Auditing the pulse generator's performance for the quick check points (designated by a \mathbf{Q}) verifies performance for "normal" accuracy drift mechanisms.

To perform the quick performance check, do the following:

• Perform a complete self-test (*TST?).

• Set the function generator to reset state (*RST).

See the Programming Reference for the complete listing of the default values, standard seetings!

Short information:

* Pulse Mode		
* Internal Frequency	1 MHz	(VFO, Per = 1 μ S)
* Delay	0.0	(Double OFF)
* Width	100 ns	(= DCYCL 10%)
* Transition Times	1.3 ns	
* Output 1 2	OFF	
Amplitude	1.0 V	(= HIGH 0.5 V)
Offset	0.0 V	(= LOW -0.5 V)

Connecting an oscilloscope to the trigger output and output 1 | 2 you can already check the output signals after *using the following commands to switch the outputs to ON*:

:OUTP1 ON :OUTP2 ON

• Perform only the performance verification tests indicated with the letter **Q**.

If the pulse generator fails the quick performance check repair is required.

Performance Verification Tests

The performance verification tests are recommended as acceptance tests when you first receive the pulse generator. The acceptance test results should be compared against the 1 year test limits. After acceptance, you should repeat the performance verification tests at every calibration interval.

Allow the pulse generator to warm up for 30 minutes before performing the tests.

Perform the tests in the order they appaer. Always start with the reset state (*RST)

If the pulse generator fails performance verification, repair is required.

Instrument Serial Number

You will need to write the serial number of the instrument at the top of the Test Reports. These can be found as follows:

Use the following command to read the module information.

*IDN?

The display lists the instrument's product and serial number as well as the firmware revision. It should look similar to this:

Slot Number 3	Product ID	E 8312A
Logical Addi. 16	Senal Num	DE 39400104
Model Code 682	Sys. Version	REV 01.01.01
Num Channels 2	Inst. Options	8312A .8312A
		Selftest
		Calibrate
atus Online web GPIR3000-16-		
and Online with GPIB-VXI016.;	INSTH (E8312A)	

Typical Examples of Displayed Screens

The Screen of a E8312A of the Virtuelle instrument driver are:

Channel 1 Norm Dut inv Dut C Dn C Dn C Dit C Dit	Channel 2 Norm. Dut Inv. Out C On C On C Oll C Oll
Delay 0.000 +	Delay 0.000
1	
Online with GPIB-VXI0:16:INSTR	(E8312A)

The TIMING Screen Agilent E8312A

CHANNEL 1 Norm Out Inv. Out Polarity C On C On C Normal C Ott C Ott C Compl.	CHANNEL 2 Noim Out Inv. Gut Polarity C On C On C Norma C Off C Off C Comp
High 2 500 + V Low 0 000 + NV Disput ling +	Officier 0.000 + m Arapitude 1.000 + V Output ling +
Level Format High-Low Voltage/Current Voltage	Level Former Offset-Amplitude
🕫 Seconde Durpyla	C Charle Added Acclarate 1
UN Online with GPI8-VX00.16:INSTR (E8312A)

The LEVELS Screen Agilent E8312A

281100 Virtual Instrument			
losts, Mode/Tro Iming Levels Pa	attern Limits Trg-Lex	Config Dr	xions
Slot Number 3	Product ID	E8312A	-
Logical Addi. 16	Senal Num	DE 394001	54
Model Code 682	Sys. Version	REV 01.01	.01
Num Channels 2	Inst. Options	8312A .831	2A
Source for the second s			Reset Instr Selftest
			Calibrate
aluit Online with GPIB-W00, 16: INS	ŤR (E8312A)		
Enors Warnings Downlo	ad From Instrument	100453	1 To Instrument

The CONFIG Screen Agilent E8312A

Initial Setup of the Agilent E8312A

In the majority of these tests the initial setting up of the instrument is identical. Therefore, it is described once here, and then referredto where appropriate. In cases where the initial setup differs, an illustration of the settings is shown.

Set up the Agilent E8312A as follows:

- 1. Select [mode/trg]
- CONTINUOUS PULSES
- Single-Pulses at Out 1 plus Single-Pulses at Out 2
- Pulse-Period:internal Osc
- 2. Select [CONFIG] screen and set up as follows:

last. Mode/Tra Limina Levels E	attern Limits Tig-Lev	Copfig Options	ļ
Slot Number 3	Product ID	E 8312A	
Logical Addi. 16	Senal Num	DE39400104	_
Model Code 682	Sys. Version	REV 01.01.01	
Num Channels 2	Inst. Options	8312A .8312A	
Fing. EMHz y			set Instr Selltest
			albrate
Nut Online with GPI8-V/00:16:INS	TR (E8312A)		

CONFIG Screen setup

NOTE:

Set-ups are given in all the tests for [OUTPUT 1] and [OUTPUT 2].

Test 1: Period (PLL not active)

Test Specifications

Range3.03 ns to 999.5 sResolution3.5 digits, best case 5 psAccuracy $\pm 3\%$ typical $\pm 0.5\%$ after selfcal

Equipment Needed

Counter Cable, 50 Ω , coaxial, BNC

Procedure

1. Connect the Counter Input A (C) to the TRIG OUT of the Agilent E8312A.

Set up the Agilent E8312A as described in "Initial Setup of the Agilent E8312A" and set up the Timing as schown in the following illustrations:



Period 3030 mm Channel 1 Channel 1 C Dat Inv Qut C Dat C Dat C Dat C Dat	Channel 2 Nom. Dut Inv. Dut C Dn C Dn C Dtt C Dt
Delay 0.000 + s Width 1.515 + ne Leading Edge 800.0 + po Trailing Edge + 800.0 + is	Defay 0.000 +
1	
Continue with GPIB-VX00.16:INSTR (E8312AJ

Configuring The Timing

CHANNEL 1 Nom. Out Inv. Out Polaity C. On C. Normal C. Oll C. Compl.	CHANNEL 2 Norm Gut Inv. Gut Polarity C. On C. On C. Norma G. Ott C. Ott C. Compl
Offset 0.000 + V Amplitude 1.000 + V Displatibility -	Offset 0.000 ± V Amplitude 1.000 ± V Output Imp ±
Level Format Officet-Amplitude	Level Format Offset-Amplitud
Coconste Dirayta	🐔 i Landa Addel Attinud I
Online with GPIB-V/00::16::INSTR (E8	312A)

Levels Screen setup

NOTE: Testing instruments with 2 output channels it is necessary to:

a. Configure *both* channels.b. For the Period test you can switch OFF the channels that are not being tested.

2. Set the Counter to:

FUNCTION	Period A / Freq C
INPUT A	50 Ω
SENSE	On

3. Check the Agilent E8312A period at the following settings:

Period	Acceptable Range	TR entry
3.030 ns 6.060 ns 10.00 ns 50.00 ns 99.90 ns	without selfcal! 2.9391 ns to 3.1209 ns 5.878 ns to 6.242 ns 9.7 ns to 10.3 ns 48.5 ns to 51.5 ns 96.903 ns to 102.897 ns	1 - 1 1 - 2 1 - 3 1 - 4 1 - 5
100 ns 500 ns 1 μs 500 μs 500 ms	97 ns to 103 ns 485 ns to 515 ns 970 ns to 1030 ns 485µs to 515 µs 485 ms to 515 ns	1 - 6 1 - 7 1 - 8 Q 1 - 9 1 - 10

4. To perform the Timing Calibration (shown as selfcal) set up [CONFIG] page as shown in the following illustration:

	Number 3		ID E8312A	
	cal Addr. 16		m DE394001	
	Sel Code 682		on REV 01.01	12
Num C	Ihannels 2	Inst, Optic	ations 8312A,8312A	
	auce (nume) Reg (EMH)	2		Reset Instr
				Selftest
				Calibrate
atus []	nline with GPIB-V/0) 16:INSTR (E8312A)		

Config screen setup

5. Press the Calibrate button press Yes and wait till Calibration is ready.

Test 2: PLL Period

NOTE: This test is only performed if PLL is switched on.

