# Agilent 81110A/’11A Performance Test

# Introduction

Use the tests in this chapter if you want to check that the Agilent 81110A Pulse Generator Frame with the Agilent 81111A 165 MHz Output Channel(s) is working correctly. Before starting any testing allow all test equipment to warm up for at least 30 minutes.

## Conventions Used

When referring to actions that you perform during the tests, the following conventions are used:

FUNCTION This indicates that a labelled button must be pressed

[**MODE/TRG**] This shows that a soft-key must be pressed. A soft-key is an unlabelled button whose label is shown on the display, and which can vary according to the job that the button is doing

**CONTINUOUS PULSES** This is an option shown on the display, and is selected by use of the vernier keys. It is shown in upper or lower case to match the case displayed.

## 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<br>or | Agilent 54121T | 20 GHz, 10 bit vertical resolution, Histogram |
| Oscilloscope | Agilent 54750A +<br>Agilent 54751A | 20 GHz, 15 bit vertical resolution, Histogram |
| Counter<br><br>or | Agilent 5334B<br>#010, 030 | Period and Time Interval measurements<br>Oven Osci, 1.3 GHz C-Channel |
| Counter | Agilent 53132A<br>#001/010, 030 | Frequency measurements > 150 MHz<br>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 |

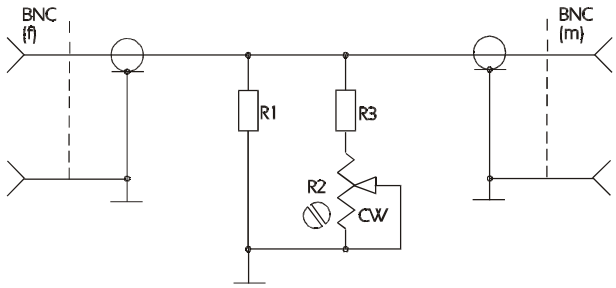
| Accessories | Model | Critical Specifications |
|---|---|---|
| Digitizing Oscilloscopes Accessories<br>Attenuators<br><br>Power Splitter<br>SMA/SMA (m-m)Adapter<br>SMA/BNC Adapter<br>SMA Cable | <br>33340C#020<br>33340C#006<br>11667B<br>1250-1159<br>1250-1700<br>8120-4948 | <br>20 dB<br>6 dB |

| Accessories | Model | Critical Specifications |
|---|---|---|
| 50 Ω Feedthrough Termination | 10100C<br>**See Figure** | 2 W,1%<br>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

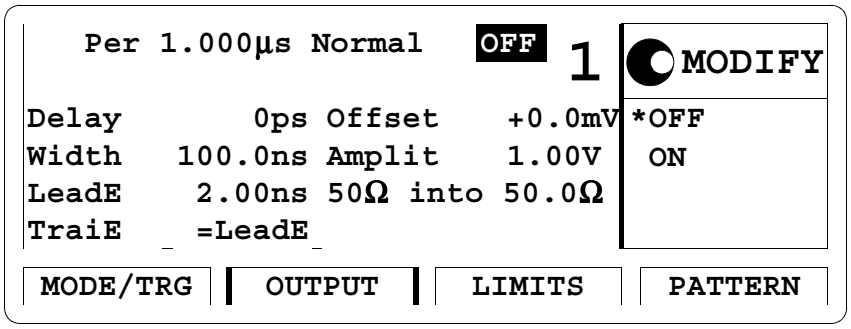
The following parts are required:

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

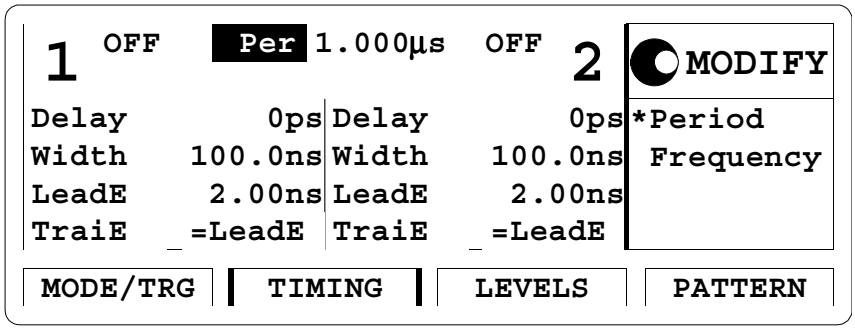
## Getting Started

The Agilent 81110A is controlled by selecting options in a series of **pages** that are displayed on the instrument's screen. These options vary with the boards that are fitted in the instrument. When the Agilent 81110A is being tested, therefore, different situations can arise, depending on whether you have a standard instrument or one that has had additional boards fitted. The following examples illustrate this

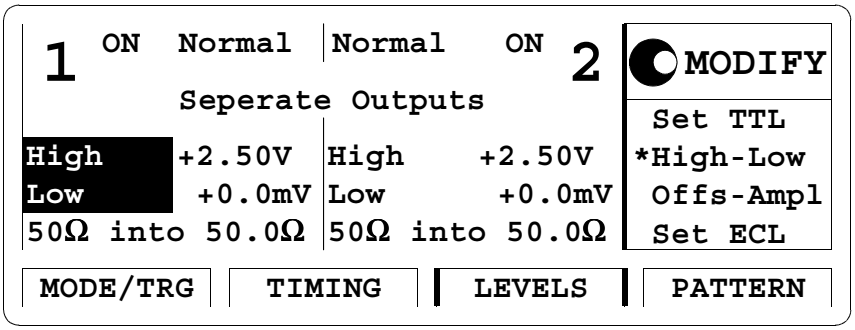
### Typical Examples of Displayed Screens




The OUTPUT Screen in a Standard Agilent 81110A




The TIMING Screen in an Agilent 81110A with qty 2 of Agilent 81111A




The LEVELS Screen in an Agilent 81110A with qty 2 of Agilent 81111A

## Instrument Serial Numbers

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

Press HELP, [**SERIAL #**]

The Agilent 81110A display lists the instrument's products and serial number.

The display on your instrument should look similar to this:

**FRAME : 81110A 165 MHz**

**Serial No : DE38700135**

**OUTPUTS**

**Ch1-Bd. : 81111A**

**Ch2-Bd. : 81111A**

The serial number given for the **FRAME** applies to the Mainframe, the Power Supply, the Microprocessor Board, and the Timing Board. The number(s) available of the Output Channel(s) applies to the installed numbers of outputs and Model Number.

## Initial Setup of the Agilent 81110A

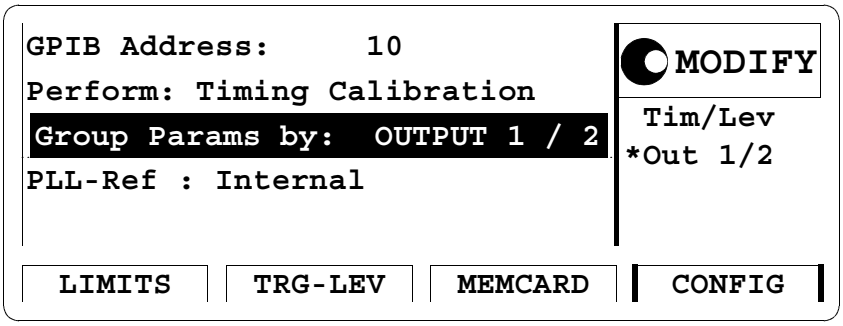
In the majority of these tests the initial setting up of the instrument is identical. Therefore, it is described once here, and then referred-to where appropriate. In cases where the initial setup differs, an illustration of the settings is shown.

Set up the Agilent 81110A as follows:

1. Select [**MODE/TRG**]

- **CONTINUOUS PULSES**
- **Single-Pulses at Out 1** (plus **Single-Pulses at Out 2**, if second channel is installed
- **Pulse-Period:internal Osc**

2. If a second output channel is installed, select MORE [**CONFIG**] screen and set up as follows:




CONFIG Screen, Parameters grouped by OUTPUT

***NOTE:*** Set-ups are given in all the tests for [**OUTPUT 1**] and [**OUTPUT 2**]. If you are testing a single channel instrument set up the [**OUTPUT**] screen with the settings given for [**OUTPUT 1**].

# Test 1: Period (PLL not active)

## Test Specifications

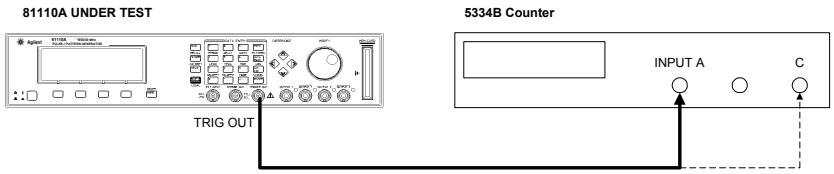
| | |
|---|---|
| Range | 6.06 ns to 999.5 s |
| Resolution | 3.5 digits, best case 5 ps |
| Accuracy | ±3% |
| | typical ±0.5% after selfcal |

## Equipment Needed

Counter
Cable, 50 Ω, coaxial, BNC

## Procedure

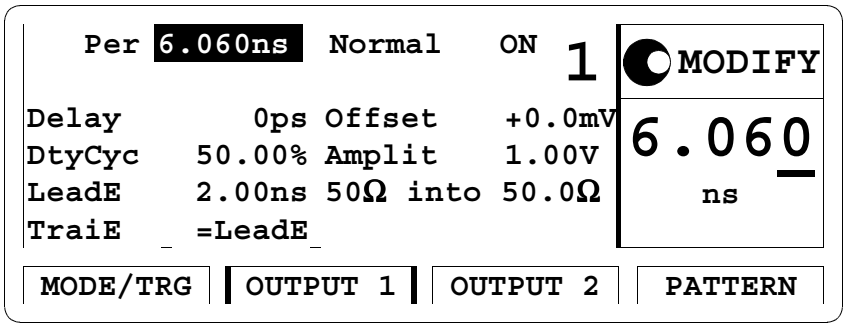
1. Connect the Agilent 81110A to the Counter as shown:



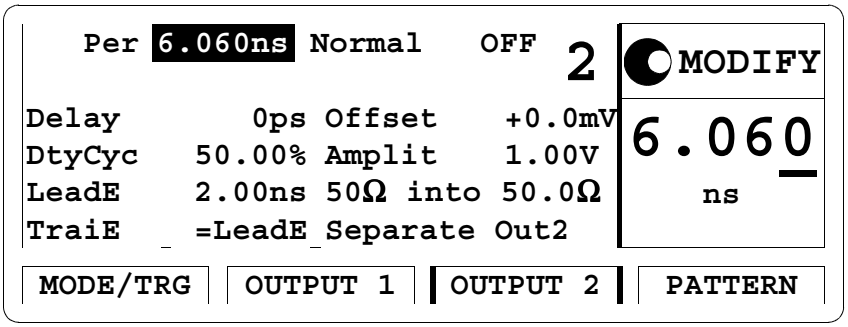

Connecting the Agilent 81110A to the Counter

2. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

On the Agilent 81110A press MORE and set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output 1




