



QICK AMO Extension Updates

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Architecture of Generator

- Fifth order polynomial function for frequency modulation:

$$f[t] = c_0 + c_1t + c_2t^2 + c_3t^3 + c_4t^4 + c_5t^5$$

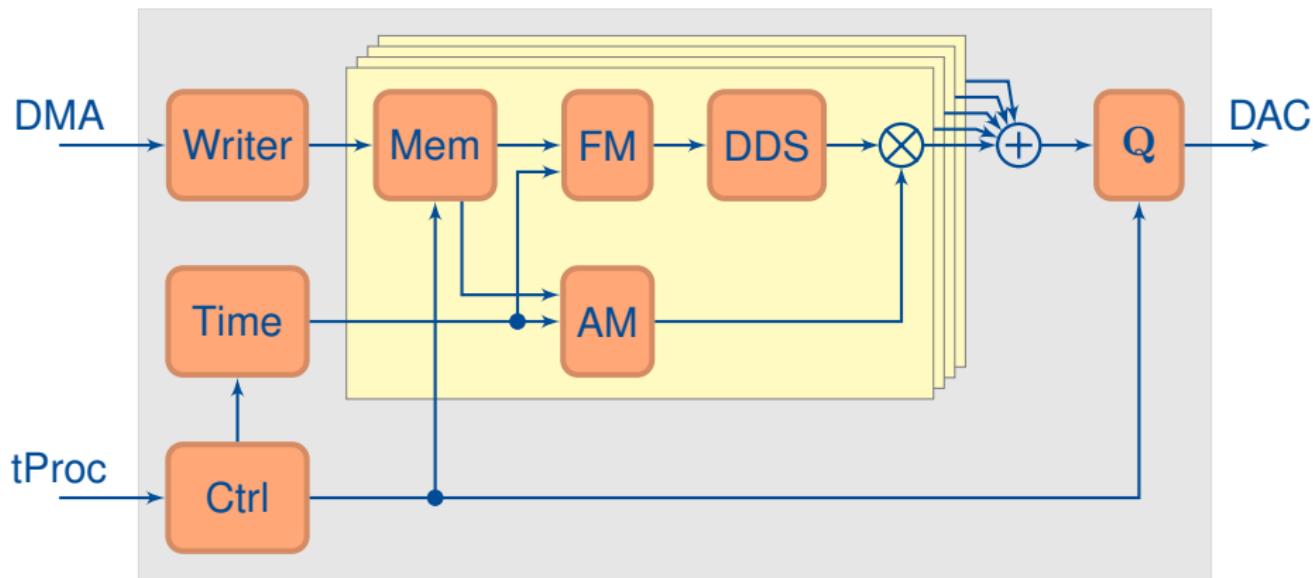
- Linear function for amplitude modulation:

$$a[t] = a_0 + a_1t$$

- Gain for modulation scaling.
- tProc control for sweep start and control.
- Independent parameter memory per DDS instance.
- Updated implementation: 32 independent DDS instances.

AMO Generator V3 Block Diagram

- 32 independent DDSs: FM, AM and Memory.
- Parameter memory: configurable size (256 actual).
- Added tProc control input to push waveforms.
- tProc control: address, wait, quantization and ctrl.



Generator Control

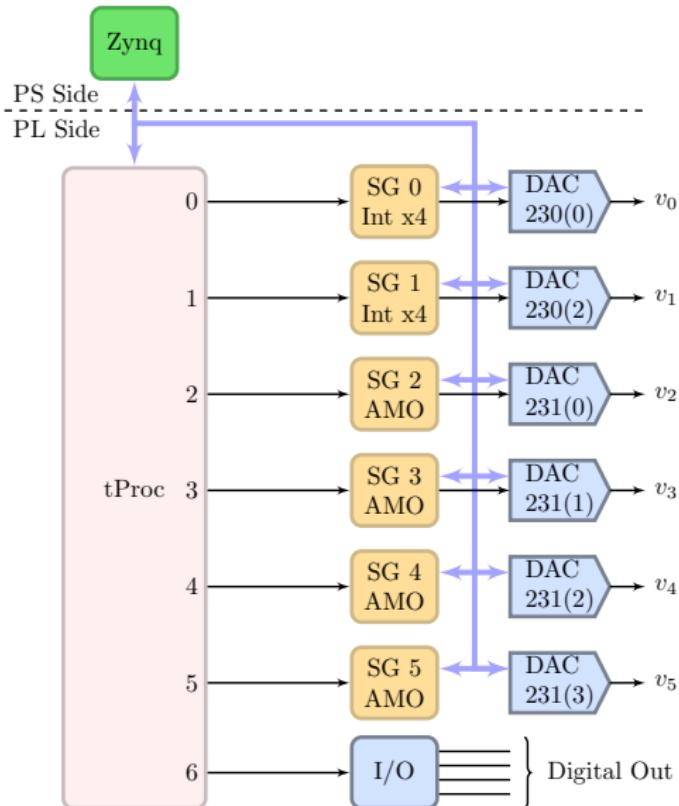
- Parameter memory holds sweep coefficients.
- Each memory location stores a set.
- The total number of sets can be controlled by Firmware.