Test Specifications

Range3.03 ns to 999.5 sResolution4 digits, best case 1 psAccuracy $\pm 0.01\%$

Equipment Needed

Counter Agilent 53132A Cable, 50 Ω , coaxial, BNC

NOTE:

The Agilent 53132A counter is used in frequency mode to meet the MIL CAL A uncertainty requirements for TAR (Test Accuracy Ratio) > 4:1.

Procedure

1. Connect the Counter Input 1 (3) to the TRIG OUT of the Agilent E8312A.

Set up the Agilent E8312A as described below and change the period setting as shown in the table:

2. Set up the Agilent E8312A as described in "Initial Setup of the Agilent 8311A"

3. Select the [MODE/TRG] screen and set up as follows:

C Gated	Pube Type Single Pulses at Dutput 1 💌 Single Pulses at Dutput 2 💌
C ExtWidth	Period Source Internal PLL
Pulse Mode Pulse Stream Burst Pattern	Form D 000 - Ha
ut Online with GPIB-VAD	10:16::INSTR (E83124)

The MODE/TRG Screen Setup

4. On the Virtual Instrument E8312A set up the Timing as shown in the test before!

NOTE:

Testing instruments with 2 output channels it is necessary to:

a. Configure *both* channels.

b. For the Period test you can switch OFF the channels that are not being tested.

- 5. Set the Counter to measure the frequency at the choosen input 1/3
- 6. Check the Agilent E8312A PLL pulse period at the following settings:

Period	Frequency	Acceptable Range	TR Entry
10.00 ns 50.00 ns 100 ns 500 ns 1 μs 50 μs 5 ms 500 ms	330.000MHz 100 MHz 20 MHz 10 MHz 2 MHz 1 MHz 20 kHz 200 Hz 2 Hz 0.2 Hz	329.9670 MHz to330.0330 MHz 99.990 MHz to 100.010 MHz 19.9980 MHz to 20.0020 MHz 9.9990 MHz to 10.0010 MHz 1.9998 MHz to 2.0002 MHz 999.9 kHz to 1.0001 MHz 9.998 kHz to 20.002 kHz 199.980 Hz to 200.020 Hz 1.9998 Hz to 2.0002 Hz	2 - 1 2 - 2 2 - 3 2 - 4 2 - 5 2 - 6 2 - 7 2 - 8 2 - 9 2 - 10

Test 3: Width

Test Specifications

Range1.515 ns to (period - 1.515 ns)Resolution3.5 digits, best case 5 psAccuracy $\pm 3\% \pm 250$ pstypical $\pm 0.5\% \pm 250$ ps after selfcal

Equipment Needed

Digitizing Oscilloscope with Accessories Counter Cable, 50 Ω, coaxial, BNC

Procedure

1. Connect Agilent E8312A to the Scope as follows:

connect a 6 dB Attenuator to Input 2 of the Agilent 54121T
connect a 20 dB Attenuator to TRIG Input of the Agilent 54121T
connect the TRIG OUT of the Agilent E8312A to the TRIG Input and
connect the OUT 1/2 to the Input 2 of the scope

Set up the Timing as shown in the following illustrations:



Channel 1 Norm. Dut inv. Dut C. Dn C. Dn C. Dit C. Dit	Channel 2 Norm. Dut Inv. Dut C Dn C Dn C Dif C Dif
Delay 0.000 ± s Width 100 ± nc Leading Edge 800 0 ± ps Trailing Edge + 100 ± ps	Delay 0.000 + + Width 1.515 + ns Leading Edge 800.0 + ps Traing Edge 1000 + ps
1	
2 Online with GPIB-W00::16:INSTR (E8	31241

The Timing Screen setup

NOTE: Testing instruments with 2 output channels it is necessary to: a. Configure both channels. b. Switch OFF the channel that is not being tested. If you then test the other channel: c. Switch ON the channel your are testing, and switch OFF the other channel. 2. Set the Digitizing Oscilloscope Agilent 54121T: Press AUTOSCALE Select the Display menu and set the Number of Averages to 32 Select the delta V menu and turn the voltage markers On ٠ Set the preset levels to 50% -50% and press AUTO LEVEL SET Select the delta t menu and turn the time markers ON Set START ON EDGE = POS 1 and STOP ON EDGE = NEG1 3. Change the oscilloscope timebase to 1 ns/div 4. Change the Agilent E811A Ch-1 Width to 3.03 ns 5. Center the pulse in the Scope display 6. Press the PRECISE EDGE FIND key for each new Width setting

Oscilloscope Timebase	Period	Width	Acceptable Range	TR Entry
1 ns/div 1 ns/div 2 ns/div 10 ns/div 20 ns/ 100 ns	200 ns 200 ns 200 ns 200 ns 1 μs 1 μs	<i>without selfcal!</i> 1.515 ns 6.060 ns 10.00 ns 50.00 ns 100.0 ns 500.0 ns	1.22455 ns to 1.80545 ns 5.528 ns to 6.492 ns 9.450 ns to 10.55 ns 48.25 ns to 51.75 ns 96.75 ns to 103.25 ns 484.75 ns to 515.25 ns	3 - 1 3 - 2 3 - 3 3 - 4 3 - 5 3 - 6

7. Check the Agilent E8312A pulse width at the following settings:

- 8. Connect the Agilent E8312A Output1 to the Counter input1
- 9. Set the Counter to:

$TI A \rightarrow B$
On
50 Ω
On
50 Ω , negative slope

10. Check the Agilent E8312A width at the following settings:

	Period	Width	Acceptable Range	TR Entry
10	00 μs	50 μs	48.5 μs to 51.5 μs	3 - 7
	0 ms	5 ms	4.85 ms to 515ms	3 - 8
	99 ms	500ms	485 ms to 515 ms	3 - 9

NOTE:

Repeat the entire test for the second channel.

Test 4: Delay

Test Specifications

Range	Fixed typical Delay of EXT INPUT to TRIGGER OUT 12 ns TRIGGER OUT to OUTPUT 1/2 8 ns Variable Delay: 0 ns to (period - 3.03ns)
Resolution Accuracy	3.5 digits, best case 5 ps $\pm 3\%$ ± 0.5 ns typical $\pm 0.5\%$ ± 0.5 ns after selfcal

Equipment Needed

Digitzing Oscilloscope with Accessories Pulse Generator Counter Cable, 50 Ω , coaxial, BNC

Procedure

1.	Connect Agilent E8312A to the Scope as follows:
	- connect a 20 dB Attenuator to Input 3 of the Agilent 54121T
	- connect a 20 dB Attenuator to Input 4 of the Agilent 54121T
	- connect a 20 dB Attenuator to TRIG Input of the Agilent
	54121T
	- connect the TRIG OUT of the Pulse Generator to the TRIG
	Input of the scope
	- connect the OUT 1 of the Pulse Generator to the EXT IN of
	the E8312A
	and

- connect the TRIG OUT of the Agilent E8312A to Input 3 of the scope

- connect the OUT 1 to the Input 4 of the scope
- 2. Set up the Agilent E8312A as described in "Initial Setup of the Agilent E8312A"
- 3. Set the Pulse Generator to:

Period	1 µs
Width	100 ns
Amplitude	1 V
Offset	+1.0 V
Output	Enable

4. Select the [MODE/TRG] screen on the Agilent E8312A and set up as follows:

C Continuous	Pube Type Single Puises	at Dutput 1 💌
C Gated	Single Pulses	at Output 2 💌
C ExtWidth	Pront Soleco	1
	Cent.Edge Plung	<u>.</u>
Pulse Mode	Triggered By External Input	
C Burst	Trigger Slope Rising	*
C Pattern	First D.D.	ST HE
Online with GPI8-V/0	0.16.INSTR (E8312A)	

