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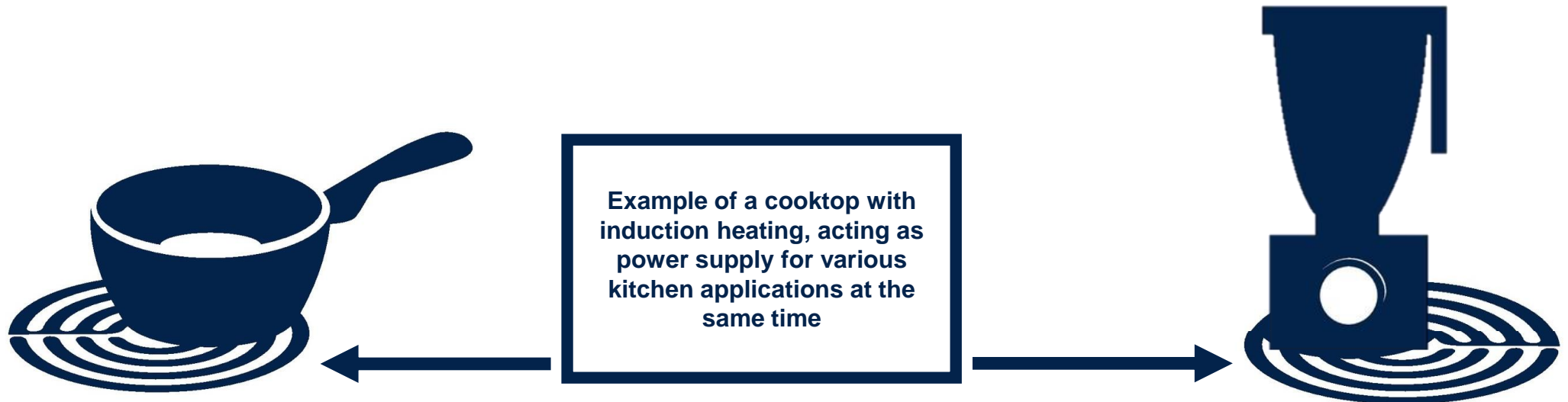
# ST brings the cordless kitchen to life

ST MDG Korea

양태영 부장 (Duke Yang)

# Ki Cordless Kitchen General Information

- **Ki Cordless Kitchen** : standard targets to **replace traditional kitchen appliances using power cords (e.g. Mixer, Toaster, Rice Cooker, Coffee Makers..)** and to **combine eventually with induction cooktop**  
<https://www.youtube.com/watch?v=1CXDmqv9ws8>
- **Efficiencies > 90% of equivalent corded devices required – up to 2.2kW can be provided**
- **Advantages:** Higher Safety (no cords, liquids spilled), Higher flexibility, High interoperability between transmitter and receiver
- **Communication** between Transmitter and Appliance **based on NFC** : Power Control & additional smart features can be implemented



# NFC in the Ki Cordless Kitchen

- Standards body: WPC
- Ki Cordless Kitchen: up to 2300 Watts
- TX: Kitchen Hob, Induction Cooktop or Under Counter Hob
- RX: Small kitchen appliances (Airfryers, Blenders, Rice Cookers, etc.)
- Use Case for NFC with High Power:
  - Enables auxiliary power and bi-directional data path
  - Provides advanced features via connectivity
  - Essential for interoperability and safety





# Benefits of using NFC usage in Ki kitchen

- **Existing standard** allows easy integration into all appliances
- Short range allows for correct detection of the appliance
- NFC usage in **KI kitchen**

