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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ENEE 4113, Communication Laboratory

Experiment. 11 Prelab

Frequency shift-keying (FSK) & Phase shift-keying (PSK)

Prepared by:

Layan Salem 1221026

Supervised by:

Dr. Qadri Mayyala

T.A:

Eng. Hazem Awaysa

Date: 7/5/2025

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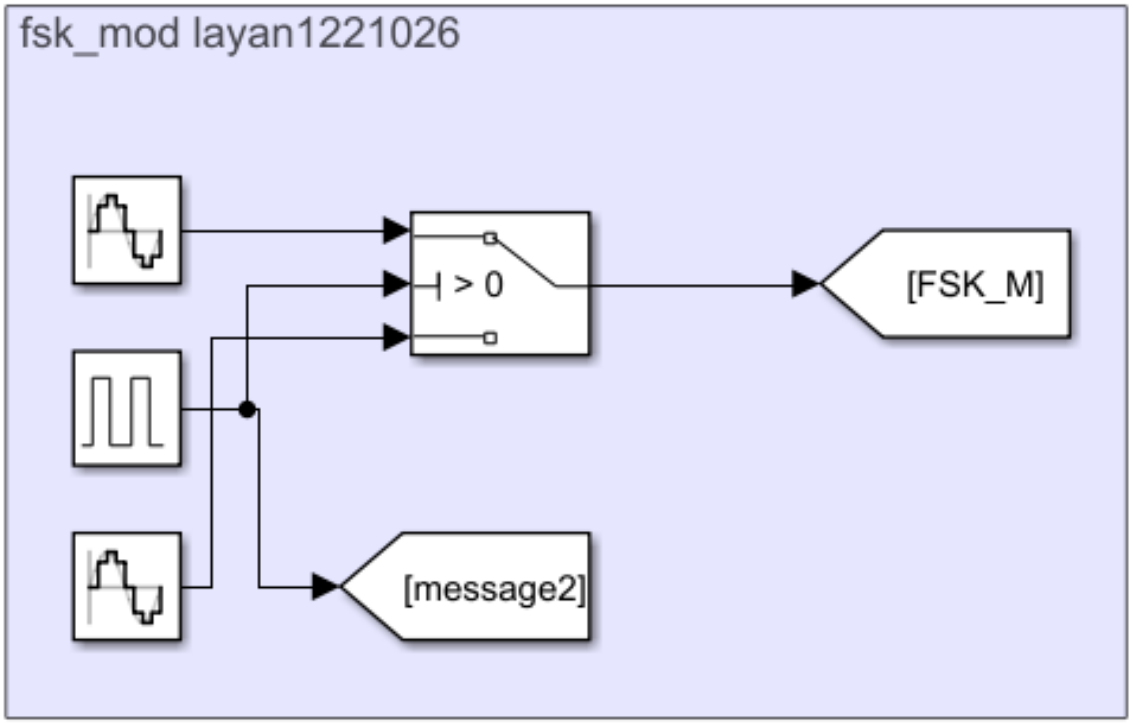
Simulation and Data analysis

FSK modulating block:



- Am=5, D=50%, f=1kHz: The output shows a clear frequency shift between two levels, indicating correct modulation.
- Am=2, D=50%, f=1kHz: Lower amplitude affects signal strength but the frequency shift remains distinguishable.
- Am=5, D=50%, f=0.5kHz: Reducing frequency results in longer bit durations, making transitions smoother.
- Am=5, D=10%, f=1kHz: Narrower duty cycle reduces time per symbol, which may cause detection challenges at high speeds.

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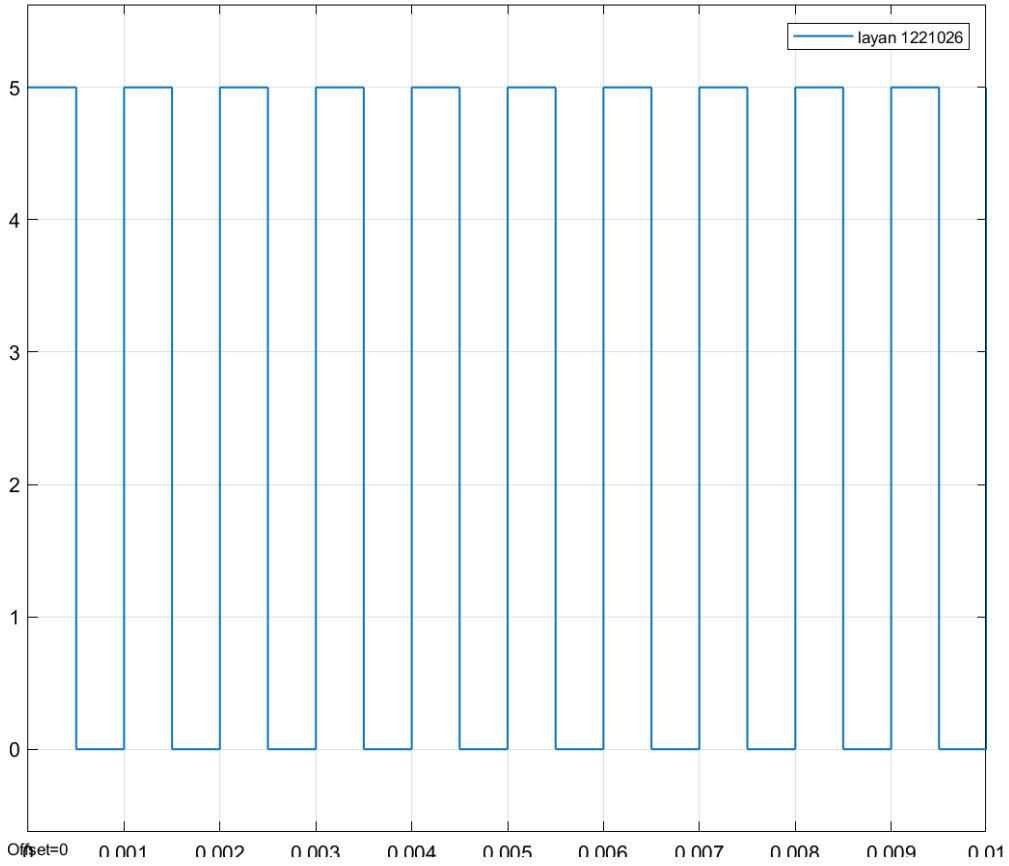
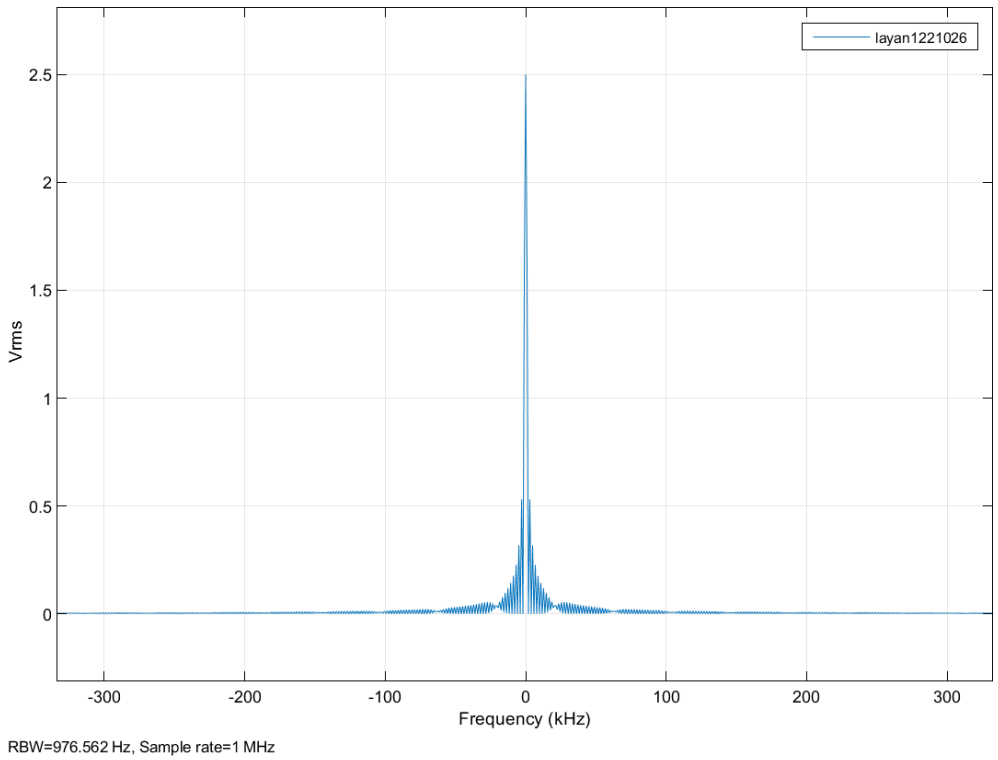
- FSK Message signal



- Offset=0



RBW=976.562 Hz, Sample rate=1 MHz

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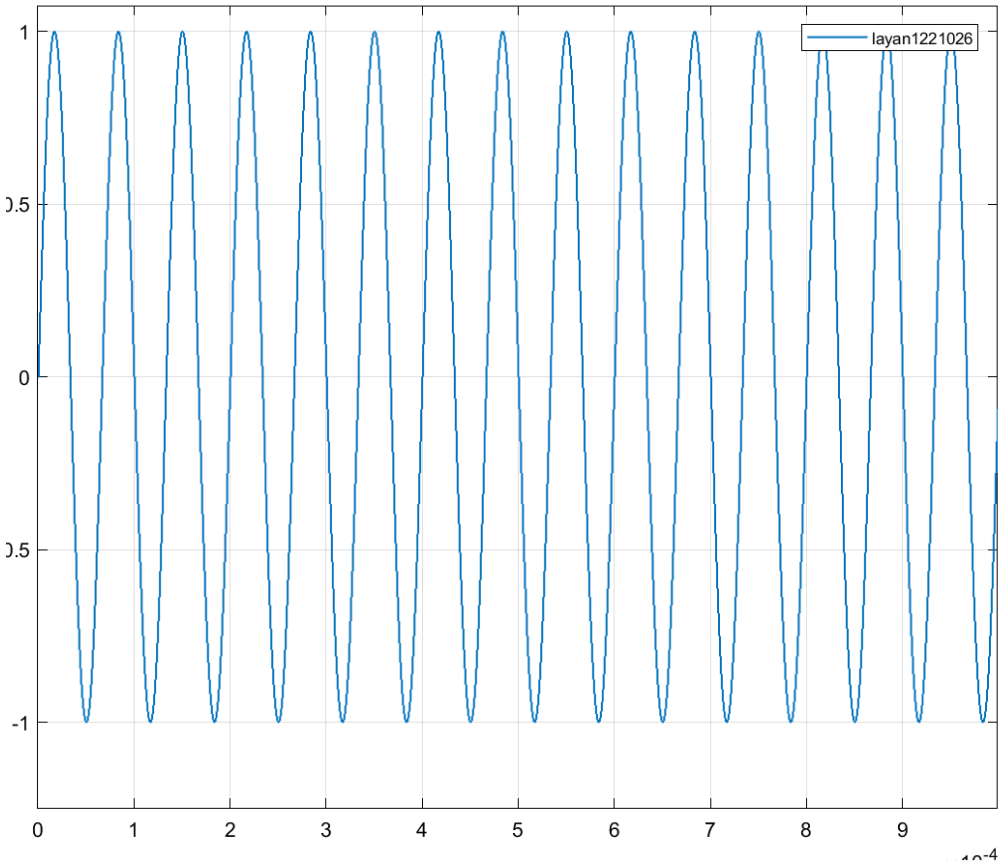
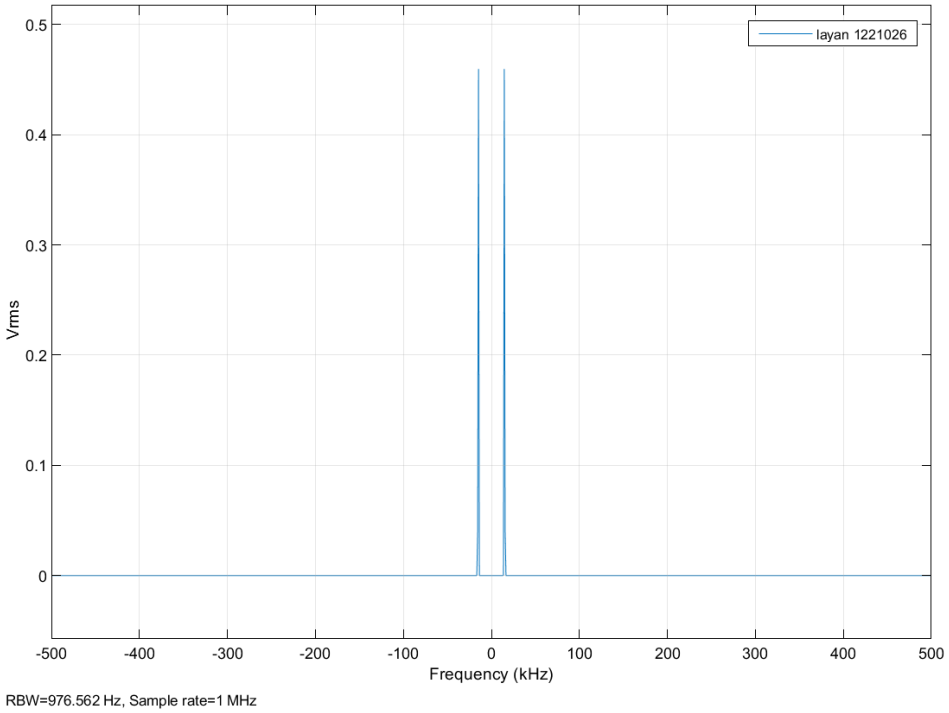
❖ FSK Carriers 1





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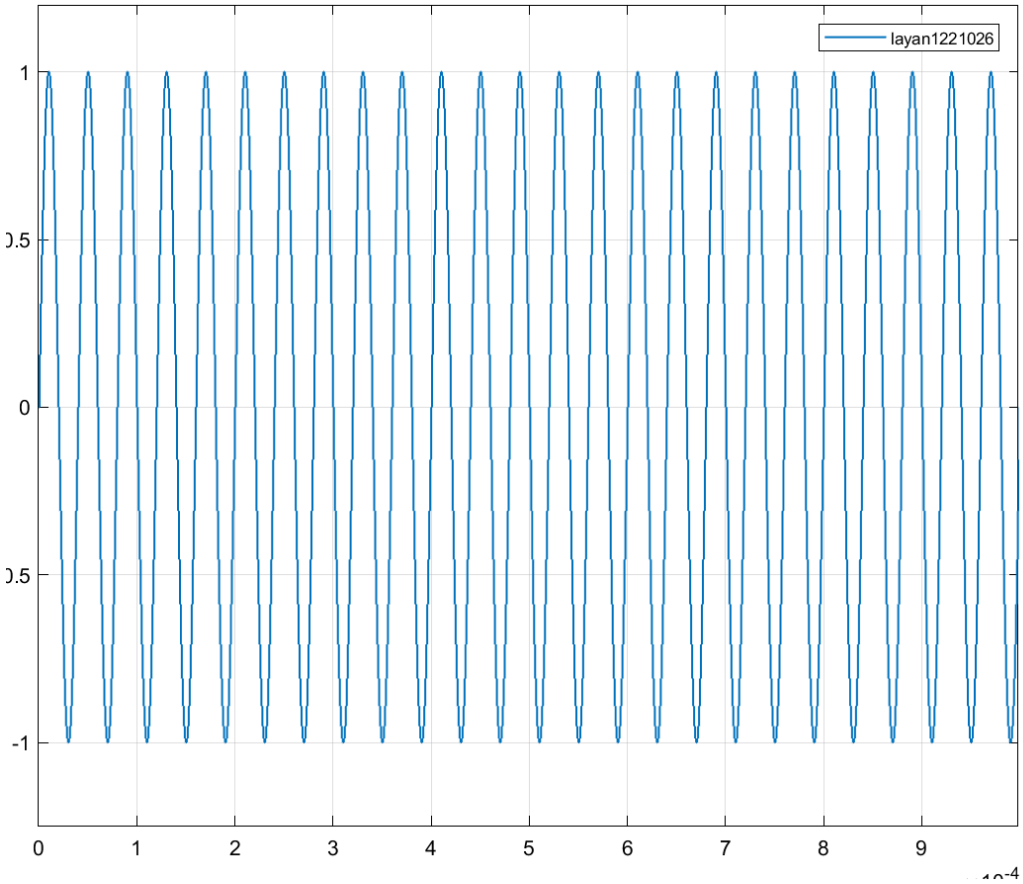
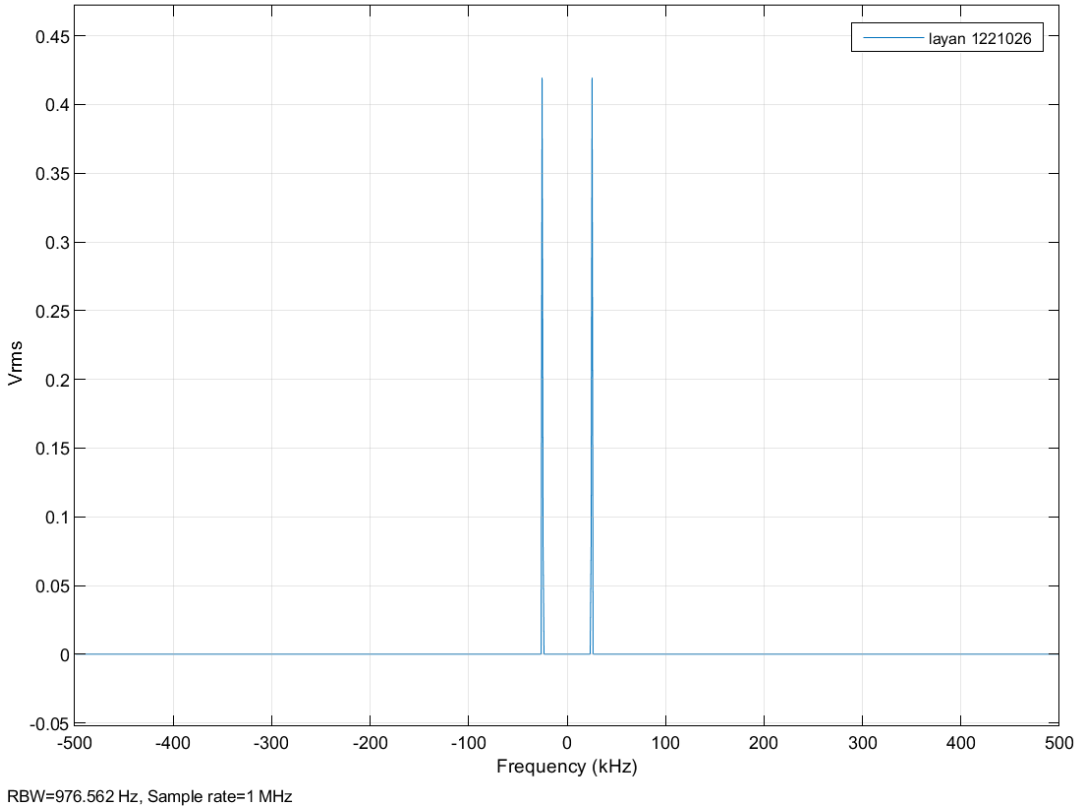
❖ FSK Carriers 2





