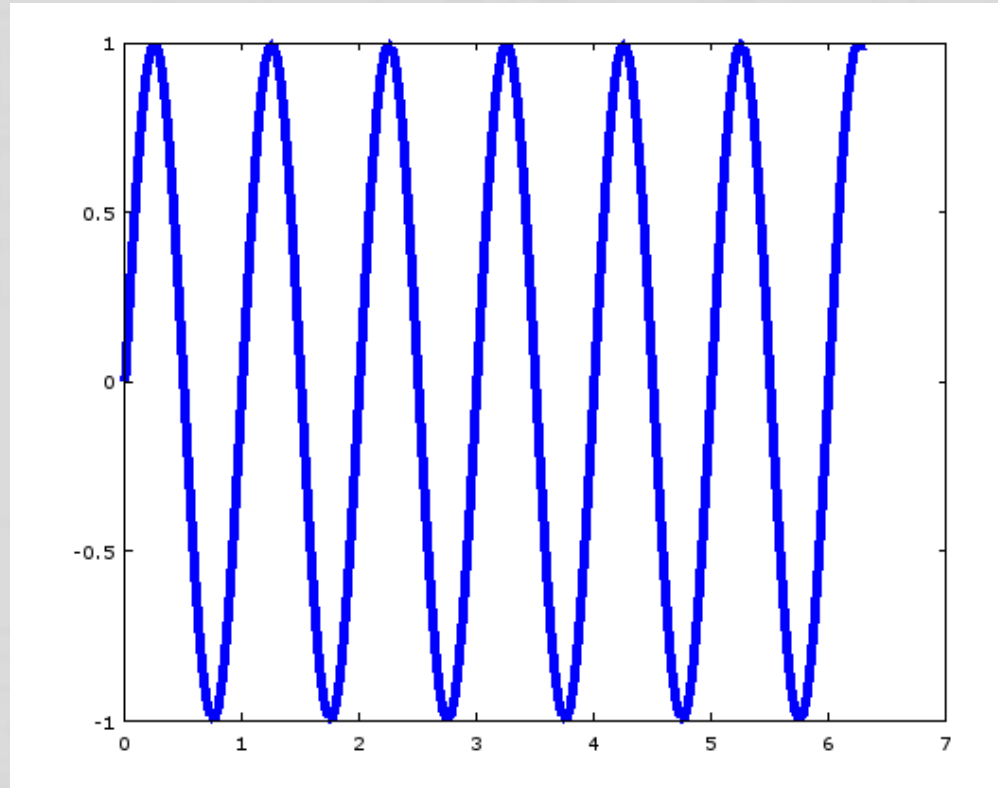# ELINT and Radar Signals

Short Course on Radar and Electronic Warfare

Kyle Davidson

Overview

- Waveform characteristics
- Modulating signals
- Pulsed radar signals
  - Unmodulated
  - Linear Frequency Modulation (LFM)
  - Frequency Hopping
  - PRI Jitter
  - PSK / Barker Code
  - FSK
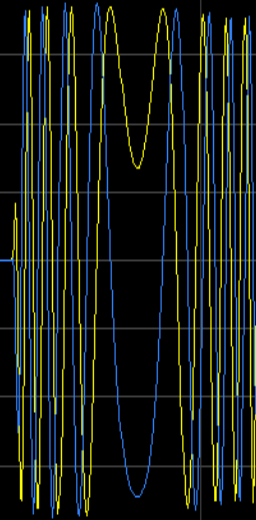- Continuous Wave (CW) radar signals
  - FMCW
- LPI/LPD waveforms

