FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ENEE 4113, Communication Laboratory

Experiment. 10 Prelab

Amplitude shift-keying (ASK)

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T.A:

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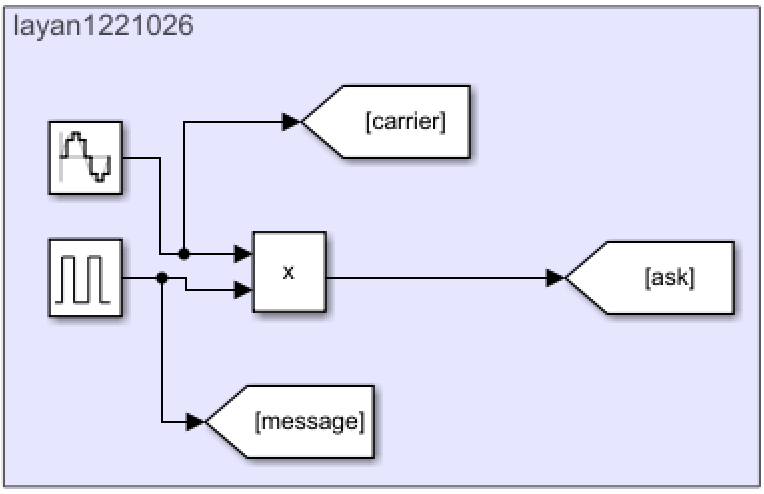
Simulation and Data analysis

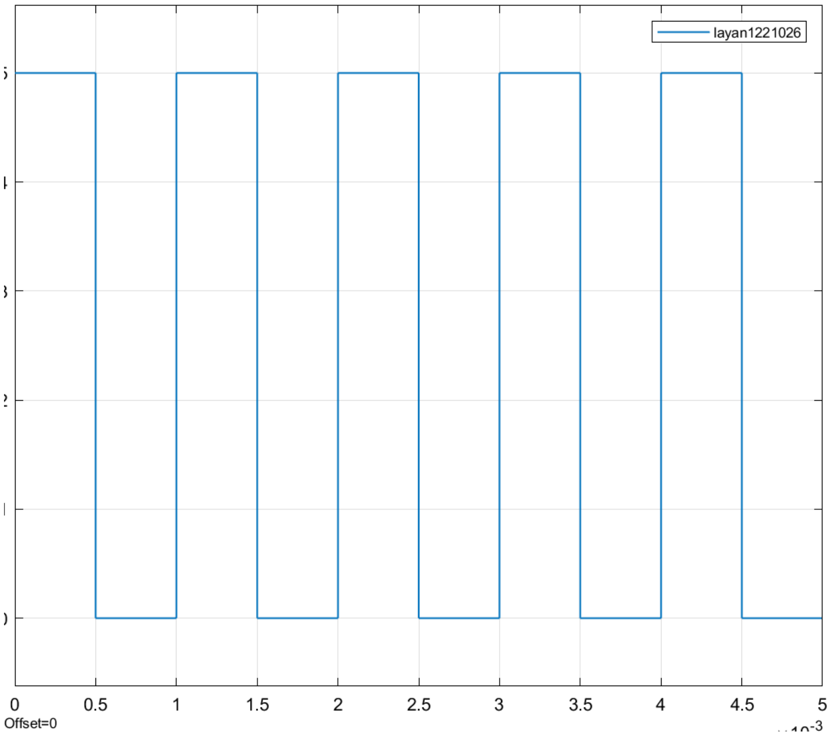
Part 1: Message Signal and Carrier :

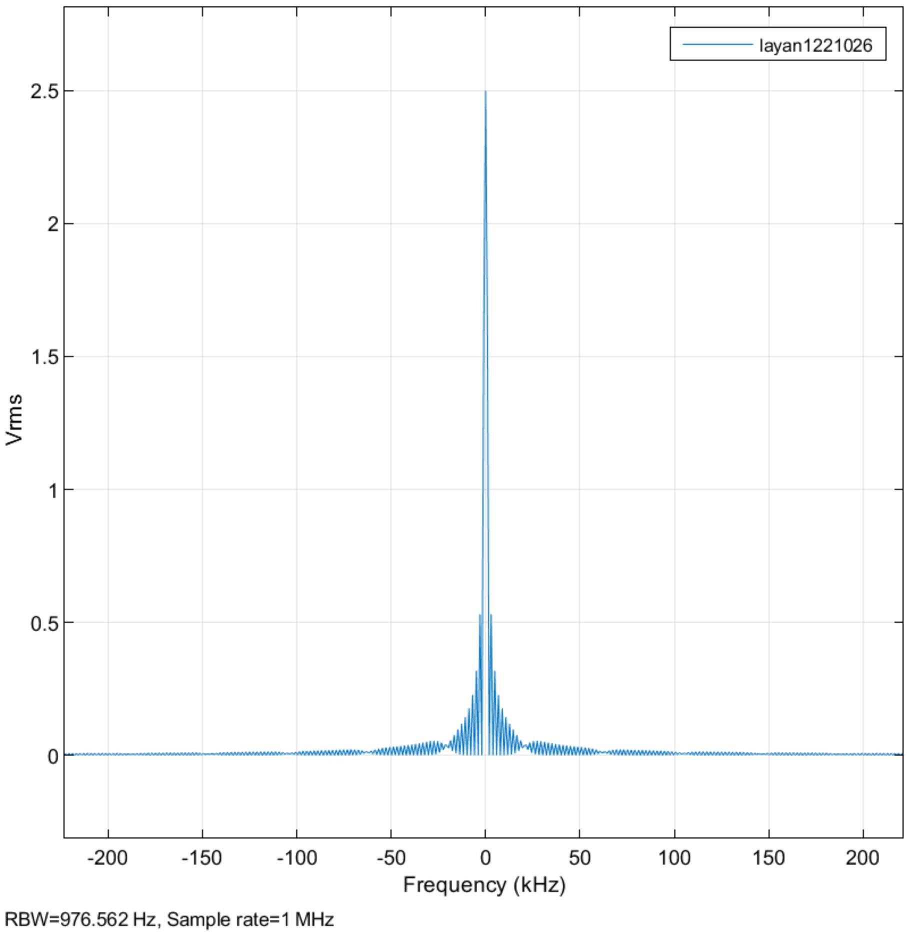
Here, the ASK modulation is shown, where the message is impulses (like a square wave) and the carrier is sinusoidal with frequency (20K) , the ASK modulated signal is the product of these two waves.

For this part we want to show the message and the carrier, the message is set to Amplitude=5, duty cycle= 50% and frequency = 1k:

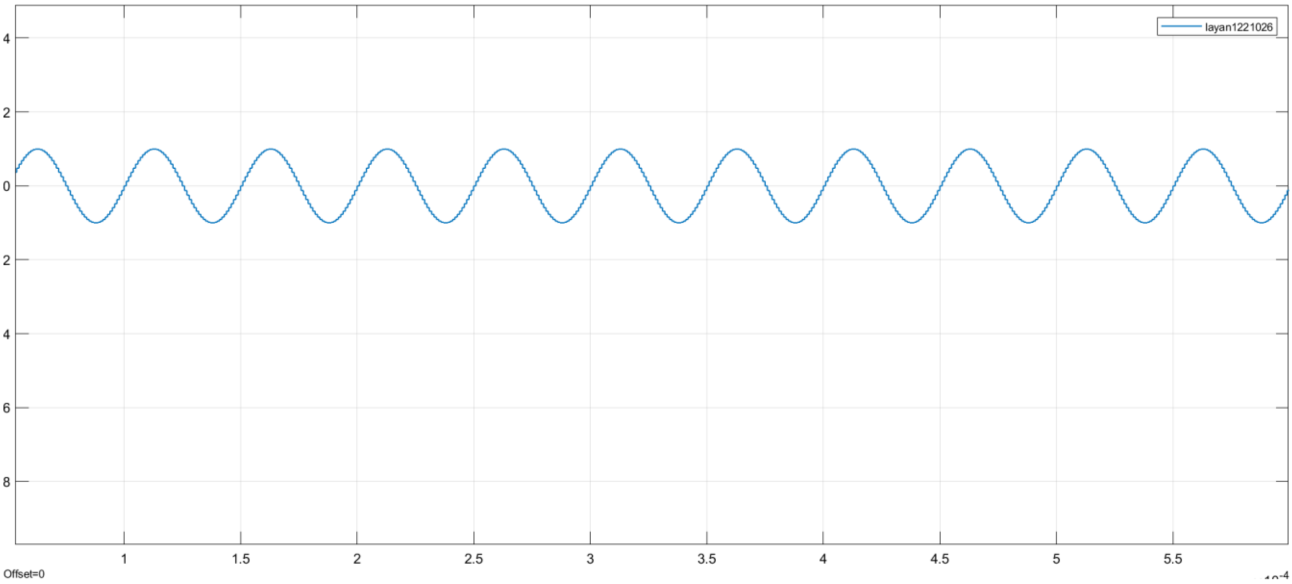


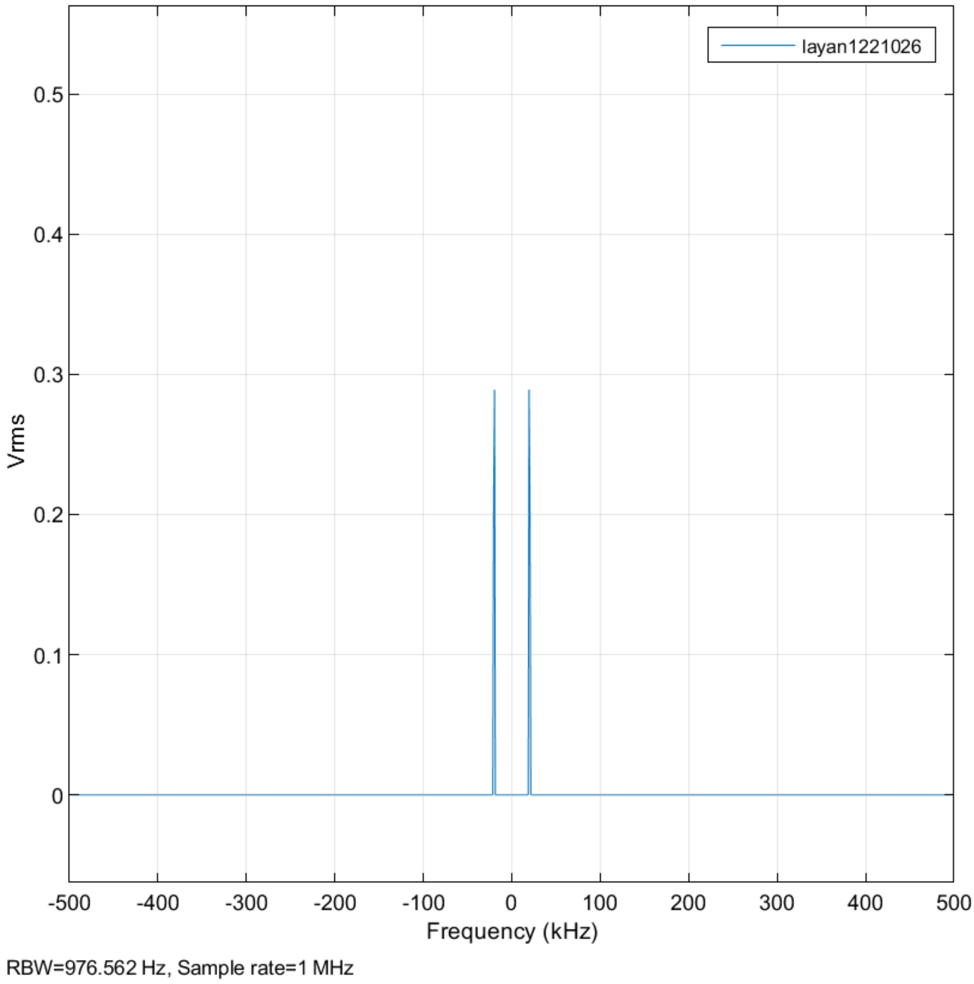
→**Message Signal :**





→Carrier Signal :

