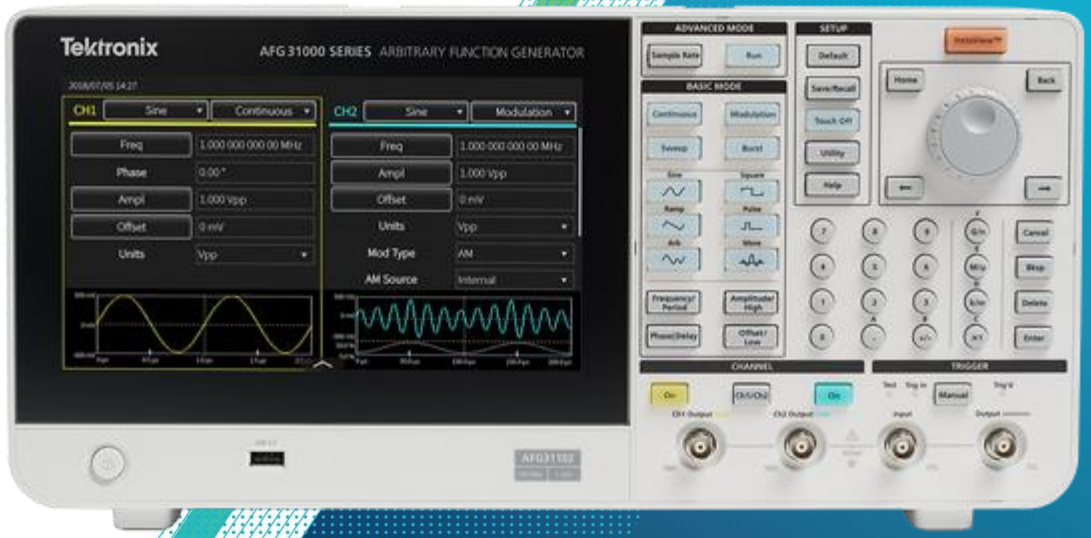
Tektronix

Advance your AFG. Advance your test.

Introducing the New AFG31000 Series Arbitrary/Function Generators



PARTNER EXECUTIVE PRESENTATION

Eric Yang (eric.yang@tektronix.com)
Richeal Chen (richeal.chen@tektronix.com)

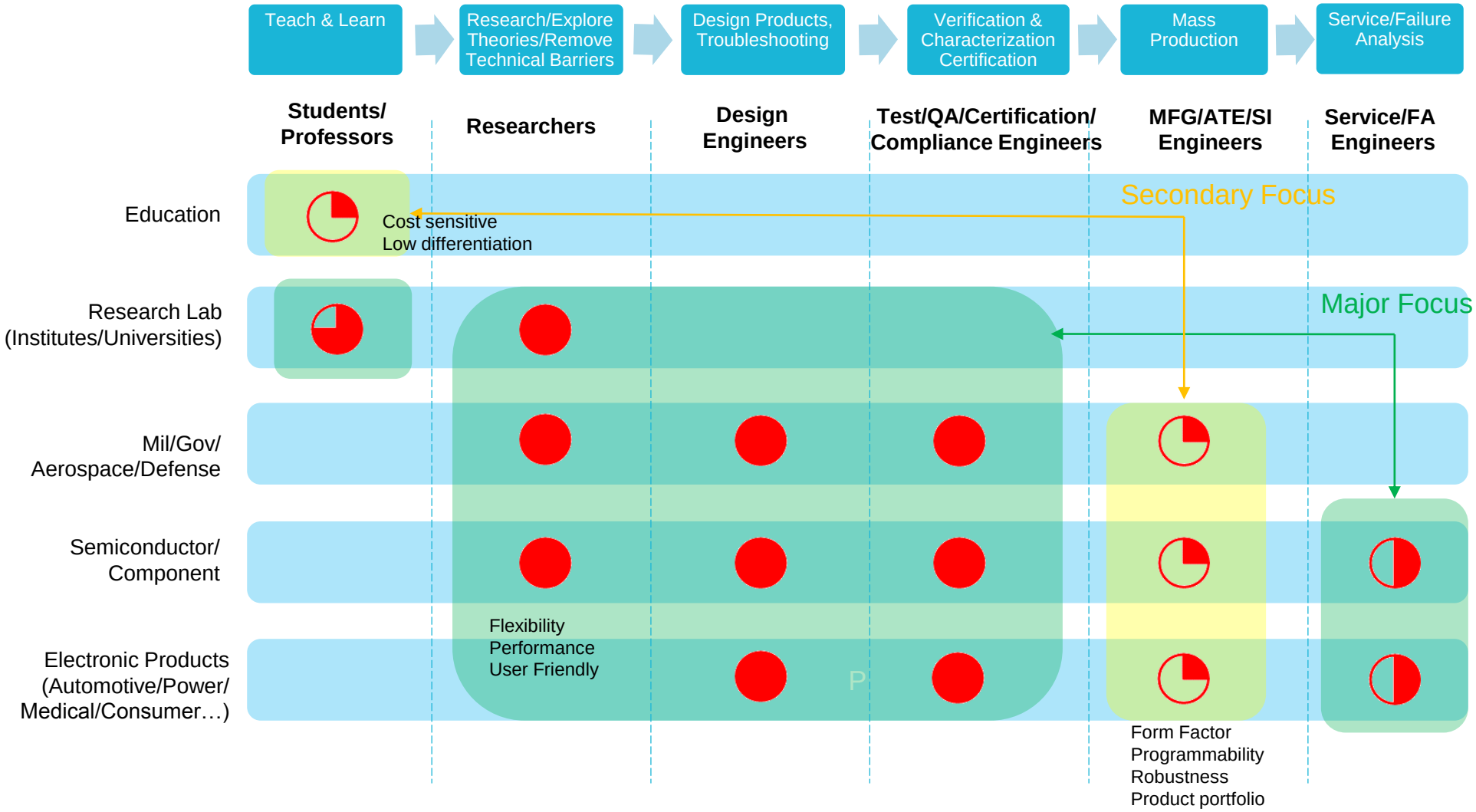
Customer challenges

- Electronic designs are getting more complex than ever
- More sophisticated test are needed to validate if designs meet specifications and compliance requirements
- Design and test engineers are facing pressure to get their test job done with shorter time and less cost

AFG31000 is a waveform generation platform with an up-to-date user experience, versatile functionality, high performance, and low cost. It greatly improves test efficiency so users can focus more on their innovative jobs.

