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ST25R3920 product presentation

MMY Division

May 2020

ST25R3920 use cases

Car access

Compliant to CCC DK2.0 specs

NFC card protection

Protects NFC cards like creditcard, access cards from powerful Qi field

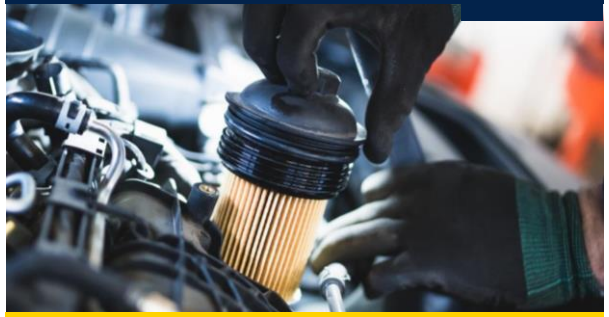
Car start

Compliant to CCC DK2.0 specs

Car sharing

Allows shared key with preference settings

Consumable authentication



Increases safety, traceability and convenience of replacement parts

Payment

In-car or external payment for electric charge

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ST25R3920 benefits

Outstanding analog performance

- No external amplifier required to achieve high field strength
- Excellent P2P interoperability
- Low power wakeup

Advanced Features

- Noise suppression receivers
- Automatic antenna tuning
- Active waveshaping

Fast time to market

- ISO, MISRA compliant SW library
- Single SW library for all products
- Full integration into STM32 eco system

Proven solution

- Market proven solution in the consumer and automotive space
- Ensures best customer experience

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ST25R NFC / HF readers product family

	ST25R95	ST25R3911B	ST25R3912	ST25R3914/15	ST25R3916	ST25R3917	ST25R3920
Description	Entry-Level NFC Reader	High-Performance NFC Forum Reader	Mid-Range NFC Forum Reader	Automotive Grade NFC Forum Reader	High-performance NFC Universal Device & EMVCo Reader	High-performance NFC & EMVCo Reader	Automotive Grade NFC Forum Reader
Reader/Writer mode	ISO14443A/B ISO15693 Felica	ISO14443A/B ISO15693 FeliCa	ISO14443A/B ISO15693 FeliCa	ISO14443A/B ISO15693 FeliCa	ISO14443A/B ISO15693 FeliCa	ISO14443A/B ISO15693 FeliCa	ISO14443A/B ISO15693 FeliCa
Card emulation mode	Yes	-	-	-	Yes	-	Yes
AP2P mode	-	Initiator & Target	Initiator & Target	Initiator & Target	Initiator & Target	Initiator & Target	Initiator & Target
PP2P mode	-	Initiator	Initiator	Initiator	Initiator & Target	Initiator	Initiator & Target
RF speed	424kbps	6.8Mbps (VHBR)	848kbps	848kbps	848kbps	848kbps	848kbps
Market	Consumer	Payment EMVCo 2.6, Industrial	Access control, Metering, Consumer	Automotive AEC-Q100 grade 1	Payment EMVCo 3.0, Industrial, Consumer	Payment EMVCo 3.0, Industrial, Consumer	Automotive AEC-Q100 grade 1
Advanced features	IWU	AAT, DPO, CIWU	DPO, IWU	AAT (3914), DPO, CIWU	AAT, DPO, NSR, DSA, AWS, CIWU, EMD	DPO, NSR, DSA, AWS, IWU, EMD	AAT, DPO, NSR, DSA, AWS, CIWU, EMD
HW interface	SPI 2Mbps	SPI 6Mbps	SPI 6Mbps	SPI 6Mbps	I²C // SPI 10Mbps	I²C // SPI 10Mbps	I²C // SPI 5Mbps
SW interface	RFAL Unified Software Library for Frontends						
Power supply	2.7V - 5.5V	2.4V – 5.5V	2.4V – 5.5V	2.4V – 5.5V	2.4V – 5.5V	2.4V – 5.5V	2.4V – 5.5V
Output power	0.23W	1.4W	1.0W	1.0W	1.6W	1.6W	1.6W
Temperature range	-25°C to +85°C	-40°C to +125°C	-40°C to +125°C	-40°C to +125°C	-40°C to +125°C	-40°C to +125°C	-40°C to +125°C
Package	32-pin QFN	32-pin QFN / Wafer	32-pin QFN / WF 32-pin QFN / WLCSP-30	32-pin QFN / WF 32-pin QFN	WF 32-pin QFN / WLCSP-36	WF 32-pin QFN	WF 32-pin QFN