Sinusoid

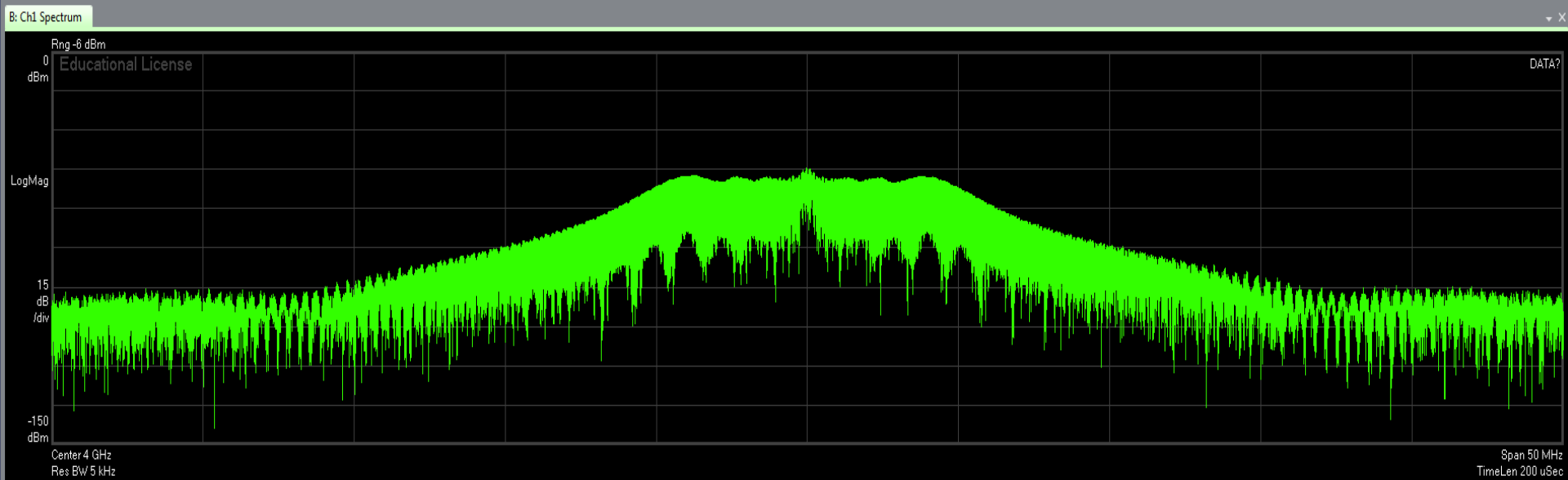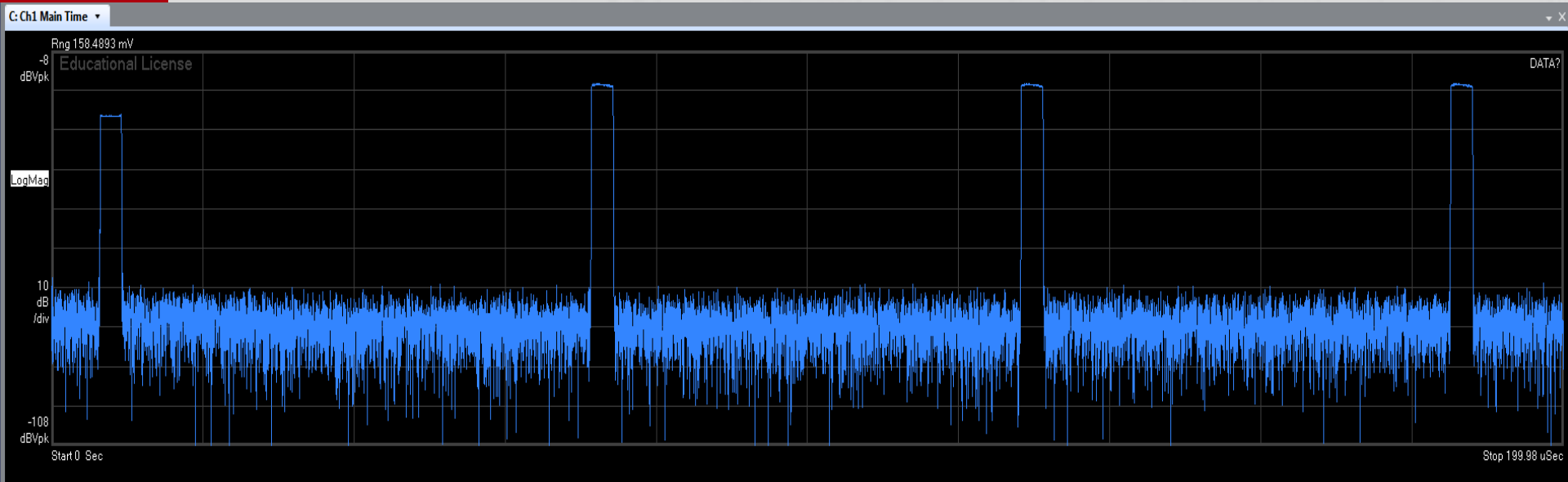$$x(t) = \mathrm{A}(t)\sin\big(2\pi f(t)t + \phi(t)\big)$$