 **Auxiliary Power transfer:** wireless power transfer via induction to operate appliance with auxiliary power

 **Communication:** power negotiation, pairing, authentication, parameter setting, ...

 **Power control:** dynamic control of transferred energy

 **Protection:** detection of foreign objects to avoid damaging credit cards, passport,...

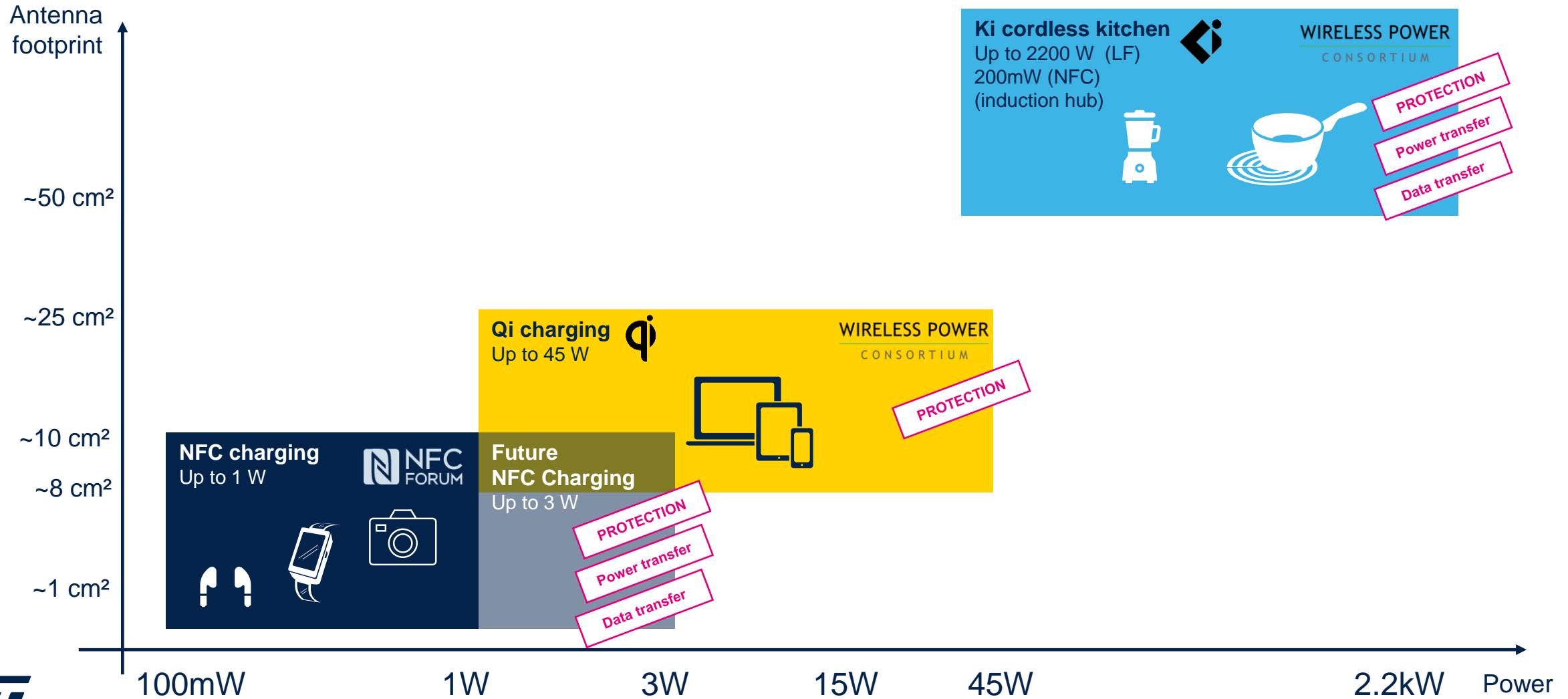
# Ki kitchen applications vs. mode

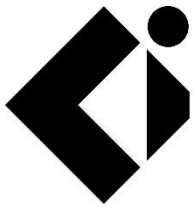
- Ki kitchen defines two different modes depending on appliance requirements
  - Static power transfer
    - The receiver in the appliance carries the information of the requested power to be transferred and additionally a ON/OFF message
    - A water kettle would be a typical appliance
  - Dynamic power transfer
    - The transmitter & receiver exchange information to dynamically adjust the power transferred to the given situation
    - A blender would be a typical appliance

Static appliance	Dynamic appliance
Kettels	Blender
Rice Cooker	Freestand Hob
Filter Coffee	Food Processor
Pod Coffee	Mixer
Espresso Coffee	Slow Cooker
Deep Fat Fryer	Juice Extractor
Electric Grill	Coffee Mill
Light Fryer	Breadmaker

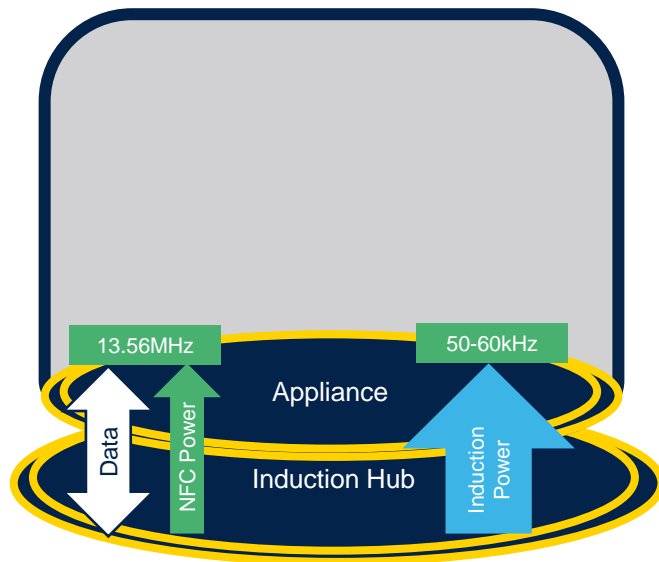
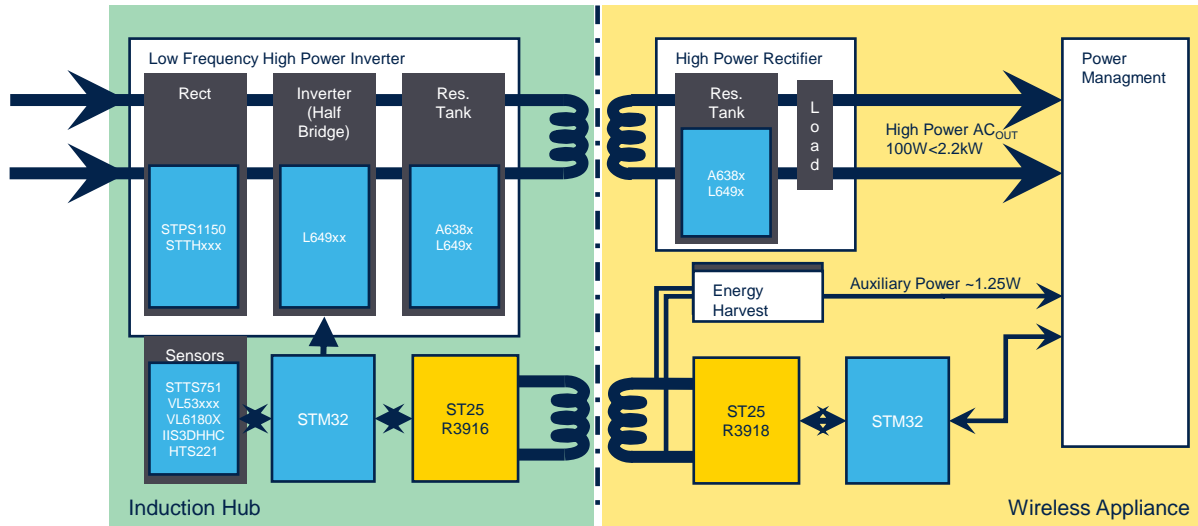