	8	18	16	16	18	18	18	18	18	18	18	18
0	CTRL	P OFF	AMOD_C1	AMOD_CO	F MOD_G	F MOD_C5	F MOD_C4	F MOD_C3	F MOD_C2	F MOD_C1	F MOD_CO	
1	CTRL	P OFF	AMOD_C1	AMOD_CO	F MOD_G	F MOD_C5	F MOD_C4	F MOD_C3	F MOD_C2	F MOD_C1	F MOD_CO	
2	CTRL	P OFF	AMOD_C1	AMOD_CO	F MOD_G	F MOD_C5	F MOD_C4	F MOD_C3	F MOD_C2	F MOD_C1	F MOD_CO	
:		:			:		:		:			:

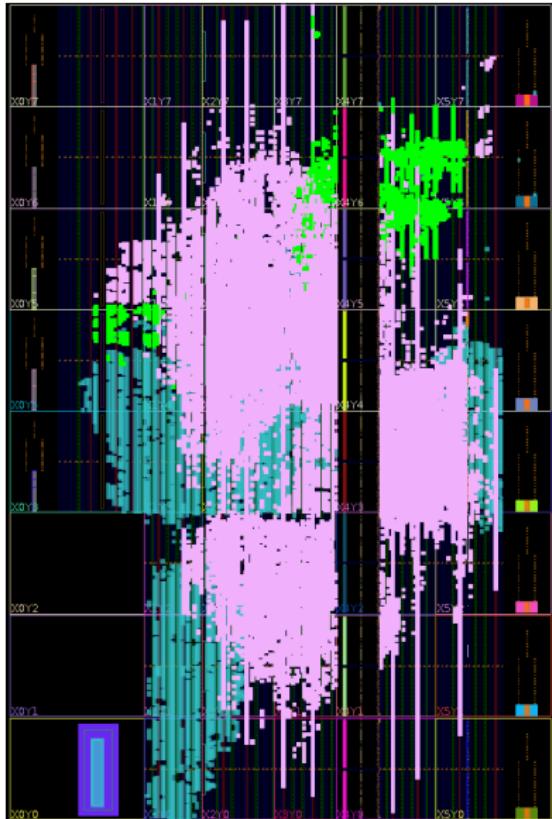
- The tProc pushed waveforms in real time.
- Parameters: set number, duration and quantization.