The TRG MODE Screen Setup

5. On the Agilent E8312A Set up [TRIG-LEV] page as shown:

CLK.IN Theshold 1000 ±V CLK.IN Input Impedance C ECL 1000 ±V 0 10 k0 km C ECL 50 Dhm 50 Dhm Trigger Out VM Trigger Line Strobe Out Source Trigger Enable	EXT-IN Threshold C TTL C ECL C ECL C ECL	EXT-IN Input Impedance C 10 kOhm C 50 Ohm
C TTL C ECL Source Trigger		10 k0hm
Strobe Out	Contraction Contraction	And the second s
	a second state and second state	

The TRG-LEV Screen Setup

6. Set up the Timing as shown in the following illustrations:

Channel 1 Norm Out Inv Out C On C On C Ott C Ott	Channel 2 Norm, Gut Inv. Gut C On C On C Off C Off
	+ n: Width 100.0 + ns + n: Leading Edge 1.600 + ns
1	
1 2 Infine with GPIB-V/00:16:	INSTR (E8312A)

The Timing Screen setup



CHANNEL 1 Norm Dut Inv. Out Polarity C Dri C Dri C Normal C Dti C Dti C Compl	CHANNEL 2 Nom Out Inv Out Polarity C On C On C Norma C Ott C Ott C Comp
Offset 0.000 + V Amplitude 1.000 + V Disput linp	Offset 0.000 + V Anglitude 1.000 + V Output ling +
Level Format Officet-Amplitude Voltage/Current Voltage	Level Format Officet-Amplitude Voltage
C Seconde Dubplia	California (Andre & Classifi I)
Online with GPIB-V/00::16:INSTR (E8	1312A)

The levels screen setup

NOTE: Testing instruments with 2 output channels it is necessary to: a. Configure *both* channels.

b. Switch OFF the channel that is not being tested.

If you then test the other channel:

c. Switch ON the channel your are testing, and switch OFF the other channel.

Set the Digitizing Oscilloscope Agilent 54121T:

- Press <u>AUTOSCALE</u>
- Set timebase to TIME/DIV = 10 ns/div
- Center the positive-going edges of the two signals
- Select the Display menu and set the screen function to single; set the number of averages to 32
- Select the Delta V menu and turn the voltage markers ON and assign marker 1 to channel 3 and marker 2 to channel 4
- Set Preset levels to 50% 50% and press AUTO LEVEL SET
- Select the Delta t menu and turn the time markers ON
- Set START ON EDGE= POS1 and STOP ON EDGE= POS 1
- Press the <u>PRECISE EDGE FIND</u> key
- 7. Check the Agilent E8312A delay at the following settings:

NOTE:

Record the value of the fixed delay and subtract it from the other readings.

Oscilloscope Timebase	Delay	Acceptable Range	TR Entry
10 ns/div 10 ns/div	0 ps without selfcal! 5.000 ns	fixed Delay of TRIG OUT to OUT 1/2: 8 ns typ. 4.35 ns to 5.65 ns	4 - 1 4 - 2
20 ns/div 20 ns/div 50 ns/div 200 ns/div	10.00 ns 50.00 ns 100.0 ns 500.0 ns	9.200 ns to 10.80 ns 48.00 ns to 52.00 ns 96.50 ns to 103.50 ns 484.50 ns to 515.50 ns	4 - 3 4 - 4 4 - 5 4 - 6

- 8. Connect the Agilent E8312A TRIG OUT to the counter INPUT A and E8312A OUTPUT1 to the Counter INPUT B .
- 9. Set the agilent E8312A to **Continuous-Pulses** on the MODE/TRG screen
- 10. Set the Counter to:

FUNCTION TI	$A \rightarrow B$
SENSE	On
INPUT A	50 Ω
INPUT B	50 Ω

11. Check the Agilent E8312A delay at the following settings:

NOTE:

Subtract the fixed delay from the other readings

Period	Delay	Acceptable Range	TR Entry
100 μs	50 μs	48.5 μs to 51.5 μs	4 - 7
10 ms	5 ms	4.85 ms to 515ms	4 - 8
999 ms	500ms	485 ms to 515 ms	4 - 9

NOTE:

Repeat the entire test for the second channel.

Test 5: Double Pulse Delay

Test Specifications

Range	3.030 ns to (period - width - 1.5 ns)
Resolution Accuracy	3.5 digits, best case 5 ps \pm 3% \pm 150 ps typical \pm 0.5% \pm 150 ps after selfcal

Equipment Needed

Digitizing Oscilloscope with Accessories Counter Cable, 50 Ω , coaxial, BNC

Procedure

- 1. Connect Agilent E8312A to the Scope as follows:
 - connect a 6 dB Attenuator to Input 2 of the Agilent 54121T
 connect a 20 dB Attenuator to TRIG Input of the Agilent 54121T
 connect the TRIG OUT of the Agilent E8312A to the TRIG Input

and

- connect the OUT 1/2 to the Input 2 of the scope

2. Set up the Agilent E8312A as described in "Initial Setup of the Agilent E8312A"

3. Select the [MODE/TRG] screen on the Agilent E8312A and set up the Agilent E8312A as follows:

Trigger Mode C Continuous C Triggered C Sisted	Basis Length Double Pulses at Dutput 1 💌 Double Pulses at Dutput 2 💌
C Ext-Width	Period Source Internal Oscillator
Pulse Mode Pulse Steam Pulse Steam Pulse Steam Pulse Mode Pulse Mode	Fieq D 000 Hz
tur Online with GPIB-V	00::16::INSTFI (E8312A)

The Mode/Trg Screen setup



4. Set up the Timing as shown in the following illustrations:

Channel 1 Norm Dut Inv Out © On C On © Dit © Dit	Channel 2 Norm: Dut Inv: Dut C Dn C Dn C Dif C Dif
Delay 3010 + In Width 1.515 + In Leading Edge 800.0 + In Trailing Edge • 10000	Width 1.515 + ns Leading Edge 800.0 + ps
1 2	
fue Online with GPIB-VX00.16:INSTR	I (E8312A)

The Timing Screen setup

Testing instruments with 2 output channels it is necessary to:

- a. Configure *both* channels.
- b. Switch OFF the channel that is not being tested.

If you then test the other channel:

c. Switch ON the channel your are testing, and switch OFF the other channel.

Set the Digitizing Oscilloscope Agilent 54121T:

- Press <u>AUTOSCALE</u>
- Center the double pulse signal
- Select the Display menu and set the Number of Averages to 32
- Select the Delta V menu and turn the Voltage markers On
- Set Preset Levels = 50% -50% and press $\overline{\text{AUTO LEVEL SET}}$
- Select the Delta t menu and turn the Time markers On
- Set START ON EDGE = POS1 and STOP ON EDGE = POS2
- 5. Press the <u>PRECISE EDGE FIND</u> key for each new Double Delay setting
- 6. Check the Agilent E8312A double delay at the following settings:

Oscilloscope Timebase	Double Delay	Acceptable Range	TR Entry
2 ns/div 2 ns/div 10 ns/div 20 ns/div	without selfcal! 3.030 ns 10.00 ns 50.00 ns 100.0 ns	2.7891 ns to 3.2709 ns 9.550 ns to 10.45 ns 48.35 ns to 51.65 ns 96.85 ns to 103.15 ns	5 - 1 5 - 2 5 - 3 5 - 4

Test 6: Jitter

The following tests are required:

- 1. Period Jitter
 - a. Internal Oscillator
 - b. Internal PLL
- 2. Width Jitter
- 3. Delay Jitter