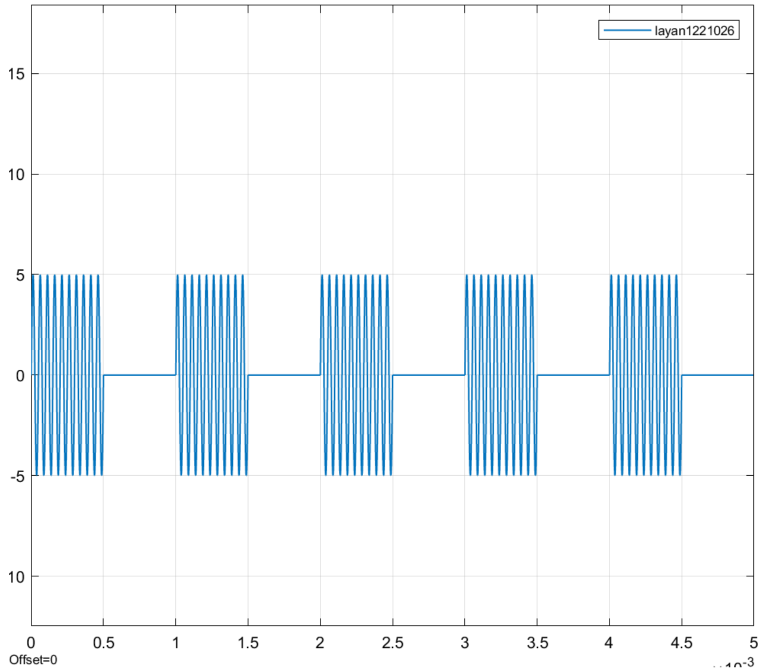


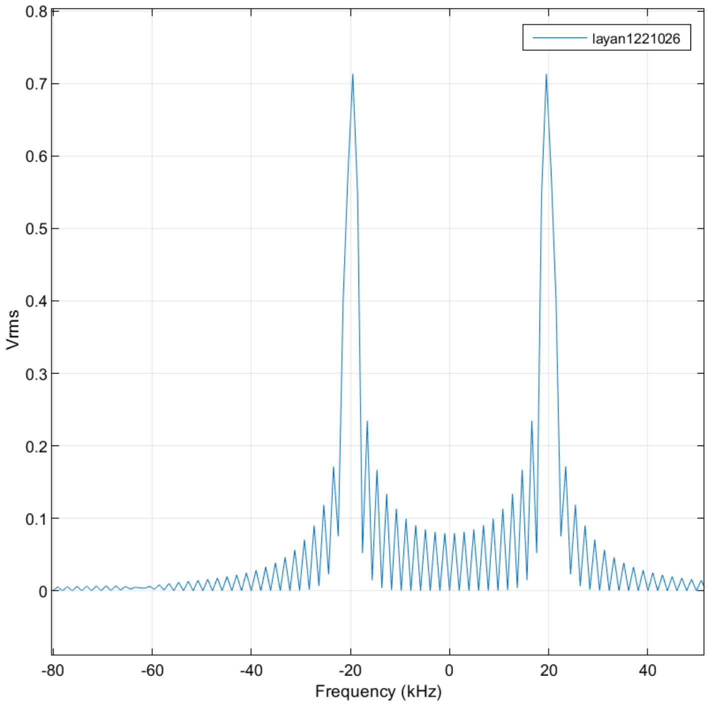


Part 2: ASK Modulated Signal:

In this part we used the ASK modulator that was shown in the last part and experimented with different frequencies and duty cycle for the message.

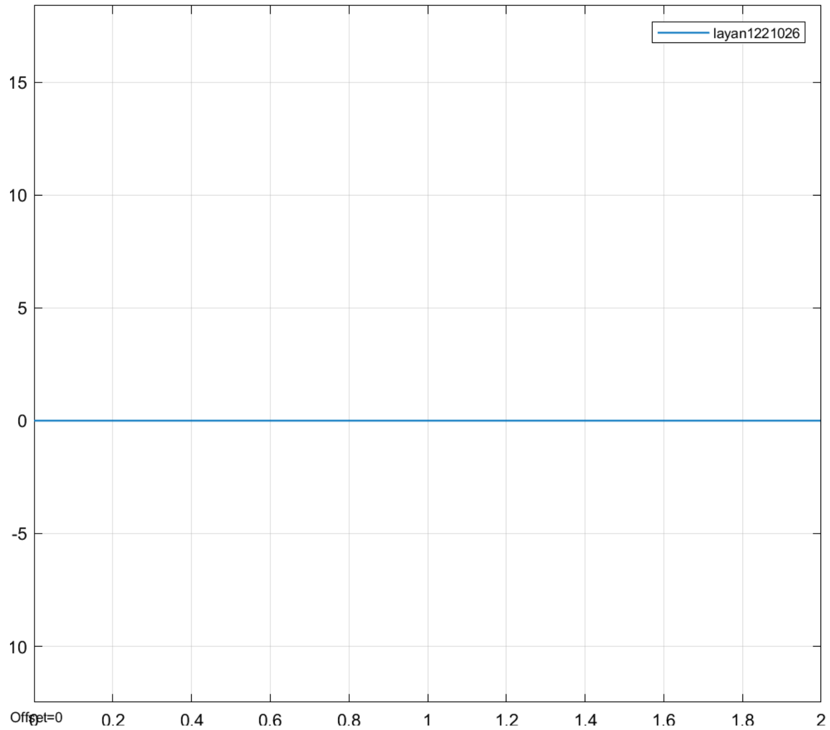
→ASK modulated at Am=5, f=1kHz, D=50% :