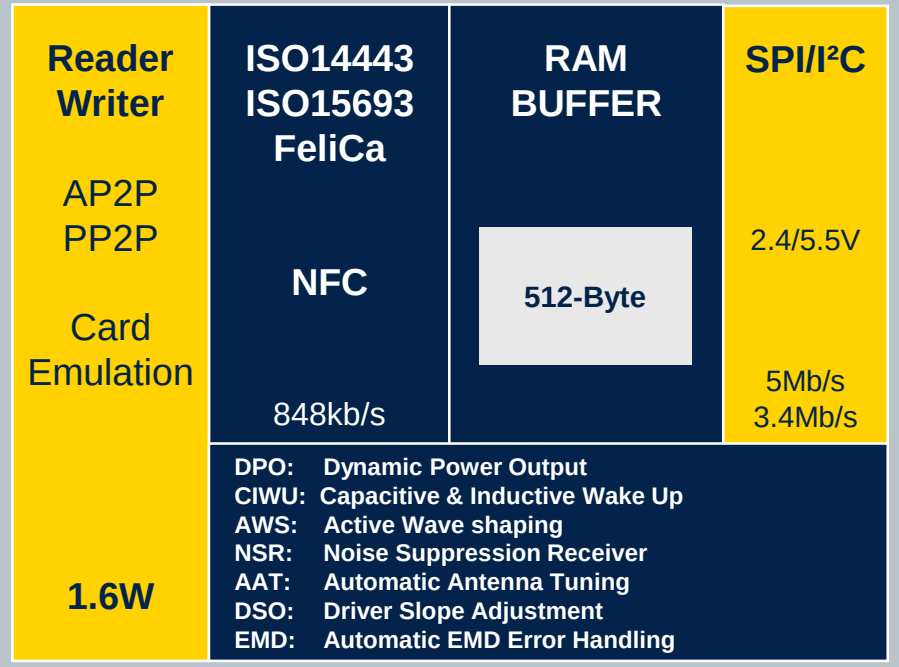
VHBR: Very High Baud Rate
P2P: Peer to Peer mode
AAT: Automatic Antenna Tuning
AWS: Active Wave Shaping

EMD: Automatic EMD suppression
VHBR: Very High Baud Rate
DPO: Dynamic Power Output
CIWU: Capacitive & Inductive Wakeup

DSA: Drive Slope Adjustment
* Peak output power
NSR: Noise Suppression Receiver
IWU: Inductive Wakeup

ST25R3920
high-perf. reader for CCC digital key and car center console

ST25R3920



QFN32
Wettable flank

Use cases

- Ideal for **Car Consortium Consortium Digital Key** (CCC DK) applications
- IoT and pairing in the car (center console)

Key Features

- NFC Forum Device
- **AEC-Q100 grade 1**
- **1.6W** output power at 5V with **2.5W** peak current
- **Active Waveshaping**
- Automatic Antenna Tuning
- **Noise Suppression Receiver**
- -40°C to **105°C** ambient temperature range

Key Benefits

- Low power operation & Standby mode (capacitive wake-up)
- Works in challenging environment like small antennas

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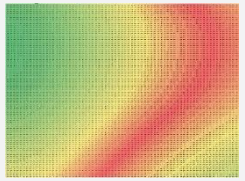
ST25R3920 benefits

NSR: Noise Suppression Receiver

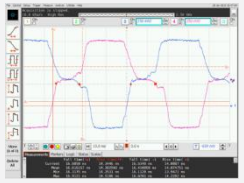
- Decoding at high noise level with up to 19.3dB better SNR
- increases immunity to interference from noise sources and therefore simplifies electro-magnetic immunity and eases certification.

AAT: Automatic Antenna Tuning



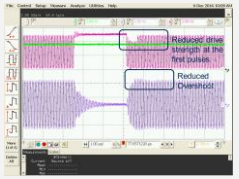
- Easiest environmental/ lifetime compensation:
- Automatic adjustment of the tuning resonance and matching impedance driving adjustable capacitors

DSA: Driver Slope Adjustment



- Easier FCC approval
- Programmable Push/Pull driver slope, minimizes high frequency EMC noise

AWS: Active Waveshaping



- Faster/easier NFC Forum/ EMVCo analog approval
- Under/Overshoot can be reduced to achieve required wave shaping easily and fast

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ST25R3920 benefits

Large FIFO, Automatic EMD

- Reduced/faster SW integration effort:
- Complete frames can be transmitted and received without SW interaction
- Time critical EMD suppression is handled automatically

Improved RF Performance

- Larger operating volume/ smaller antenna
- Unrivaled RX sensitivity with high output power delivers maximum margin for challenging antenna designs.

CIWU: Capacitive & Inductive Wakeup

- Low power consumption in card detection mode
- Capacitive and Inductive wakeup allow for low power consumption while in card detection mode.

DPO: Dynamic Power Output

- Increase Efficiency and achieve min/max Limits
- The output power is adjusted automatically to reduce power and stay within certification limits.

