NICScatter: Backscatter as a Covert Channel in Mobile Devices

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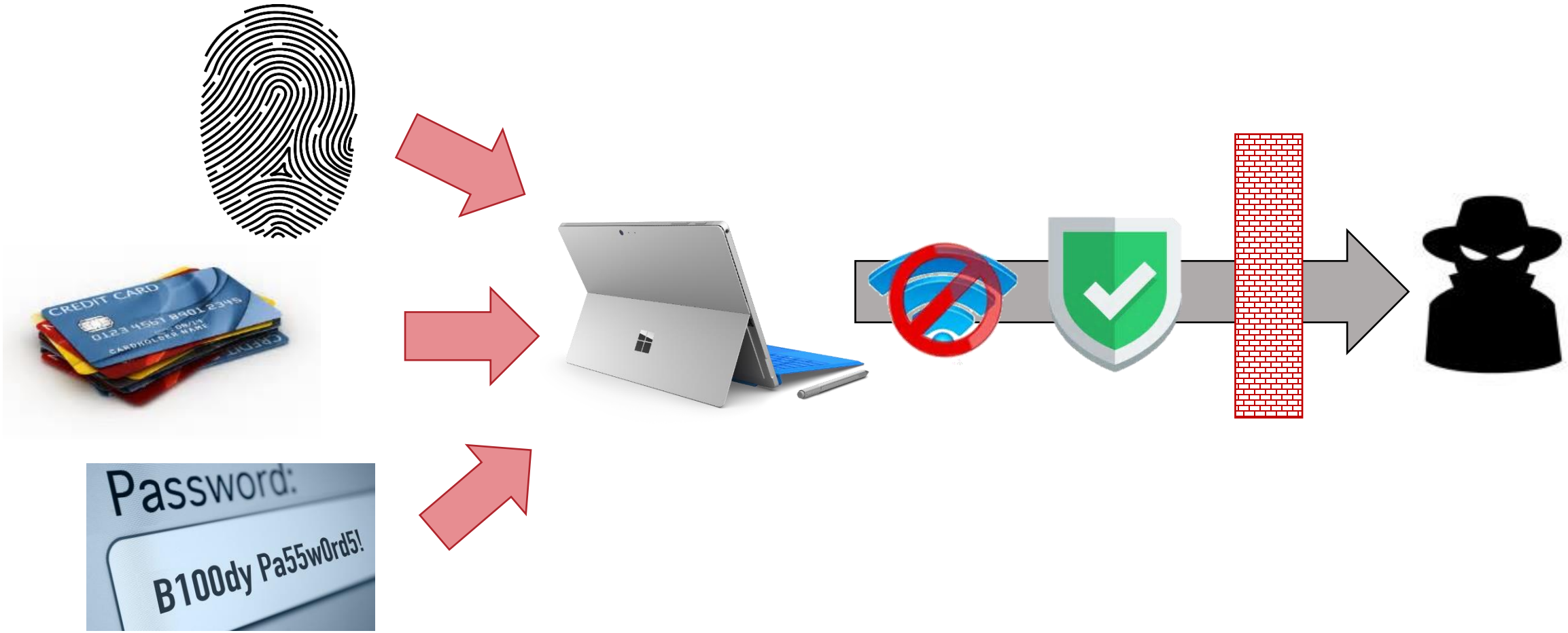
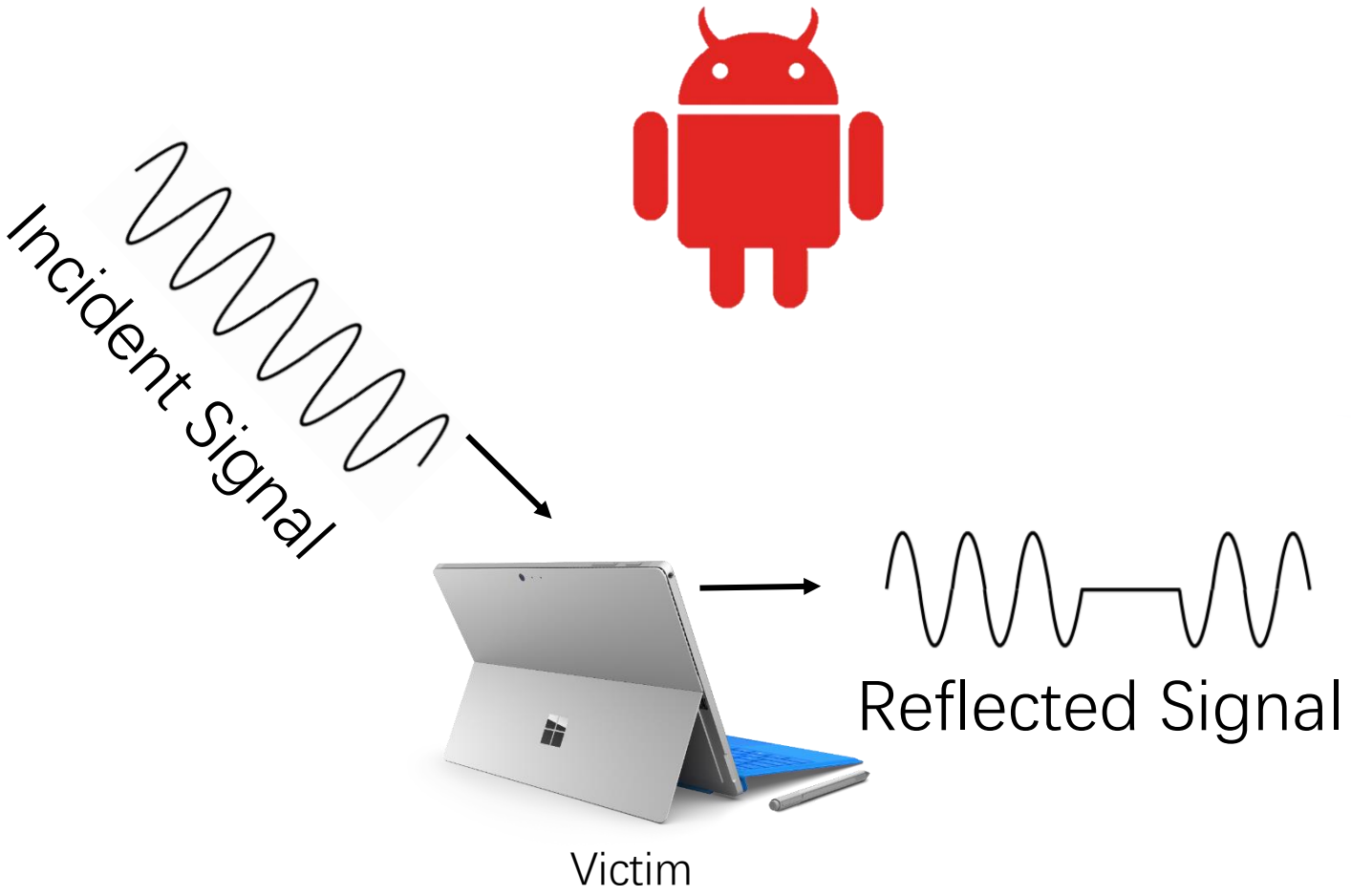
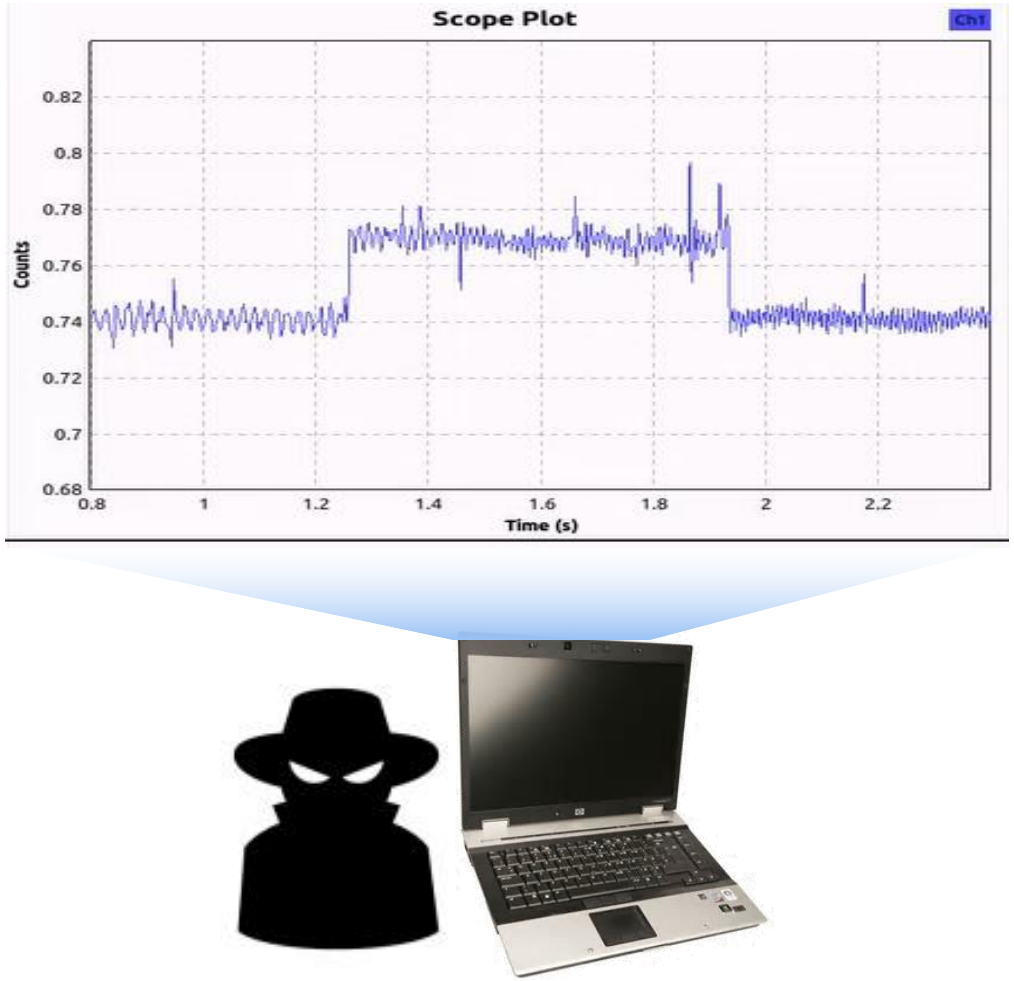
Is Our Data Safe Enough ?



