Multilevel RF Power Detector

Dual-Band 433 MHz / 915 MHz RF Presence Indicator

General Description

The **Multilevel RF Power Detector** is a compact dual-band RF sensing device designed to detect and visually indicate the relative power of radio-frequency signals in the **433 MHz** and **915 MHz** ISM bands. The system employs band-pass filtering, low-noise amplification, and logarithmic detection to provide reliable RF presence indication using a multi-level LED display.

The device is intended for educational, laboratory, and experimental RF applications where quick visual feedback is required without the use of complex RF measurement equipment.

Key Features

- Dual-band RF detection: 433 MHz and 915 MHz
- Logarithmic RF power detection
- Multi-level LED signal strength indication
- RF-optimized PCB layout
- Operates from single DC supply
- Compact and portable design

Applications

- ISM band signal monitoring
- RF laboratory demonstrations
- Educational RF experiments
- RF activity detection
- Wireless system debugging

Functional Block Diagram

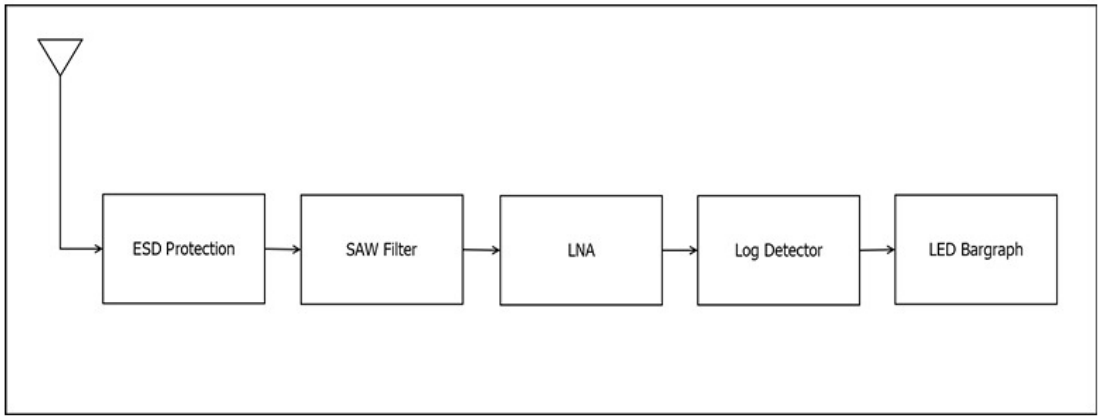

Figure 1: Block Diagram

Electrical Characteristics

Parameter	Typical Value
Supported Frequency Bands	433 MHz, 915 MHz
Input Impedance	50 Ω
LNA Gain	433 MHz : 20.25 dB, 915 MHz : 17.9 dB
Noise Figure	433 MHz : 2.3 dB, 915 MHz : 2.8 dB
Supply Voltage (Nominal)	9 V
Supply Current	200 mA

LED Signal Indication

LED Status	RF Power Level (Relative)
1 LED ON	Very Low
2–3 LEDs ON	Low to Medium
4–5 LEDs ON	Medium to High
All LEDs ON	High RF Power

Power Supply

- Single DC supply operation
- On-board voltage regulation

Mechanical Information

Parameter	Specification
PCB Dimensions	126.37 mm x 129 mm
Antenna Connector	SMA Edge-Mount
Enclosure	Custom Enclosure (See Figures Below)

Handling and Precautions

- Device contains ESD-sensitive RF components.
- Avoid hot-plugging the antenna.
- Do not exceed maximum supply voltage.
- Use only matched SMA antennas.

Disclaimer

This product is intended for educational and experimental use only. It is not a calibrated RF power measurement instrument. Specifications are subject to change without notice.

Department of Electronic
& Telecommunication Engineering
University of Moratuwa, Sri Lanka