Test 6.1a: Period Jitter, Internal Oscillator

Test Specifications

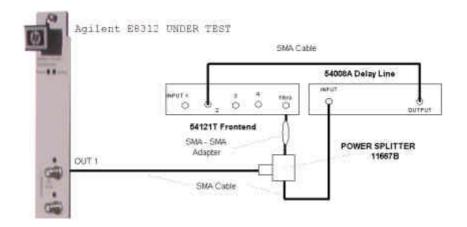
RMS-Jitter 0.01% + 15 ps

Equipment Needed

Digitizing Oscilloscope with Accessories Delay Line (22 ns) Power Splitter Cable, 50 Ω , coaxial, BNC Cable, SMA

Procedure

1. Connect the Agilent E8312A to the Scope as shown:



Equipment Set-up for Jitter Test

2. Set up the Agilent E8312A as described in "Initial Setup of the Agilent E8312A"

3. Set up the Timing as shown in the following illustrations:

Channel 1 Norm Dut Inv Dut © On C On © Dif © Dif	Charinel 2 Norm: Dut Inv: Dut C Dn C Dn C Dlf C Dlf
Delay 0.000 + m Width 25.00 + m Leading Edge 800.0 + ps Trailing Edge - 1000	Delay 0.000 + m Width 25 0 + m Leading Edge 800.0 + m Trailing Edge + 1000 + m
2	

The Timing Screen setup

CHANNEL 1 Norm Out Inv. Out Polarky C Dri C Sn C Normal C Dri C Dri C Compl	CHANNEL 2 Norm: Dut Inv: Out Polarity C On C On C Norma C Off C Off C Congl
Offset 500.0 ± mV Amplitude 1.000 ± V Duppet inco	Other 500.0 ± m Amplitude 1.000 ± V Output Imp
Level Format Offset-Amplitude Voltage/Current Voltage	Level Format Giffset-Amplitude Voltage/Current Voltage
6 Segmen Dirpati	C (Transsocial #1709/00)
UI Online with GPIB-W00:16:INSTR (E8	312A]

The Levels screen setup

NOTE:	Do not change the Amplitude to $>1V$. This may damage the scope!
NOTE:	Testing instruments with 2 output channels it is necessary to:
	a. Configure <i>both</i> channels.b. Switch OFF the channel that is not being tested.
	If you then test the other channel:
	c. Switch ON the channel your are testing, and switch OFF the other channel.
	Set the Digitizing Oscilloscope Agilent 54121T:
	Press <u>AUTOSCALE</u>
	• Select the Display menu and set the Number of Averages to 64
	• Select the Channel menu and set the Attenuation factor of channel 2 to 2
	• Set the VOLTS/DIV of channel 4 to 10 mV/div
	• Set OFFSET to 500 mV
	• Select the Timebase menu and set the TIME/DIV to 100 ps/div
	• Center the first positive-going edge of the signal (approximate Delay = 29ns)
	• Select the Delta V menu and turn the V markers On
	 Set the Marker 1 Position to 490 mV and the Marker 2 Position to 500 mV
	• Select the Delta t menu and turn the T Markers On
	• Set START ON EDGE = POS1 and STOP ON EDGE = POS1
	• Press the <u>PRECISE EDGE FIND</u> key
46	Agilent E8312A Performance Test

- 4. RECORD the delta t reading. This is the rise time of the reference signal within a 1% amplitude window of the signal connected to Input 2. This value is needed later to calculate the correct jitter.(delta.t.up)
- 5. Select the Timebase menu and center the second positivegoing edge of the signal(approximate Delay = 79 ns)

6. Press MORE and HISTOGRAM

- Select the Window submenu and set:
- Source is channel 2
- Choose the Time Histogram
- Press WINDOW MARKER 1 and set it to 490 mV
- Press WINDOW MARKER 2 and set it to 500 mV
- 7. Select the Acquire submenu, set the Number of Samples to 1000 and press <u>START ACQUIRING</u>
- 8. After the data for the time histogram has been acquired (# Samples = 100%), select the Result submenu.
- 9. Press MEAN and SIGMA. RECORD the values of sigma
- 10. The RMS-jitter is calculated as follows:

$$RMS - jitter = \frac{6sigma - delta.t.up}{6}$$

- 11. The RMS-jitter for period of 50 ns is 20 ps. Enter the result in the Test Report as TR entry 6.1a 1 Q
- 12. Set the Agilent E8312A period to 500 ns
- 13. Repeat steps 6 to 11

NOTE:

TIME/DIV = 200 ps/div; approximate Delay = 529 ns 14. The RMS-jitter for period of 500 ns is 65 ps. Enter the result in

the Test Report as TR entry 6.1a - 2

Test 6.1b: Period Jitter, Internal PLL

Test Specifications

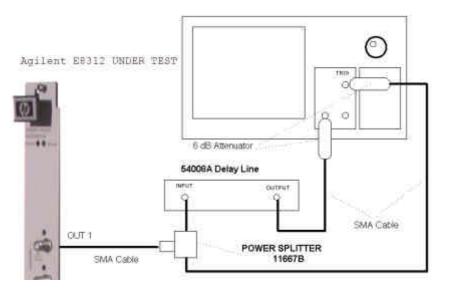
RMS-Jitter 0.001% + 15 ps

Equipment Needed

Digitizing Oscilloscope with Accessories Delay Line (22 ns) Power Splitter Cable, 50 Ω, coaxial, BNC Cable, SMA

Procedure

1. Connect Agilent E8312A to the Scope as shown.



Equipment Set-up for Jitter Test using the Agilent 54750A + 54751A

Using the Agilent 54121T the Set-up is the same as before.

- 2. Set up the Agilent E8312A as described in "Initial Setup of the E8312A"
- 3. Select the [MODE/TRG] screen on the E8312A and set up as follows:

Trigger Mode C Continuous C Triggered C Grated	Pulse Type Single Pulses at Output 1 Single Pulses at Output 2	-
C ExtWidth	Period Source Internal PLL Climit Edge (Plung	•
Pube Mode Fulle Stream Burst Pattern	Fiera D 2000 m Hz	-
UI Online with GPIB-VA	00:16:INSTR (E8312A)	
Carl Contraction (Contraction (Co	and a state of the second of the second of the second second second second second second second second second s	

The TRG MODE Screen Setup

4. Set up the Timing as shown in the following illustrations:

Channel 1 Nom Out Inv Out C On C Olt C Ott	Channel 2 Norm. Du C Dn C Dif	Inv. Out C On C Of
Width 10 Leading Edge 80	200 10 10 10 10 10 10 10 10 10 10 10 10 1	
	/	

The Timing Screen setup

NOTE:

Testing instruments with 2 output channels it is necessary to:

- a. Configure *both* channels.
- b. Switch OFF the channel that is not being tested.

If you then test the other channel:

c. Switch ON the channel your are testing, and switch OFF the other channel.

- 5. Set the Digitizing Oscilloscope Agilent 54121T:
- Press AUTOSCALE
- Select the Display menu and set the Number of Averages to 64
- Select the Channel menu and set the Attenuation factor of channel 2 to 2
- Set the VOLTS/DIV of channel 2 to 10 mV/div
- Set OFFSET to 500 mV
- Select the Timebase menu and set the TIME/DIV to 100 ps/div
- Center the first positive-going edge of the signal (approximate Delay = 29 ns)
- Select the Delta V menu and turn the V markers On
- Set the Marker 1 Position to 490 mV and the Marker 2 Position to 500 mV
- Select the Delta t menu and turn the T Markers On
- Set START ON EDGE = POS1 and STOP ON EDGE = POS1
- Press the PRECISE EDGE FIND key
- 6. RECORD the delta t reading. This is the rise time of the reference signal within a 1% amplitude window of the signal connected to Input 2. This value is needed later to calculate the correct jitter. (delta.t.up)
- 7. Select the Timebase menu and center the second positivegoing edge of the signal (approximate Delay = 49 ns)

8. Press MORE and HISTOGRAM

- Select the Window submenu and set:
- Source is channel 2
- Choose the Time Histogram
- Press WINDOW MARKER 1 and set it to 490 mV
- Press WINDOW MARKER 2 and set it to 500 mV
- 9. Select the Acquire submenu, set the Number of Samples to 1000 and press START ACQUIRING
- 10. After the data for the time histogram has been acquired (# Samples = 100%), select the Result submenu.
- 11. Press MEAN and SIGMA. RECORD the values of sigma
- 12. The RMS-jitter is calculated as follows:

$$RMS - jitter = \frac{6sigma - delta.t.up}{6}$$

13. The RMS-jitter for period of 20 ns is 15.2 ps. Enter the result in the Test Report as TR entry 6.1b - 1 **Q**

NOTE: See the Agilent54750A User's Guide / Service Guide to get the info needed to do the Jitter Test using this scope.

