

Digital Communications Lab

Laboratory report submitted for the partial fulfillment
of the requirements for the degree of

Bachelor of Technology
in
Electronics and Communication Engineering

by

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Chapter 1

Experiment - 05

1 Aim

1. Implementation of FSK Modulation.
2. Non-Coherent Demodulation of modulated FSK.

2 Apparatus Used

ICs: XR-2206 (Monolithic Function Generator)	LM741 (Op - Amp)	LM393 (Voltage Comparator)
1N4007 (Diode)	Capacitor	Connecting wires
DSO Probe	Breadboard	DC power supply
Digital Storage Oscilloscope	Function Generator	

3 Theory

3.1 FSK Modulator circuit and Block diagram of FSK Demodulation

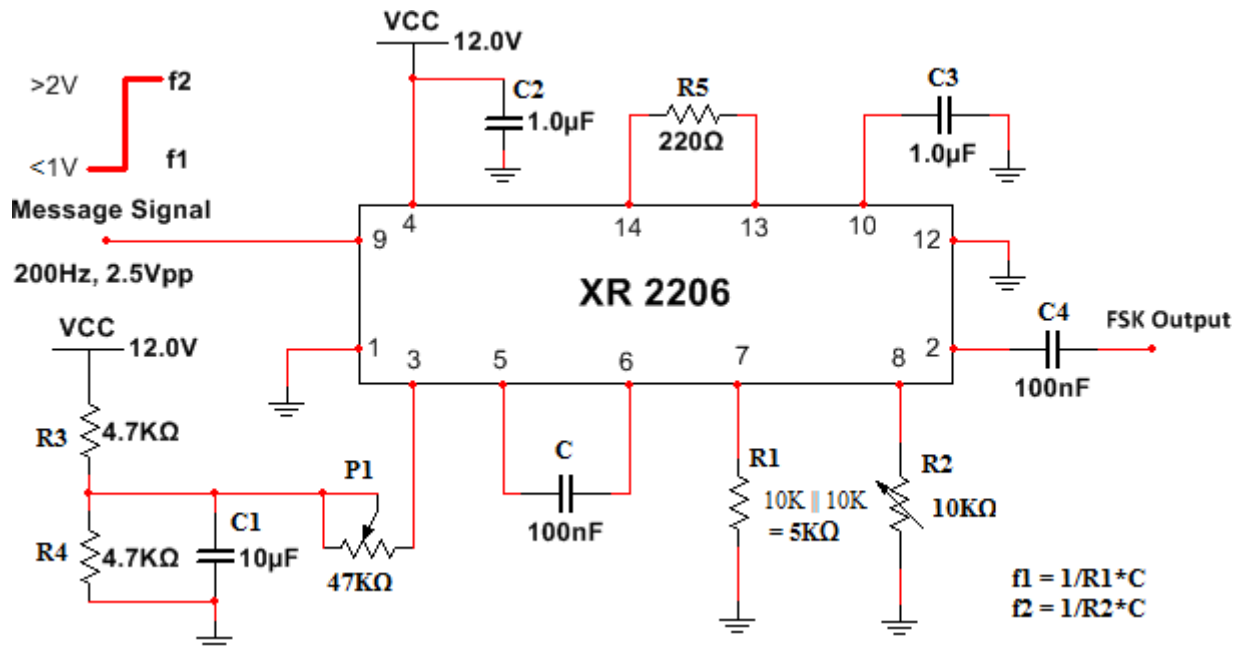


Figure 1: FSK Modulator circuit

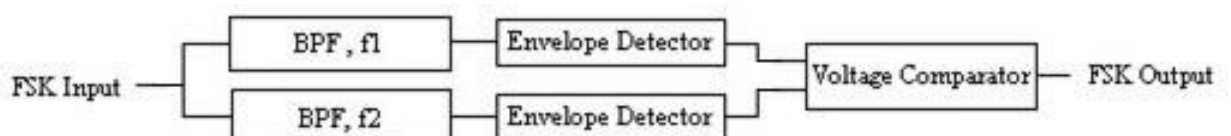


Figure 2: Block Diagram of FSK Demodulation

3.2 Band Pass Filter Circuit and Designing Equations

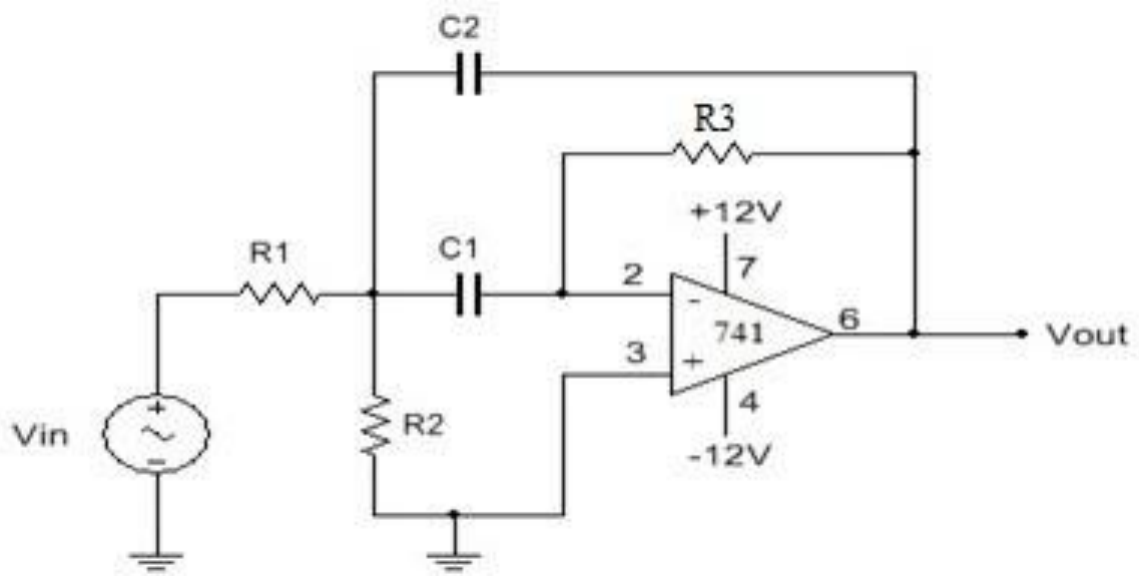


Figure 3: Band Pass Filter

$C_1 = C_2 = C = 0.01\mu F; BW = 500Hz$					
1.	$R_1 = \frac{Q}{2\pi f_c C A_f}$	3.	$R_3 = \frac{Q}{\pi f_c C}$	5.	$A_f < 2Q^2$
2.	$R_2 = \frac{Q}{2\pi f_c C (2Q^2 - A_f)}$	4.	$Q = \frac{f_c}{BW}$	6.	$A_f = \frac{R_3}{2R_1}$

