16.36: Communication Systems and Networks

USRP Laboratory 5: Multiple Access Techniques

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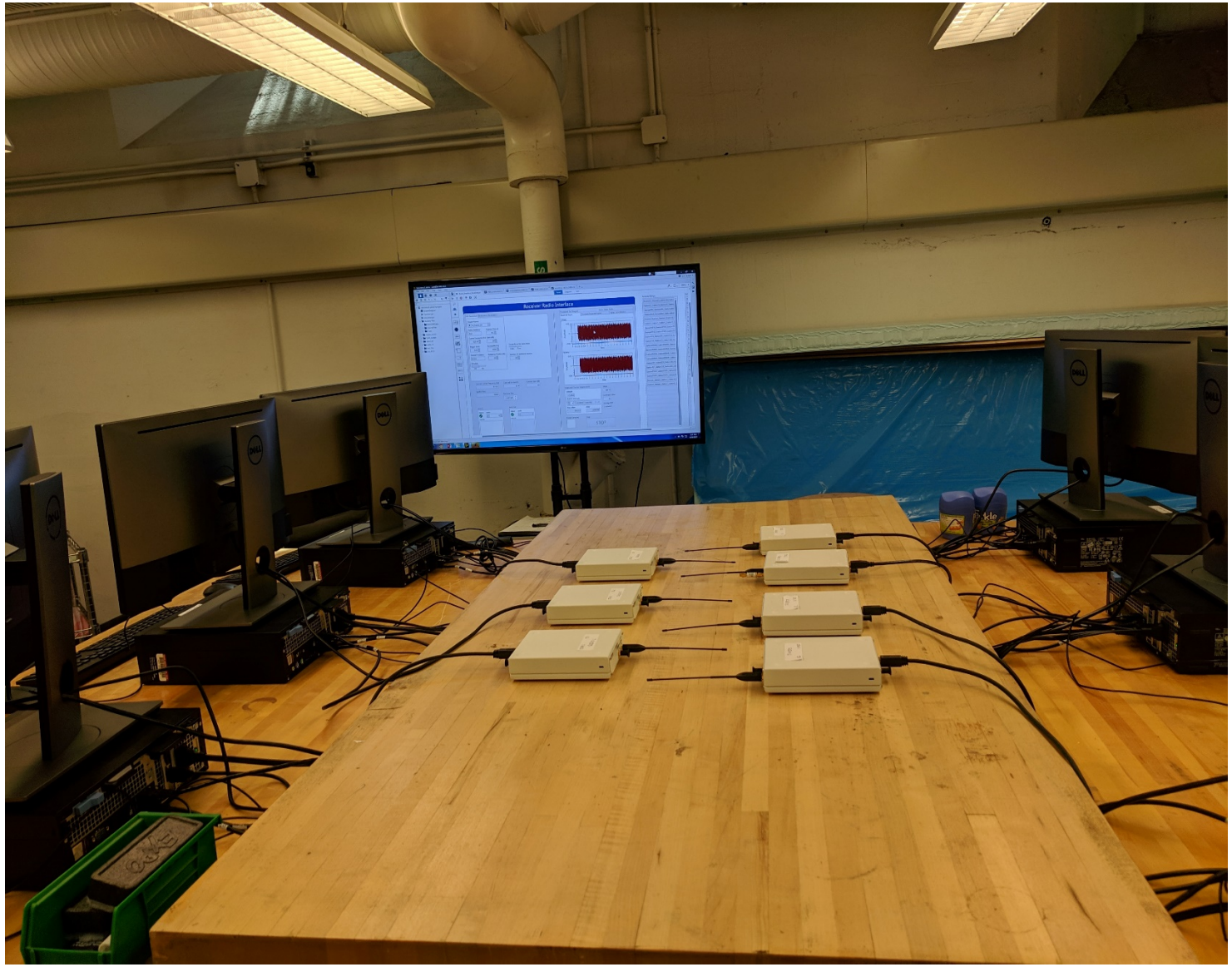
Setup

Six Transmitters (for students)

Single Receiver (for the TA)



