

Transmitting, Receiving, and Interpreting ECG Waveforms

6.101 Final Project

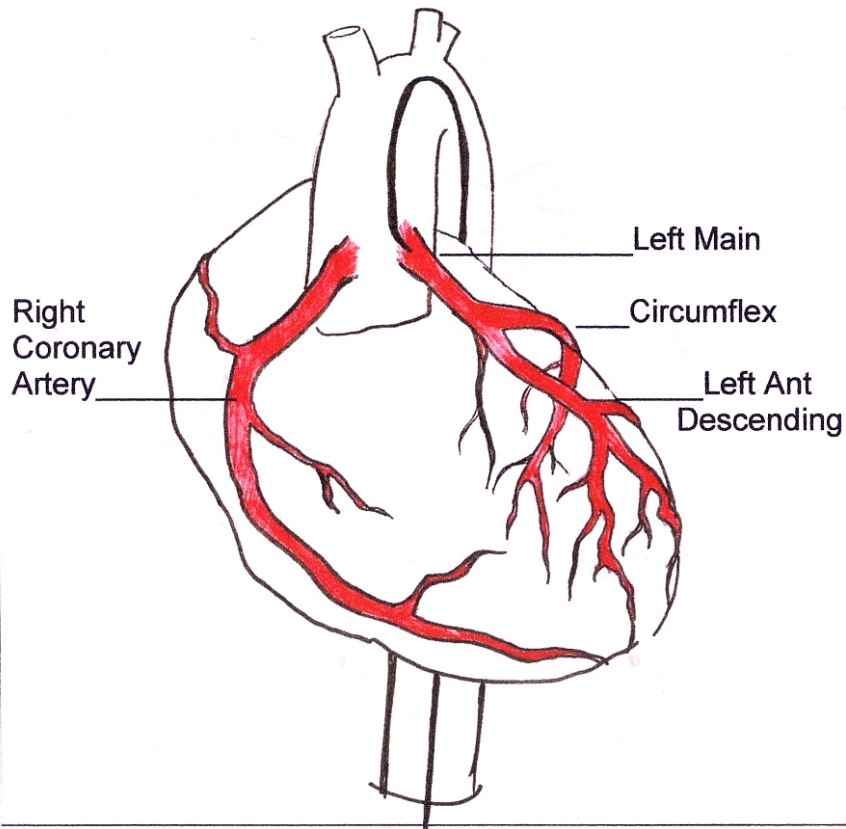
April 16, 2015

Daniel H. Moon

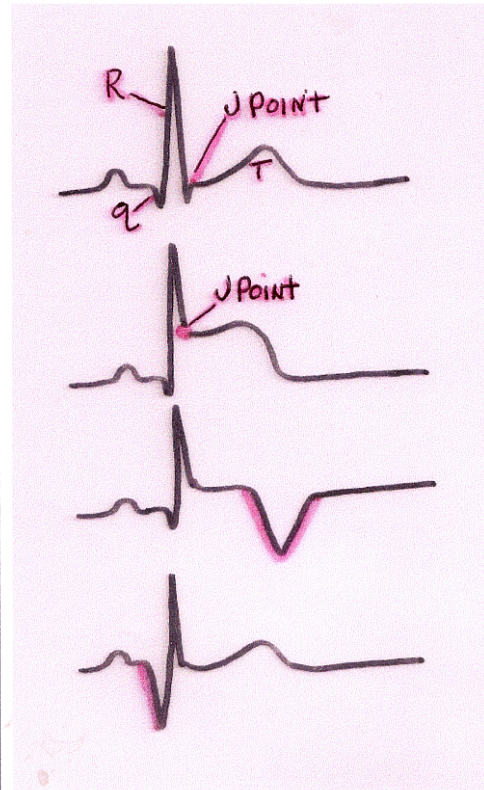
Thipok (Ben) Rak-amnouykit

Electrocardiogram (ECG)

Coronary Arteries



ECG Signs of M.I.