Configuring Output 2

***NOTE:*** When you are 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.

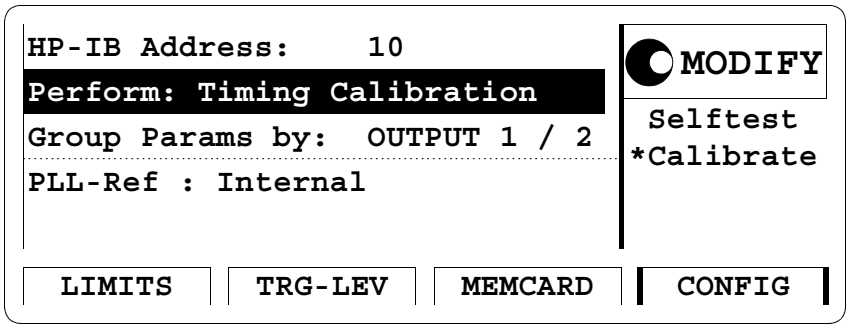
3. Set the Counter to:

| | |
|---|---|
| FUNCTION | Period A / **Freq C** |
| INPUT A | 50 Ω |
| SENSE | On |

4. Check the Agilent 81110A period at the following settings:

| Period | Acceptable Range | TR entry |
|---|---|---|
| | *without selfcal!* | |
| **6.060 ns** | **5.878 ns to 6.242 ns** | 1 - 1 |
| **9.990 ns** | **9.690 ns to 10.290 ns** | 1 - 2 |
| 10.00 ns | 9.7 ns to 10.3 ns | 1 - 3 |
| 50.00 ns | 48.5 ns to 51.5 ns | 1 - 4 |
| 99.90 ns | 96.903 ns to 102.897 ns | 1 - 5 |
| 100 ns | 97 ns to 103 ns | 1 - 6 |
| 500 ns | 485 ns to 515 ns | 1 - 7 |
| 1 µs | 970 ns to 1030 ns | 1 - 8 |
| 500 µs | 485µs to 515 µs | 1 - 9 |
| 500 ms | 485 ms to 515 ms | 1 - 10 |

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




6. Press ENTER and wait till the display shows
   TIMING CALIBRATION PASSED
   and gets back to the above shown display .

## Test 2: PLL Period

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

**Test Specifications**

| | |
|---|---|
| Range | 6.06 ns to 999.5 s |
| Resolution | 3.5 digits, best case 5 ps |
| Accuracy | ± 0.01% |

**Equipment Needed**

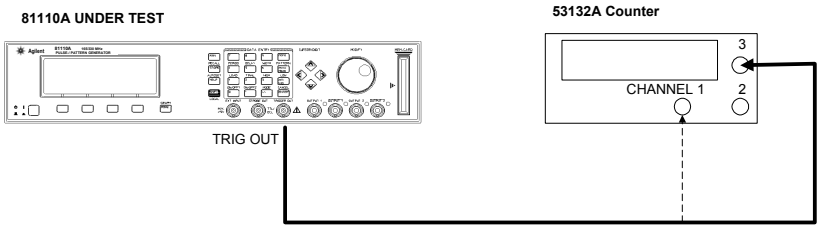
Counter Agilent 53132A

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**

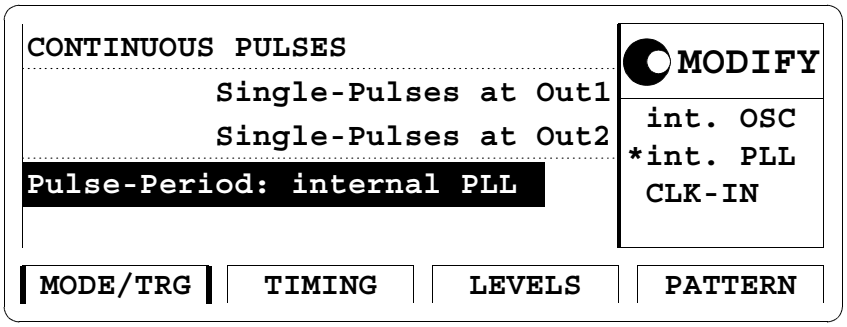
Connect the Agilent 81110A to the counter as follows:




Connecting Agilent 81110A to the Counter

7. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

8. Select the [**MODE/TRG**] screen on the Agilent 81110A and set up as follows:




The MODE/TRG Screen Setup

9. On the Agilent 81110A set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the test before!

***NOTE:*** When you are 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.

10. Set the Counter to measure the frequency at the choosen input 1 / 3

11. Check the Agilent 81110A PLL pulse period at the following settings:

| Period | Frequency | Acceptable Range | TR Entry |
|---|---|---|---|
| 6.061 ns | 165.000MHz | 164.9835 MHz to 165.0165 MHz | 2 - 1 |
| 10.00 ns | 100 MHz | 99.990 MHz to 100.010 MHz | 2 - 2 |
| 50.00 ns | 20 MHz | 19.9980 MHz to 20.0020 MHz | 2 - 3 |
| 100 ns | 10 MHz | 9.9990 MHz to 10.0010 MHz | 2 - 4 |
| 500 ns | 2 MHz | 1.9998 MHz to 2.0002 MHz | 2 - 5 |
| 1 µs | 1 MHz | 999.9 kHz to 1.0001 MHz | 2 - 6 |
| 50 µs | 20 kHz\| | 9.998 kHz to 20.002 kHz | 2 - 7 |
| 5 ms | 200 Hz | 199.980 Hz to 200.020 Hz | 2 - 8 |
| 500 ms | 2 Hz | 1.9998 Hz to 2.0002 Hz | 2 - 9 |
| 5 s | 0.2 Hz | 0.19998 Hz to 0.20002 Hz | 2 - 10 |

# Test 3: Width

## Test Specifications

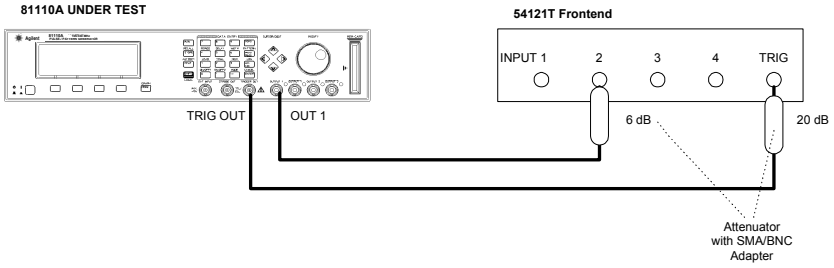
| | |
|---|---|
| Range | 3.03 ns to (period - 3.03 ns) |
| Resolution | 3.5 digits, best case 5 ps |
| Accuracy | ± 3% ± 250 ps |
| | typical ± 0.5% ± 250 ps after selfcal |

## Equipment Needed

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

## Procedure

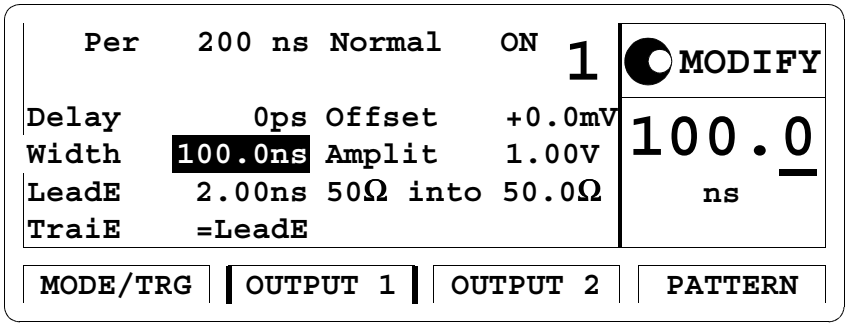
1. Connect Agilent 81110A to the Scope as shown:



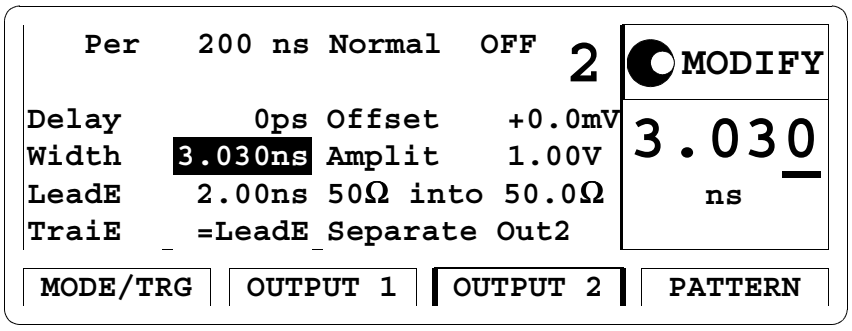

Connecting Agilent 81110A to the Scope

2. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

3. On the Agilent 81110A press MORE and set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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.

4. 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
- 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

5. Change the oscilloscope timebase to 1 ns/div

6. Change the Agilent 81110A Ch-1 Width to 3.03 ns

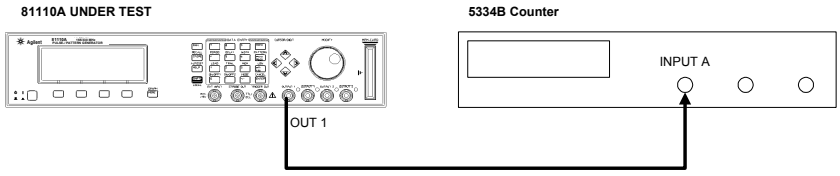
7. Center the pulse in the Scope display

8. Press the PRECISE EDGE FIND key for each new Width setting

9. Check the Agilent 81110A pulse width at the following settings:

| Oscilloscope Timebase | Period | Width | Acceptable Range | TR Entry |
|---|---|---|---|---|
| | | *without selfcal!* | | |
| 1 ns/div | 200 ns | 3.030 ns | 2.689 ns to 3.371 ns | 3 - 1 |
| 1 ns/div | 200 ns | 6.060 ns | 5.528 ns to 6.492 ns | 3 - 2 |
| 2 ns/div | 200 ns | 10.00 ns | 9.450 ns to 10.55 ns | 3 - 3 |
| 10 ns/div | 200 ns | 50.00 ns | 48.25 ns to 51.75 ns | 3 - 4 |
| 20 ns/ | 1 µs | 100.0 ns | 96.75 ns to 103.25 ns | 3 - 5 |
| 100 ns | 1 µs | 500.0 ns | 484.75 ns to 515.25 ns | 3 - 6 |

10. Connect the Agilent 81110A to the Counter as shown:




Connecting Agilent 81110A to the Counter

11. Set the Counter to:

| | |
|---|---|
| FUNCTION | TI A→ B |
| SENSE | On |
| INPUT A | 50 Ω |
| COM A | On |
| INPUT B | 50 Ω, negative slope |

