

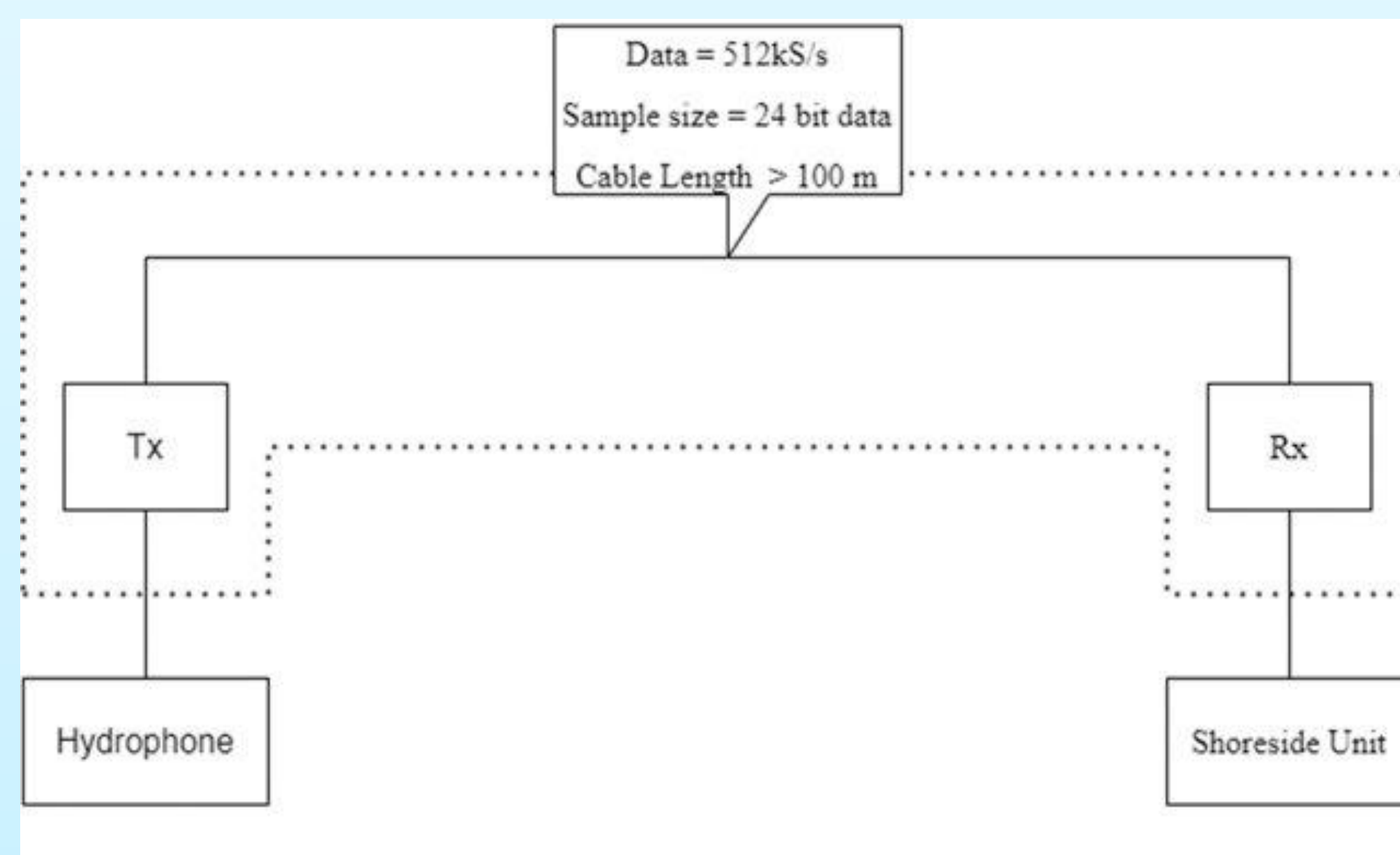
# Long-Range Data & Power Transmission

## Introduction

- The hydrophone is used to measure acoustic underwater signals from marine wildlife, vessel traffic and noise level.
- The limited internal storage and battery life for the hydrophone make it impossible for long-term deployment.
- The design requires a minimum of 11.78 Mbit/s, at least 100 meters underwater transmission as well as power supply for the hydrophone.
- The hydrophone requires 2.25 W (run mode) to 3.70 W (charge mode) each and are tolerant of a 18-36 V input voltage.
- Service annually basis or no need any service.