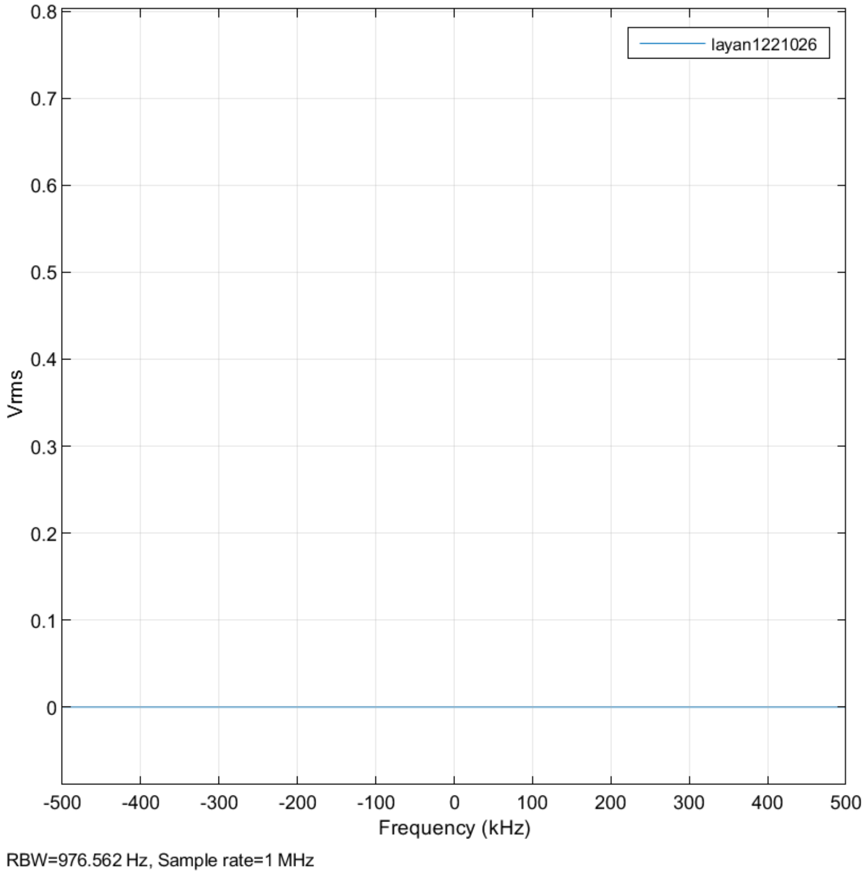




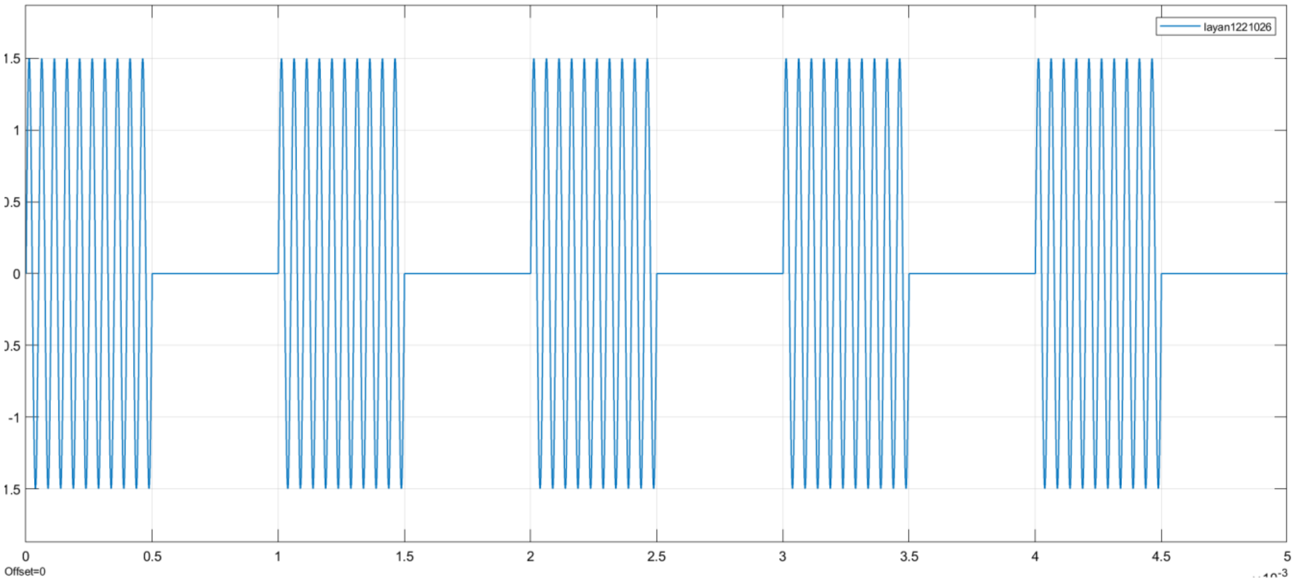
RBW=976.562 Hz, Sample rate=1 MHz

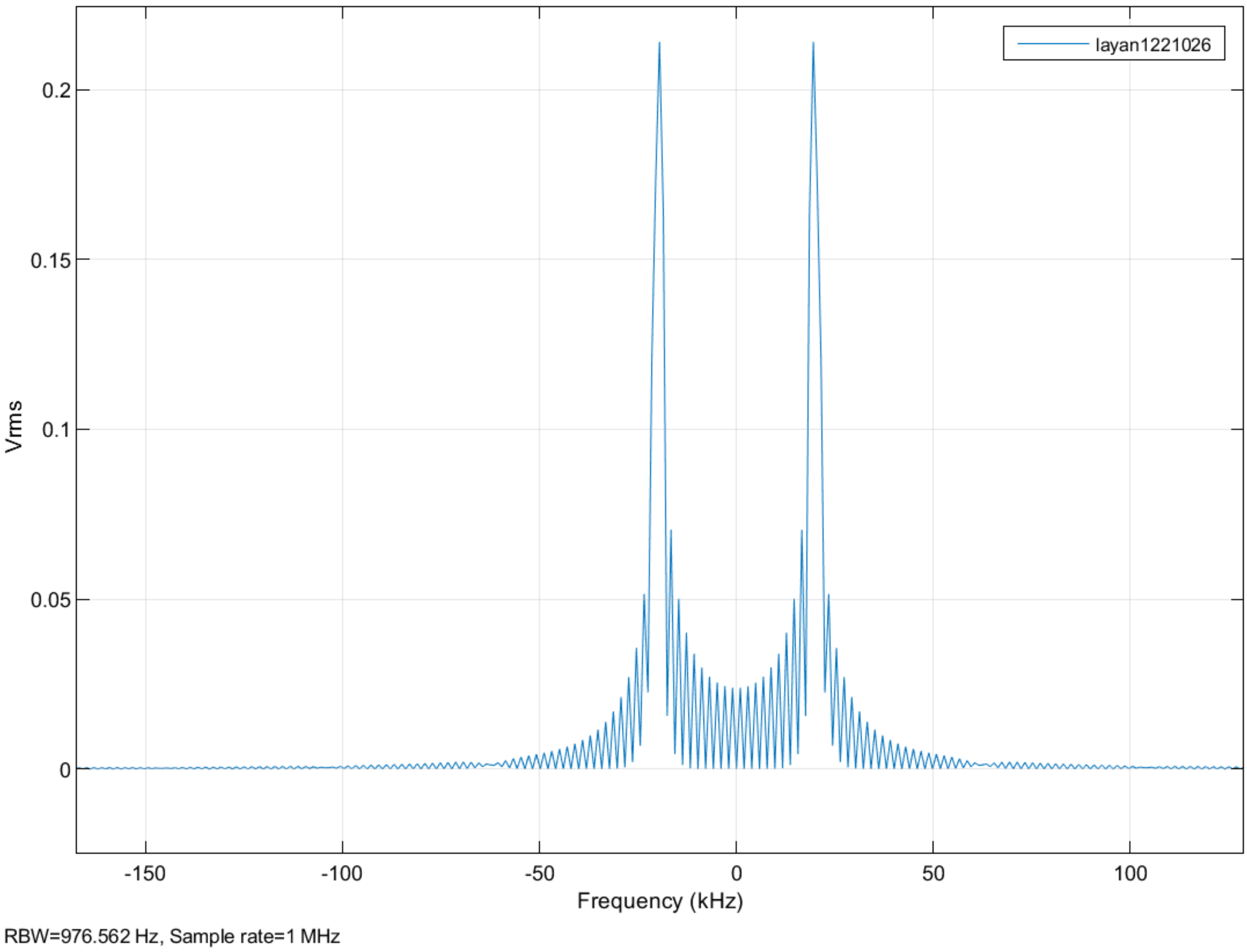
→ASK modulated at DC=0:



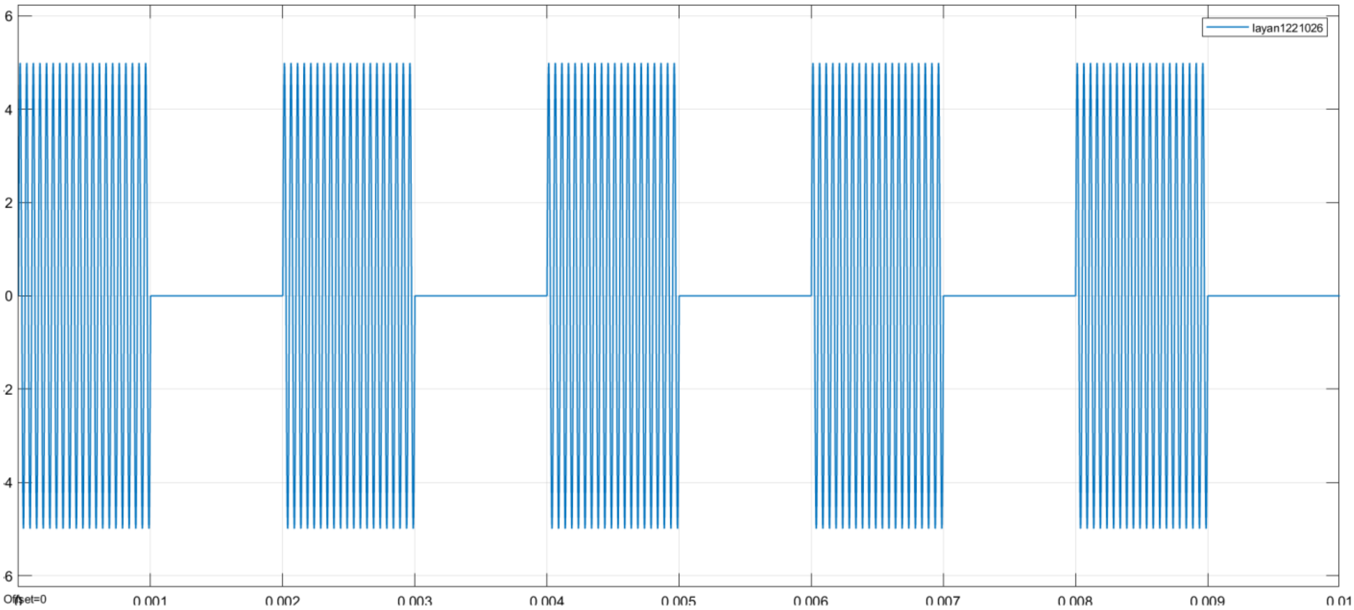


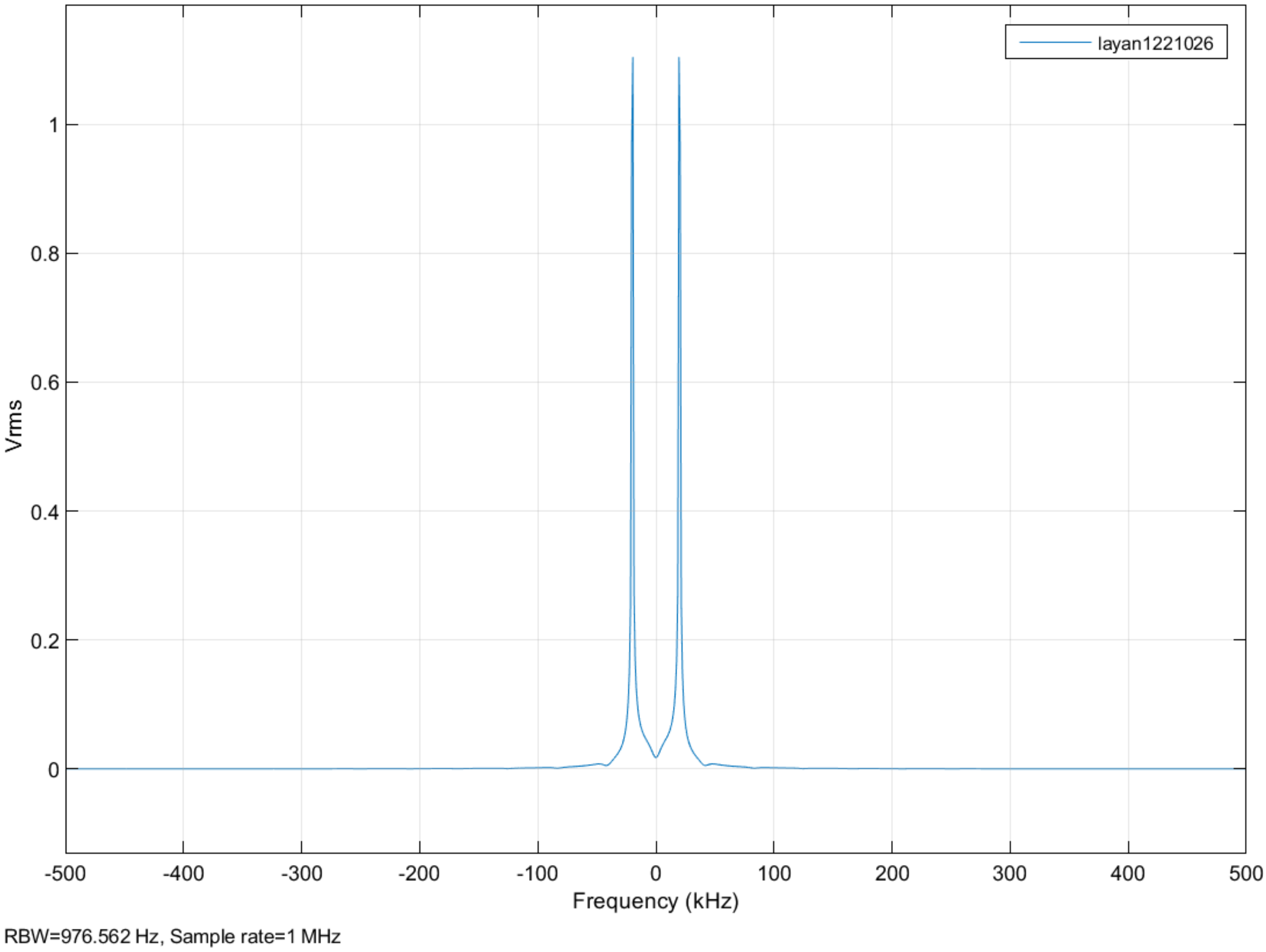
→**ASK modulated at Am=1.5, f=1kHz, D=50% :**