Who are the customers?

PRODUCT REALIZATION FLOW



What do the customers do?

THREE COMMON USE CASES

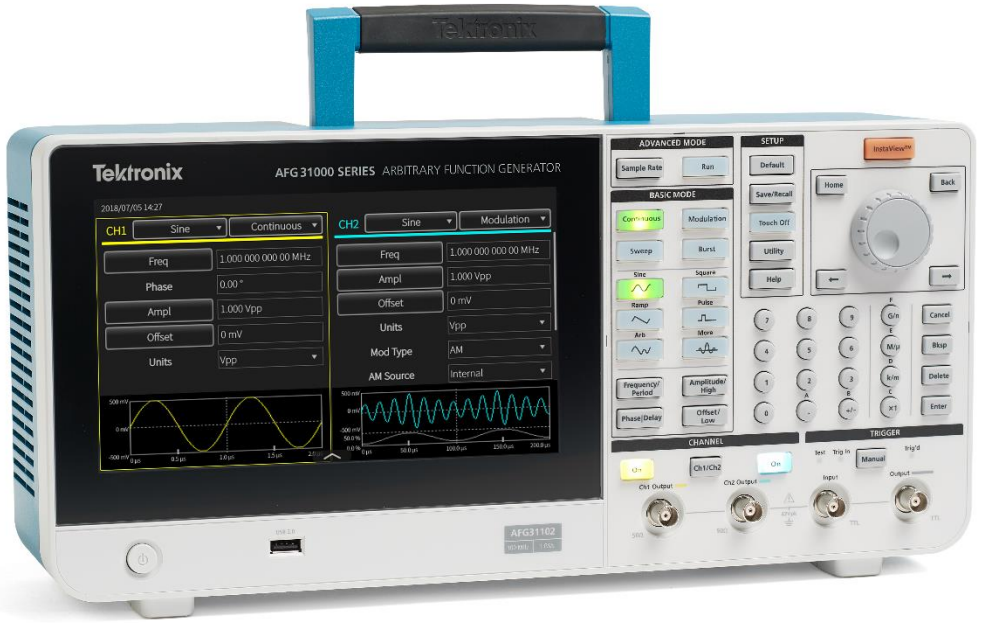
- Generate function waveforms
  - Use built-in waveforms like sine, square, pulse, etc., running in continuous, modulation, sweeping, or burst modes, to stimulate DUTs
- Generate arbitrary waveforms
  - Create an unavailable waveform with software, or capture real world waveforms with oscilloscopes, then transfer to the AFG for replication and to stimulate DUTs
- Automated test
  - A series of tests programmed and automatically run by a PC to validate function or characterize performance of DUTs

Market trend and customer pain points

- Shorter time-to-market, but
  - Reading manual/training is time consuming and painful
  - Exploring in deep menu to change settings is annoying
  - Product and designs are getting more complex, more tests are needed to be done
- Avoid risk/uncertainty, but
  - “Nominal” settings sometimes are misleading; it may lead to wrong test results, schedule delay, or even faulty design/product
  - Some users even are not aware of that!!!
- Reduce cost, but
  - Tests are getting more complex and must be done with limited budget

Creating a new AFG standard

AN AFG BEYOND JUST AN AFG



FOUR Industry Firsts

1. Nine-inch capacitive display
2. Monitor waveform added at device under test (DUT) in real time (InstaView™)
3. Waveform sequencer integrated*
4. Draw waveform with fingertips with the built-in waveform creation tool

** optional*

Key Specifications

CLEANER SIGNAL, DEEPER MEMORY

		AFG31021 / AFG31022	AFG31051 / AFG31052	AFG31101 / AFG31102	AFG31151* / AFG31152*	AFG31251* / AFG31252*
Basic (AFG) Mode	Vertical resolution	14-bit				
	Sine frequency range	1 µHz to 25 MHz	1 µHz to 50 MHz	1 µHz to 100 MHz	1 µHz to 150 MHz	1 µHz to 250 MHz
	Square/Pulse frequency range	1 µHz to 20 MHz	1 µHz to 40 MHz	1 µHz to 80 MHz	1 µHz to 120 MHz	1 µHz to 160 MHz
	Edge time	7.0 ns	5.0 ns	3.5 ns	3.0 ns	2.0 ns
	Amplitude (into 50 ohm)	≤ 60 MHz: **1 mVpp** to 10 Vpp > 60 MHz to ≤ 80 MHz: **1 mVpp** to 8 Vpp > 80 MHz to ≤ 100 MHz: **1 mVpp** to 6 Vpp			≤ 200 MHz: **1 mVpp** to 5 Vpp > 200 MHz to ≤ 250 MHz: **1 mVpp** to 4 Vpp*	
	Arb Waveform length	2 to 128kpts				
	Sample rate	250 MSa/s	1 GSa/s (wfm length>16kpts: 250 MSa/s)		2 GSa/s (wfm length>16kpts: 250 MSa/s)	
	Jitter (typ)	**2.5ps**				
Advanced (Waveform Sequencer) Mode	Waveform length	**16 Mpts standard, 128 Mpts optional**				
	Number of entries	1 (continuous, gated, triggered), 1 - 256 (sequence mode)				
	Variable sample rate	1 µSa/s to 250 MSa/s	1 µSa/s to 500 MSa/s	1 µSa/s to 1 GSa/s	1 µSa/s to 2 GSa/s	

