Testing Document Readers to the limit

The active display attack
Black-Box Testing of ABC Systems
EMP vulnerability report

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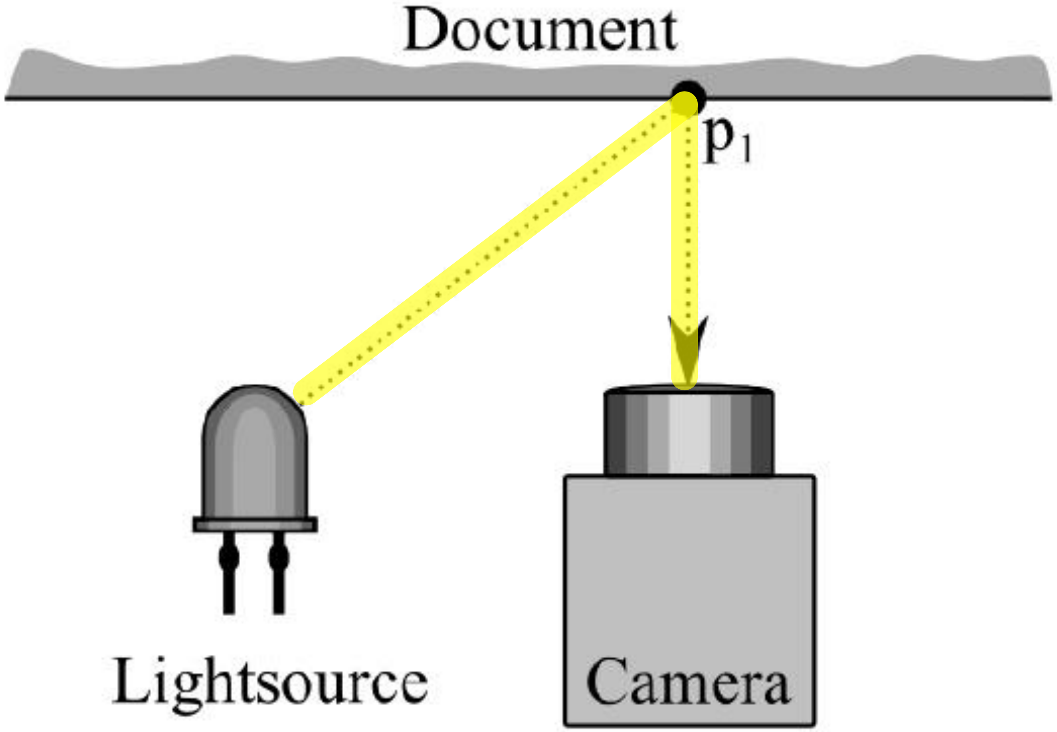
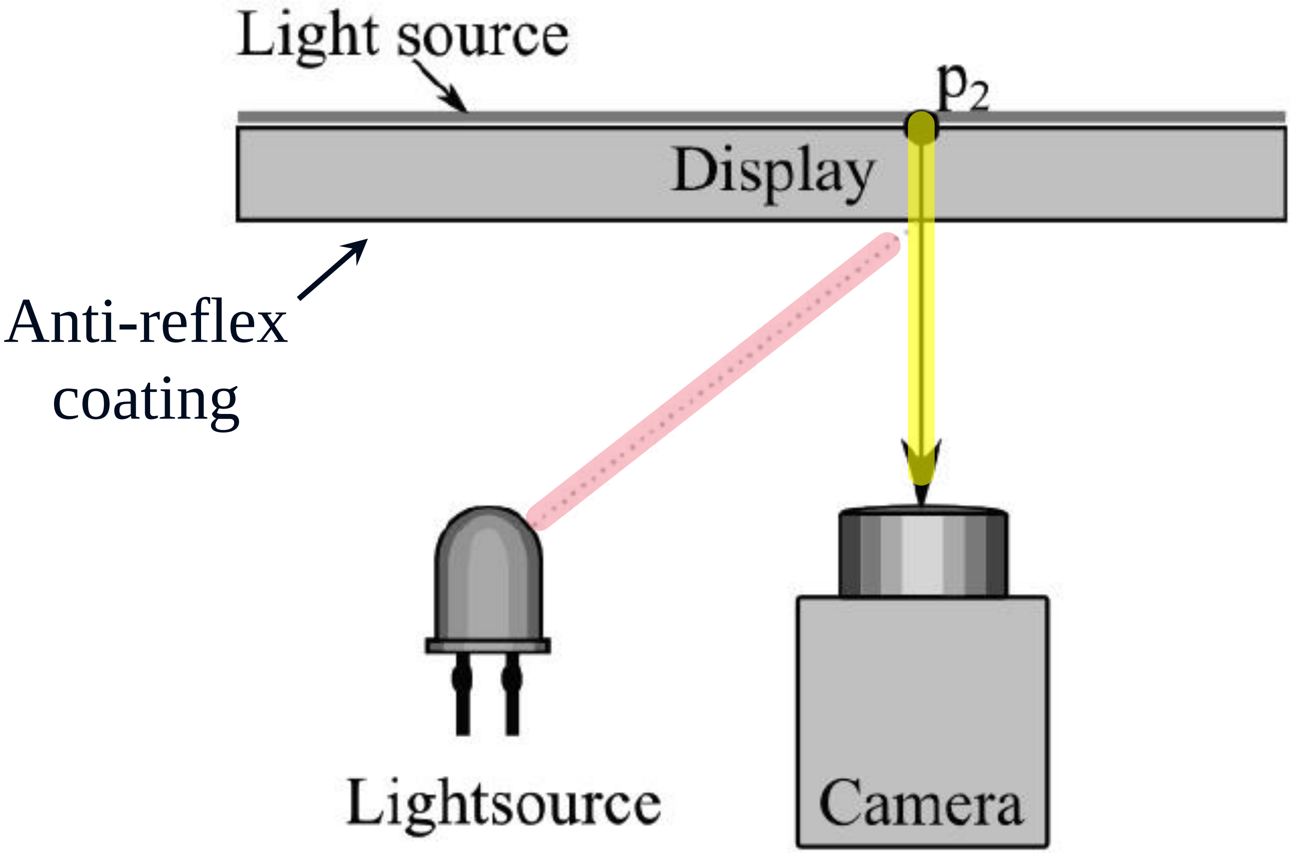
Active display attack