Modulation

- Amplitude

- Frequency

- Phase

Pulsed Radar Signals

Pulsed Descriptor Word
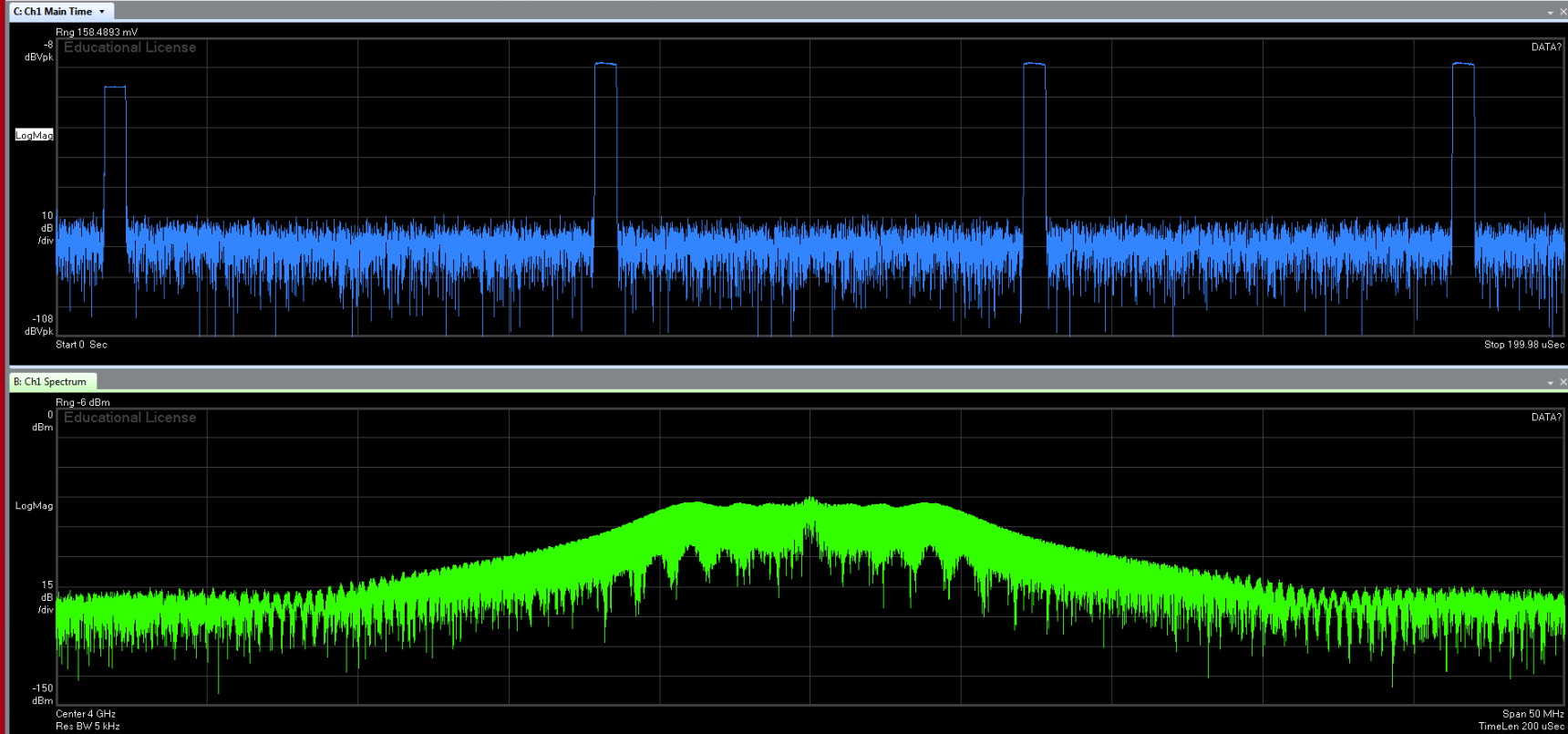