12. Check the Agilent 81110A width at the following settings:

| Period | Width | Acceptable Range | TR Entry |
|---|---|---|---|
| 100 µs<br>10 ms<br>999 ms | 50 µs<br>5 ms<br>500ms | 48.5 µs to 51.5 µs<br>4.85 ms to 515ms<br>485 ms to 515 ms | 3 - 7<br>3 - 8<br>3 - 9 |

***NOTE:*** Repeat the entire test for the second channel, if it is installed

# Test 4: Delay

## Test Specifications

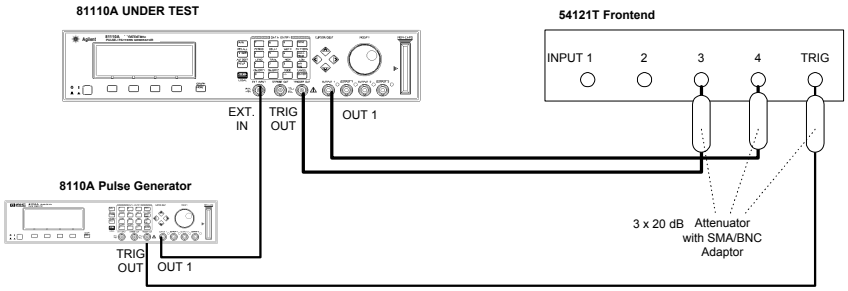
| | |
|---|---|
| Range | Fixed typical Delay of<br>EXT INPUT to TRIGGER OUT 12 ns<br>TRIGGER OUT to OUTPUT 1/2 14 ns<br>Variable Delay:<br>0 ns to period - 3.03ns |
| Resolution | 3.5 digits, best case 5 ps |
| Accuracy | ±3% ±0.5 ns<br>typical ±0.5% ±0.5 ns after selfcal |

## Equipment Needed

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

## Procedure

Connect Agilent 81110A to the Scope as shown:



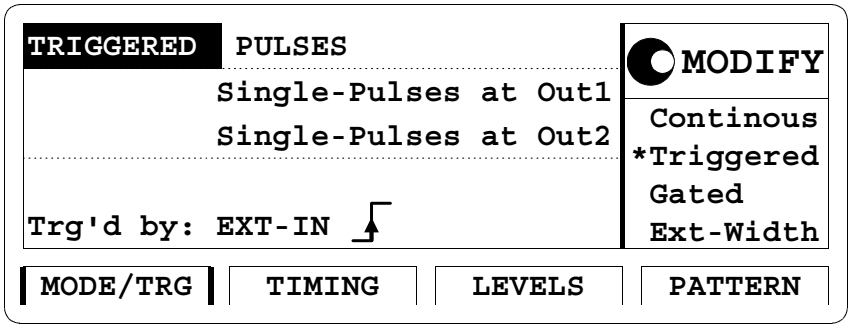

Connecting Agilent 81110A to the Scope

13. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

14. Set the Pulse Generator to:

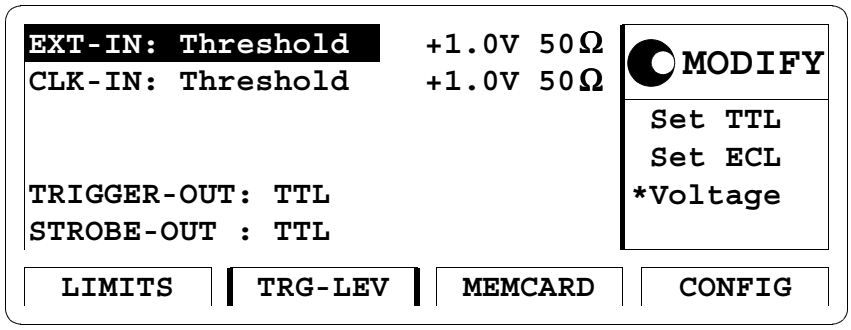
| | |
|---|---|
| Period | 1 µs |
| Width | 100 ns |
| Amplitude | 1 V |
| Offset | +1.0 V |
| Output | Enable |

15. Select the [**MODE/TRG**] screen on the Agilent 81110A and set up as follows:



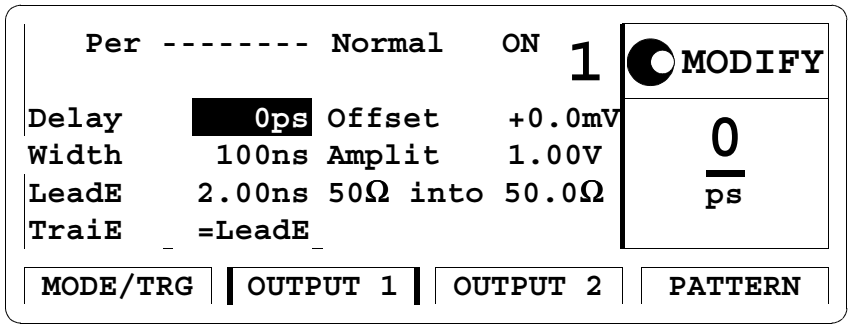

The TRG MODE Screen Setup

16. On the Agilent 81110A press MORE and set up [TRIG-LEV] page as shown:

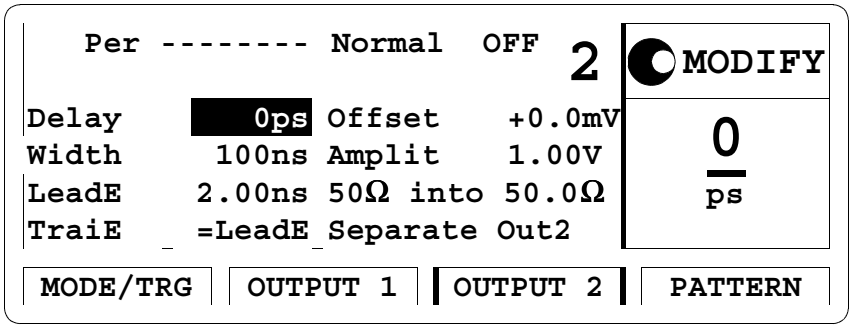



The TRG-LEV Screen Setup

17. On the Agilent 81110A set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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:

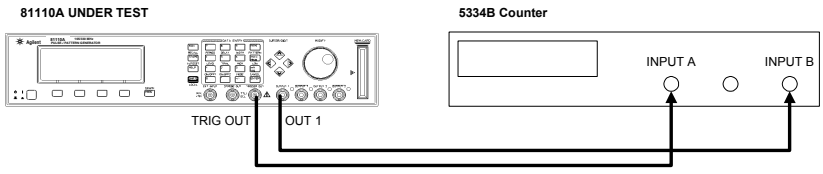
- Press AUTOSCALE
- Set timebase to TIME/DIV = 10 ns/div
- Center the positive-going edges of the two signals
- Select the Display menu and set the screen function to single; set the number of averages to 32
- Select the Delta V menu and turn the voltage markers ON and assign marker 1 to channel 3 and 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 PRECISE EDGE FIND key

18. Check the Agilent 81110A 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 | 0 ps<br><br>*without selfcal!* | fixed Delay of TRIG OUT to OUT 1/2:<br>14 ns typ. | <br>4 - 1 |
| 10 ns/div | 5.000 ns | 4.35 ns to 5.65 ns | 4 - 2 |
| 20 ns/div | 10.00 ns | 9.200 ns to 10.80 ns | 4 - 3 |
| 20 ns/div | 50.00 ns | 48.00 ns to 52.00 ns | 4 - 4 |
| 50 ns/div | 100.0 ns | 96.50 ns to 103.50 ns | 4 - 5 |
| 200 ns/div | 500.0 ns | 484.50 ns to 515.50 ns | 4 - 6 |

19. Connect the Agilent 81110A to the Counter as follows:




Connecting Agilent 81110A to the Counter

20. Set Agilent 81110A to **`Continuous-Pulses`** on the MODE/TRG screen

21. Set the Counter to:

| | |
|---|---|
| FUNCTION TI | A → B |
| SENSE | On |
| INPUT A | 50 Ω |
| INPUT B | 50 Ω |

22. Check the Agilent 81110A delay at the following settings:

***NOTE:*** Subtract the fixed delay from the other readings

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

***NOTE:*** Repeat the entire test for the second channel, if it is installed.

# Test 5: Double Pulse Delay

## Test Specifications

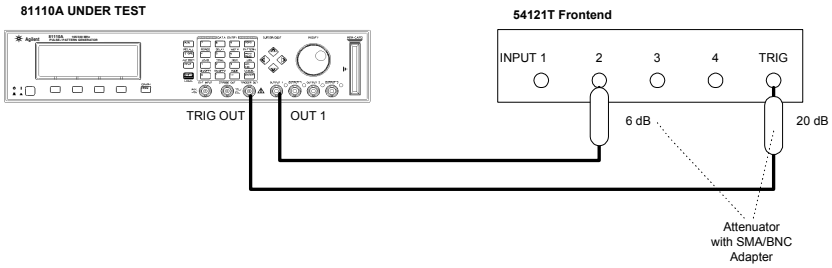
| | |
|---|---|
| Range | 6.06 ns to<br>(period - width - 3.03 ns) |
| Resolution | 3.5 digits, best case 5 ps |
| Accuracy | ± 3% ± 150 ps<br>typical ± 0.5% ± 150 ps |

## Equipment Needed

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

## Procedure

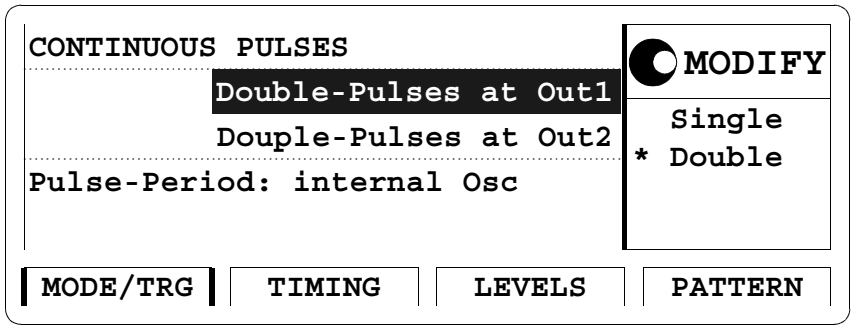
1. Connect Agilent 81110A to the Scope as shown:




Connecting Agilent 81110A to the Scope

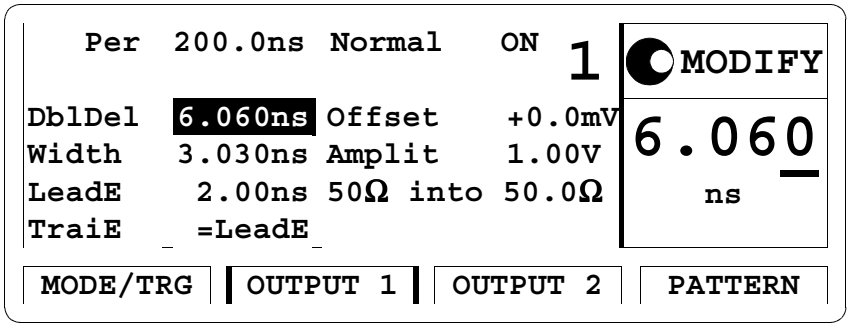
2. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