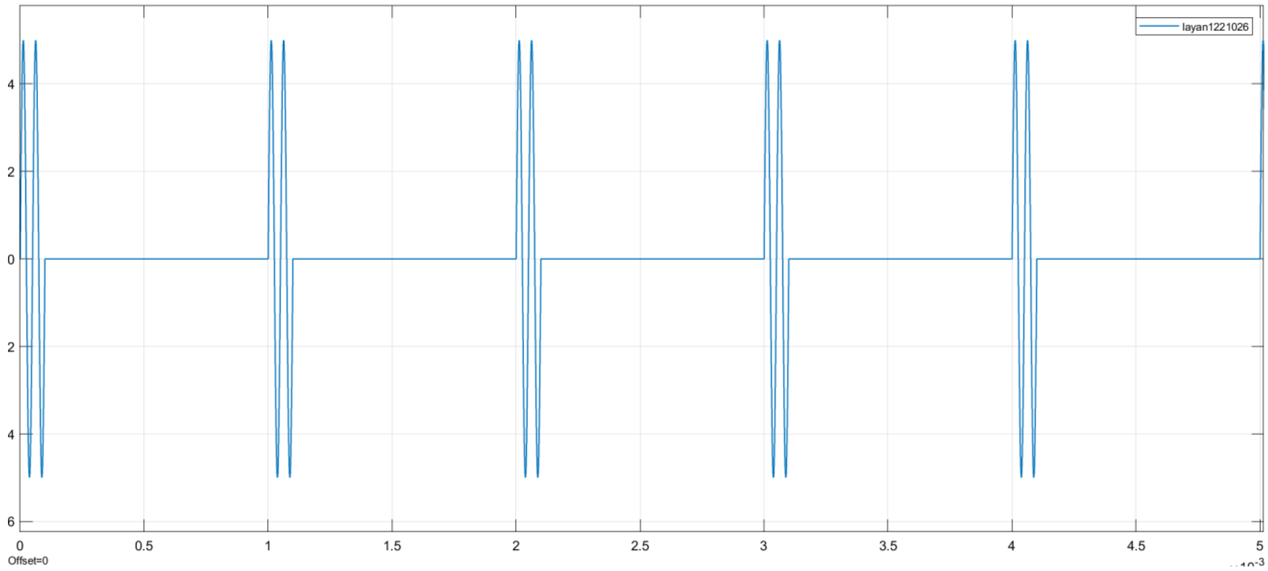


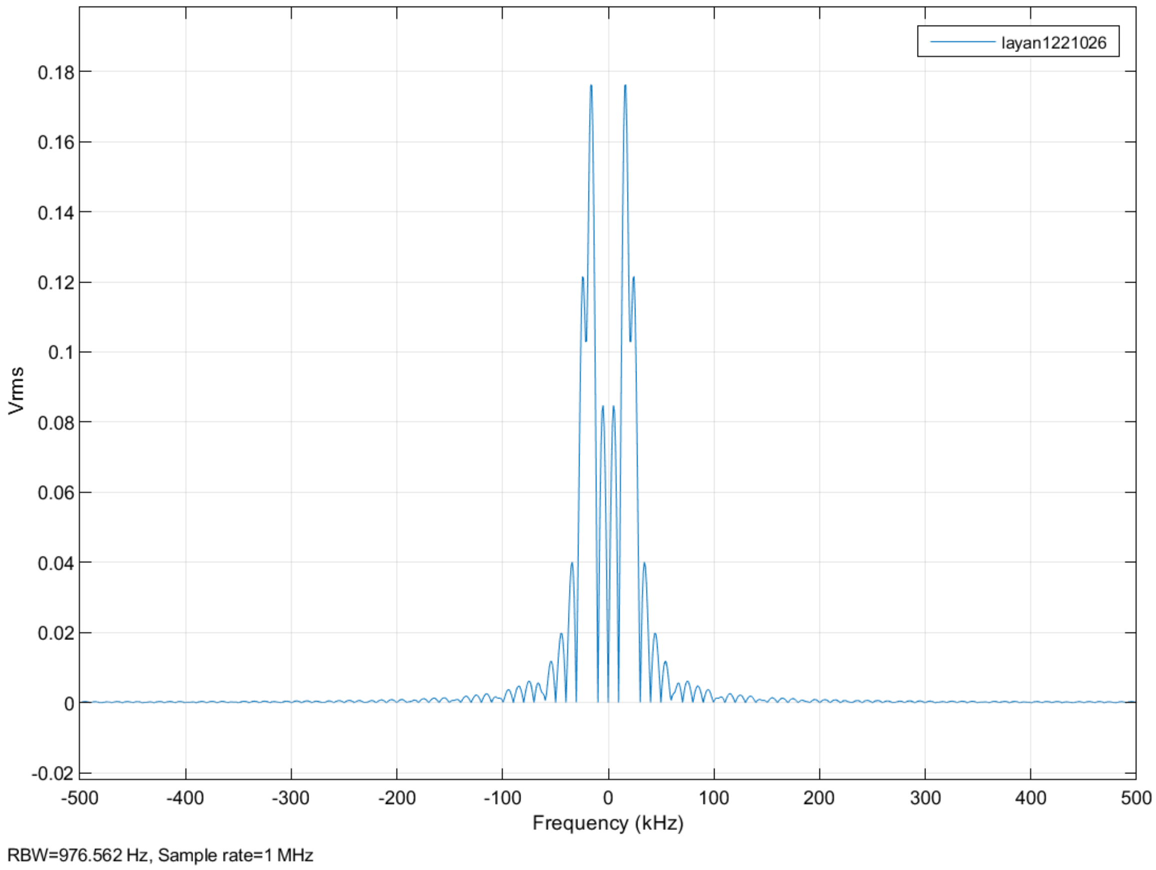
→ASK modulated at Am=5, f=0.5kHz, D=50% :





→ASK modulated at Am=5, f=1kHz, D=10% :





Discussion:

- At Am=5, f=1kHz, D=50%: The ASK signal alternates between full-amplitude carrier and zero, matching the square message.

- At DC=0: No modulation occurs; the message is constantly zero, so the output is flat no carrier transmission.

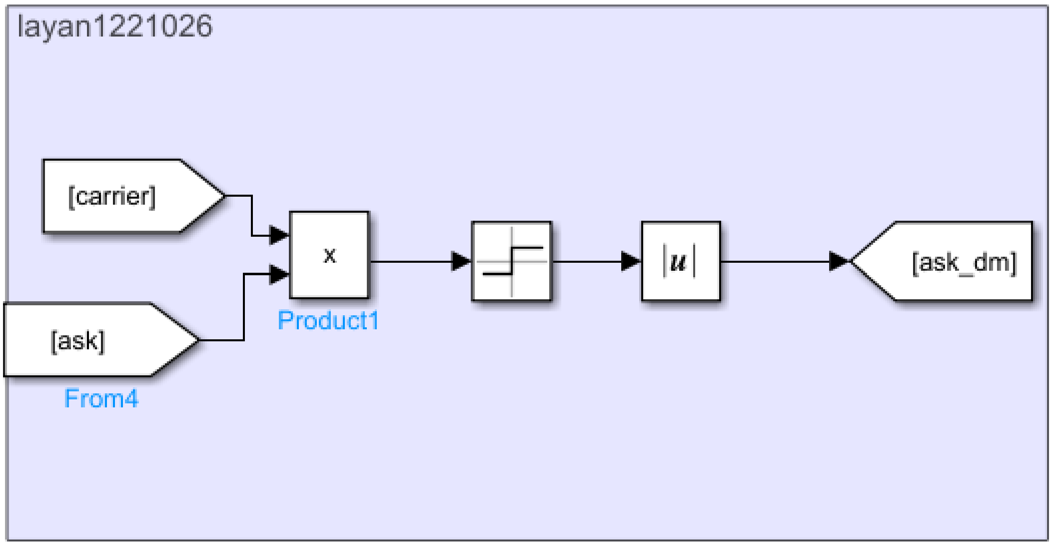
- At Am=1.5, f=1kHz, D=50%: The ASK signal has a lower amplitude, showing that message amplitude directly scales the carrier.

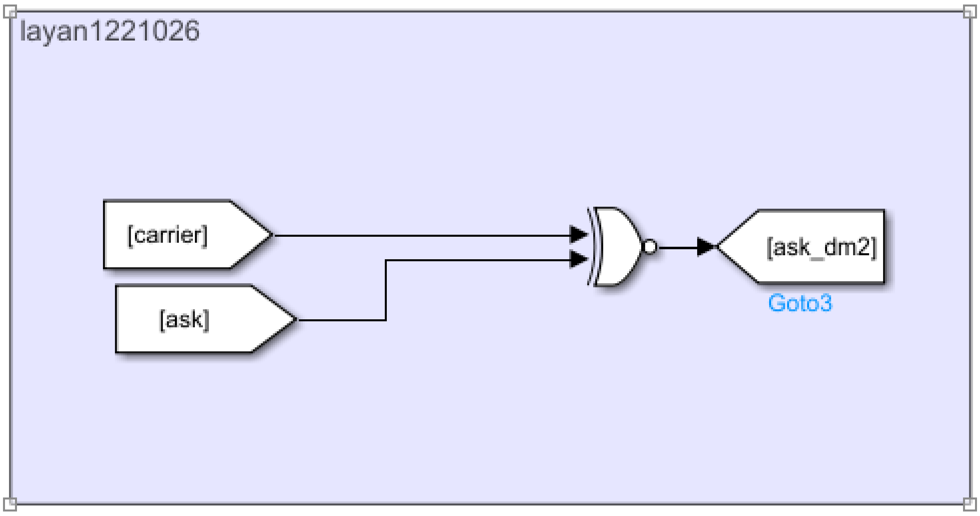
- At Am=5, f=0.5kHz, D=50%: The modulation rate slows, reflecting the reduced frequency in fewer transitions.

- At Am=5, f=1kHz, D=10%: The short duty cycle means the carrier is transmitted only briefly during each cycle, making the output more sparse.