Information Leakage under Isolation





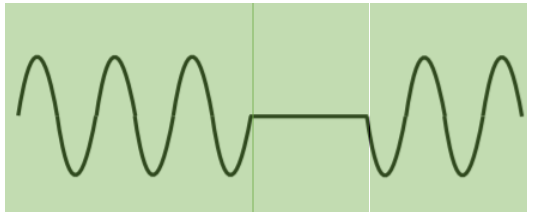
Covert Communication through Backscatter

NICScatter: backscatter through commercial NICs

System vulnerabilities in smartphone and Linux notebook

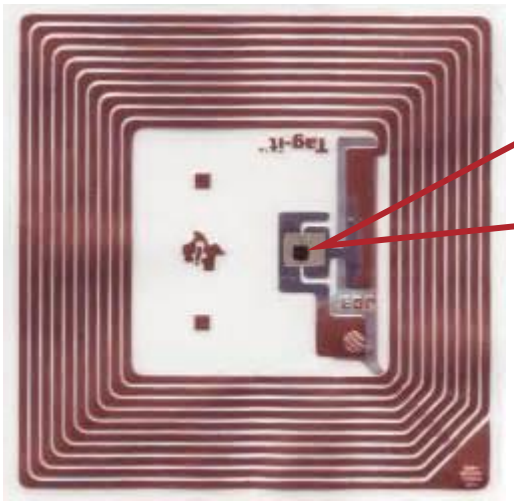
Backscatter Basics

Incident Signals

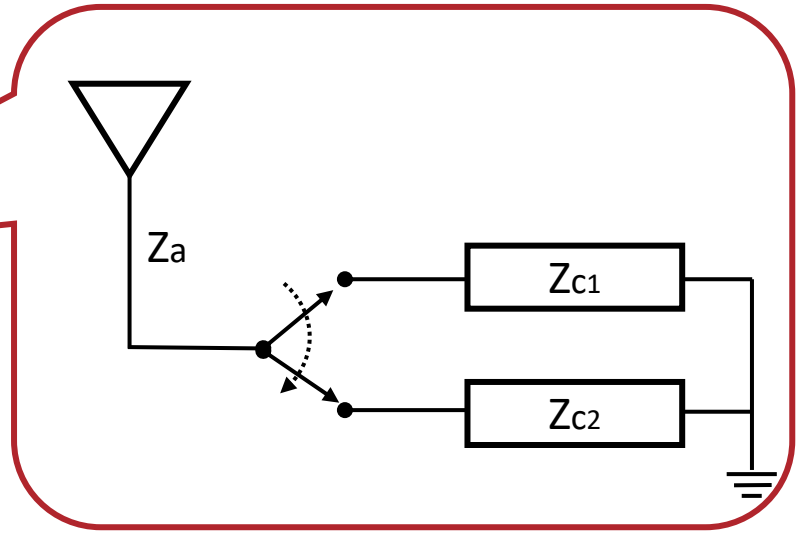


Reflected Signals

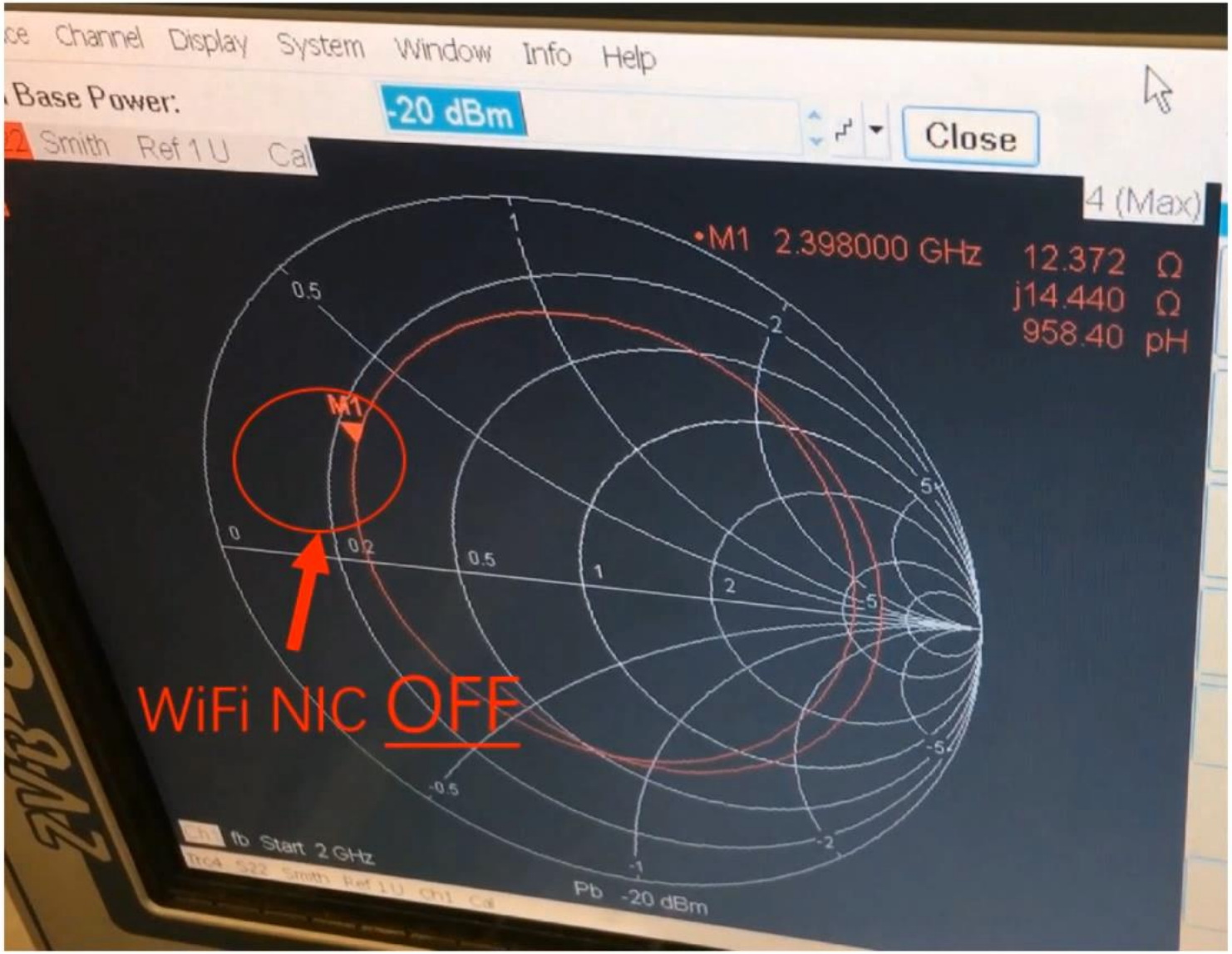
Backscatter Transmitter



Impedance Switching Circuits