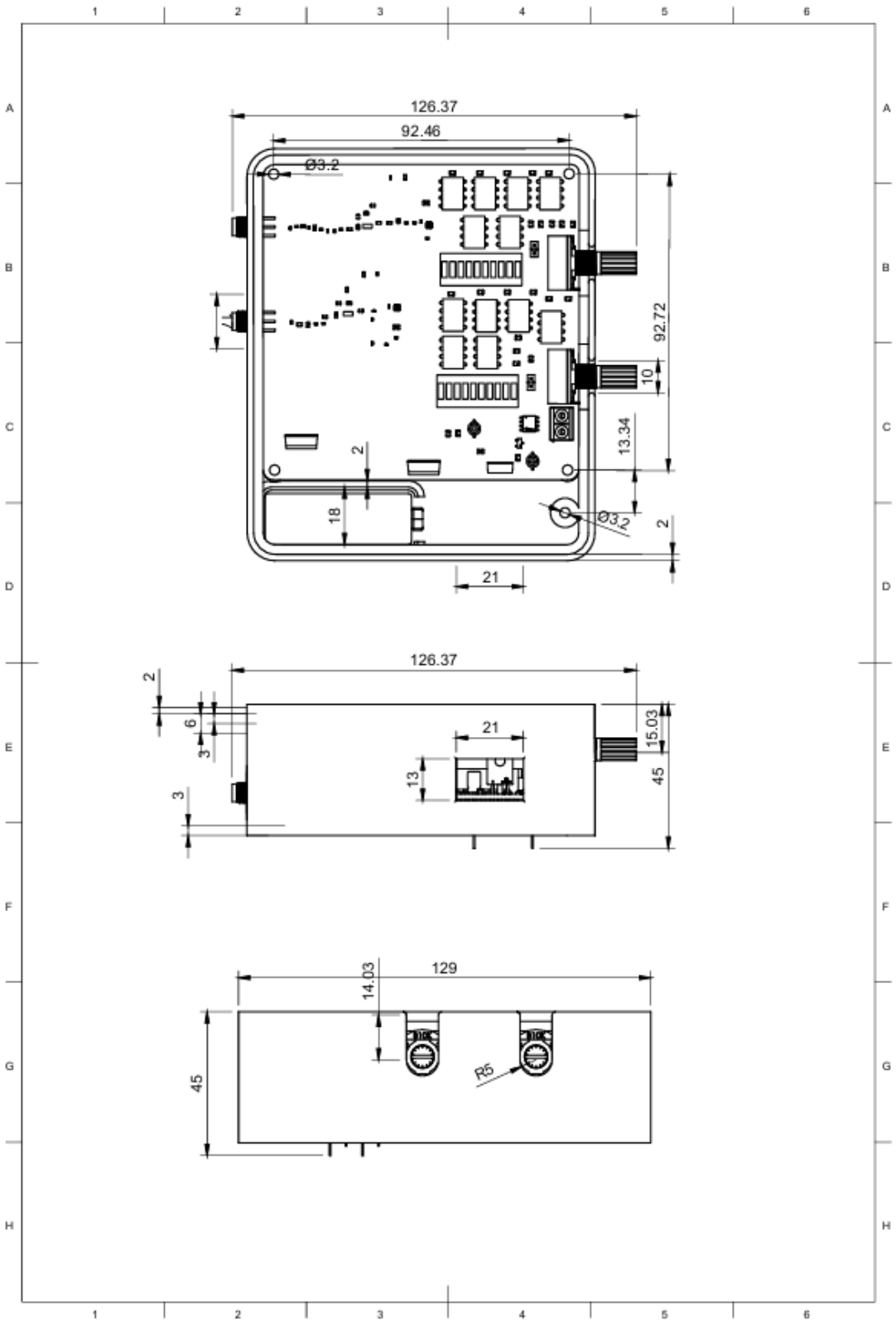

Figure 2: Mechanical Drawing – Page 1 from uploaded design.

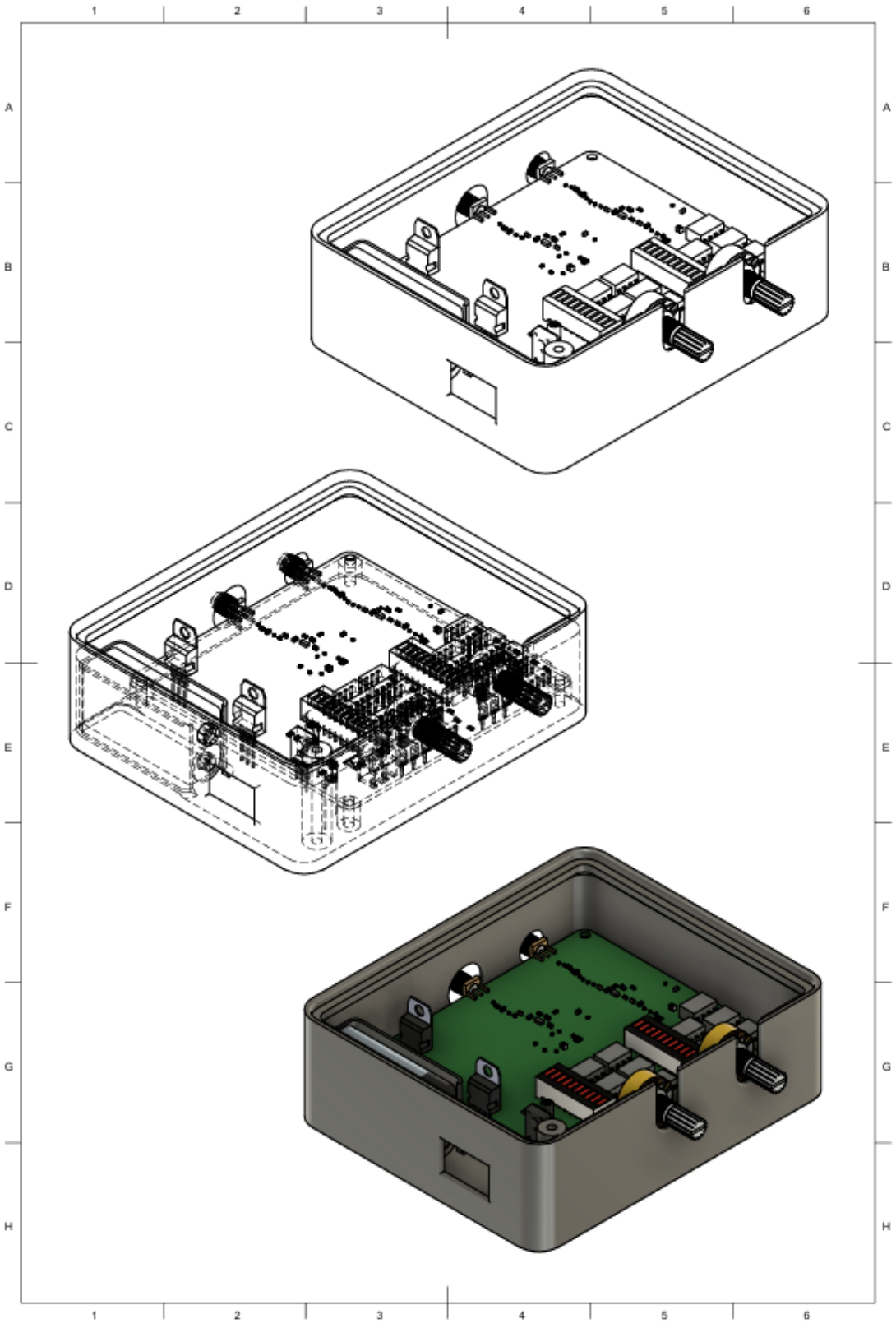

Figure 3: Mechanical Drawing – Page 2 showing assembly views.