Table 1: BPF Designing Equations

3.3 Envelope Detector Circuit

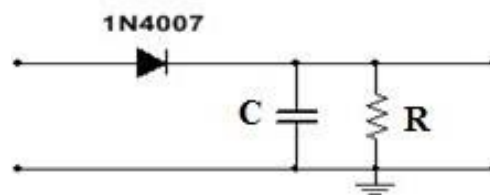


Figure 4: Envelope Detector Circuit

1.1 Observations

1.1.1 Calculation

210E071
210E072

DC- lab 5

$10 \times 10^3 \text{ p}$

$f_1 = 2 \text{ kHz}$
 $f_2 = 5.2 \text{ kHz}$

$Q = \frac{f_c}{\text{BW}}$

$\text{BW} = 400 \text{ Hz}$

$A_f \approx 2Q^2$

$Q = \frac{2 \text{ kHz}}{500}$
 $= 4$

$A_f < 32$

Envelope Detector

$\frac{1}{2000} < RC < \frac{1}{200}$

$1 < 2000 \times 10^3 \times C < 10$

$\frac{1}{2 \times 10^7} < C < \frac{1}{2 \times 10^6}$

$0.05 \mu\text{F} < C < 0.5 \mu\text{F}$
 $50 \text{ nF} < C < 500 \text{ nF}$

$R_1 = \frac{Q}{2\pi f_c C A_f}$

$= \frac{f_c}{2\pi (\text{BW}) f_c C A_f}$

$= \frac{1}{2\pi (\text{BW}) C A_f}$