RBW=976.562 Hz, Sample rate=1 MHz

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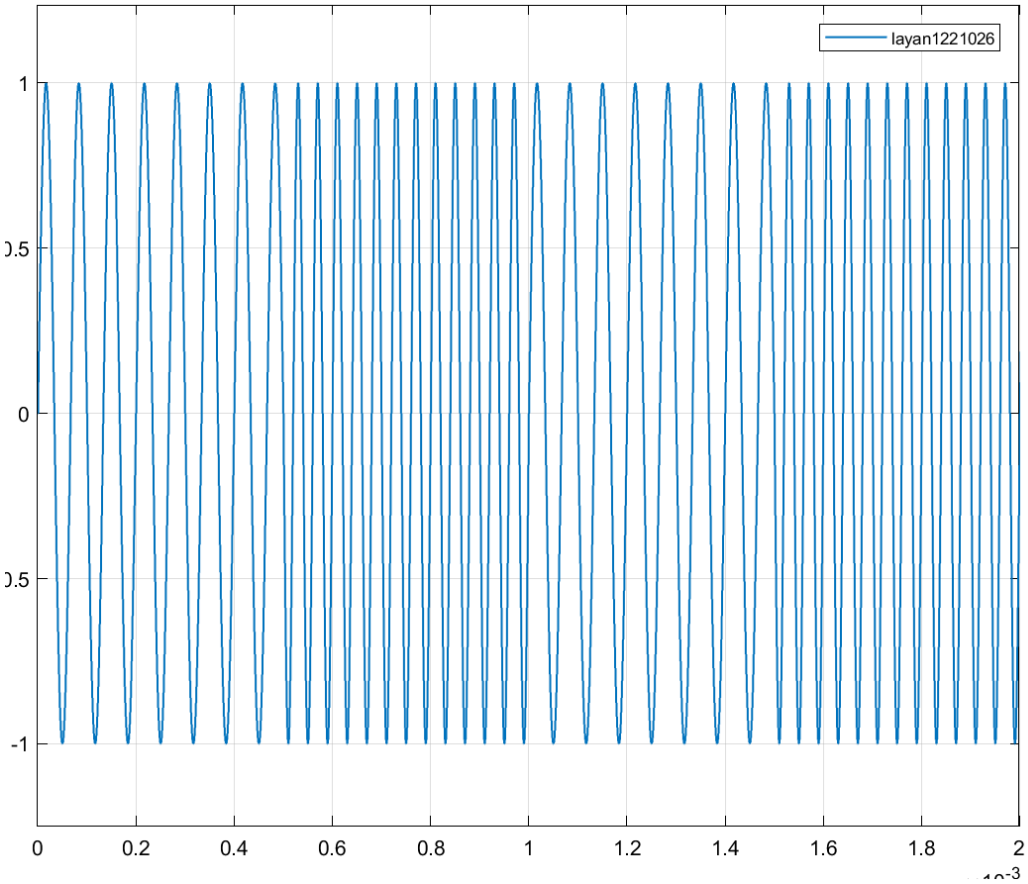
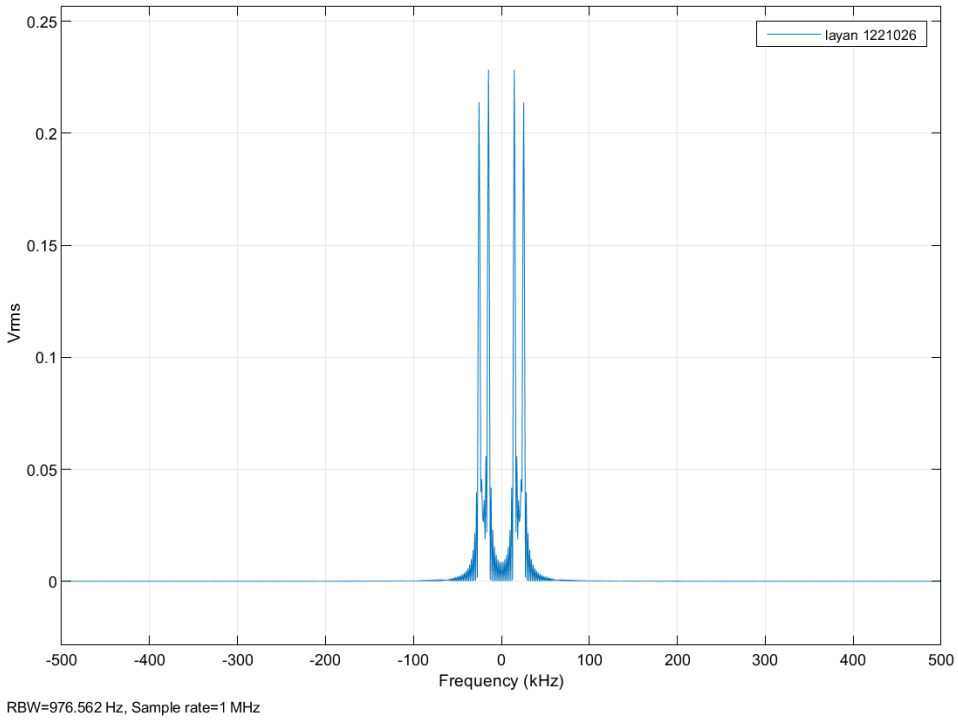
❖ FSK Modulated signal @ Am=5, D=50% & f=1KHz





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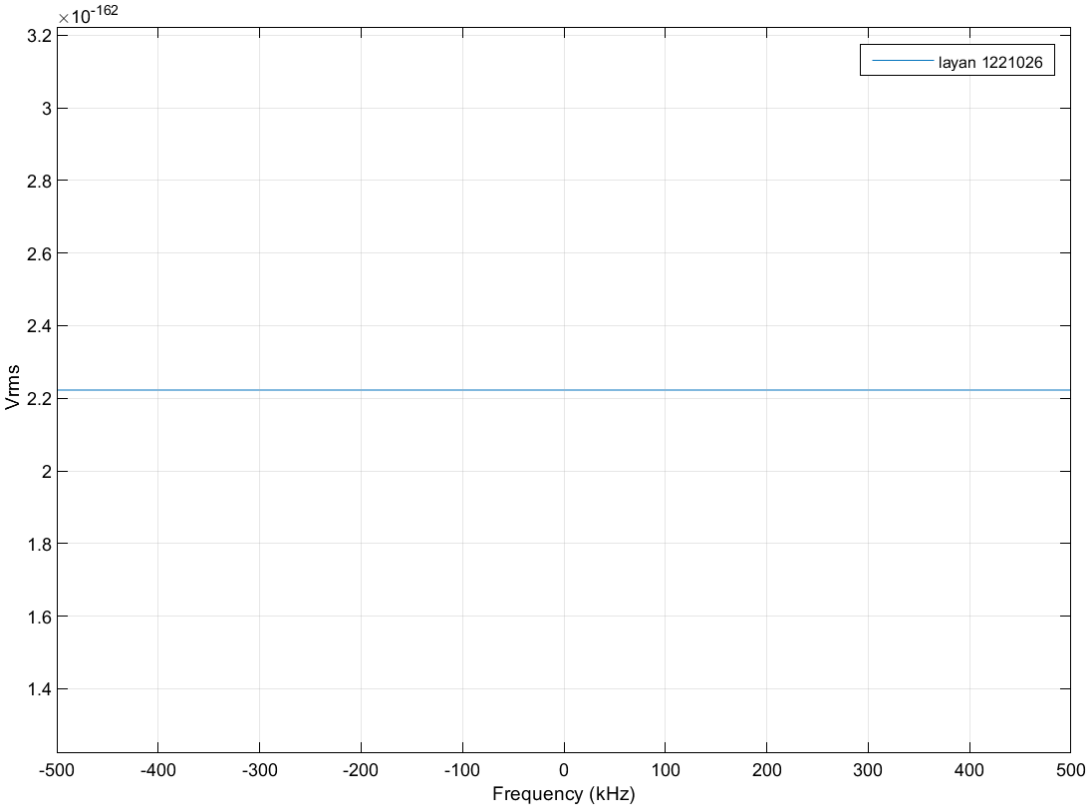
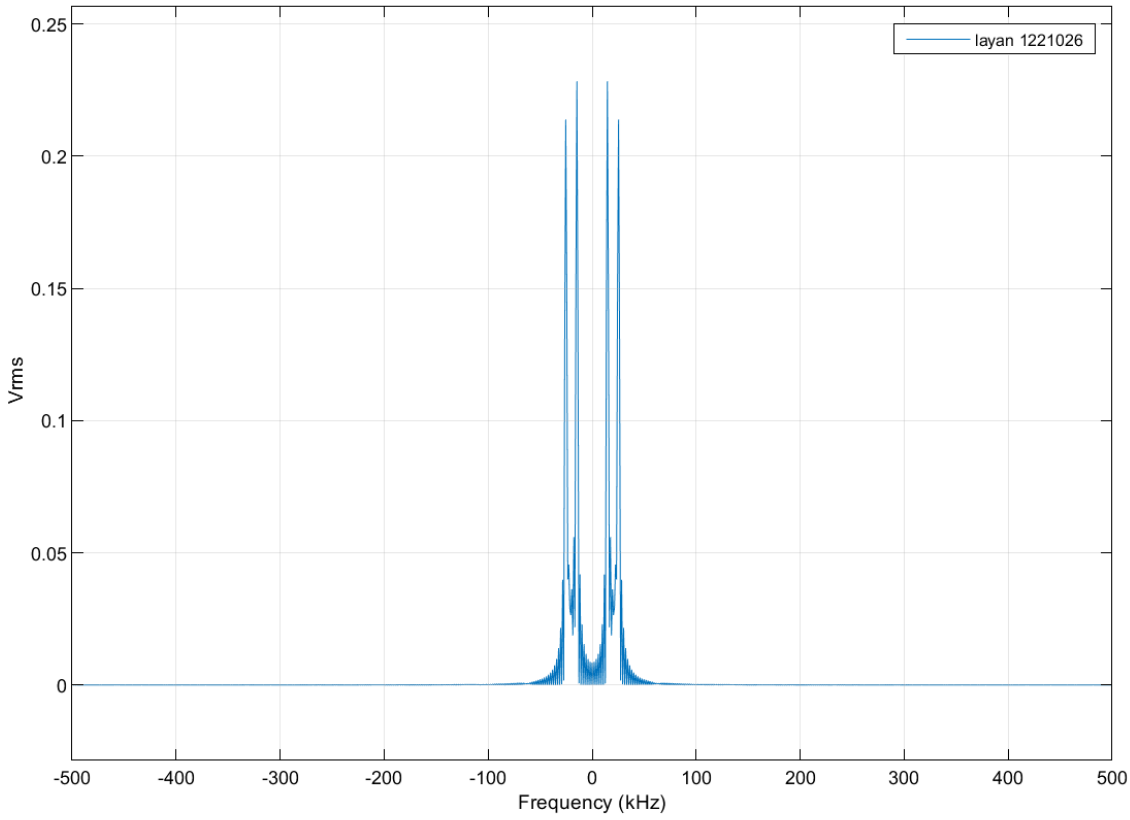
❖ FSK Modulated signal @ Am=2, D=50% & f=1KHz



RBW=976.562 Hz, Sample rate=1 MHz



RBW=976.562 Hz, Sample rate=1 MHz

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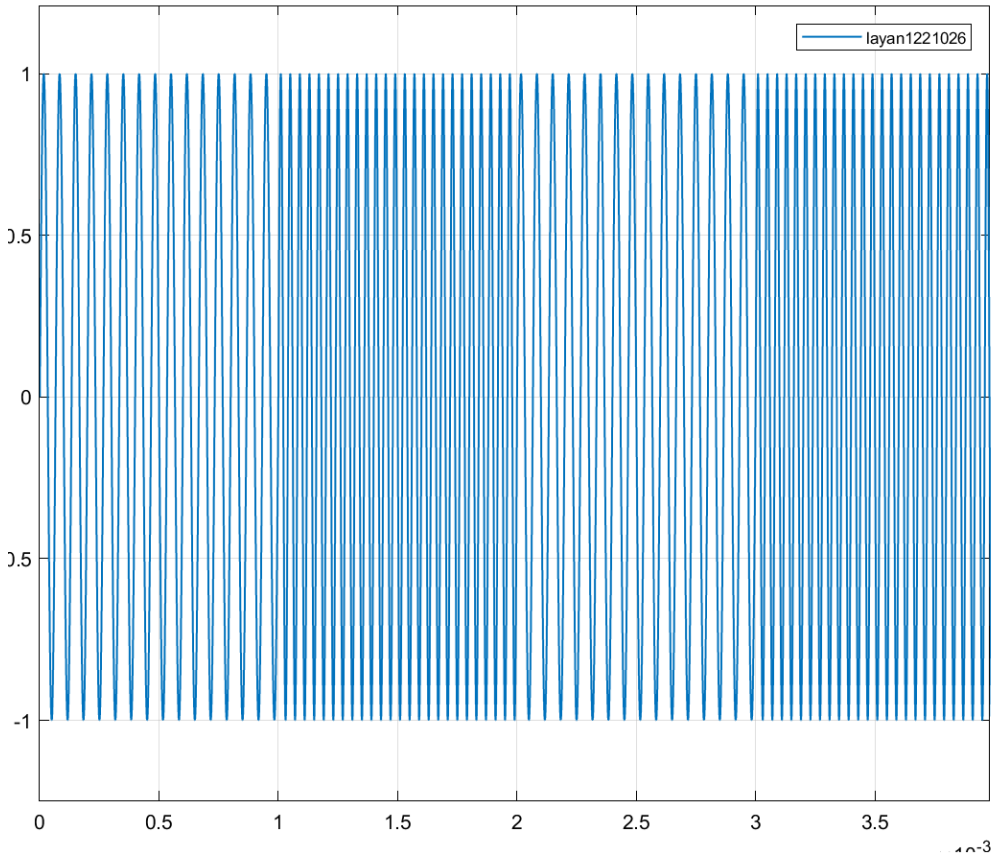
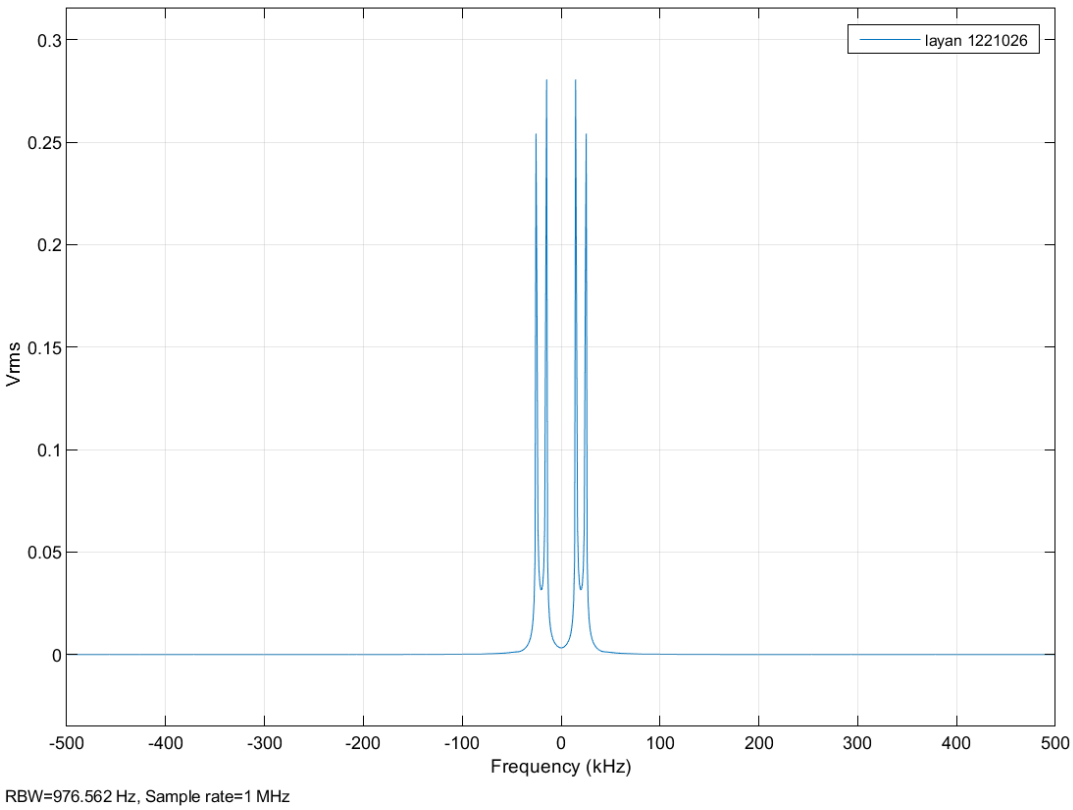
❖ FSK Modulated signal @ Am=5, D=50% & f=0.5KHz