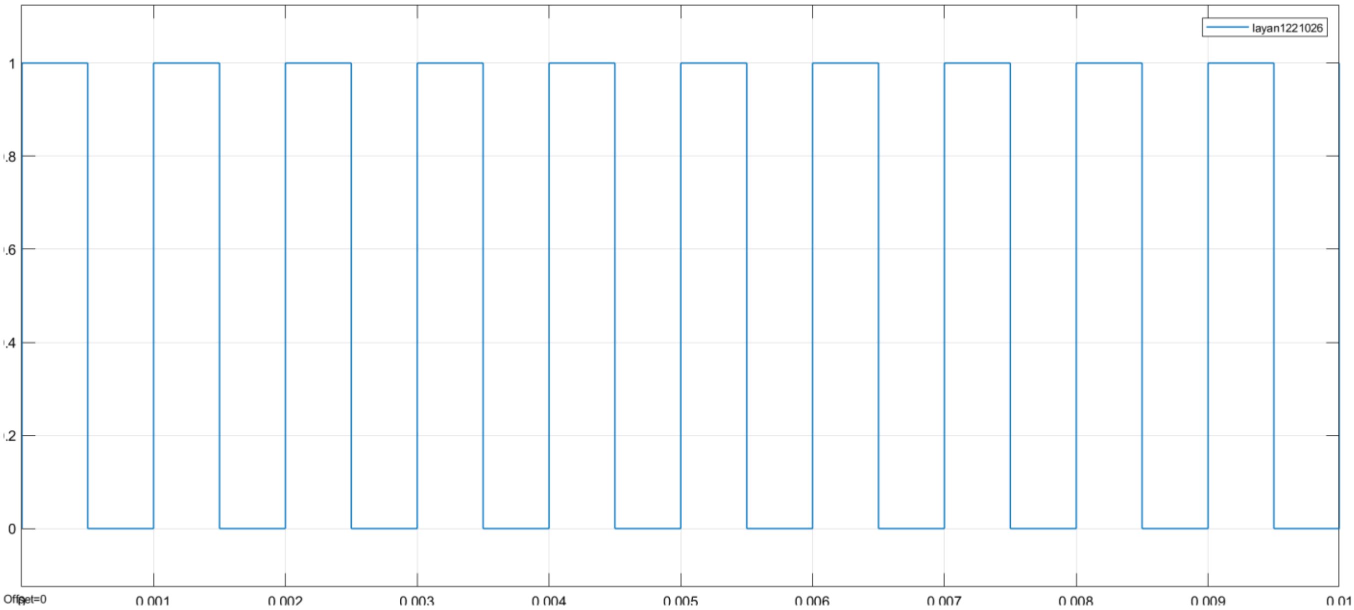
These variations demonstrate how the amplitude, frequency, and duty cycle of the message affect the modulated signal's shape. ASK relies on amplitude variation, so signal clarity can degrade with low amplitude or very brief pulses.

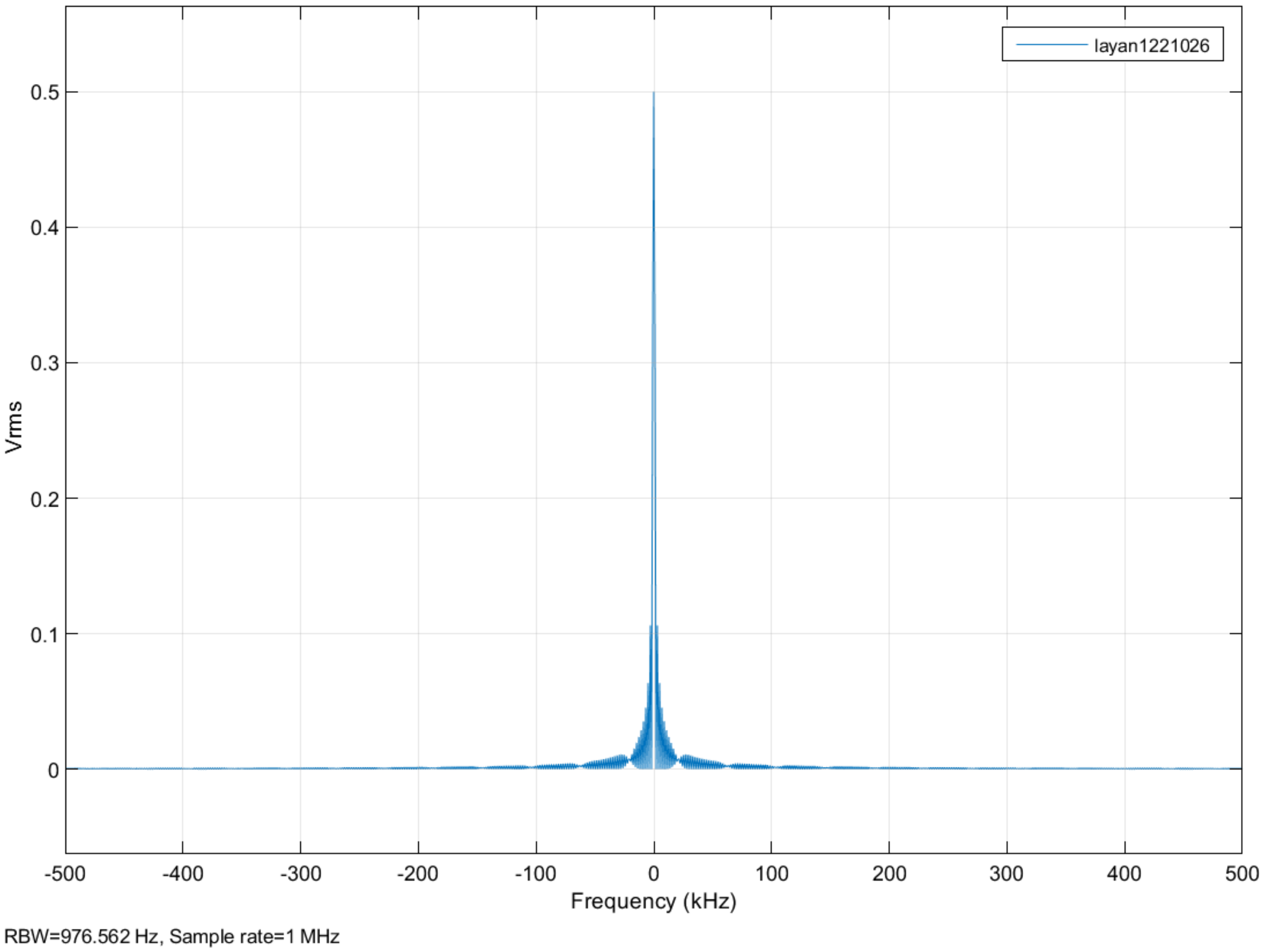
Part 3: Demodulated Signal :



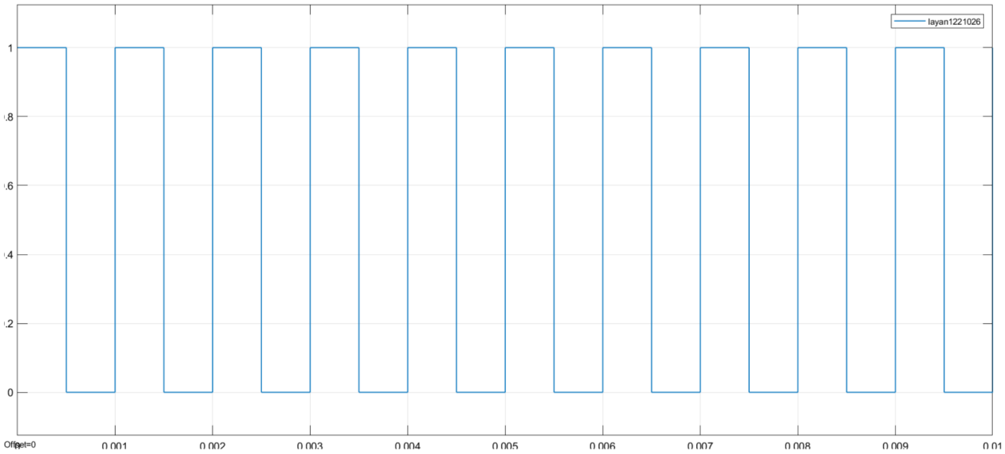


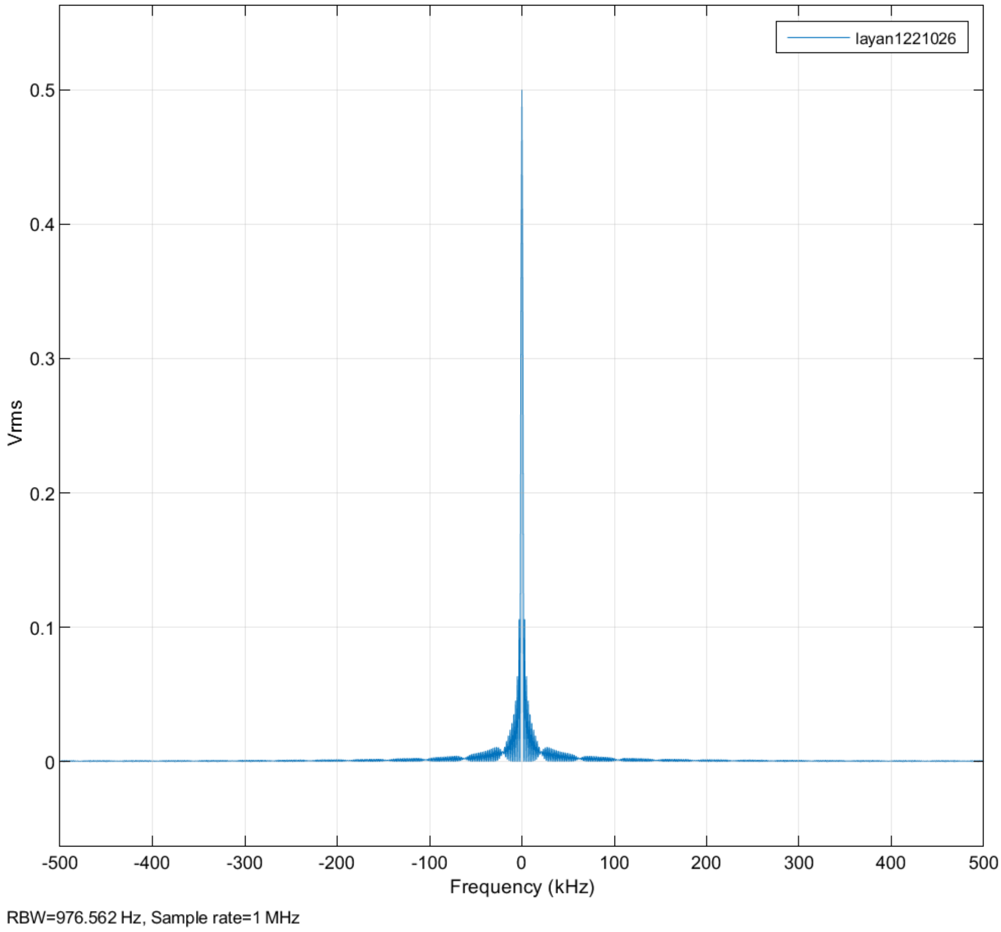
→**ASK Demodulated 1 at Am=5 f=1kHz, D=50% :**



