



# MIMO Telecommunications with Near Ultrasounds

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Institut **Langevin**  
ONDES ET IMAGES



# Context

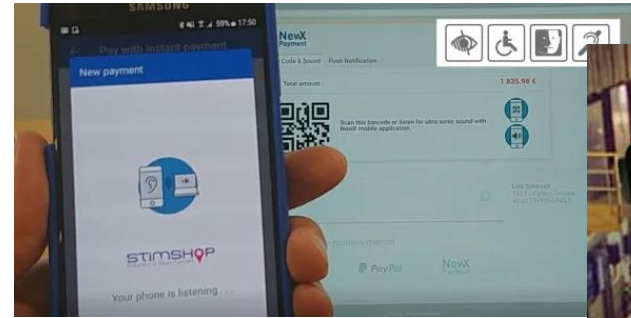
Radio-frequencies telecommunications not always appropriate / allowed

⇒ Ultrasound telecommunications

Stimshop (Near-ultrasound)

- Industrial: sensor telecommunication / security monitoring
- Public: Ultrasonic tags / wireless signature

But low bit rate / range



# CIFRE PhD

⇒ Acoustic antenna for near ultrasonic MIMO telecommunications

## Goals:

Increase bit rate and control  
Telecommunication security  
Multi-user

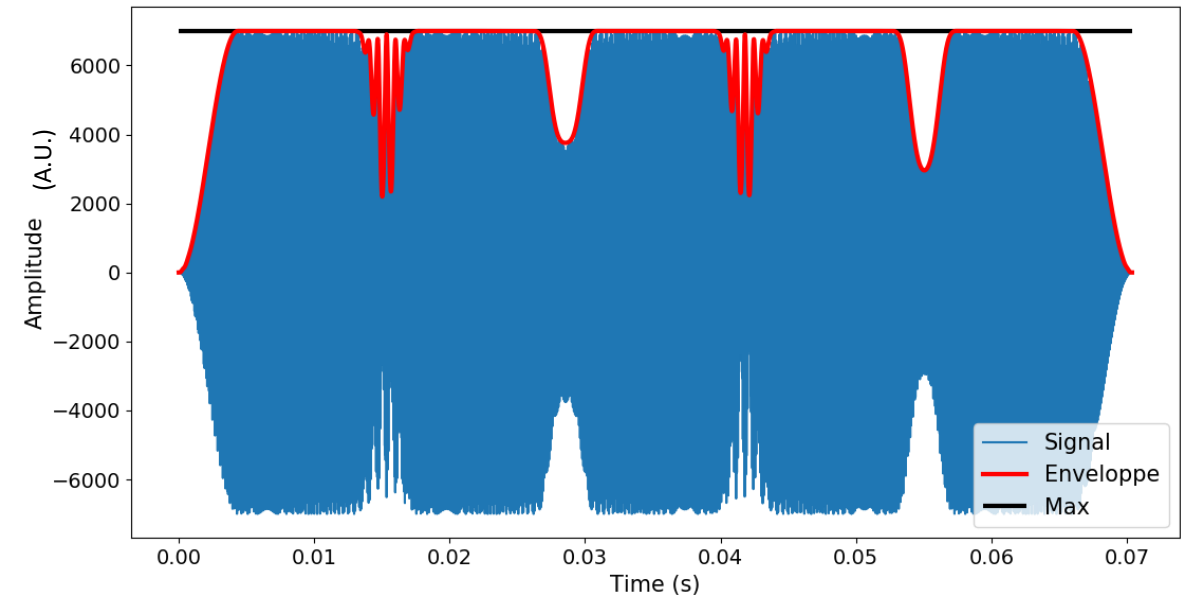
## Results:

### Bit Error Rate model

- Transmission analytical model
- Approximate model
- Simulation
- Impact of chirp-symbol time on BER

### Experimental prototype

- Channel estimations
- Beam Forming / Time Reversal focusing
- Multi-users telecommunications (MIMO)



Ultrasonic-telecommunication frame