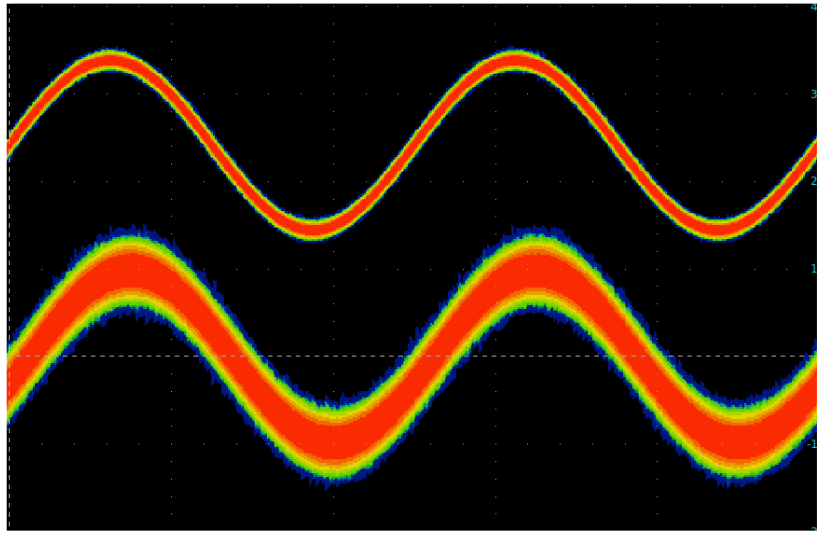
** Preliminary, subject to change*

Key improvements vs. AFG3kC

LESS NOISE, LOWER JITTER, DEEPER MEMORY

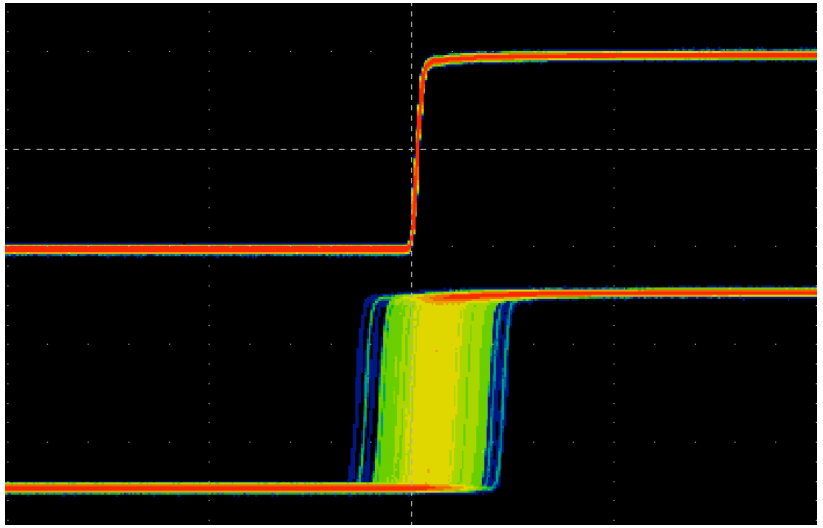
10x less noise

Better signal fidelity



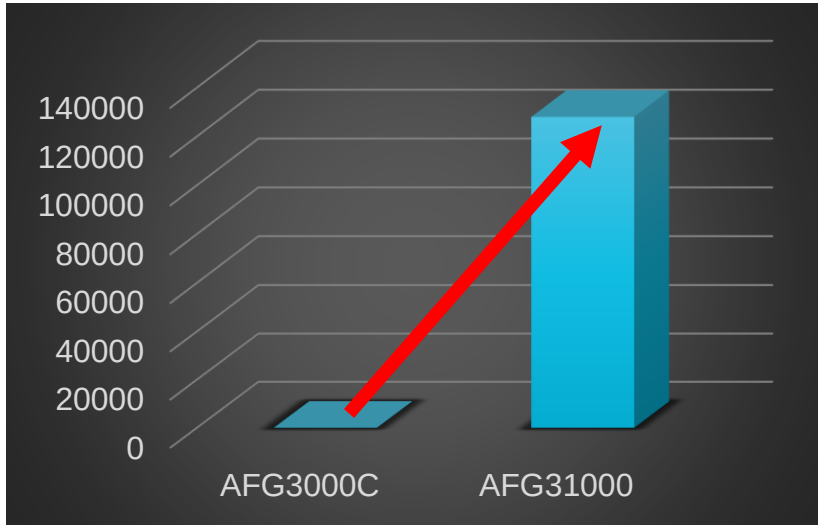
40x lower jitter

Higher timing precision



1000x memory

Larger space for arb waveforms



1. Industry First Nine-inch Capacitive Display

PINCH, ZOOM, SWIPE USER INTERFACE OPERATES AS YOU THINK IT SHOULD

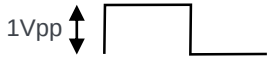
- No need to read manual
- Easier to locate the settings and parameters with a shallow menu tree
- Keep using your ways to change settings with touchscreen, button, or knob
- Shortcut to access frequently-used settings with swipe operations

2. Industry First InstaView™ Realtime Waveform Monitoring

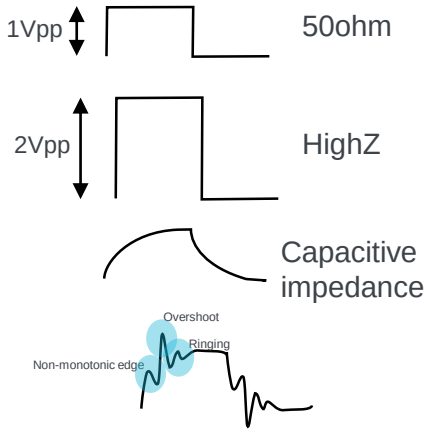
UNMATCHED IMPEDANCE ISSUE CANNOT BE NEGLECTED

- During design/debug, R&D customers noticed that the output waveform from the AFG could be different from the one added at the DUT due to an impedance mismatch issue.
- An extra step, to use an oscilloscope to check the signal on the DUT, cannot be neglected.