RBW=976.562 Hz, Sample rate=1 MHz

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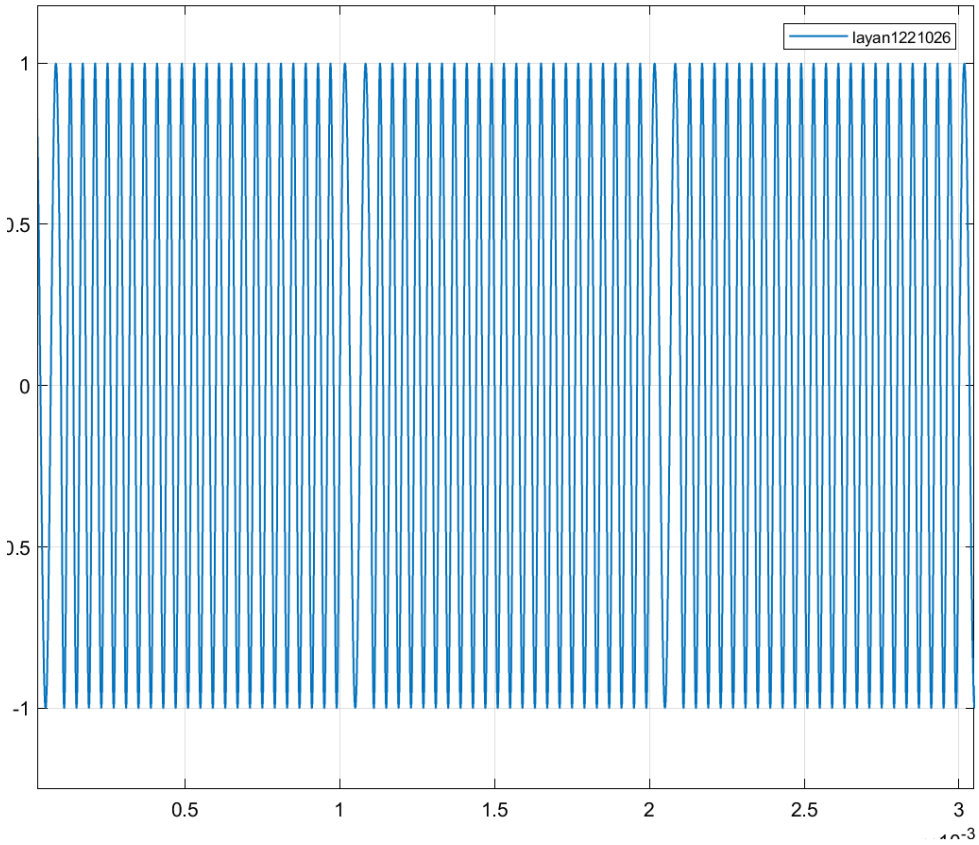
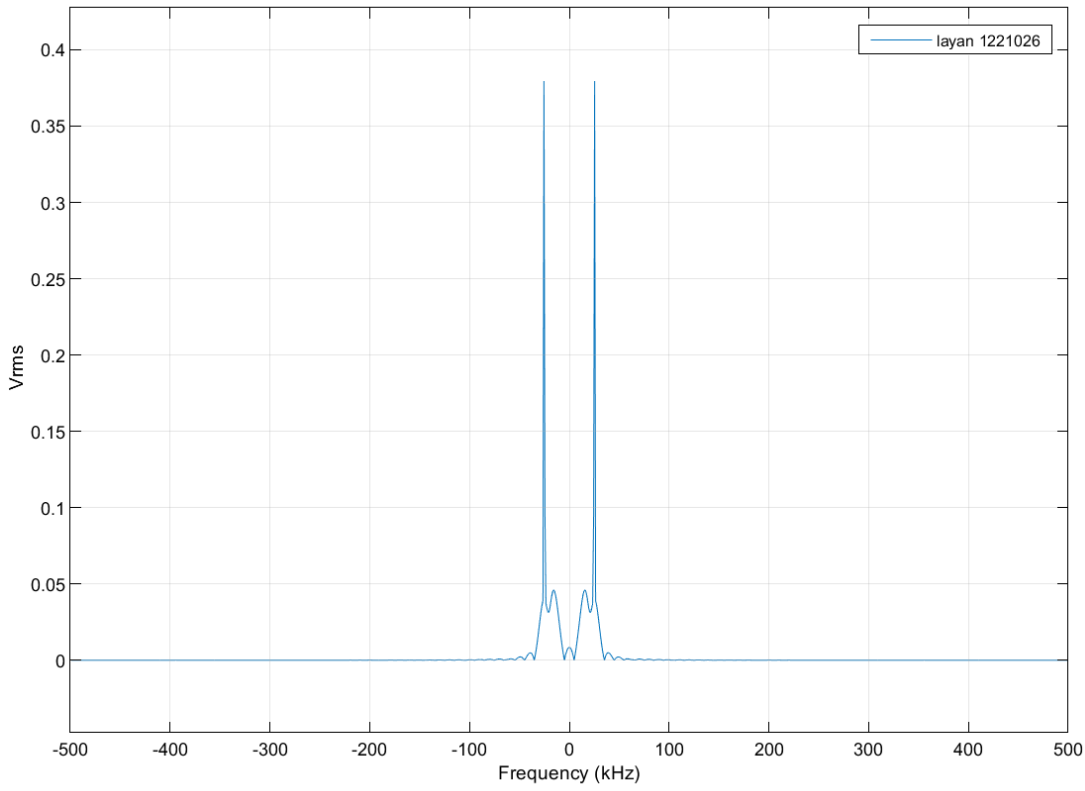
❖ FSK Modulated signal @ Am=5, D=10% & f=1KHz





RBW=976.562 Hz, Sample rate=1 MHz

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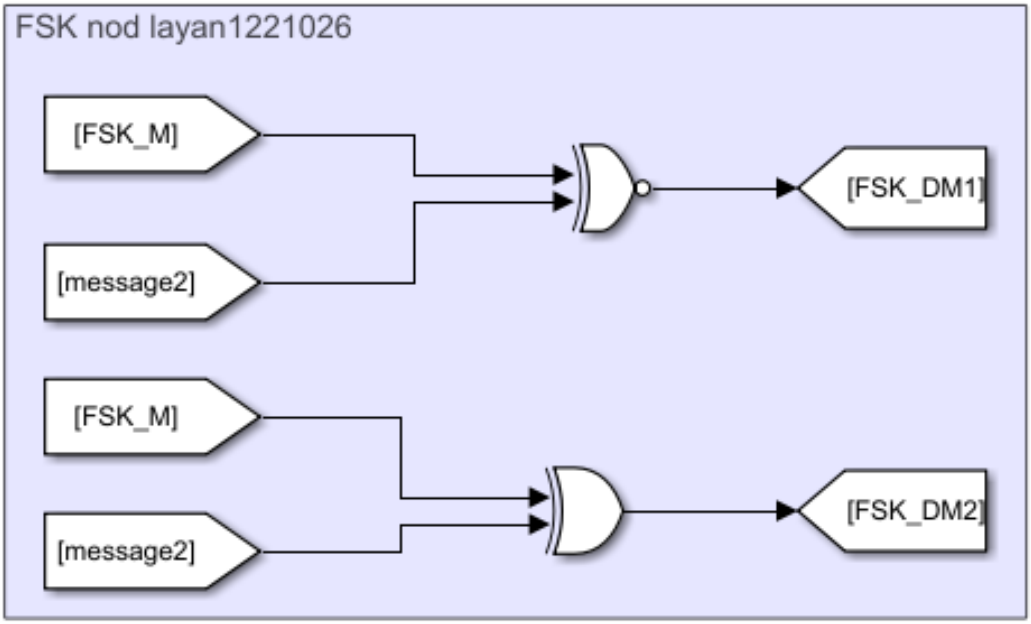
FSK Demodulating block:



This block recovers the original binary data by detecting which frequency is present in the received signal. Proper filtering is crucial to separate the two carriers accurately.

Each output shows a square wave resembling the original message. Variations in amplitude and frequency affect noise sensitivity, but correct demodulation is observed across the test cases.

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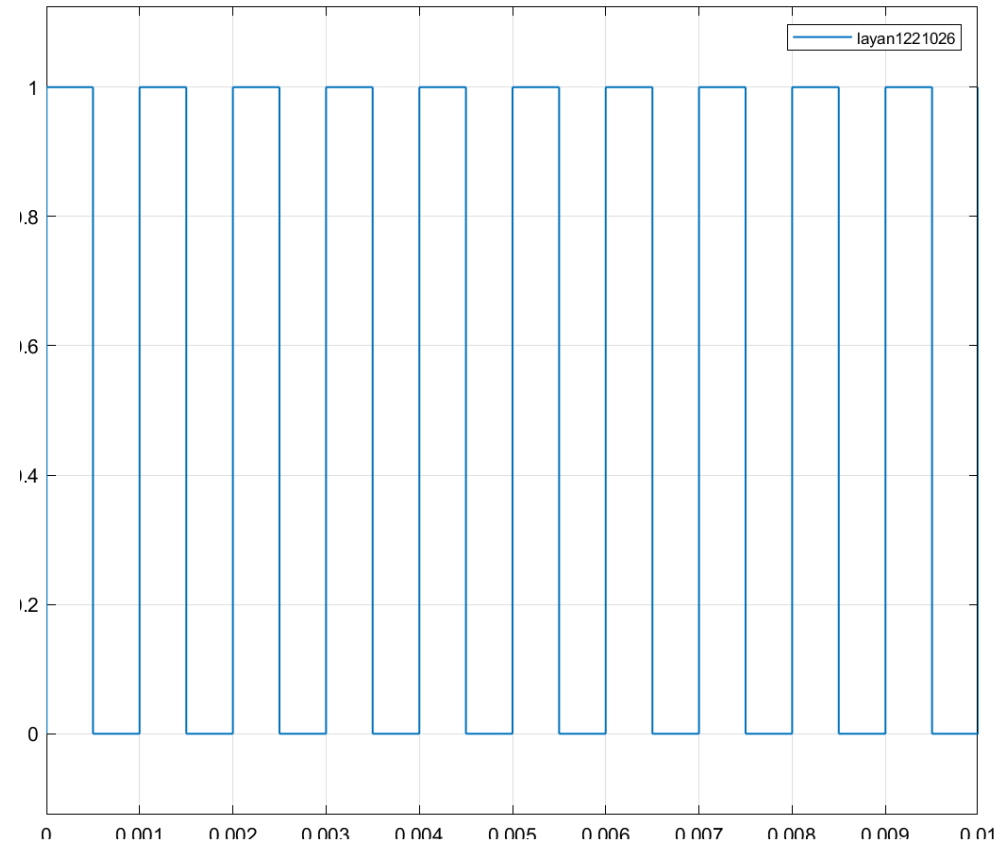
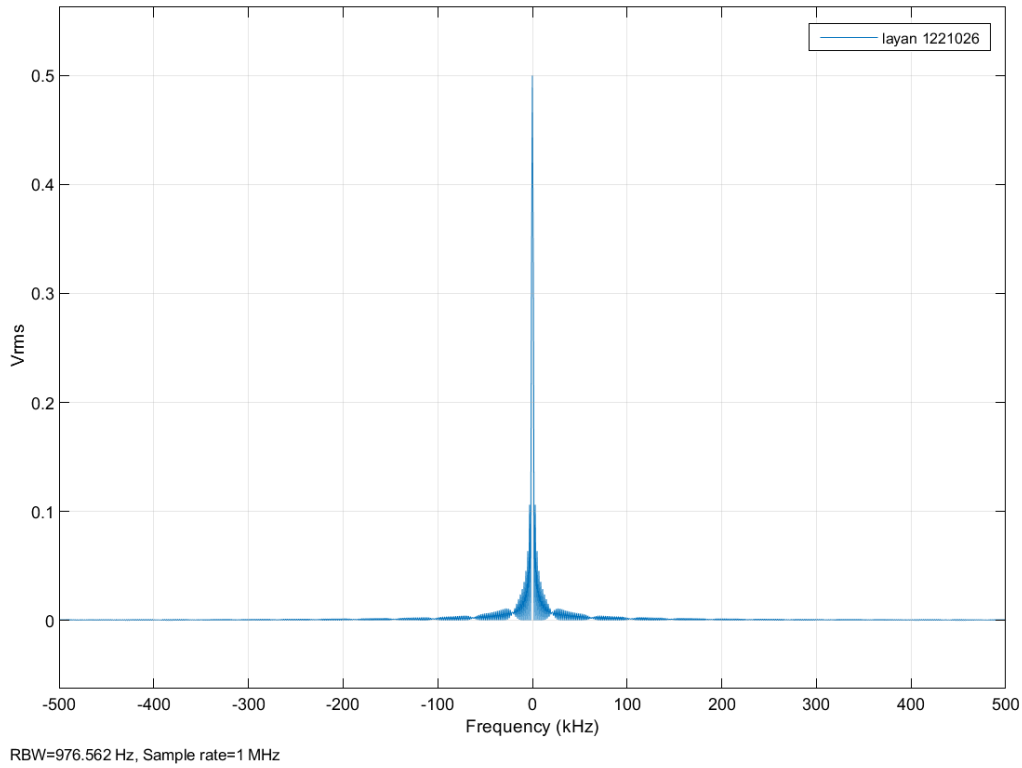
❖ FSK De-Modulated 1 signal @ Am=5, D=50% & f=1KHz





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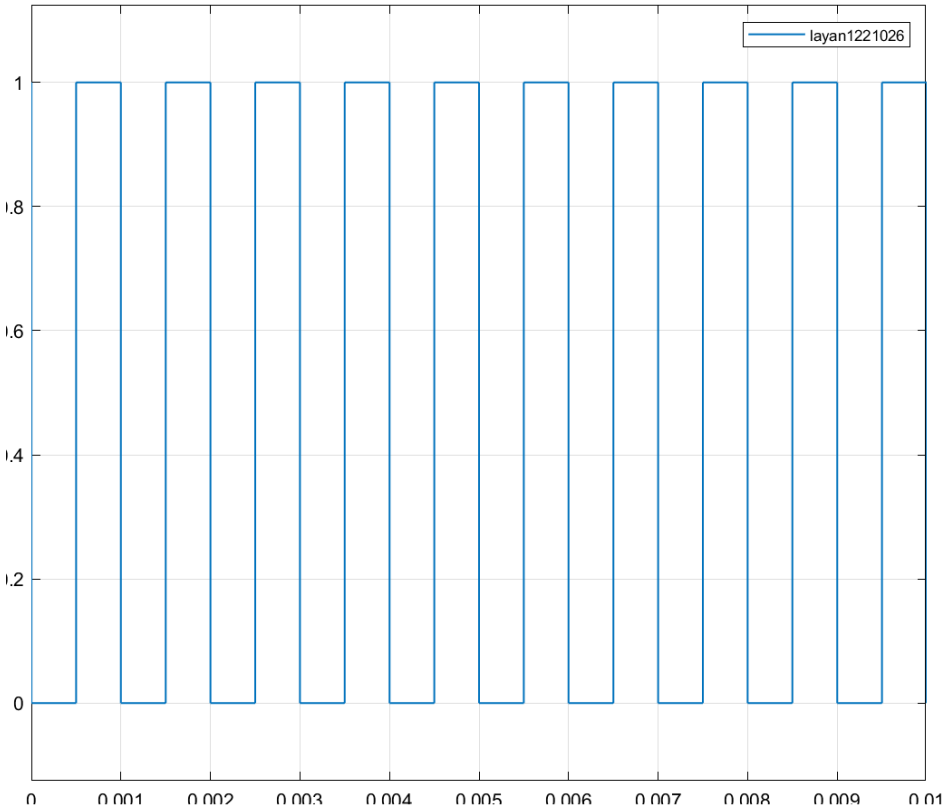
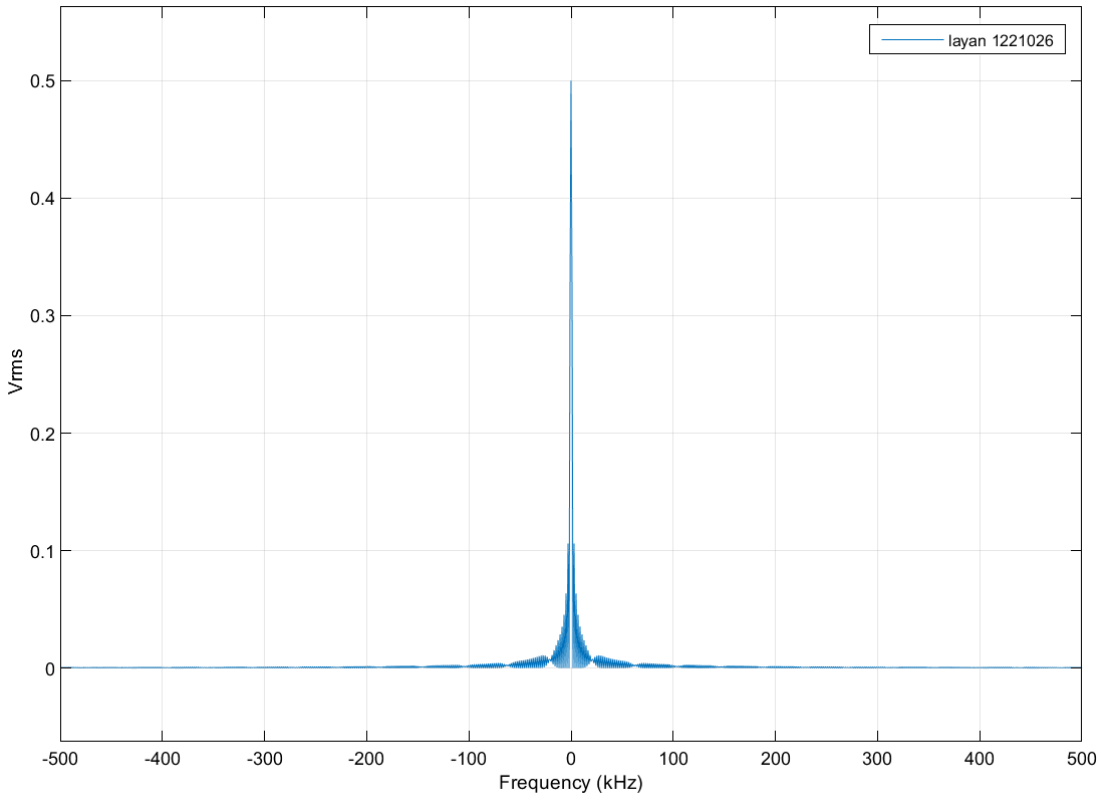
❖ FSK De-Modulated 2 signal @ Am=5, D=50% & f=1KHz