Normal

ST Segment Elevation
Acute Injury

T Wave Inversion
Ischemia

Pathological Q Wave
Necrosis

Wireless ECG

- Frequency Modulation
- Signals transmitted digitally



LifeSync



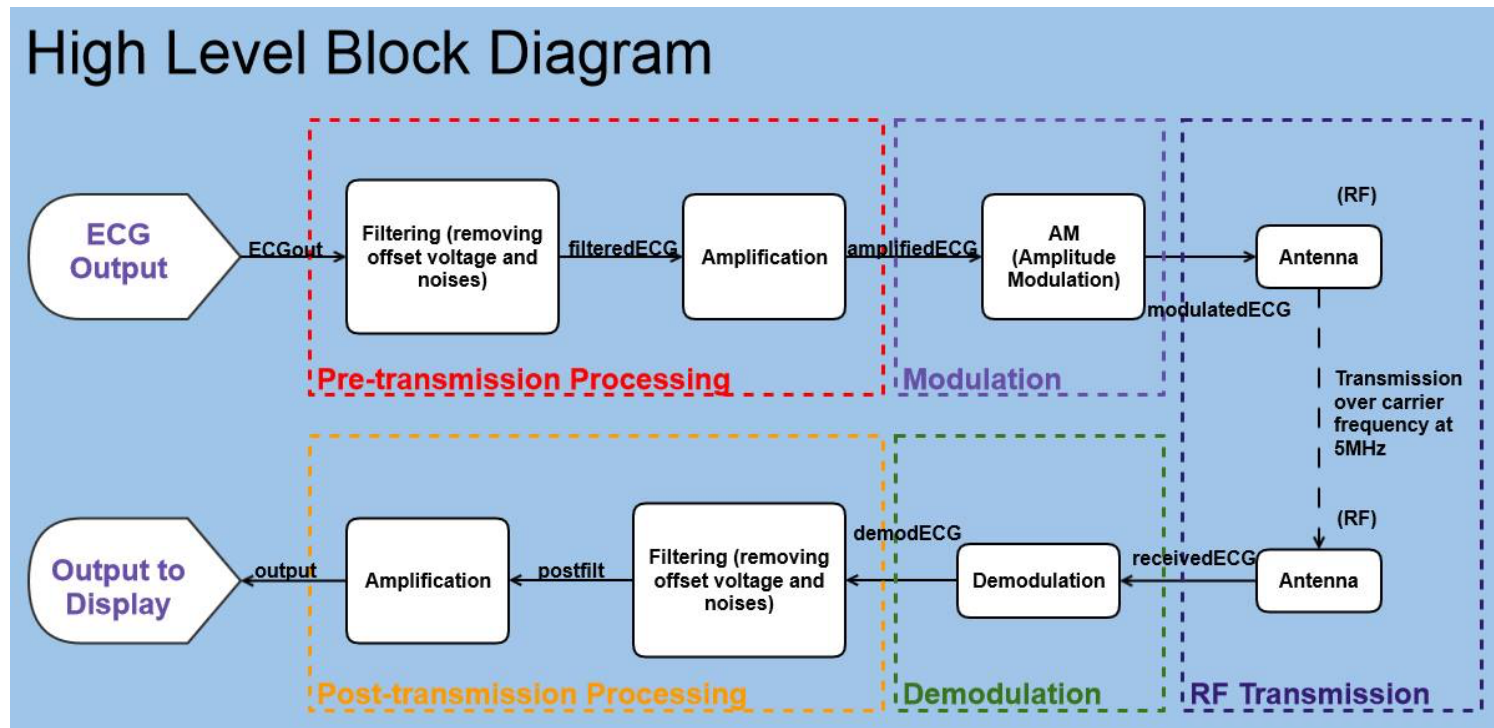
BioRadio

Our Goals