# NFC usage in wireless power transfer



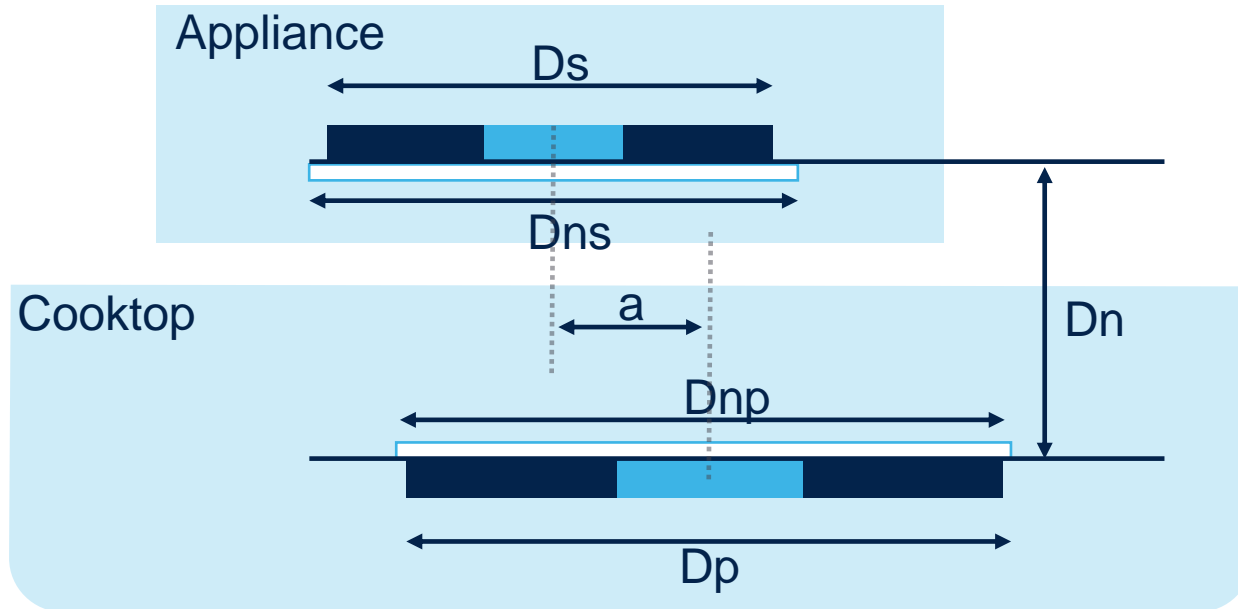


# Ki Kitchen system setup



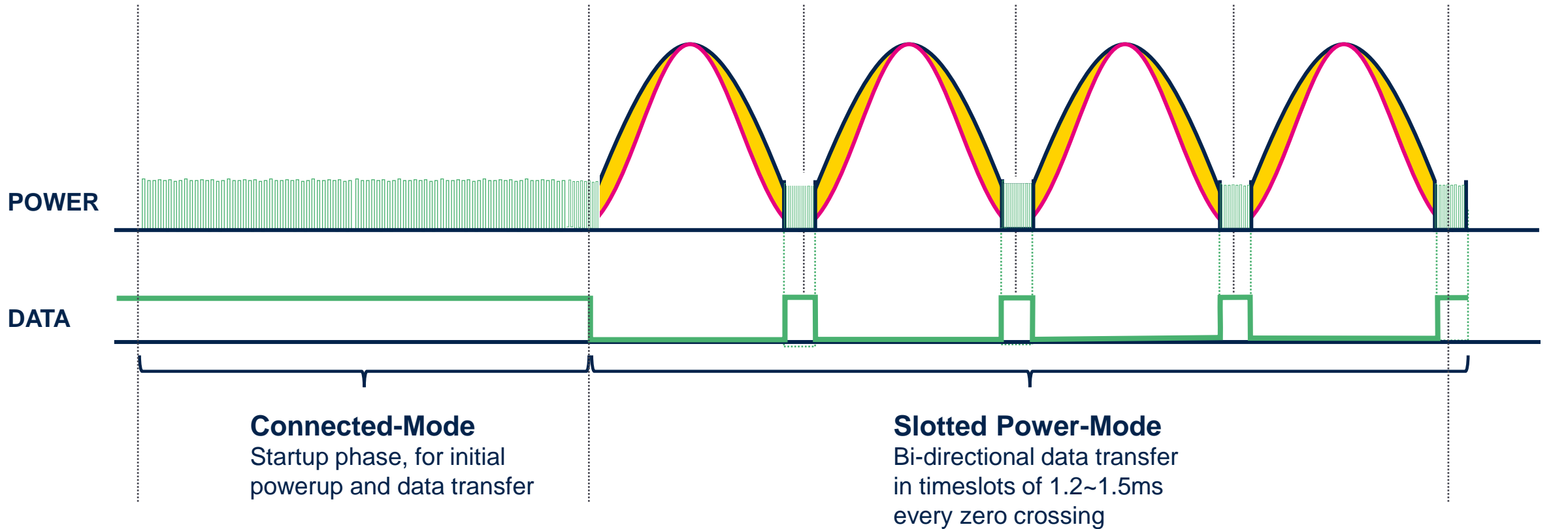
- ST25 inside Induction Hob (PTx side)
  - ST25R3916 usable on PTx side (induction hob), each cookspot requires an own NFC reader for fast data feedback loops
- ST25 inside Kitchen Appliance (PRx side)
  - Dedicated tag development needed
  - Short term gap filler
    - ST25R3918 in CE mode (limited to 106 kbps)
    - STM32 with software emulated tag
    - Next gen Dynamic Tag
- NFC Power Transfer
  - 200 mW over 4 cm
    - E.g. power kitchen appliance user interface
- NFC Communication
  - NFC-A 106 – 848
  - Proprietary Tag state machine and data transfer commands
  - Interleaved with wireless power transfer (50 / 60 Hz)