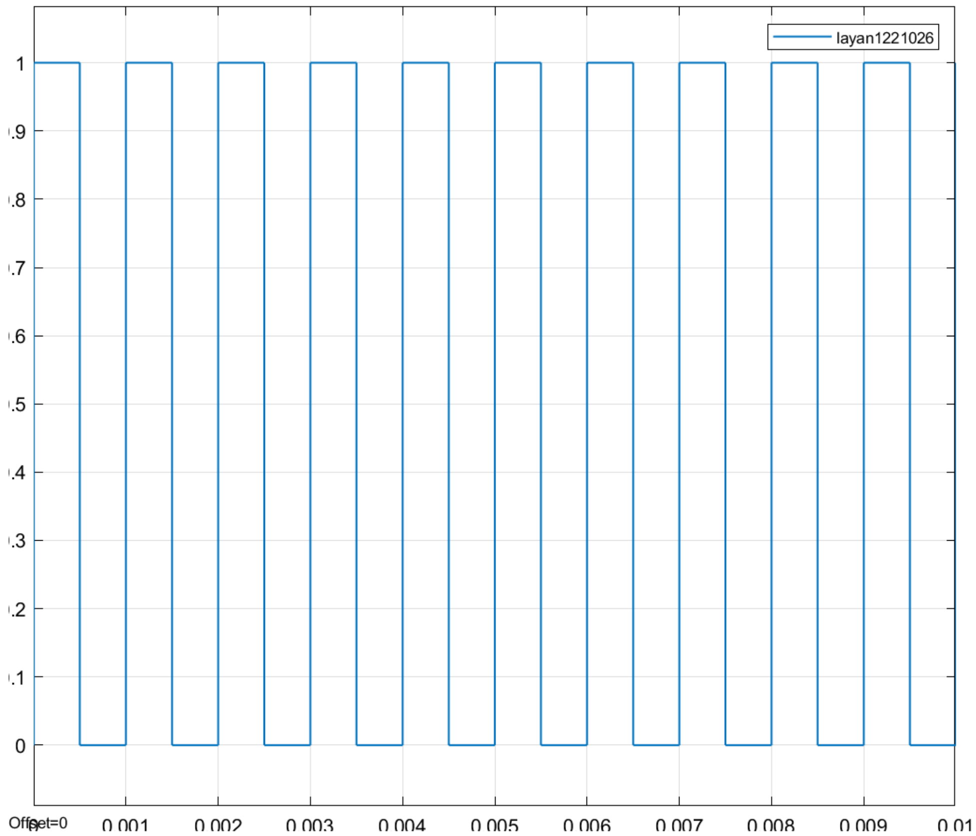


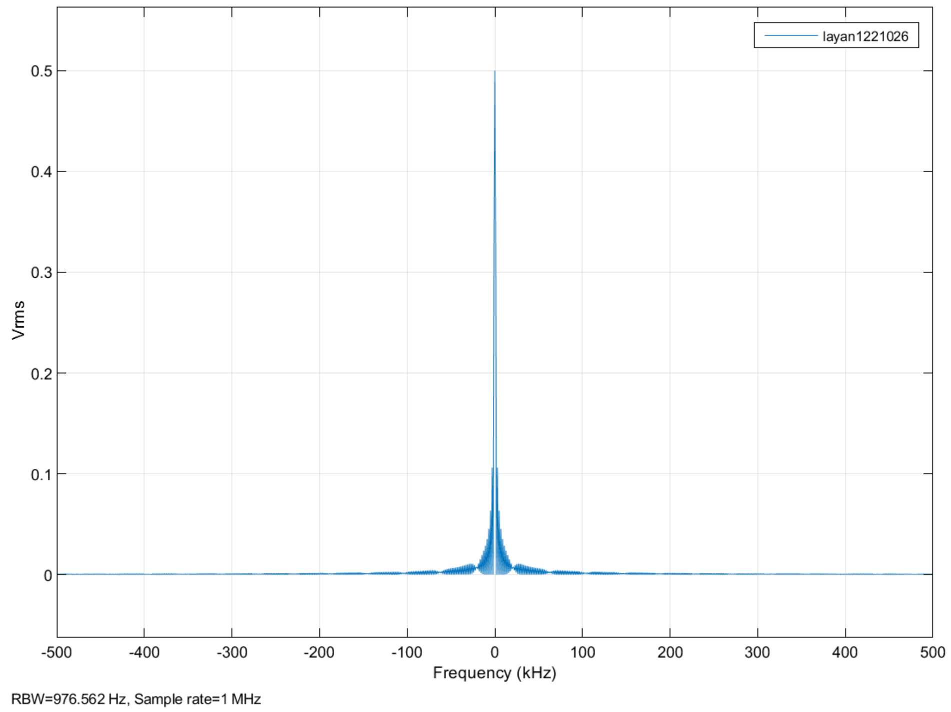
→ASK Demodulated 2 at Am=5, f=1kHz, D=50% :



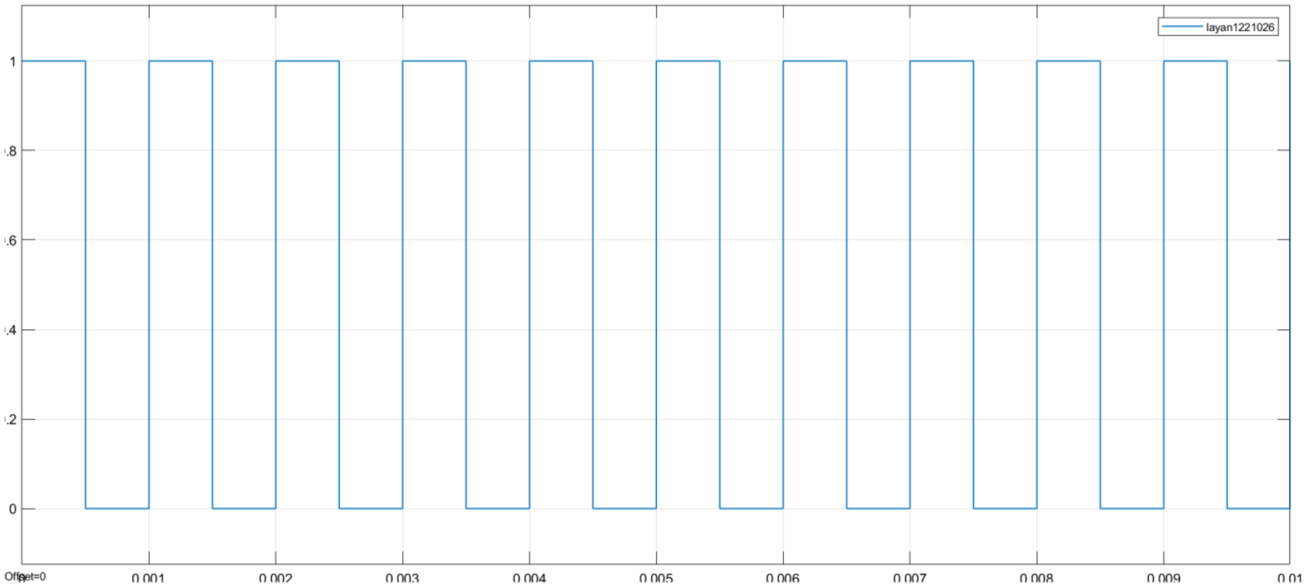


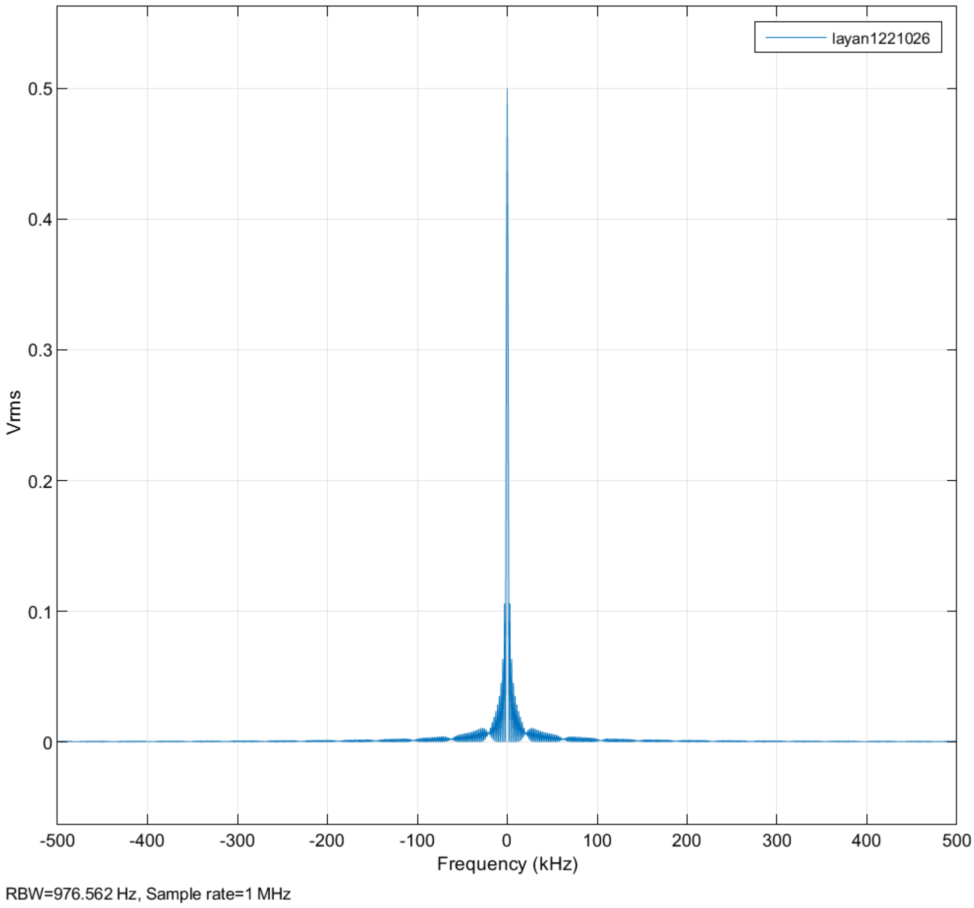
→ASK Demodulated 1 at Am=1.5, f=1kHz, D=50%