AFG output signal with 50 Ohm impedance



Signal added on DUT with various impedance

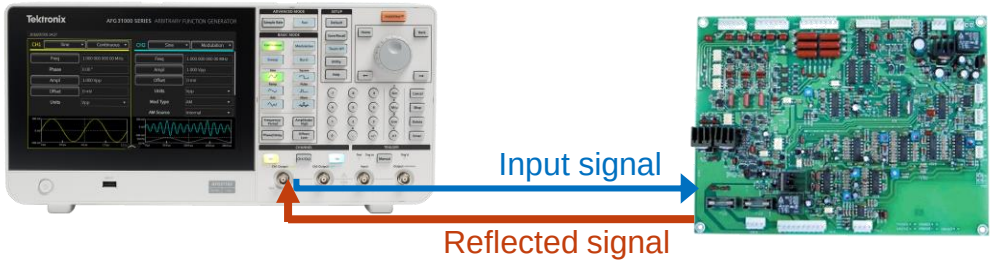


The signal's output from the AFG and added at the DUT can be different due to unmatched impedance.

2. Industry First InstaView™ Real-time Waveform Monitoring

MINIMIZE THE UNCERTAINTY CAUSED BY UNMATCHED IMPEDANCE

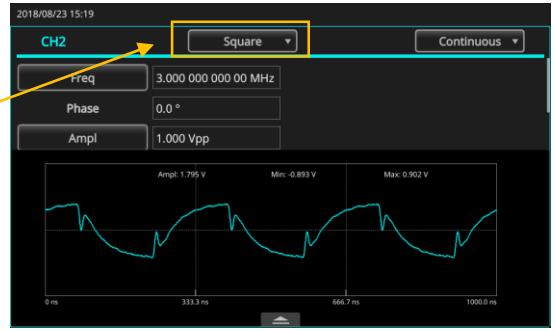
- When impedance is unmatched, some signal is reflected. With the reflected signal, InstaView rebuilds the waveform added at the DUT.



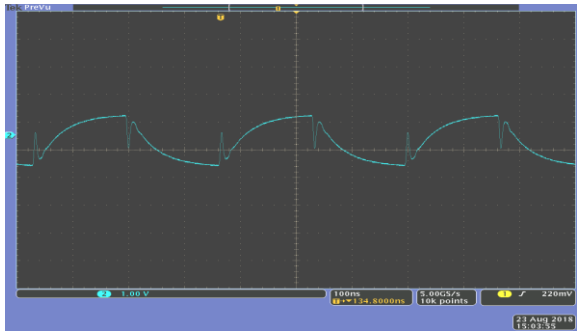
With reflected signal, InstaView rebuilds the waveform added at the DUT.

- With InstaView, users can now monitor the waveform added on the DUT from the AFG in real time.

Output a **Square** wave



Waveform on DUT captured by AFG31K



Waveform on DUT captured by oscilloscope

2. Industry First InstaView™ Realtime Waveform Monitoring

WHAT YOU SEE IS WHAT YOU GET AT THE DUT

When DUT impedance is changed, 50 Ohm/High-Z and capacitive load with different frequencies, the waveform added at the DUT is changed and can be monitored from the AFG

3. Industry First AFG with Waveform Sequencer Integrated

DESIGN VALIDATION / CHARACTERIZATION CAN REQUIRE HUNDREDS OF TEST CASES

- During design validation/characterization, QA and hardware testing engineers need to perform hundreds of test cases with the combining different waveforms and settings.

- These test cases are performed manually or through programming to control the AFG. Either method is complex and time consuming.

	A	B	C	D	E	F
1	No.	Funciton	Frequency	Amplitude	Duration	Pass or Fail
2	Case1	Sine	20KHz	1 Vp-p	20 S	
3	Case2	Sine	25KHz	1 Vp-p	20 S	
4	Case3	Sine	30KHz	1 Vp-p	20 S	
5	Case4	Sine	40KHz	1 Vp-p	20 S	
6	Case5	Square	20KHz	1 Vp-p	20 S	
7	Case6	Square	25KHz	1 Vp-p	20 S	
8	Case7	Square	30KHz	1 Vp-p	20 S	
9	Case8	Square	40KHz	1 Vp-p	20 S	
10	Case9	Sine	20KHz	2 Vp-p	20 S	
11	Case10	Sine	25KHz	2 Vp-p	20 S	
12	Case11	Sine	30KHz	2 Vp-p	20 S	
13	Case12	Sine	40KHz	2 Vp-p	20 S	
14	Case13	Square	20KHz	2 Vp-p	20 S	
15	Case14	Square	25KHz	2 Vp-p	20 S	
16	Case15	Square	30KHz	2 Vp-p	20 S	
17	Case16	Square	40KHz	2 Vp-p	20 S	