8	8	32	32
qsel	ctrl	wait	addr

Test Firmware

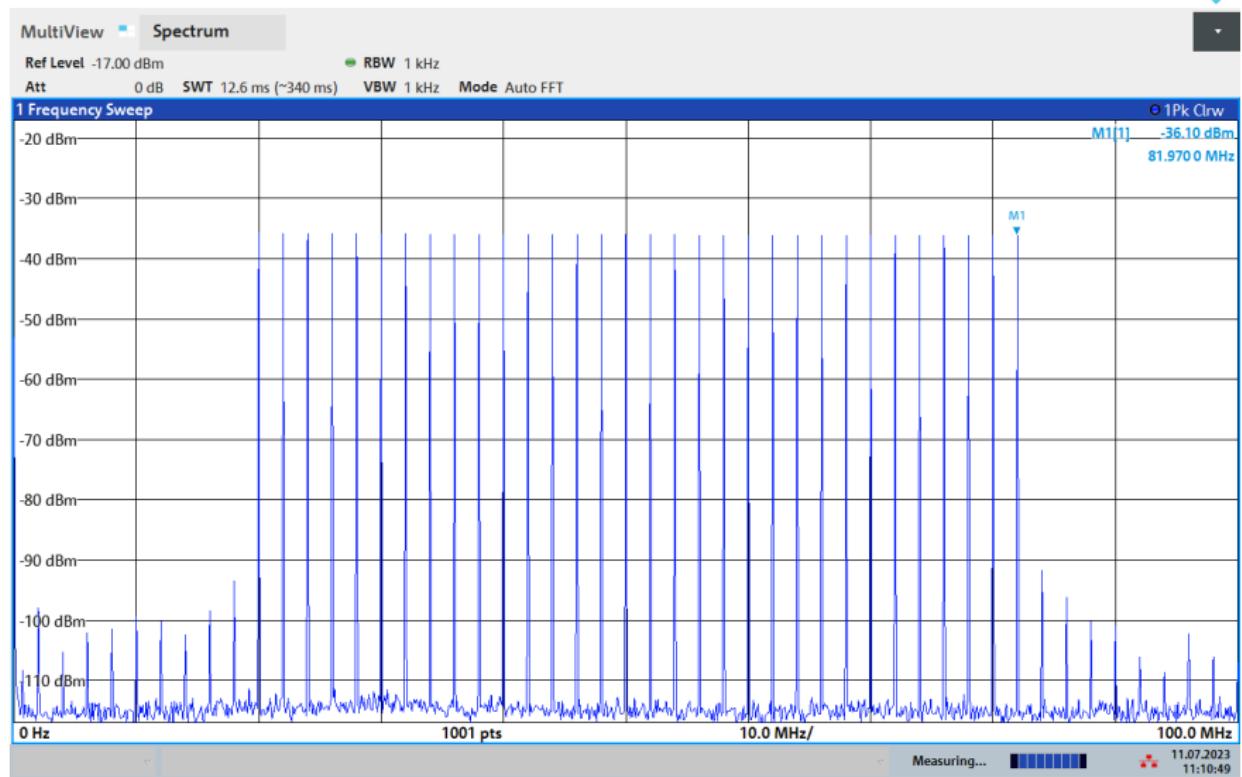


FPGA Resource Usage



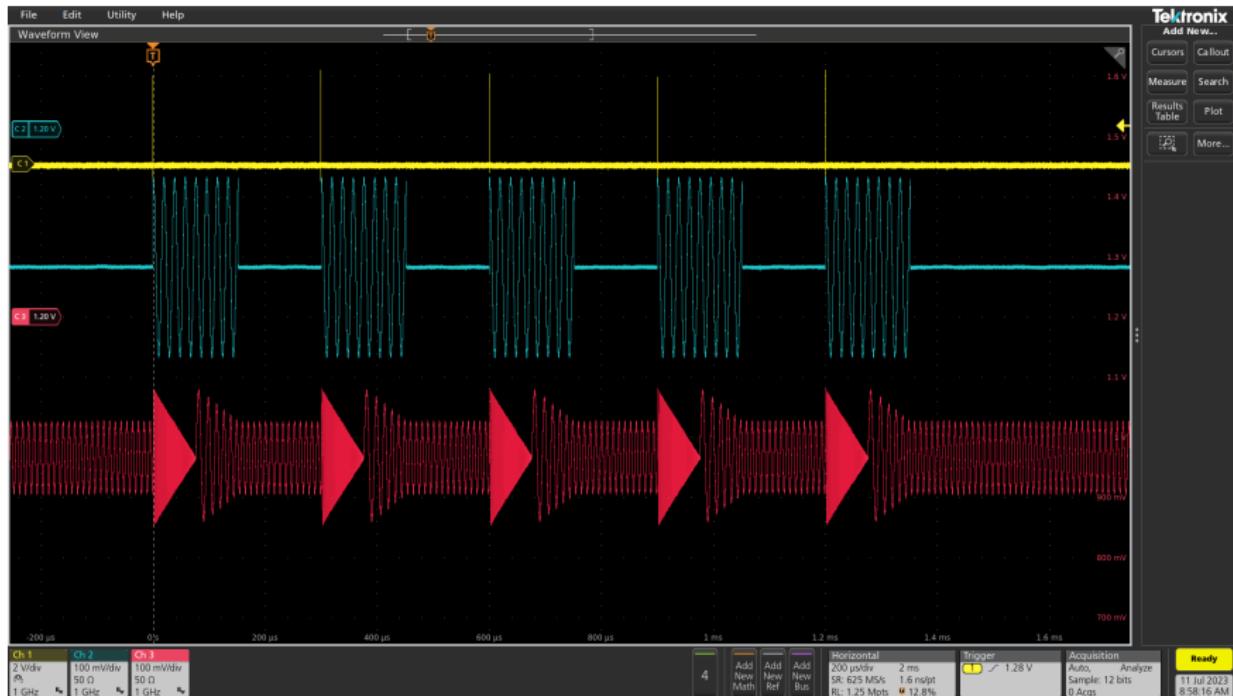
- > █ axis_clock_converter_2 (d_1_axis_clock_converter_2_0)
- > █ axis_clock_converter_3 (d_1_axis_clock_converter_3_0)
- > █ axis_set_reg_0 (d_1_axis_set_reg_0_0)
- > █ axis_sg_int4_v1_0 (d_1_axis_sg_int4_v1_0_0)
- > █ axis_sg_int4_v1_1 (d_1_axis_sg_int4_v1_1_0)
- > █ axis_signal_gen_amo_0 (d_1_axis_signal_gen_amo_0_0)
- > █ axis_signal_gen_amo_1 (d_1_axis_signal_gen_amo_1_0)
- > █ axis_signal_gen_amo_2 (d_1_axis_signal_gen_amo_2_0)
- > █ axis_signal_gen_amo_3 (d_1_axis_signal_gen_amo_3_0)
- > █ axis_switch_gen (d_1_axis_switch_gen_0)
- > █ axis_switch_gen_amo (d_1_axis_switch_gen_amo_0)
- > █ axis_tproc64x32_x8_0 (d_1_axis_tproc64x32_x8_0_0)
- > █ clk_tproc (d_1_clk_tproc_0)
- < █ rot_100 (d_1_rot_100_0)