Test 6.2: Width Jitter (PLL not active)

Test Specifications

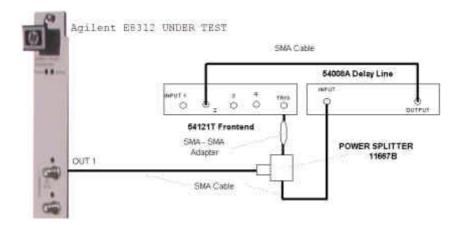
RMS-Jitter 0.01% + 15 ps

Equipment Needed

Digitizing Oscilloscope with Accessories Delay Line (22 ns) Power Splitter Cable, 50 Ω , coaxial, BNC Cable, SMA

Procedure

1. Connect the Agilent E8312A to the Scope as described:



Equipment Set-up for Jitter Test

- 2. Set up the Agilent E8312A as described in "Initial Setup of the E8312A"
- 3. Set up the Timing as shown in the following illustrations:

Channel 1 Norm Dut Inv Dut C On C On C Dif C Off	Channel 2 Norm: Dut Inv. Dut C Dn C Dn C Dif C Dif
Delay 0.000 * m Width 1.515 * n Leading Edge 800.0 * px Trailing Edge 1000.0 * px	Delay 0.000 + ms Width 1515 + ms Leading Edge 800.0 + ms Traing Edge + 1000 + ms
2	
Mult Online with GPIB-V/00:16:INSTR (E	8312A)

The Timing Screen setup

HANNEL 1 Norm Out Inv Dut Polarity © [Dr] C Dr C Normal © Ott C Ott C Compil	CHANNEL 2 Norm Dut Inv Dut Polaitly C Dn C Dn C Normal C Dif C Off C Compl
Offset 500.0 + rW Ampitude 1.000 + V Ougst hep	Clifteet 500.0 + m// Amplitude 1.000 + V Climpat limpt
Lavel Format Offset-Amplitude Voltage/Current Voltage	Level Format Offset-Amplitude
C Deserve Dutara.	🖸 Gurpati ((ddeg2)) Garbat I
Online with GPI8-VXI0:16:INSTR (E83	124)

The Levels Screen setup

NOTE:	Testing instruments with 2 output channels it is necessary to:
	a. Configure <i>both</i> channels.b. Switch OFF the channel that is not being tested.
	If you then test the other channel:
	c. Switch ON the channel your are testing, and switch OFF the other channel.
	Set the Digitizing Oscilloscope Agilent 54121T:
	Press <u>AUTOSCALE</u>
	• Select the Display menu and set the Number of Averages to 128
	• Select the Channel menu and set the Attenuation factor of channel 2 to 2
	• Set the VOLTS/DIV of channel 2 to 10 mV/div
	• Set OFFSET to 500 mV
	• Select the Timebase menu and set the TIME/DIV to 10 ps/div
	• Center the first negative-going edge of the signal (approximate Delay = 33.8 ns)
	• Select the Delta V menu and turn the V markers On
	 Set the Marker 1 Position to 500 mV and the Marker 2 Position to 490 mV

- Select the Delta t menu and turn the T Markers On
- Set START ON EDGE = NEG1 and STOP ON EDGE = NEG1
- Press the <u>PRECISE EDGE FIND</u> key
- 4. RECORD the delta t reading. This is the fall time of the referencesignal within a 1% amplitude window of the signal connected to Input 2. This value isneeded later to calculate the correct jitter. (delta.t.dn)
- 5. Set the Agilent E8312A Pulse Width to 50 ns
- 6. Select the Timebase menu and center the first negative-going edge of the signal (approximate Delay = 80.5 ns)
- 7. Press MORE and HISTOGRAM
- 8. Select the Window submenu and set:
- Source is channel 2
- Choose the Time Histogram
- Press WINDOW MARKER 1 and set it to 500 mV
- Press WINDOW MARKER 2 and set it to 490 mV
- 9. Select the Acquire submenu, set the Number of Samples to 1000 and press <u>START ACQUIRING</u>
- 10. After the data for the time histogram has been acquired (# Samples = 100%), select the Result submenu.
- 11. Press MEAN and SIGMA. RECORD the value of sigma

12. The RMS-jitter is calculated as follows:

 $RMS - jitter = \frac{6 \text{ sigma - delta.t.dn}}{6}$

- 13. The RMS-jitter for pulse width of 50 ns is 20 ps. Enter the result in the Test Report as TR entry 6.2 1 Q
- 14. Set the Agilent E8312A for pulse width of 500ns
- 15. Repeat steps 7 to 13

NOTE: TIME/DIV = 100ps/div. Approximate delay = 530 ns

- 16. The RMS-jitter for pulse width of 500 ns is 65 ps. Enter the result in the Test Report as TR entry 6.2 2
- *NOTE:* Repeat the entire test for the second channel.

Test 6.3: Delay Jitter (PLL not active)

Test Specifications

RMS-Jitter 0.01% + 15 ps

Equipment Needed

Digitizing Oscilloscope with Accessories

Procedure

1. Connect Agilent E8312A to the Scope as follows:

connect a 6 dB Attenuator to Input 2 of the Agilent 54121T
connect a 20 dB Attenuator to TRIG Input of the Agilent 54121T
connect the TRIG OUT of the Agilent E8312A to the TRIG Input and
connect the OUT 1/2 to the Input 2 of the scope

- 2. For calculating the RMS-jitter, the rise time of the reference signal within a 1% amplitude window is required. If this value is not already measured in the Period Jitter test, then perform the first 6 steps of the Period Jitter test.
- 3. Set up the Agilent E8312A as described in "Initial Setup of the E8312A"

4. Set up the Timing as shown in the following illustrations:

Channel 1 Norm. Out Inv. Out G. On C. Dit G. Ott	Channel 2 Nom: Dut Inv. Dut C On C On
Delay 50.00 + m Width 50.00 + nt	Width 50.00 + ns
Leading Edge 800.0 Hps Trailing Edge • 800.0	Leading Edge 800.0 + ps Trailing Edge + 800.0 + ps
2	
Online with GPIB-V/00-16-INSTF	3 (E8312A)

The Timing Screen setup

CHANNEL 1 Norm Dut Inv Oc C On C Off C Off	f Polaity Normal Compl	CHANNEL 2 Nom: Dut Inv. 0 C 0n C 0n C 011 C 011	# Polarity
Officet Ampilitude Dialgoal Imp	500.0 ±m¥ 1.000 ±V -	Offset AmpRude Culput log	500.0 + mV 1.000 + V
Level Format Office Voltage/Current Volta	et Amplituch • nge •	Level Formet Offs Voltage/Current Volt Une / Contern	el-Ampítude 💌
G Licon	në Durjesta	C.Duranta Addet At D	ugal 1
tun Online with GPIE	-VXI0::16:INSTR (E83	12AJ	