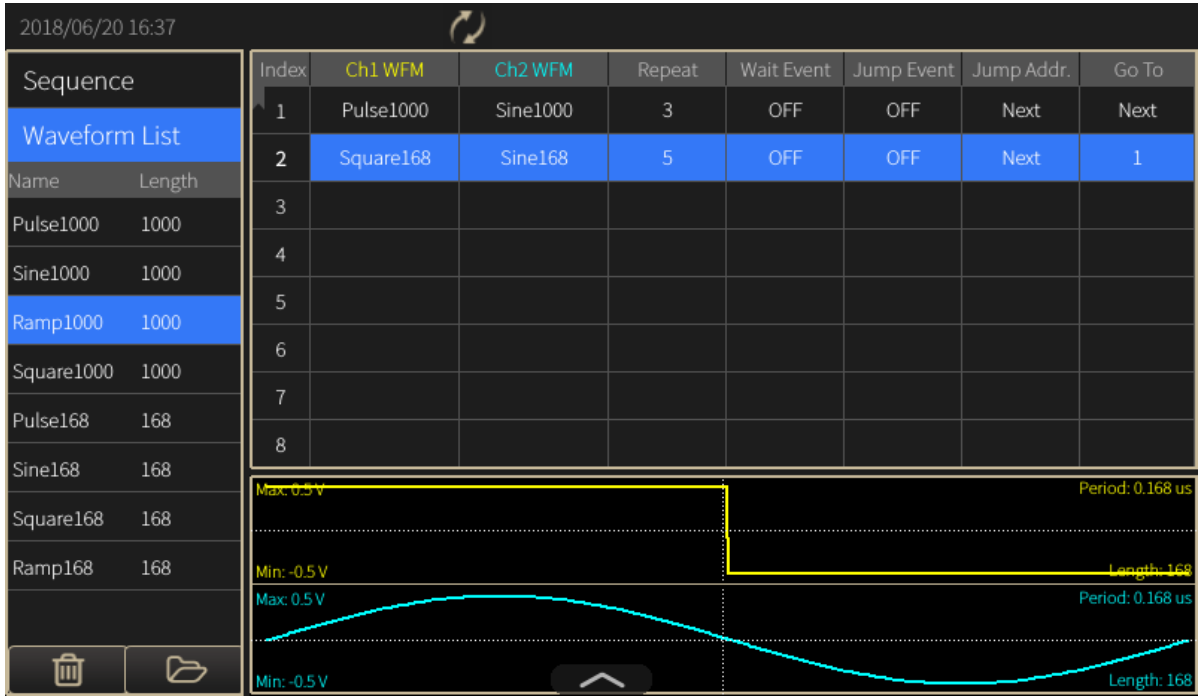
A medical device needs to pass a stress test with hundreds of combinations of waveforms and settings.

3. Industry First AFG with Waveform Sequencer Integrated

REDUCE THE COST TO GENERATE WAVEFORMS WITH COMPLEX TIMING

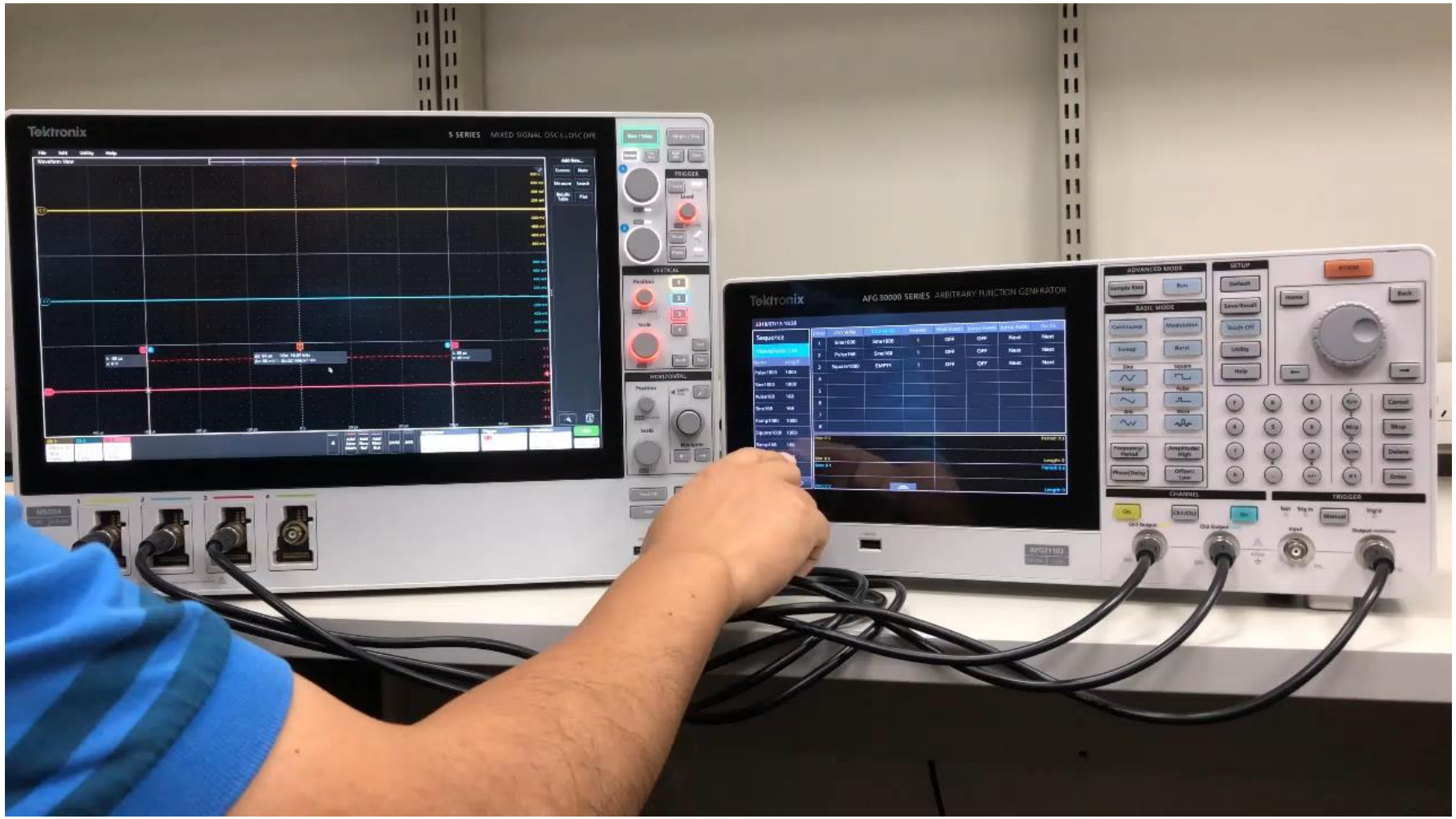
As an MP3 player can play songs in a user-defined list, the waveform sequencer can output waveforms in a customer defined sequence.

