Agilent 81100 Family of Pulse Pattern/Generators

Radar Distance Test to Airborne Planes

Product Note 1

Introduction

Agilent Technologies pulse generators are used for testing radar communication systems in the military industry, and as demonstrated in this product note, the aviation industry.

A trigger pulse train of double pulses is sent from the control tower's radar system to an airborne plane. The plane responds with a standard signature signal which is sent back to the control tower. This occurs up to 450 times per second. The control tower receives the signal, recognizes its signature, and then analyzes the delay to determine the distance between the tower and the airborne plane.

To test a radar system on a regular basis, an 81110A is used to simulate the signature signal. Varying the delay from the external trigger to the start of the output signal, various distances from the control tower can be simulated. This delay can be up to
2 ms. Therefore it has to be created by leading zeroes added to the signature signal.

Due to the legal safety requirements, it is critical to have very accurate edge placement of the pulses. After self-calibration, the 81110A can provide a sufficient frequency accuracy below 1% without PLL.

Required equipment for Lab 1:

- 1x Pulse/Pattern Generator (81110A + 2x 81111A, 81104A + 2x 81105A or 8110A + 2x 81103A)
- 1x Infiniium oscilloscope
- 2x BNC cables

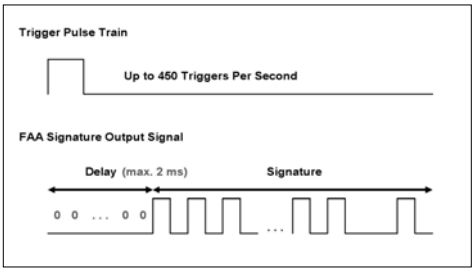

Figure 2: Simulated Signature Signal

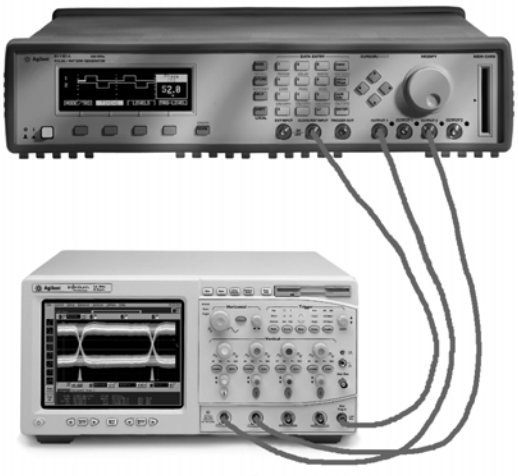

Figure 1: The setup of an Agilent pulse generator and an Agilent Infiniium oscilloscope

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What do we need to simulate the response signal of an airborne plane?

We need:

- externally triggered pulses
- at 0.6 MHz frequency (figure 3)

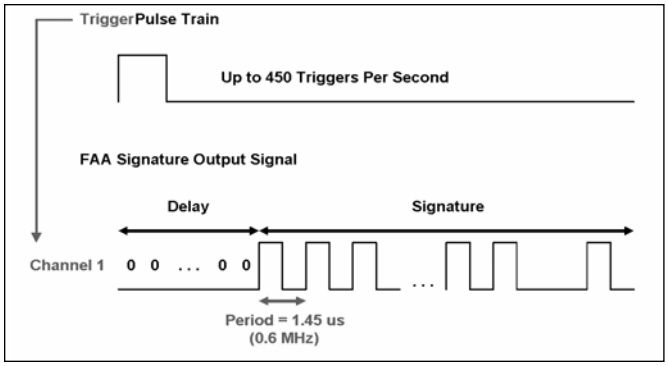


Figure 3

- a programmable bit pattern
- of RZ pulses
- and highest possible frequency accuracy (figure 4).

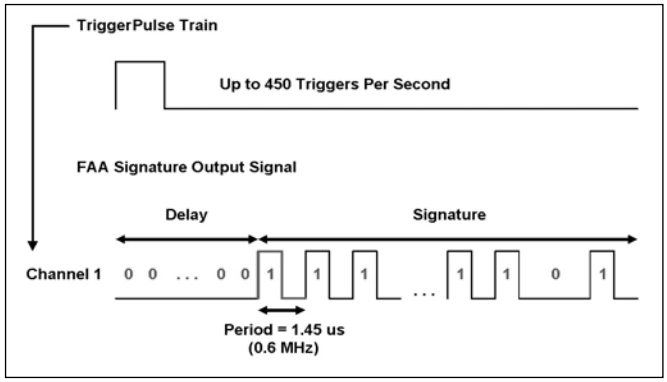
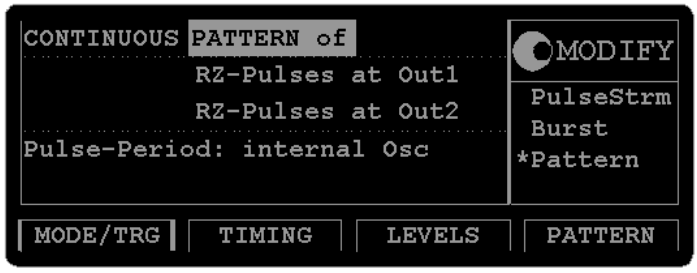