RBW=976.562 Hz, Sample rate=1 MHz

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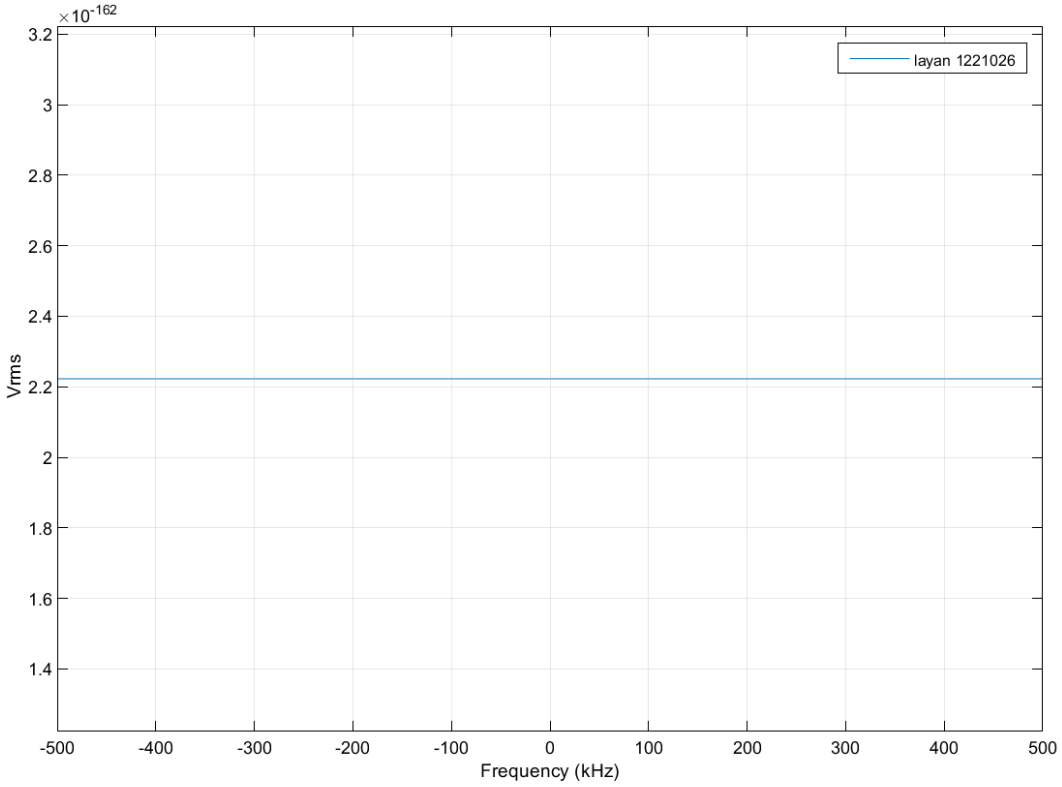
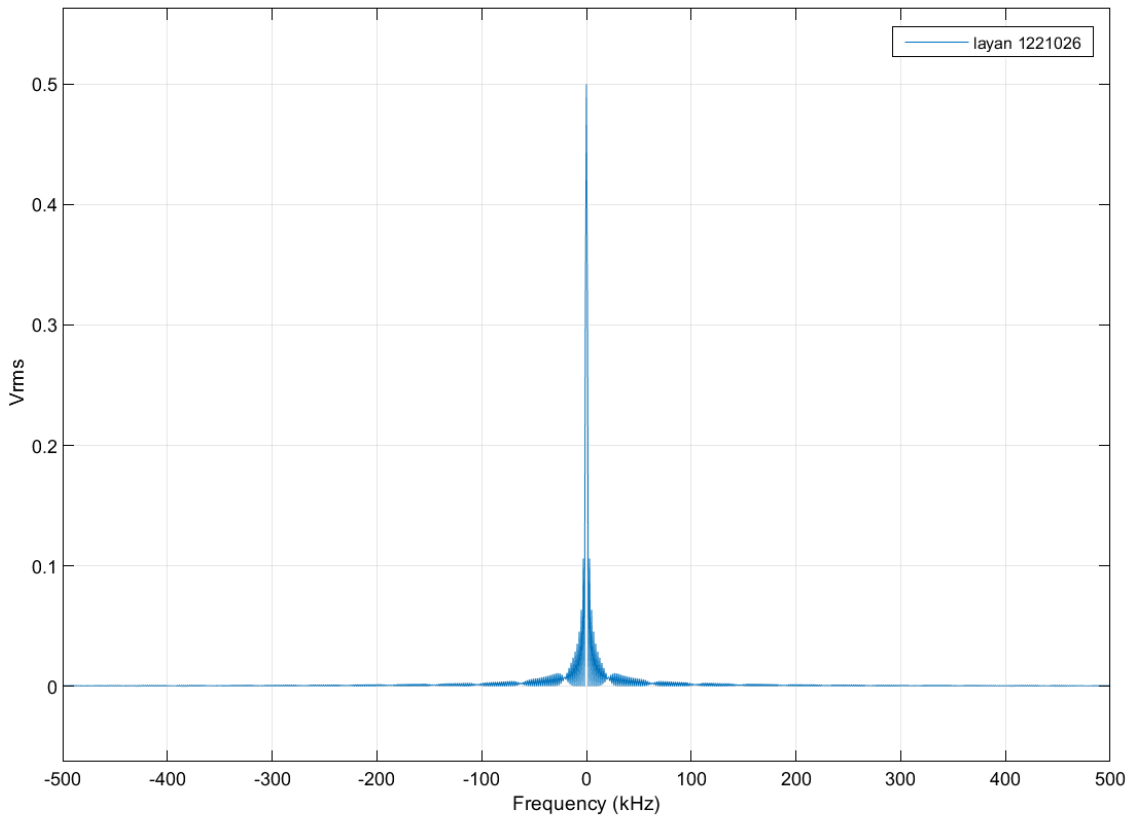
❖ FSK De-Modulated signal @ Am=2, D=50% & f=1KHz



RBW=976.562 Hz, Sample rate=1 MHz



RBW=976.562 Hz, Sample rate=1 MHz

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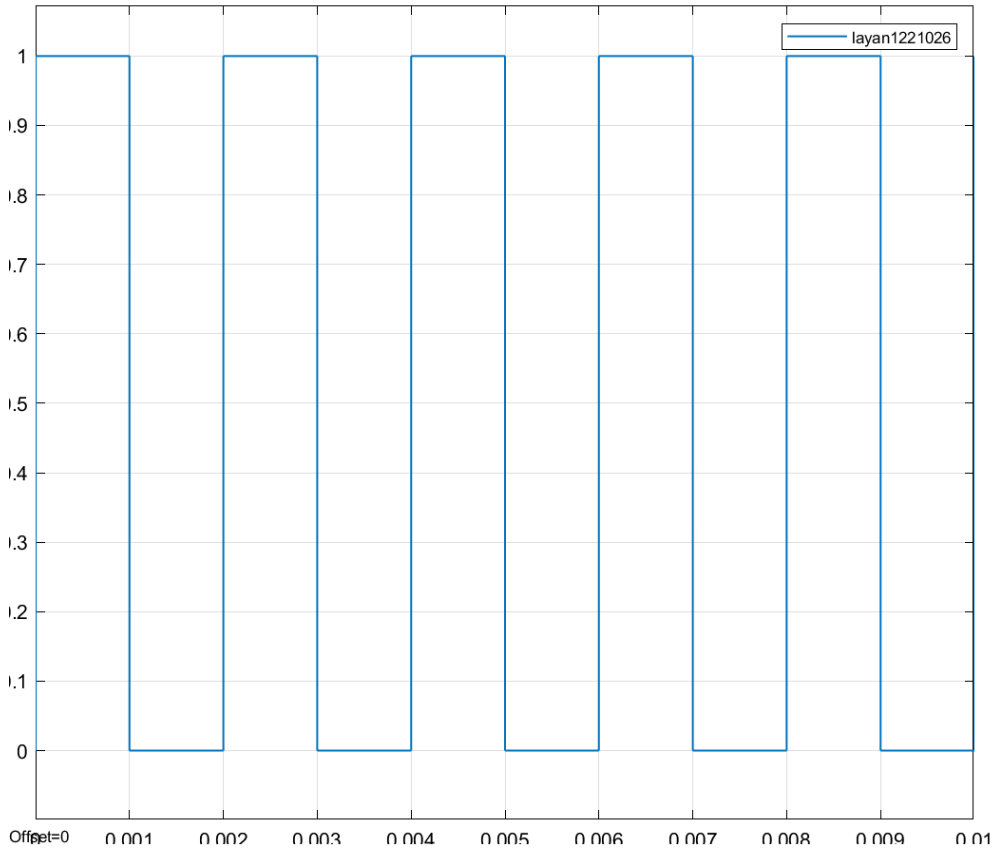
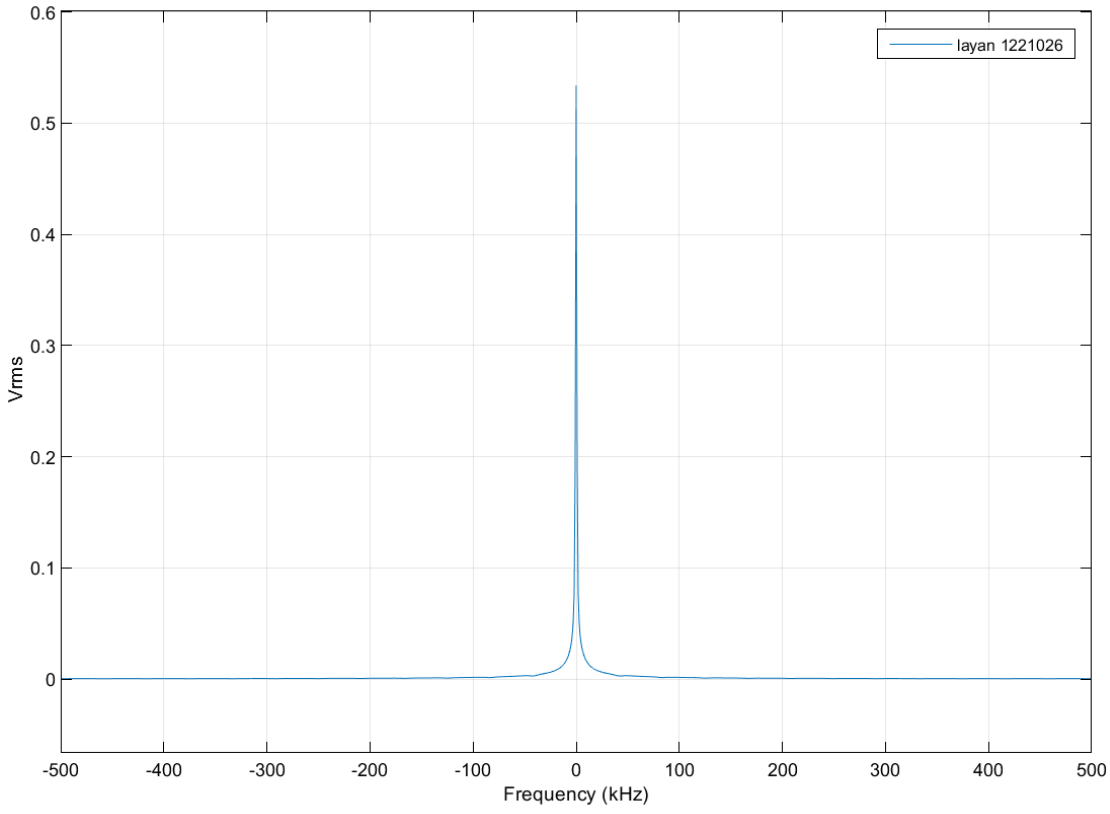
❖ FSK De-Modulated signal @ Am=5, D=50% & f=0.5KHz





RBW=976.562 Hz, Sample rate=1 MHz

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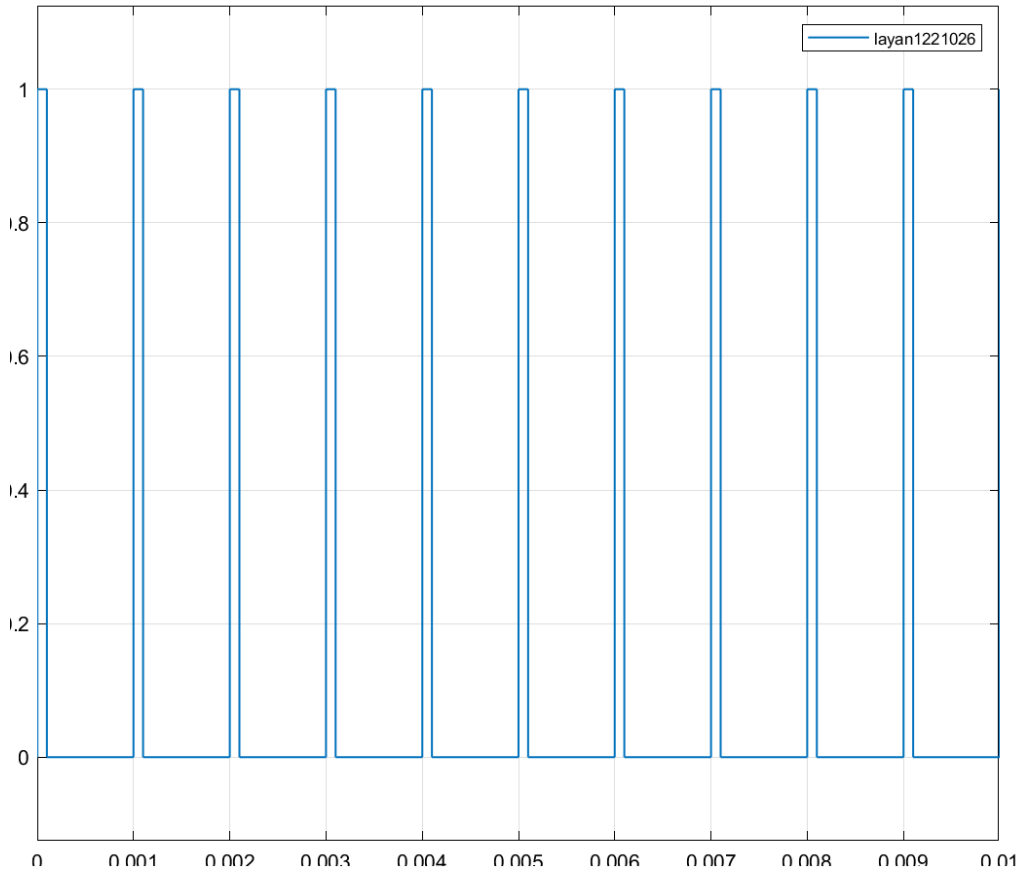
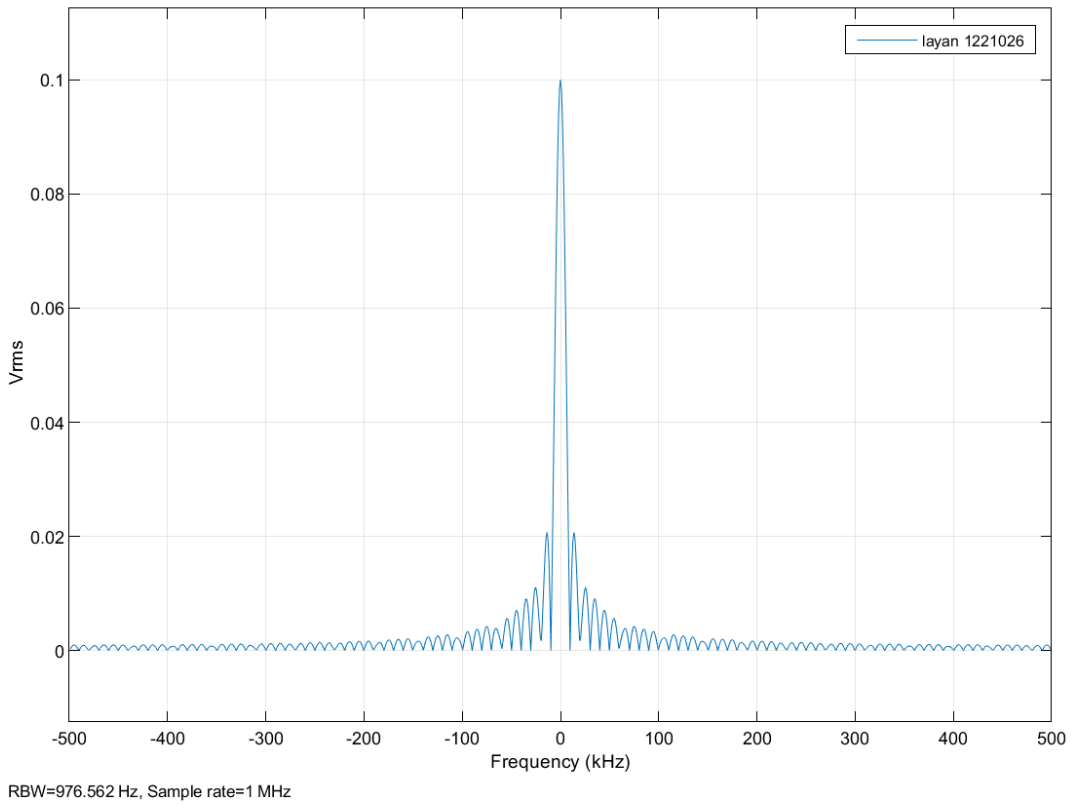
❖ FSK De-Modulated signal @ Am=5, D=10% & f=1KHz





RBW=976.562 Hz, Sample rate=1 MHz

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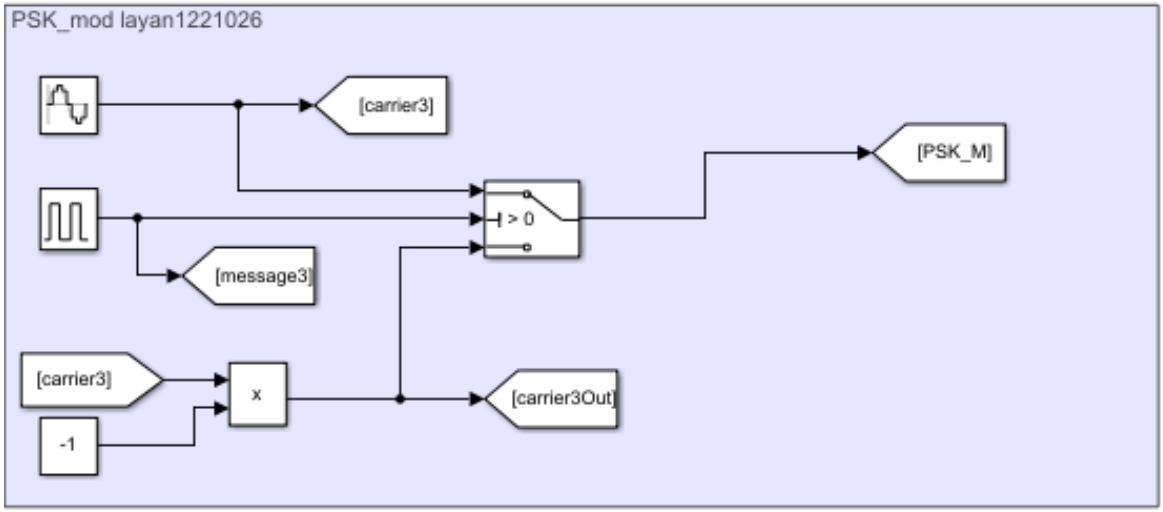
❖ PSK modulating block:



- Am=5, D=50%, f=1kHz: Distinct phase shifts are visible. Clear and strong transitions.