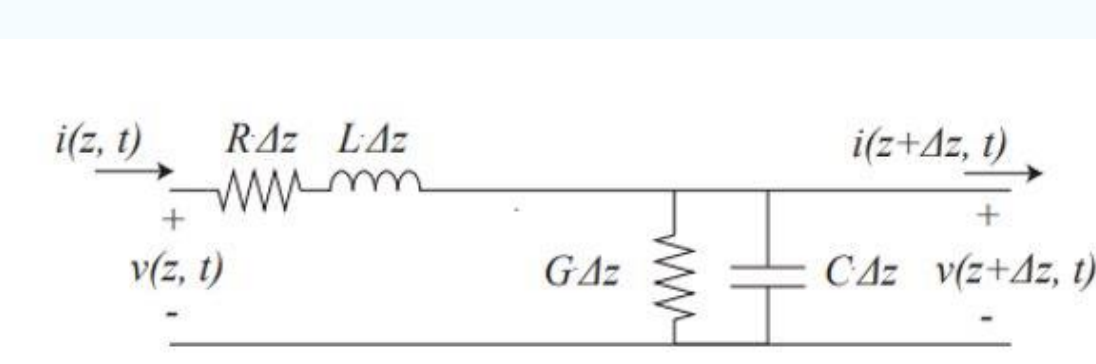
## System Architecture



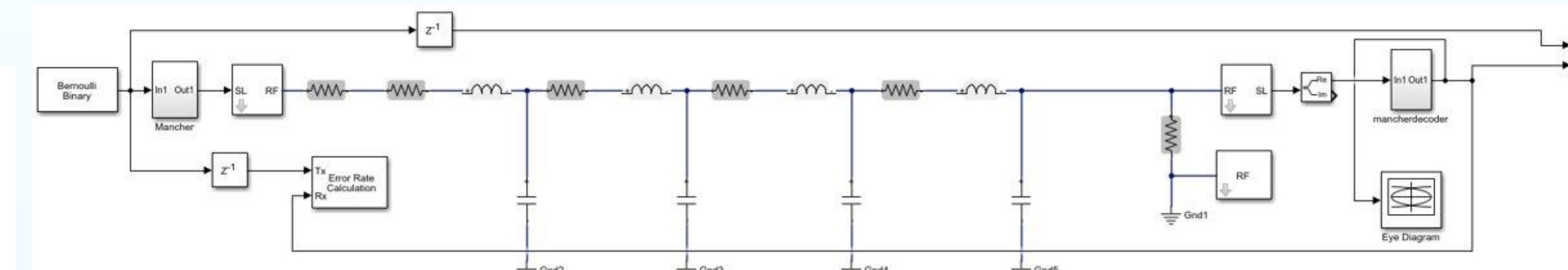
## Design Process

- Search for well-known platforms that meet the requirements according to customer needs, compare their advantages and disadvantages.
- Select the appropriate cable for the project and build a simulation model of the system for testing.
- Purchase 100m long cable and POE injector, tester and other equipment for practical test.