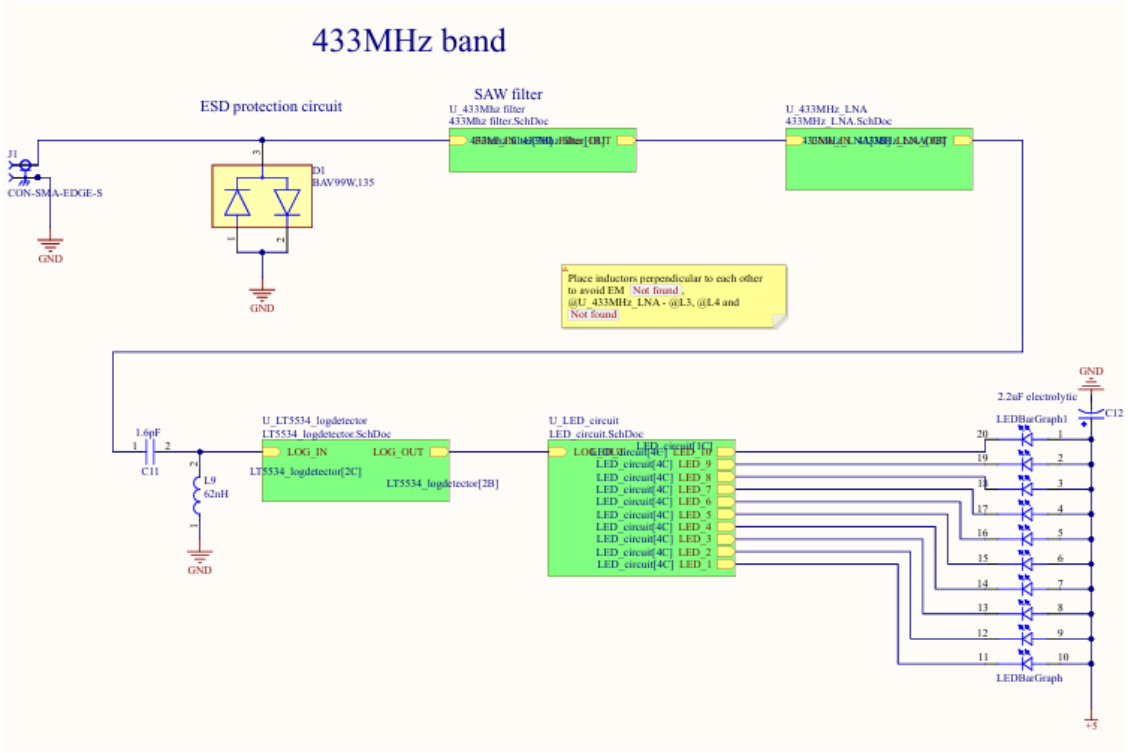

Figure 4: Schematic Drawing – 433 MHz

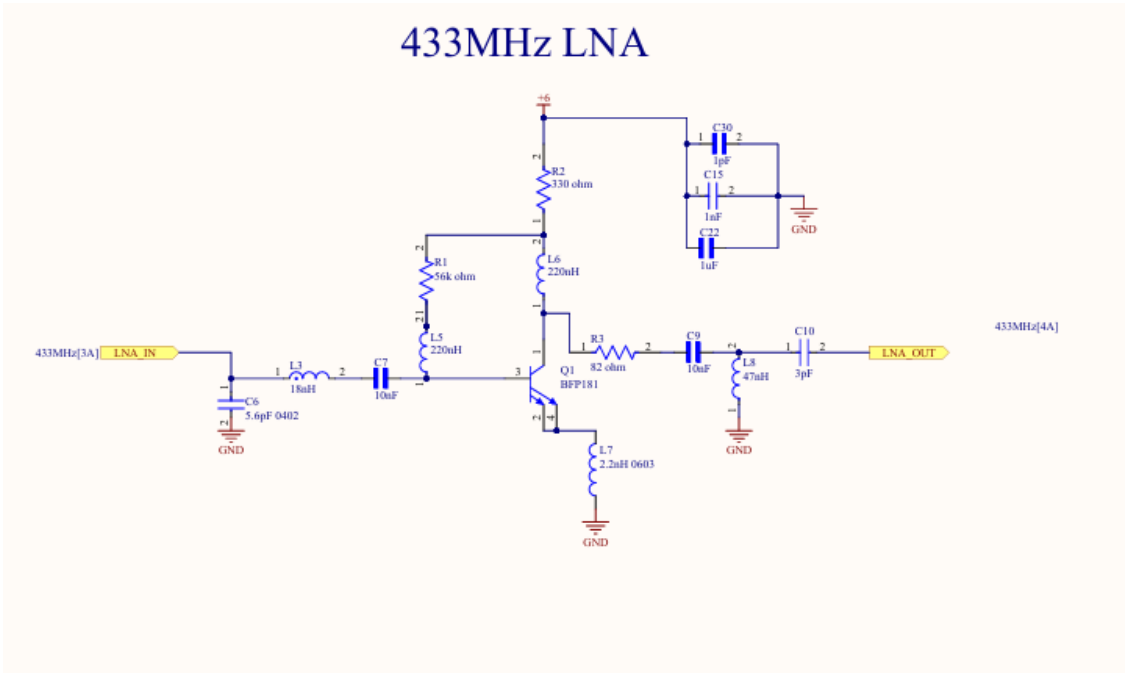

Figure 5: Schematic Drawing – 433 MHz LNA Design

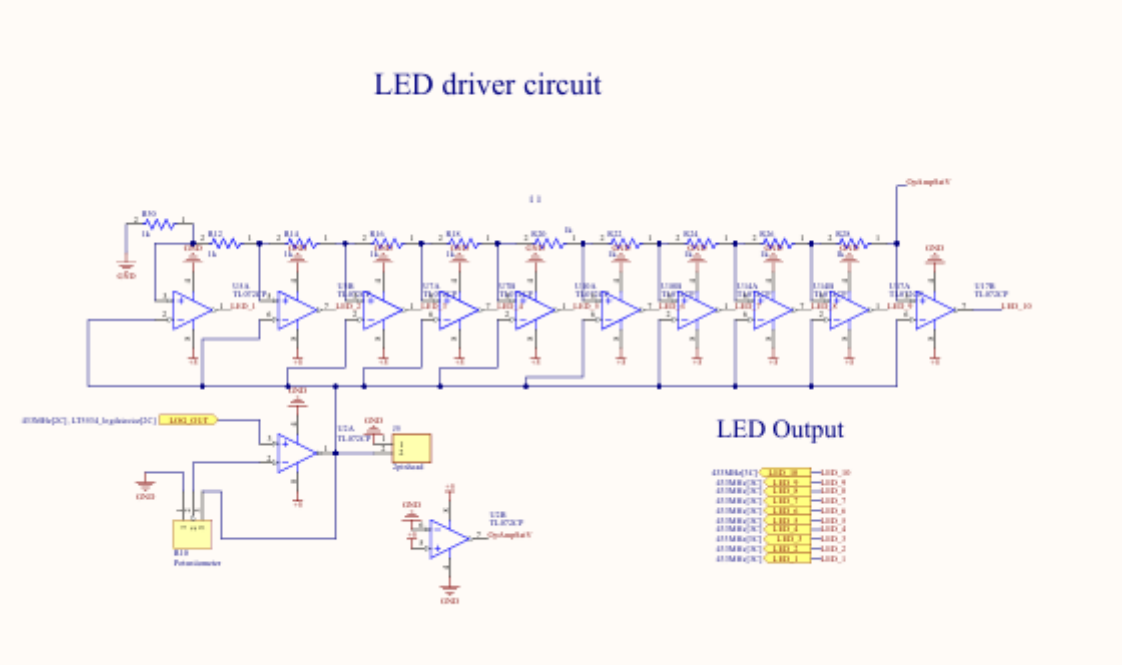