The Levels Screen setup

NOTE: Ttesting instruments with 2 output channels it is necessary to: a. Configure *both* channels. b. Switch OFF the channel that is not being tested. If you then test the other channel: c. Switch ON the channel your are testing, and switch OFF the other channel. Set the Digitizing Oscilloscope Agilent 54121T: Press AUTOSCALE Select the Display menu and set the Number of Averages to 64 Set the VOLTS/DIV = 10 mV/divSet OFFSET to 500 mV Select the Timebase menu and set the TIME/DIV to 100 ps/div Center the first positive-going edge of the signal (approximate Delay = 64 ns) 5. Press MORE and HISTOGRAM 6. Select the Window submenu and press <u>WINDOW MARKER</u> $\underline{1}$ and set it to 490 mV 7. Press WINDOW MARKER 2 and set it to 500 mV 8. Select the Acquire submenu, set the Number of Samples to 1000 and press START ACQUIRING 9. After the delta for the time histogram has been acquired (#

- After the delta for the time histogram has been acquired (# Samples = 100%), select the Result submenu.
- 10. Press MEAN and SIGMA. RECORD the values of sigma!
- 11. The RMS-jitter is calculated as follows:

$$RMS - jitter = \frac{6sigma - delta.t.up}{6}$$

- 12. The RMS-jitter for delay of 50 ns is 20 ps. Enter the result in the Test Report as TR entry 6.3 1
- 13. Set Agilent E8312A for delay of 500 ns
- 14. Repeat steps 9 to 12

NOTE:

TIME/DIV = 100 ps/div. Approximate delay = 514 ns

15. The RMS jitter for delay of 500 ns is 65 ps. Enter the result in the Test Report as TR entry 6.3 - 2 Q

NOTE:

Repeat the entire test for the second channel.

Test 7: High and Low Levels

The following tests are required:

- 1. High level from 50Ω into 50Ω
- 2. Low level from 50Ω into 50Ω

Test Specifications

	Load Impedance 50 Ω
Source Impedance	50 Ω
High Level	-1.900 V to +3.8 V
Low Level	-2.0 V to +3.7 V
Amplitude	0.100 Vpp to 3.8 Vpp
Level Resolution	10 mV
Level Accuracy	$\pm 2\%$ of ampl $\pm 50 \ mV$

Equipment Needed

- 1. Digitizing Voltmeter (DVM)
- 2. 50 Ω Feedthrough Termination, 0.1%, 10 W Adapter.
- 3. BNC to dual banana plug (Agilent 1251-2277)
- 4. Cable, 50 Ω , coaxial, BNC

Procedure

- 1. Connect Agilent E8312A to the DVM as follows:
 - connect the OUT1 /2 to the 50 Ohm Feedthrough Terminator and via a BNC dual banana plug to the DVM Input

Test 7.1: High Level, 50 Ohms into 50 Ohms

- 1. Set up the Agilent E8312A as described in "Initial Setup of the E8312A"
- 2. Set up the Timing as shown in the following illustrations:

C On C	o Gua On Olf	C On C	nv Out On 5 Oil
Delay Width Leading Edge Trailing Edge •	25.00 + ma 50.00 + ma 800.0 + pt 800.0 + pt	Delay Width Leading Edge Trailing Edge •	10 C
1			
dut Online with GP	18-V/00:16:INSTR (E8	312AJ	

The Timing Screen setup



CHANNEL 1 Norm Dut Inv. Out Polarity C Dri C Dri C Normal C Dti C Dti C Compl	CHANNEL 2 Nom Out Inv Out Polarity C On C On C Norm C Ott C Ott C Comp
High 3 800 ↔ V Low 0 000 ↔ V Dizpot ling:	High 3.800 ↔ V Low 0.000 ↔ V Output linp
Level Format High-Low Voltage/Current Voltage	Level Format High-Low Voltage/Current Voltage
🧟 Séconite Diripita	🕿 i di asolo Anderi A Chastel I
Crime with GPIB-VX00::16::INSTR (E8	(312A)

The Levels Screen setup

NOTE:

Testing instruments with 2 output channels it is necessary to:

a.Configure *both* channels.b. Switch OFF the channel that is not being tested

If you then test the other channel:

c.Switch ON the channel you are testing, and switch OFF the other channel.

3. Set the DVM Agilent 3458A to:

Function:DCVTrigger:TRIG EXTAD-Converter integration time NPLC:0.1(Number of Power Line Cycles)

4. Check the agilent E8312A high level at the following high level settings with the low level set to 0.0 V.

High Level	Acceptable Range	TR Entry
3.80 V	3.678 V to 3.922 V	7.1 - 1
1.0 V	0.93 V to 1.07 V	7.1 - 2
0.5 V	440 mV to 560 mV	7.1 - 3
0.1 V	48 mV to 152 mV	7.1 - 4

The low level may vary within $\pm 2\%$ of amplitude $\pm 50 \text{ mV}$

Test 7.2: Low Level, 50 Ohms into 50 Ohms

- 1. Set up the Agilent E8312A as described in "Initial Setup of the Agilent E8312A"
- 2. Set up The Timing as shown in the following illustrations:



Channel 1 Nom Out Inv Out C On C Ott C Ott	Channel 2 Norm. Dut Inv. Dut C On C On C Ott C Ott
Oelay 75.00 + ma Width 50.00 + ma Leading Edge 800.0 + ma Trailing Edge 800.0 + ma	Delay 75.00 + ms Width 50.00 + ms Leading Edge 800.0 + ms Trailing Edge + 100 + ms
1	
Multi Online with GPIB-V/00::16::INSTR	(E8312A)

The Timing Screen setup

CHANNEL 1 Norm Out Inv. Out Polarity C Dri C Dri C Normal C Dif C Dri C Compl.	CHANNEL 2 Norm, Gut Inv. Gut Polarity C Dn C Bri C Norm C Dtt C Ott C Comp
High 0.000 + V Low 100.0 + reV Disput ling	High 0.000 + V Low 100.0 + W Output lep
Level Format High-Low Voltage/Current Voltage	Level Former High-Low Voltage Used Connerse
🧟 Seconde Diapola	🐔 Classify Added A Classifi I
Online with GPIB-V/00:16:INSTR (E8	312AJ

The Levels Screen setup

NOTE: Testing instruments with 2 output channels it is necessary to:

a. Configure *both* channels.

b. Switch OFF the channel that is not being tested

If you then test the other channel:

c. Switch ON the channel you are testing, and switch OFF the other channel.

3. Check the Agilent E8312A low level at the following low level settings with the high level set to 0.0 V

Low Level	Acceptable Range	TR Entry
-0.1 V	-48 mV to -152 mV	7.2 - 1
-0.5 V	-440 mV to -560 mV	7.2 - 2
-1.0 V	-0.93 V to -1.07 V	7.2 - 3
-2.00 V	-1.910 V to -2.090 V	7.2 - 4

The high level 0.0 V may vary $\pm 2\%$ of amplitude ± 50 mV.

NOTE:

Repeat the High and Low Level tests for the second channel.

Test 8: Transition Time

Test Specifications

Range	0.8 ns OR 1 (measured betw	.6 ns een 10% and 90% of amplitude)
Minimum Transitions	\leq 600 ps for \sim \leq 900 ps for \sim (typical 450 ps f measured between	Vpp > 1 V
Accuracy	± 10%	$\pm 200 \text{ ps}$

Equipment Needed

Digitizing Oscilloscope with Accessories Cable, SMA

Procedure

Perform the tests as shown in the following sections:

Test 8.1a: Leading Edge Test

Minimum Leading Edge and Leading Edge ranges .

1. Connect Agilent E8312A to the Scope as follows:

connect a 20 dB Attenuator to Input 2 of the Agilent 54121T
connect a 20 dB Attenuator to TRIG Input of the Agilent 54121T
connect the TRIG OUT of the Agilent E8312A to the TRIG Input and
connect the OUT 1/2 to the Input 2 of the scope

NOTE:

When you connect the test equipment the first time, and whenever you change the setup during the following tests, use the torque wrench (8170-1582) to tighten and loosen the SMA connectors. This will ensure that the connectors are at the correct tightness and give the best signal transfer!