3. Select the [MODE/TRG] screen on the Agilent 81110A and set up Output 1 and Output 2 as follows:

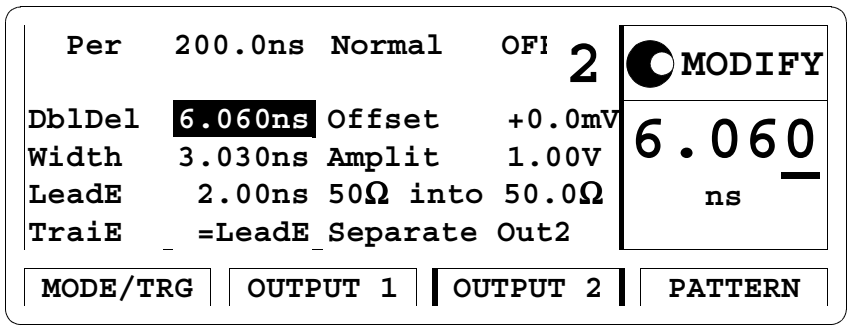



The MODE/TRG Screen Setup

4. On the Agilent 81110A set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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:

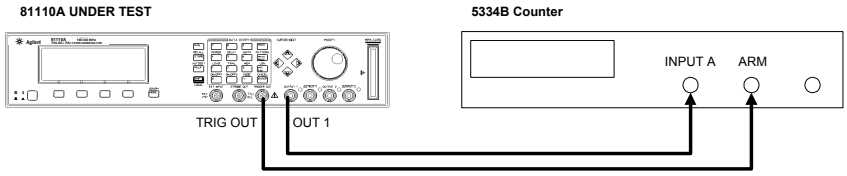
- Press AUTOSCALE
- Center the double pulse signal
- Select the Display menu and set the Number of Averages to 32
- Select the Delta V menu and turn the Voltage markers On
- Set Preset Levels = 50% -50% and press AUTO LEVEL SET
- Select the Delta t menu and turn the Time markers On
- Set START ON EDGE = POS1 and STOP ON EDGE = POS2

5. Press the PRECISE EDGE FIND key for each new Double Delay setting

6. Check the Agilent 81110A double delay at the following settings:

| Oscilloscope Timebase | Double Delay | Acceptable Range | TR Entry |
|---|---|---|---|
| | *without selfcal!* | | |
| 2 ns/div | 6.060 ns | 5.628 ns to 6.392 ns | 5 - 1 |
| 2 ns/div | 10.00 ns | 9.550 ns to 10.45 ns | 5 - 2 |
| 10 ns/div | 50.00 ns | 48.35 ns to 51.65 ns | 5 - 3 |
| 20 ns/div | 100.0 ns | 96.85 ns to 103.15 ns | 5 - 4 |

7. Connect the Agilent 81110A to the Counter as shown:



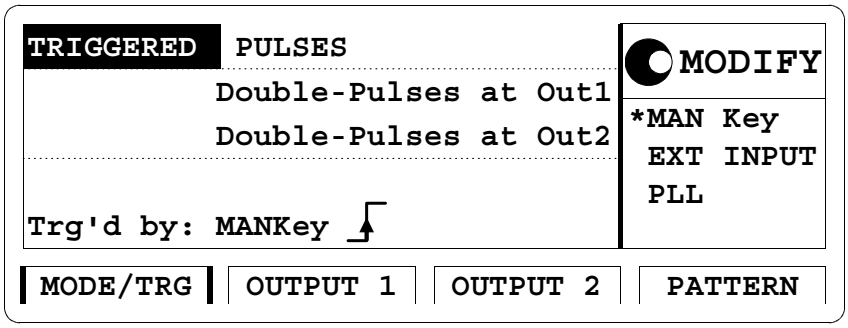

Connecting Agilent 81110A to the Counter

8. Set the Counter to:

| | |
|---|---|
| FUNCTION | Period A |
| INPUT A | 50 Ω |
| SENSE | On |
| ( EXT ARM | |
| SELECT | a. Start (ST): leading edge |
| | b. Stop (SP): trailing edge ) |

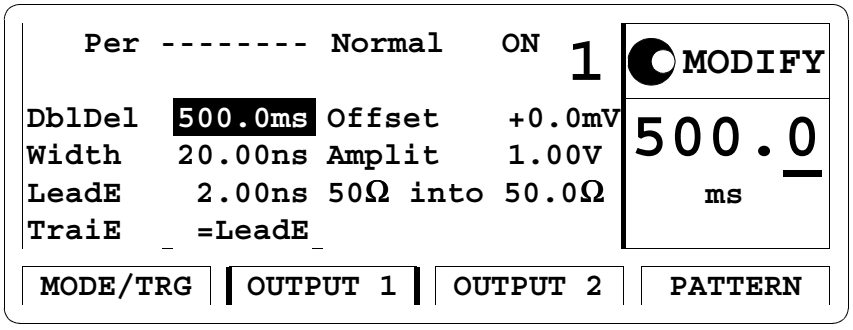
9. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

10. Select the[MODE/TRG]screen on the Agilent 81110A and set up as follows;

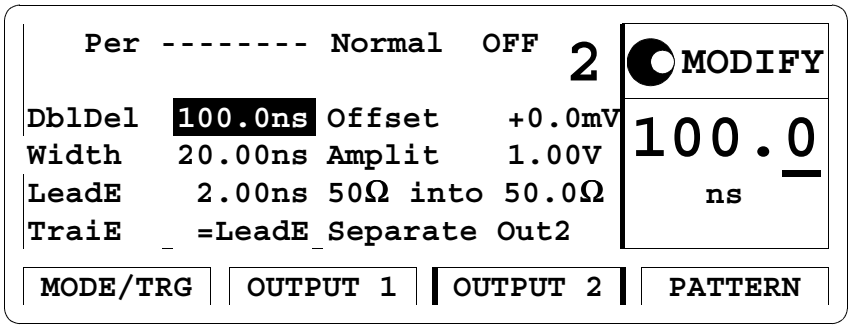



The MODE/TRG Screen Setup

11. On the Agilent 81110A set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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.

12. Check the Agilent 81110A double pulse delay at the following settings:

    Press MAN to check each new setting!

| Double Delay | Acceptable Range | TR Entry |
|---|---|---|
| *after selfcal!* | | |
| 500 ms | 485 ms to 515 ms | 5 - 5 |
| 1 s | 970.00 ms to 1030.00 ms | 5 - 6 |

***NOTE:*** Repeat the entire test for the second channel, if it is installed.

## 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**

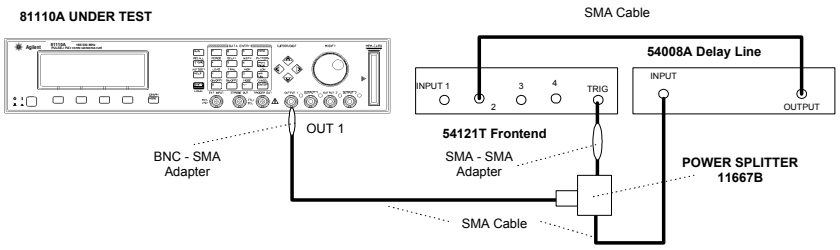
RMS-Jitter 0.01% + 15 ps

**Equipment Needed**

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

**Procedure**

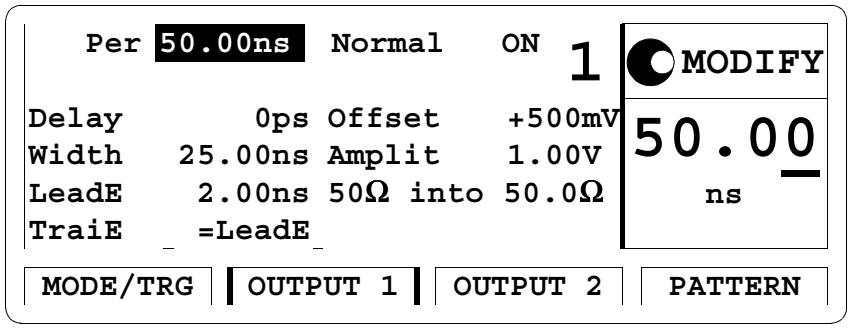
1. Connect Agilent 81110A to the Scope as shown:



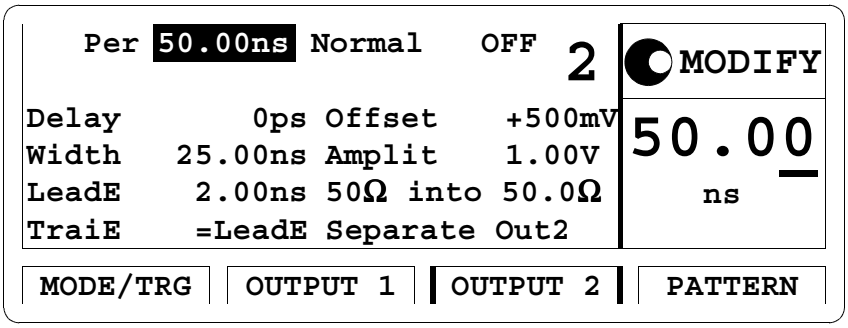

Equipment Set-up for Jitter Test

2. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

3. On the Agilent 81110A set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** Do not change the Amplitude to >1V. This may damage the scope!

***NOTE:*** When you are 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 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 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 PRECISE EDGE FIND key

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 positive-going 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 START ACQUIRING

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:

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

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

12. Set the Agilent 81110A 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

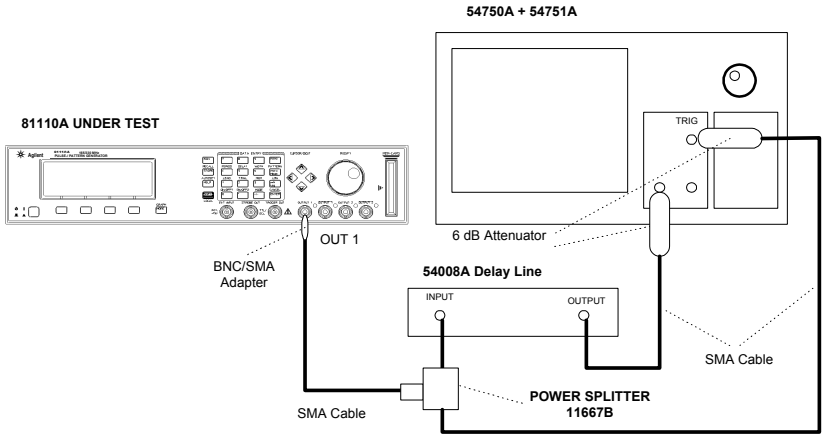
RMS-Jitter 0.001% + 15 ps

### Equipment Needed

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

### Procedure

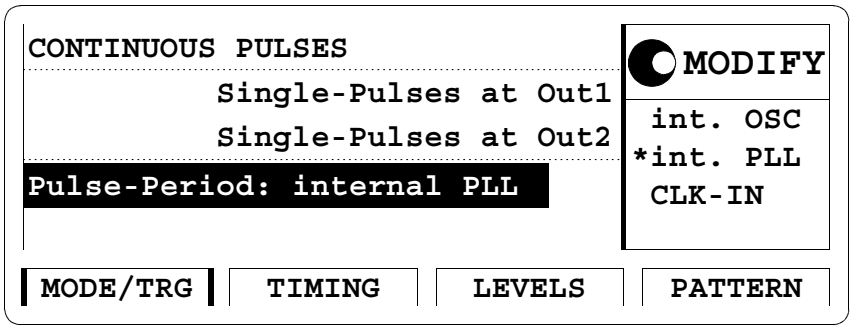
1. Connect Agilent 81110A to the Scope as shown.