Backscatter through Commercial NICs

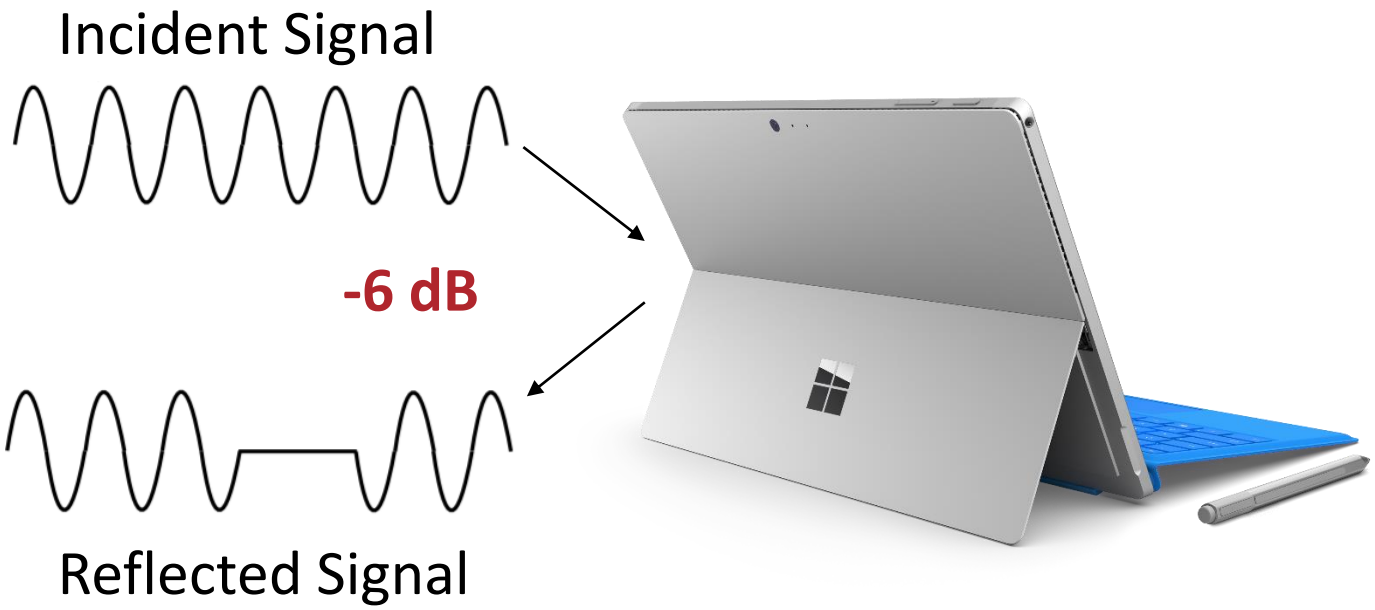


Vector Network Analyzer

BCM 1045 Wi-Fi NIC

NICScatter Efficiency

Model	Off State	On State
BCM1045, ant1	12.4+j14.4	106.9-j9.8
Intel5300, ant1	119.0+j137.0	80.3+j66.8
Intel5300, ant2	54.3+j122.7	57.7+j78.4



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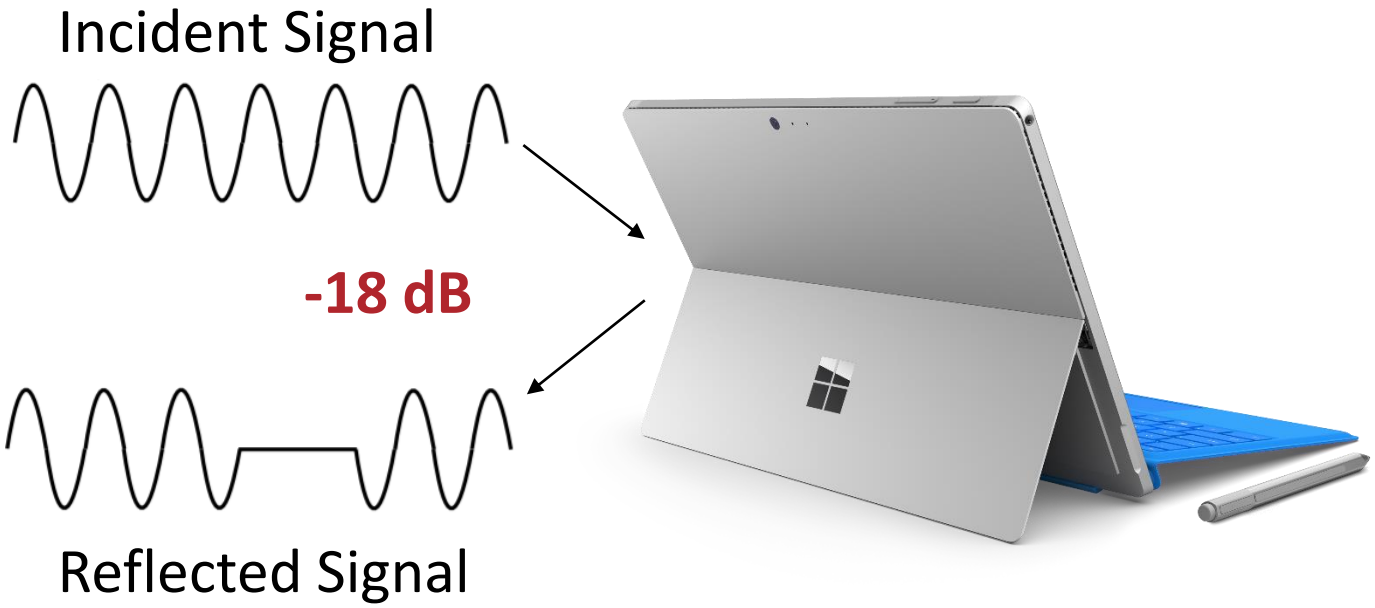
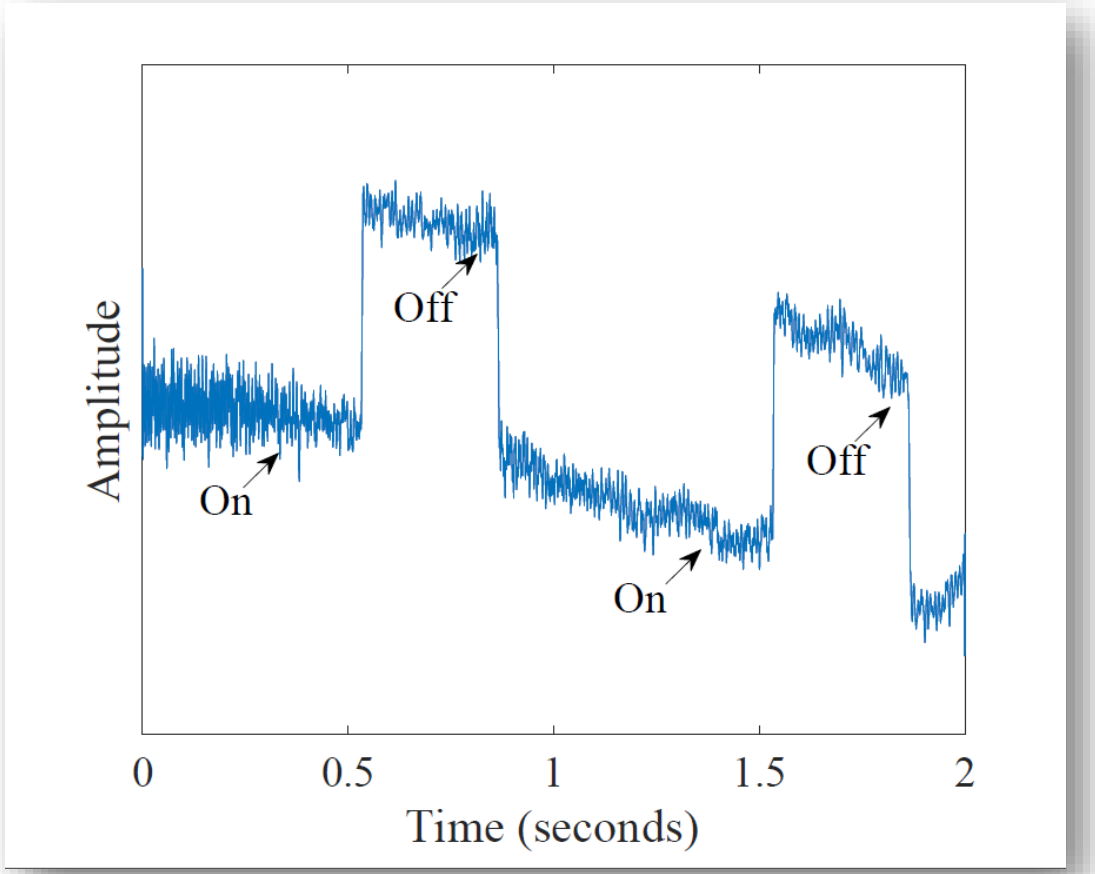
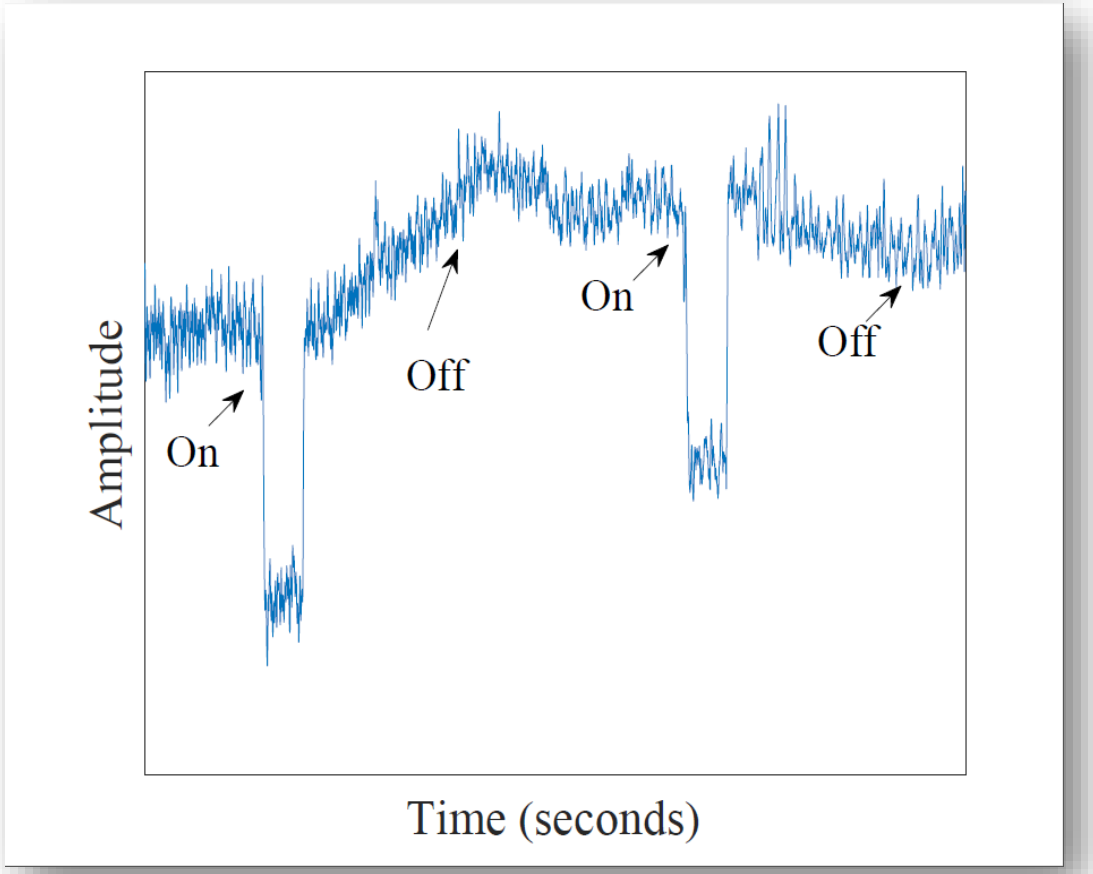