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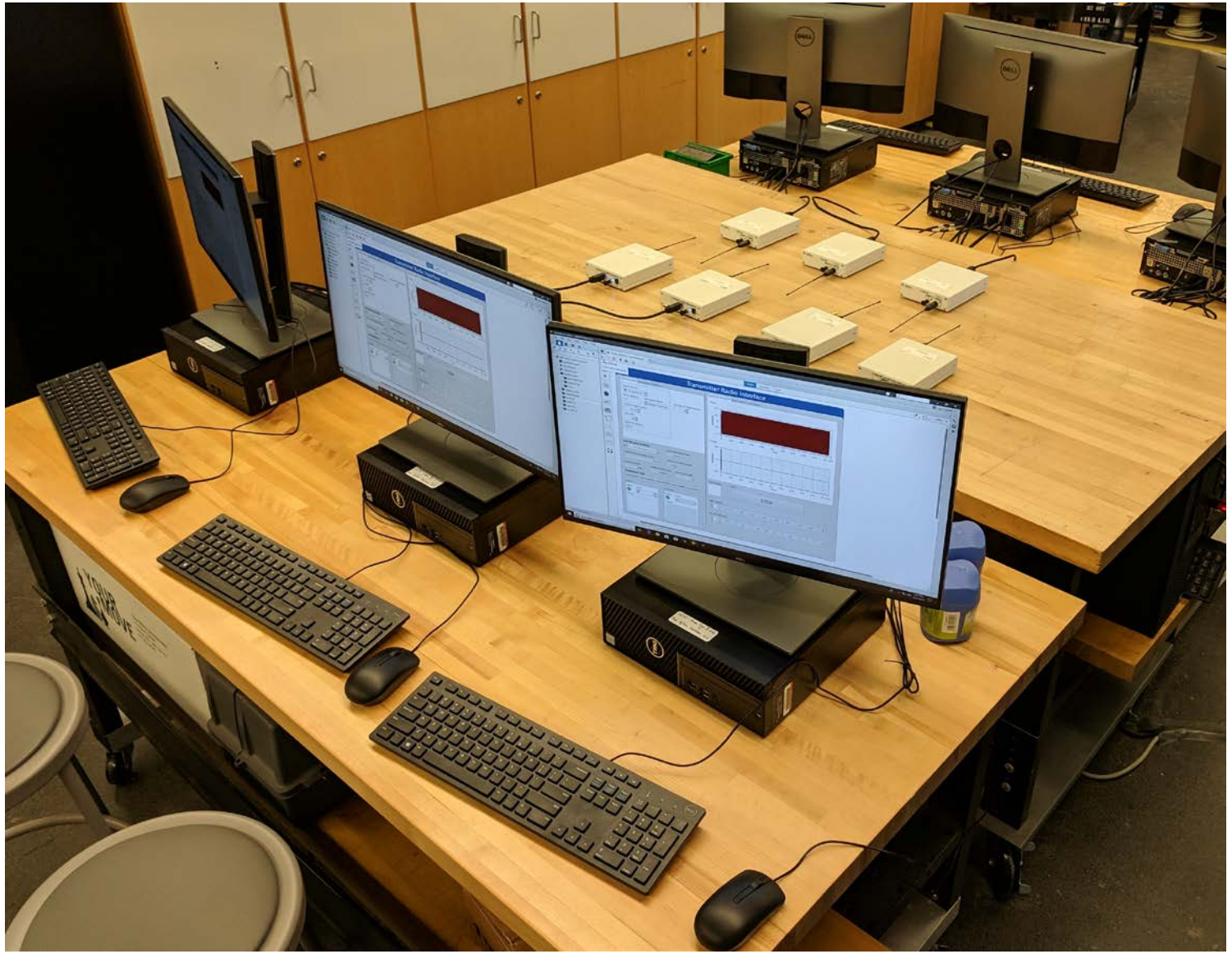