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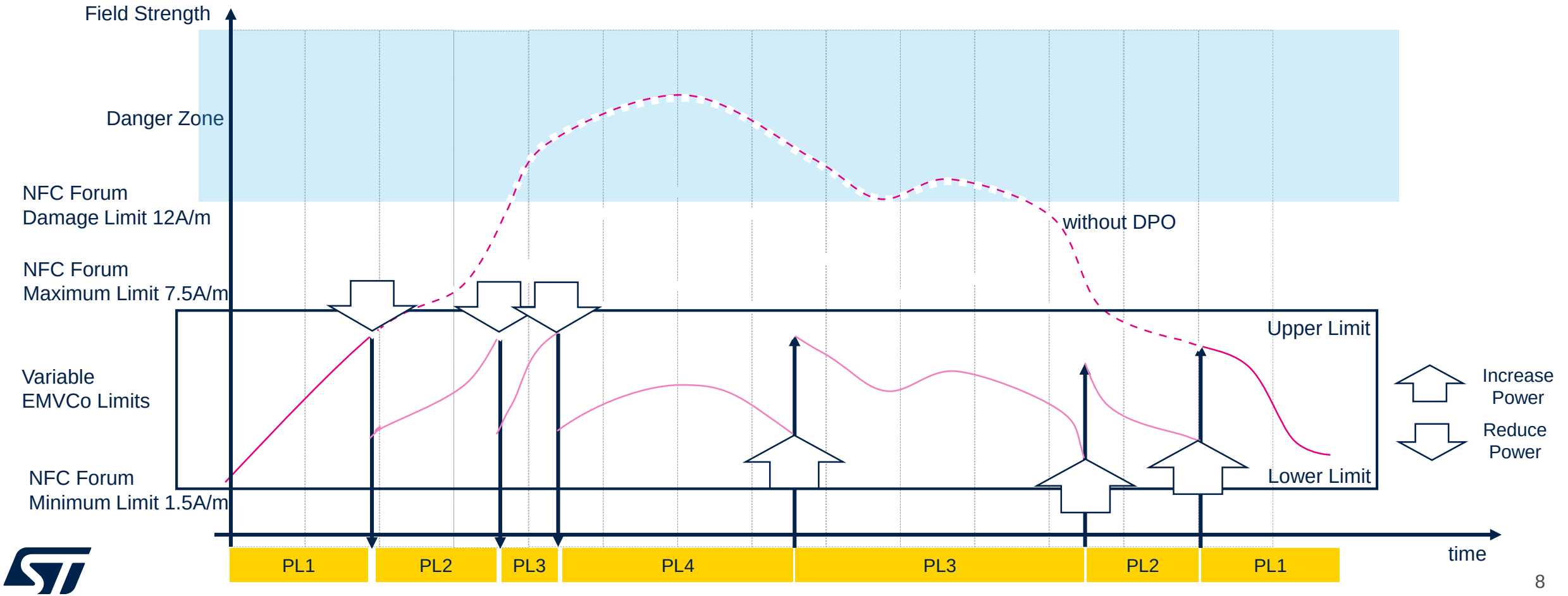
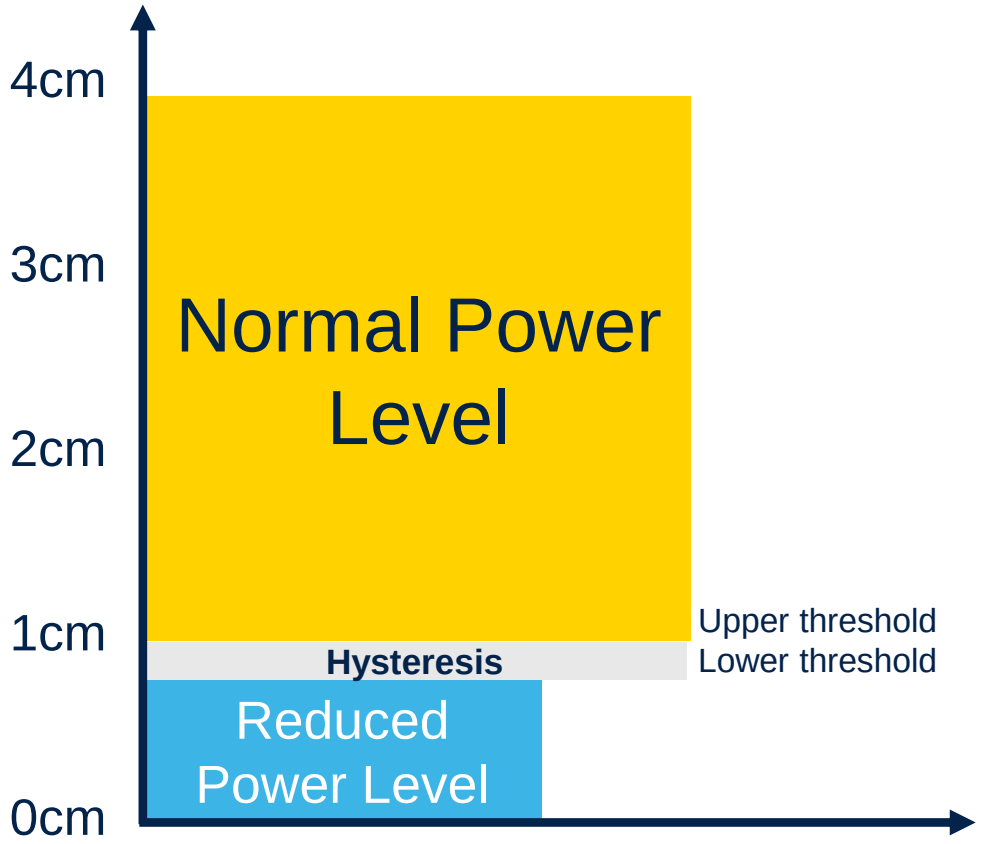
DPO: dynamic power output tweaks the power to your needs