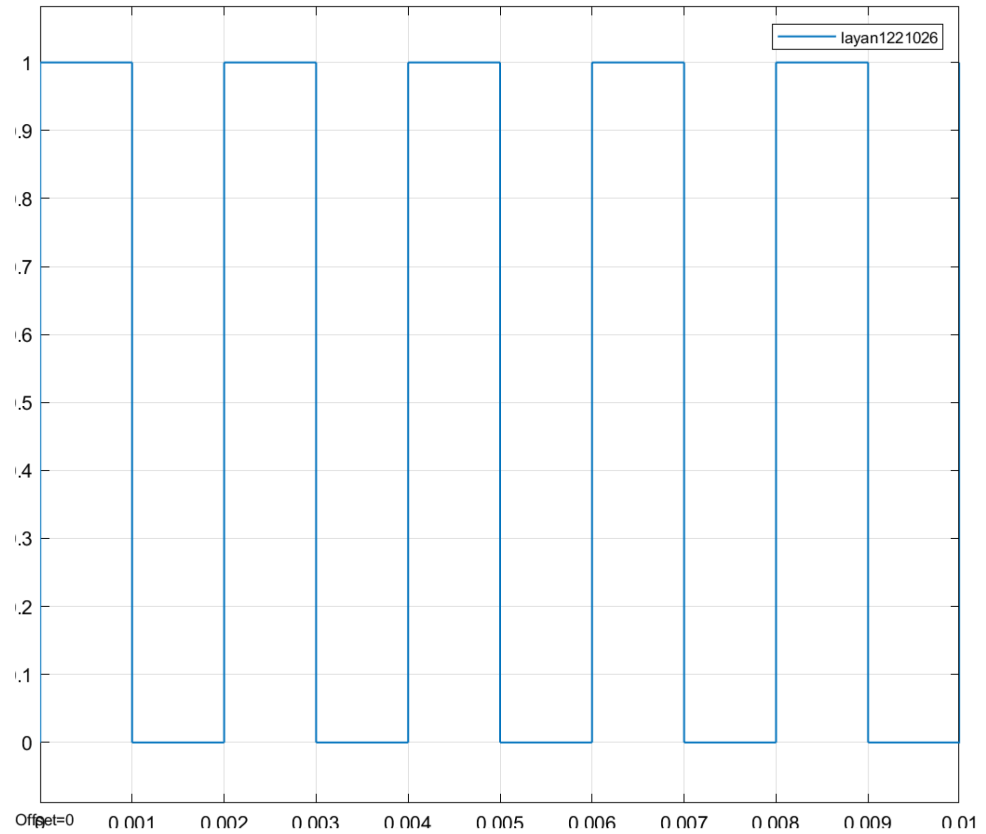


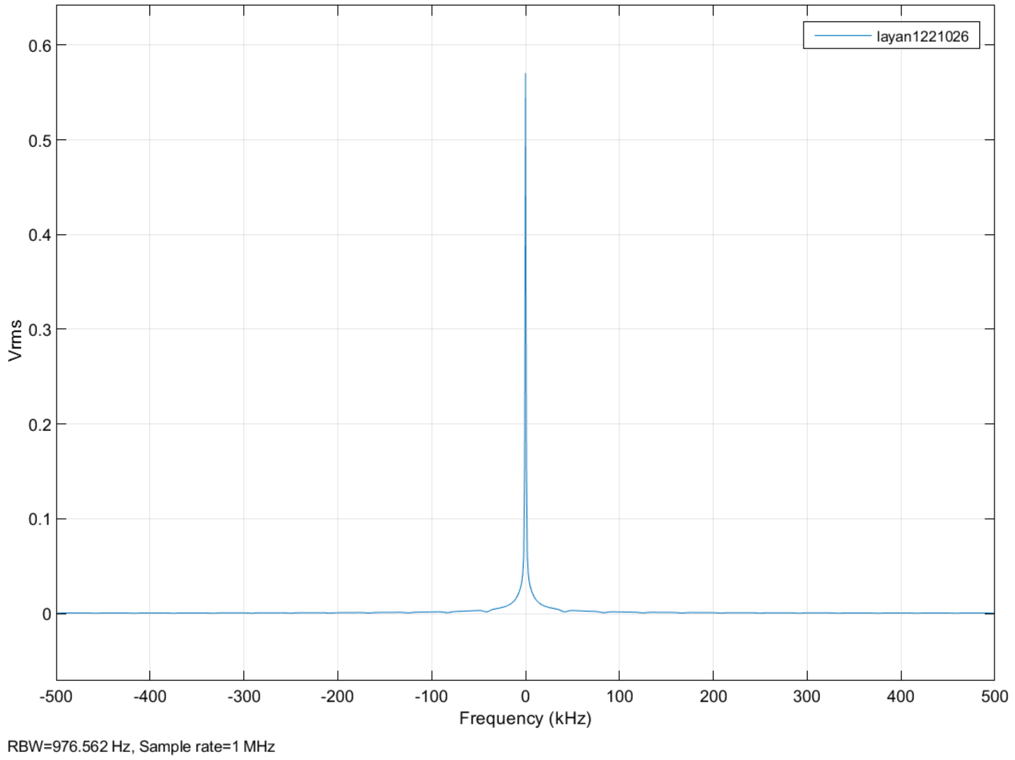
→ASK Demodulated 2 at Am=1.5, f=1kHz, D=50%



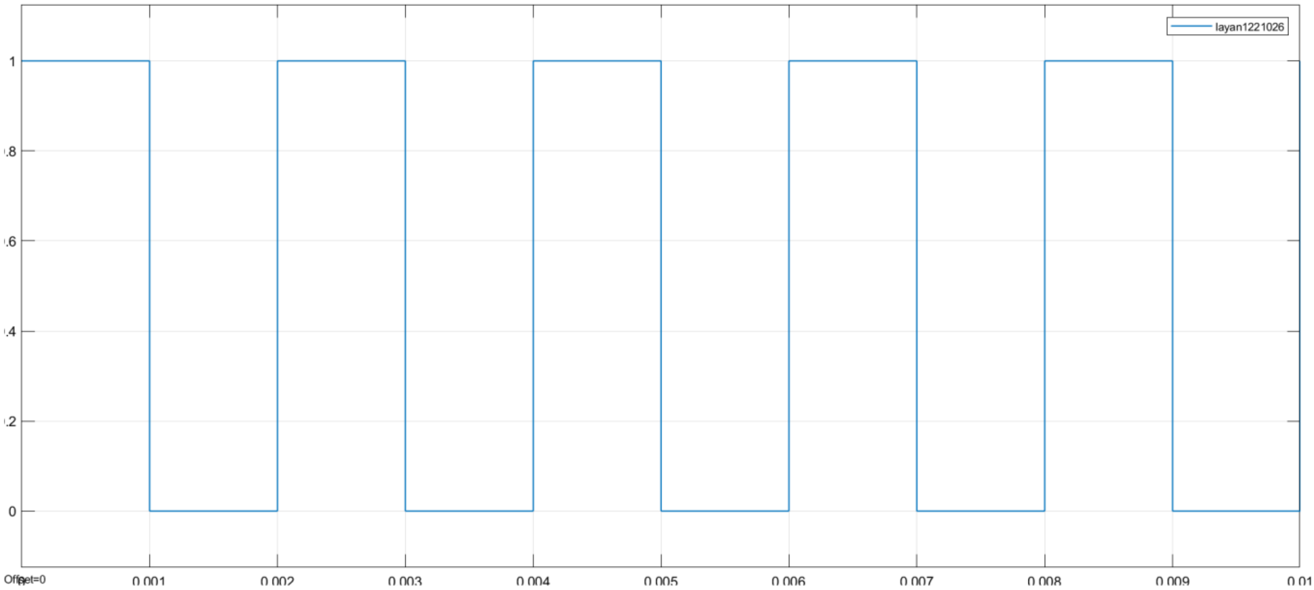


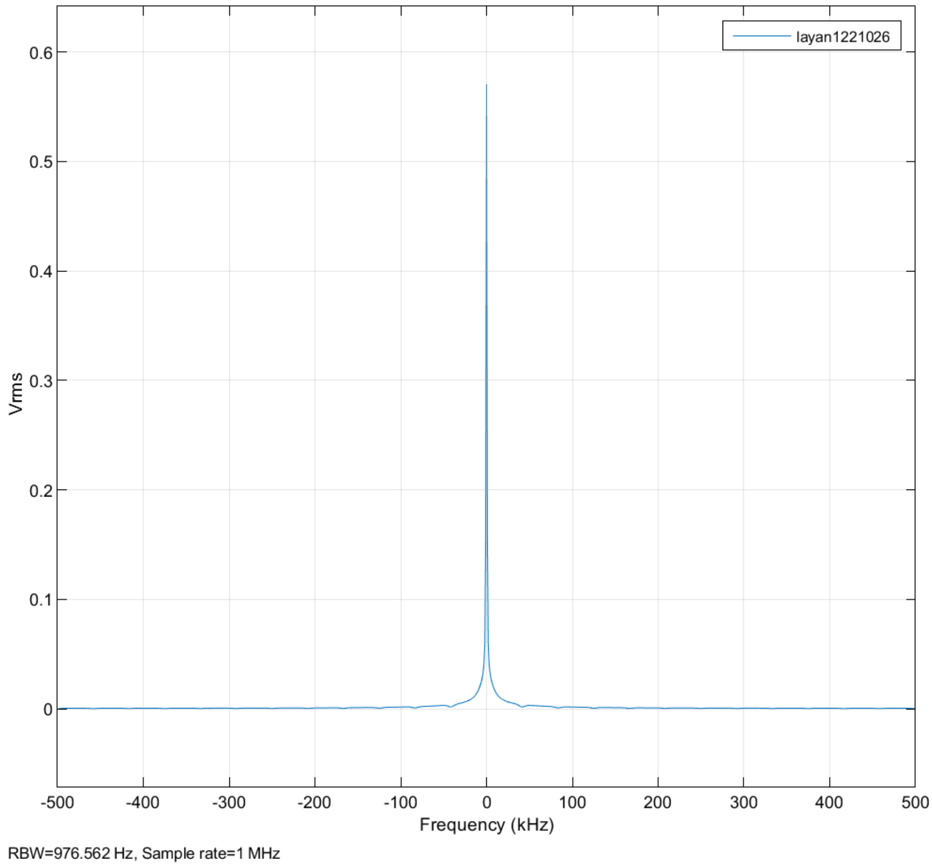
→ASK Demodulated 1 at Am=5, f=0.5kHz, D=50%