$= \frac{1}{2\pi \times 500 \times 0.01 \times 10^{-6} \times 32}$

$= 0.001 \times 10^6$

$R_1 = \frac{10^3}{1 \text{ k}\Omega}$

$R_2 = \frac{f_c}{2\pi (\text{BW}) f_c C (2Q^2 - A_f)}$

$= \frac{1}{2 \times 3.14 \times 500 \times 0.01 \times 10^{-6} \times 2}$

$= 0.015 \times 10^6$

$= 15.9 \text{ k}\Omega$

$R_3 = \frac{Q}{\pi f_c C}$

$= \frac{4}{3.14 \times 2 \times 10^3 \times 0.01 \times 10^{-6}}$

$= 63 \text{ k}\Omega$

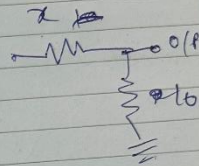
Voltage Divides

$$\frac{10}{10+210} \times 21.0 = 2.5$$

$$210 = 25 + 185$$

$$74 \text{ k}\Omega = x$$

~~for~~



1.1.2 Result Screenshots

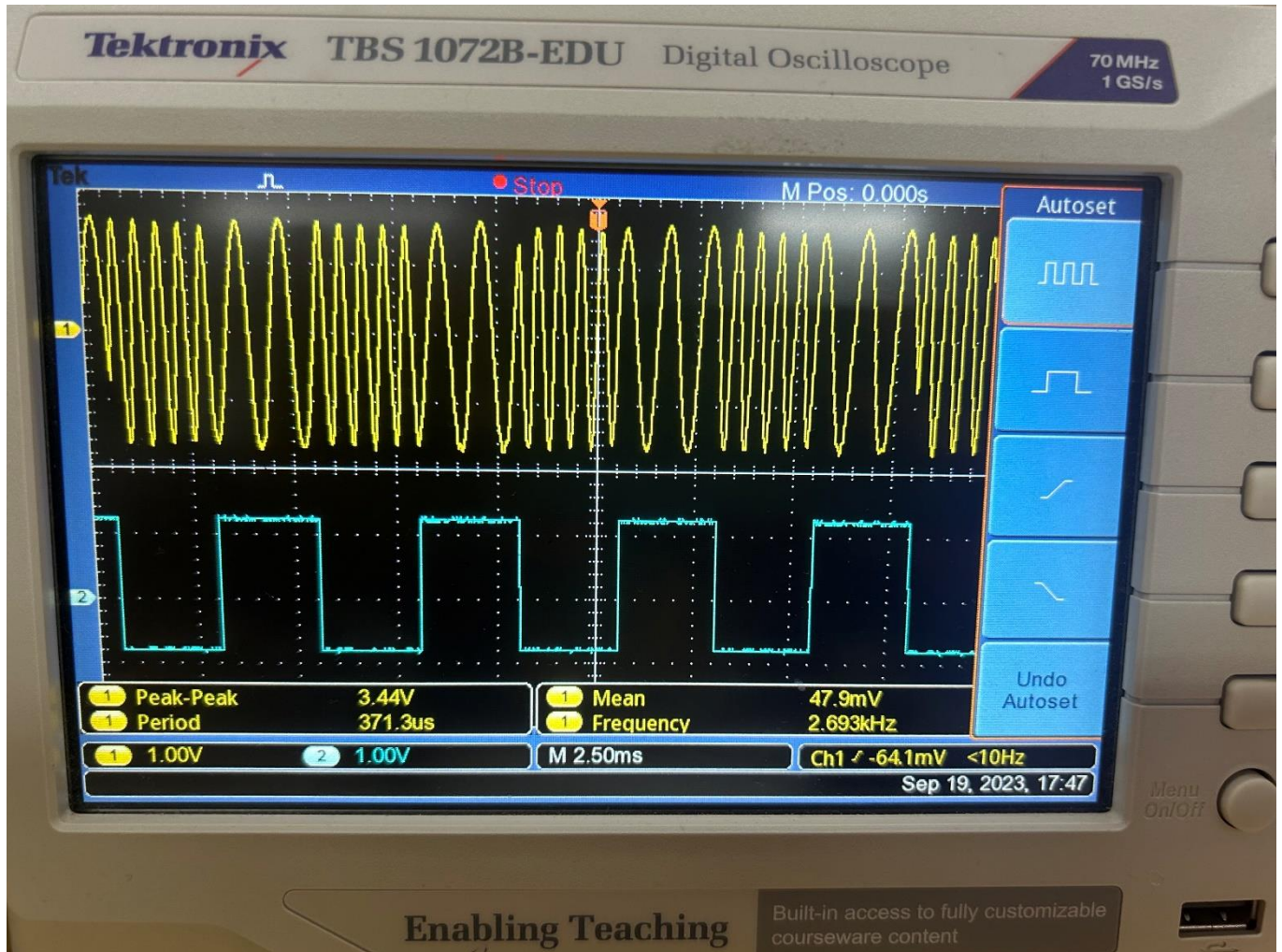


Figure 1.1: BFSK signal with Message signal

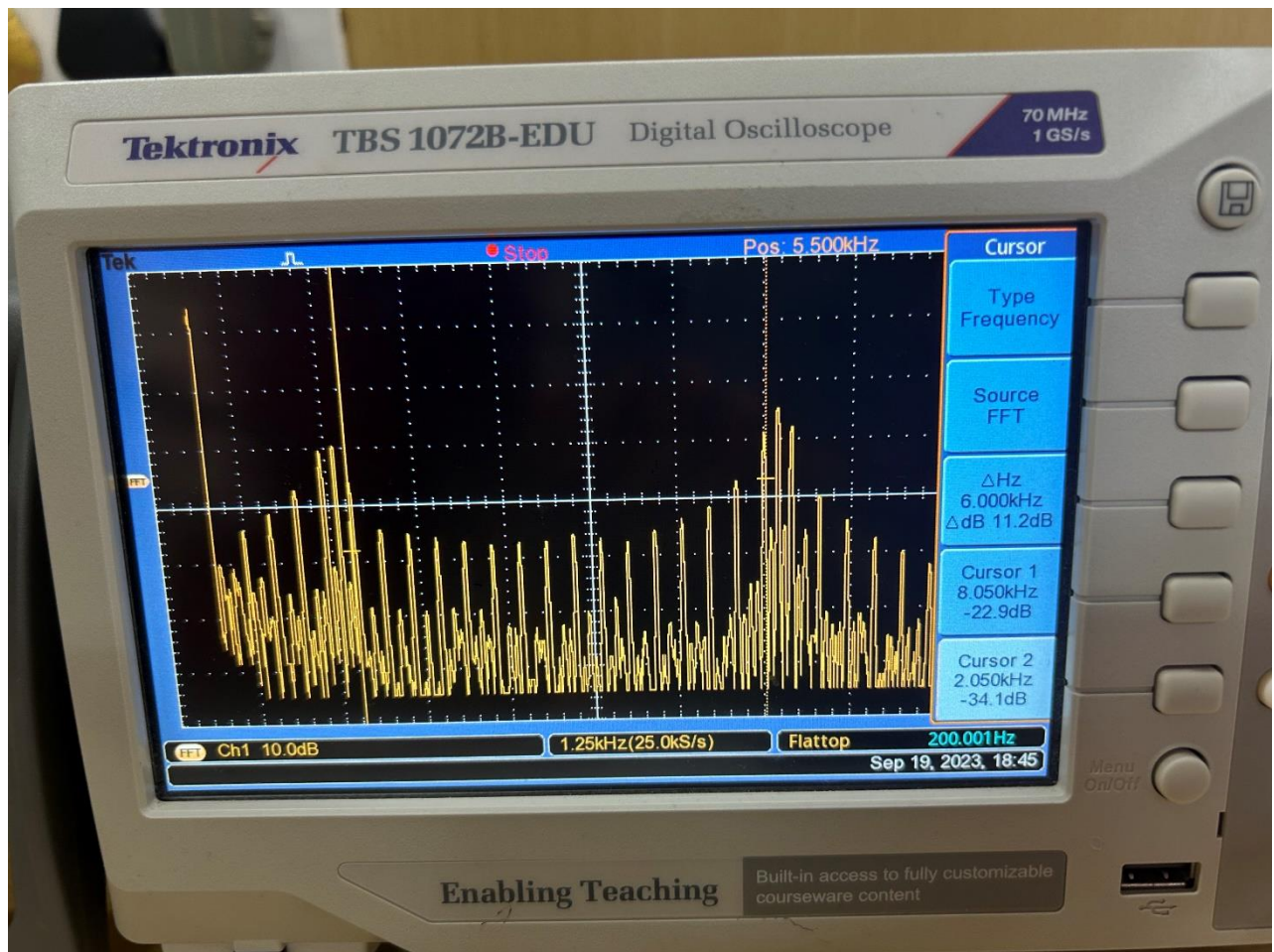


Figure 1.2: FFT with Carrier and Sideband Power at 2kHz. and 5.2kHz.