- Am=2, D=50%, f=1kHz: Reduced amplitude decreases signal power, yet phase changes remain observable.

- Am=5, D=50%, f=0.5kHz: Longer symbols make phase transitions more visible.

- Am=5, D=10%, f=1kHz: Short duty cycles make phase changes rapid, potentially harder to detect.

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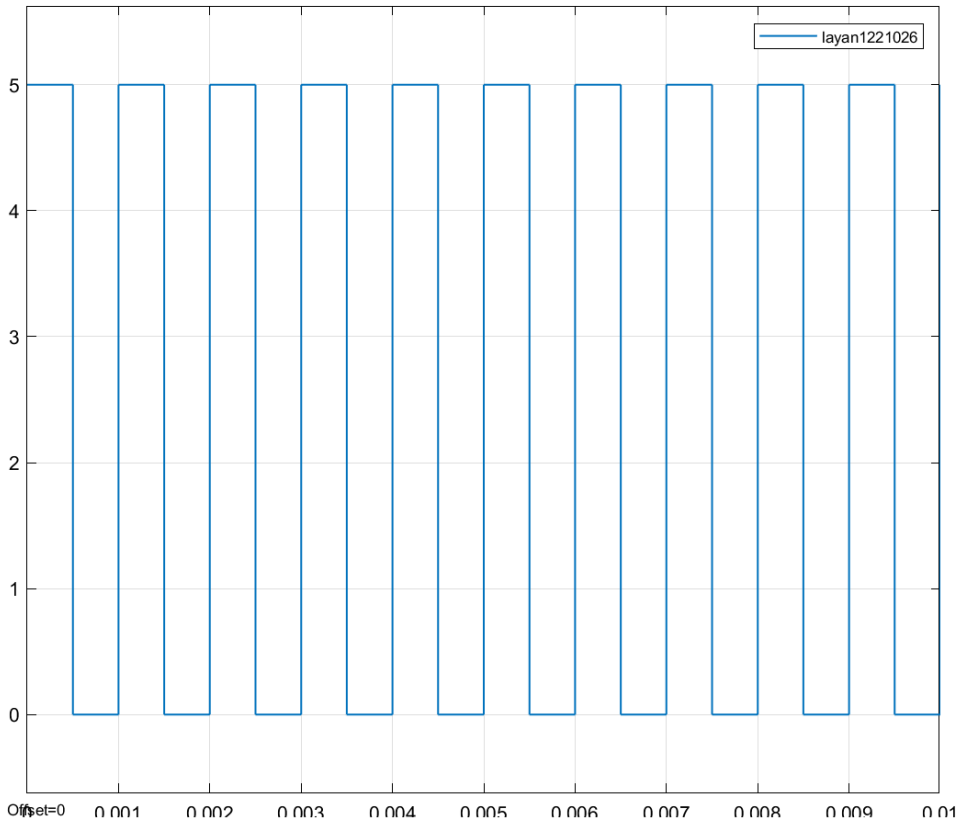
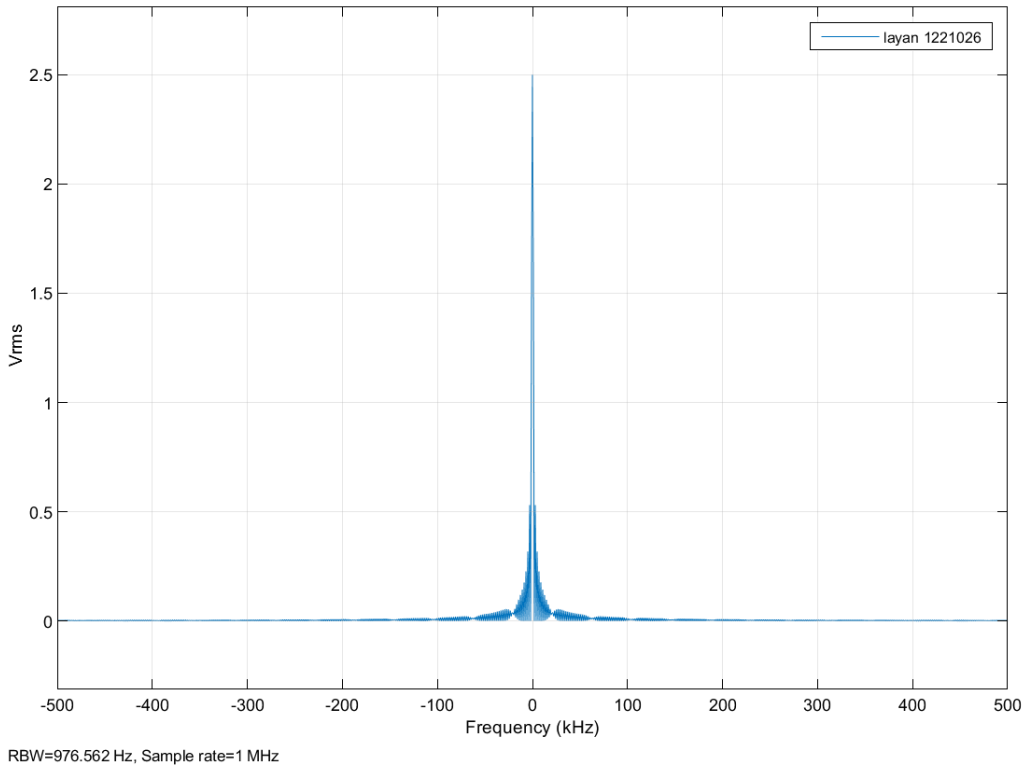
❖ PSK Message signal





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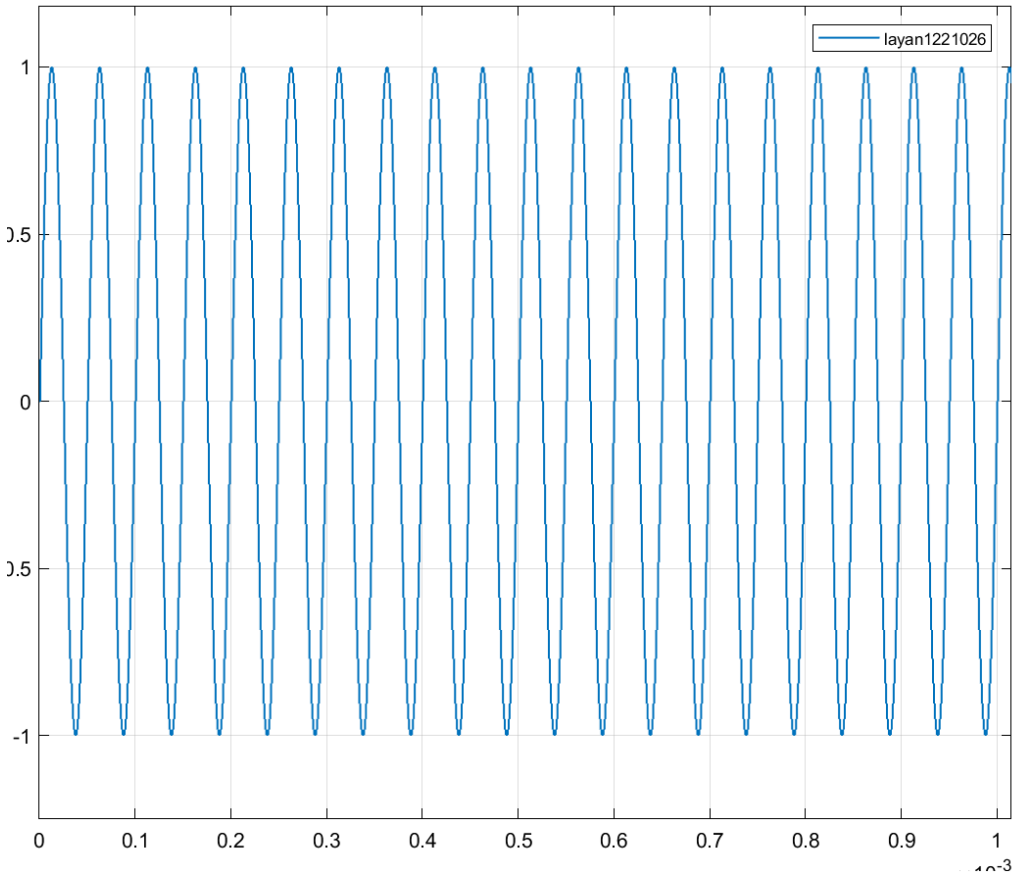
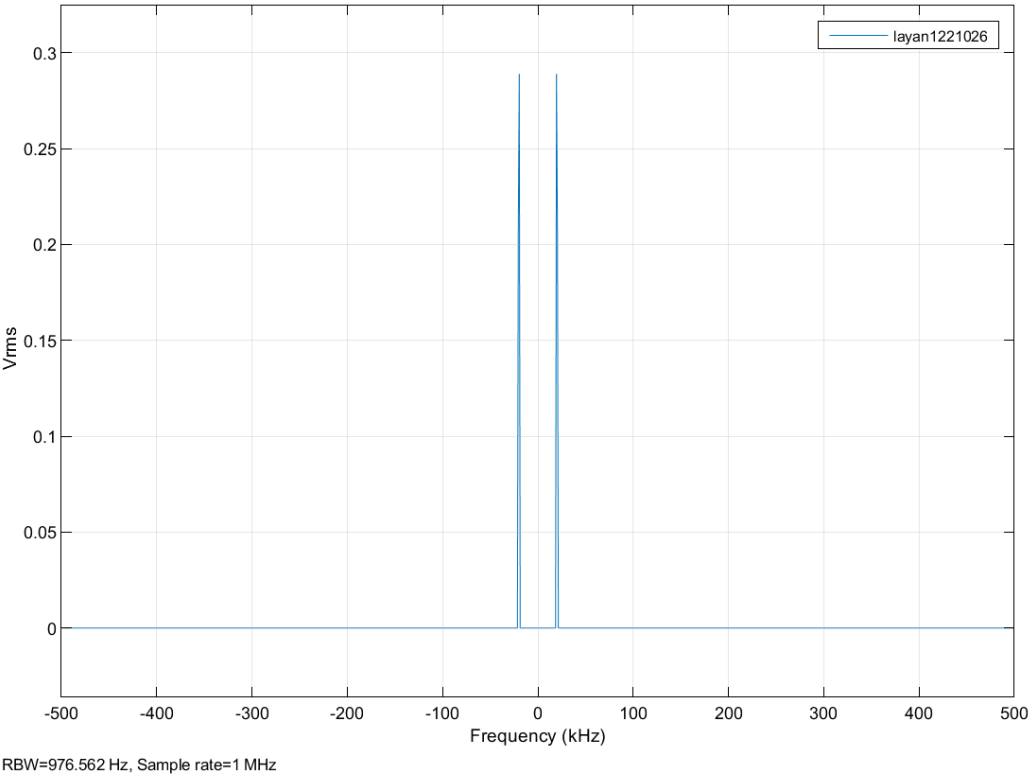
❖ PSK Carrier





RBW=976.562 Hz, Sample rate=1 MHz

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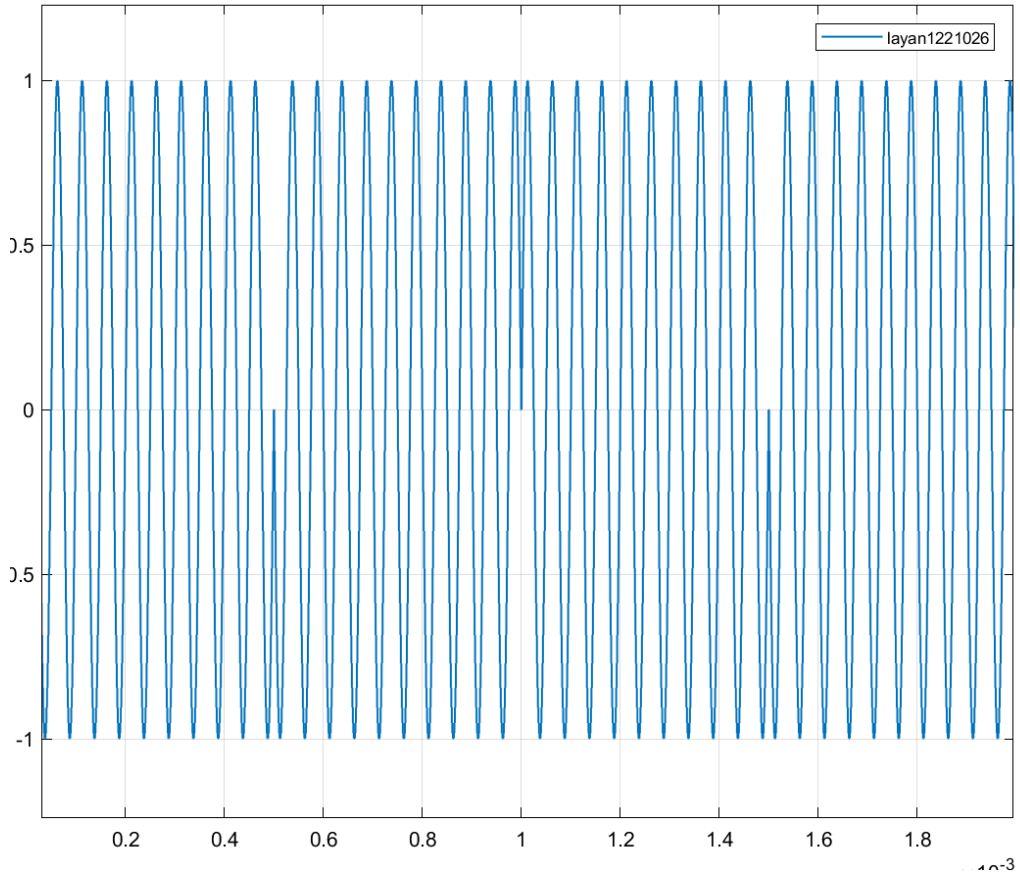
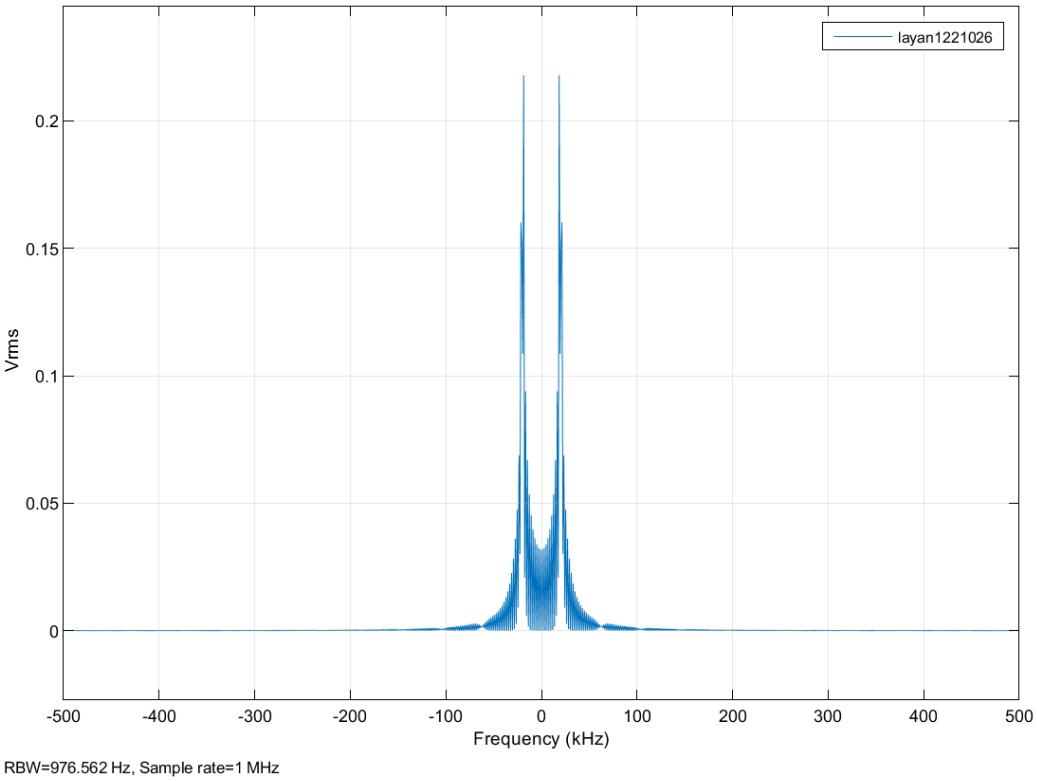
❖ PSK Modulated signal @ Am=5, D=50% & f=1KHz