- Automated Border Control (ABC) systems
- Important aspect – identity document / document reader
- Unattended operation of the document reader necessary
- Opens up new attack scenarios

Active display attack



Active display attack



Active display attack

- It works!
- Off-the-shelf hardware can be used
- Will be an issue with wider deployment of ABC Gates

Document simulator

- Automated Border Control (ABC) systems
- Important aspect – identity document / document reader
- We need quality assessment of passport readers and software!
- Testing – very tedious
- Simulate documents for automatic testing

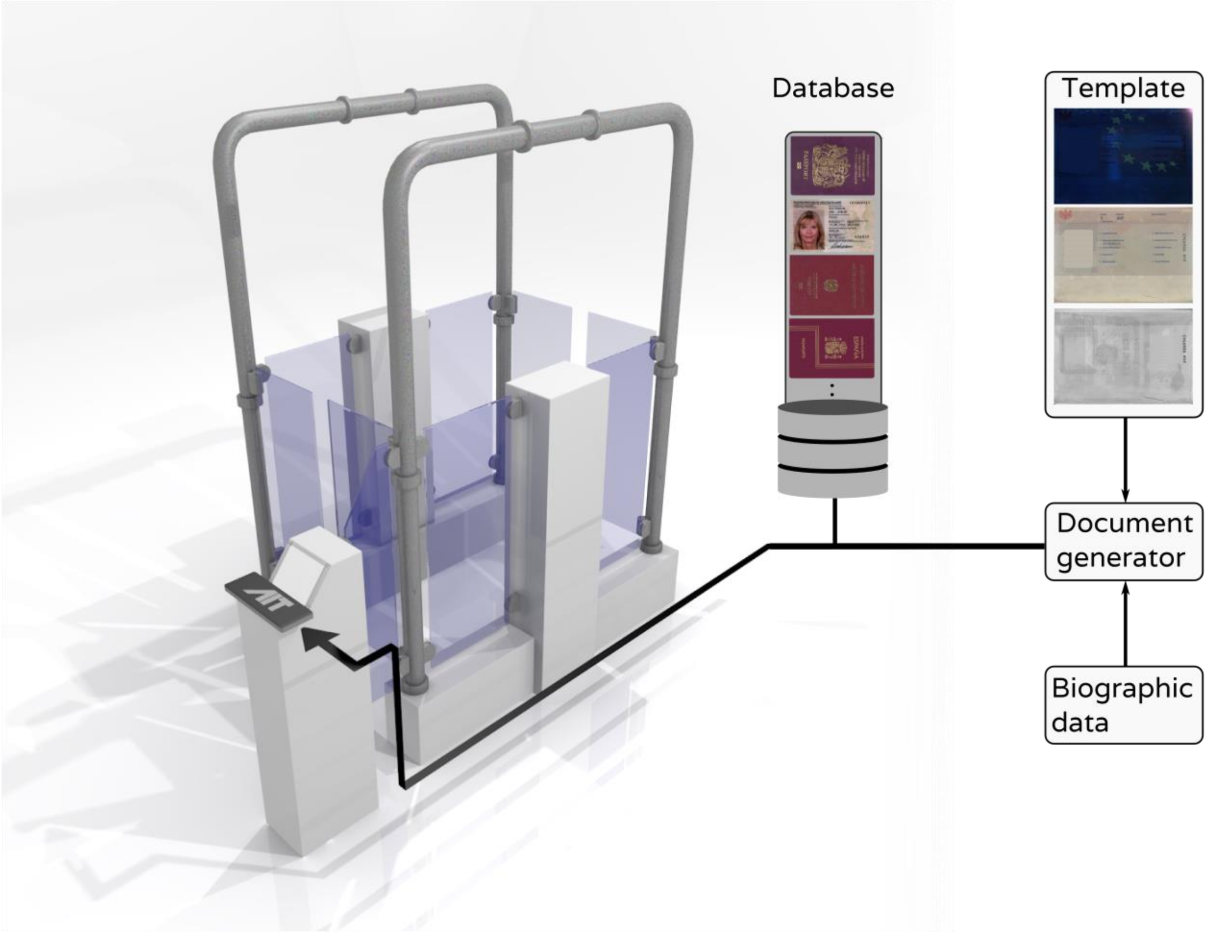
Document simulator

- **Exploit inherent “weakness” of state-of-the-art passport readers**

- Allows for
  - Black-box testing of whole ABC gate
  - Automated simulation of large quantities of passports
  - Testing robustness against the active display attack