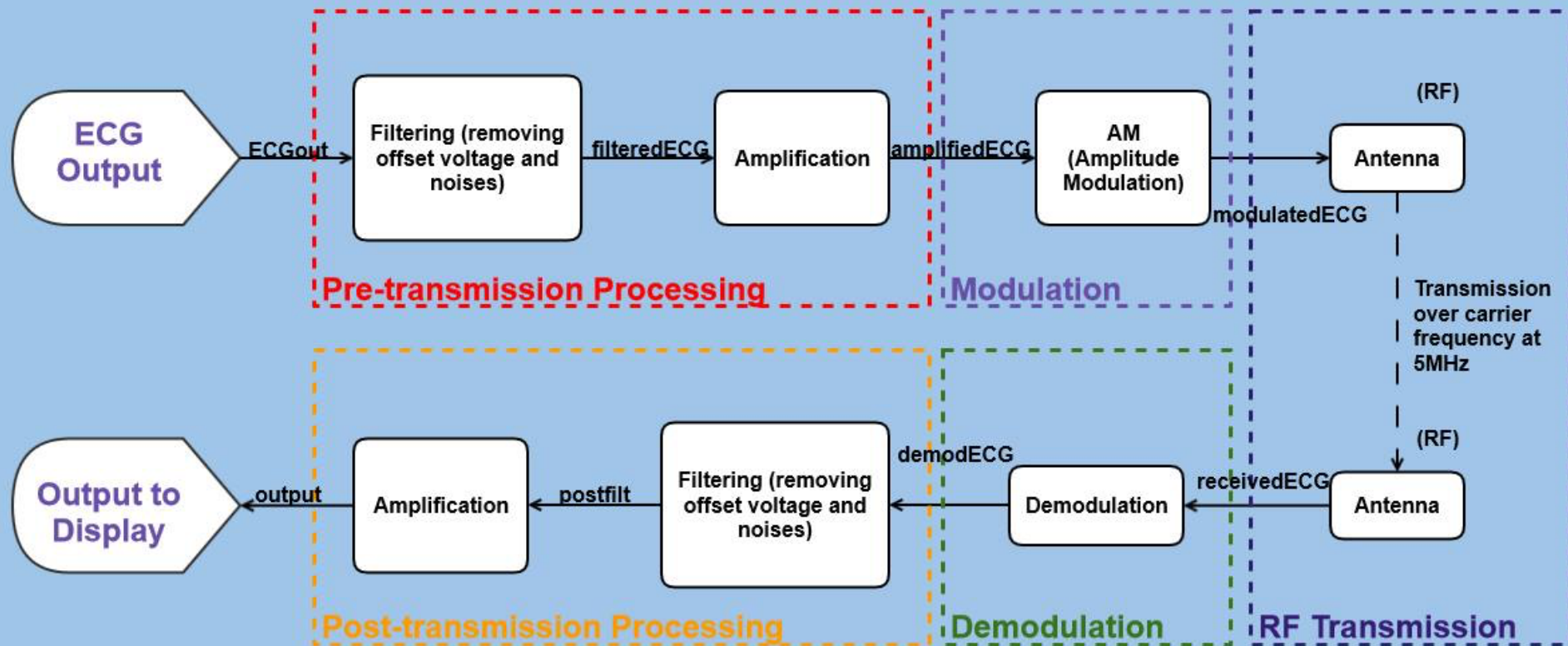
- Wireless Signal
- Good retention of original waveform
- Using basic components
- Homemade antennas

Overview

- AM modulation of ECG signal
- Radio frequency transmission
- Mobile transmitter + Stationary receivers