RBW=976.562 Hz, Sample rate=1 MHz

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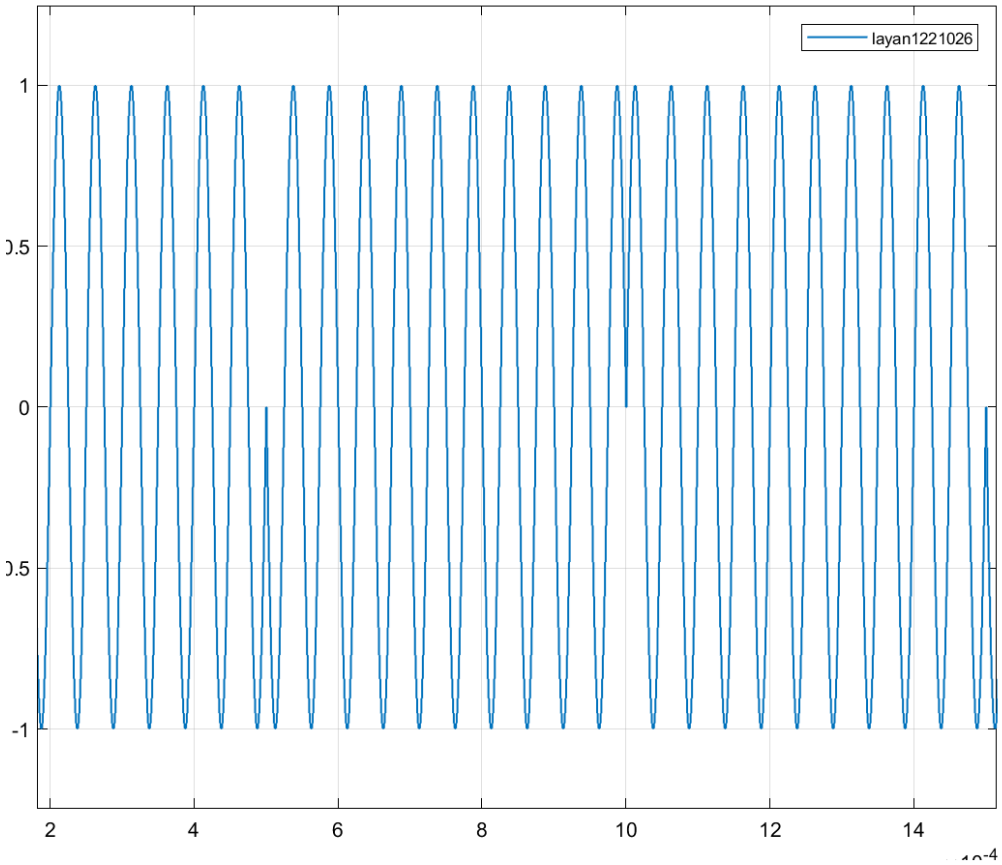
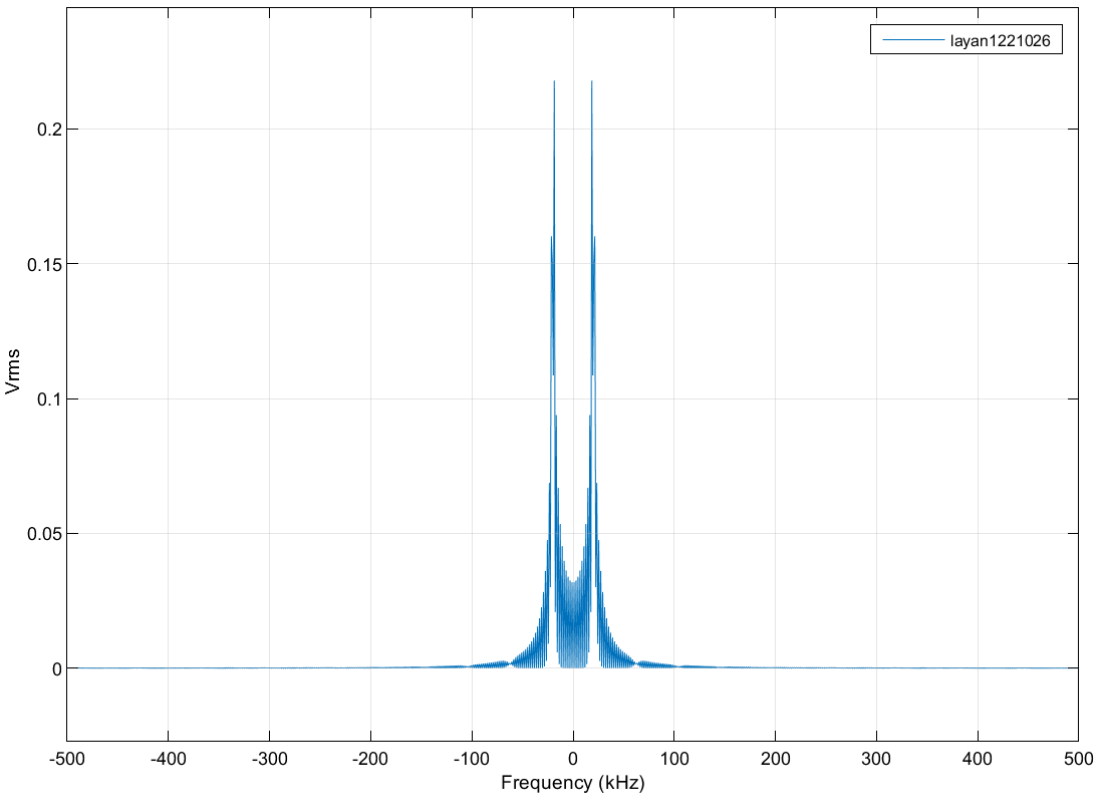
❖ PSK Modulated signal @ Am=2, D=50% & f=1KHz





RBW=976.562 Hz, Sample rate=1 MHz

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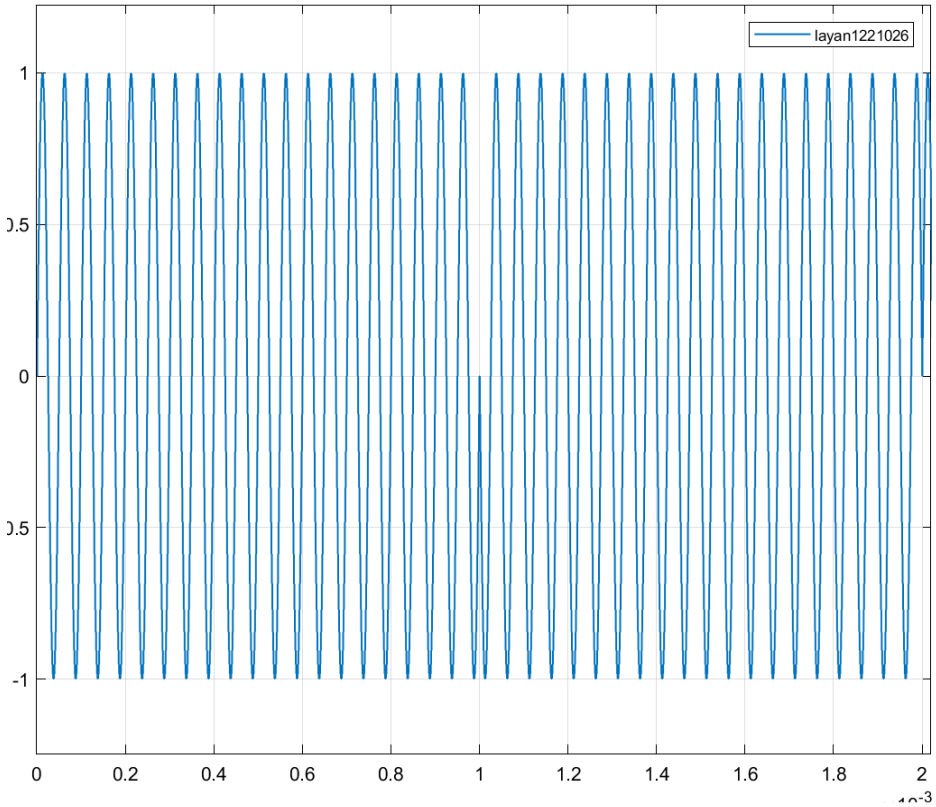
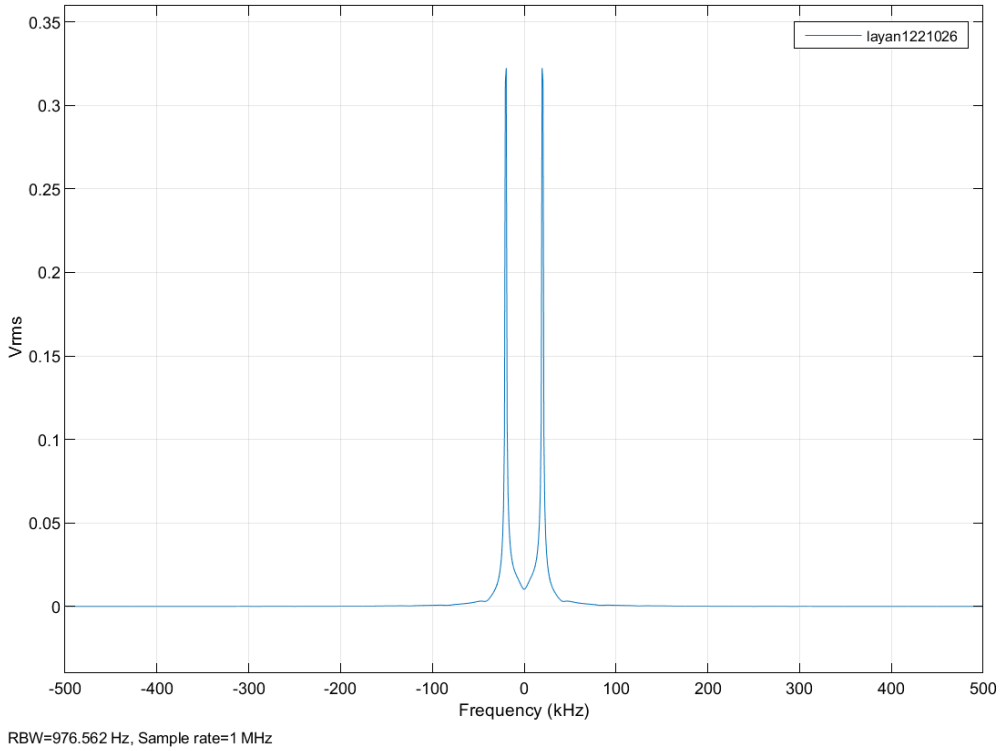
❖ PSK Modulated signal @ Am=5, D=50% & f=0.5KHz





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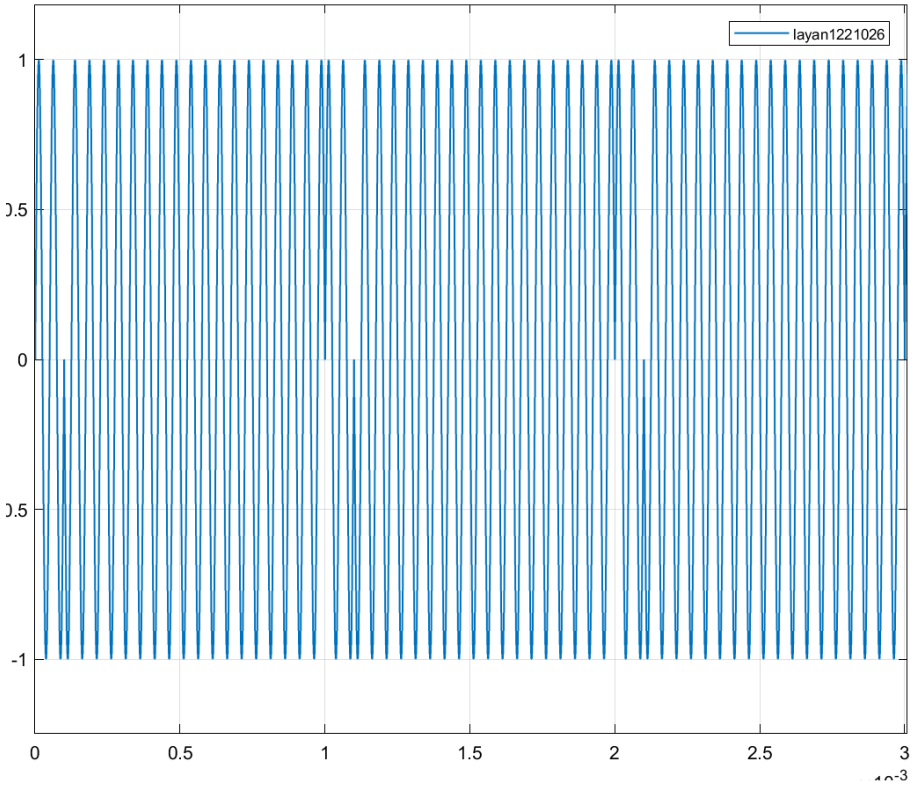
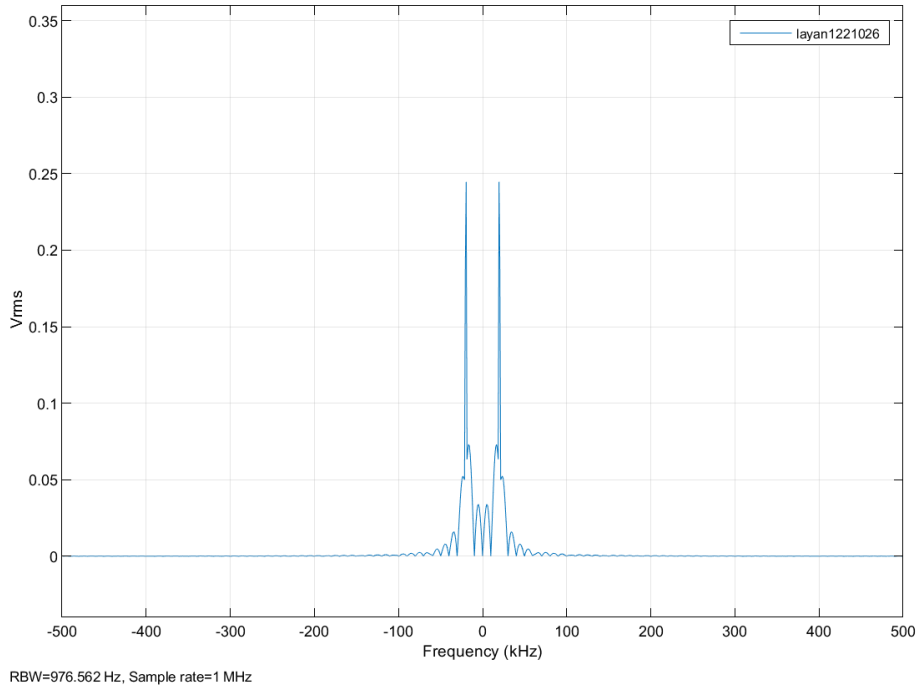
❖ PSK Modulated signal @ Am=5, D=10% & f=1KHz





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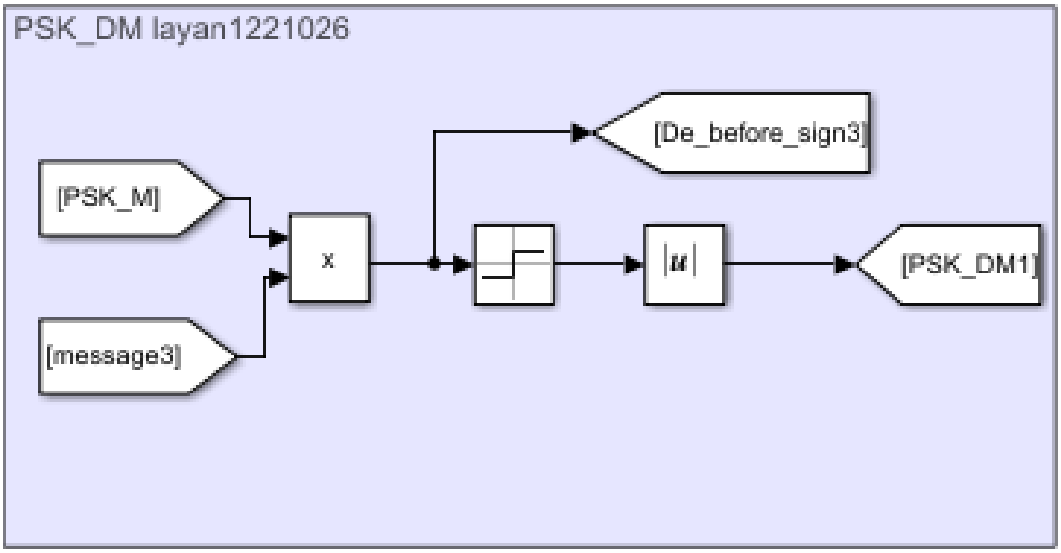
FSK Demodulating block 1:



These blocks decode the PSK signal. They require accurate synchronization with the carrier to detect phase changes correctly.

Both demodulators recover the message effectively across all test cases. Some distortion may appear in low-amplitude or short-duration cases, but general decoding remains accurate.