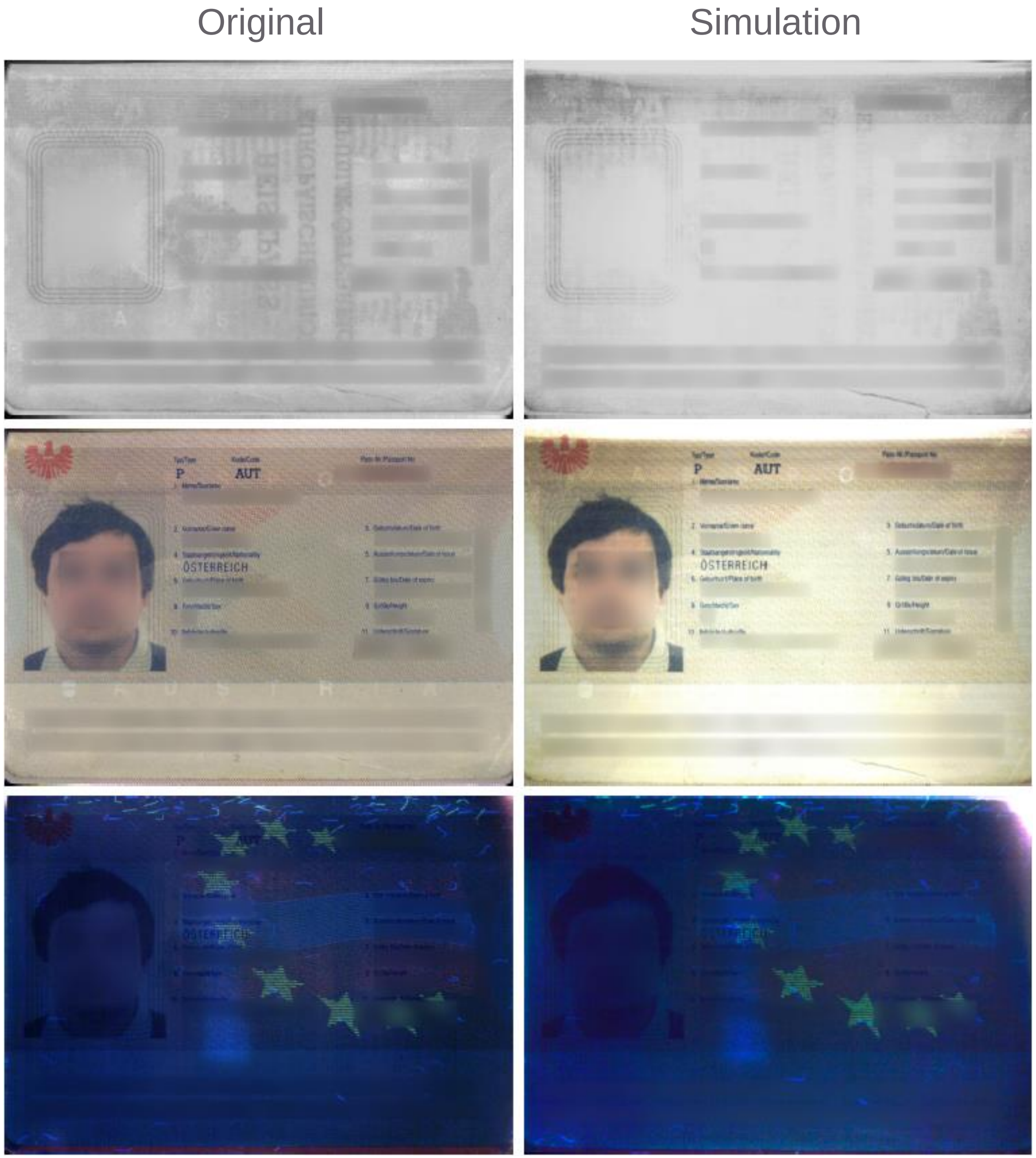
- Simulator running on dedicated hardware
  - 7“ full-HD display
  - Small CPU board
  - photo diode
  - Wi-Fi access point

Usage scenarios



Simulator demo (Video)

Results


Original

Simulation

Conclusions

- The simulator can simulate all optical security features currently checked by state-of-the-art document readers (provided accurate calibration of the simulator)
- The simulator allows for simulating a broad range of documents as well as various effects determining apparent document quality on a range of document readers

Future work

- Reconsider requirements for passport readers
    - How big deviations from normal should be reliably detected by a reader?
    - How big errors are still acceptable and allowed to pass?

- Reconsider security features for optical document security
    - Automated verification of security documents becomes inevitably more and more important
    - Most security features are not designed with automated verification in mind

Investigation of the Vulnerability of Electronic Document Readers to High Power Electromagnetic signals

- What are electromagnetic threats?

- IEMI…Intentional Electromagnetic Interference

Motivation to use IEMI sources to attack ABC Systems

- Criminals want to blackmail providers of critical infrastructures and/or governmental institutions