Figure 6: Schematic Drawing - LED Driver Circuit

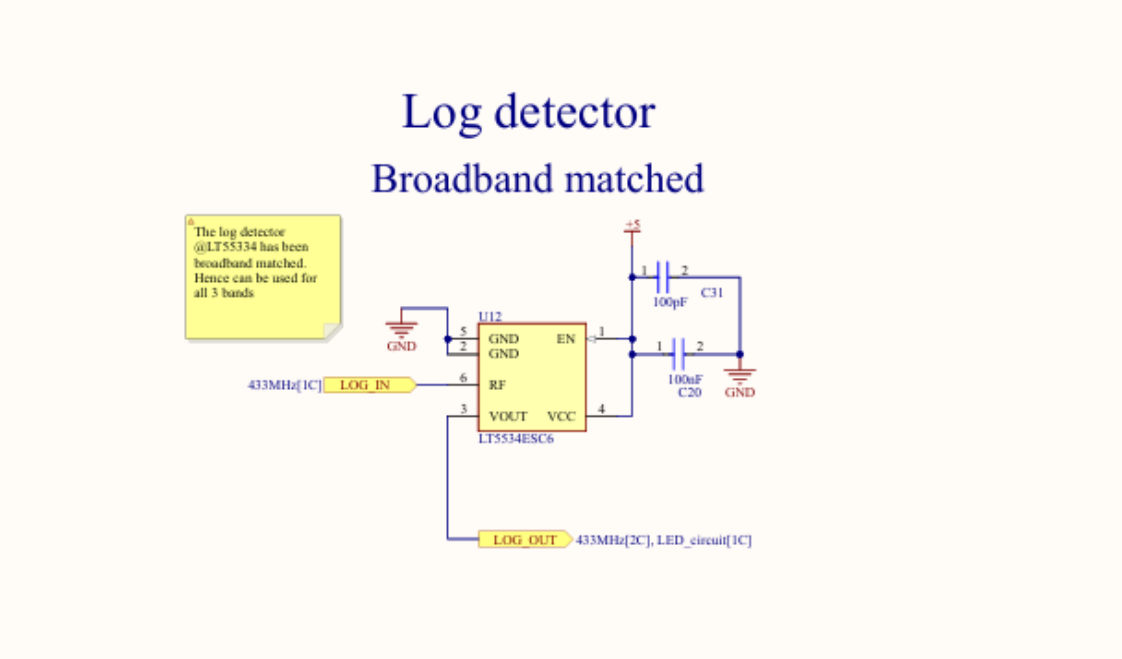

Figure 7: Schematic Drawing - Log Detector

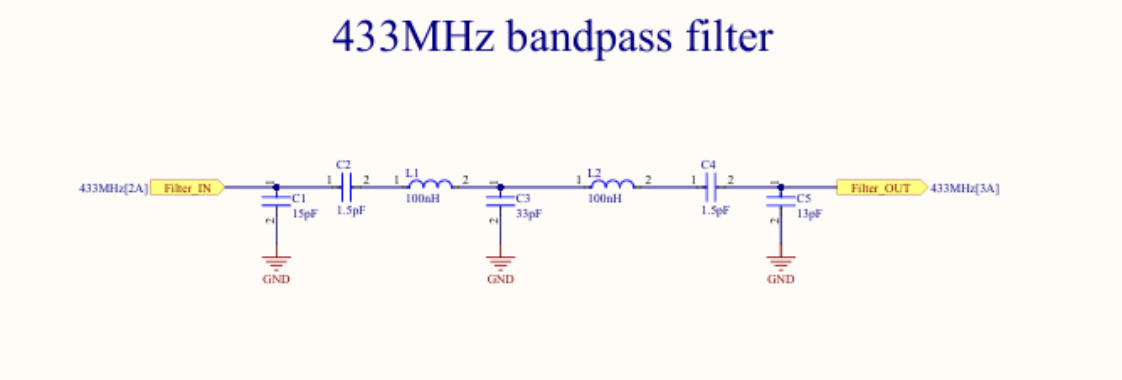

Figure 8: Schematic Drawing - 433MHz Bandpass Filter