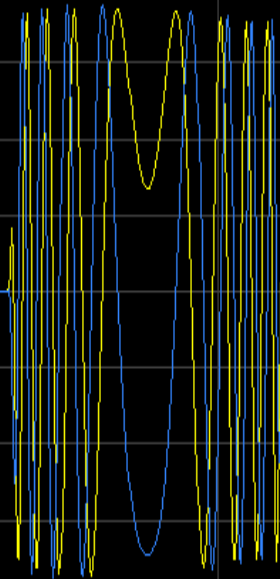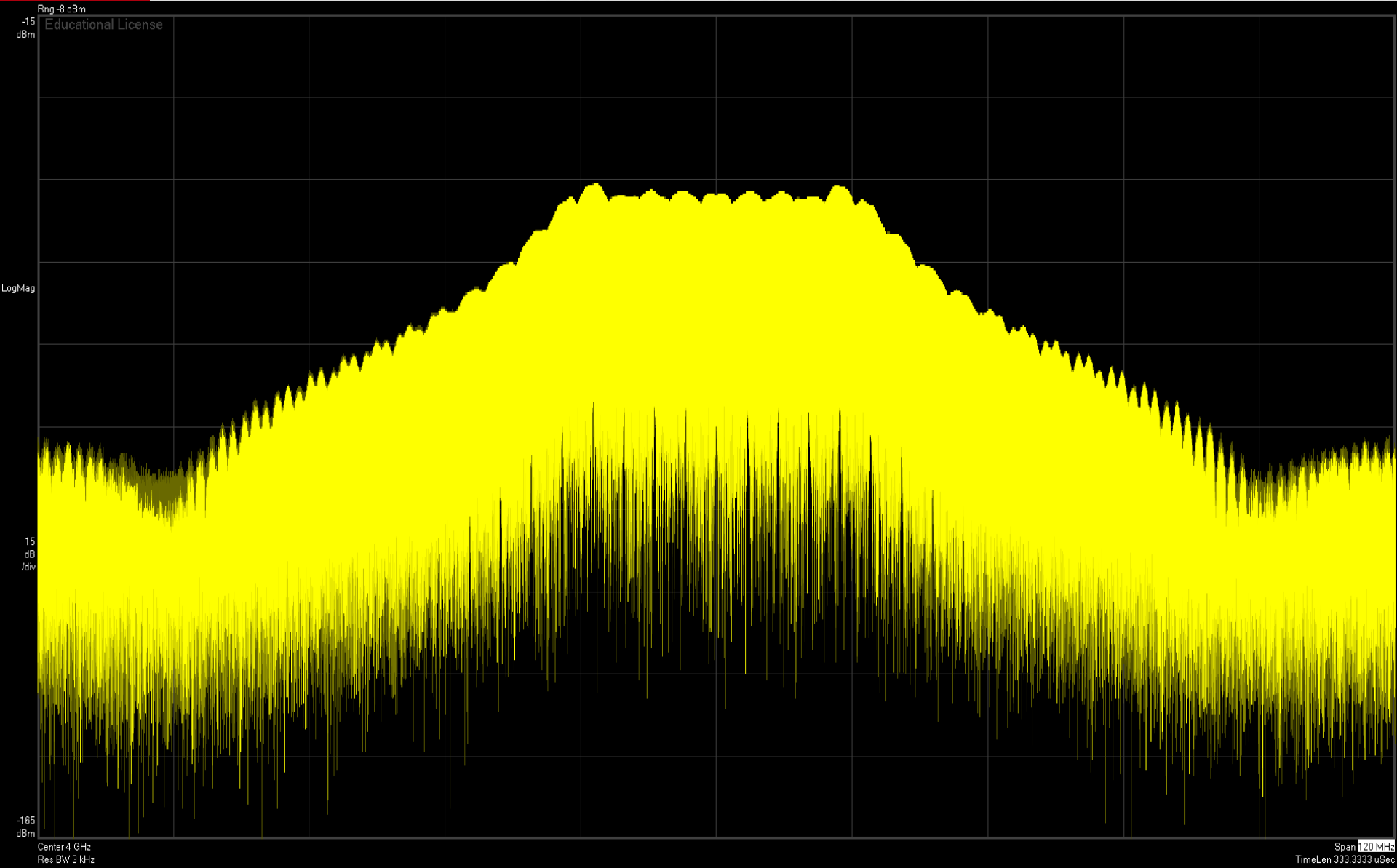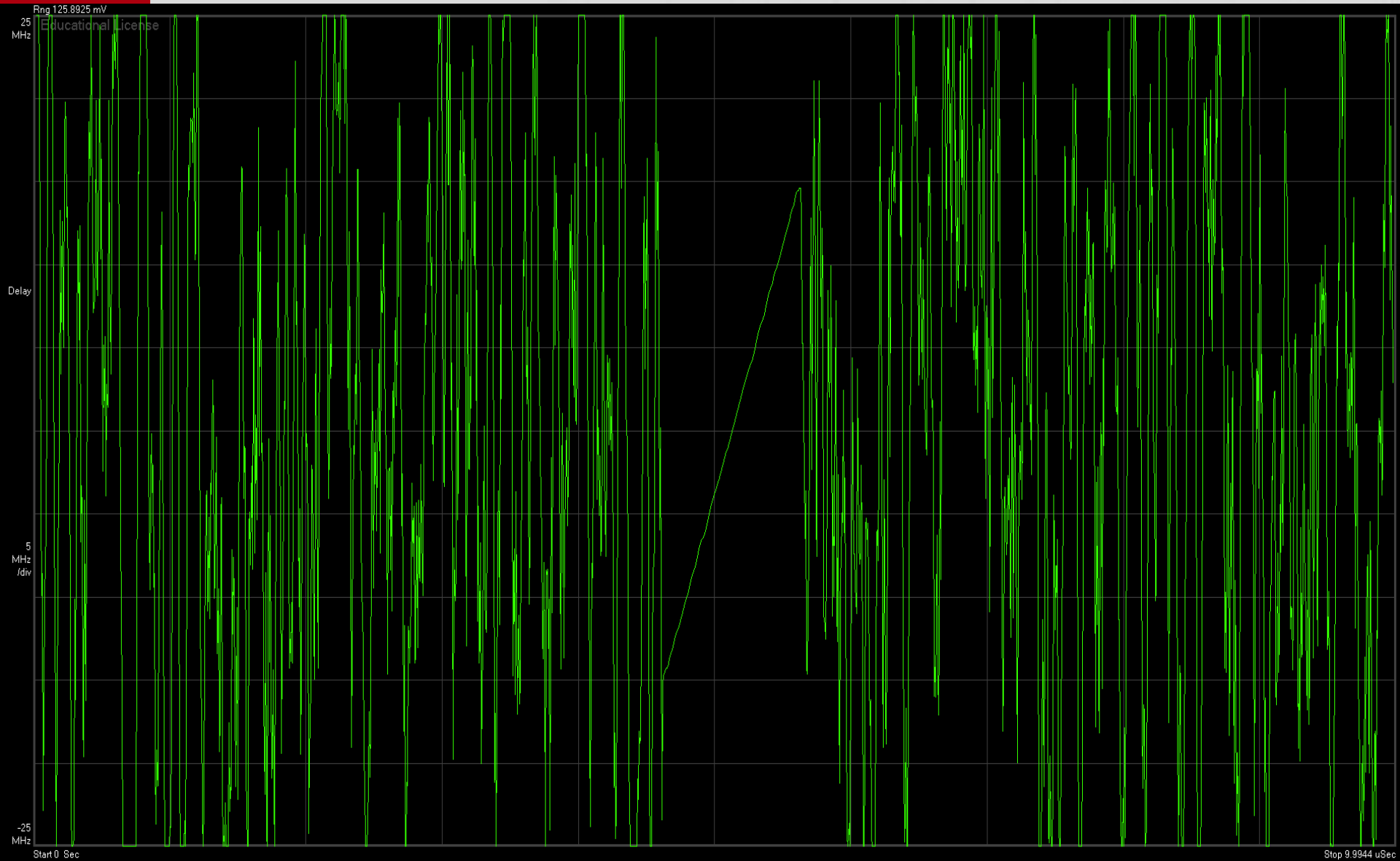