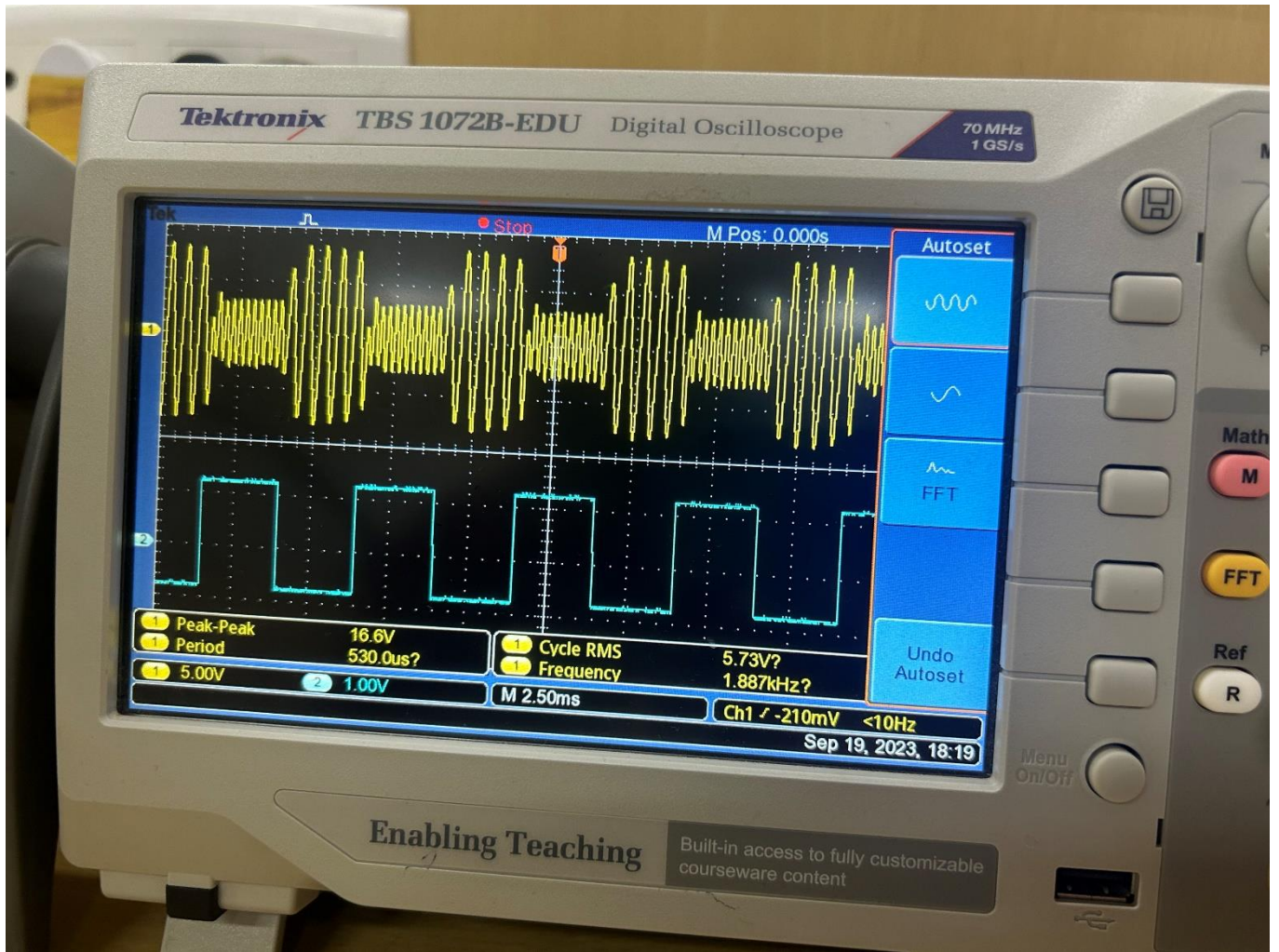


Figure 1.3: BPF Output

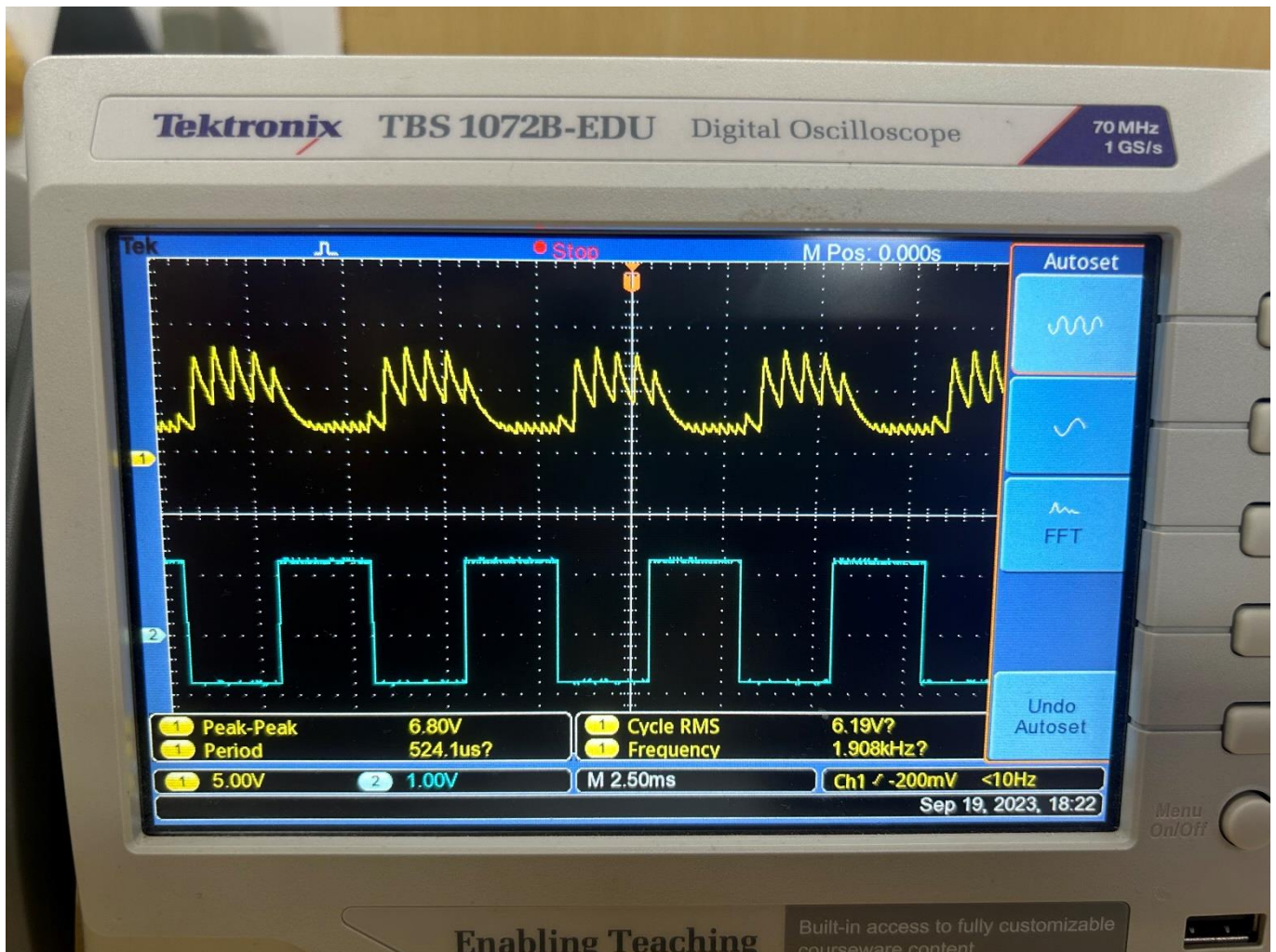


Figure 1.4: BFSK with