DPO will keep power levels within requirements & limits



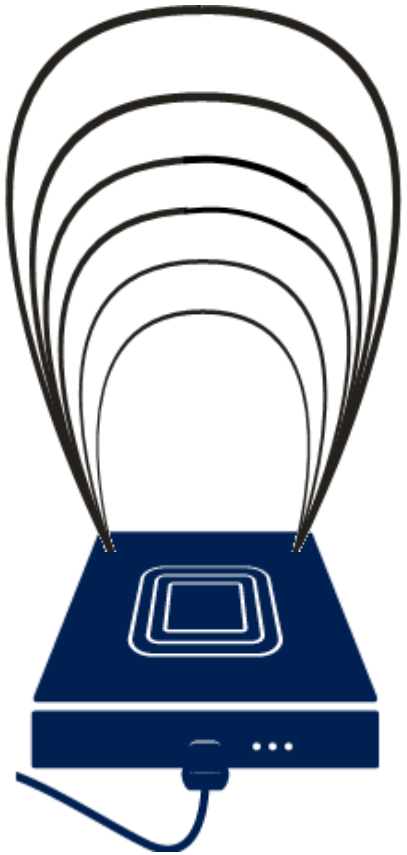
DPO: dynamic power output tweaks the power to your needs

- DPO Working Principle
  - The ST25R family is able to measure the antenna amplitude via Register 0x20 with the direct command “Measure amplitude”.
  - The antenna amplitude can be used to define certain levels/distances in which the power output defined in Register 0x27 can be changed via the driver resistance.
  - Thresholds can be set to decrease or to increase power output.

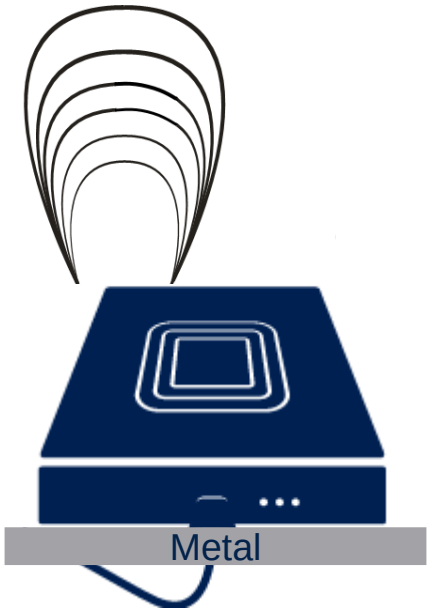


Match the antenna well and make sure it stays tuned

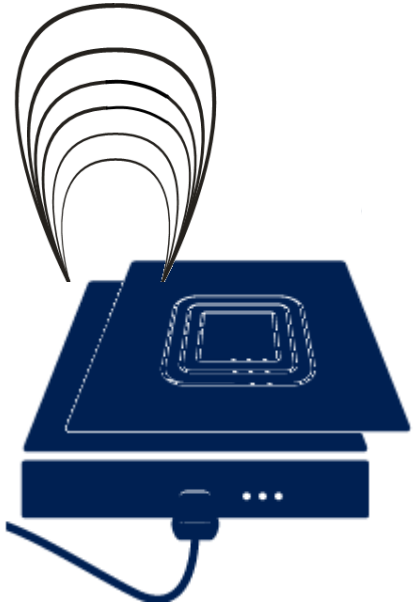
Placement, mounting and outside factors can detune and reduce performance