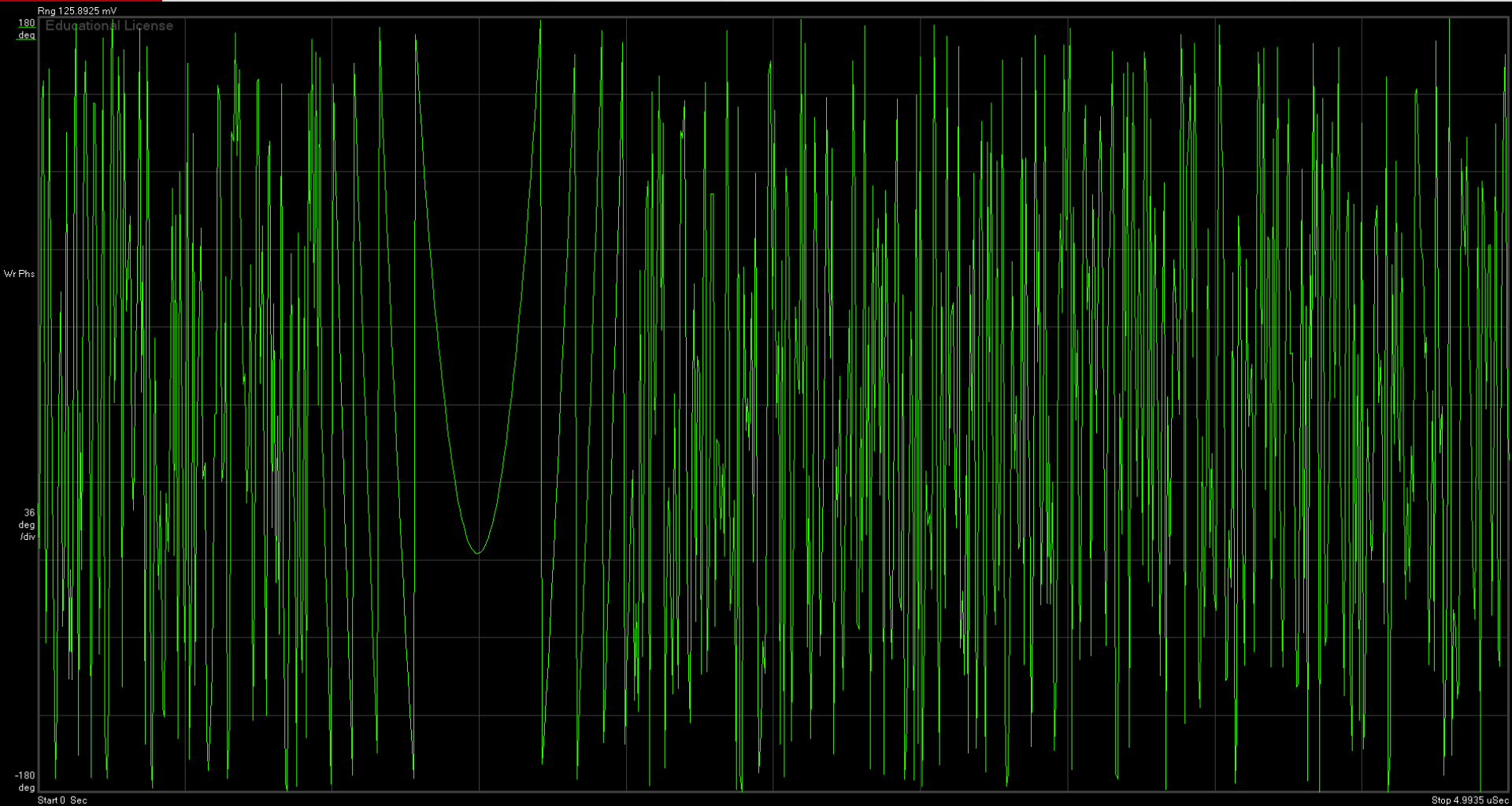| Pulse Width	PRI	PRF	Centre Freq.
Bandwidth	Modulation	Jitter	Hopping