Reflection Diversities

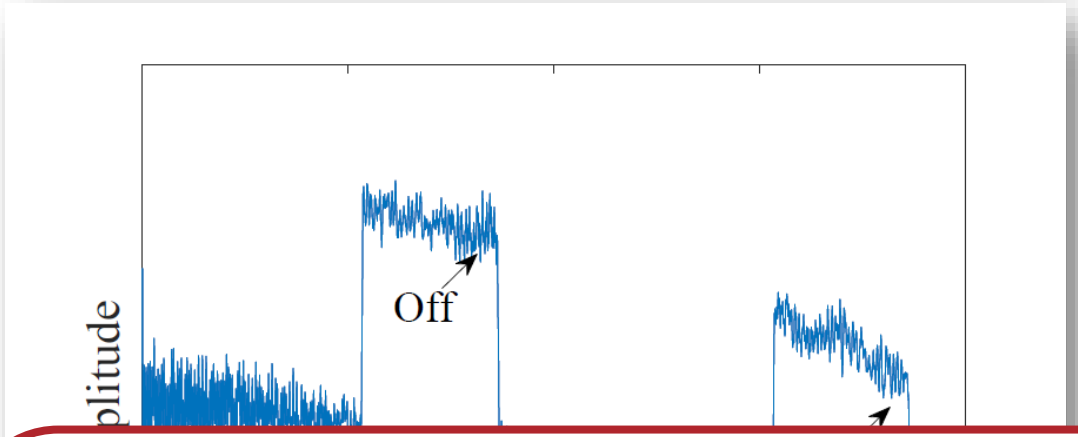


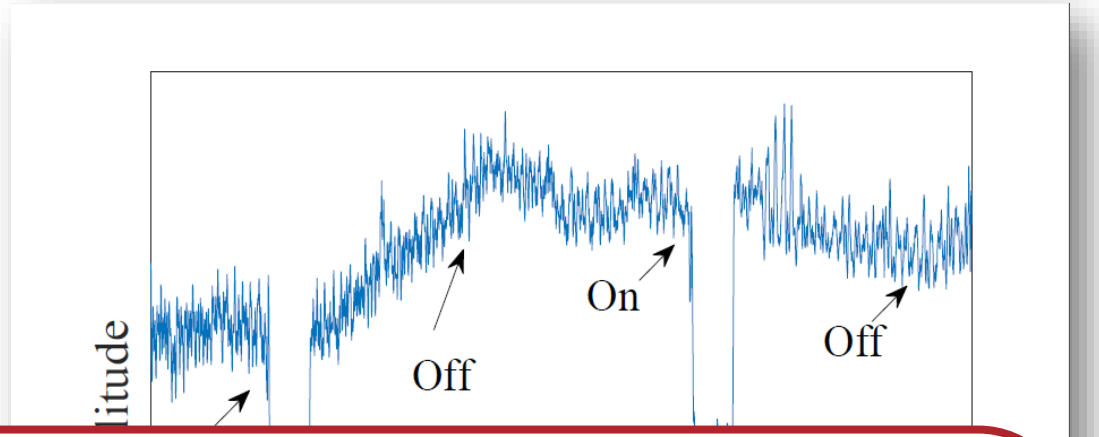
Intel 5300



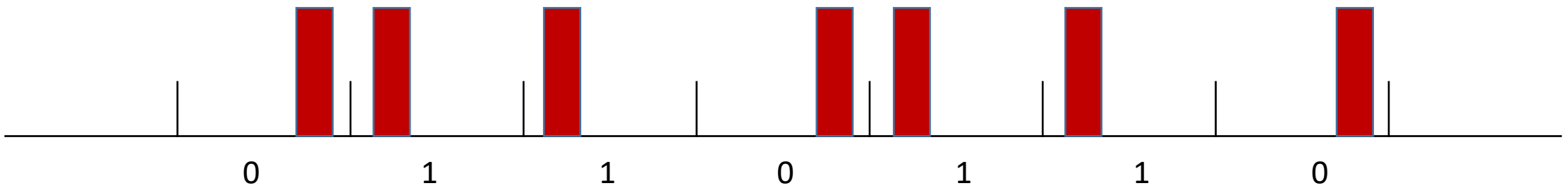
Atheros AR9285

Reflection Diversities

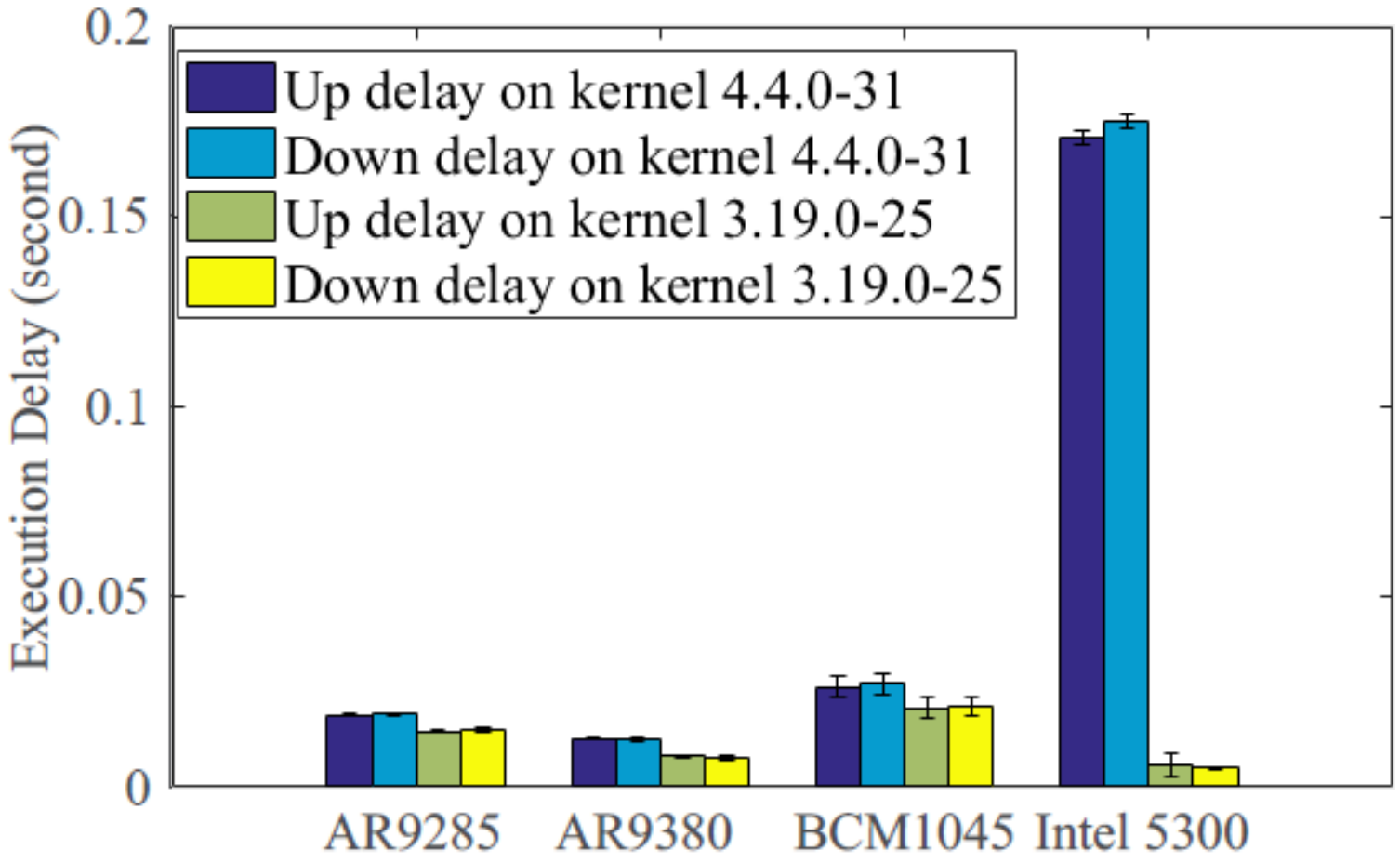




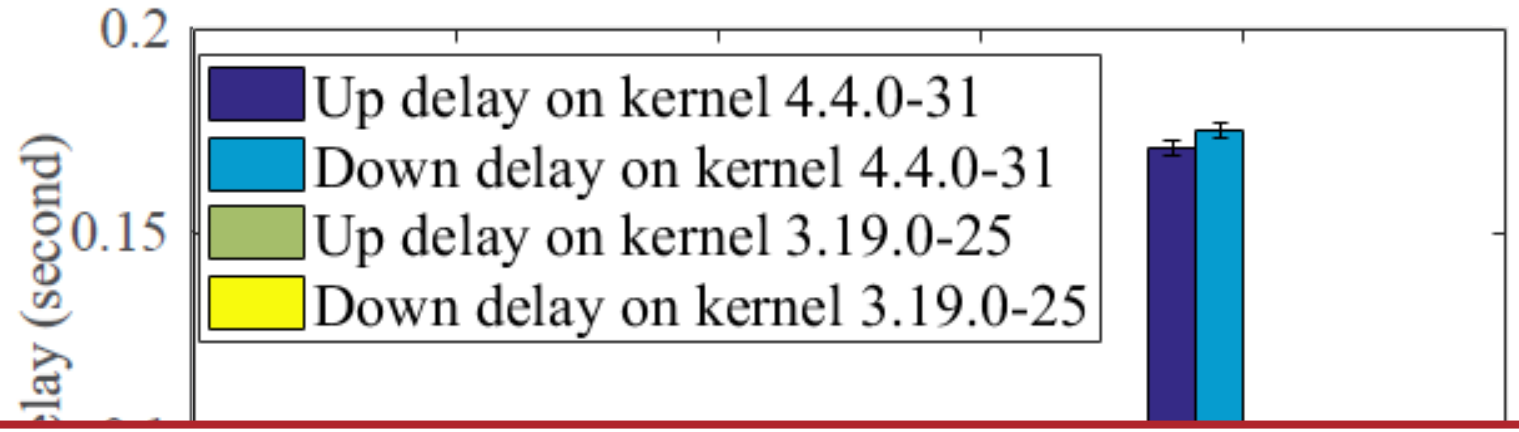