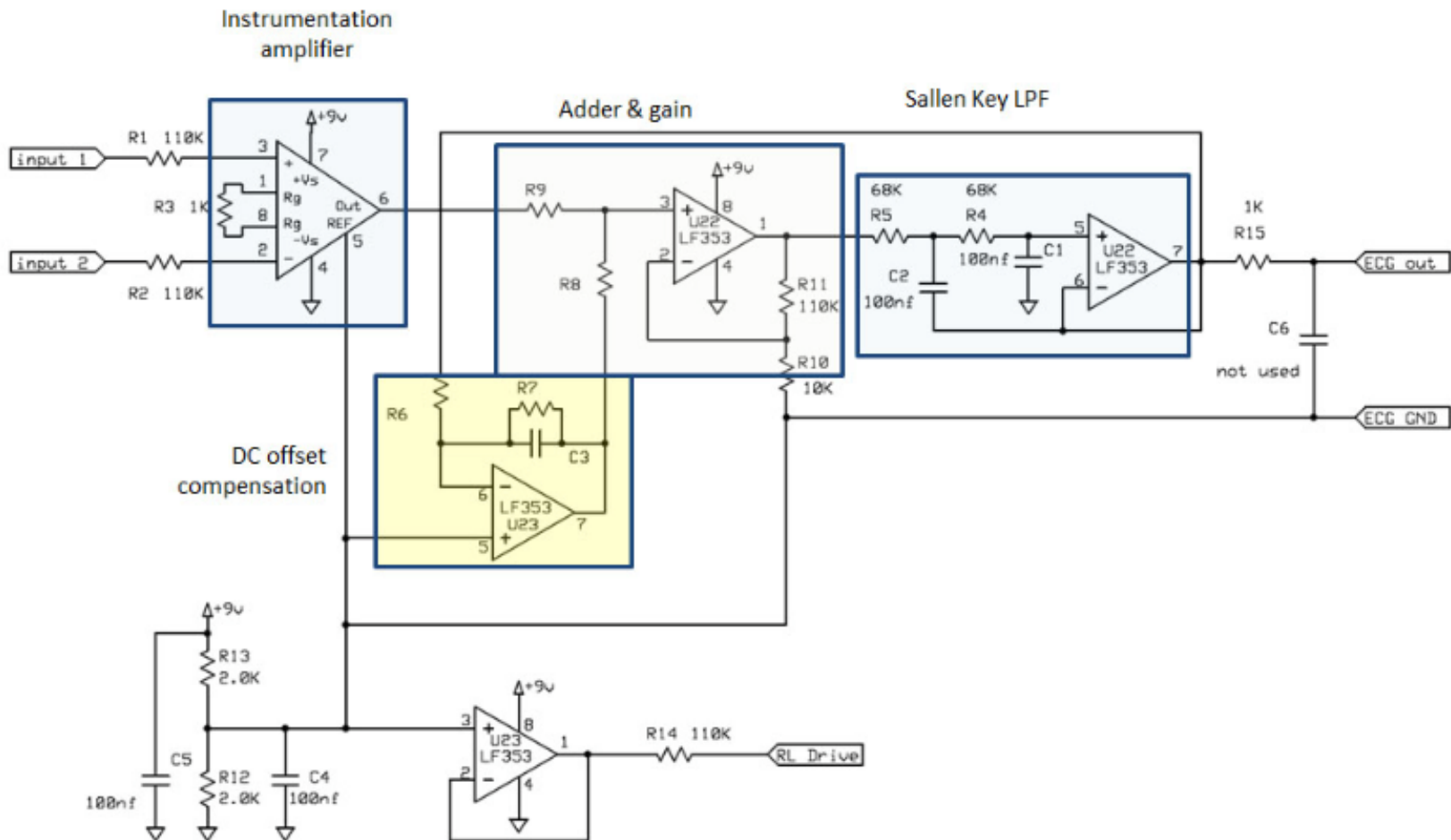


High Level Block Diagram



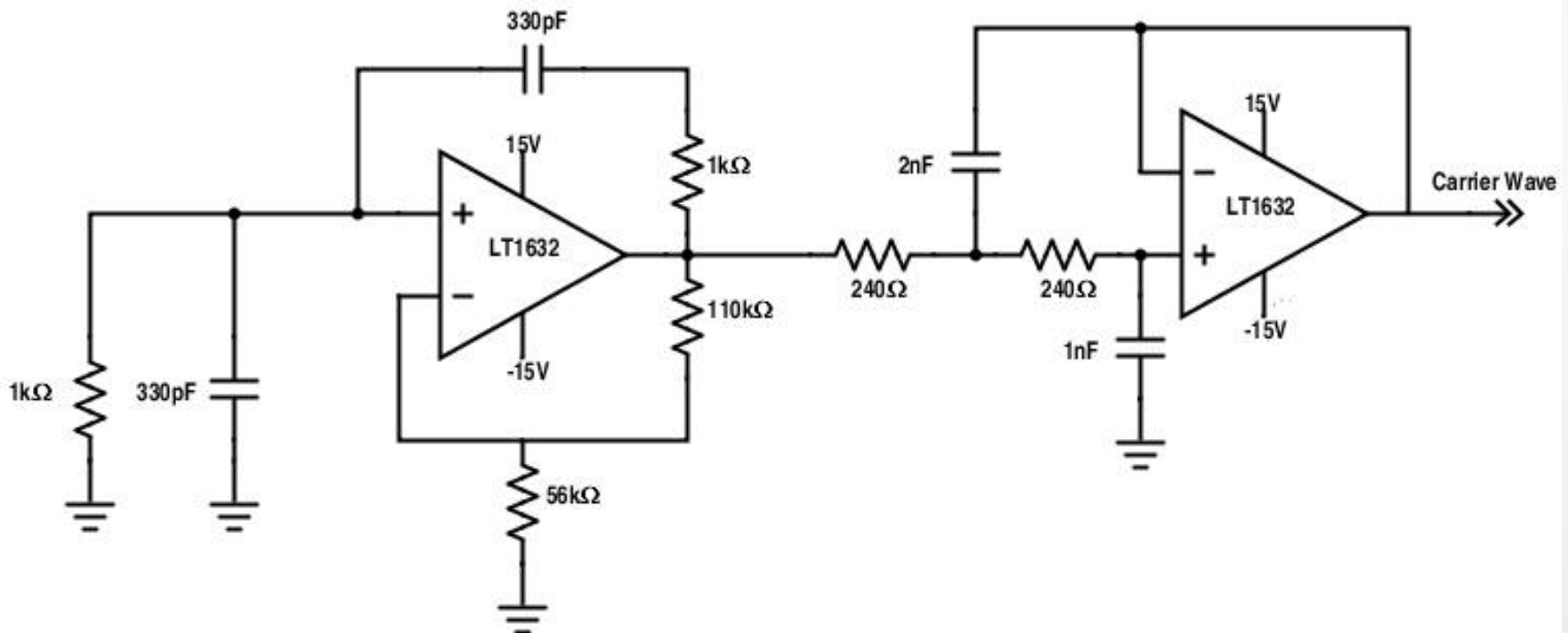
I – ECG Input