Equipment Set-up for Jitter Test using the Agilent 54750A + 54751A
Using the Agilent 54121T the Set-up is the same as before.

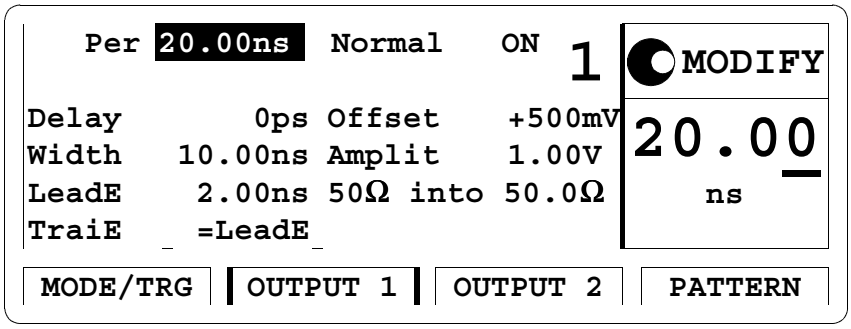
2. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

3. Select the [MODE/TRG] screen on the Agilent 81110A and set up as follows:

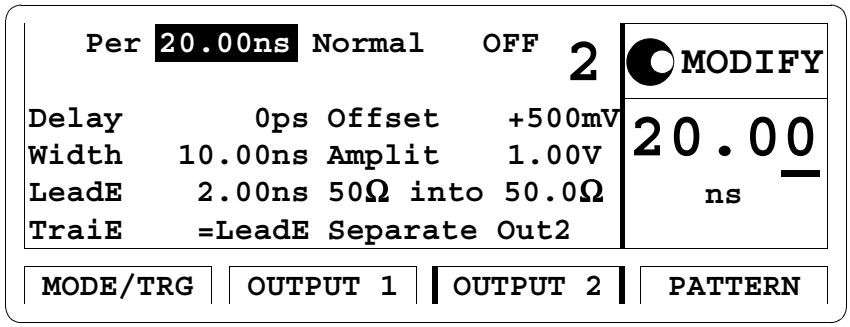



The TRG MODE Screen Setup

4. On the Agilent 81110A set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:



Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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 positive-going 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:

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

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

***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 (PPL not active)

**Test Specifications**

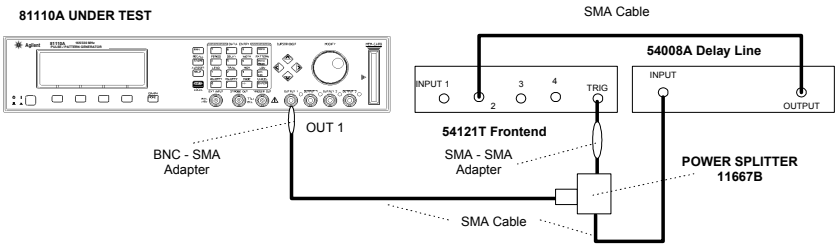
RMS-Jitter 0.01% + 15 ps

**Equipment Needed**

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

**Procedure**

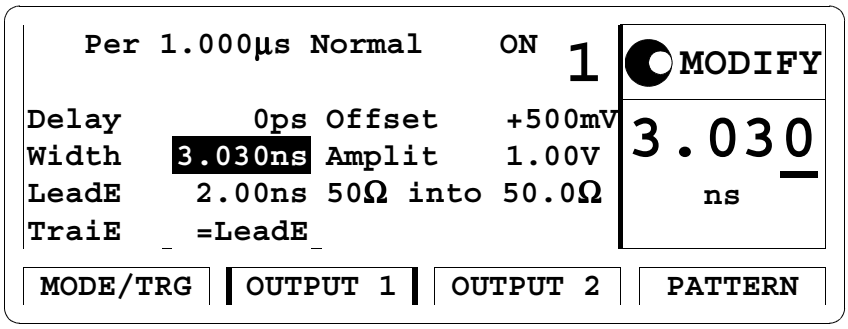
1. Connect Agilent 81110A to the Scope as shown:



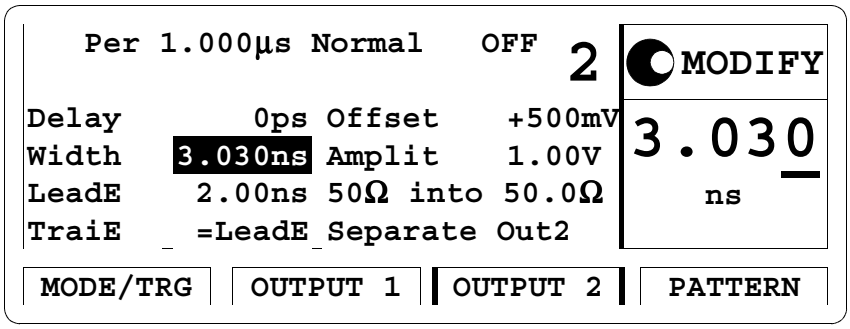

Equipment Set-up for Jitter Test

2. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

3. On the Agilent 81110A set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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 AUTOSCALE
- 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 PRECISE EDGE FIND 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 81110A 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 4
- 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 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 value of sigma

12. The RMS-jitter is calculated as follows:

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

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

14. Set the Agilent 81110A 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

17. Repeat steps 1. to 17. for **Width Jitter - PLL active**.

**Test Specifications**

RMS-Jitter 0.001% + 15 ps

18. Enter the results in the Test Report as TR entry 6.2a - 1 and TR entry 6.2a - 2
    The RMS-jitter for pulse width of 50 ns is 15.5 ps
    The RMS-jitter for pulse width of 500 ns is 20 ps

***NOTE:*** Repeat the entire test for the second channel, if it is installed.

## Test 6.3: Delay Jitter (PLL not active)

### Test Specifications

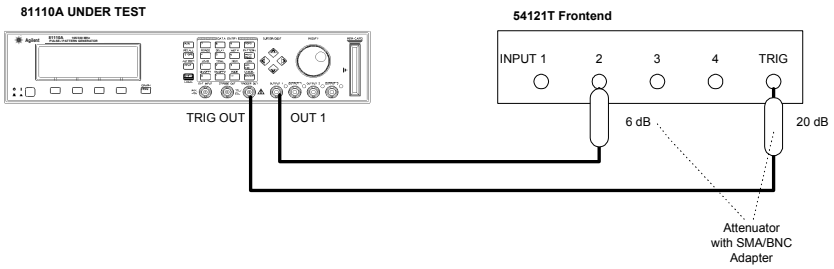
RMS-Jitter 0.01% + 15 ps

### Equipment Needed

Digitizing Oscilloscope with Accessories

### Procedure

1. Connect Agilent 81110A to the Scope as shown:



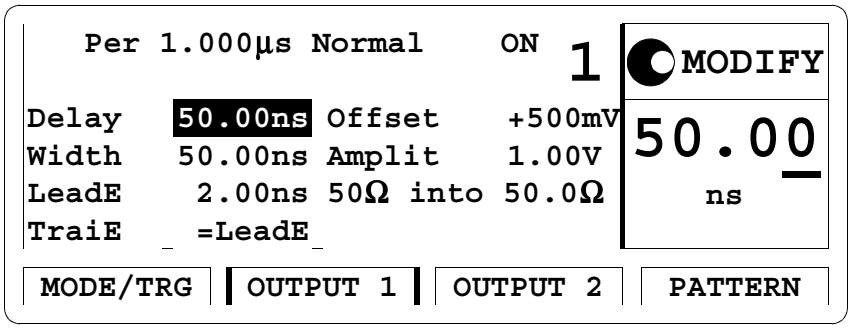

Equipment Set-up for Delay Jitter Test

2. For calculating the RMS-jitter, the rise time of the reference signal within a 1% amplitude window is required. If this value

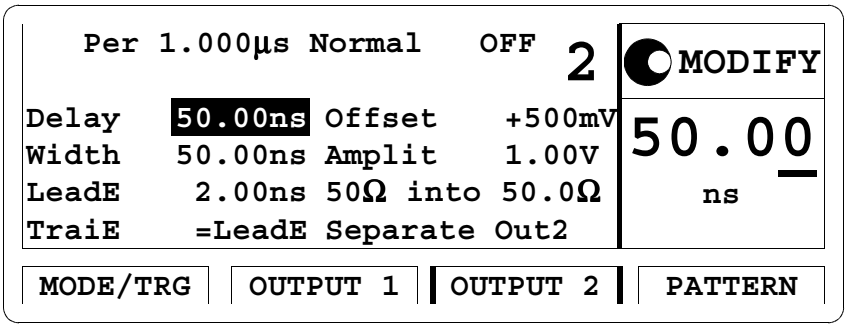
is not already measured in the Period Jitter test, then perform the first 6 steps of the Period Jitter test.

3. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

4. On the Agilent 81110A press MORE and set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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 AUTOSCALE
- Select the Display menu and set the Number of Averages to 64
- Set the VOLTS/DIV = 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 = 64 ns)

5. Press MORE and HISTOGRAM
6. Select the Window submenu and press WINDOW MARKER 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 (# Samples = 100%), select the Result submenu.
10. Press MEAN and SIGMA. RECORD the values of sigma!
11. The RMS-jitter is calculated as follows:

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

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 81110A for delay of 500 ns
14. Repeat steps 9 to 12

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

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

16. Repeat steps 1. to 16 . for **Delay Jitter - PLL active**.

**Test Specifications**

RMS-Jitter 0.001% + 15 ps

17. Enter the results in the Test Report as TR entry 6.3a - 1 and TR entry 6.3a - 2
    The RMS-jitter for pulse width of 50 ns is 15.5 ps
    The RMS-jitter for pulse width of 500 ns is 20 ps

***NOTE:*** Repeat the entire test for the second channel, if it is installed.

## 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
3. High level from 1KΩ into 50Ω
4. Low level from 1KΩ into 50Ω

### Test Specifications

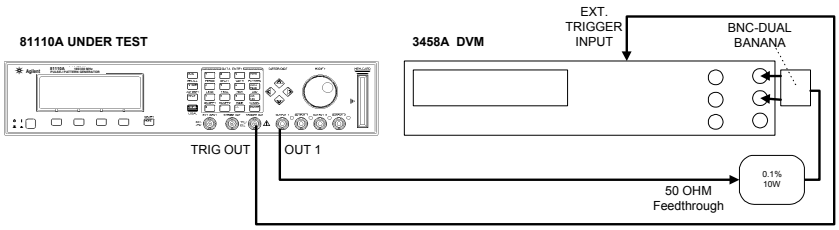
| | Load Impedance 50 Ω | |
|---|---|---|
| Source Impedance | 50 Ω | 1 KΩ |
| High Level | -9.90 V to +10.0 V | -19.8 V to +20.0 V |
| Low Level | -10.0 V to +9.9 V | -20.0 V to +19.8 V |
| Amplitude | 0.10 Vpp to 10.0 Vpp | 0.20 Vpp to 20.0 Vpp |
| Level Resolution | 10 mV | 20 mV |
| Level Accuracy | ± 1% of ampl ± 50 mV | ± 1% of ampl ± 100 mV for amlitude ≤ 19V |

### Equipment Needed

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

### Procedure

Connect Agilent 81110A to the DVM as shown:

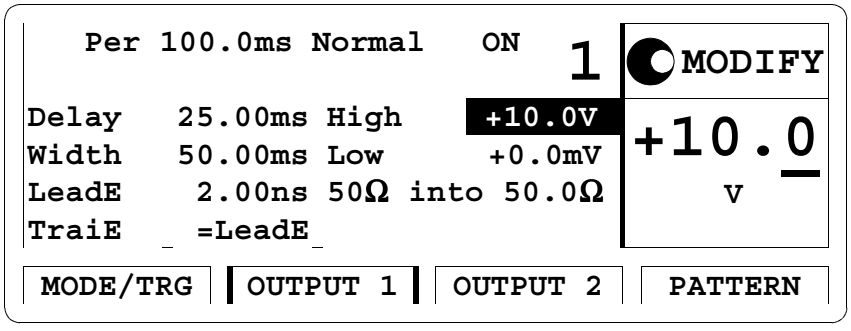



Connecting the DVM for High and Low Levels Tests

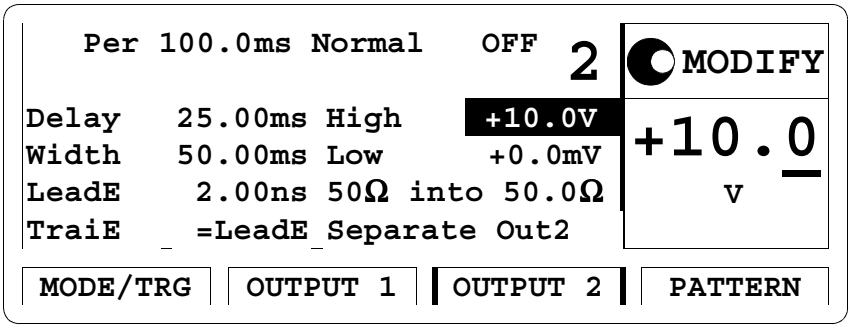
### Test 7.1: High Level, 50 Ohms into 50 Ohms

1. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

2. On the Agilent 81110A press MORE and set up [**OUTPUT 1**] and [**OUTPUT 2**] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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: DCV
Trigger: TRIG EXT
AD-Converter integration time NPLC: 0.1
(Number of Power Line Cycles)

4. Check the Agilent 81110A high level at the following high level settings with the low level set to 0.0 V.

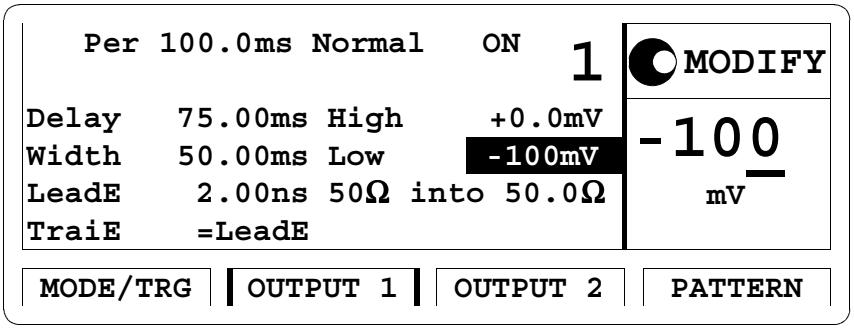
| High Level | Acceptable Range | TR Entry |
|---|---|---|
| 10.0 V | 9.85 V to 10.15 V | 7.1 - 1 |
| 5.0 V | 4.90 V to 5.10 V | 7.1 - 2 |
| 3.0 V | 2.92 V to 3.08 V | 7.1 - 3 |
| 1.0 V | 0.94 V to 1.06 V | 7.1 - 4 |
| 0.5 V | 445 mV to 555 mV | 7.1 - 5 |
| 0.1 V | 49 mV to 151 mV | 7.1 - 6 |

The low level may vary within ± 1% of amplitude± 50 mV

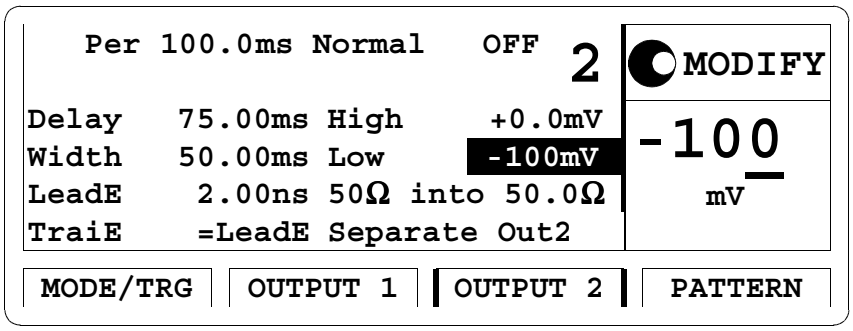
**Test 7.2: Low Level, 50 Ohms into 50 Ohms**

1. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

2. On the Agilent 81110A press MORE and set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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.

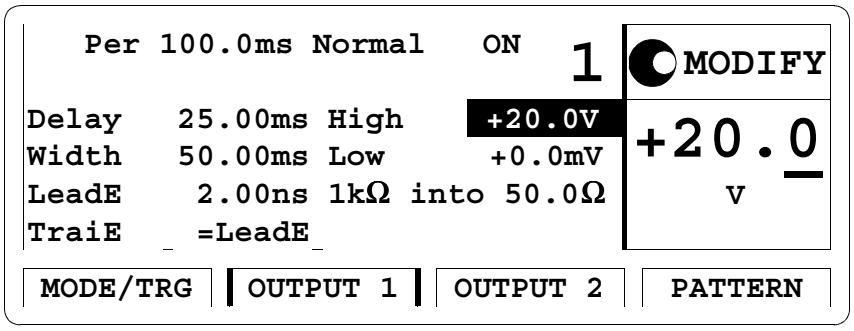
3. Check the Agilent 81110A low level at the following low level settings with the high level set to 0.0 V

| Low Level | Acceptable Range | TR Entry |
|---|---|---|
| -0.1 V | -49 mV to -151 mV | 7.2 - 1 |
| -0.5 V | -445 mV to -555 mV | 7.2 - 2 |
| -1.0 V | -0.94 V to -1.06 V | 7.2 - 3 |
| -3.0 V | -2.92 V to -3.08 V | 7.2 - 4 |
| -5.0 V | -4.90 V to -5.10 V | 7.2 - 5 |
| -10.0 V | -9.85 V to -10.15 V | 7.2 - 6 |

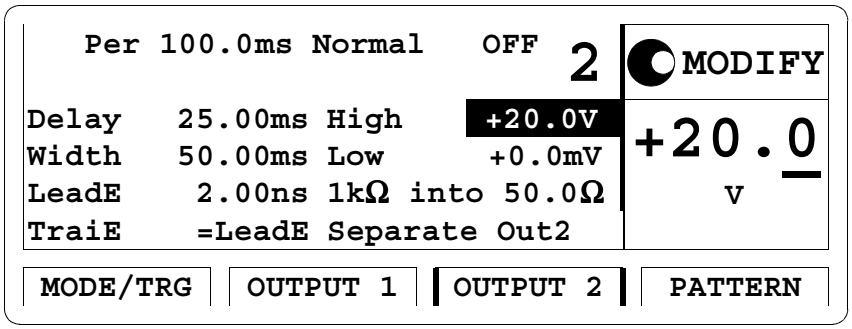
The high level 0.0 V may vary ± 1% of amplitude ±50 mV.

**Test 7.3: High Level, 1K Ohms into 50 Ohms**

1. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"
2. On the Agilent 81110A press MORE and set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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.

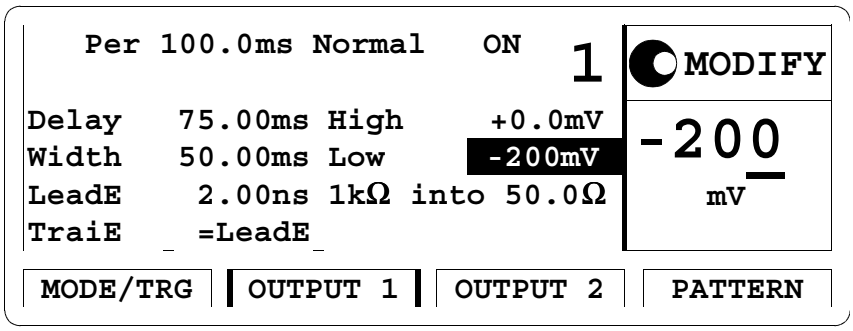
3. Check the Agilent 81110A high level at the following high level settings with the low level set to 0.0 V.

| High Level | Acceptable Range | TR Entry |
|---|---|---|
| 19.0 V | 18.71 V to 19.29 V | 7.3 - 1 |
| 10.0 V | 9.80 V to 10.20 V | 7.3 - 2 |
| 5.0 V | 4.85 V to 5.15 V | 7.3 - 3 |
| 1.0 V | 0.89 V to 1.11 V | 7.3 - 4 |
| 0.2 V | 98 mV to 302 mV | 7.3 - 5 |

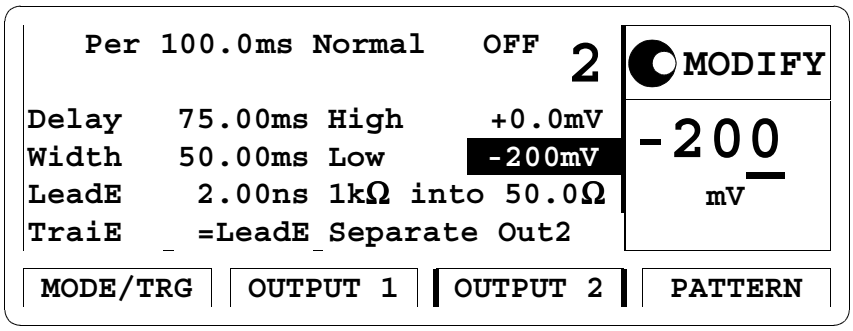
The low level 0.0 V may vary ± 1% of amplitude ± 100 mV.