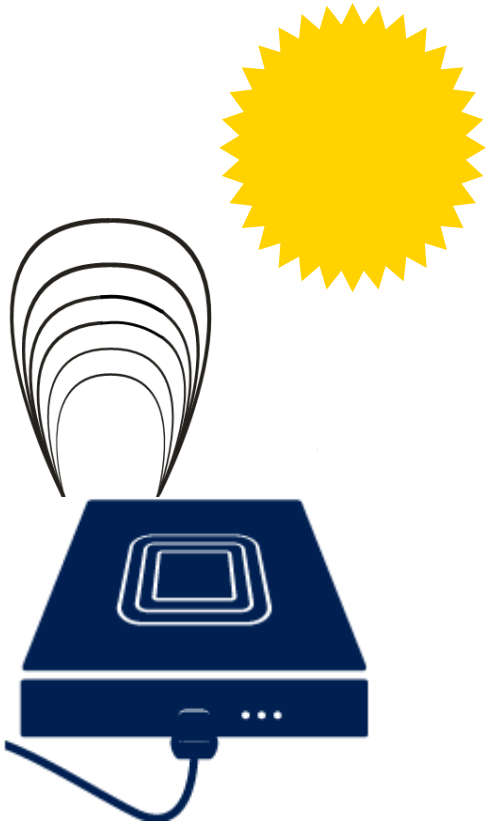
Metal objects



Placement



Mounting

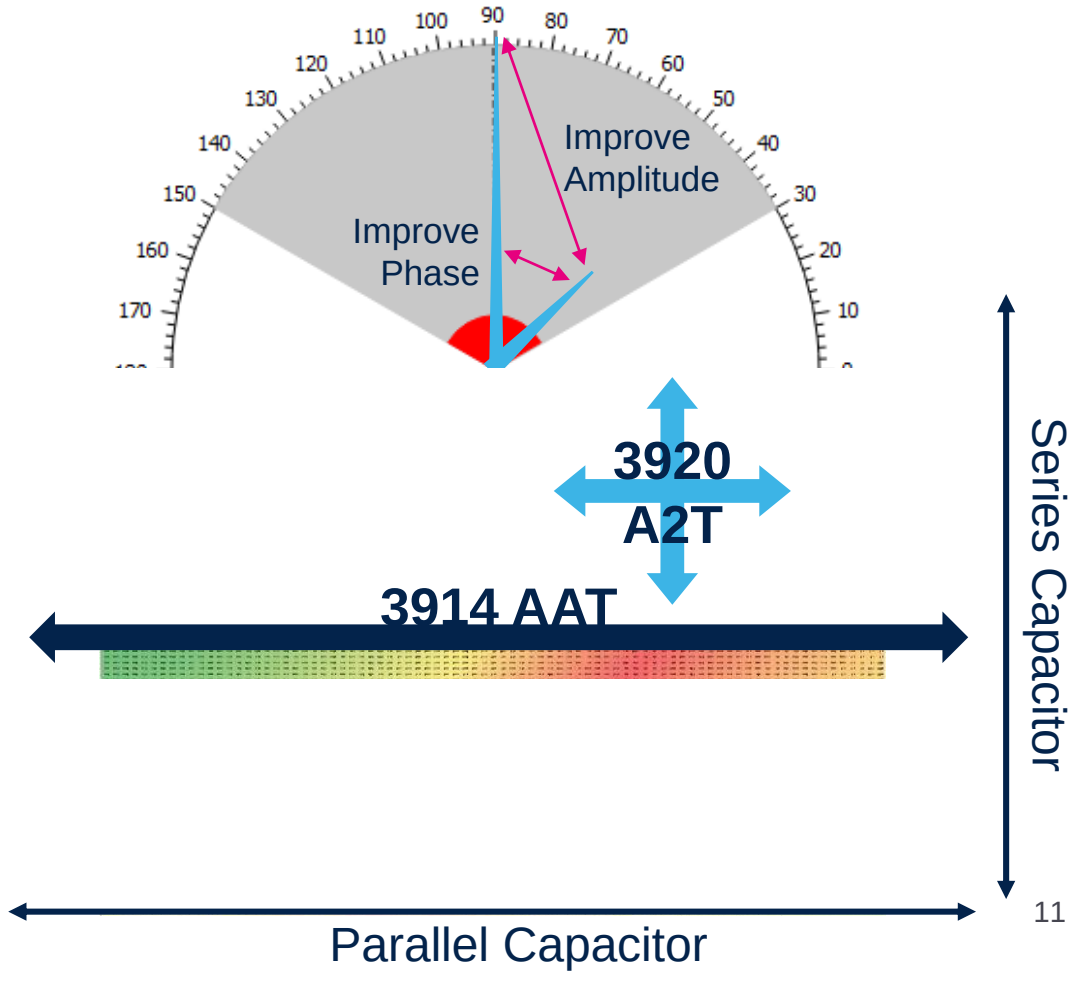


Temperature

AAT: automatic antenna tuning be sure your antenna stays tuned

AAT will help to maximize performance in different situations

- Algorithm is based on antenna amplitude and phase measurement
- On 3914 tuning is possible on the parallel path of the antenna
- On 3920 tuning is possible in parallel and/or in series
- Ideal for center console applications



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Reduce power consumption while offering good detection range

Consider reaction time/sensitivity of the system

Card Polling
Can be set

System time
Varies on application

Sensitivity
Distance of detection

Time to action
Usually expected to be <500ms
for human interaction

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Reduce power consumption while offering good detection range

Consider reaction time/sensitivity of the system

Card Polling
Can be set

Timer period
Time in which the IC stays in Sleep mode before checking if a card is present.
Can be set from 10 to 800ms in 16 steps

System time
Varies on application

Time to action
Usually expected to be <500ms for human interaction

Sensitivity
Distance of detection

Delta (window size)
Set the sensitivity of the wakeup in 256 steps

Auto averaging
Higher noise immune or to compensate for slow environmental changes.
Can be set to average over the last 4/8/16/32 cycles

Automatic reference measurement
Measure the environmental influence to the capacitive sensor or the antenna
Used to calibrate the wakeup system at system start or at any required time

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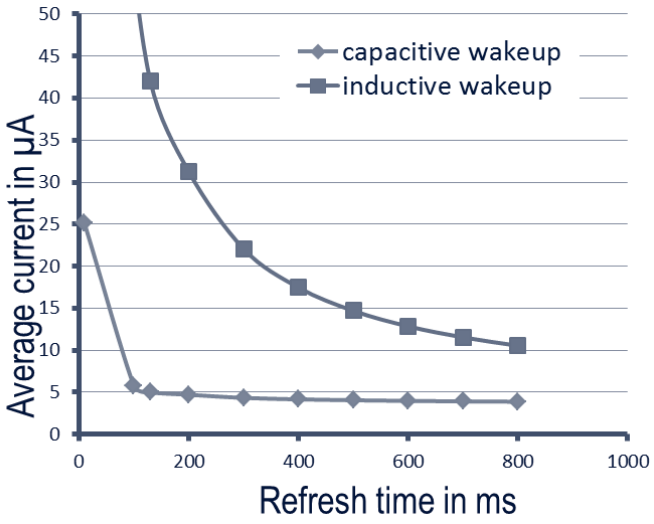
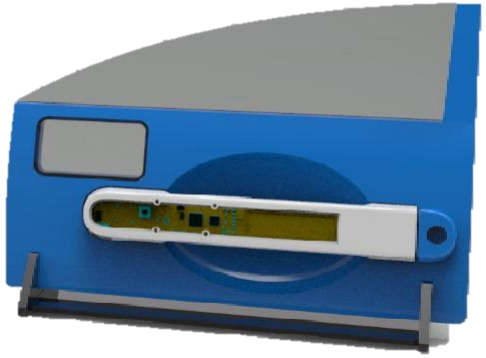
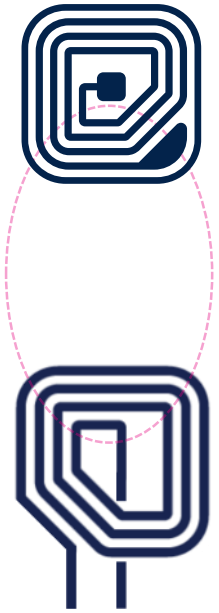
Low power wakeup keeps the power consumption low