- Similar to Lab 5's schematic.



II – AM Modulation

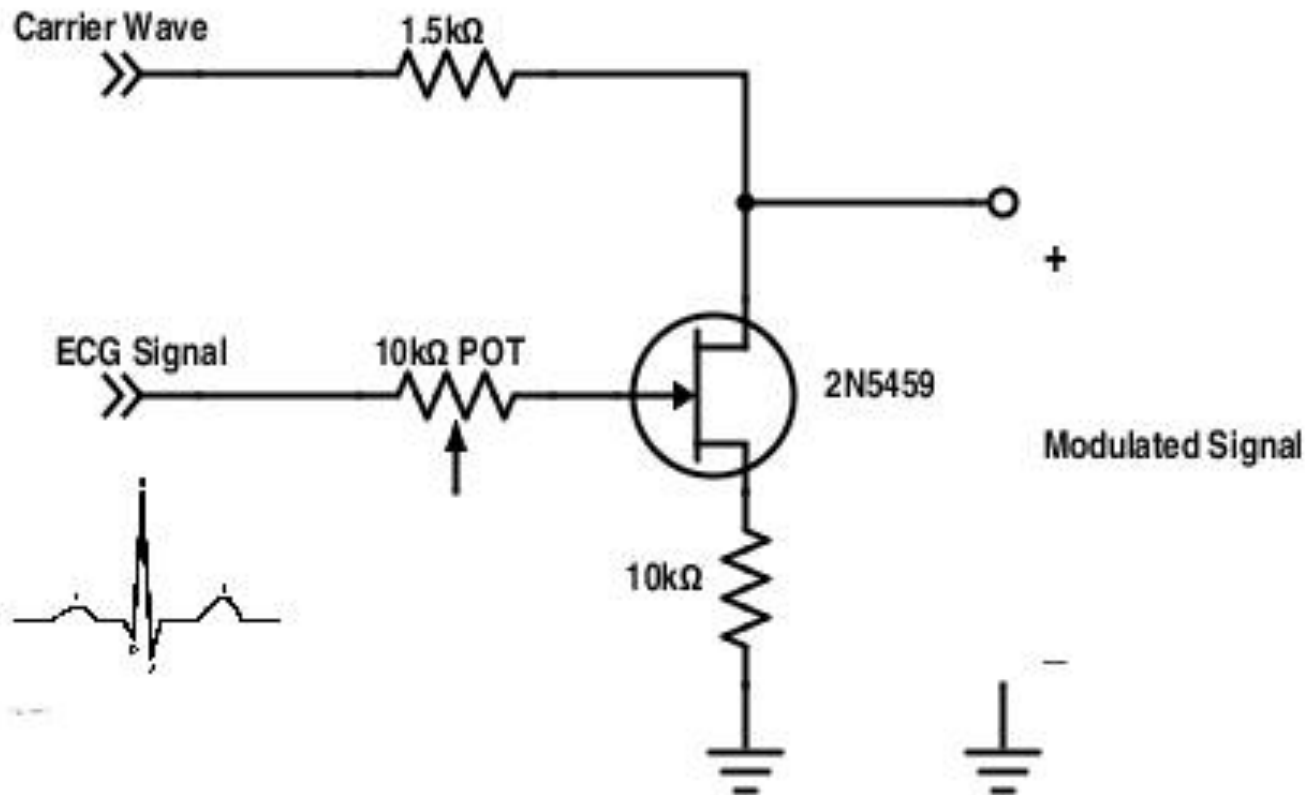
- Carrier frequency:
Wien bridge oscillator
Sallen-Key filter