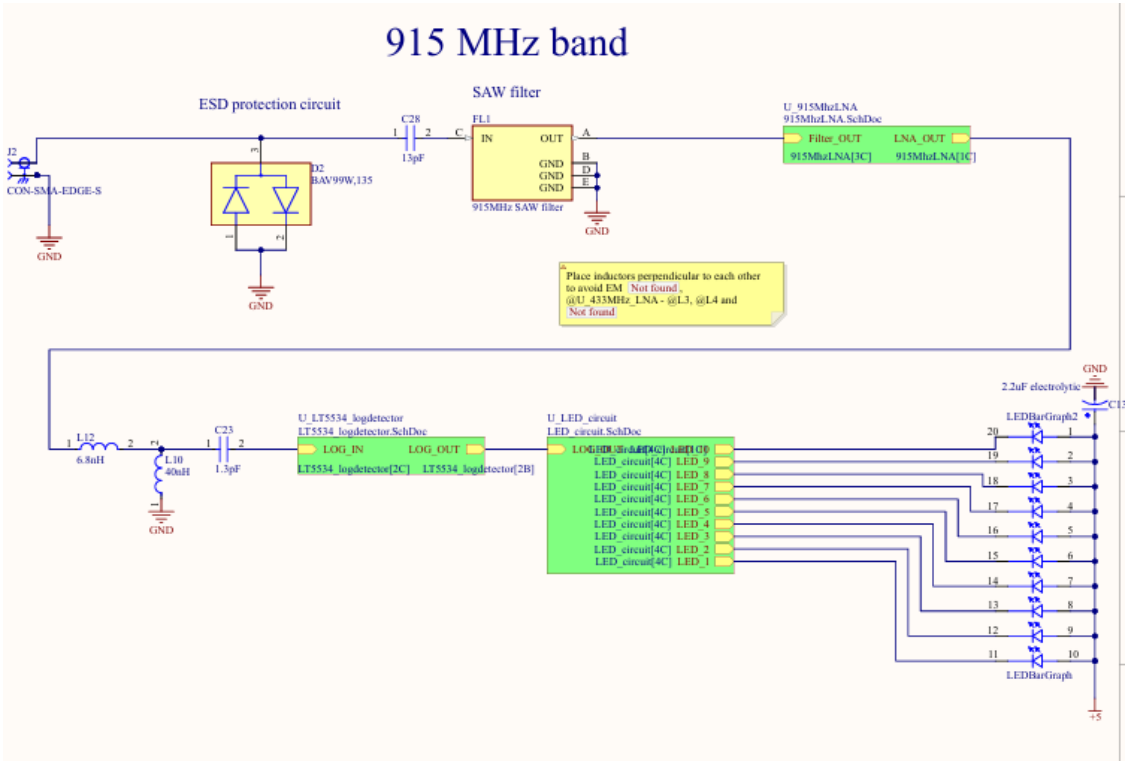

Figure 9: Schematic Drawing - 915 MHz

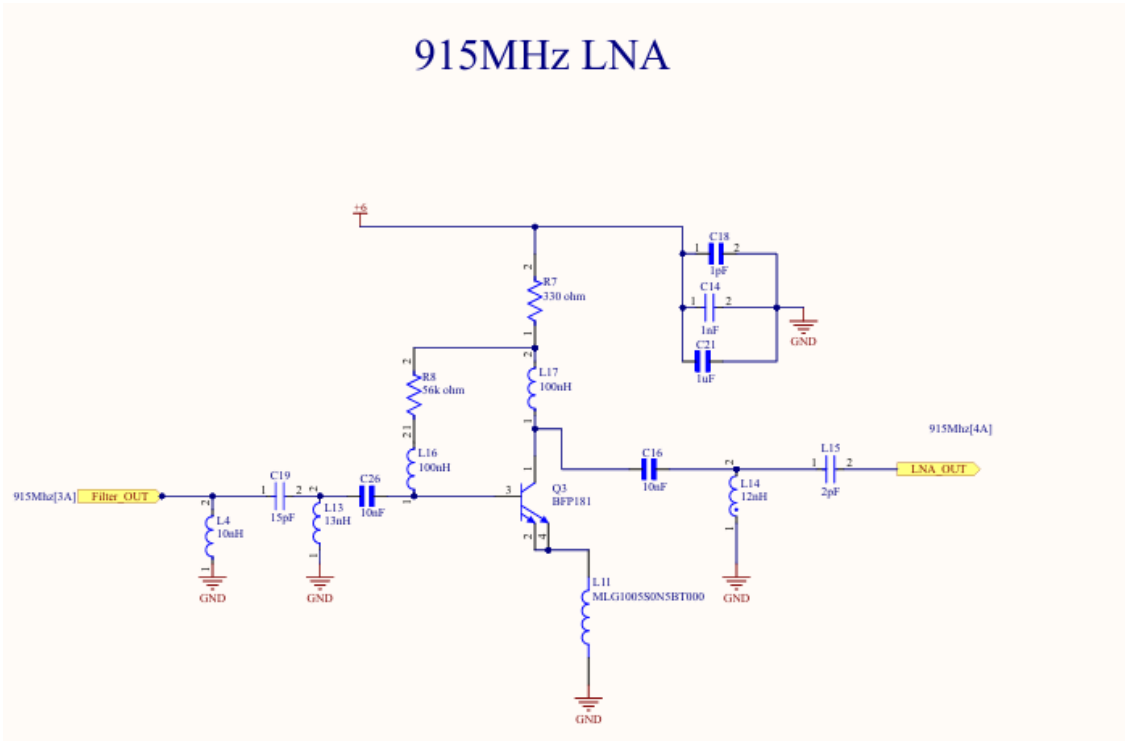

Figure 10: Schematic Drawing - 915 MHz LNA Design

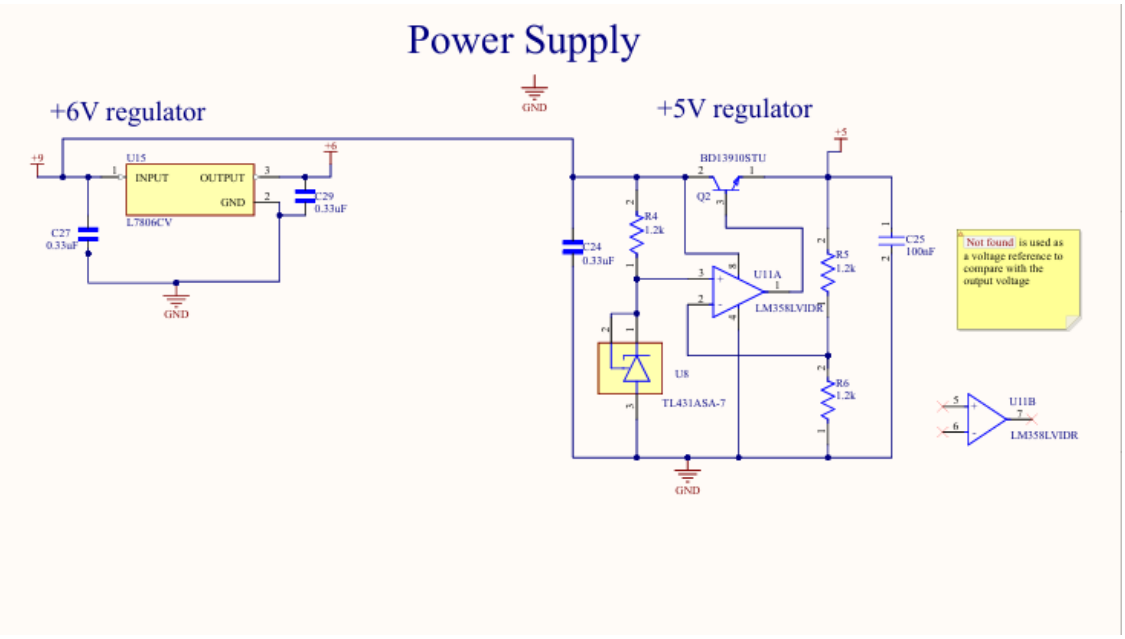