## Details of Design



Cable Modelling



System Simulation Model

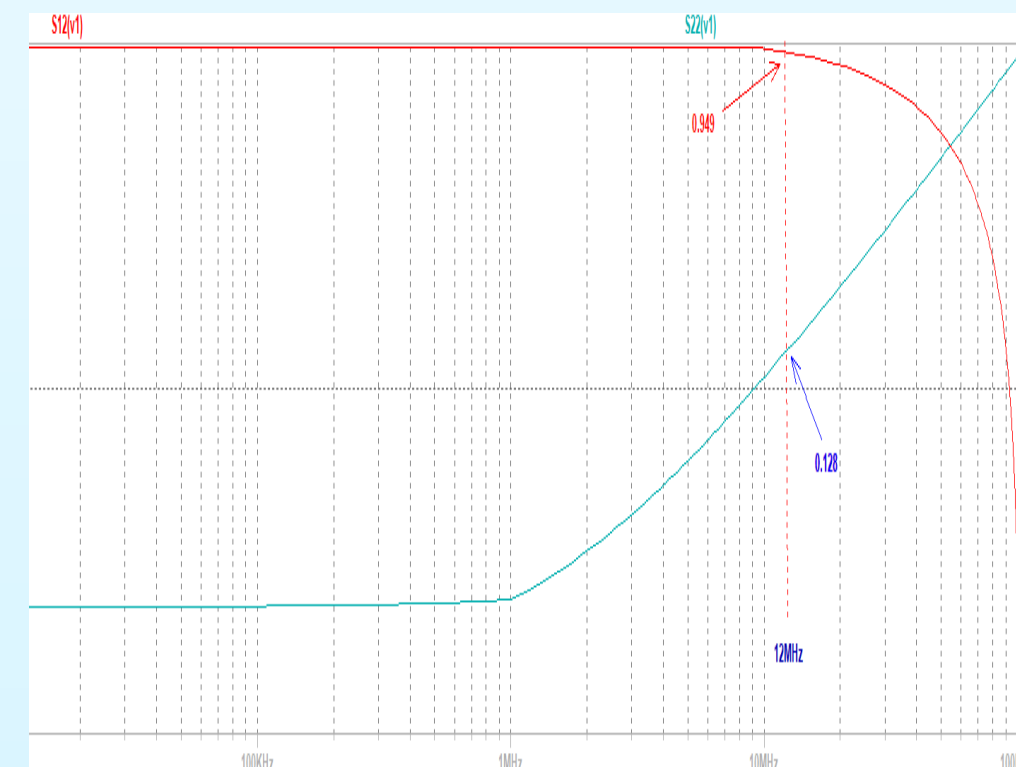
## Platform Comparison

### Ethernet

- High Speed
- Longer reachable
- Distance
- Acceptable price

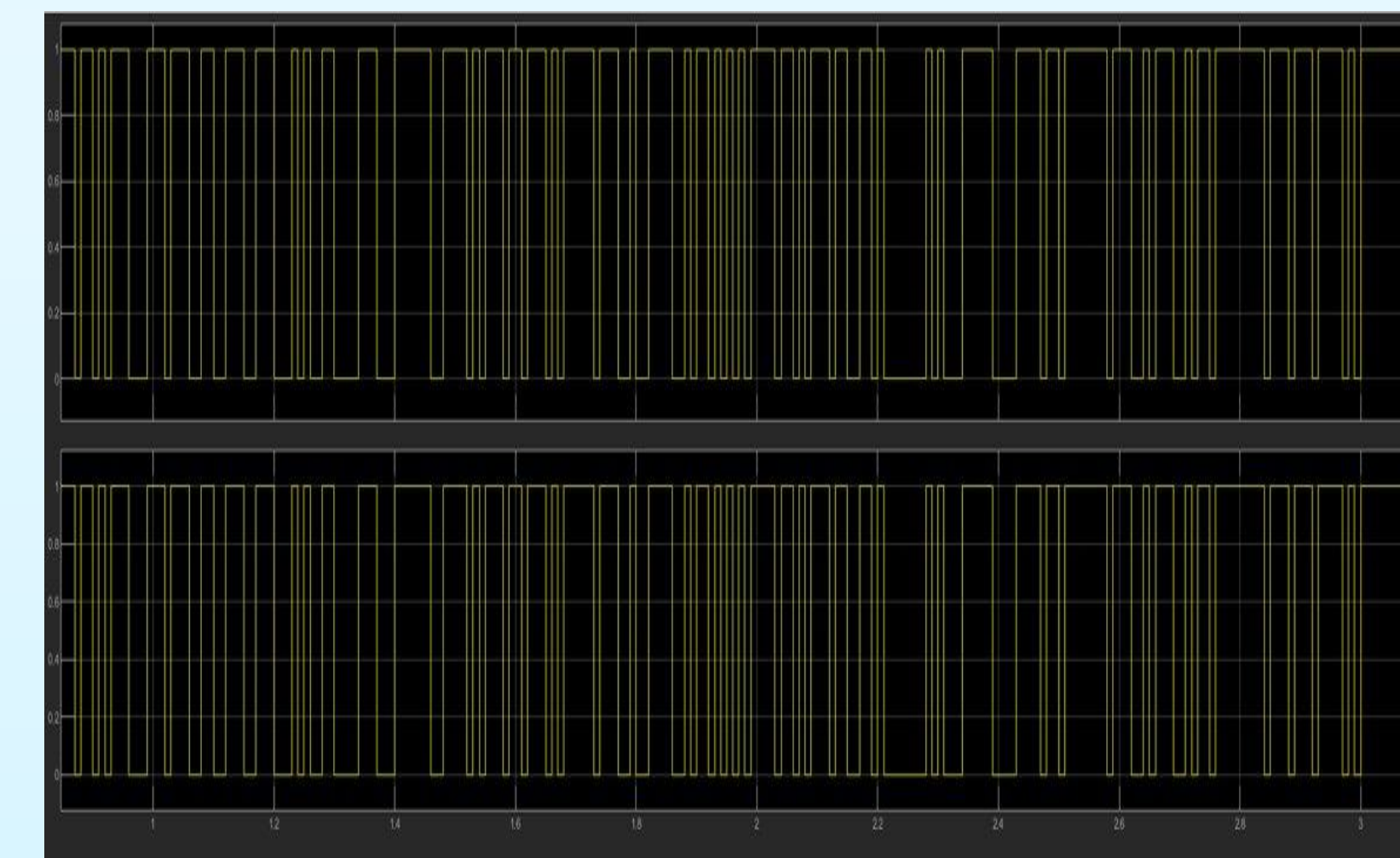
option	Criteria	Waterproof?	Max speed	Distance	Power?
RS485		Yes (model for industrial use)	10 Mbit/s	12.192 m	Need extra source
SPE		yes	10 Mbit/s 1 Gbit/s	1000 m 40 m	Power through cable
CoaXPress		yes	1.25 Gbit/s (CXP-1)	212 m	Power through cable
Ethernet		yes	1 Gbit/s	100 m	Power through cable

## Simulation Results



S-parameter

- Good transmit & reflection coefficient



Received Signal

## Practical Result - Data

100m condition



Received Signal  
Amplitude decreased 40%-50%  
Delay 520ns  
Distorted a lot at 10MHz