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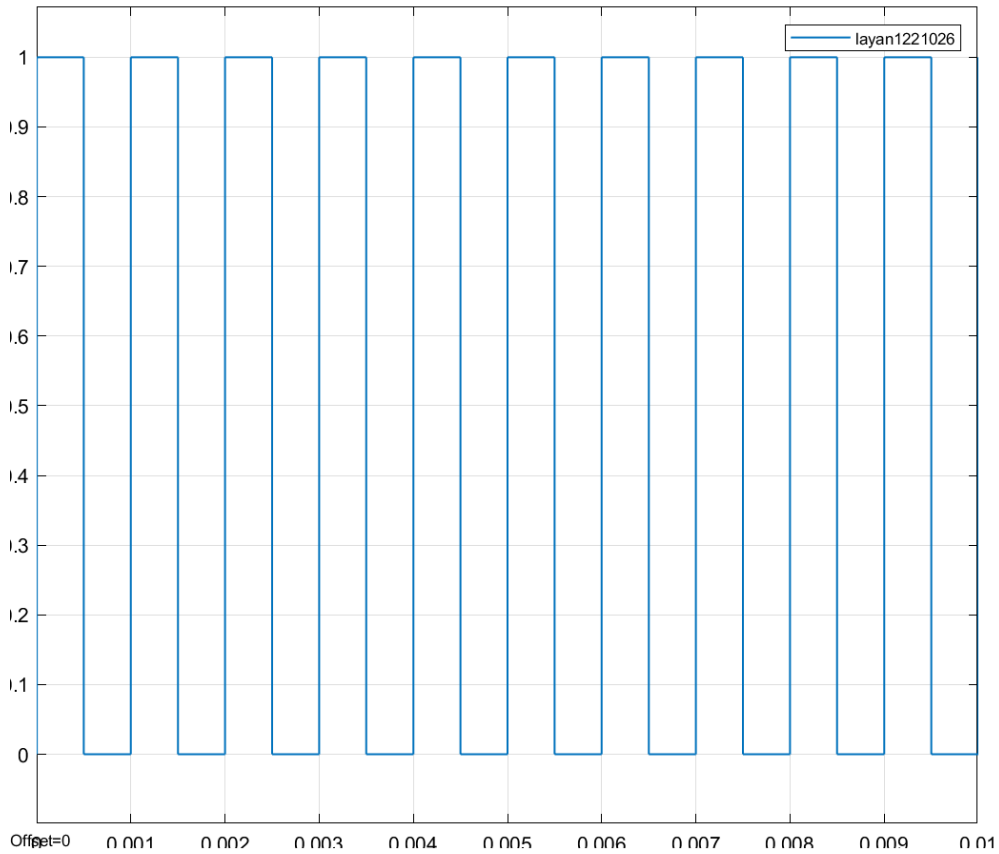
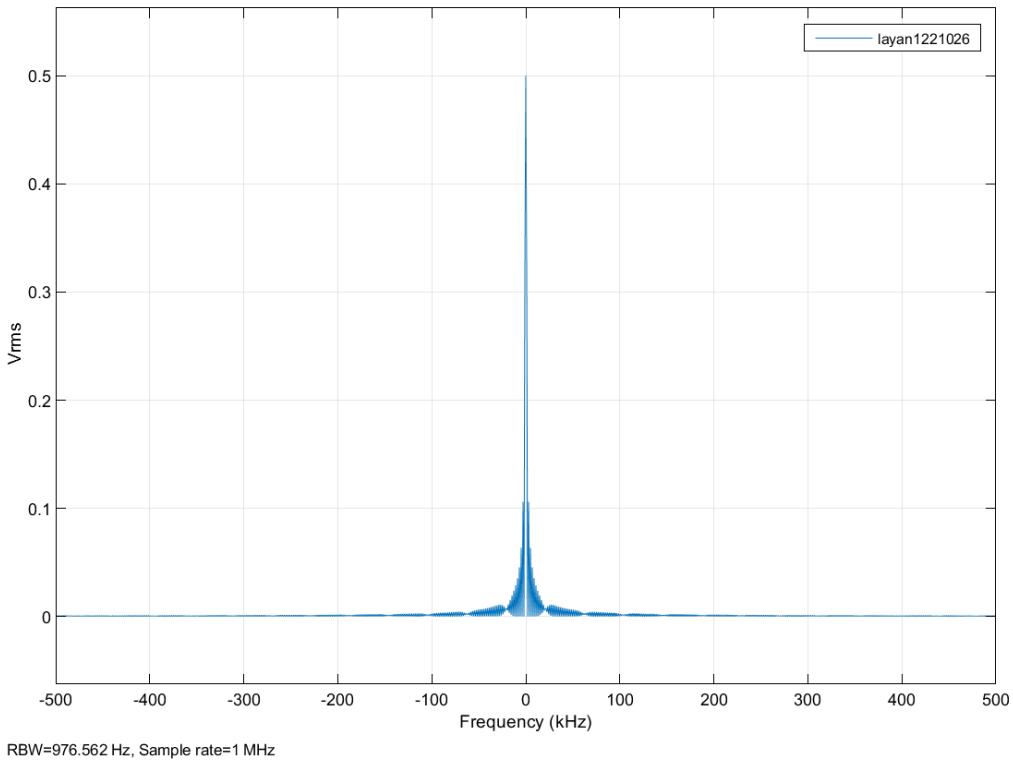
❖ PSK De-Modulated signal (1) @ Am=5, D=50% & f=1KHz





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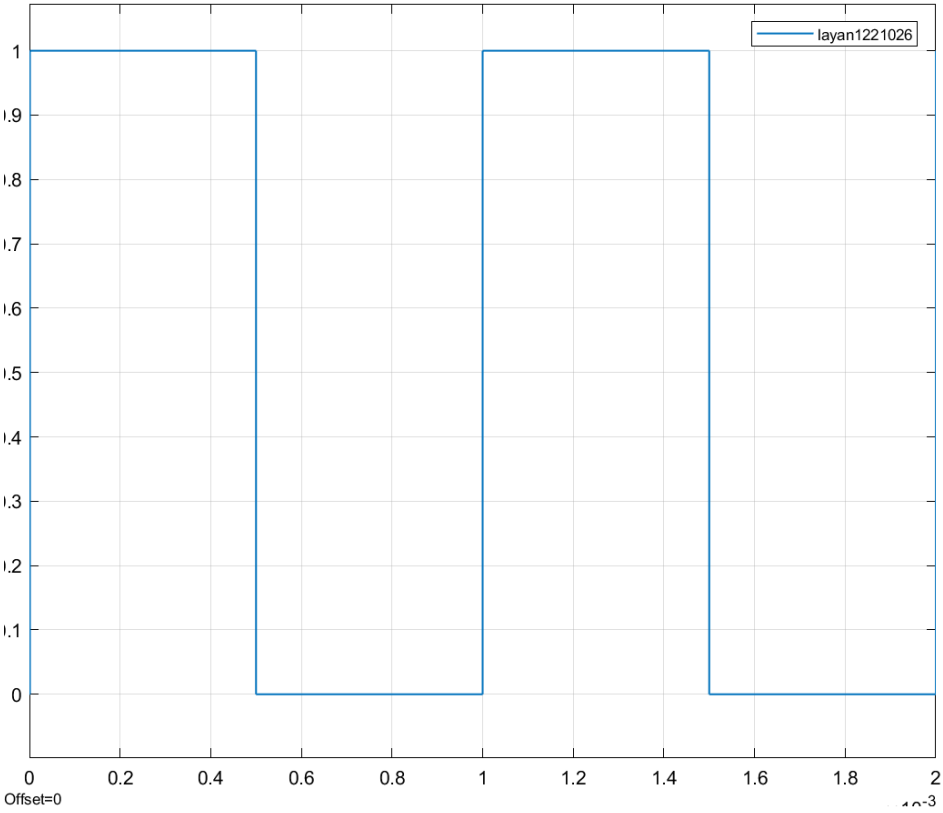
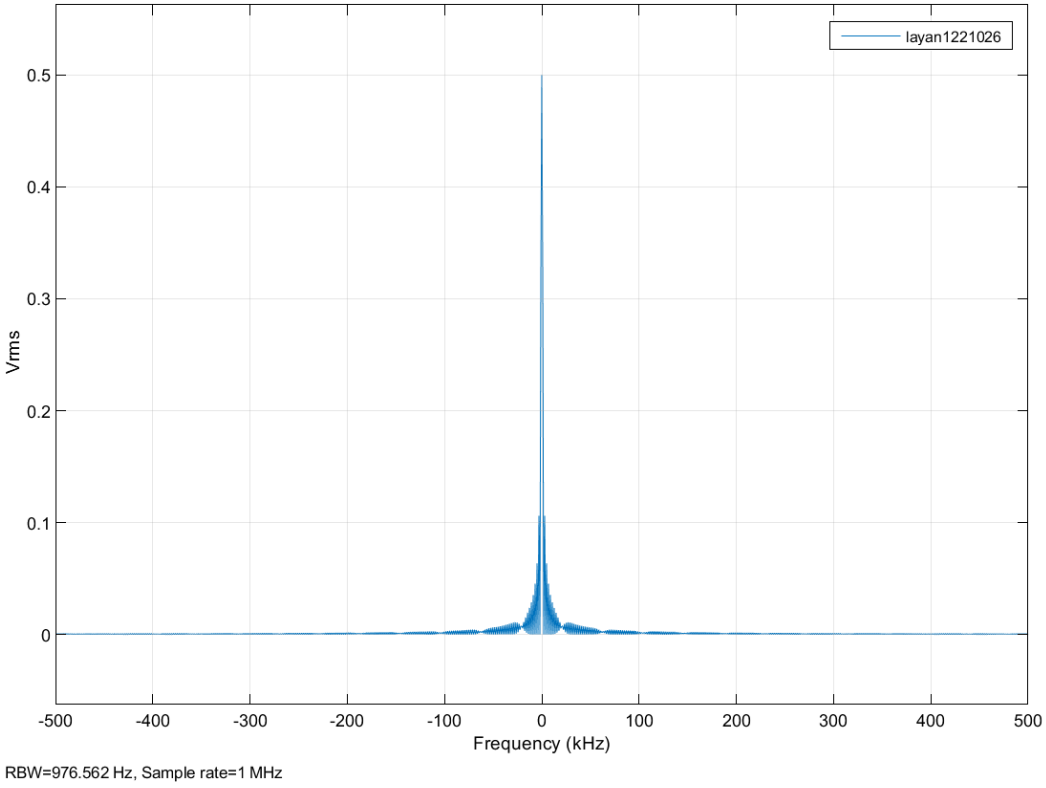
❖ PSK De-Modulated signal (1) @ Am=2, D=50% & f=1KHz





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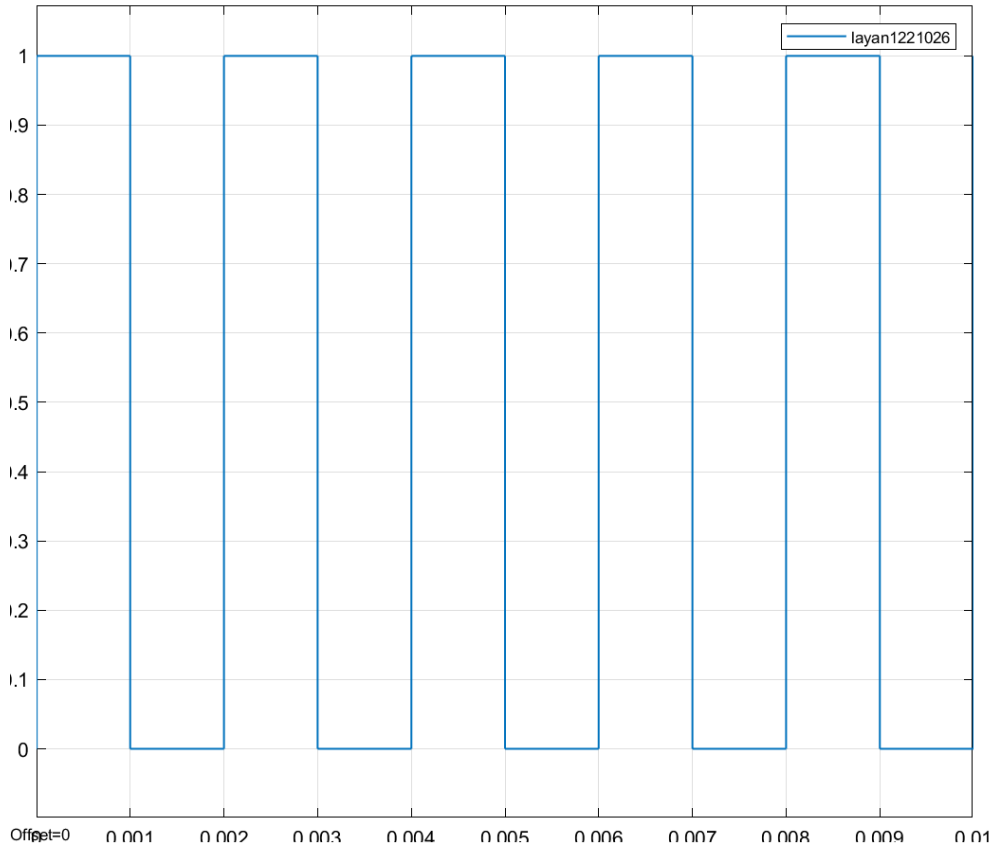
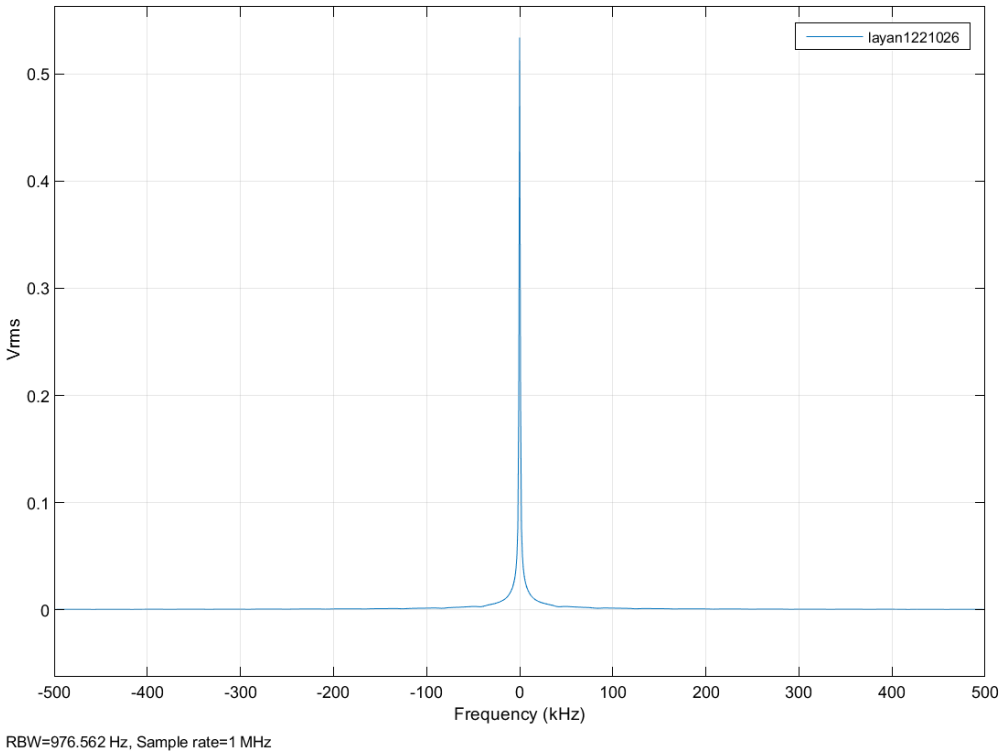
❖ PSK De-Modulated signal (1) @ Am=5, D=50% & f=0.5KHz





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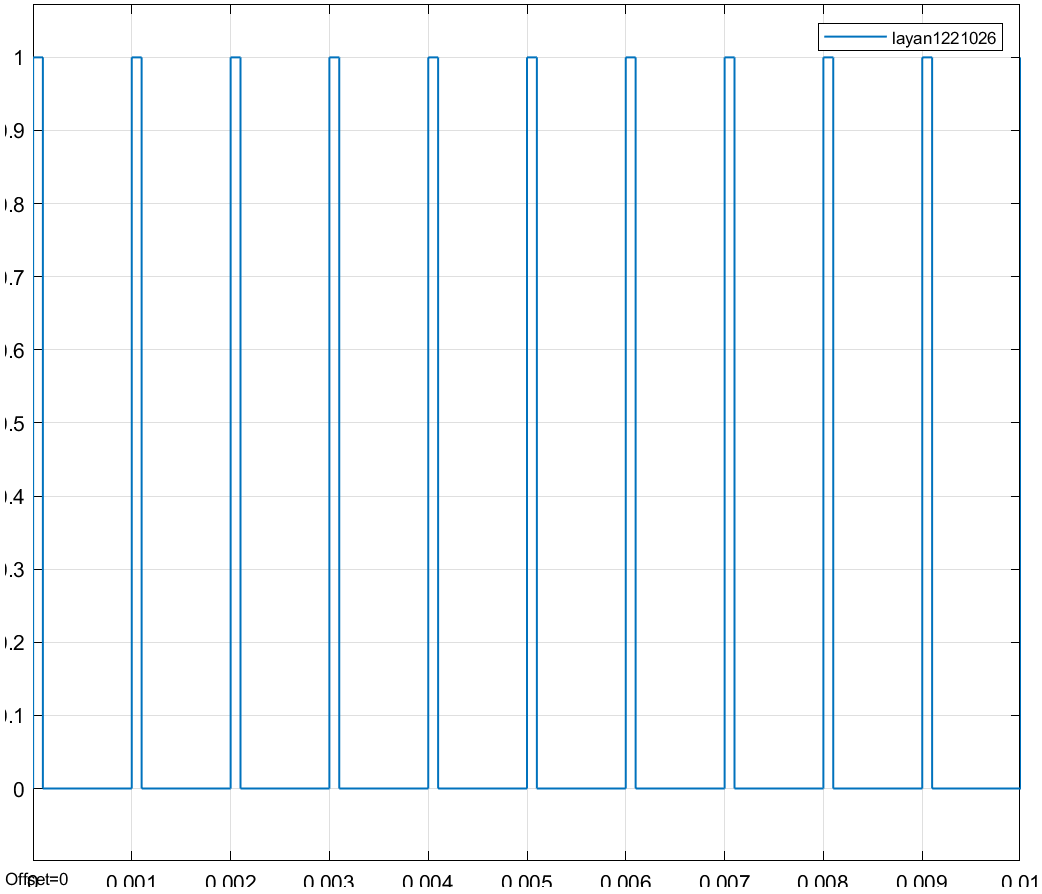
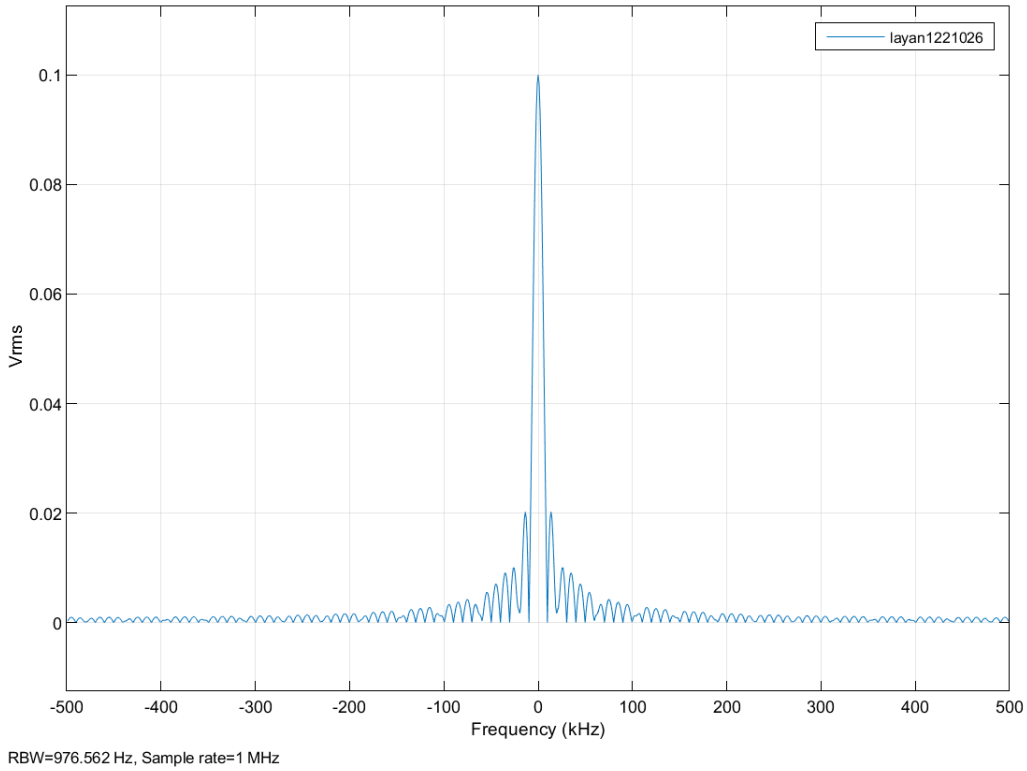
❖ PSK De-Modulated signal (1) @ Am=5, D=10% & f=1KHz