# Antenna and other dimensions



Sym	Description	Min	Max
$D_s$	Secondary coil, outer diameter	80mm	235mm
$D_p$	Primary coil, outer diameter	150mm	210mm
$D_{ns}$	Secondary NFC antenna, outer diameter	100mm	210mm
$D_{np}$	Primary NFC antenna, outer diameter	190mm	210mm
$D_n$	Distance of NFC antennas	9mm	42mm
$a$	Alignment Tolerance between the axes of antennas	0mm	40mm

# Auxiliary Power & slotted communication/power mode



-  High Frequency 13.56MHz NFC, Low Power & Data
-  Low Frequency, High power carrier
-  Power transferred



# ST solution for KI-Poller (NFC): ST25R3916



## ST25R3916

<b>Reader Writer</b>	<b>ISO14443 ISO15693 FeliCa</b>	<b>RAM BUFFER</b>	<b>SPI/I<sup>2</sup>C</b>
AP2P PP2P	<b>NFC</b>  848kb/s	<b>512-Byte</b>	2.4/5.5V
Card Emulation			3.4Mb/s 10Mb/s
<b>1.6W</b>	DPO: Dynamic Power Output CIWU: Capacitive & Inductive Wake Up AWS: Active Wave shaping NSR: Noise Suppression Receiver AAT: Automatic Antenna Tuning DSO: Driver Slope Adjustment EMD: Automatic EMD Error Handling		



QFN32  
Wettable flank



WLCSP

### Use cases

- Ideal for **NFC WLC charging** applications
- Accessories, IoT devices, small consumer electronics

### Key Features

- NFC Forum Universal Device (with CE mode)
- **1.6W** output power with dynamic power adjustment
- **Active Waveshaping, Noise Suppression Receiver**
- **Automatic Antenna Tuning**
- -40°C to **105°C** ambient temperature range (QFN)

### Key Benefits

- Low power operation & Standby mode (capacitive wake-up)
- Works in challenging environment like noisy LCD displays

# ST solution for KI-Receiver (NFC): ST25R3918



## ST25R3918

<b>Reader Writer</b>	<b>ISO14443 ISO15693</b>	<b>RAM BUFFER</b>	<b>SPI/I<sup>2</sup>C</b>
PP2P	<b>NFC</b>  848kb/s	<b>512-Byte</b>	2.4/5.5V
<b>CE</b>			3.4Mb/s 10Mb/s
<b>0.5W</b>	DPO: Dynamic Power Output LPID: Low power inductive card detection AWS: Active Wave shaping NSR: Noise Suppression Receiver DSO: Driver Slope Adjustment EMD: Automatic EMD Error Handling		



QFN32  
Wettable flank

### Use cases

- Ideal for **Reader+Tag**
- Access Control, Gaming, Consumer
- Apple AppClip; Android InstantApp

### Key Features

- **0.5W** dynamic output power
- **Active Waveshaping, Noise Suppression Receiver**
- **Low Power Tag Detection**
- -40°C to **85°C** ambient temperature range

### Key Benefits

- Low power operation & Standby mode
- Works in challenging environment like noisy LCD displays
- Excellent performance for low power applications
- CE mode allows easy start & interface with application on phones