On Off Position Modulation (OOPM)



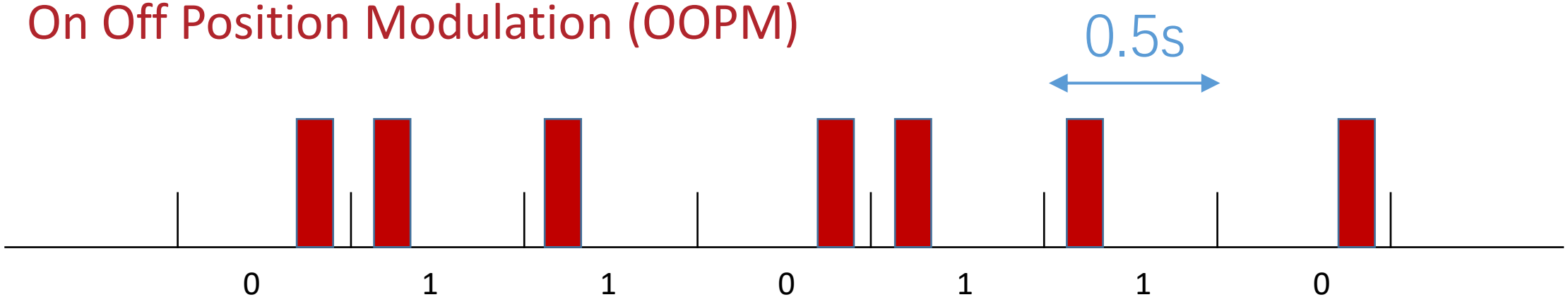
Latency Diversities



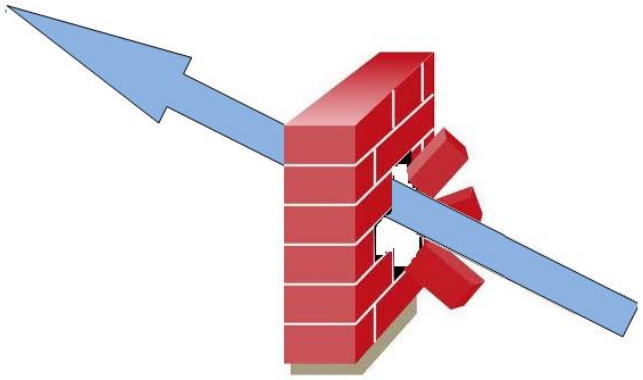
Latency Diversities



On Off Position Modulation (OOPM)

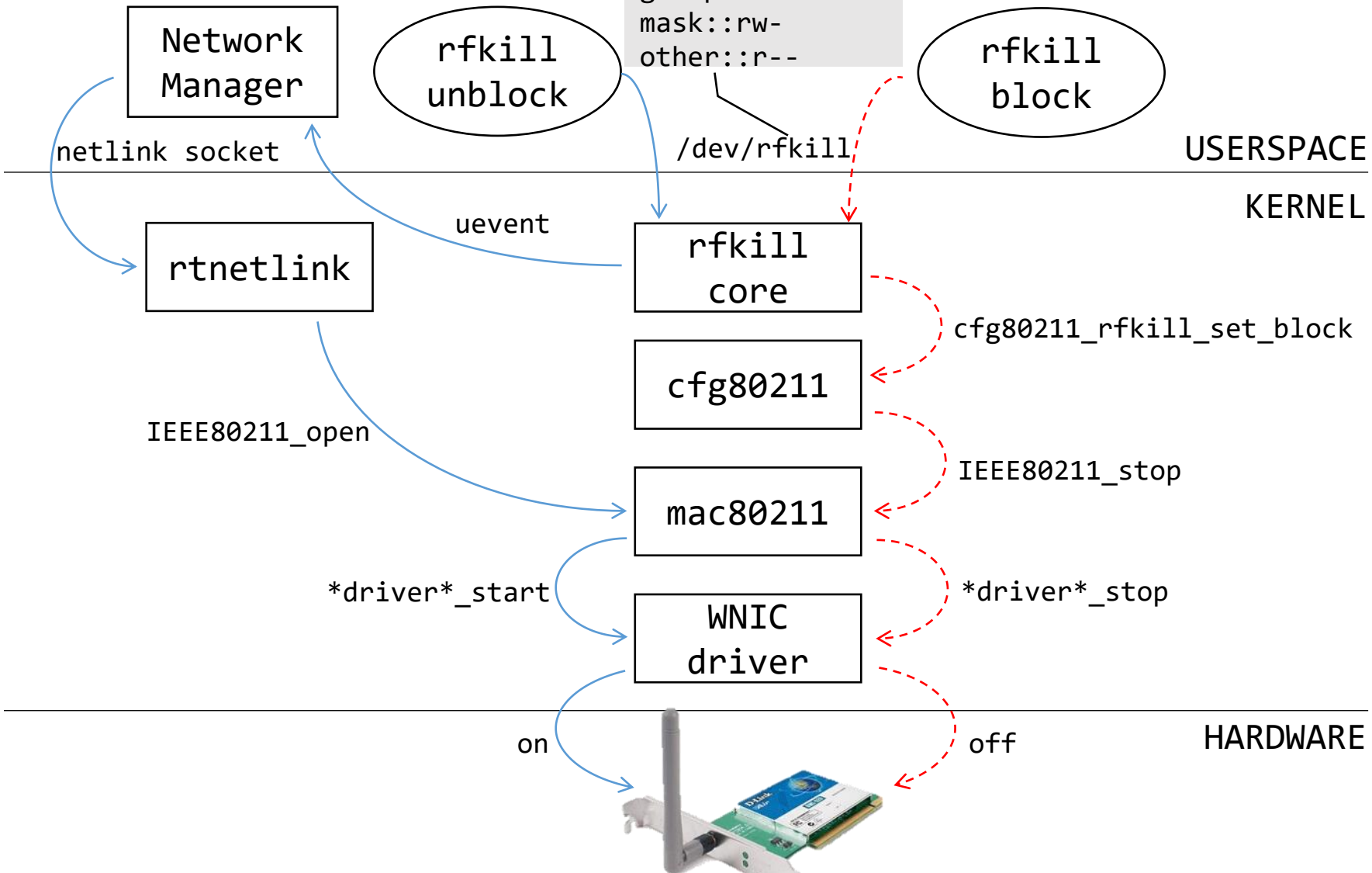


How to Hide the Communication ?