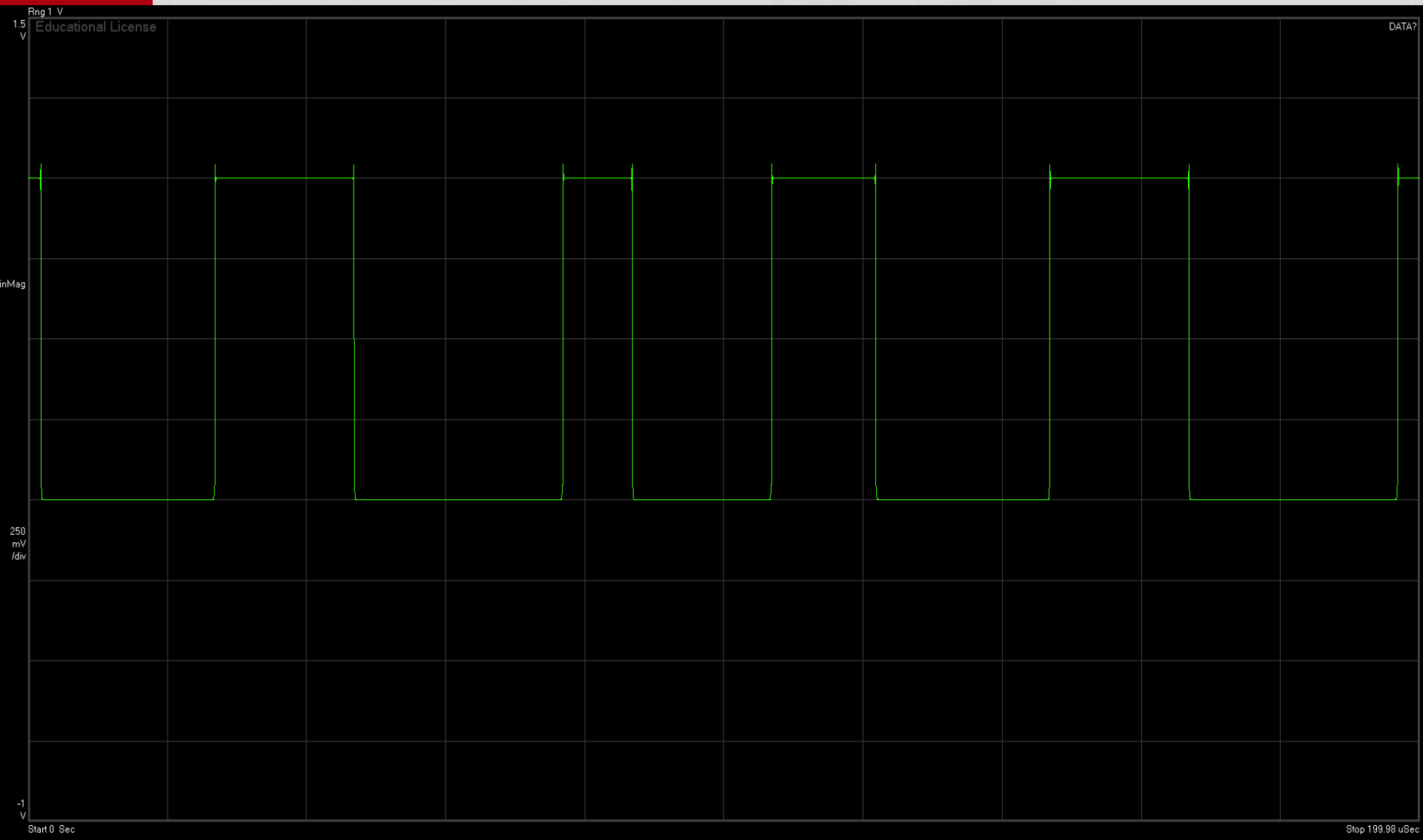# LFM – Real / Imaginary