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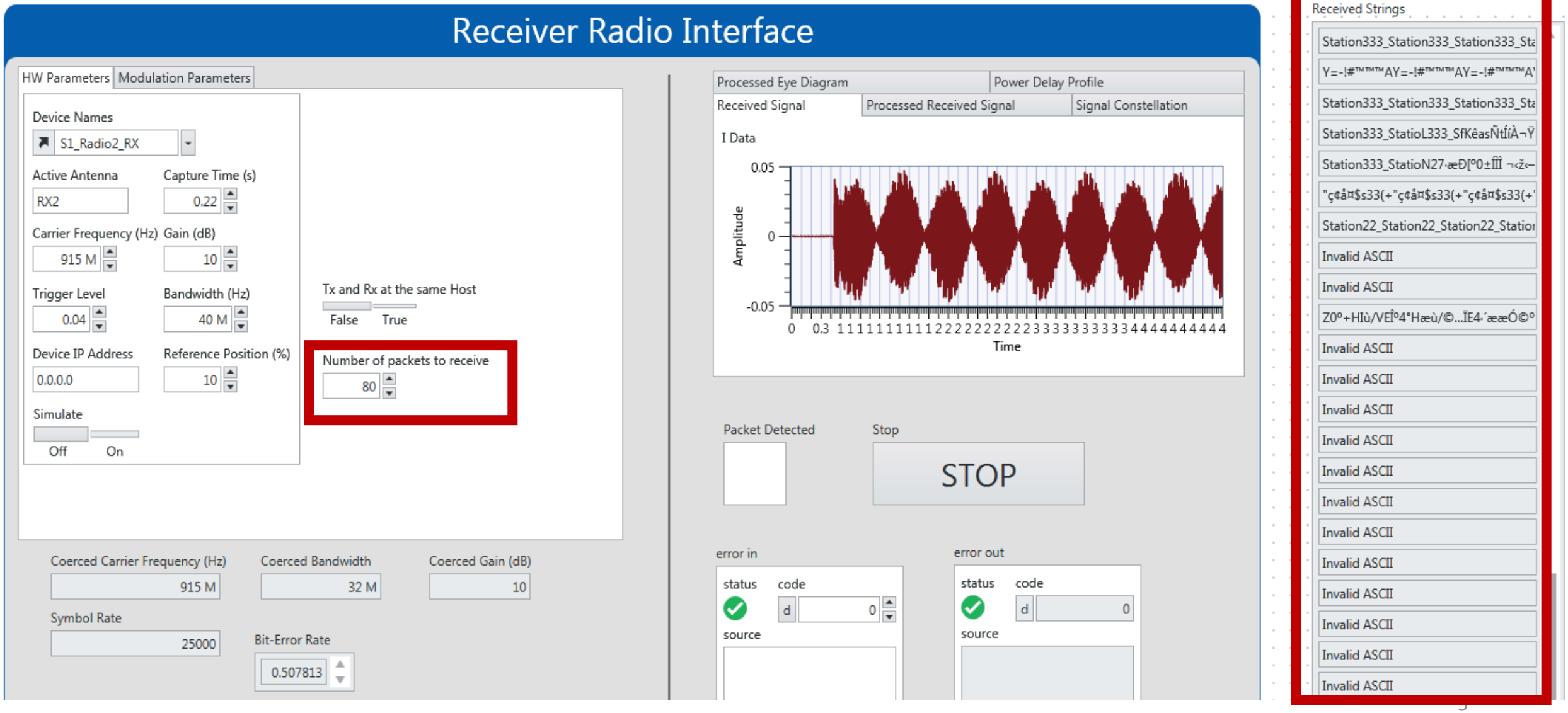