Envelope Detector Output

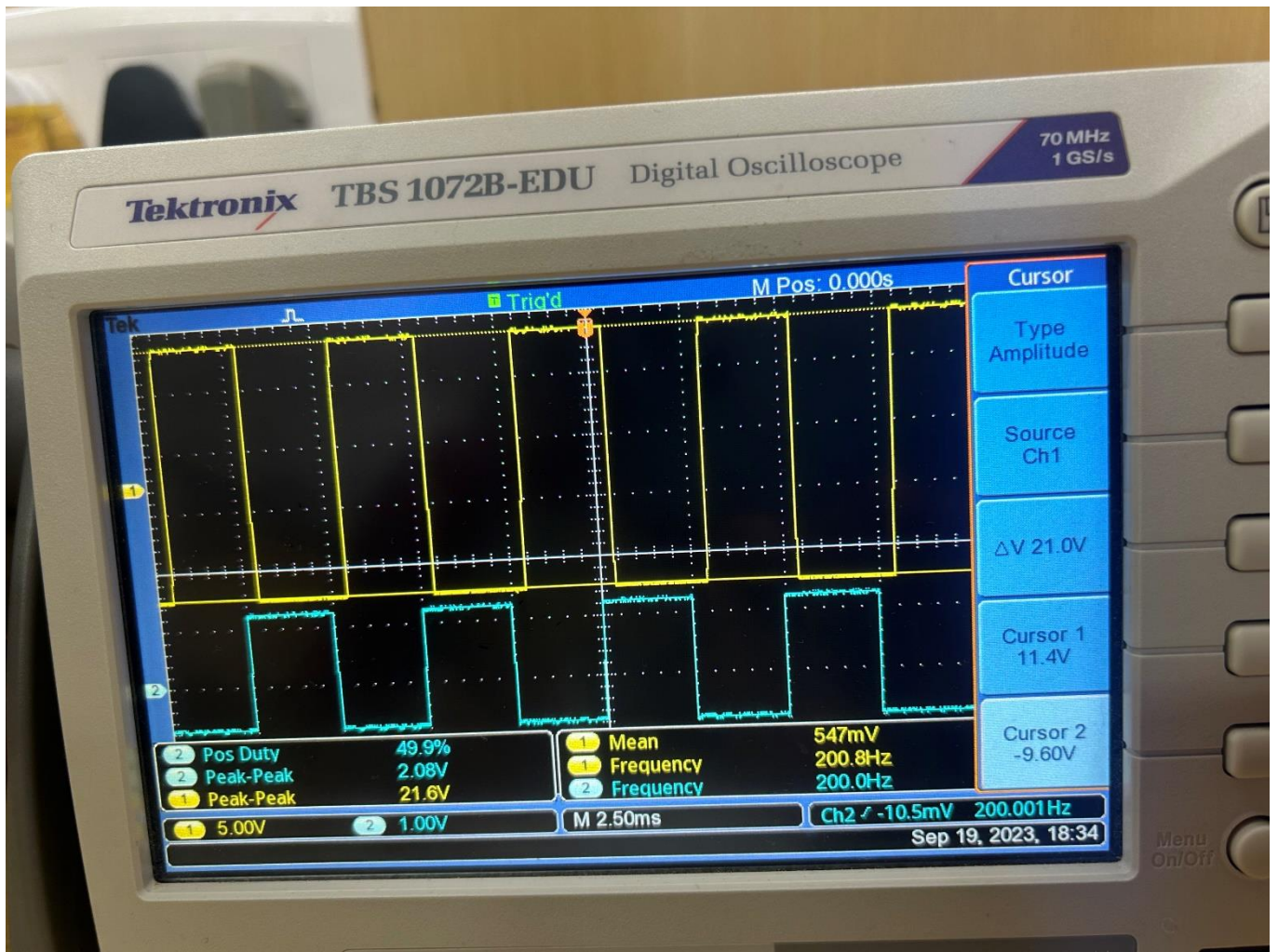


Figure 1.5: Reconstructed Signal with Message Signal