- 1/10 the price of an AWG to generate waveform sequences with
  - 256 steps
  - Up to 128MSa/channel
  - Variable sampling clock up to 2GSa/s
- Generate waveforms with complex timing
  - Continuous, triggered, gated, sequenced
- Retain details in waveforms without skipping samples



3.Industry First AFG with Waveform Sequencer Integrated

DRAG, DROP, SWIPE TO CONFIGURE THE WAVEFORM SEQUENCE ON THE AFG

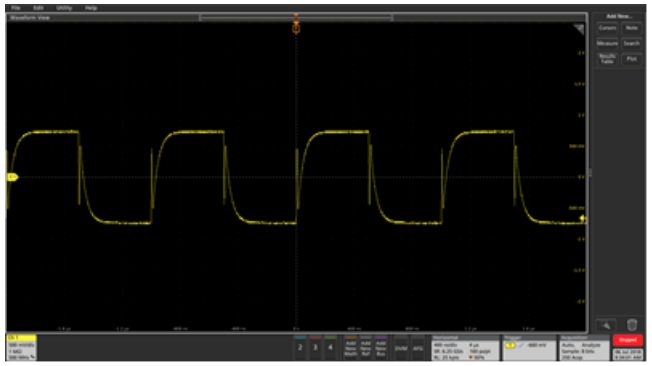


4. Industry First Integrated Waveform Creation / Editor Tool

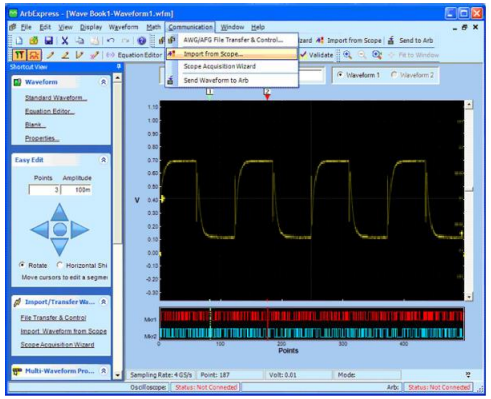
PC IS REQUIRED TO CREATE ARB WAVEFORMS

- In the traditional way, during designing/debugging/troubleshooting, R&D customers MUST use a PC to create/edit/transfer the arbitrary waveforms to the AFG.

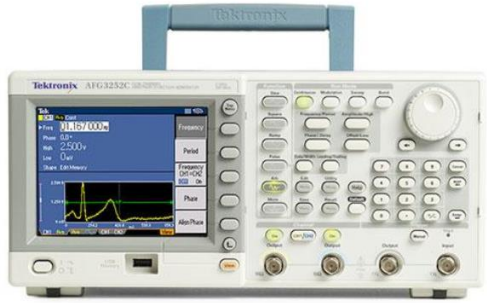
- The waveform acquired from the oscilloscope CANNOT be loaded into the AFG directly and signal amplitude information is normalized.



Capture waveform by oscilloscope



Edit waveform in PC software



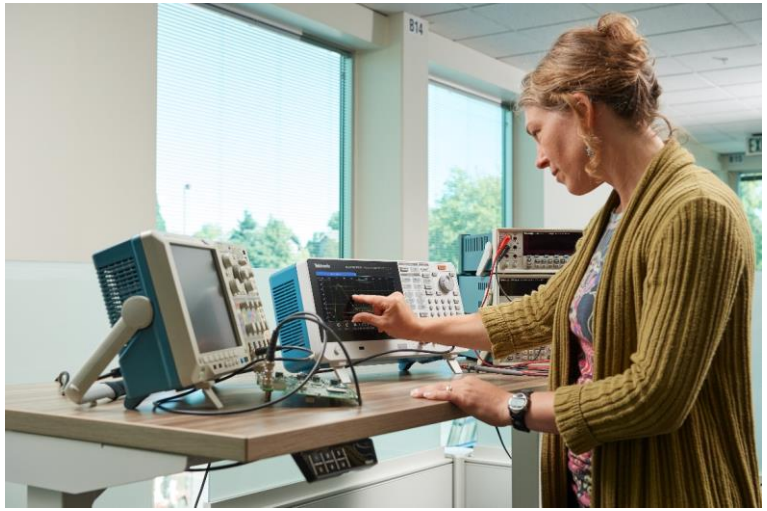
Load waveform to AFG

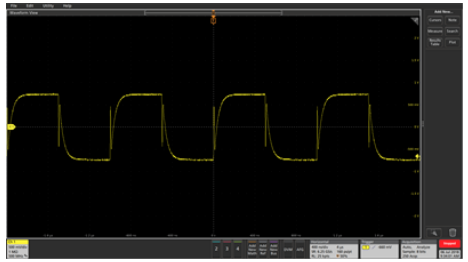
A traditional process to generate an Arb waveform on an AFG