Figure 11: Schematic Drawing - Power Supply Design

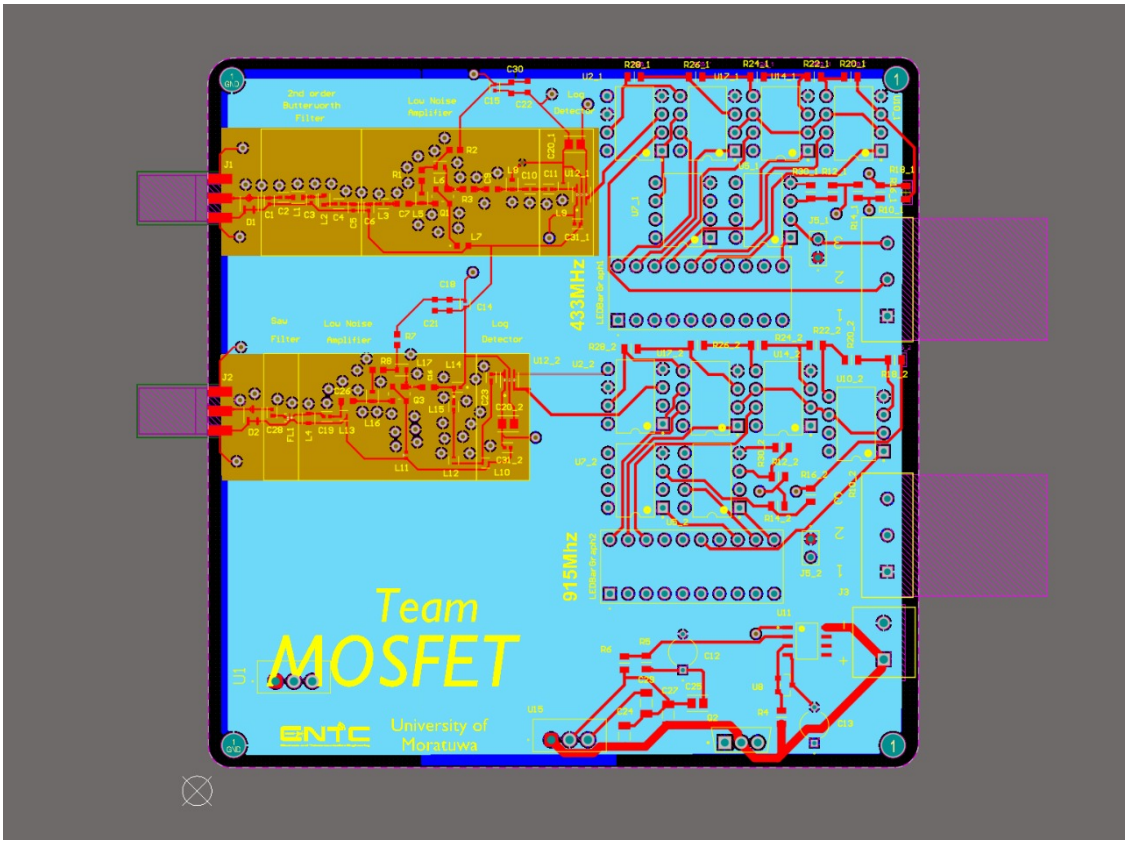

Figure 12: PCB Drawing - Top Layer

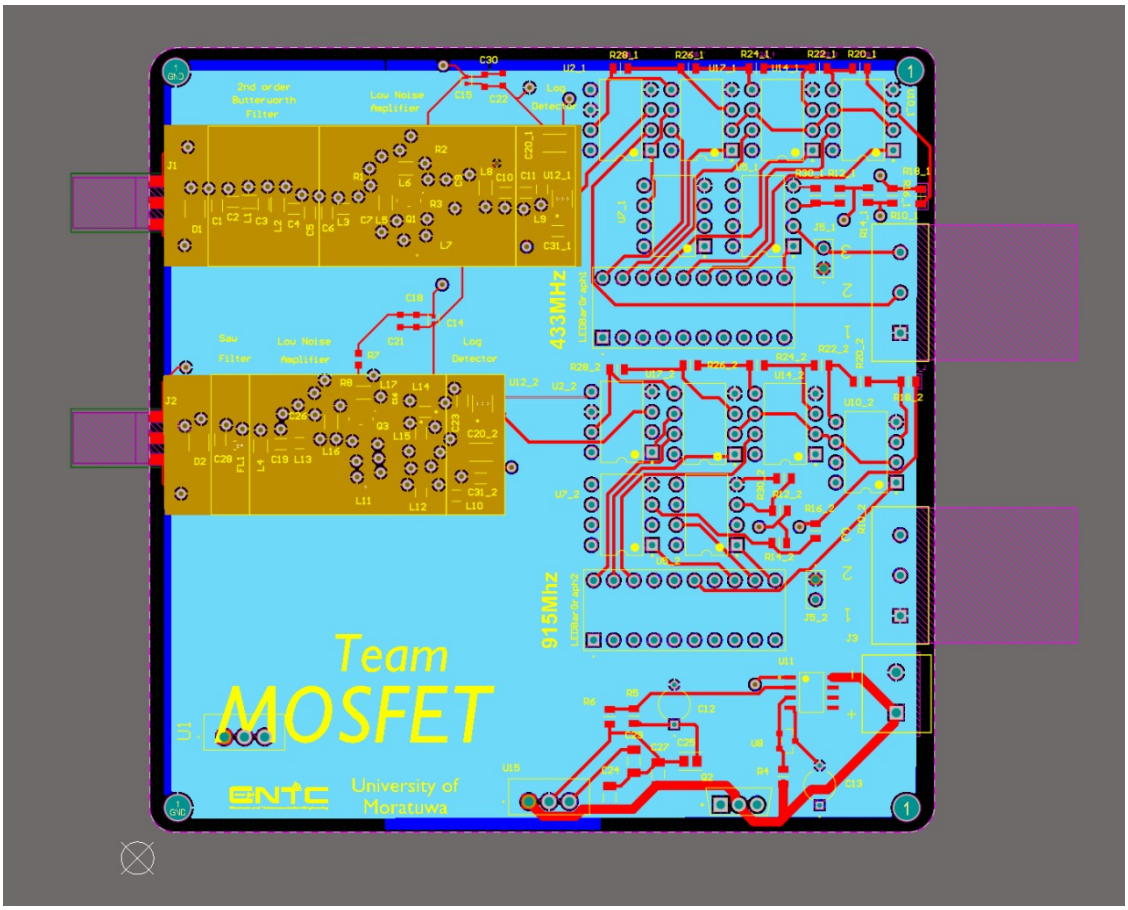

Figure 13: PCB Drawing - RF GND Layer (Layer 2)