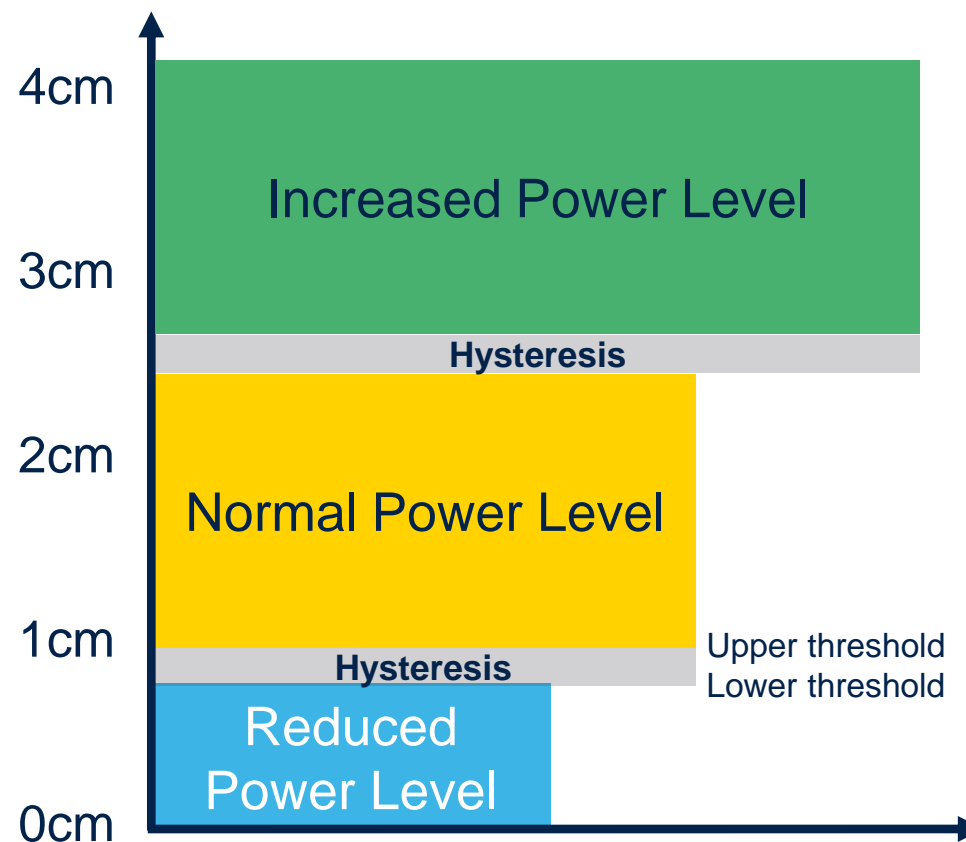
# ST25R3916/17/18 Lineup

Features	ST25R3916	ST25R3917	ST25R3918
Power	1.6W		0.5W
ISO/IEC 14443 Type-A	Yes		
ISO/IEC 14443 Type-B	Yes		
ISO/IEC 15693	Yes		
FeliCa™	Yes		No
NFC Tag read support	Yes		
ISO/IEC 18092 Passive Initiator mode	Yes		
ISO/IEC 18092 Passive Target mode	Yes	No	Yes
ISO/IEC 18092 Active Initiator and Target mode	Yes	No	
Card Emulation	Yes	No	Yes
Automatic antenna tuning (AAT)	Yes	No	
Capacitive sensor wakeup	Yes	No	
Low Power Tag Detection	Yes		



# ST25 Reader DPO: Dynamic Power Output

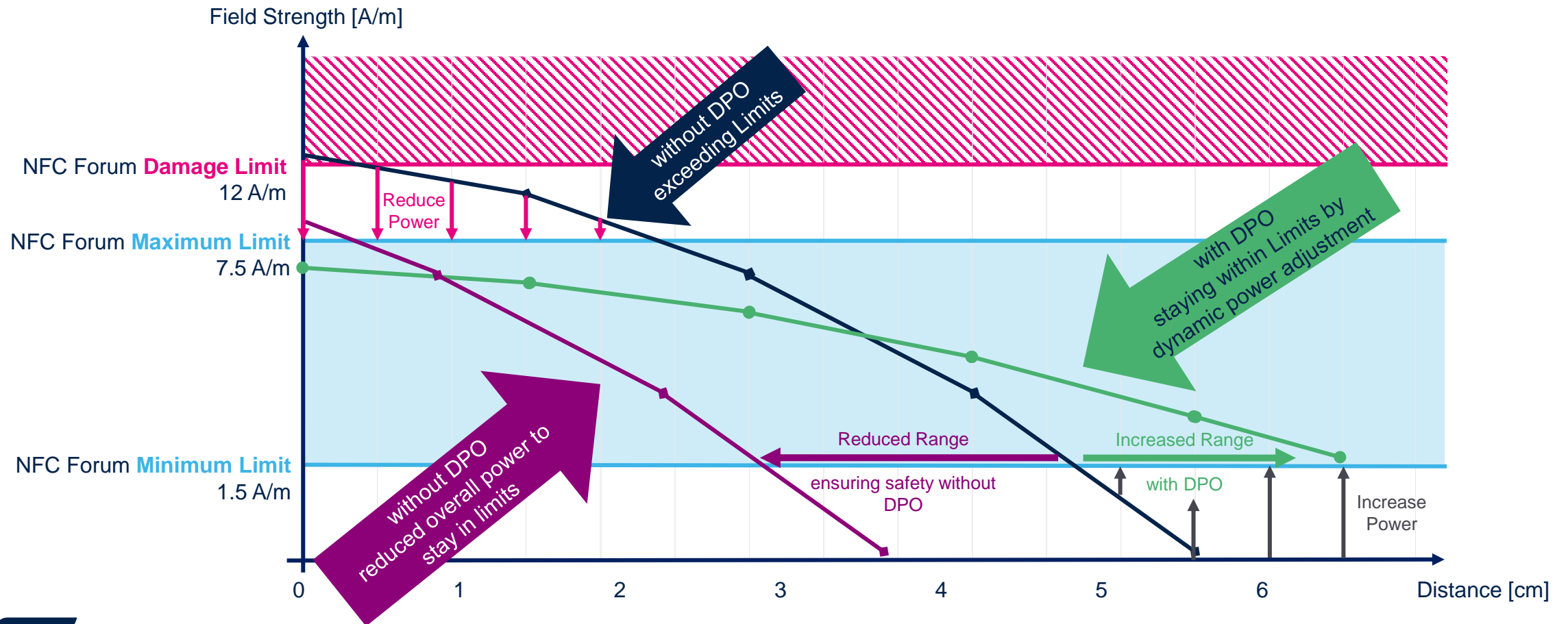
- **Achieve min/max power limits easier**  
The ST25R series allows to adjust the output power dynamically via Dynamic Power Output
- **Optimal performance from weak to strong card response**  
ST25R series allows to adopt to different power levels of card responses via Active Gain Control
- **Improved noise immunity**  
Squelch feature allows to scale the signal level to have improved immunity against noise