Spectrum with all DDSs enabled

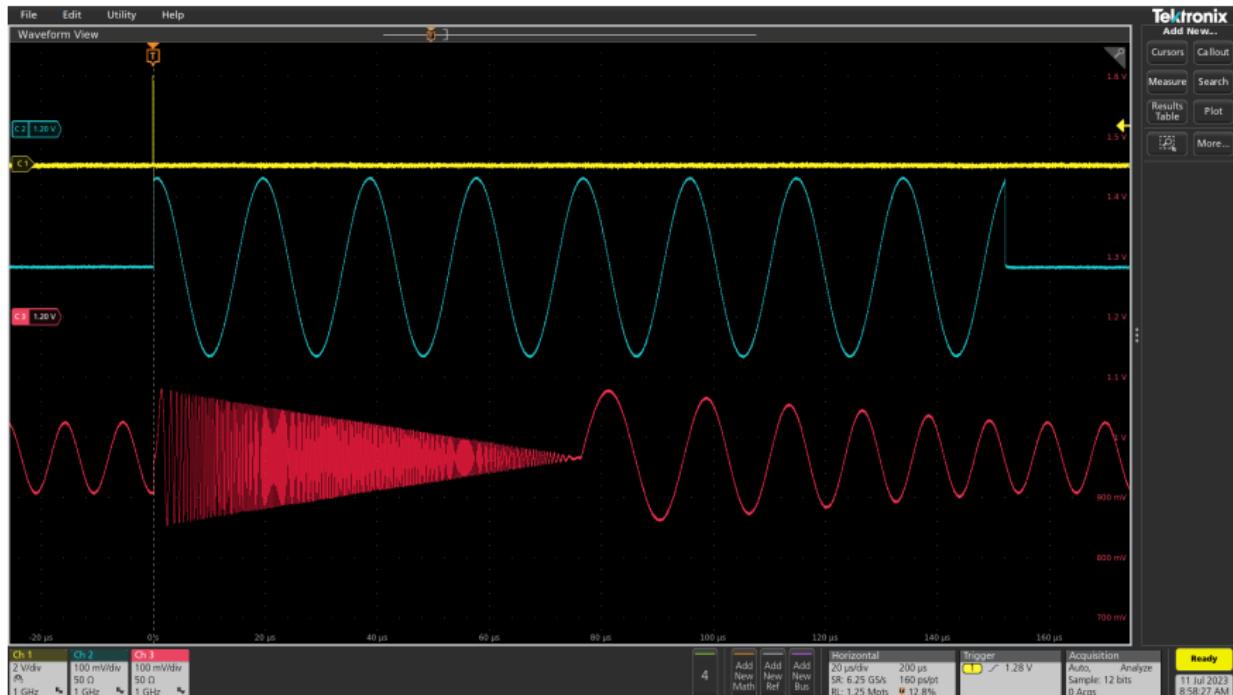


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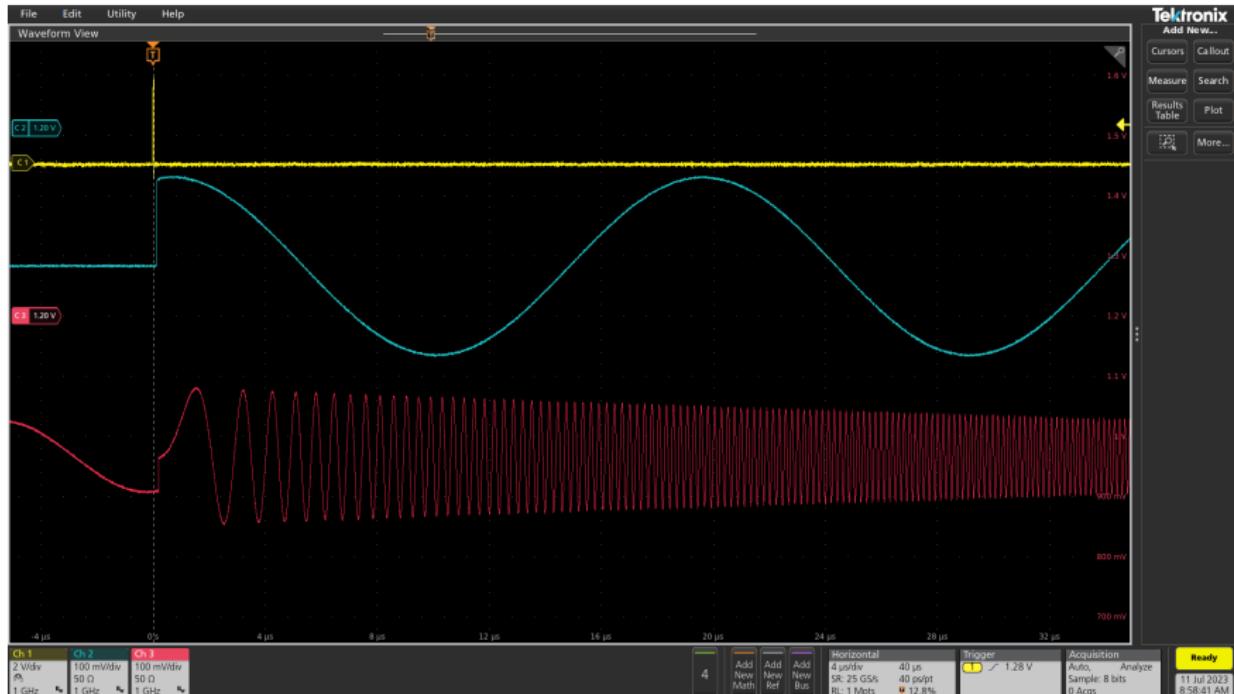
Scope Capture: modulation