Eye-diagram

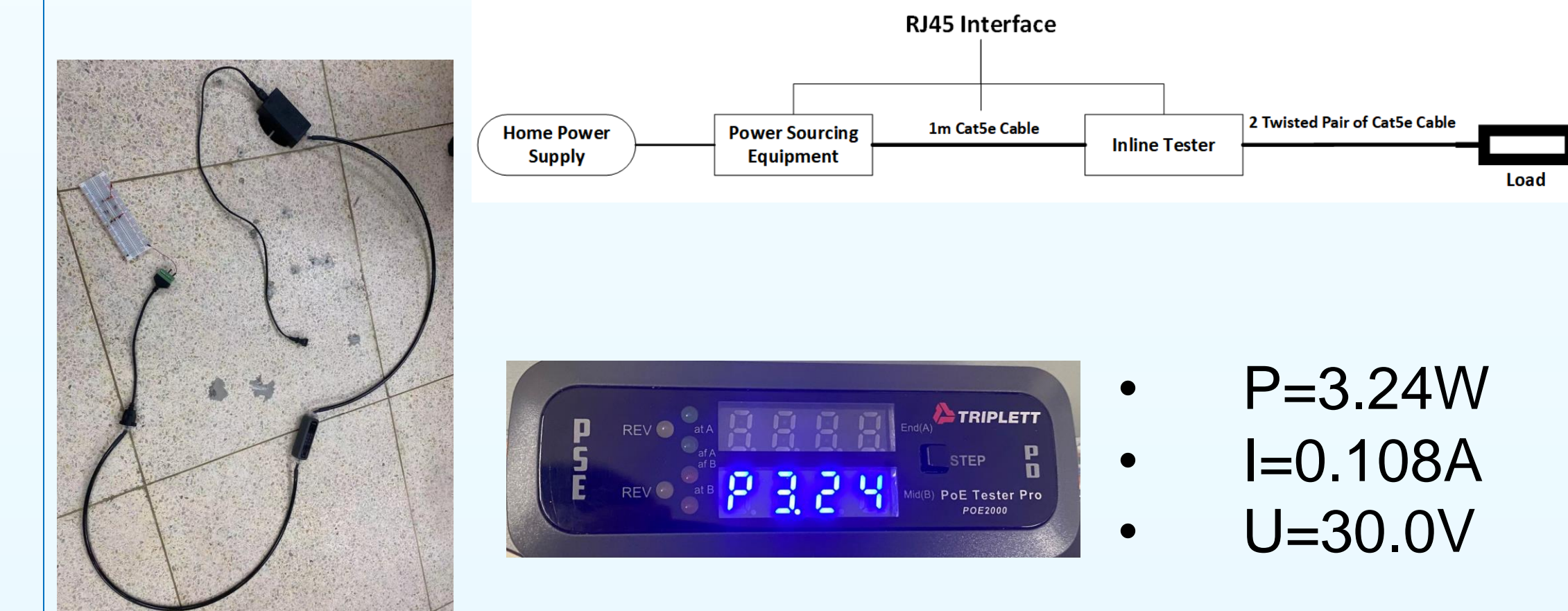
Time	Source	Destination	Tx Power	Length	Info
8055.787.141892	169.254.61.94	169.254.255.255	LOP	305	54915 - 54915 Len=263
8052.787.141934	169.254.61.94	169.254.255.255	LOP	305	54915 - 54915 Len=263
8053.787.141960	169.254.61.94	169.254.255.255	LOP	305	54915 - 54915 Len=263
8054.787.142003	169.254.61.94	169.254.255.255	LOP	305	54915 - 54915 Len=263
8055.787.142054	169.254.61.94	169.254.255.255	LOP	305	54915 - 54915 Len=263
8056.787.142138	169.254.61.94	169.254.255.255	LOP	305	54915 - 54915 Len=263
8057.787.270880	169.254.172.111	169.254.255.255	LOP	305	54915 - 54915 Len=263
8058.787.270825	169.254.172.111	169.254.255.255	LOP	305	54915 - 54915 Len=263
8059.787.270904	169.254.172.111	169.254.255.255	LOP	305	54915 - 54915 Len=263
8060.787.270958	169.254.172.111	169.254.255.255	LOP	305	54915 - 54915 Len=263
8061.787.271222	169.254.172.111	169.254.255.255	LOP	305	54915 - 54915 Len=263
8062.788.139370	169.254.61.94	169.254.255.255	LOP	305	54915 - 54915 Len=263
8063.788.139402	169.254.61.94	169.254.255.255	LOP	305	54915 - 54915 Len=263
8064.788.139434	169.254.61.94	169.254.255.255	LOP	305	54915 - 54915 Len=263

Frame Error check

No single error occurred

## Practical Result – Power

- Use 250Ω resistor to simulate hydrophone



- P=3.24W
- I=0.108A
- U=30.0V

## Conclusion & Complementation

- The feasibility of Ethernet hydrophone signal transmission platform had been successfully proven.
- Simulation model and prototype have been created and ready for implementation.
- Eye diagram and bit error rate are the important results generated from simulation, and evident the feasibility.
- Model B for power over ethernet is adopted for the success in satisfying the power requirement of run mode.
- Signal transmission performs with perfection and towards nearly zero frame error.

## Recommendations

- In future design stages, RJ45 interface will be replaced by waterproof SubConn Micro Circular.
- The prototype is ready for underwater test after interface replacement.
- Coding chip can be included in the system to implement Manchester Coding
- Amplifier can be covered in the receiver to boost amplitude

## References

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