II – AM Modulation

- Modulation

Using JFET to a variable resistor

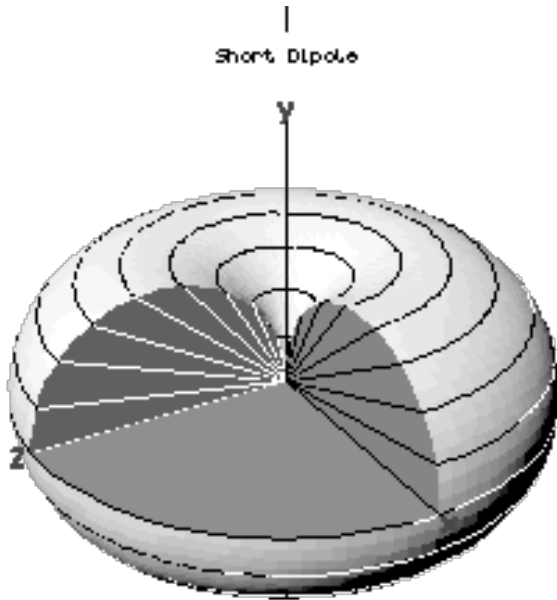


III – Antenna

- Carrier Frequency = 455 kHz
- Transmitting Antenna

A: Solenoid antenna in an RLC resonator

B: Resonant antenna at higher freq



$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$Q = \frac{\omega_0 L}{R}$$

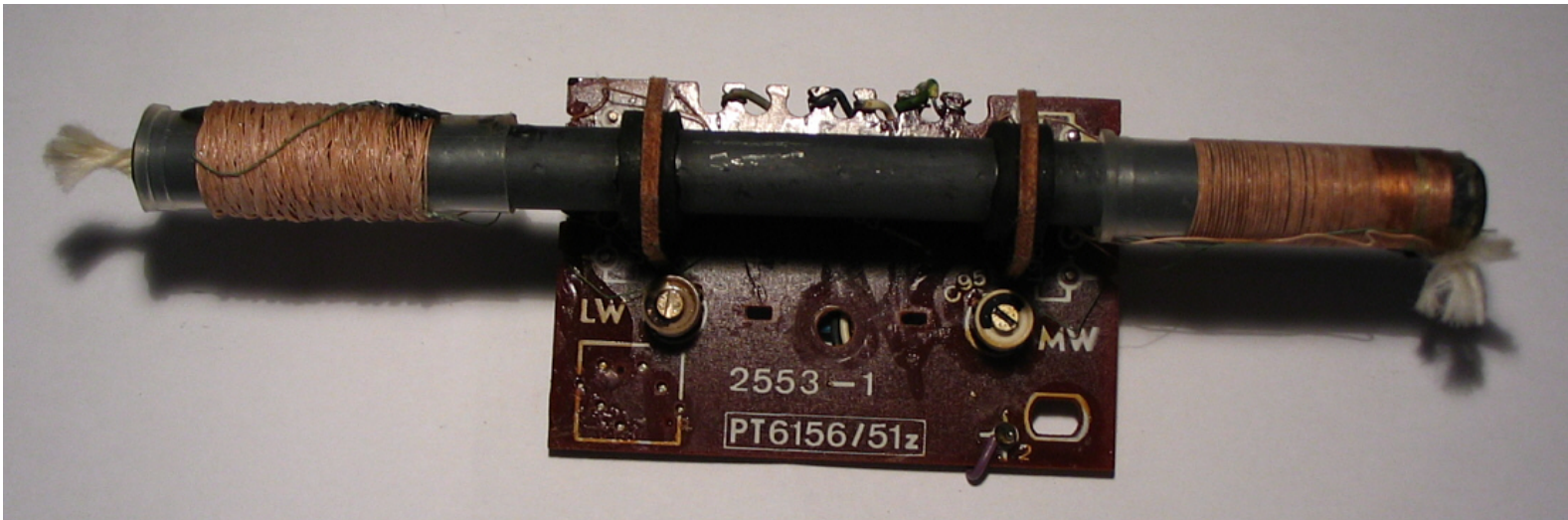
III - Antenna

- Receiving Antenna: “Loopstick”