RFKILL tem

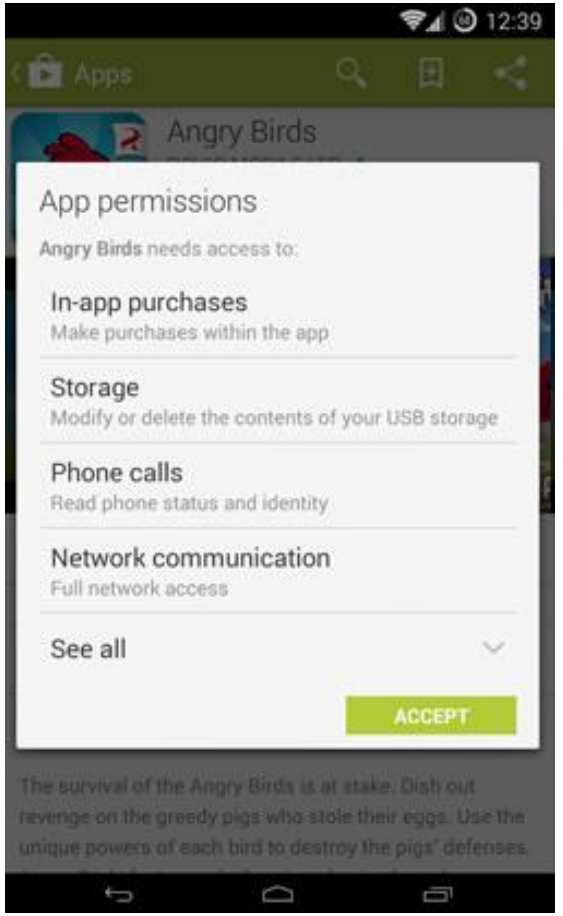
```
# file: rfkill
# owner: root
# group: netdev
user::rw-
user:testu:rw-
group::rw-
mask::rw-
other::r--
```



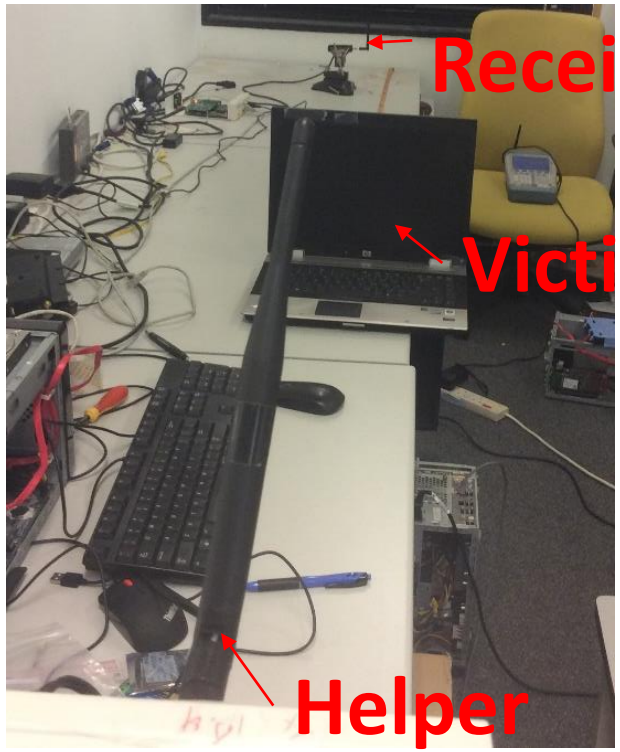
Android App Permissions

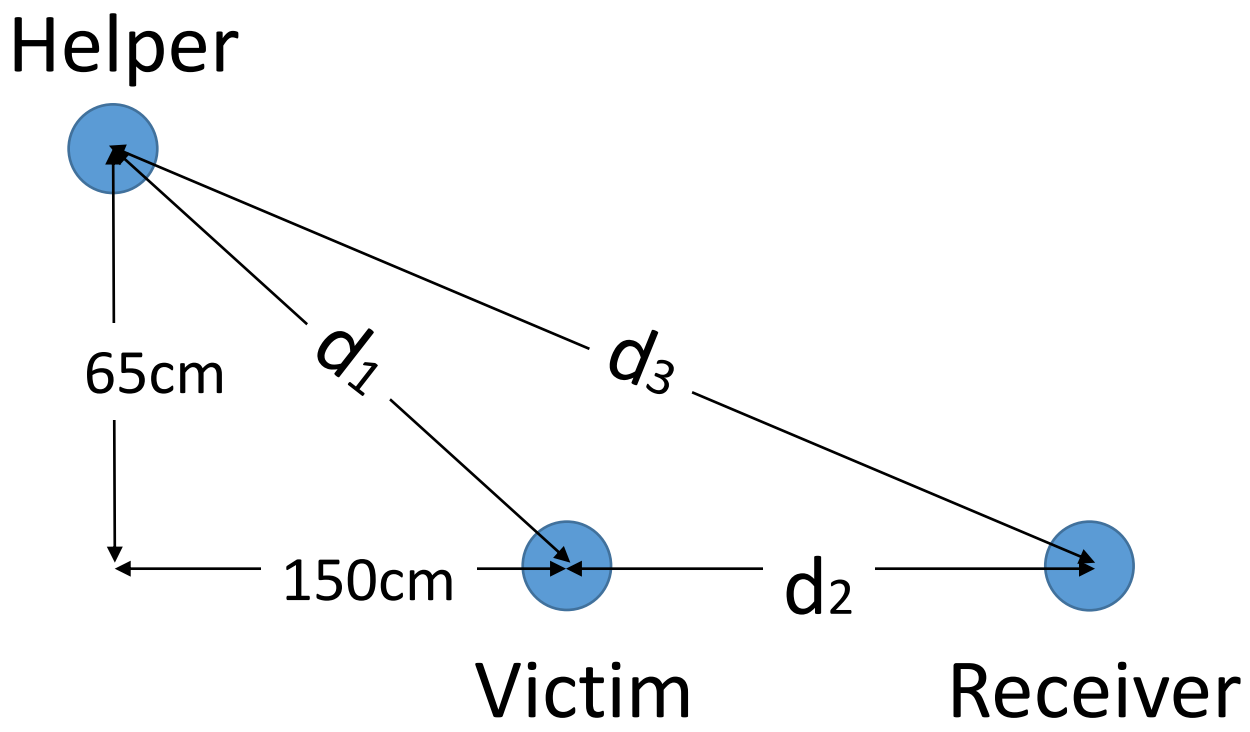
- Dangerous Permissions
  - READ_CALENDAR, CAMERA, READ_SMS, READ_CALL_LOG …
- Normal Permissions
  - SET_ALARM, SET_TIME_ZONE, …