2. Set up the Agilent E8312A as described in "Initial Setup of the Agilent E8312A"

3. Set up The Timing as shown in the following illustrations:

Channel 1 Norm Out inv Out © On © Out © Ott	Channel 2 Norm. Dut Inv. Out On COn COn COn
Delay 0.000 + m Width 250.0 + us Leading Edge 800.0 + p	Width 250.0 + + + us Leading Edge 800.0 + + + pa
Trailing Edge + 2000 - ;=	Traing Edge + 1 8880 - 19
Unline with GPIB-V/00::16:INSTF	1 (58)124)

The Timing Screen setup



Nom Out Inv. Out C Ion C On C On C On	Polarity Norm Gut © Normal C Dn C Compl © Ott	Inv Out Polarity C On C Nor C Off C Con
100 m	000 V Offeer 800 V Anpitude Cutper Imp	0.000 ± 3.800 ±
Level Format Ottoet-Amp Voltage/Current Voltage	Audi T Level Form Voltage/Cu	nent Voltage
C Seconde Du	optia 🥌 🗗 Li Licente	Wederlât Charach I
UP Online with GPIB-V/00.	16::INSTR (E8312A)	

The Levels Screen setup

NOTE:

Testing instruments with 2 output channels it is necessary to:

a. Configure *both* channels.

b. Switch OFF the channel that is not being tested

If you then test the other channel:

- c. Switch ON the channel you are testing, and switch OFF the other channel.
- 4. Set the Digitizing Oscilloscope Agilent 54121T:
- Press <u>AUTOSCALE</u>
- Center one pulse on screen, e.g.:
- TIME/DIV = 50 μ s/div, DELAY = 380 μ s,
- Select the Display menu and set the Number of Averages to 32
- Select the Channel menu and set the Attenuation factor to 10
- Select the Delta V menu and turn the voltage markers On
- Set the Preset Levels = 10-90% and press <u>AUTO LEVEL SET</u>
- Select the Timebase menu and set TIME/DIV = 1 ns/div, DELAY = 19.5 ns
- Select the Delta t menu and turn the markers On
- Set START ON EDGE = POS1 and STOP ON EDGE = POS1
- 5. Set period of E8312A to: Period = 1 μ s and change the E8312A Delay to center the leading edge of the first pulse on the screen
- 6. After the averaging, while the oscilloscope is in the Delta t menu, Press the <u>PRECISE EDGE FIND</u> key

Oscilloscope TIME/	Period	Leading	Trailing	Acceptable	TR
DIV		Edge	Edge	Range	Entry
1 ns/div	1 μs	0.8 ns	0.8 ns	540 ps to 1.080 ns	8.1a - 1
1 ns/div	1 μs	1.6 ns	1.6 ns	1.240 ns to 1.960 ns	8.1a - 2

7. Check the Agilent E8312A rise times at the following leading edge settings:

Test 8.1b: Trailing Edge Test

Minimum Trailing Edge and Trailing Edge range.

- 1. Connect E8312A to the Scope as shown in Test 8.1a Leading Edge Test.
- 2. Set up the E8312A as described in Test 8.1a Leading Edge Test.

NOTE: Ttesting instruments with 2 output channels it is necessary to:

- a. Configure *both* channels.
- b. Switch OFF the channel that is not being tested

If you then test the other channel:

c. Switch ON the channel you are testing, and switch OFF the other channel.

- 3. Set the digitizing oscilloscope Agilent 54121T:
- Select the oscilloscopes Timebase menu and set TIME/DIV to 1 ns/ div

and DELAY to approximately 510 ns

- Select the oscilloscopes Delta t menu and set START ON EDGE = NEG1 and STOP ON EDGE = NEG1
- 4. While the oscilloscope is in the Delta t menu, press the <u>PRE-</u> <u>CISE EDGE FIND</u> key
- 5. Check the E8312A output signal falls at the following trailing edge settings:

1		1	1				1
	Oscilloscope TIME/DIV	Delay	Period	Trailing Edge	Leading Edge	Acceptable Range	TR Entry
	1 ns/div 1 ns/div	529 ns 529 ns	1 μs 1 μs	0.8 ns 1.6 ns	0.8 ns 1.6 ns	540 ps to 1.080 ns 1.240 ns to 1.960 ns	8.1b - 1 8.1b - 2

Test 9: Pulse Aberration Test

The following tests are required:

Overshoot and Ringing Preshoot

Test Specifications

Overshoot/Preshoot/Ringing \pm 5% of amplitude \pm 50 mV

Equipment Needed

Digitizing Oscilloscope with Accessories

Procedure

1. Connect Agilent E8312A to the Scope as follows:

connect a 20 dB Attenuator to Input 2 of the Agilent 54121T
connect a 20 dB Attenuator to TRIG Input of the Agilent 54121T
connect the TRIG OUT of the Agilent E8312A to the TRIG Input and
connect the OUT 1/2 to the Input 2 of the scope

Set up the Agilent E8312A as as shown:



Channel 1 Norm Dut Inv Du C Din C Dn C Dil C Dit	<i>i</i>	Channel 2 Norm. Dut Inv. 0 C On C Or C Ott C Ot	1
Delay Width Leading Edge Trailing Edge +	0 000 + tw 250.0 + us 800.0 + ps	Delay Width Leading Edge Trailing Edge +	0.000 + ns 250.0 + us 800.0 + ps
1			
Status Online with GPIB-V	X10::16:INSTR (E831	2A)	

The Timing Screen setup

CHANNEL 1 Norm Dut Inv. Out Polarity C Dn C Normal C Dil C Dn C Compl.	CHANNEL 2 Norm. Gut Inv. Gut Polarity C Dn C Dri C Norm C Dtt C Ott C Comp
Offset 0 000 ± V Amplitude 3 800 ± V Durped legs -	Diffeet 0.000 + V Anglitude 3.800 + V Output lep
Level Format Ottoet-Ampilude Voltage Voltage	Level Format Offset-Amplitude
C Seconde Dispyta	Collector (del Acland)
UI Online with GPIB-V/00.16:INSTR (E8	312A)

The Levels Screen setup

NOTE:

Ttesting instruments with 2 output channels it is necessary to:

- a. Configure *both* channels.
- b. Switch OFF the channel that is not being tested

If you then test the other channel:

c. Switch ON the channel you are testing, and switch OFF the other channel.

Overshoot and Ringing

- 2. Set the digitizing oscilloscope Agilent 54121T:
- Press <u>AUTOSCALE</u>
- Select the Display menu and set the Number of Averages to 32
- Select the Channel menu and set the Attenuation factor to 10
- Center one pulse horizontally and vertically on screen
- (e.g. TIME/DIV = $50\mu s/div$, DELAY = $250 \mu s$)
- Select the delta V menu and turn the voltage markers On
- Set the VARIABLE LEVELS = 95% 105% and press AUTO LEVEL SET
- Select the channel menu and center vertically the top pulse (offset = 5 V)
- Set the VOLTS/DIV = 200 mV/div
- Select the Timebase menu and set TIME/DIV = 5 ns/div, DELAY = 16 ns (>> 500 ns)
- 3. Set the E8312A to period = 500 ns
- 4. Check that Overshoot and Ringing are within the $\pm 5\%$ of amplitude ± 20 mV window
- 5. Enter the result in the Test Report as TR entry 9 1 \mathbf{Q}

NOTE: Take the oscilloscope's trace flatness error (GaAs input circuit) into account.