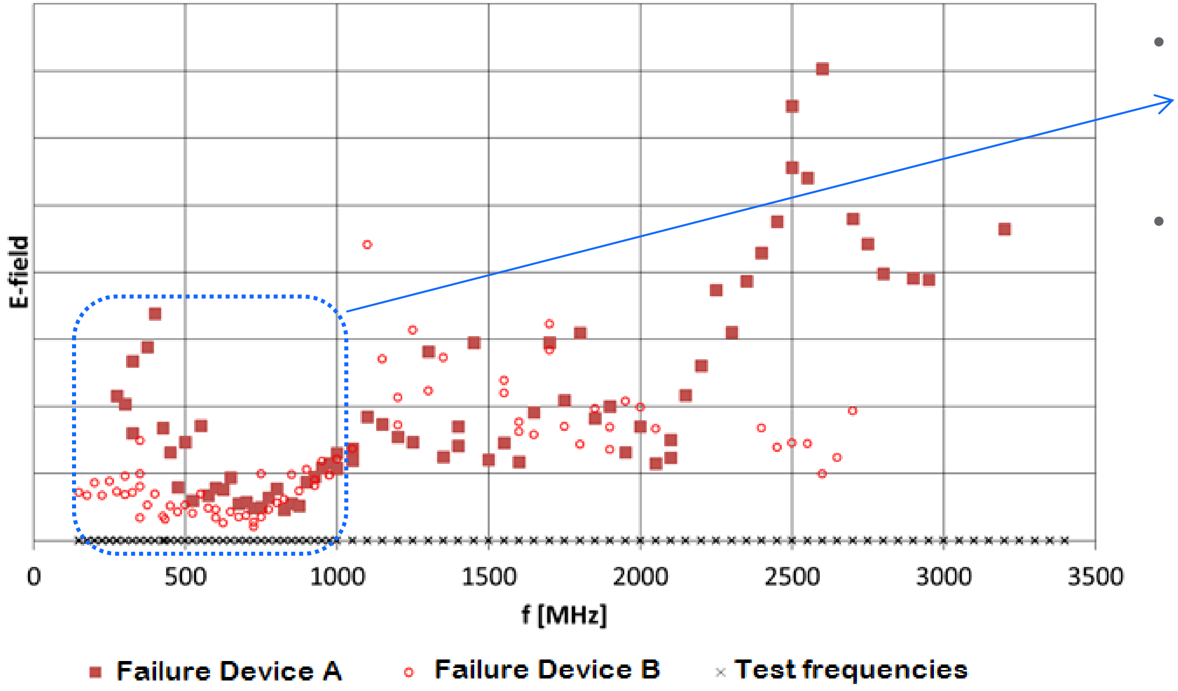
- Attackers want to bypass security zones by disturbing border control systems

- Terrorists want to immobilize the critical infrastructure airport

- Curiosity, some individuals in the society want to create chaos and so they see distortion of electronic components at an airport as a challenge

Results

- Multiple disturbances, but no destruction of the electronic passport readers were observed in our tests
- Many disturbances made a manual reset of the devices necessary – need for skilled staff in order to re-establish routine procedures

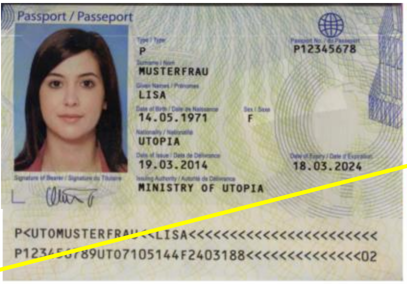


- Highest sensitivity of both devices was found below 1 GHz
- In particular below 1 GHz disturbances can be induced by using small handheld IEMI sources – such systems can be easily hidden and do not require high qualified users

Results: Type of disturbances

- Interference: passport readers re-establish routine operation without external intervention
- Upset: external intervention is required in order to re-establish routine operation

Correct readout



Passport / Passeport

Type / Type
P

Passport No. / du Passeport
P12345678

Surname / Nom
MUSTERFRAU

Given Names / Prénomes
LISA

Date of Birth / Date de Naissance
14.05.1971

Sex / Sexe
F

Nationality / Nationalité
UTOPIA

Date of Issue / Date de Délivrance
19.03.2014

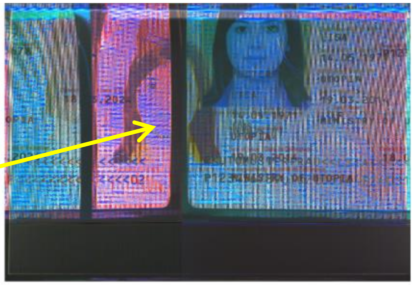
Date of Expiry / Date d'Expiration
18.03.2024

Signature of Bearer / Signature du Titulaire

Issuing Authority / Autorité de Délivrance
MINISTRY OF UTOPIA

P<UTOMUSTERFRAU<<LISA<<<<<<<<<<<<<<<<<<<<<<<
P123456789UT07105144F2403188<<<<<<<<<<<<<<02

Failed readout



Errors	Effect during exposure
Interference (no reset required)	- No picture, distorted picture - No Machine Readable Zone (MRZ) - RFID could not be read out
Upset (Reset necessary)	- USB disconnect - Software error (crash)

Conclusion

- The campaign has shown that it is possible to disturb electronic passport readers with both pulsed and CW signals at various frequencies.
- Consequences of manipulated document readers on the ABC system?

  → loss of time, chaos on the airport, reduction of security at control point
- Measures to protect critical infrastructures against IEMI are required
- We have only looked at a part of the whole system!

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