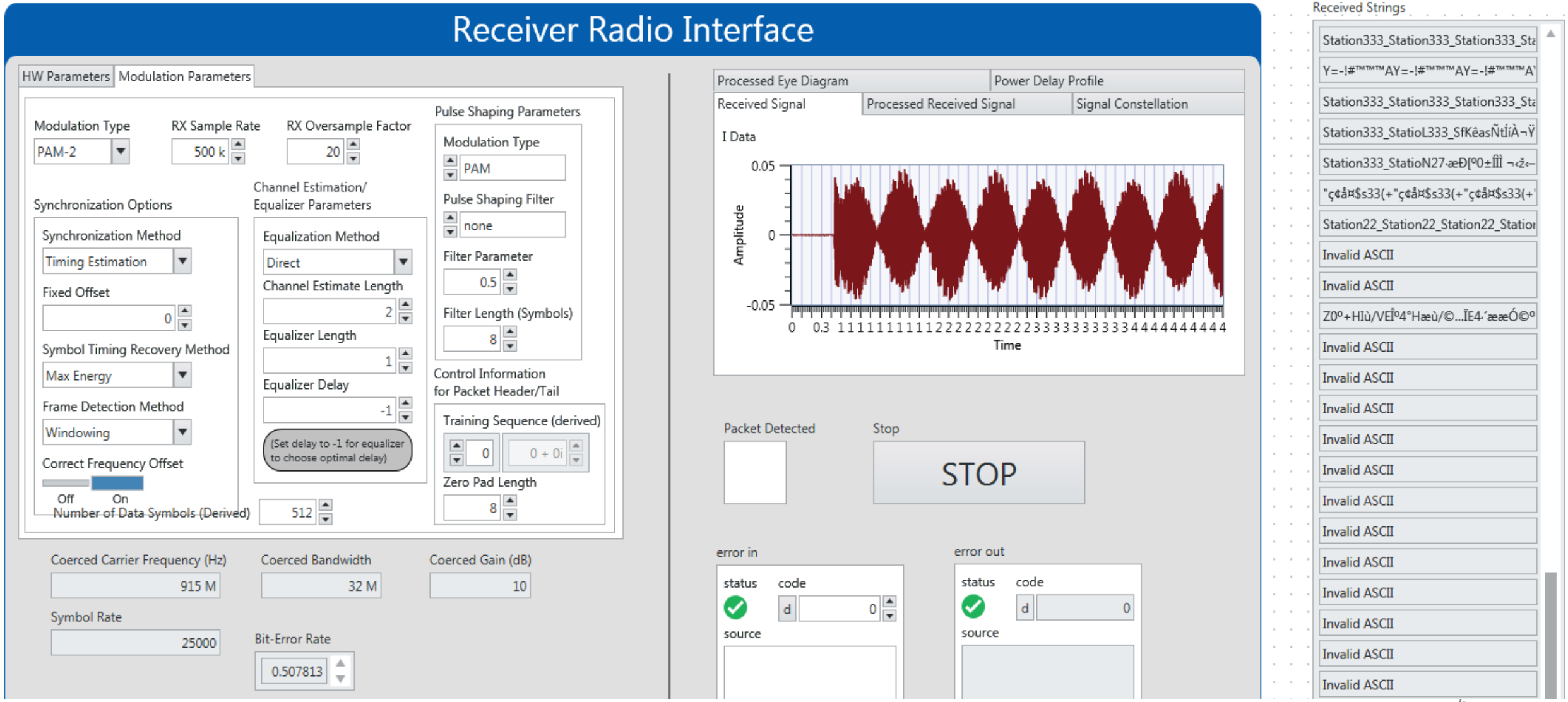
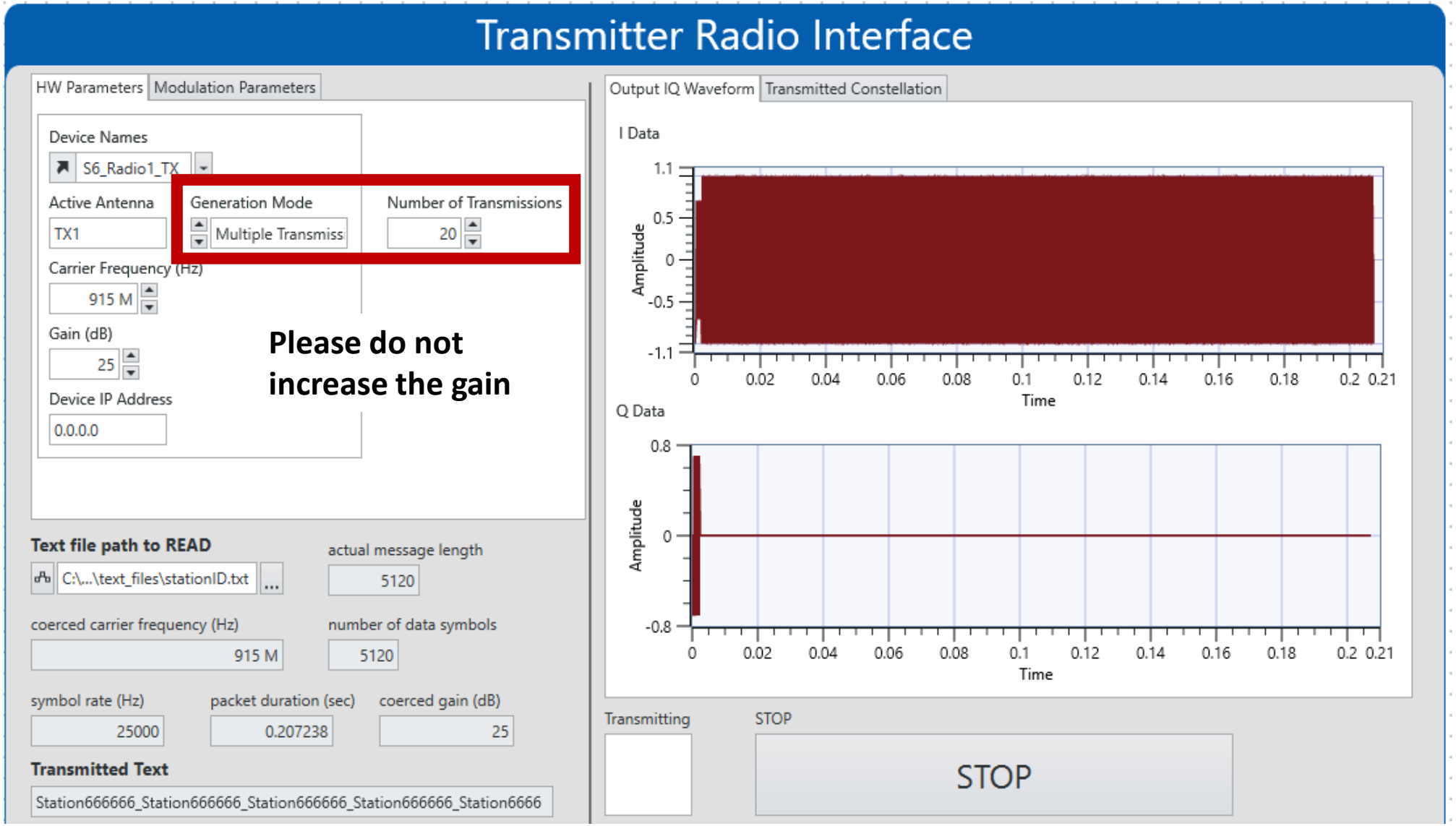
Receiver Configuration (**TA**)