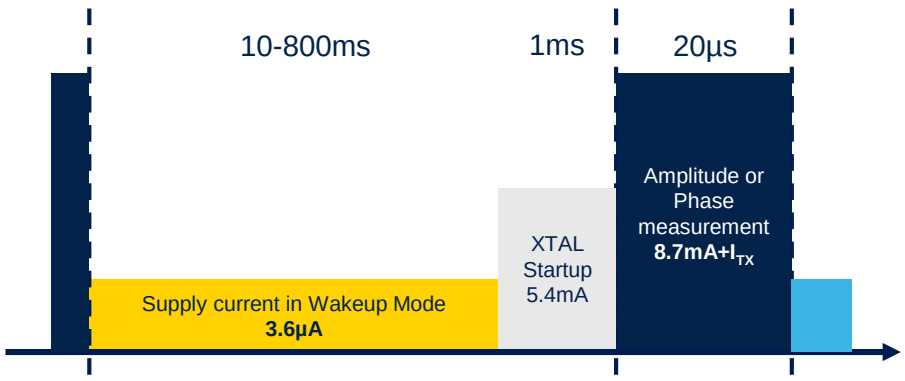
Low Power Wakeup will maximize your application lifetime







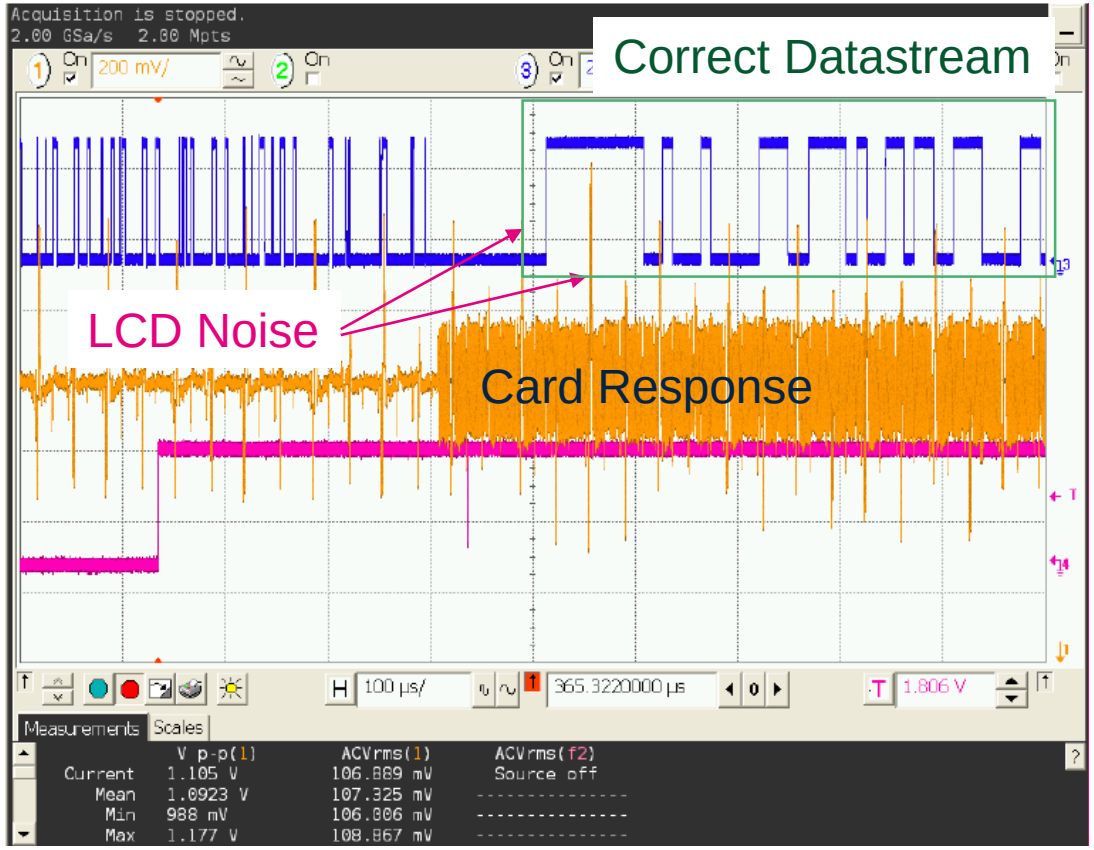
Inductive antenna



Fully programmable wakeup scheme.
All relevant parameters like cycle time & sensitivity can be programmed and do not need MCU interaction.