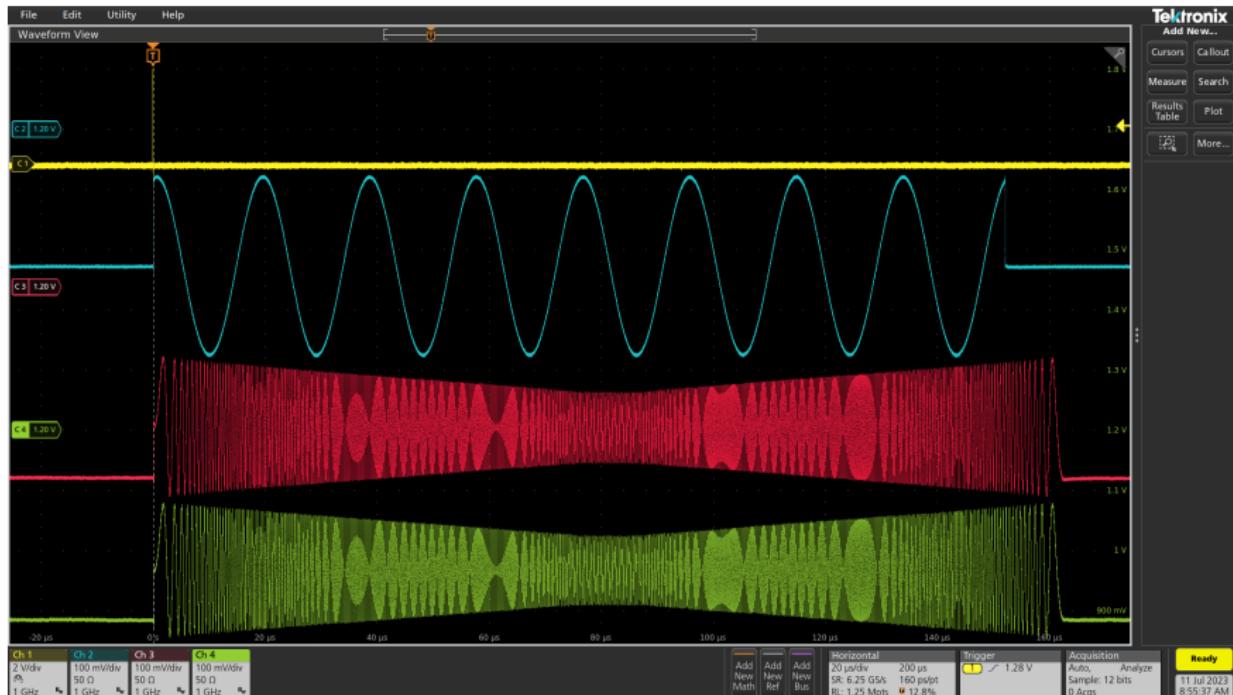
Scope Capture: modulation



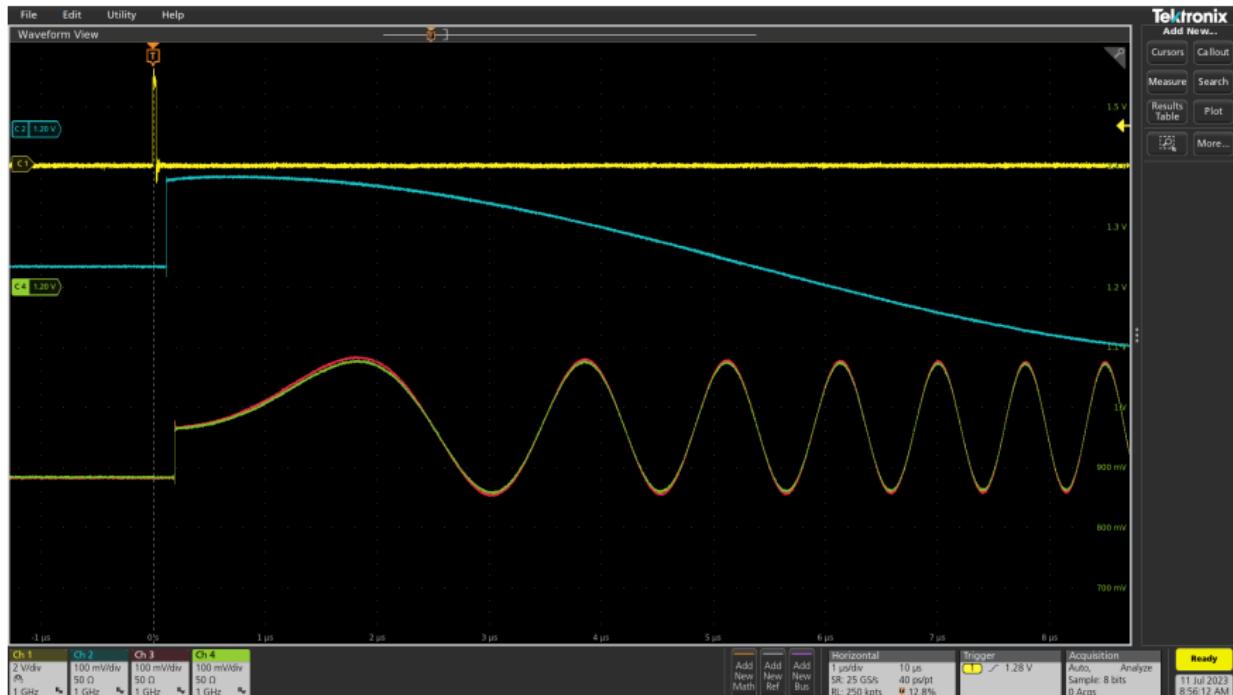
Scope Capture: modulation