Receiver Configuration (**TA**)



Transmitter Configuration (**Student**)



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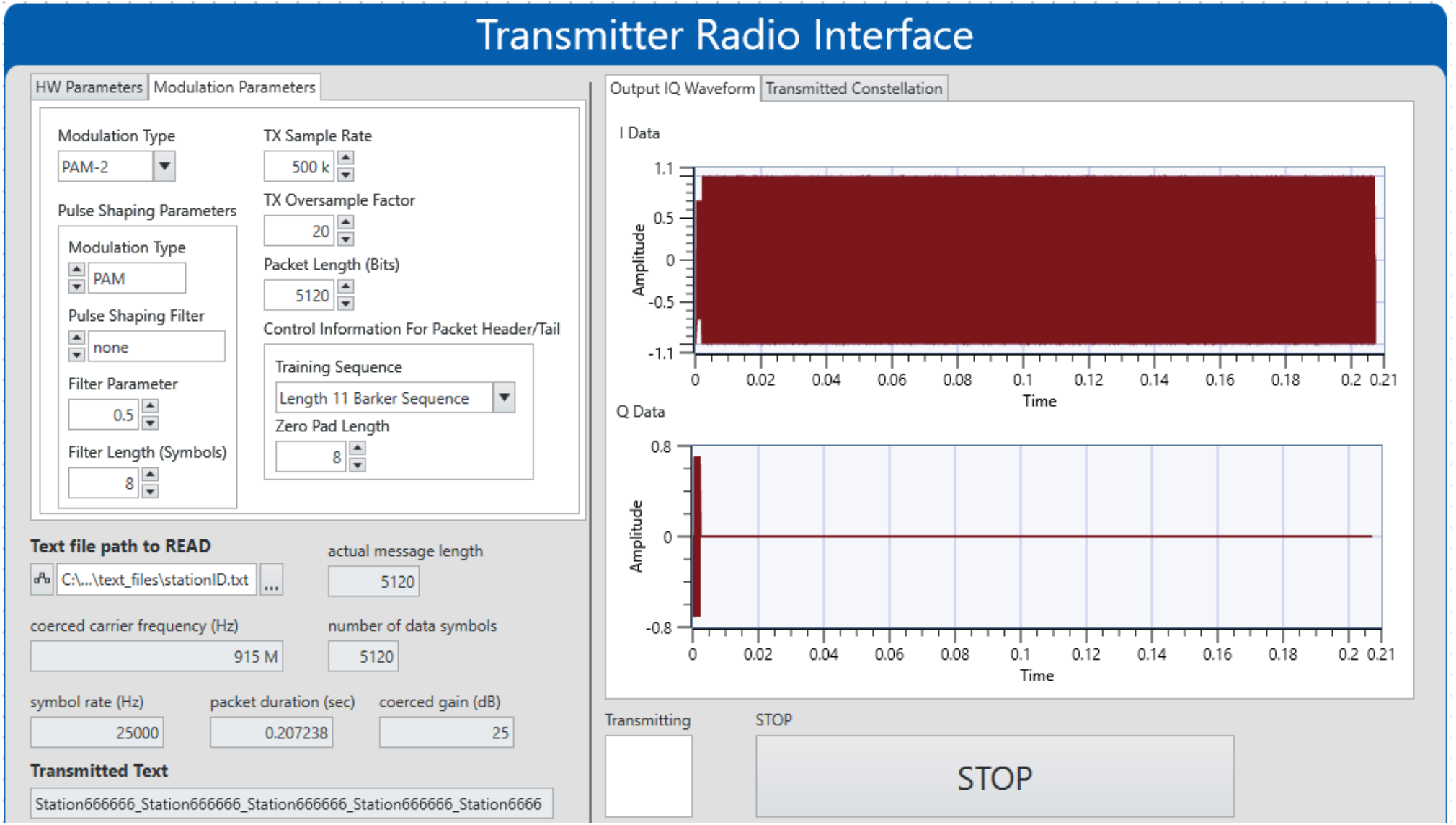