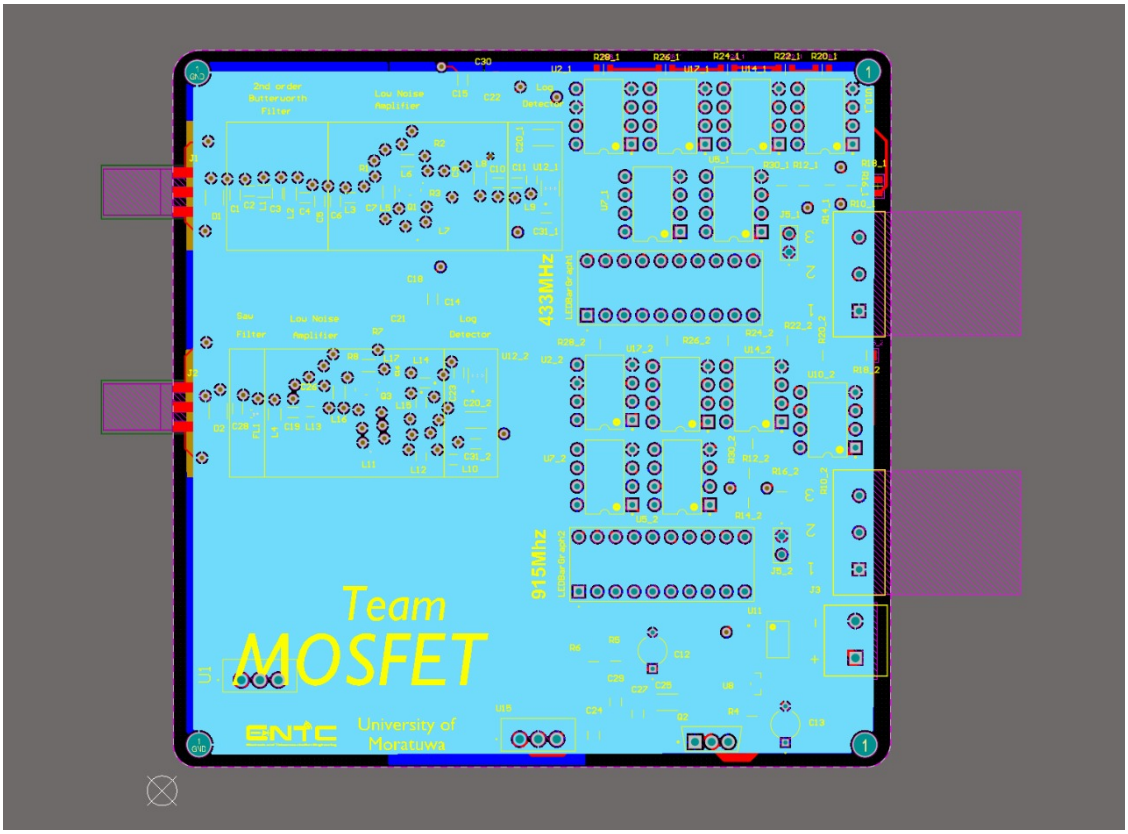

Figure 14: PCB Drawing - PCB GND Layer (Layer 3)

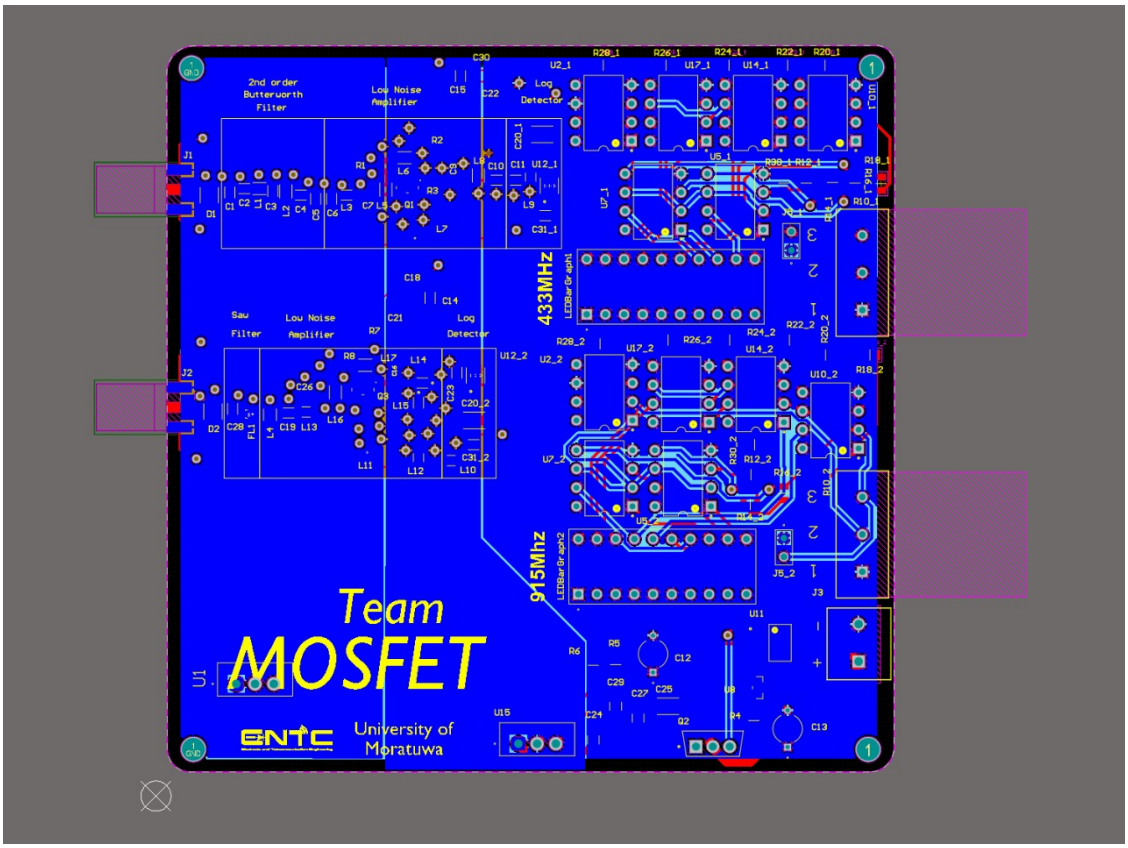

Figure 15: PCB Drawing - Bottom Layer

#	Name	Material	Type	Weight	Thickness	Dk	Df
	Top Overlay		Overlay				
	Top Solder	Solder Resist	Solder Mask		0.0127mm	3.8	
1	Top Layer 1		Signal	1oz	0.03505mm		
	Dielectric 1	PP-022	Prepreg		0.21031mm	4.5	0.02
2	RF GND		Signal	1/2oz	0.01524mm		
	Core	FR-4	Core		1.06502mm	4.5	
3	GND		Signal	1/2oz	0.01524mm		
	Dielectric 2	PP-022	Prepreg		0.21031mm	4.5	0.02
4	PWR		Signal	1oz	0.03505mm		
	Bottom Solder	Solder Resist	Solder Mask		0.0127mm	3.8	
	Bottom Overlay		Overlay				