  CHANGE_WIFI_STATE



Attack Scenario



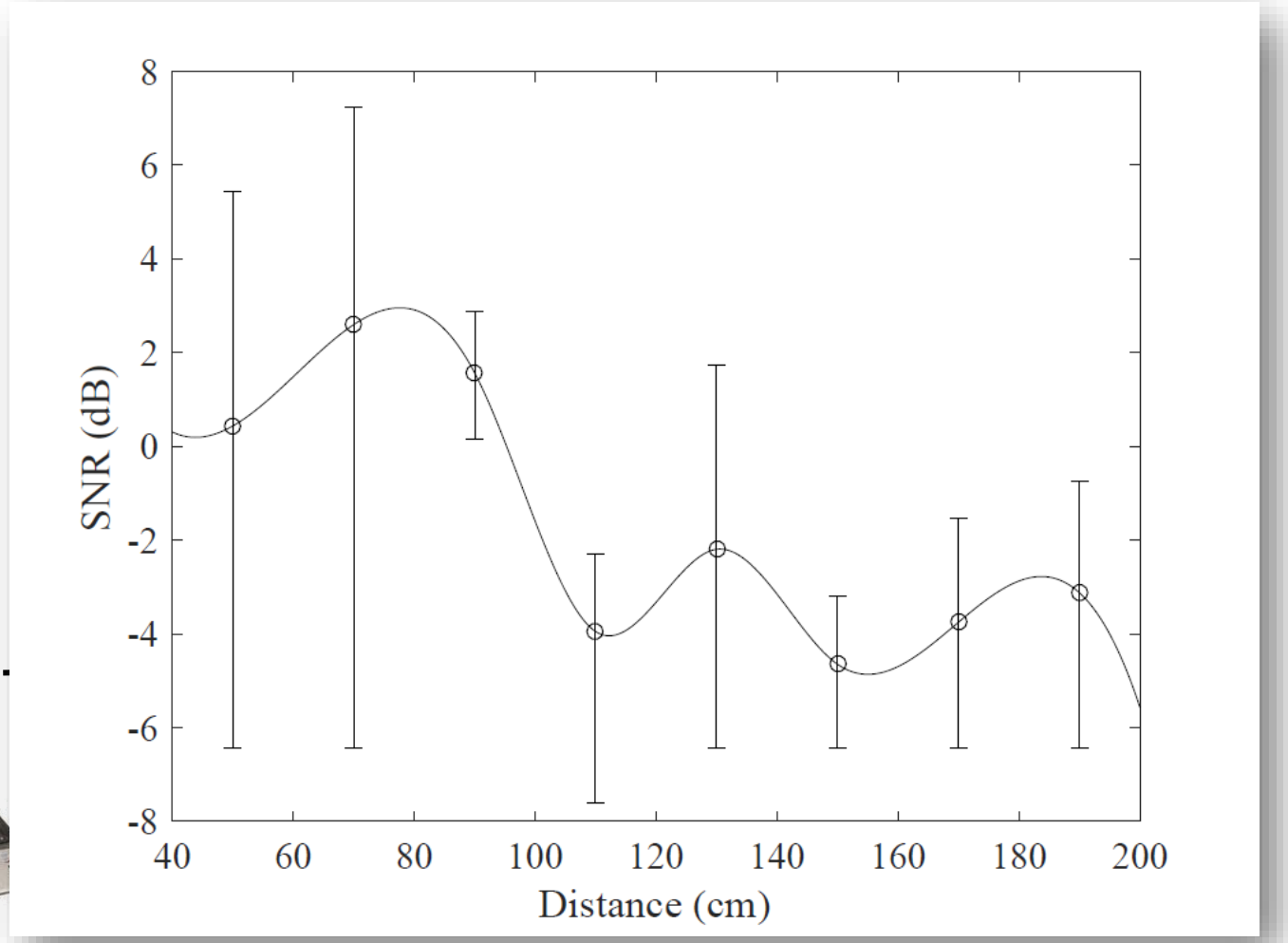


Attack Scenario

N210

Incident Signal

HP Elitebook 8530P

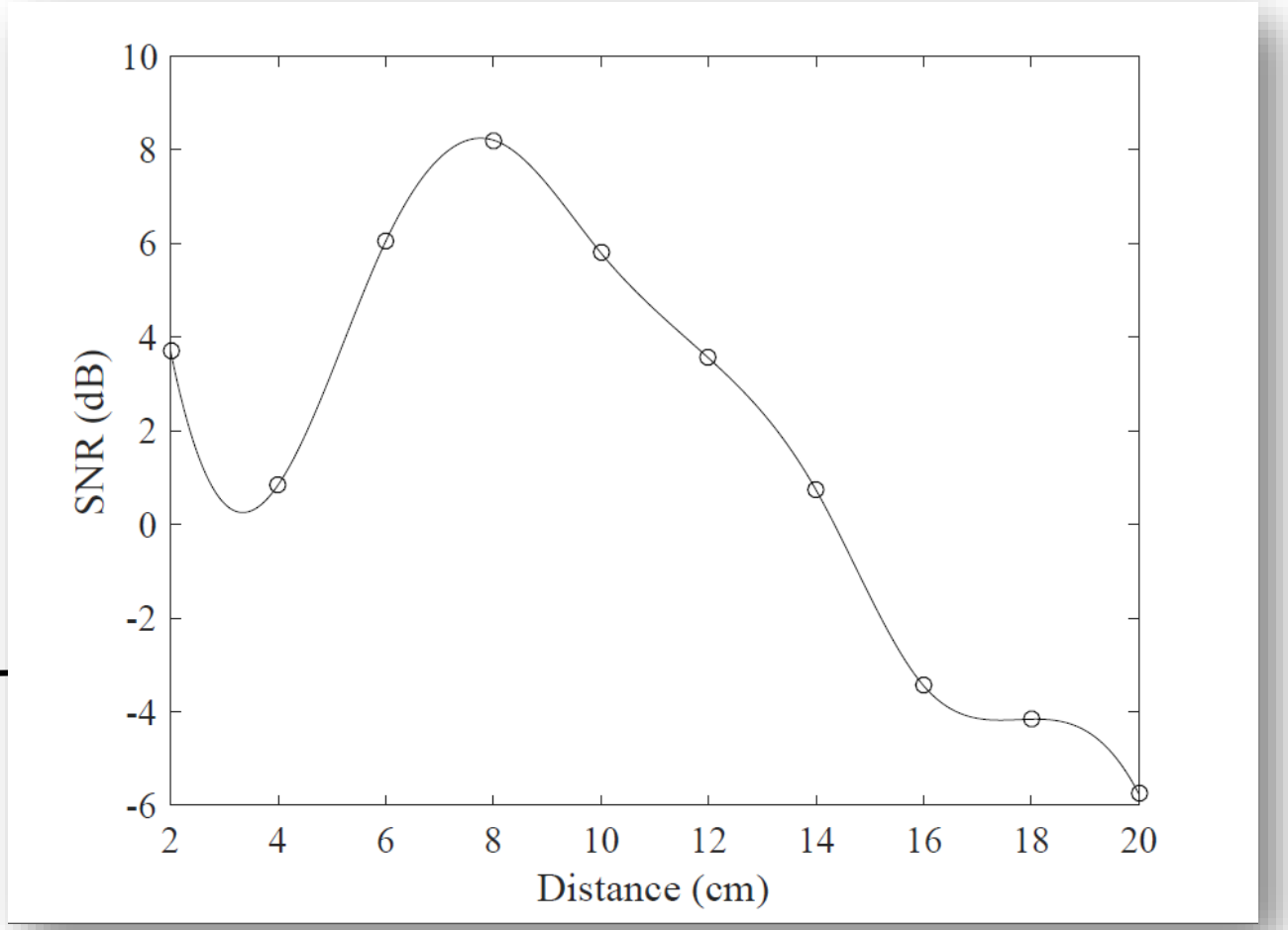


Attack Scenario

N210

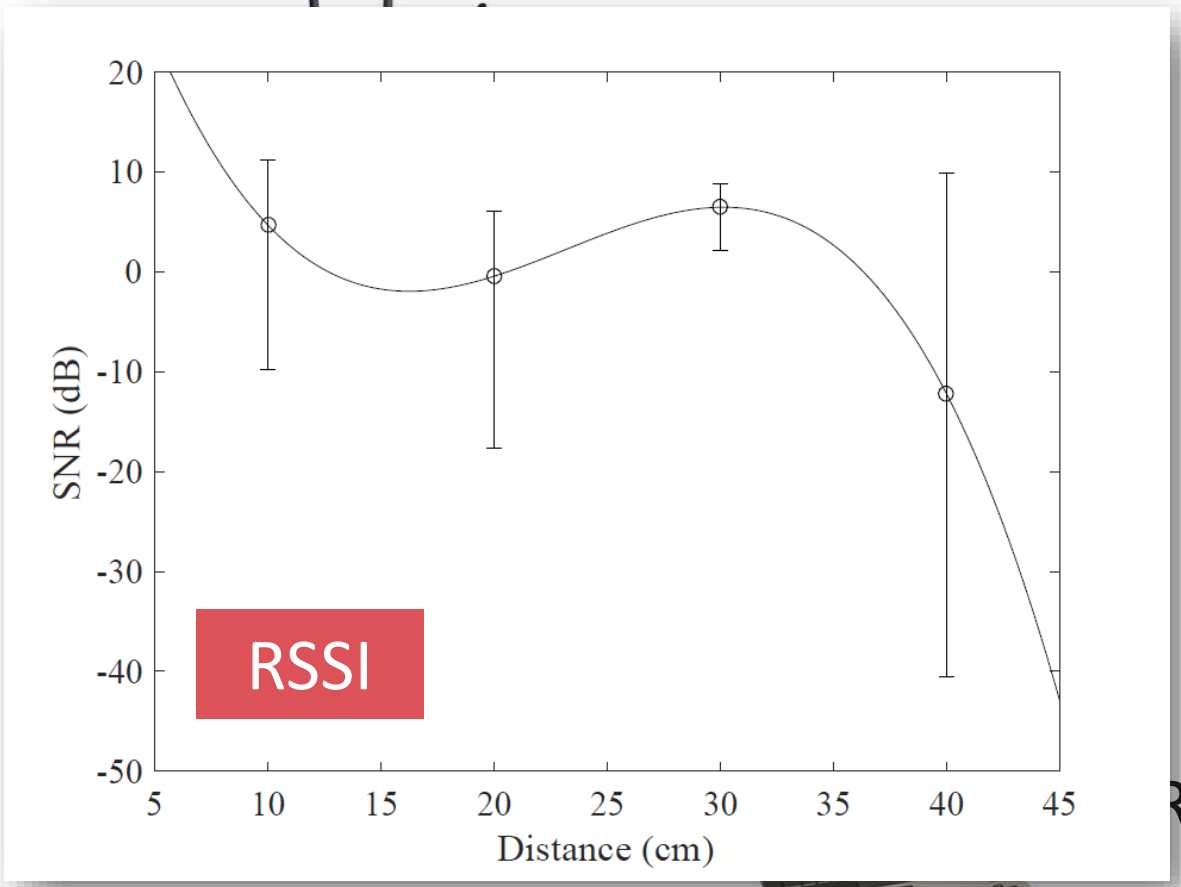
Incident Signal

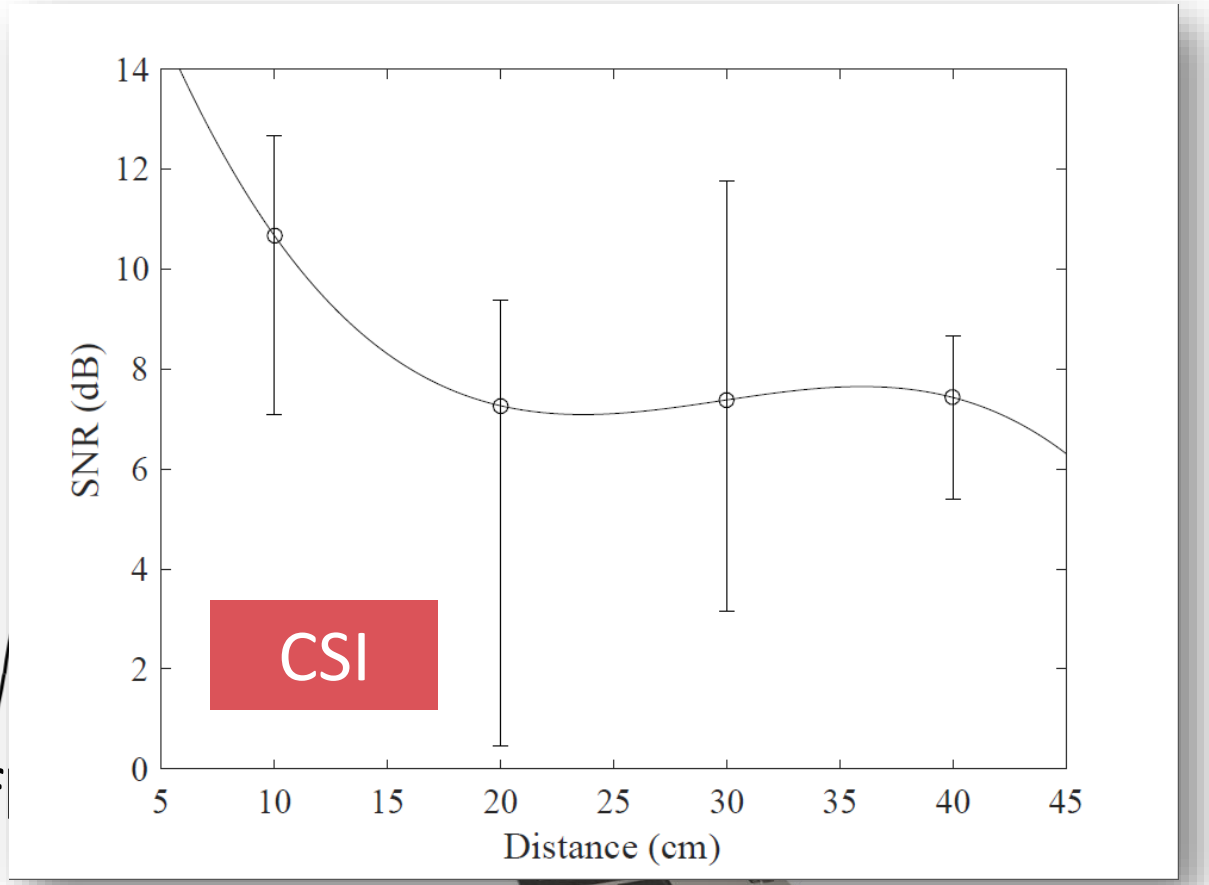
Galaxy S2



Attack Scenario

TPLink 4300



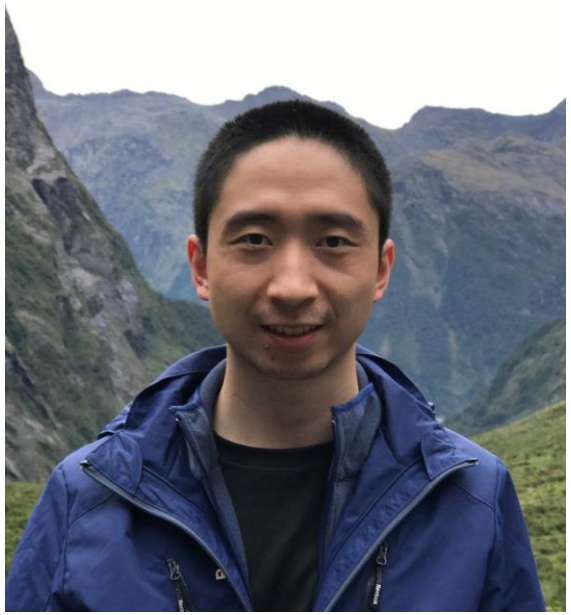


HP Elitebook 8530P

HP Elitebook 8530P

Limitations and Discussion

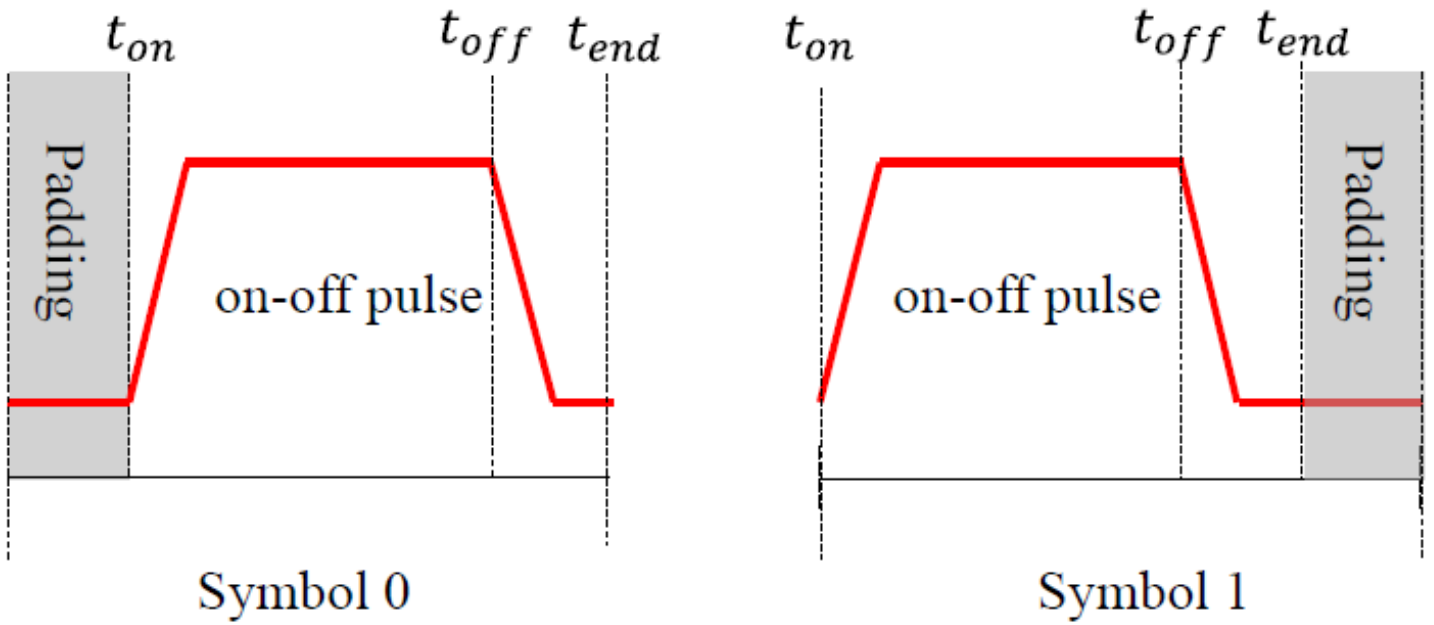
- Communication Distance
  - SINR, NIC Models, Antenna Gain, etc.
  - ➢Interference Cancellation
- Date Rate
  - Software: NIC Driver, Hardware: On-off processing logic
  - ➢Fast impedance change
- Possible Applications
  - Cross Protocol Communication, Wireless Sensing, etc.



Thank you!

Backup Slides

On-o Position Modulation (OOPM)



Transmission Time of Sensitive Information

Data	bits	Laptop@30cm	USRP@90cm
MAC Address	48	49 sec	54 sec
Plain Password	64	1.09 min	1.20 min
MD5	128	2.18 min	2.40 min
GPS Coordinate	128	2.18 min	2.40 min
SHA1 Hash	160	2.72 min	3.00 min
Disk Encryption Key	256	4.35 min	4.80 min

Receiving Range