Figure 4

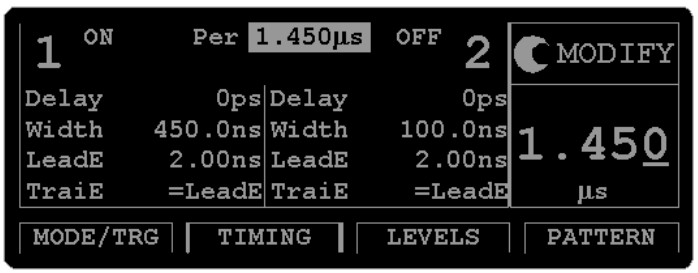
Now let's set up the instruments as shown in the screen shots.

First, reset the instrument by selecting RECALL + 0 (SHIFT, STORE + 0).

Select PATTERN mode in the TRG-MODE menu.



Go to the TIMING menu and set the pulse period and width specified in the timing diagram. Switch on output 1.



In order to get the 2.0 ms delay, we need to add leading zeros to the 18 bit pattern (the 81110A will not allow us to ask for more than 1.37 ms delay). With the RZ pulses set at 1.45 ms period we need 1,379 leading zeros. That will give us 1,999.55 ms of delay.

To get these leading zeros, go to the PATTERN menu, and set the last address to 1,397 (that is 1,379 + 18). Then highlight CH1, select FILL 0 and press ENTER.

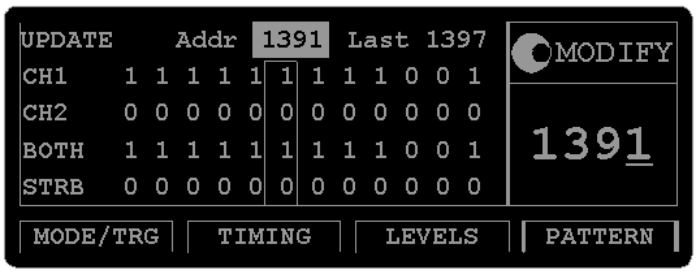
Starting at address 1380, set the 18 bit pattern of the radar signal.

Note: The pattern from address 1380 to 1397 is 111111111111111001.

Start with setting the last bit to 1397.

Switch on OUTPUT 1 by pressing SHIFT + 0.

Finally, have a look at the last 14 bits of the pattern on a 54845A Infiniium oscilloscope.



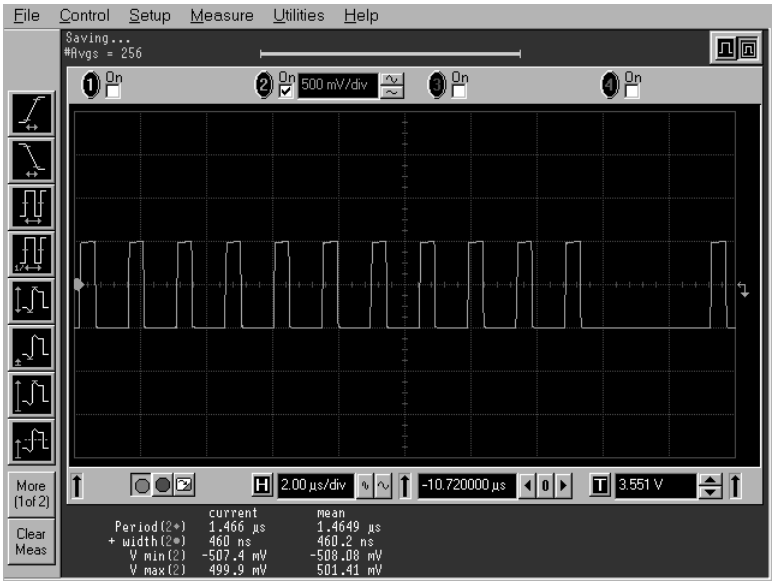


Figure 5: Agilent 54845A Infiniium oscilloscope showing the last 14 bits

Related Literature	Pub. Number
Agilent 81100 Family of Pulse/Pattern Generators, brochure	5890-0489E.
Agilent 81130A Pulse-/Pattern Generator, data sheet	5967-6237E
Agilent 81101A Pulse Generator, data sheet	5967-6274E
Agilent 81110A/81104A Pulse/Pattern Generators, data sheet	5967-5984E
The Dual Clock Gbit Chip Test, product note 2	5968-5844E
Magneto-Optical Disk Drive Research, product note 3	5968-5845E
Simulation of Jittering Synchronization Signals for Video Interfaces, product note 4	5968-5846E

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