4. Industry First Integrated Waveform Creation / Editor Tool

DRAW A WAVEFORM WITH YOUR FINGERTIPS;
MINIMIZE THE TIME IT TAKES TO CREATE / TRANSFER ARB WAVEFORMS

- ArbBuilder is an integrated tool for arbitrary waveform creation/editing
  - All operations are on the AFG; no extra PC is needed
  - Amplitude/offset is kept in the waveform; no normalization
- Use a USB drive to directly load CSV files saved from the oscilloscope into the AFG





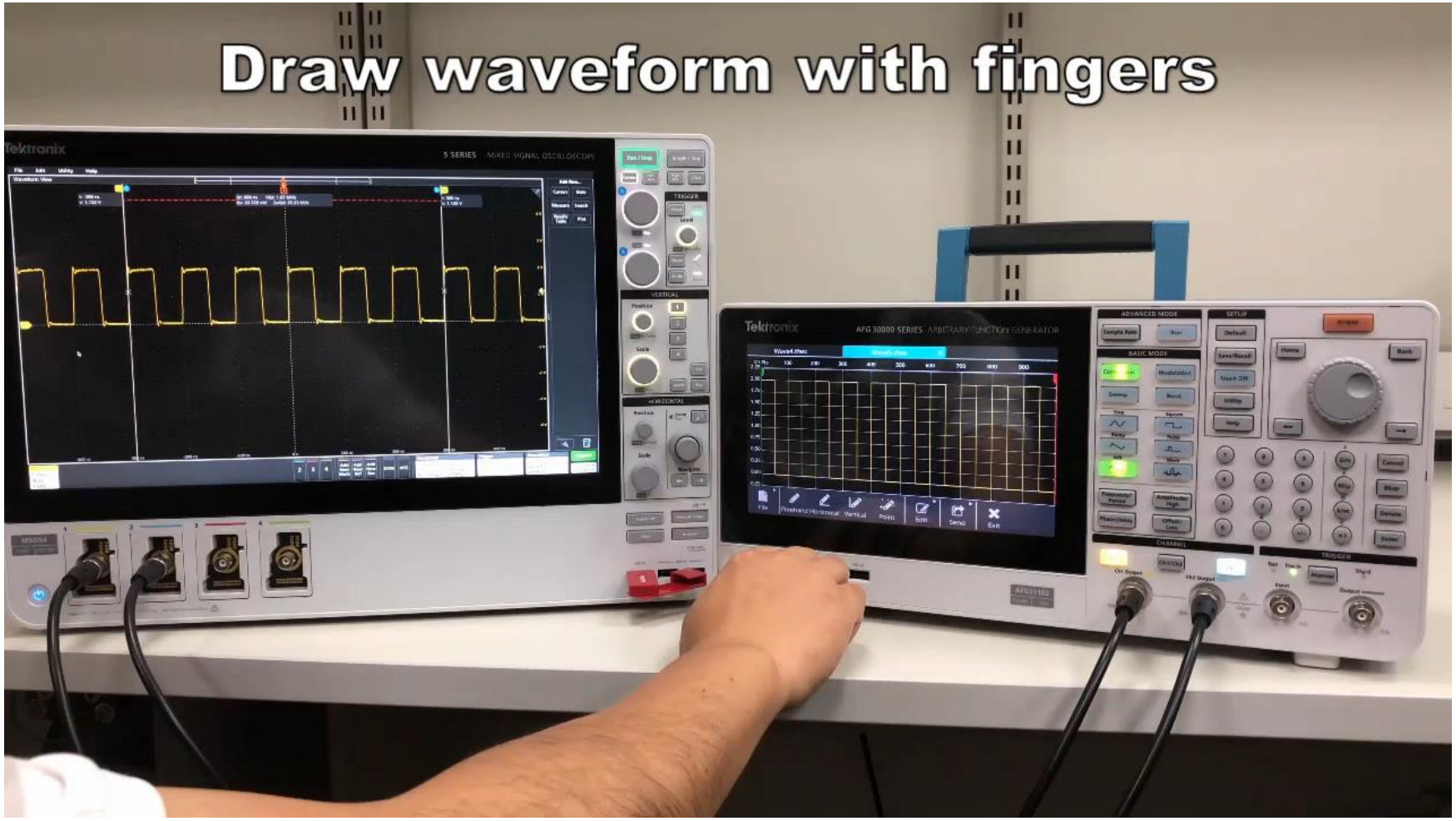
*Save *.csv in a USB drive*

*Load *.csv from the USB drive*

Load oscilloscope captured waveform to AFG directly

4. Industry First Integrated Waveform Creation / Editor Tool

CREATE, EDIT, AND OUTPUT ARB WAVEFORMS ON THE AFG DIRECLTY



Pricing and Positioning

AFG31K Series Pricing

MAIN MODELS

Model	Main Specs					Master Price
	Bandwidth	Max Sample Rate	Memory Depth	Channels	Output	
AFG31021	25 MHz	250 MS/s	16 MSa/ch	1	10 V_{p-p}	$2,210
AFG31022	25 MHz	250 MS/s	16 MSa/ch	2	10 V_{p-p}	$3,340
AFG31051	50 MHz	500 MS/s	16 MSa/ch	1	10 V_{p-p}	$2,440
AFG31052	50 MHz	500 MS/s	16 MSa/ch	2	10 V_{p-p}	$3,680
AFG31101	100 MHz	1 GS/s	16 MSa/ch	1	10 V_{p-p}	$4,270
AFG31102	100 MHz	1 GS/s	16 MSa/ch	2	10 V_{p-p}	$6,090
AFG31151	150 MHz	2 GS/s	16 MSa/ch	1	5 V_{p-p}	$5,020
AFG31152	150 MHz	2 GS/s	16 MSa/ch	2	5 V_{p-p}	$7,150
AFG31251	250 MHz	2 GS/s	16 MSa/ch	1	5 V_{p-p}	$9,600
AFG31252	250 MHz	2 GS/s	16 MSa/ch	2	5 V_{p-p}	$14,100