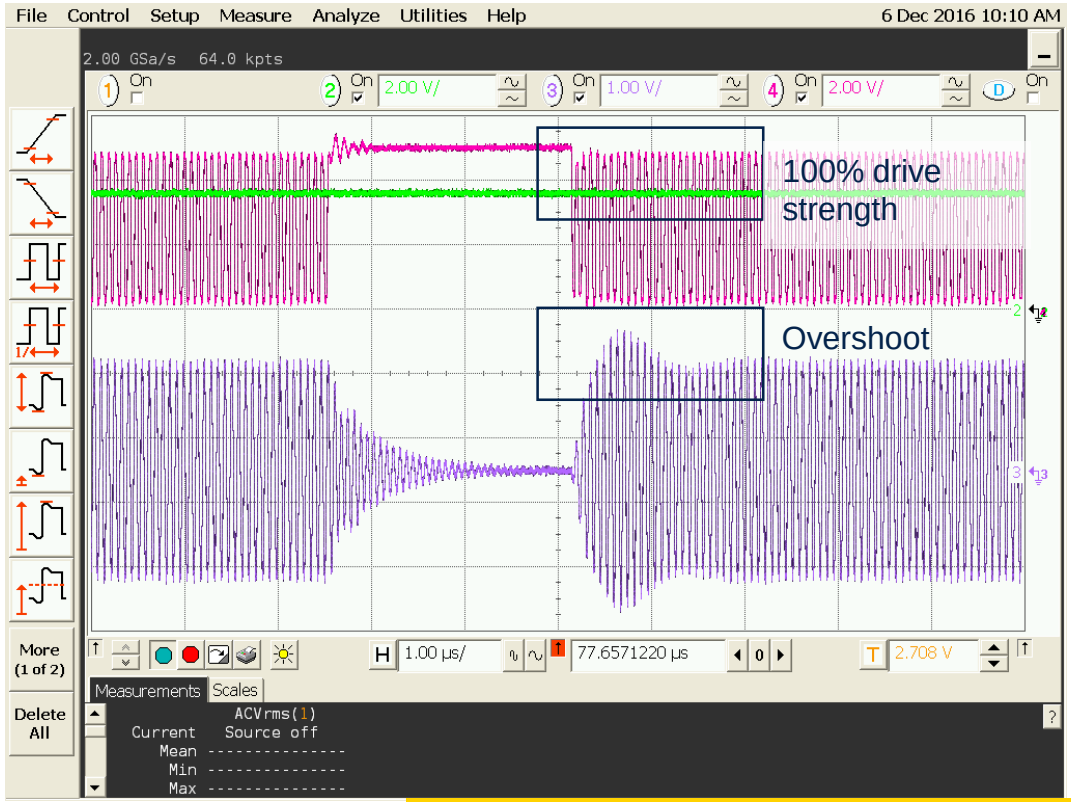
NSR: noise suppression receiver

- 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 ST25R3914
  - Type B 106 display noise immunity improved by a factor of 9.2 vs ST25R3914