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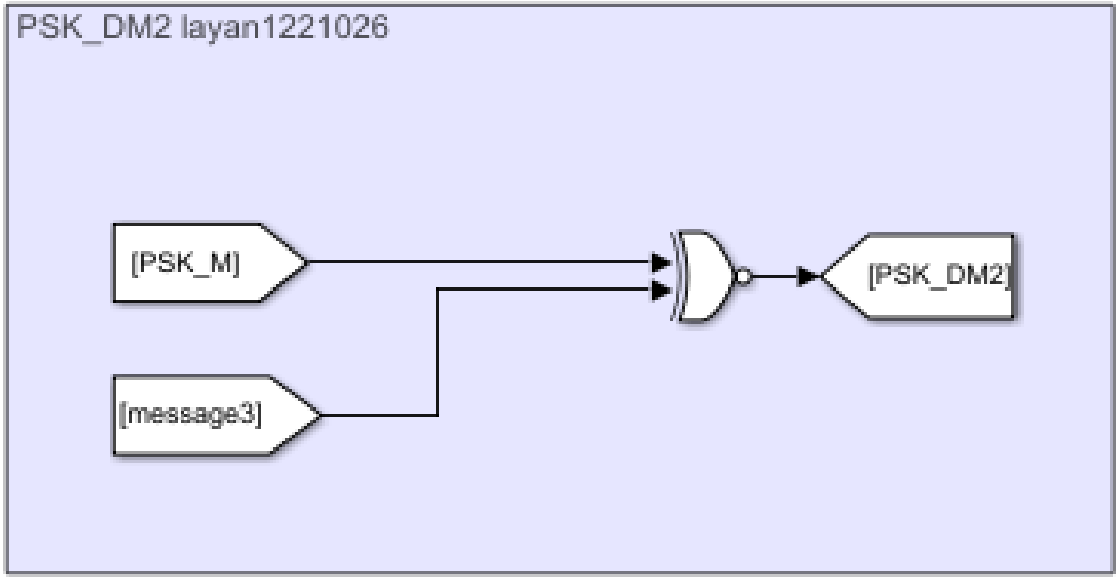
FSK Demodulating block 2:



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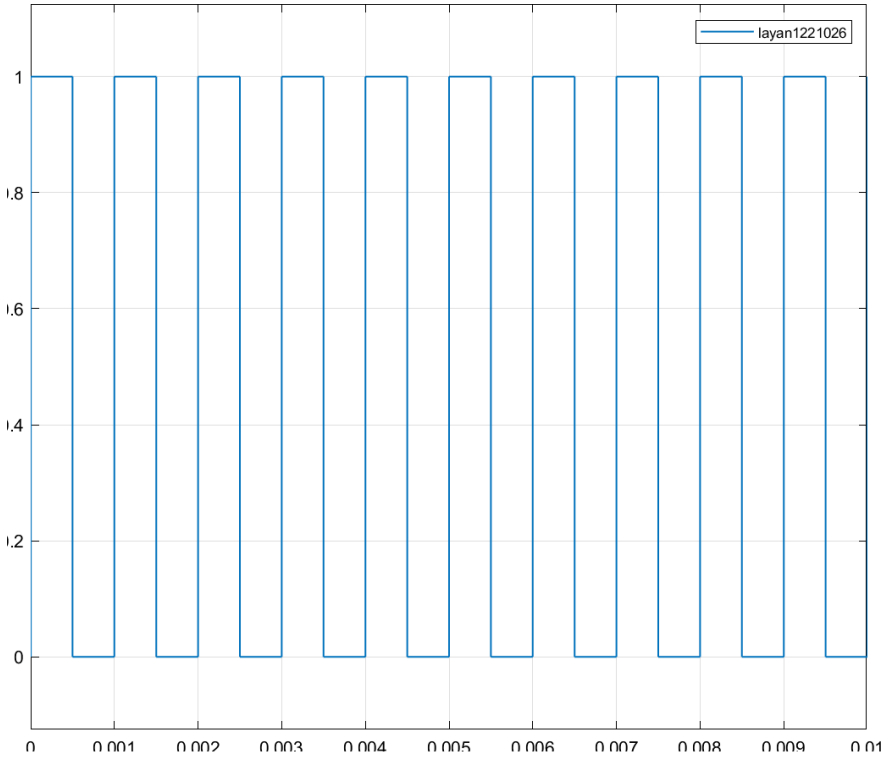
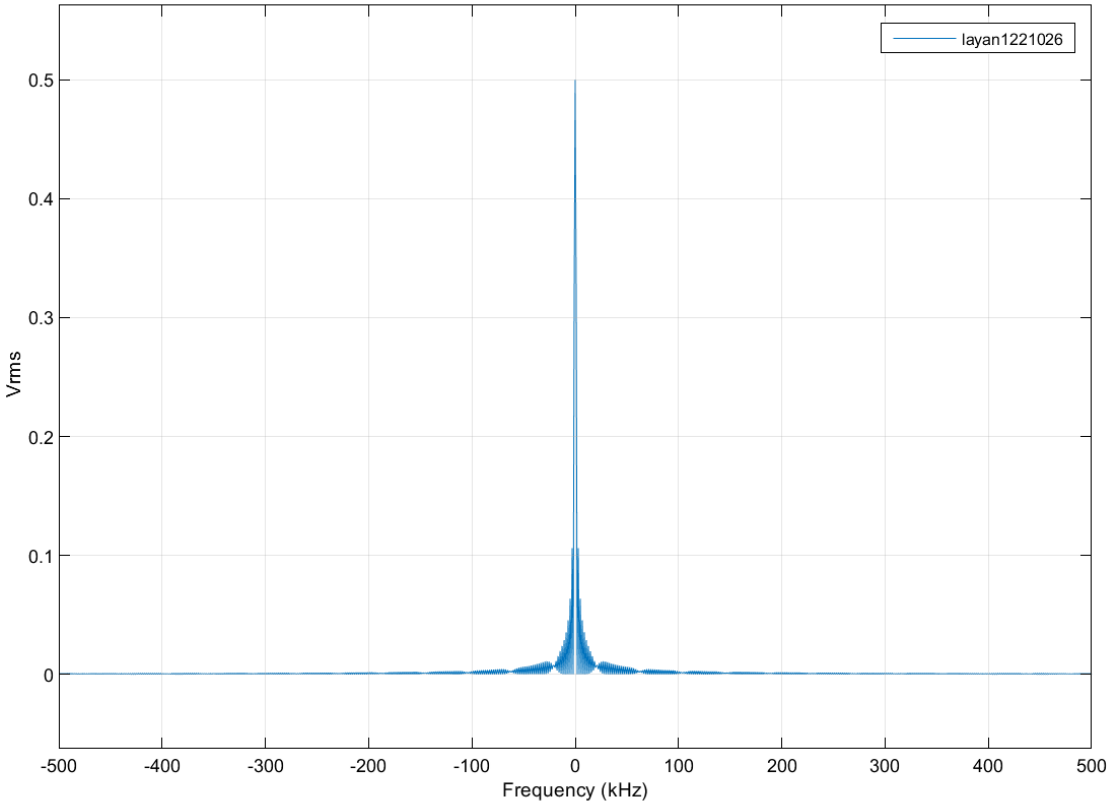
❖ PSK De-Modulated signal (2) @ Am=5, D=50% & f=1KHz





RBW=976.562 Hz, Sample rate=1 MHz

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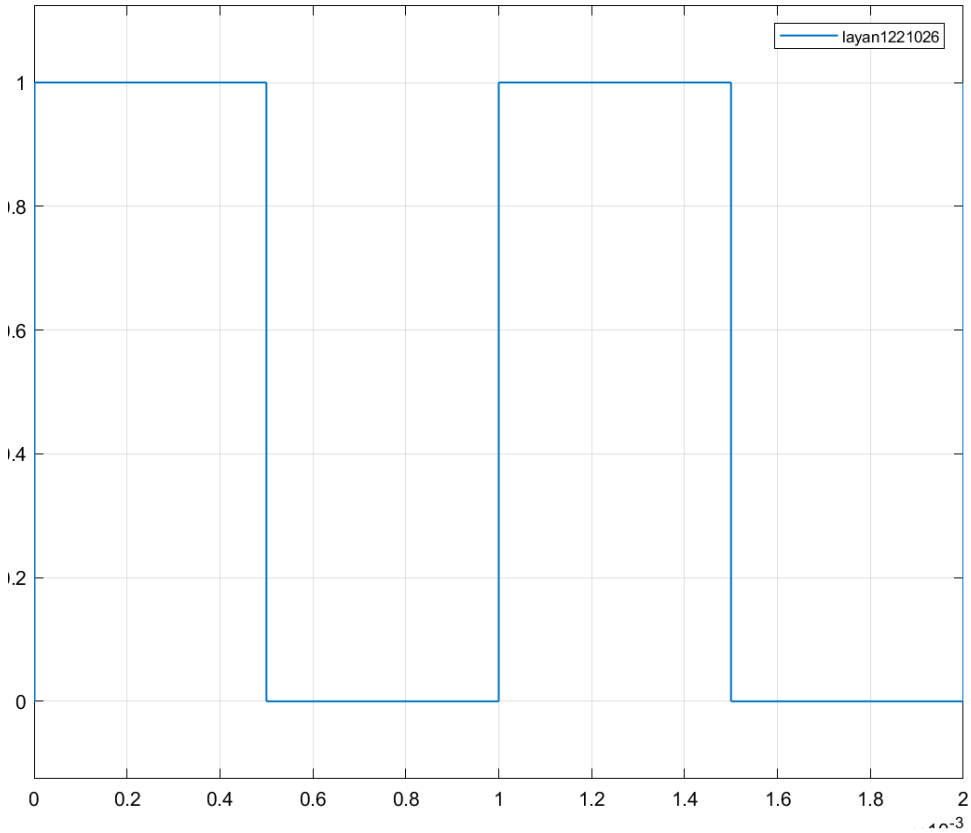
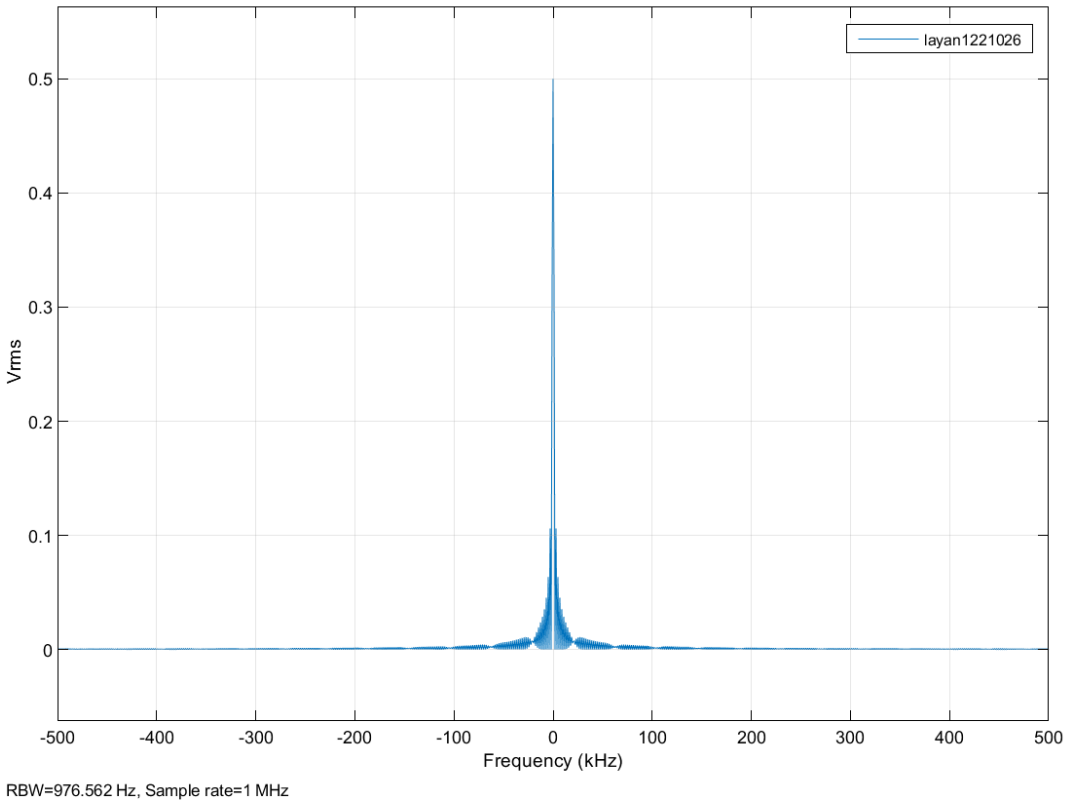
❖ PSK De-Modulated signal (2) @ Am=2, D=50% & f=1KHz





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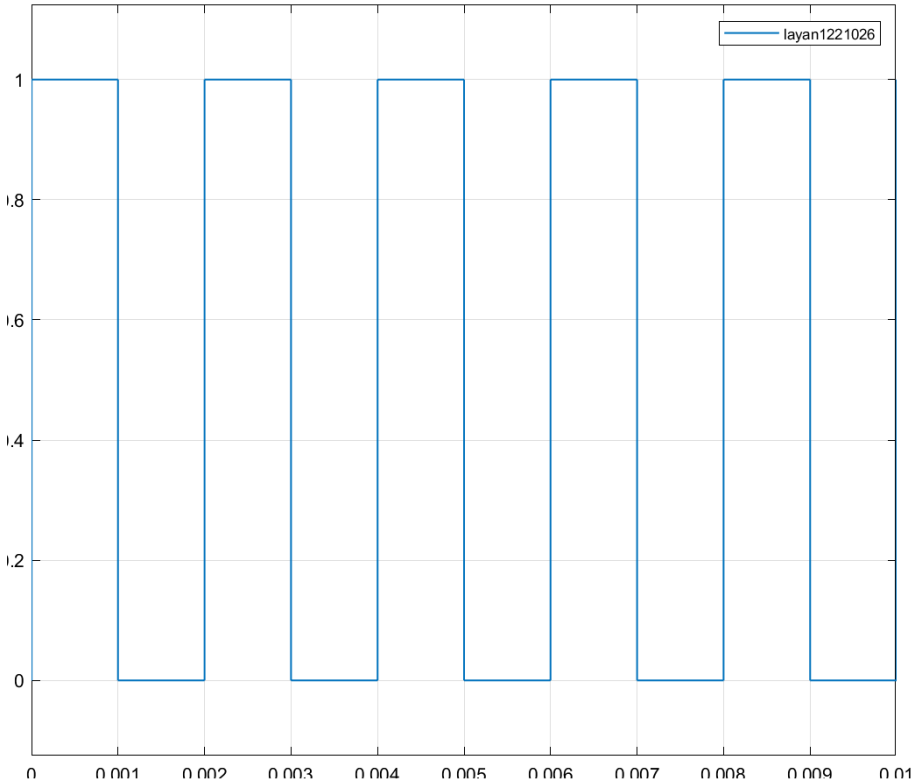
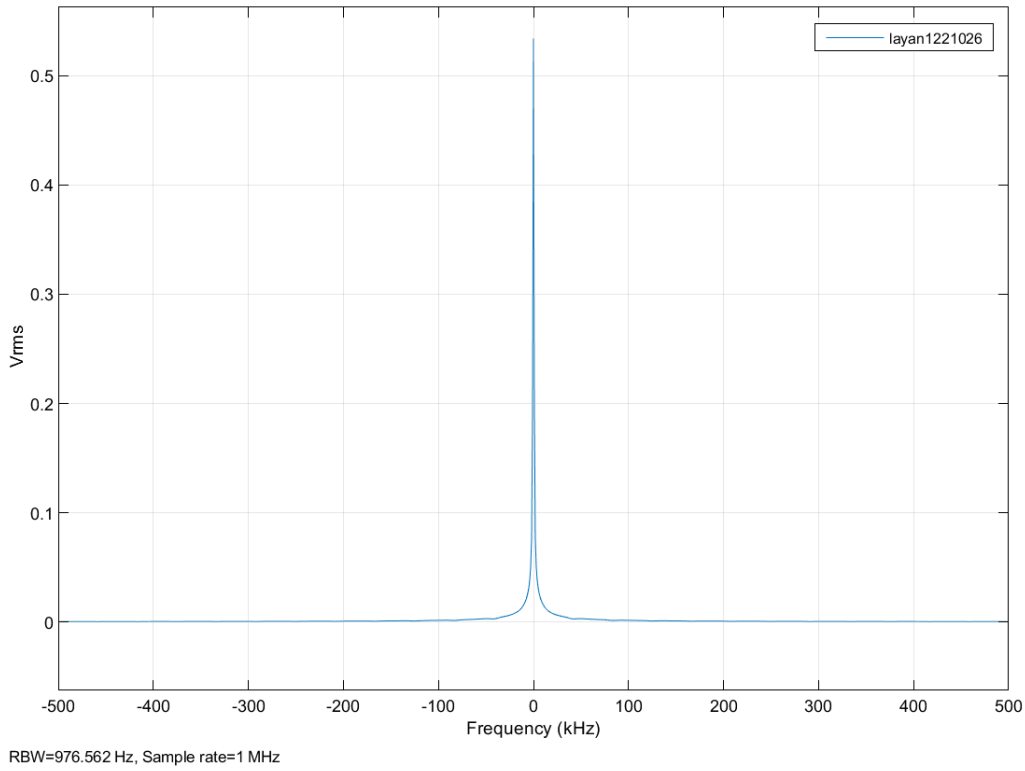
❖ PSK De-Modulated signal (2) @ Am=5, D=50% & f=0.5KHz





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❖ PSK De-Modulated signal (2) @ Am=5, D=10% & f=1KHz