Preshoot

- 6. Set E8312A to:
- Period = $500 \,\mu s$
- High Level = 3.8 V
- Low Level = 0 V
- Delay = 10 ns
- 7. Set the digitizing oscilloscope, Agilent 54121T:

Press <u>AUTOSCALE</u>

- Select the Display menu and set the Number of Averages to 32
- Select the Channel menu and set the Attenuation factor to 10
- Center one pulse horizontally and vertically on screen
- (e.g. TIME/DIV = $50\mu s/div$, DELAY = $265 \mu s$)
- Select the delta V menu and turn the voltage markers On
- Set the VARIABLE LEVELS = -5% to +5% and press AUTO LEVEL SET
- Select the channel menu and center vertically the bottom of the pulse (offset = 0 V)
- Set the VOLTS/DIV = 200 mV/div
- Select the Timebase menu and set TIME/DIV = 5 ns/div, DELAY = 16 ns
- 8. Set E8312A to period = 500 ns

- 9. Check that Preshoot is within the $\pm 5\%$ of amplitude ± 20 mV window.
- 10. Enter the result in the Test Report as TR entry 9 3 \mathbf{Q}

Agilent E8312A Performance Test Records

Test Facility:	
	Report No.
	Date
	Tested By
X	
Model E8312A MH	Iz Pulse Generator
Serial No.	
Ontions	Ambient temperature °C
Options	• • • • • • • • • • • • • • • • •
	Kelative number%
Firmware Rev.	Line frequencyHz
Special Notes:	

Test Equipment Used Description Date	Model No.	Trace No.	Cal. Due
1. Oscilloscope	Agilent 54121T		
2. Counter	Agilent 5334B		
3. Digital Voltmeter	Agilent 3458A		
4. Pulse Generator	Agilent 8110A		
5. Delay Line	Agilent 54008A		
б			
7			
8			
9			
10			
11			
12			
13			
14			

Test Results for E8312A Mainframe

Serial No.	Ambient temperature	 °C
Customer	Relative humidity	 %
CSO#	Line frequency	 Hz
Tested by	Date	
Comments		

Internal Oscillator Period

Scope Uncertainty factor

TR Entry	Test	Limit Min	Actual Result	Limit Max	Pass	Fail
1-1	3.03ns	2.9391 ns		3.1209 ns		
1-2	6.06ns	5.878 ns		6.242 ns		
1-3	10.0ns	9.7 ns		10.3 ns		
1-4	50.0ns	48.5 ns		51.5 ns		
1-5	99.9ns	96.903 ns		102.897 ns		

TR Entry	Test	Limit Min	Actual Result	Limit Max	Pass	Fail
1-6	100 ns	97.0ns		103.0 ns		
1-7	500 ns	485.0 ns		515.0 ns		
Q 1-8	1 µs	970.0 ns		1030.0 ns		
1-9	5 00µs	485 µs		5 15 µs		
1-10	500 ms	485 ms		515 ms		

Counter Uncertainty factor

PLL Period (Results measured as frequency by counter)

Counter Uncertainty factor

			Actual Result		Pass	Fail
2-1	3.03 ns	329.9670M	Hz	_ 330.0330	MHz _	
2-2	10.00 ns	99.990M	Hz	_ 100.010 N	/IHz	
2-3	50.00 ns	19.9980M	Hz	_ 20.0020N	/IHz	
2-4	100 ns	9.9990M	Hz	_ 10.0010M	IHz	
2-5	500 ns	1.9998M	Hz	_ 2.0002M	Hz	
Q 2-6	1 µs	999.9 kH	[z	1.0001 N	MHz _	
2-7	50 µs	19.998 kl	Hz	_ 20.002 1	KHz _	
2-8	5 ms	199.98 I	Hz	200.02 H	-Iz	
2-9	500 ms	1.9998	Hz	2.0002 H	Hz _	
2-10	5 s	0.19998 I	Hz	0.20002	Hz	

Period Jitter

Scope Uncertainty factor

TR Entry	y Test	Limit Min	Actual Result	Limit Max	Pass Fail
Q 6.1a-1	50 ns			20 ps	
6.1a-2	500 ns			65 ps	
Q 6.1b-1	20 ns			15.2 ps	

Test Results for Agilent E8312A Output Channel _____

Width

Scope Uncertainty factor

TR Ent	try Test		Actual Result		Pass	Fail
3-1	1.515 ns	1.22455 ns		1.80545 ns		
3-2	6.06ns 5	5.528 ns		_ 6.492 ns		
3-3	10.0 ns	9.450ns		_ 10.550 ns		
3-4	50.0 ns	48.25 ns		51.75 ns		
3-5	100 ns 9	96.75 ns		103.25 ns		
3-6	500 ns	484.75 ns		_ 515.25 ns		
3-7	50 µs - 4	48.5 μs _		_ 51.5 μs		
3-8	5 ms 4.	.85 ms		5.15 ms		
3-9	500 ms	485 ms		_ 515 ms		

Width Jitter

Scope Uncertainty factor

TR Entry	Test	Limit Min	Actual Result	Limit Max	Pass	Fail
6.2-1	50 ns	-		20 ps		
6.2-2	500 ns	-		65 ps		

Delay

Scope Uncertainty factor

TR Ent	ry Test	Limit Min	Actual Result		Pass	Fail
4-1	0.00 ns			Fixed Delay		
4-2	5.00 ns	4.35 ns		5.65 ns		
4-3	10 ns 9	9.20 ns		10.80 ns		
4-4	50.0 ns	48.0 ns		52.0 ns		
4-5	100 ns 96	5.5 ns		103.5 ns		
4-6	500 ns 48	4.5 ns _		_ 515.5 ns		
4-7	50 µs 🗸	48.5 μs		51.5 μs		
4-8	5 ms 4	.85 ms		_ 5.15 ms		
4-9	500 ms 4	85 ms _		515 ms		

Delay Jitter

Scope Uncertainty factor

TR Entry	Test	Limit Min	Actual Result	Limit Max	Pass	Fail
6.3-1	50 ns	-		20 ps		
6.3-2	500 ns	-		65 ps		

Double Pulse Delay

Scope Uncertainty factor

TR Entry	Test	Limit Min	Actual Result		Pass	Fail
5-1	3.03 ns	2.7891 ns		_ 3.2709 ns		
5-2	10.0 ns	9.550 ns		_ 10.45 ns		
5-3	50.0ns	48.35 ns		_ 51.65 ns		
5-4	100ns	96.85 ns		103.15 ns		
Counter V						
TR Entry	Test	Limit Min	Actual Result	Limit Max	Pass	Fail
5-5	500 ms	485 ms		515 ms		
5-6	1 s	970.0 ms		1030.0 ms		

High Level 50Ω - 50Ω

TR Entry	Test	Limit Min	Actual Result	Limit Max	Pass	Fail
7.1-1	3.8 V	3.674 V		3.926 V		
7.1-2	1.0 V	0.93 V		1.07 V		
7.1-3	0.5 V	440 mV		560 mV		
7.1-4	0.1 V	48 mV		152 mV		

Low Level 50Ω - 50Ω

TR Entry	y Test	Limit Min	Actual Result	Limit Max	Pass	Fail
7.2-1	-0.1 V	-48 mV		152 mV		
7.2-2	-0.5 V	-440 mV		560 mV		
7.2-3	-1.0 V	-0.93 V		1.07 V		
7.2-4	-2.0V	-1.91 V		2.09 V		

Leading Edge

Scope Uncertainty factor

TR Entry	Test	Limit Min	Actual Result		Pass Fail
8.1a-1	0.8 ns	540 ps _		_ 1.08 ns	
8.1a-2	1.6 ns	1.24 ns		_ 1.96 ns	

Trailing Edge

TR Entr	y Test		Actual Result	Limit Max	Pass Fail
8.1b-1	0.8 ns	540 ps		_ 1.08 ns	
8.1b-2	1.6 ns	1.24 ns		1.96 ns	

Overshoot and Ringing

Scope Uncertainty factor

TR E	ntry Test	Limit Min	Actual Result	Limit Max	Pass	Fail
9-1	3.8V			<u>+</u> 5% of ampl <u>+</u> 50mV		
9-2	500 mV	-		_ <u>+</u> 5% of ampl. <u>+</u> 50mV		

Preshoot

TR Entry	Test	Limit Min	Actual Result	Limit Max	Pass	Fail
9-3	0 V			_ <u>+</u> 5% of ampl <u>+</u> 50mV	·	

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