AFG31K Series Pricing

INSTRUMENT OPTIONS

	Description	Master Price (For 1 channel)	Master Price (For 2 channels)
-SEQ	License; Enables sequence mode; Node locked	$300	$600
-MEM	License; Extends arb memory to 128Mpts; Node locked	$500	$1,000

POST-PURCHASE UPGRADES

All post purchase upgrades upgrades can be done in the field with a license upgrade; no need to return to factory

	Description	Master Price (For 1 channel)	Master Price (For 2 channels)
AUP-AFG3SEQ	License ; Enables sequence mode; Node locked	$330	$660
AUP-AFG3MEM	License ; Extends arb memory to 128Mpts; Node locked	$550	$1,100
AUP-AFG3BW25T50	License ; Bandwidth extension from 25MHz to 50MHz; Node locked	$253	$374
AUP-AFG3BW25T100	License ; Bandwidth extension from 25MHz to 100MHz; Node locked	$2,270	$3,030
AUP-AFG3BW50T100	License ; Bandwidth extension from 50MHz to 100MHz; Node locked	$2,010	$2,650
AUP-AFG3BW150T250	License ; Bandwidth extension from 150MHz to 250MHz; Node locked	$5,040	$7,650

POSITIONING

REPLACEMENT OF AFG3KC SERIES

Master Price	Tektronix AFG Family
$15,000	
$13,000	
$11,000	
$9,000	
$7,000	
$5,000	
$3,000	
$1,000	
$0	

AFG1K

25 MHz/60 MHz model, for teaching lab application

AFG2K

Superior performance, compact form factor fits bench and rack applications

AFG3KC

Superior performance, versatile functionality cover diversified customer needs on testing

NEW !

AFG31K

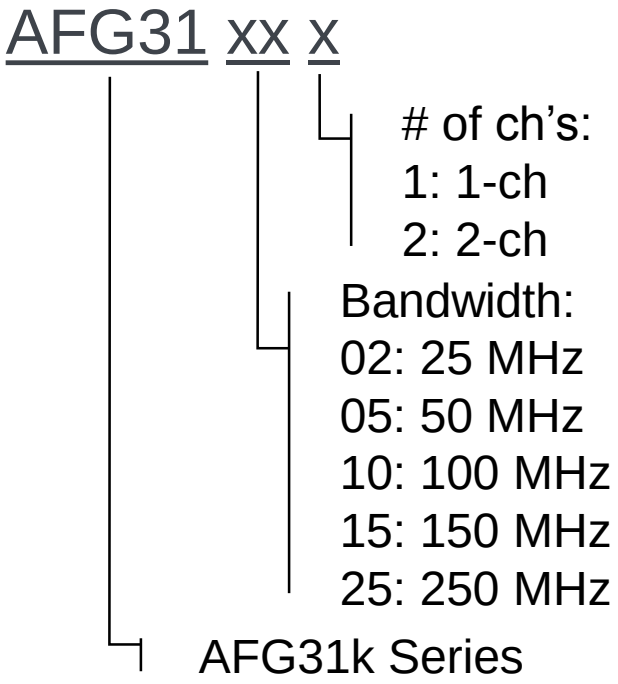
9-inch capacitive touchscreen, with InstaView™, waveform sequencer and waveform editor integrated for high-end design and research

AFG3000C will be replaced by AFG31000 one year after launch*

* Limited supply and supply deplete dates will depend on the availability of materials.

Replacement of AFG3000C

NOMENCLATURE AND AFG3000C COUNTERPARTS



AFG31000 Series	Master Price	AFG3000C Series	Master Price
AFG31021	$2,210	AFG3021C	$1,980
AFG31022	$3,340	AFG3022C	$2,980
AFG31051	$2,440	AFG3051C	$2,200
AFG31052	$3,680	AFG3052C	$3,330
AFG31101	$4,270	AFG3101C	$3,890
AFG31102	$6,090	AFG3102C	$5,550
AFG31151	$5,020	AFG3151C	$4,580
AFG31152	$7,150	AFG3152C	$6,530
AFG31251	$9,600	AFG3251C	$8,970
AFG31252	$14,100	AFG3252C	$12,500

Schedule and Stocking

AFG31K Schedule

Milestone	Phase I *	Phase II *
VIP OOQ (open order queue for channel partners)	Aug. 25, 2018	Oct. 27, 2018
PSR (product shipment release)	Sept. 23, 2018	Nov. 16, 2018
PA (public announcement)	Oct. 23, 2018	
Public OOQ (open order queue for end customers)	Oct. 20, 2018	Oct. 27, 2018

* Phase I: AFG31021, AFG31022, AFG31051, AFG31052, AFG31101, AFG31102
* Phase II: AFG31151, AFG31152, AFG31251, AFG31252

AFG31K Stocking Recommendation

- AFG31K is to replace AFG3KC.
- All AFG3KC will be phased out 12 months after AFG31K PA.
- AFG31K is expected to achieve 20% more sales versus AFG3KC.
- Recommended to stock the equivalent model of AFG3000C that you currently stock.

- For demo units, order with -DDU option or post purchase upgrade option AFG3DDU
  - The option is valid for 400 days after installation
  - The option enables the highest bandwidth (100MHz for low end models or 250MHz for high end models), 128Mpts arb memory (-MEM option) and sequence mode (-SEQ option)

End

Find more valuable resources at TEK.COM

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