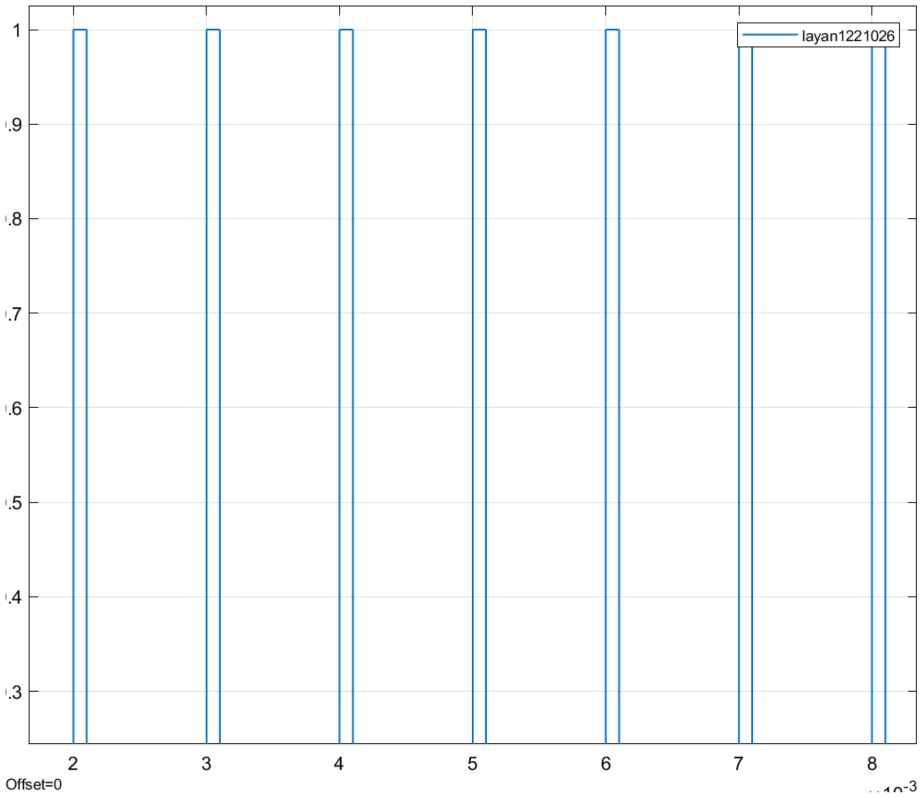


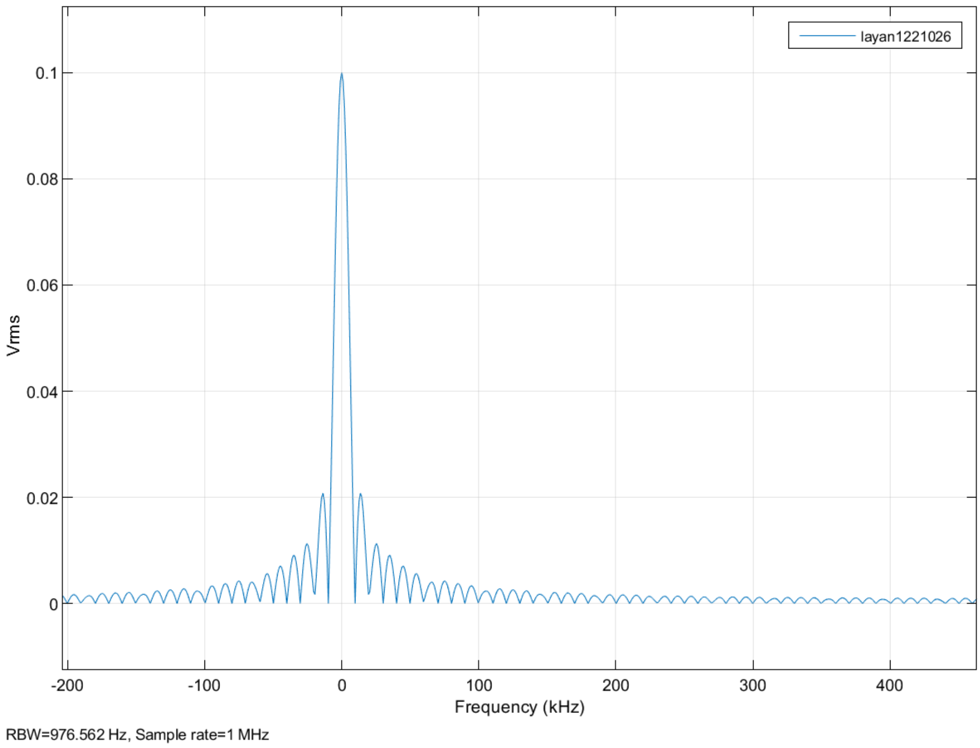
→**ASK Demodulated 2 at Am=5, f=0.5kHz, D=50% :**



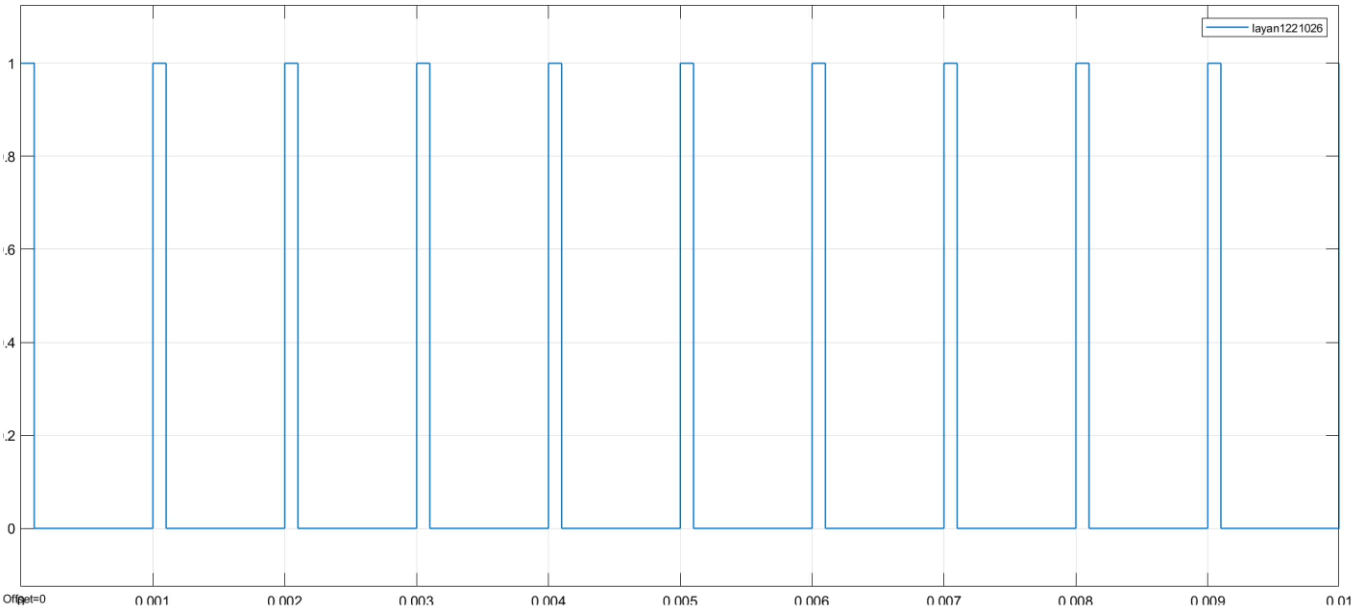


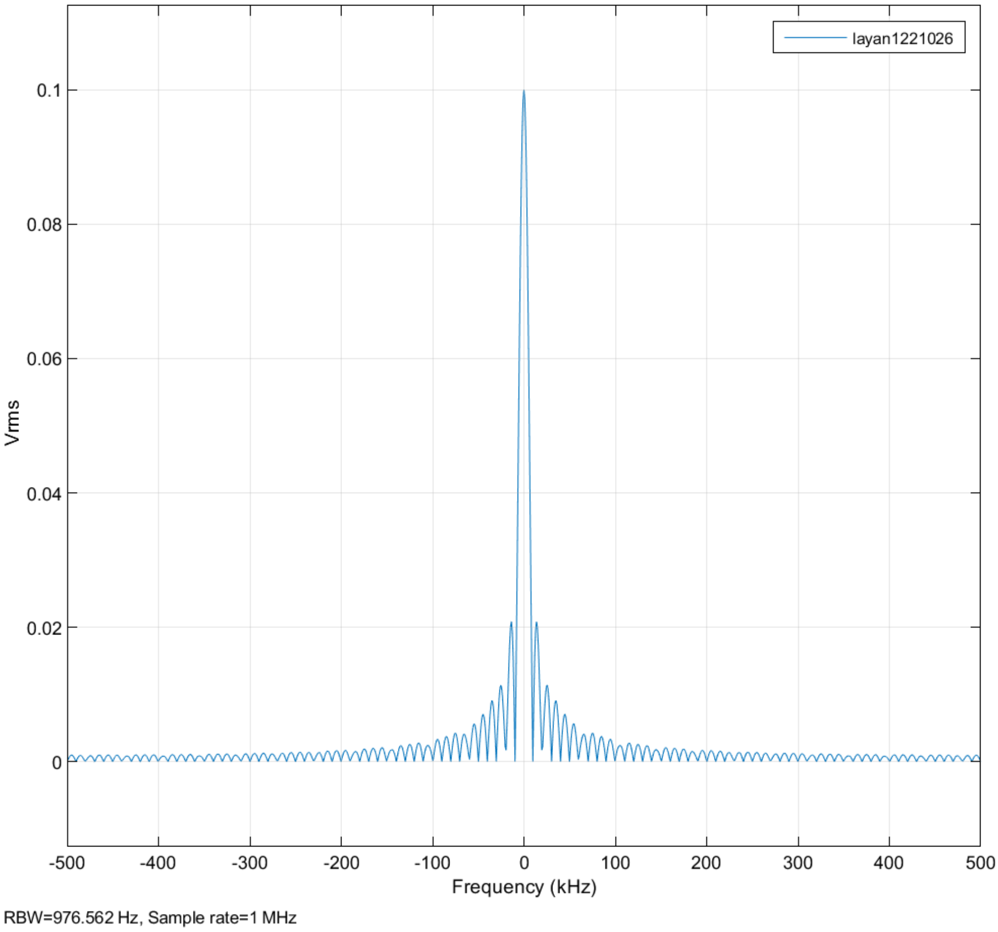
ASK Demodulated 1 at Am=5, f=1kHz, D=10% :





→**ASK Demodulated 2 at Am=5, f=1kHz, D=10% :**





Discussion:

- For higher amplitude signals (Am=5), the demodulated waveform clearly resembled the original message.
- With lower amplitude (Am=1.5), the demodulated output weakened but still followed the pattern.
- At lower frequencies (0.5 kHz), the waveform was stretched in time, matching expectations.
- At 10% duty, only short bursts appeared in the demodulated signal, and recovery was partial due to the brief carrier presence.

Proper demodulation quality depends on signal strength, carrier synchronization, and pulse width. Lower amplitudes and duty cycles can reduce detection accuracy. However, when amplitude and synchronization are sufficient, ASK demodulation reconstructs the original binary message effectively.