Figure 16: PCB Stackup

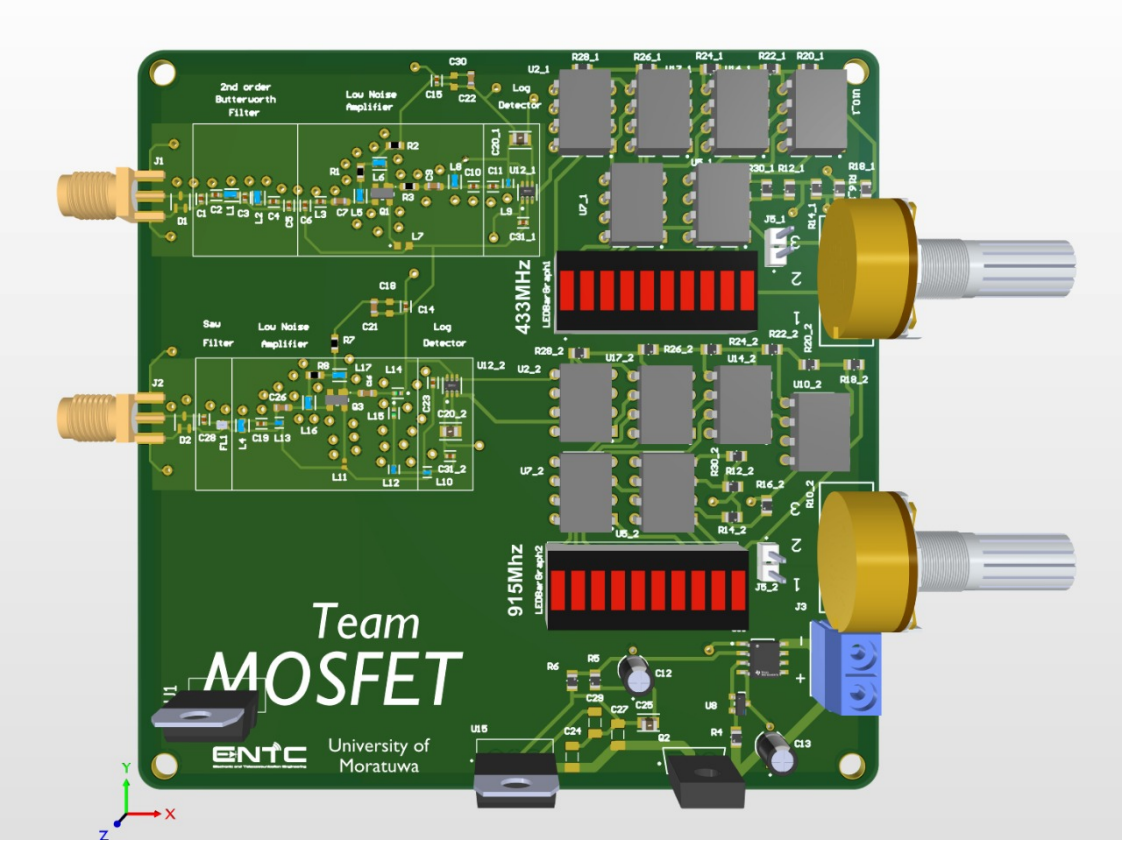

Figure 17: PCB Drawing - 3d view

Figure 18: frequency response for 433 Mhz band

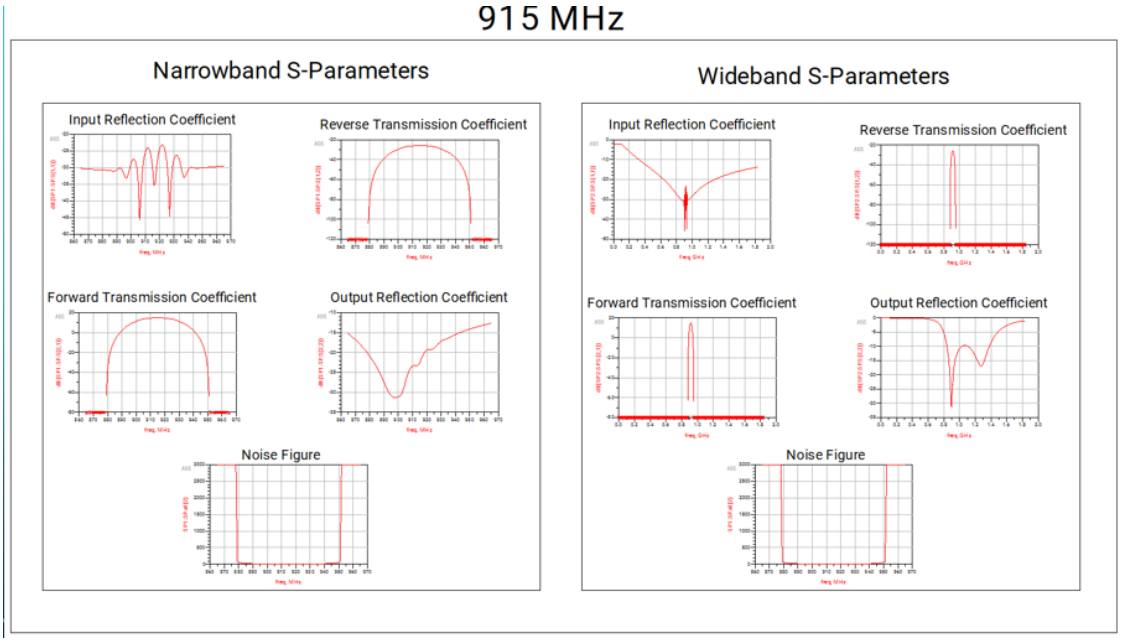

Figure 19: frequency response for 915 Mhz band

Figure 20: Final Product