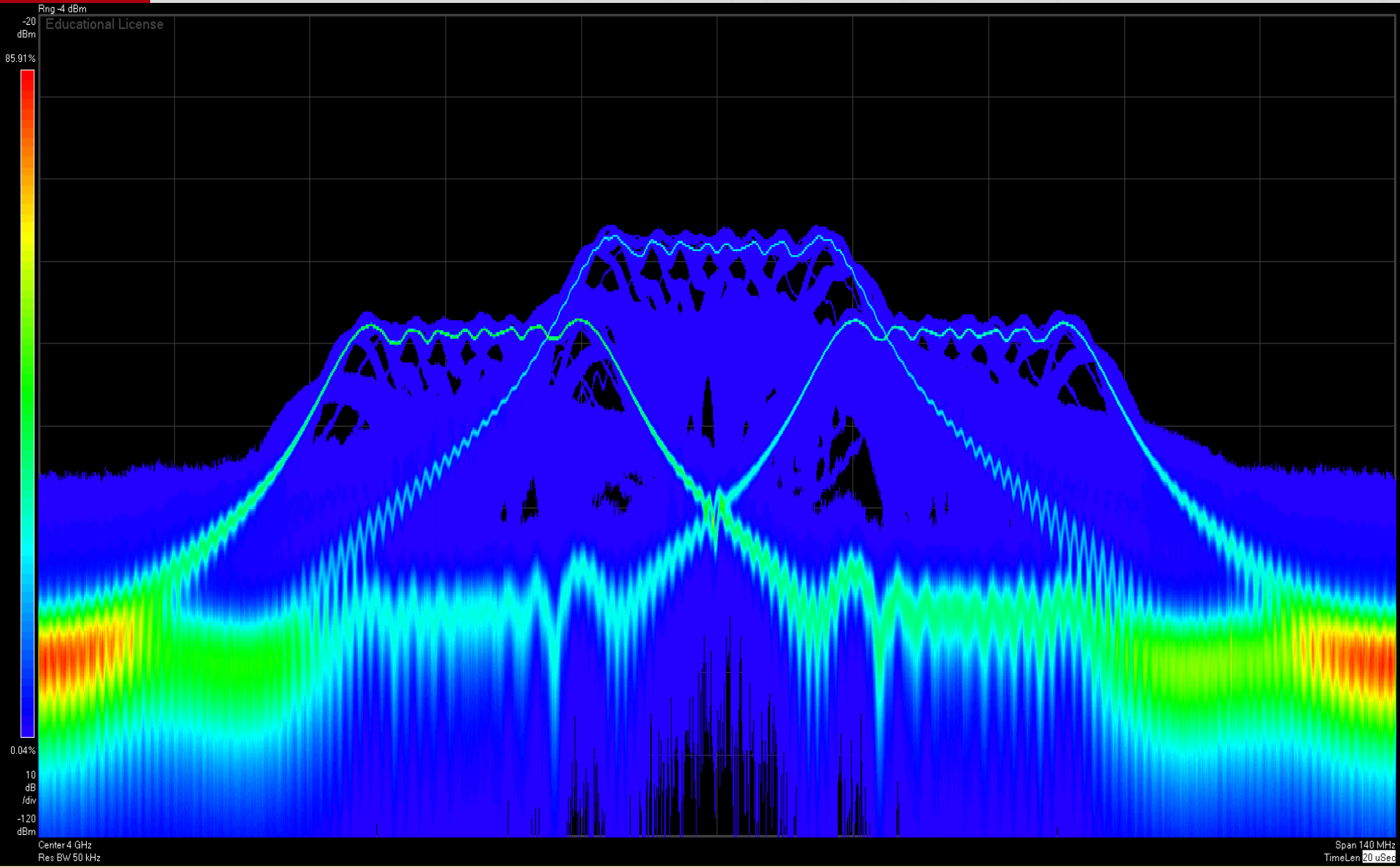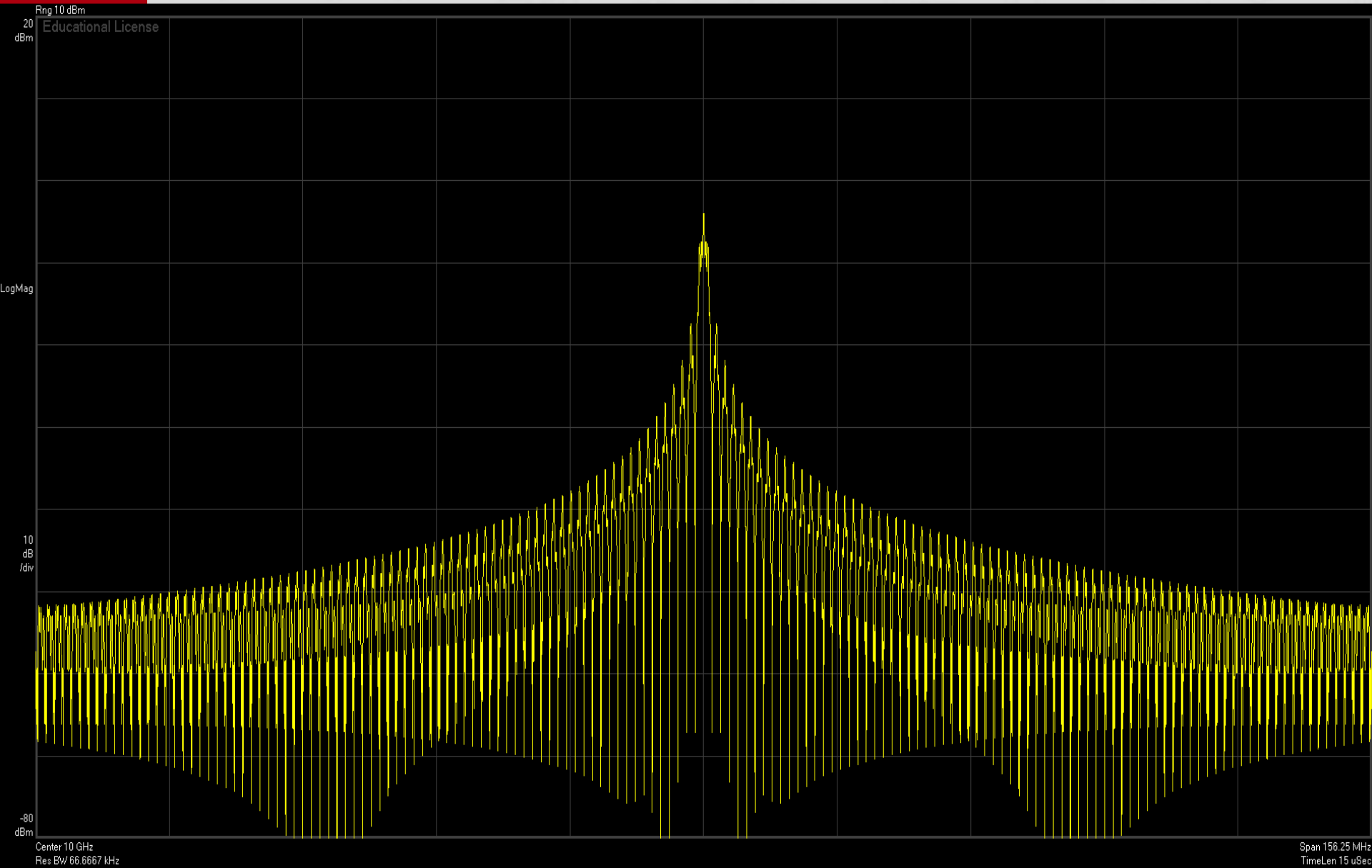
LFM – Spectrum