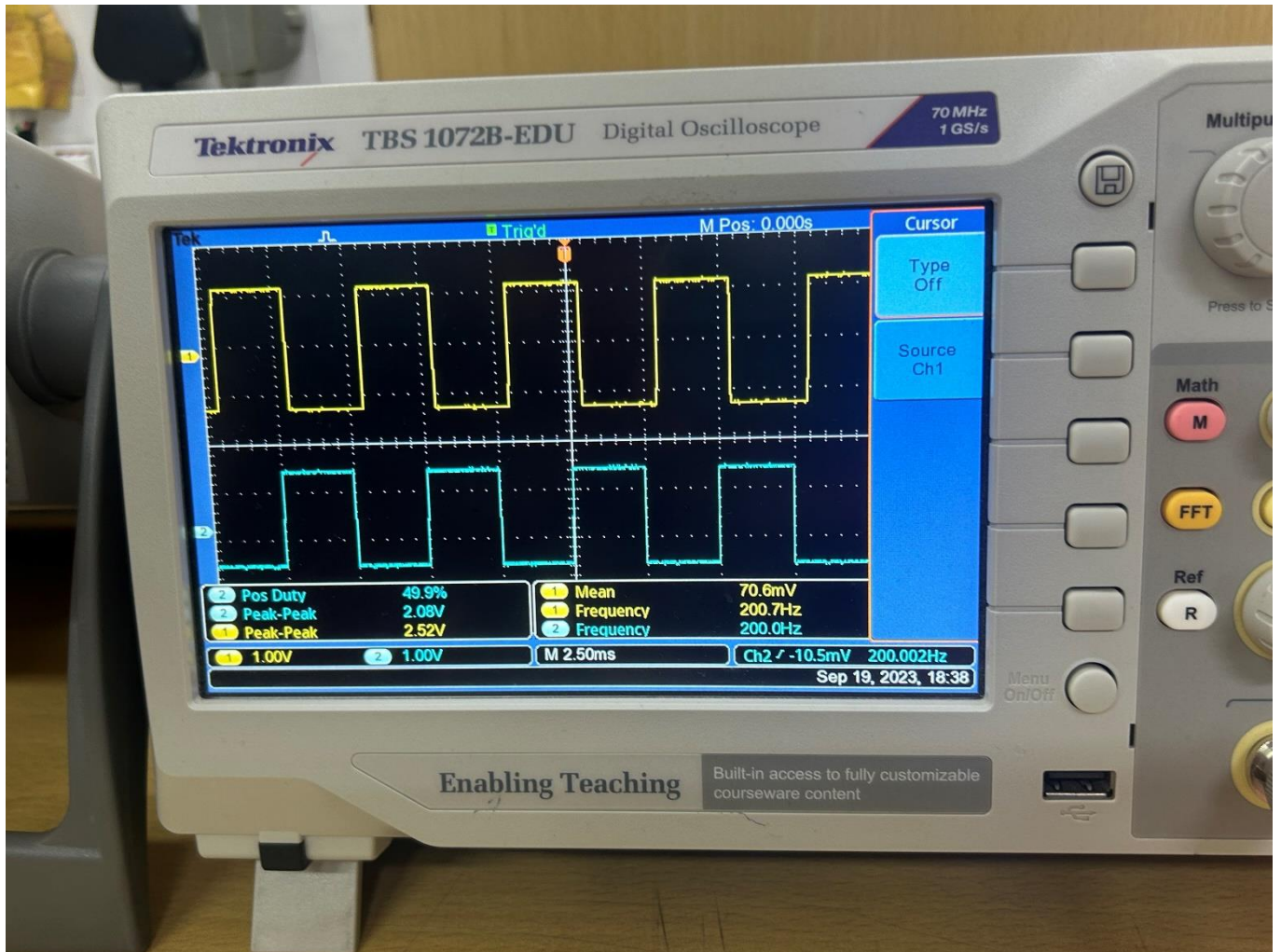


Figure 1.6: Reconstructed Signal with Message Signal after Voltage Divider

1.2 Precautions

1. Check the connections before switching on the kit.
2. Connections should be done properly.
3. Observation should be taken properly.