# ST25 Reader DPO: Dynamic Power Output

DPO of reader will keep power levels within requirements & limits





# NSR: noise suppression receiver

- Proper decoding

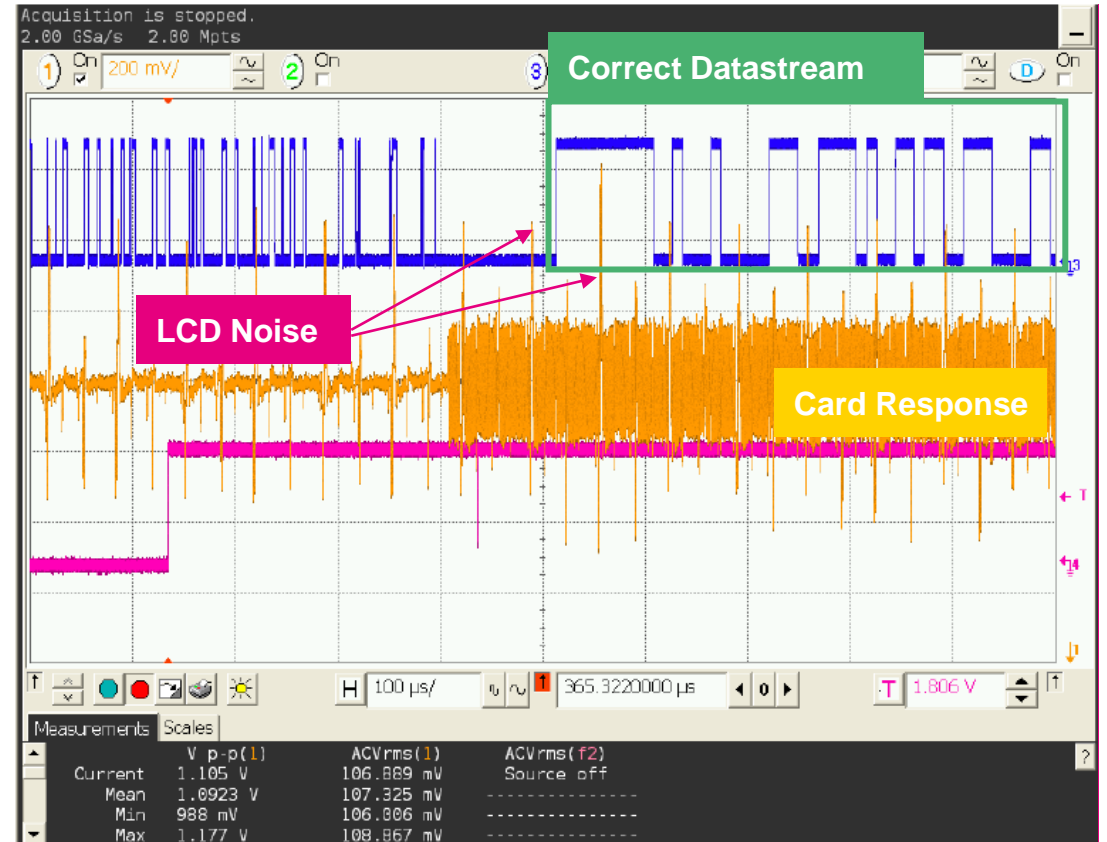
Proper decoding still possible even though LCD noise level exceeds card signal strength

ANS jumps in as soon as the receiver locks on a card response.

- Noise immunity compared to non NSR

Type A 106 display noise immunity improved by a factor of 3.3 vs ST25R3912

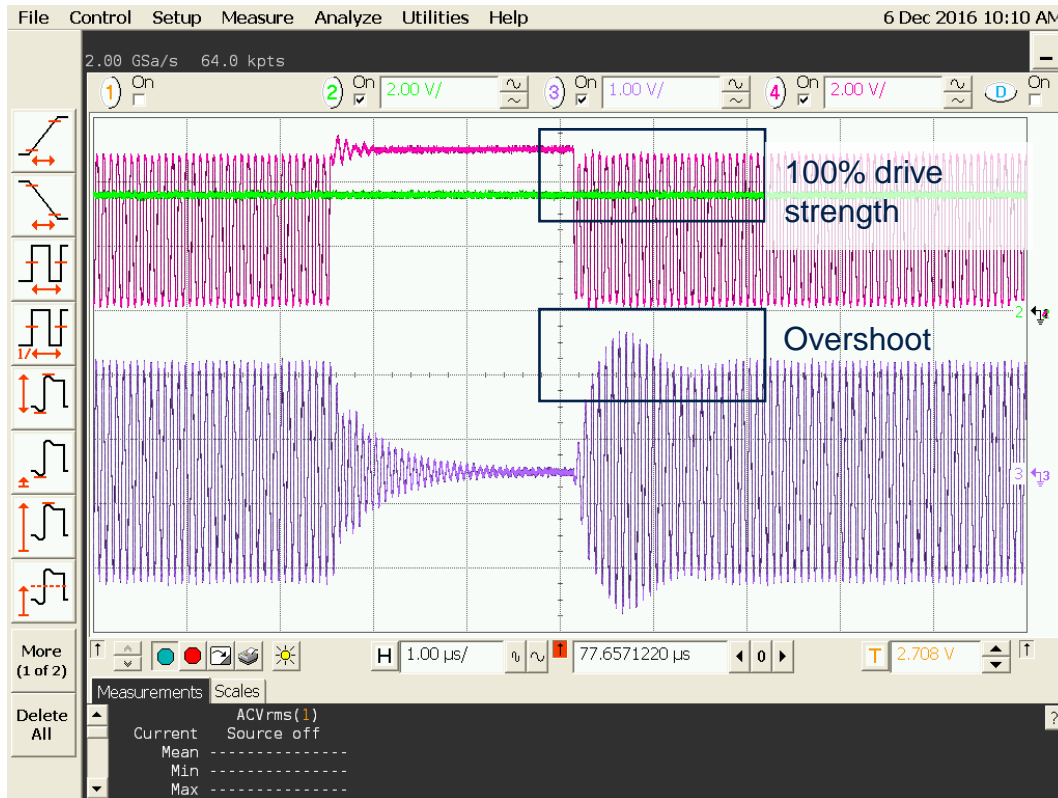
Type B 106 display noise immunity improved by a factor of 9.2 vs ST25R3912