**Test 7.4: Low Level, 1K Ohms into 50 Ohms**

1. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"
2. On the Agilent 81110A press MORE and set up [OUTPUT 1] and [OUTPUT 2] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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 81110A low level at the following low level settings with the high level set to 0.0 V.

| Low Level | Acceptable Range | TR Entry |
|---|---|---|
| -0.2 V | -98 mV to -302 mV | 7.4 - 1 |
| -1.0 V | -0.89 V to -1.11 V | 7.4 - 2 |
| -5.0 V | -4.85 V to -5.15 V | 7.4 - 3 |
| -10.0 V | -9.80 V to -10.20 V | 7.4 - 4 |
| -19.0 V | -18.71 V to -19.29 V | 7.4 - 5 |

The high level 0.0 V may vary $\pm$ 1% of amplitude $\pm$ 100 mV

***NOTE:*** Repeat the High and Low Level tests for the second channel, if it is installed.

# Test 8: Transition Time

## Test Specifications

| | |
|---|---|
| Range | 2.0 ns to 200 ms<br>(measured between 10% and 90% of amplitude) |
| Minimum Transitions | ≤ 2.0 ns<br>(typical 1.4 ns for ECL levels<br>measured between 20% and 80% of amplitude<br>typical 5 ns for 1kOhm source impedance) |
| Accuracy<br>Linearity | ± 10% ± 200 ps<br>typical ± 3% for transitions > 100 ns |

## Equipment Needed

Digitizing Oscilloscope with Accessories
Cable, SMA

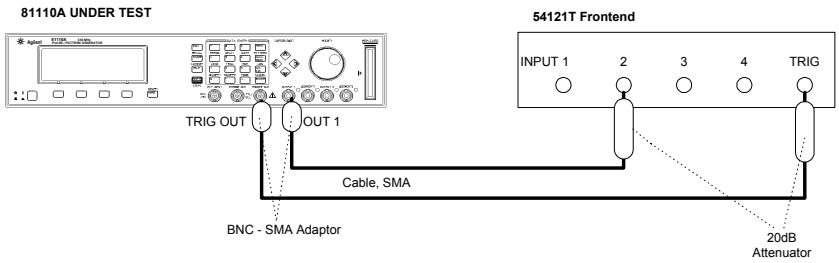
## Procedure

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 81110A to the Scope as shown:



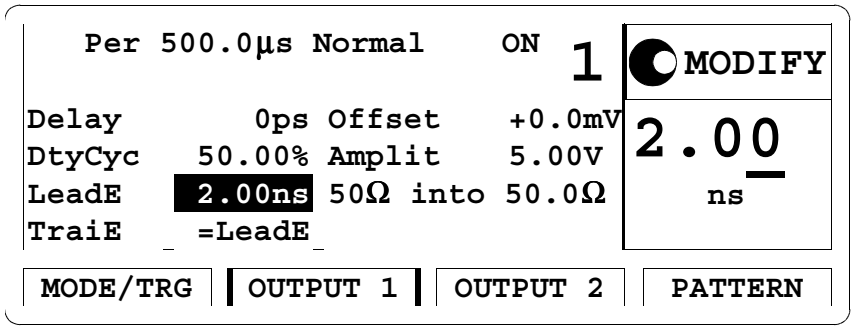

Connecting Agilent 81110A to the Scope

***NOTE:***

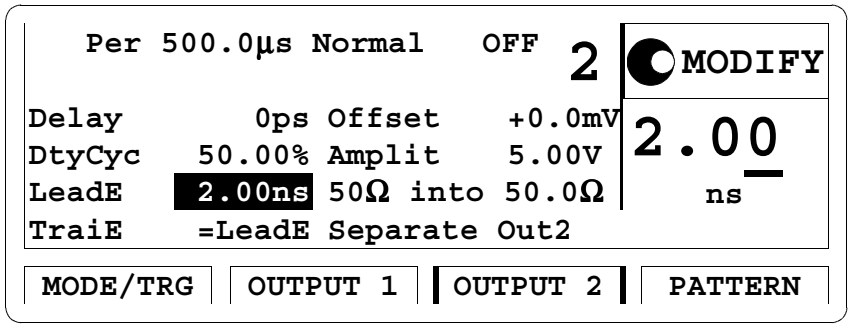
When you connect the test equipment the first time, and whenever you change the setup during the following tests, use the torque wrench (8170-1582) to tighten and loosen the SMA connectors. This will ensure that the connectors are at the correct tightness and give the best signal transfer!

2. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

3. On the Agilent 81110A press MORE and set up [`OUTPUT 1`] and [`OUTPUT 2`] pages as shown in the following illustrations:




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:***

When you are 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 AUTOSCALE
- Center one pulse on screen, e.g.:
- TIME/DIV = 50 µs/div, DELAY = 380 µs,
- 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 AUTO LEVEL SET
- 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 Agilent 81110A to: Period = 1 µs and change the Agilent 81110A 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 PRECISE EDGE FIND key

7. Check the Agilent 81110A rise times at the following leading edge settings:

| Oscilloscope TIME/ DIV | Period | Leading Edge | Trailing Edge | Acceptable Range | TR Entry |
|---|---|---|---|---|---|
| 2 ns/div | 1 µs | 2.0 ns | 2.0 ns | ≤2 ns to 2.4 ns | 8.1a - 1 |
| 5 ns/div | 1 µs | 10 ns | 10 ns | 8.8 ns to 11.2 ns | 8.1a - 2 |
| 10 ns/div | 1 µs | 50 ns | 50 ns | 44.8 ns to 55.2ns | 8.1a - 3 |
| 100 ns/div | 5 µs | 500 ns | 500 ns | 449.8 ns to 550.2 ns | 8.1a - 4 |
| 1µs/div | 50 µs | 5 µs | 5 µs | 4.4998 µs to 5.5002 µs | 8.1a - 5 |
| 10 µs/div | 500 µs | 50 µs | 50 µs | 45 µs to 55 µs | 8.1a - 6 |
| 100 µs | 5 µs | 500 µs | 500 µs | 450 µs to 550 µs | 8.1a - 7 |
| 10 ms/div | 500 ms | 50 ms | 50 ms | 45 ms to 55 ms | 8.1a - 8 |

Programming down to 1.8 ns is allowed, to meet the minimum of ≤2 ns.

Use the Agilent 81110A Delay (scope delay) to center the leading edge on screen.

### Test 8.1b: Trailing Edge Test

Minimum Trailing Edge and Trailing Edge range.

1. Connect Agilent 81110A to the Scope as shown in Test 8.1a Leading Edge Test.

2. Set up the Agilent 81110A as described in Test 8.1a Leading Edge Test.

***NOTE:*** When you are 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 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 PRECISE EDGE FIND key

5. Check the Agilent 81110A output signal falls at the following trailing edge settings:

| Oscilloscope TIME/DIV | Delay | Period | Trailing Edge | Leading Edge | Acceptable Range | TR Entry |
|---|---|---|---|---|---|---|
| 2 ns/div | 529 ns | 1 µs | 2.0 ns | 2 ns | ≤2 ns to 2.4 ns | 8.1b - 1 |
| 5 ns/div | 529 ns | 1 µs | 10 ns | 5 ns | 8.8 ns to 11.2 ns | 8.1b - 2 |
| 10 ns/div | 529 ns | 1 µs | 50 ns | 50 ns | 44.8 ns to 55.2 ns | 8.1b - 3 |
| 100 ns/div | 25 µs | 5 µs | 500 n | 50 ns | 449.8 ns to 550.2 ns | 8.1b - 4 |
| 1 µs/div | 25 µs | 50 µs | 5 µs | 5 µs | 4.4998 µs to5.5002 µs | 8.1b - 5 |
| 10 µs/div | 250 µs | 500 µs | 50 µs | 50 µs | 45 µs to 55 µs | 8.1b - 6 |
| 100 µs/div | 2.5 ms | 5 ms | 500 µs | 500 µs | 450 µs to550 µs | 8.1b - 7 |
| 10 ms/div | 250 ms | 500 ms | 50 ms | 50 ms | 45 ms to 55 ms | 8.1b - 8 |

Programming down to 1.8 ns is allowed, to meet the minimum of ≤2 ns.

## Test 9: Pulse Aberration Test

The following tests are required:

Overshoot and Ringing
Preshoot

## Test Specifications

Overshoot/Preshoot/Ringing

$\pm$ 5% of amplitude $\pm$ 20 mV

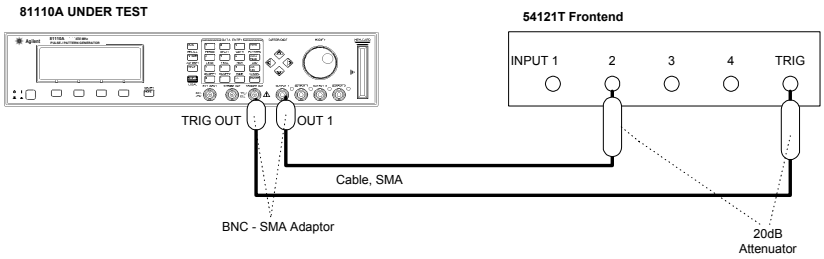
## Equipment Needed

Digitizing Oscilloscope with Accessories

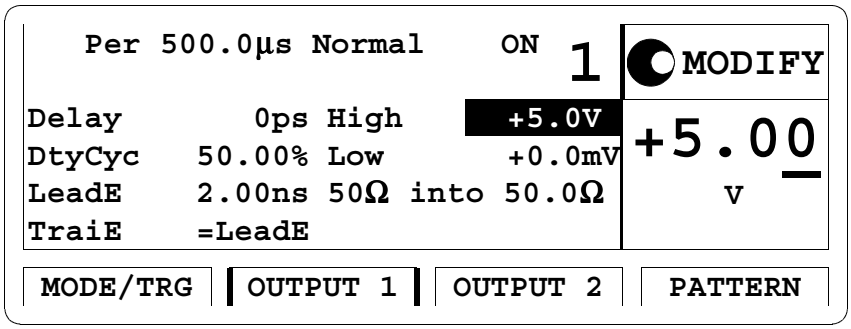
## Procedure

6. Set up the Agilent 81110A as described in "Initial Setup of the Agilent 81110A"

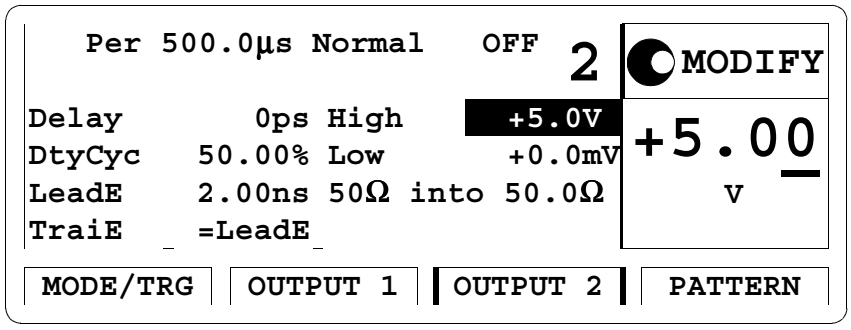
1. Connect Agilent 81110A to the Scope as shown:




Connecting Agilent 81110A to the Scope




Configuring Output Screen 1




Configuring Output Screen 2

***NOTE:*** When you are 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.

## Overshoot and Ringing

2. Set the digitizing oscilloscope Agilent 54121T:

- Press AUTOSCALE
- 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 = 50µs/div, DELAY = 250 µs)
- 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 Agilent 81110A to period = 500 ns

4. Check that Overshoot and Ringing are within the ±5% of amplitude ±20 mV window

5. Enter the result in the Test Report as TR entry 9 - 1

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

**Preshoot**

6. Set Agilent 81110A to:
- Period = 500 µs
- High Level = 5 V
- Low Level = 0 V
- Delay = 10 ns

7. Set the digitizing oscilloscope, Agilent 54121T:

- Press AUTOSCALE
- 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 = 50µs/div, DELAY = 265 µs)
- 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 Agilent 81110A to period = 500 ns
9. Check that Preshoot is within the ±5% of amplitude ± 20 mV window.
10. Enter the result in the Test Report as TR entry 9 - 2

## Agilent 81110A/’11A Performance Test Records

Test Facility:

_____ Report No. _____
_____ Date _____
_____ Customer _____
_____ Tested By _____

×

Model Agilent 81110A/’11A 165 MHz Pulse Generator

Serial No. _____

Options _____ Ambient temperature _____°C
_____ Relative humidity _____%
_____
_____

Firmware Rev. _____ Line frequency _____Hz

Special Notes:

_____
_____
_____
_____
_____

| Test Equipment Used<br>Description | Model No. | Trace No. | Cal. Due Date |
|---|---|---|---|
| 1. Oscilloscope | Agilent 54121T | _____ | _____ |
| 2. Counter | Agilent 5334B | _____ | _____ |
| 3. Digital Voltmeter | Agilent 3458A | _____ | _____ |
| 4. Pulse Generator | Agilent 8110A | _____ | _____ |
| 5. Delay Line | Agilent 54008A | _____ | _____ |
| 6. _____ | | | |
| 7. _____ | | | |
| 8. _____ | | | |
| 9. _____ | | | |
| 10._____ | | | |
| 11._____ | | | |
| 12._____ | | | |
| 13._____ | | | |
| 14._____ | | | |

## Test Results for Agilent 81110A 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 | 6.06ns | 5.878 ns | _____ | 6.242 ns | ____ | ____ |
| 1-2 | 9.99ns | 9.690 ns | _____ | 10.290 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 | ____ | ____ |

Counter Uncertainty factor _____

| 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 | ____ | ____ |
| 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 | ____ | ____ |

**PLL Period**
**(Results measured as frequency by counter)**

Counter Uncertainty factor _____

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 2-1 | 6.061 ns | 164.9835MHz | _____ | 165.0165MHz | __ | __ |
| 2-2 | 10.00 ns | 99.990MHz | _____ | 100.010 MHz | __ | __ |
| 2-3 | 50.00 ns | 19.9980MHz | _____ | 20.0020MHz | __ | __ |
| 2-4 | 100 ns | 9.9990MHz | _____ | 10.0010MHz | __ | __ |
| 2-5 | 500 ns | 1.9998MHz | _____ | 2.0002MHz | __ | __ |
| 2-6 | 1 µs | 999.9 kHz | _____ | 1.0001 MHz | __ | __ |
| 2-7 | 50 µs | 19.998 kHz | _____ | 20.002 kHz | __ | __ |
| 2-8 | 5 m | 199.98 Hz | _____ | 20002 Hz | __ | __ |
| 2-9 | 500 m | 1.9998 Hz | _____ | 2.0002 Hz | __ | __ |
| 2-10 | 5 s | 0.19998 Hz | _____ | 0.20002 Hz | __ | __ |

**Period Jitter**

Scope Uncertainty factor _____

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

**Test Results for Agilent 81111A Output Channel _____**

Serial No. _____

**Width**

Scope Uncertainty factor _____

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 3-1 | 3.030 ns | 2.689 ns | _____ | 3.371 ns | ____ | ____ |
| 3-2 | 6.06ns | 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 | 96.75 ns | _____ | 103.25 ns | ____ | ____ |
| 3-6 | 500 ns | 484.75 ns | _____ | 515.25 ns | ____ | ____ |
| 3-7 | 50 µs | 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 | ____ | ____ |
| 6.2a-1 | 50 ns | | _____ | 15.5 ps | ____ | ____ |
| 6.2a-2 | 500 ns | | _____ | 20 ps | ____ | ____ |

**Delay**

Scope Uncertainty factor _____

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 4-1 | 0.00 ns | | _____ | Fixed Delay | ____ | ____ |
| 4-2 | 5.00 ns | 4.35 ns | _____ | 5.65 ns | ____ | ____ |
| 4-3 | 10 ns | 9.20 ns | _____ | 10.80 ns | ____ | ____ |
| 4-4 | 50.0 ns | 48.0 ns | _____ | 52.0 ns | ____ | ____ |
| 4-5 | 100 ns | 96.5 ns | _____ | 103.5 ns | ____ | ____ |
| 4-6 | 500 ns | 484.5 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 | 485 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 | ____ | ____ |
| 6.3a-1 | 50 ns | | _____ | 15.5 ps | ____ | ____ |
| 6.3a-2 | 500 ns | | _____ | 20 ps | ____ | ____ |

**Double Pulse Delay**

Scope Uncertainty factor _____

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 5-1 | 6.06 ns | 5.628 ns | _____ | 6.392 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 Uncertainty factor _____

| 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 | 10.0 V | 9.85 V | _____ | 10.15 V | ____ | ____ |
| 7.1-2 | 5.0 V | 4.90 V | _____ | 5.10 V | ____ | ____ |
| 7.1-3 | 3.0V | 2.92 V | _____ | 3.08 V | ____ | ____ |
| 7.1-4 | 1.0 V | 0.94 V | _____ | 1.06 V | ____ | ____ |
| 7.1-5 | 0.5 V | 445 mV | _____ | 555 mV | ____ | ____ |
| 7.1-6 | 0.1 V | 49 mV | _____ | 151 mV | ____ | ____ |

**High Level 1KΩ–50Ω**

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 7.3-1 | 19.0 V | 18.71V | _____ | 19.29 V | ____ | ____ |
| 7.3-2 | 10.0 V | 9.80 V | _____ | 10.20 V | ____ | ____ |
| 7.3-3 | 5.0 V | 4.85 V | _____ | 5.15 V | ____ | ____ |
| 7.3-4 | 1.0 V | 0.89 V | _____ | 1.11V | ____ | ____ |
| 7.3-5 | 0.2 V | 98 mV | _____ | 302mV | ____ | ____ |

**Low Level 50Ω-50Ω**

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 7.2-1 | -0.1 V | -49 mV | _____ | -151 mV | ____ | ____ |
| 7.2-2 | -0.5 V | -445 mV | _____ | -555 mV | ____ | ____ |
| 7.2-3 | -1.0 V | -0.94 V | _____ | -1.06 V | ____ | ____ |
| 7.2-4 | -3.0V | -2.92 V | _____ | -3.08 V | ____ | ____ |
| 7.2-5 | -5.0V | -4.90 V | _____ | -5.10 V | ____ | ____ |
| 7.2-6 | -10.0V | -9.85 V | _____ | -10.15 V | ____ | ____ |

**Low Level 1KΩ-50Ω**

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 7.4-1 | -0.2V | -98 mV | _____ | -302 mV | ____ | ____ |
| 7.4-2 | -1.0V | -0.89 V | _____ | -1.11 V | ____ | ____ |
| 7.4-3 | -5.0V | -4.85V | _____ | -5.15 V | ____ | ____ |
| 7.4-4 | -10.0V | -9.80 V | _____ | -10.20 V | ____ | ____ |
| 7.4-5 | -19.0V | -18.71 V | _____ | -19.29 V | ____ | ____ |

**Leading Edge**

Scope Uncertainty factor _____

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 8.1a-1 | 2.0 ns | ≤2 ns | _____ | 2.4 ns | ____ | ____ |
| 8.1a-2 | 10 ns | 8.8 ns | _____ | 11.2 ns | ____ | ____ |
| 8.1a-3 | 50 ns | 44.8 ns | _____ | 55.2 ns | ____ | ____ |
| 8.1a-4 | 500 ns | 449.8 ns | _____ | 550.2 ns | ____ | ____ |
| 8.1a-5 | 5 µs | 4.4998 µs | _____ | 5.5002 µs | ____ | ____ |
| 8.1a-6 | 50 µs | 45 µs | _____ | 55 µs | ____ | ____ |
| 8.1a-7 | 500 µs | 450 µs | _____ | 550 µs | ____ | ____ |
| 8.1a-8 | 50 ms | 45 ms | _____ | 55 ms | ____ | ____ |

**Trailing Edge**

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 8.1b-1 | 2.0 ns | ≤2 ns | _____ | 2.4 ns | ____ | ____ |
| 8.1b-2 | 10 ns | 8.8 ns | _____ | 11.2 ns | ____ | ____ |
| 8.1b-3 | 50 ns | 44.8 ns | _____ | 55.2ns | ____ | ____ |
| 8.1b-4 | 500 ns | 449.8 n | _____ | 550.2 ns | ____ | ____ |
| 8.1b-5 | 5 µs | 4.4998 µs | _____ | 5.5002 µs | ____ | ____ |
| 8.1b-6 | 50 µs | 45 µs | _____ | 55 µs | ____ | ____ |
| 8.1b-7 | 500 µs | 450 µs | _____ | 550 µs | ____ | ____ |
| 8.1b-8 | 50 ms | 45 ms | _____ | 55 ms | ____ | ____ |

### Overshoot and Ringing

Scope Uncertainty factor _____

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 9-1 | 5V | | _____ | ± 5% of ampl. ±20mV | ____ | ____ |
| 9-2 | 500 mV | | _____ | ±5% of ampl. ±20mV | ____ | ____ |

### Preshoot

| TR Entry | Test | Limit Min | Actual Result | Limit Max | Pass | Fail |
|---|---|---|---|---|---|---|
| 9-3 | 0 V | | _____ | ±5% of ampl. ±20mV | ____ | ____ |