Solenoid wound around a ferrite rod

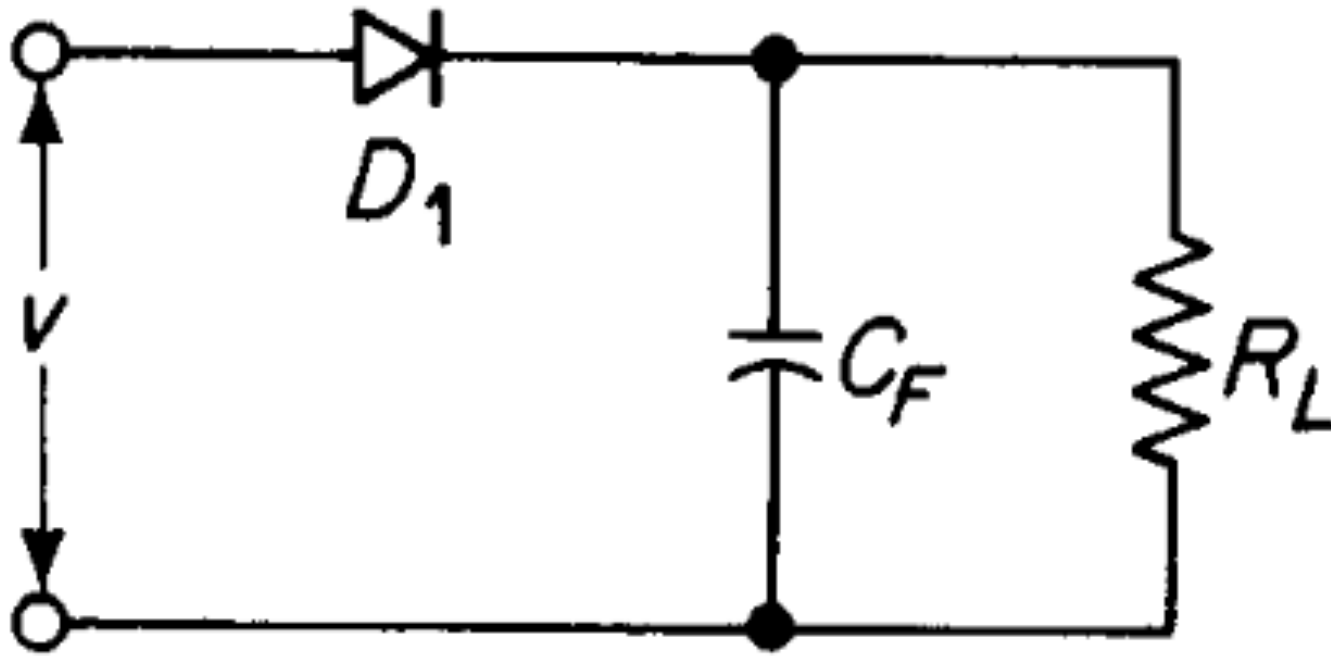
Detect magnetic field

Not suitable from transmission



IV – AM Demodulation

- Amplitude detection: Diode rectifier

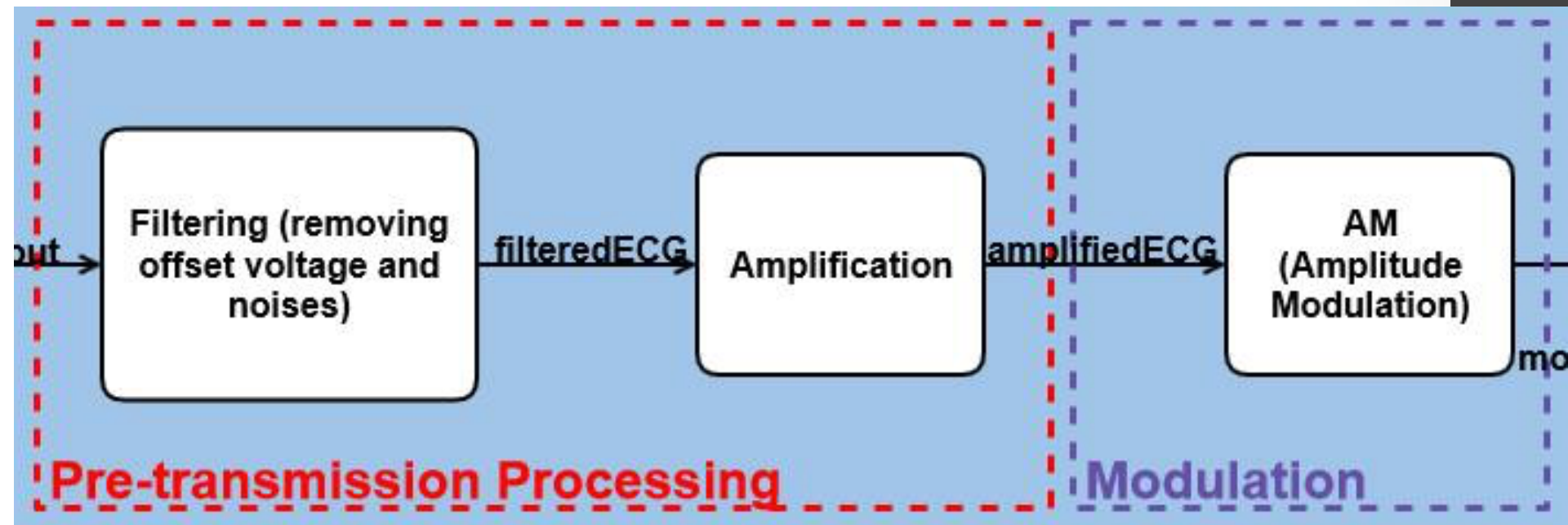


V – Post-transmission Processing

- Removing Noise
- Removing DC Offset
- Variable-Gain Amplifier, based on DC Offset

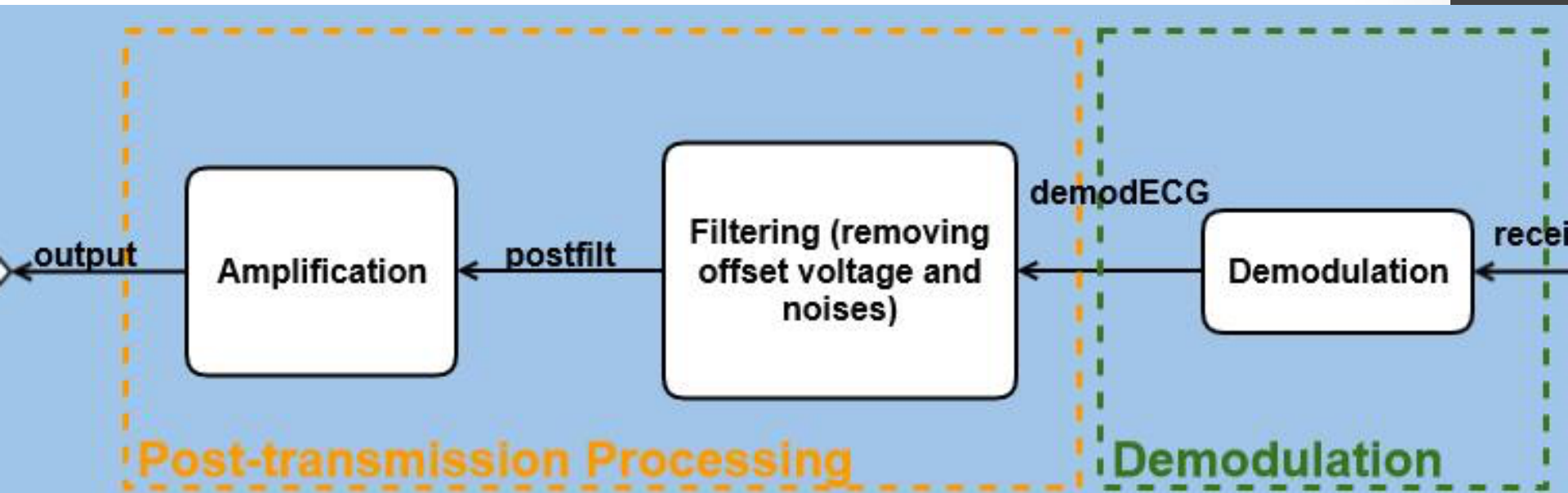
System Testing

- 1. Pre-transmission systems



System Testing

- 2. Post-transmission systems



System Testing

- 3. Overall system testing
 - Transmission at 5 feet
 - Transmission at 10 feet
 - Transmission from moving subject

Timeline

	APR																MAY				
ACTIVITY	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5
LTSpipe																					
Individual Module Design																					
Individual Module Testing																					
System Integration																					
Implementation Status																					
System testing and Bug fixing																					
Check-off																					