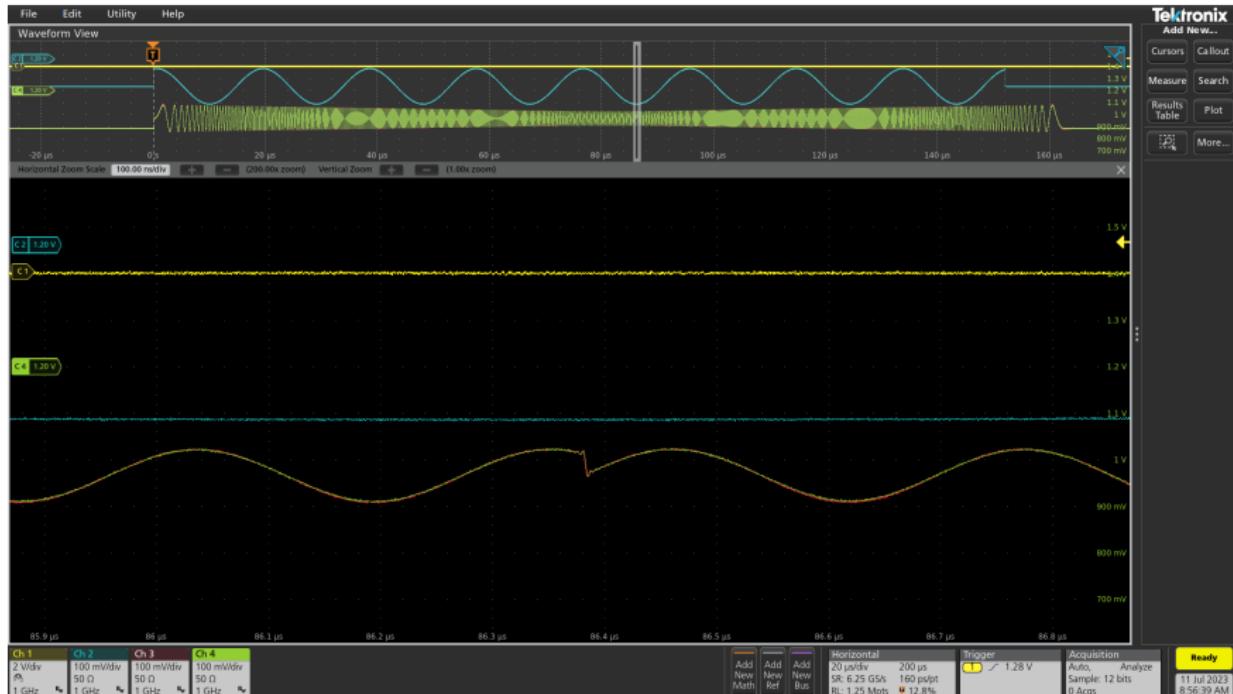
Scope Capture: phase control



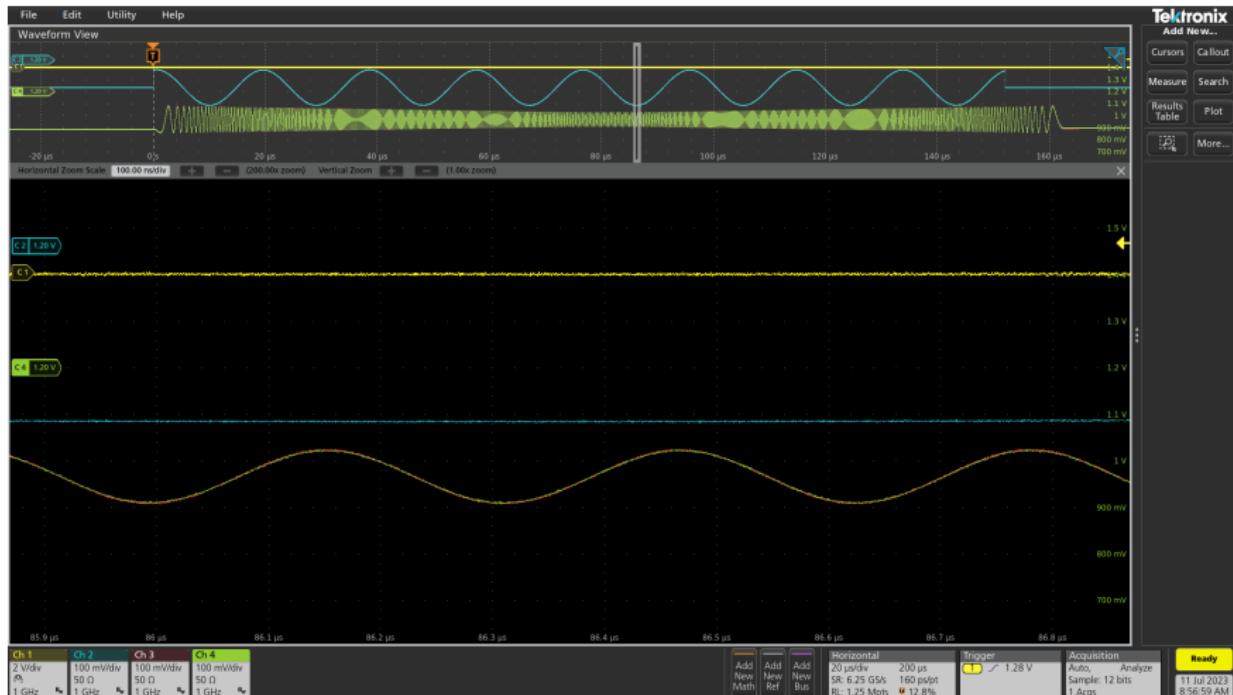
Scope Capture: phase control