LFM – Delay

LFM – Phase

PRF – Jitter

Frequency Hopping – Hop Rate

PSK – Phase – Code Size

PSK – Spectrum

Barker Codes

Code Length	Code
2	11 or 10
3	110
4	1110 or 1101
5	11101
7	1110010
11	11100010010
13	1111100110101

FSK – Spectrum
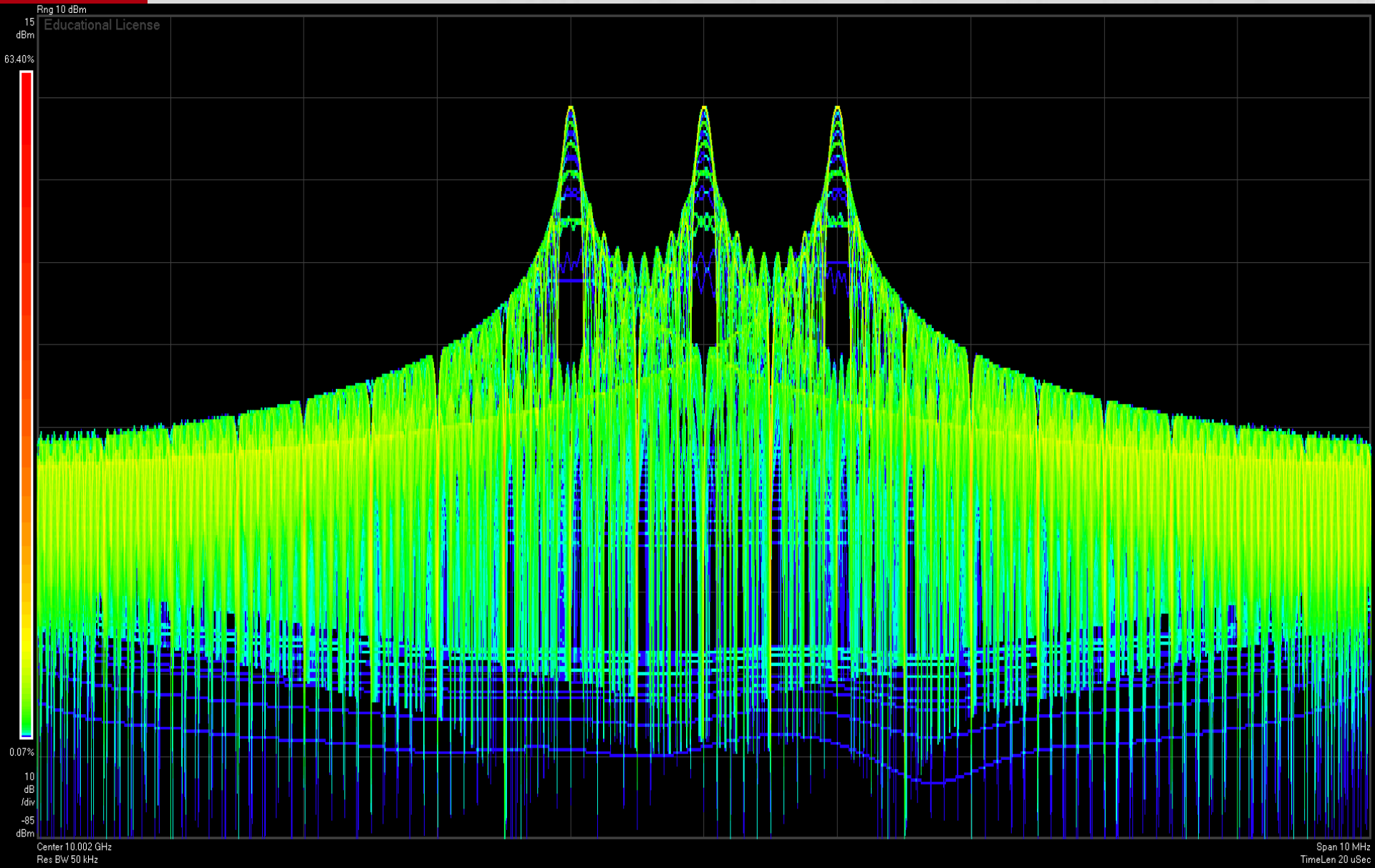
FSK – Delay
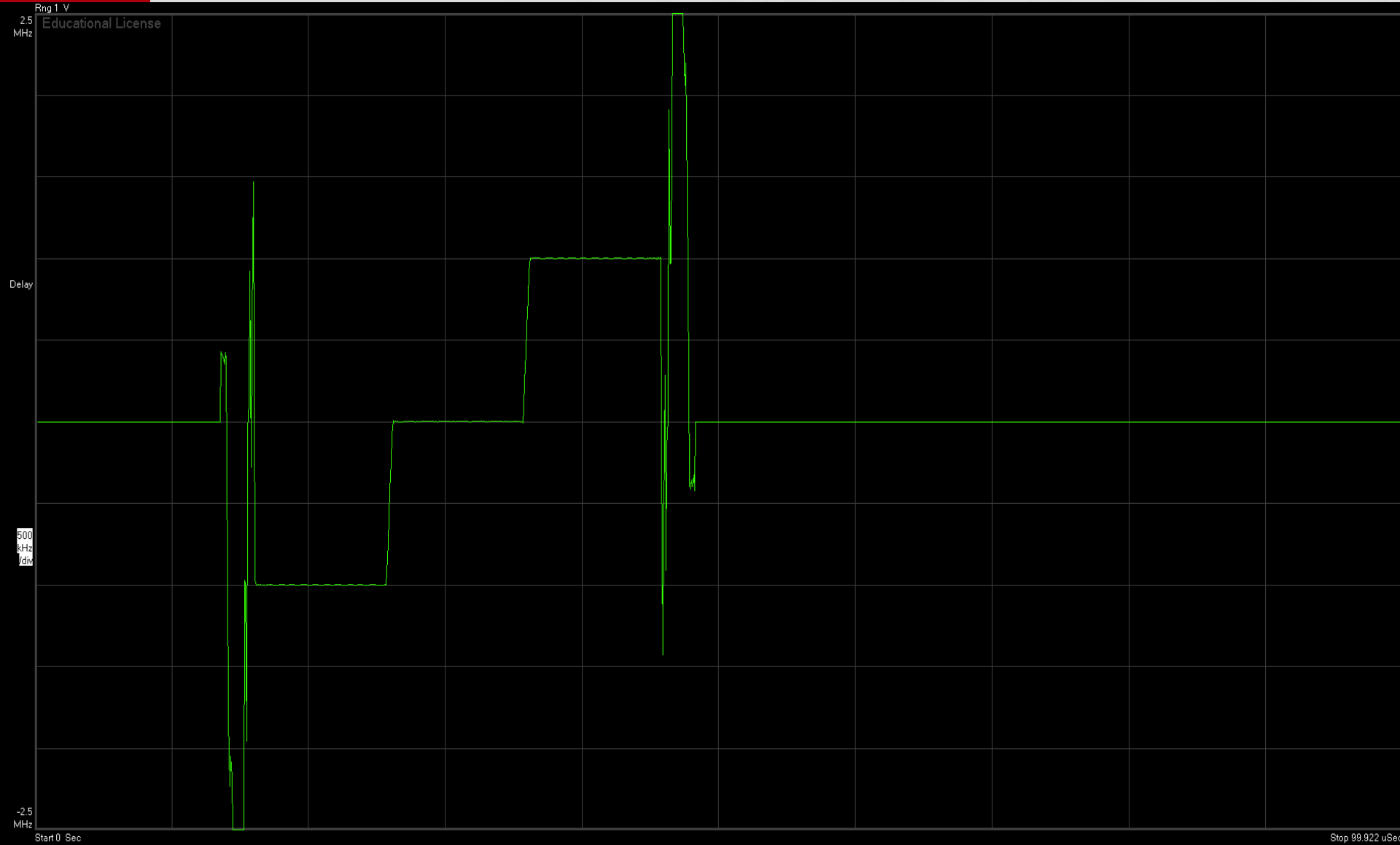
LPI / LPD

- What makes a signal LPI/LPD?
  - Low power
  - Unpredictability
- Making a radar system LPI/LPD is more complicated

FMCW – Spectrogram