Warm up for Competition

- TA will setup the radio to receive a total of 30 packets
- **In turns**, each team should transmit 5 consecutive packets. Starting from Station 1.
- TA should successfully receive 5 packets from each station.
- If packets are received as expected, let's start the competition:

May the odds be ever in your favor

Which team can deliver most packets?

- Game with four rounds.
- The team that can deliver most packets wins.
- Rules:
  - In each round, the TA will receive 80 packets **in total**
  - Teams can modify "**Number of Transmissions**" at will
  - Teams can **Run the transmitter program** as they see fit

- Think about your strategy. Wait for the TA to start the first round…

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- If you could modify ANY PARAMETER in the transmitter. Which parameter would you change in order to win?

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- If you could collaborate with other teams? How would you improve the system? Is it possible to operate distributedly? Any protocols in mind?

Slotted ALOHA

- Implementing a simplified version of Slotted ALOHA
- The TA will define the time slots (~ 10 second) using a clock.
- During every slot, teams should roll their die:
  - If the outcome is 6, the team **transmits at the beginning of the next slot**
  - Otherwise, the team **idles at the next time slot.**

- Rules next…

Slotted ALOHA

- Rules:
  - Number of Transmissions = 20 packets
  - Teams can only transmit when the protocol allows
  - The TA will synchronize the network and define slots

- Single round of transmissions with a total of 80 packet receptions.

- Wait for the TA to start the first slot…

Slotted ALOHA

- Rules:
  - Number of Transmissions = 20 packets
  - Teams can only transmit when the protocol allows
  - The TA will synchronize the network and define slots

- Single round of transmissions with a total of 80 packet receptions.

- What is the main advantage of this technique? What is the disadvantage? What if we did not have slots and you could roll the die at will?

Slotted ALOHA

- Implementing a simplified version of Slotted ALOHA
- The TA will define the time slots (~ 10 second) using a clock.
- During every slot, teams should roll their die:
  - If the outcome is **4, 5 or 6**, the team **transmits at the beginning of the next slot**
  - Otherwise, the team **idles at the next time slot.**

- Rules next…

Slotted ALOHA

- Rules:
  - Number of Transmissions = 20 packets
  - Teams can only transmit when the protocol allows
  - The TA will synchronize the network and define slots

- Single round of transmissions with a total of 80 packet receptions.

- Is this better than before? Worse? Why? Conclusion?
- Obs.: this protocol led to the development of CSMA used today in WiFi.

Example of contention-free protocols

- (Pooling) Point Coordination Function in Wi-Fi.
- (Reservation) Satellite Communications