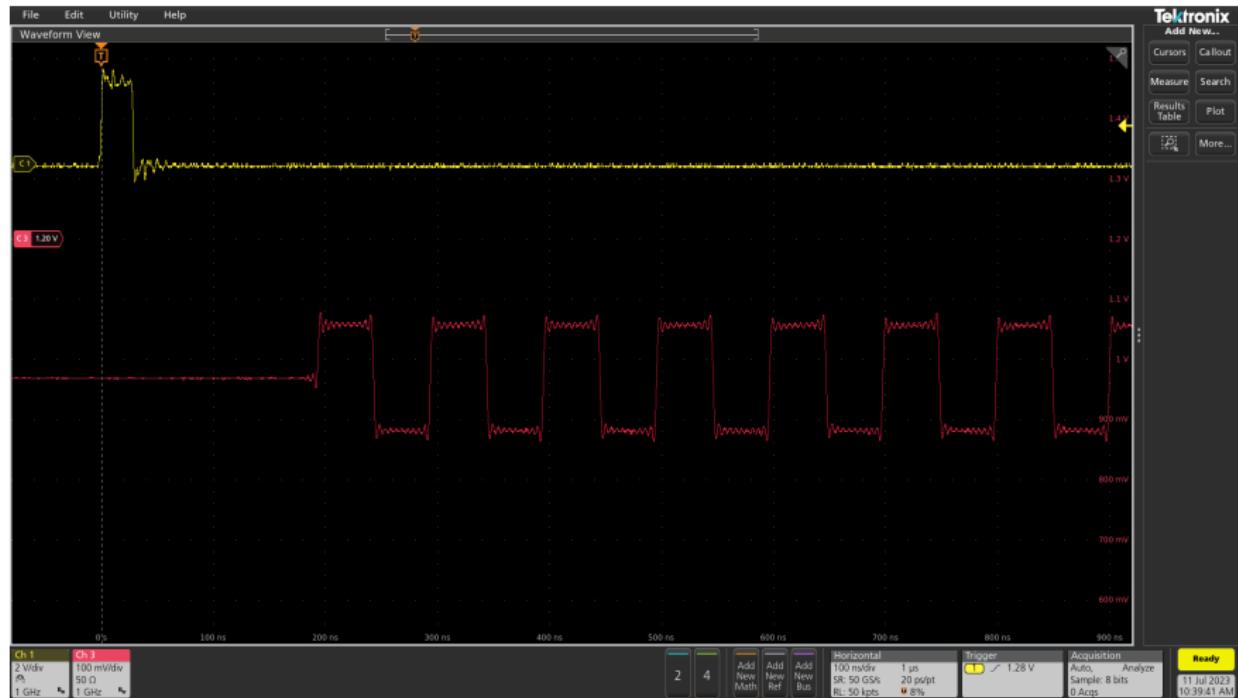
Scope Capture: phase control



Scope Capture: phase control



Scope Capture: fourier



Scope Capture: fourier