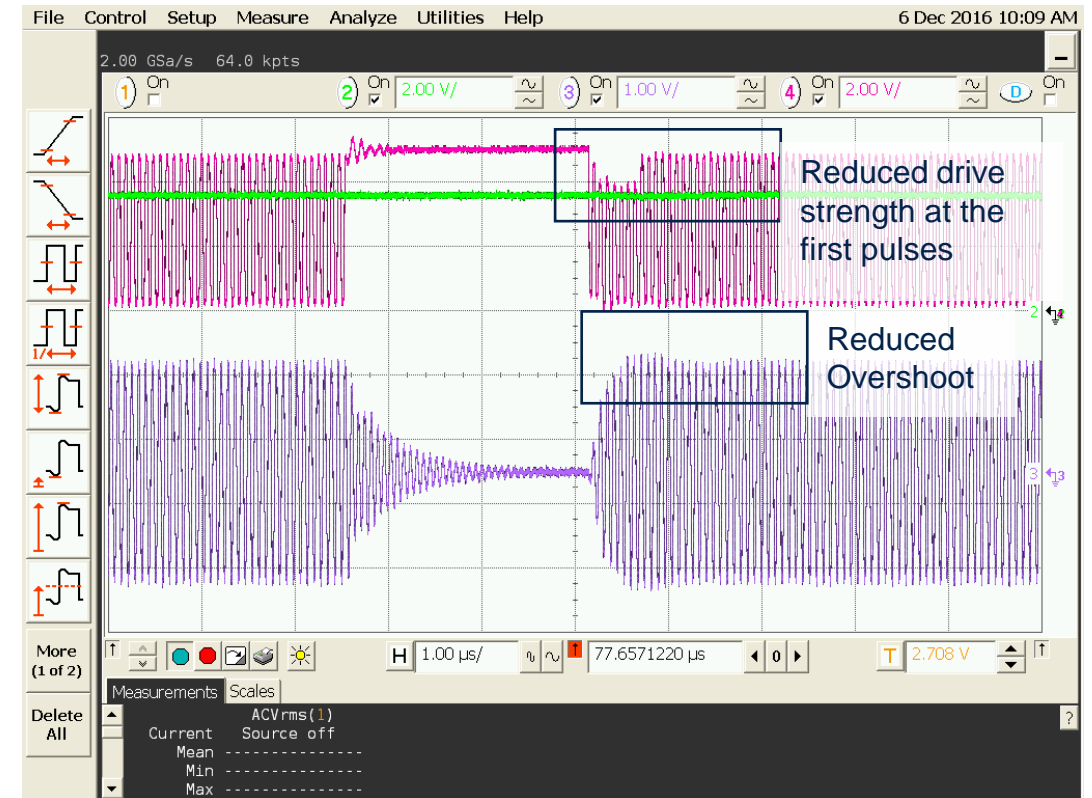


# AWS: active waveshaping

- Traditional A 106 modulation pulse



- Improved A106 modulation pulse with Over/Undershoot Protection



Over/Undershoots can be solved with register settings  
No rematching of antenna required



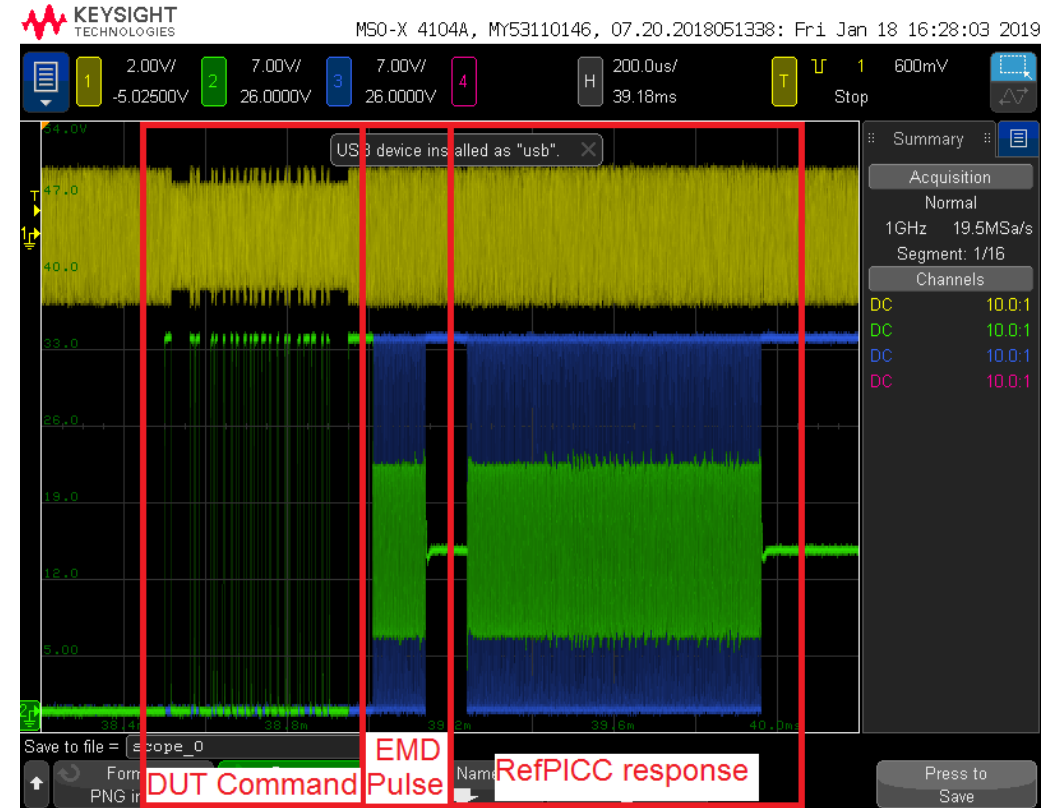
# Automatic EMD suppression

- Automatic PCD EMD handling

When the ST25R3918 receives a PICC frame it is checked for transmission errors. Transmission errors are detected in real time and if the number of received bytes when a transmission error is detected is less than 4, then the PCD shall ignore the transmission and be ready to receive a new PICC frame.

- Increased Robustness

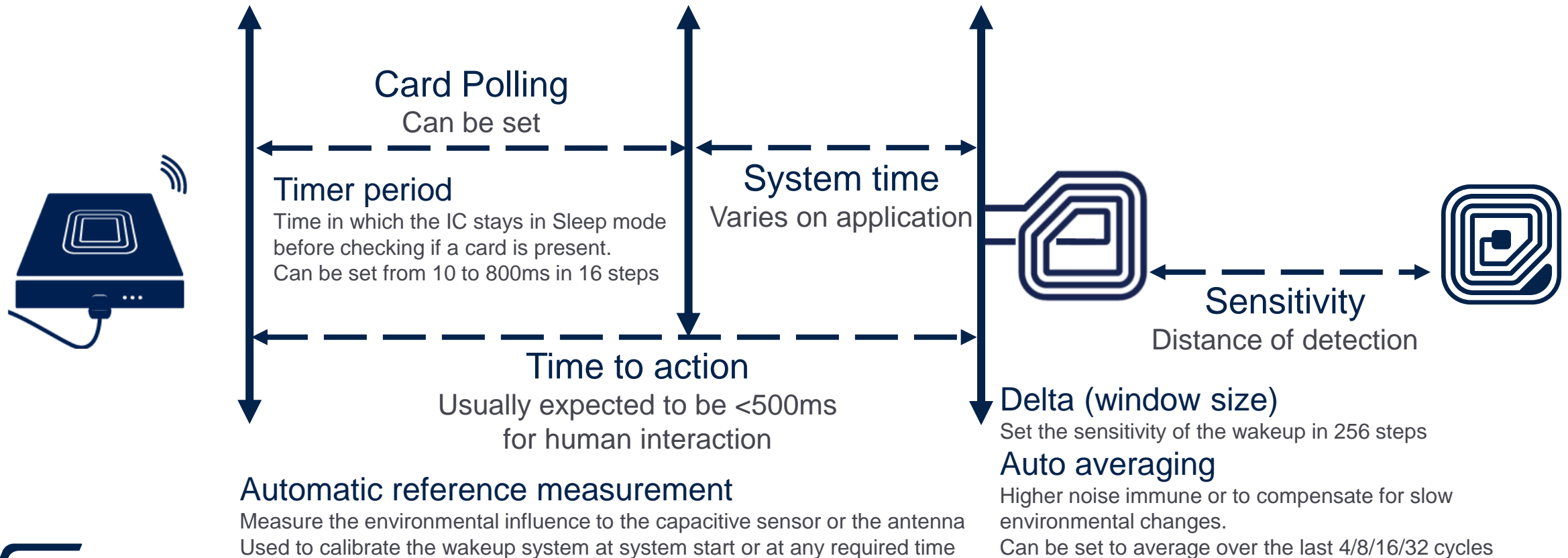
EMD handling enhances the robustness of the contactless communication between ST25R3918 and the PICC against PICC generated electromagnetic disturbance (EMD)





# Inductive low power card detection

Consider reaction time/sensitivity of the system



# Key Factor for Success of ST25R

## 1. Low current consumption

- Key factor for Energy Harvesting
- 3914 vs 3320 = 40uA vs 200uA

## 2. RF Performance

- influence at User Experiences, CTM product design
- 3914 vs 3320 = 30mm vs 20mm

## 3. Market Proven solution : Car OEMs, mPOS & POS machines

## 4. Intensive Technical Supporting to Korea Big OEM CTMs

- Disty of ST : PCB& Ant. Design
  - SW Porting
  - Local Technical Issue supporting
- ST Korea : Field Issue supporting with “Mobile Spy Machine”
  - > Record Air transaction between PCD, PICC while Issue is reproduced
  - > Analyze at the 1<sup>st</sup> level with record.
- ST Gratz : Deep Analyzing with recorded phenomenon

# Our technology starts with You



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