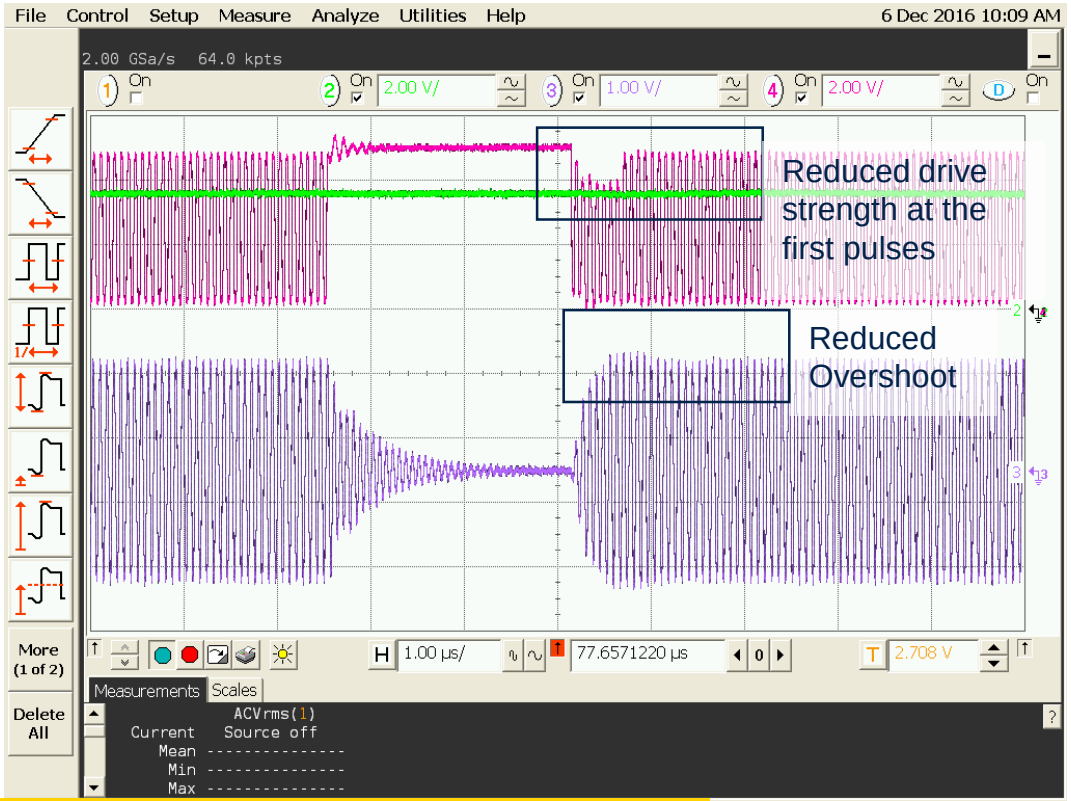


AWS: active waveshaping

- Traditional A 106 modulation pulse



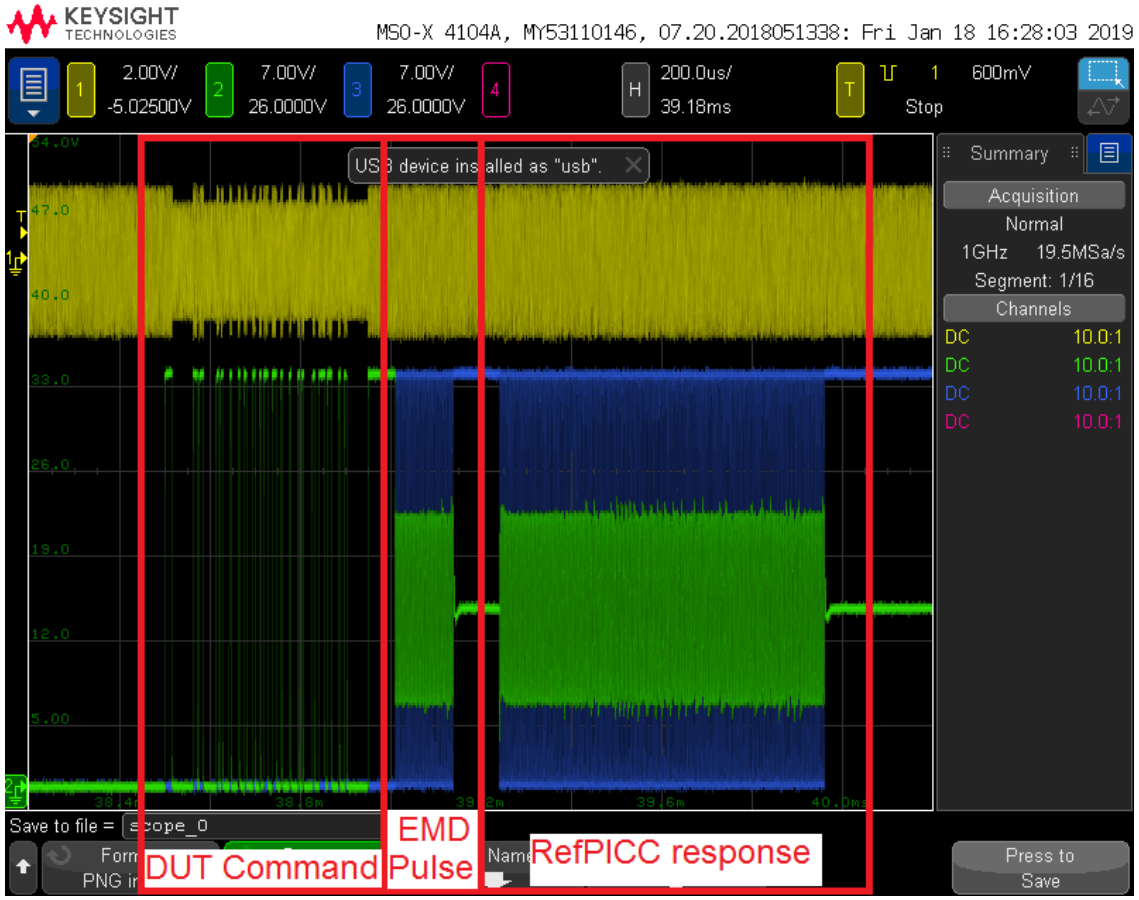
- Improved A106 modulation pulse with Over/Undershoot Protection



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

EMD: automatic EMD suppression

- Automatic PCD EMD handling
  - When the ST25R3920 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 ST25R3920 and the PICC against PICC generated electromagnetic disturbance (EMD)



Evaluation boards & ecosyste

ST25

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Competitor analysis

ST25R3920 vs. Competition

Features	AAT	NSR	AWS	DPO
	YES	YES	YES	YES
competition	NO	NO	NO	NO

AAT (Automatic Antenna Tuning): Compensates temperature, production drift; Improves communication with metal phones/watch

NSR (Noise Supression Receiver): Improves immunity against external noise sources; Improves communication with phones/watch

AWS (Active Waveshaping): Improves waveshapes and communication with phones/watch

DPO (Dynamic Power Output): Dynamically adjusts output power to requirements

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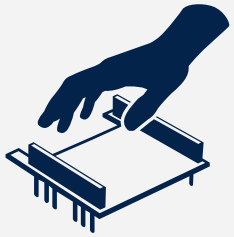
ST25R3920 rich eco-system



- Dicovery kits based on STM32 MCU
- STM32 Nucleo boards ecosystem
- STM32Cube software ecosystem

- Antenna e-design tool
- Schematic, BOM
- Gerber files

- PC software tool ST25
- MCU drivers firmware

- Documentation
- e2e community
- Webinar / MOOC
- Training

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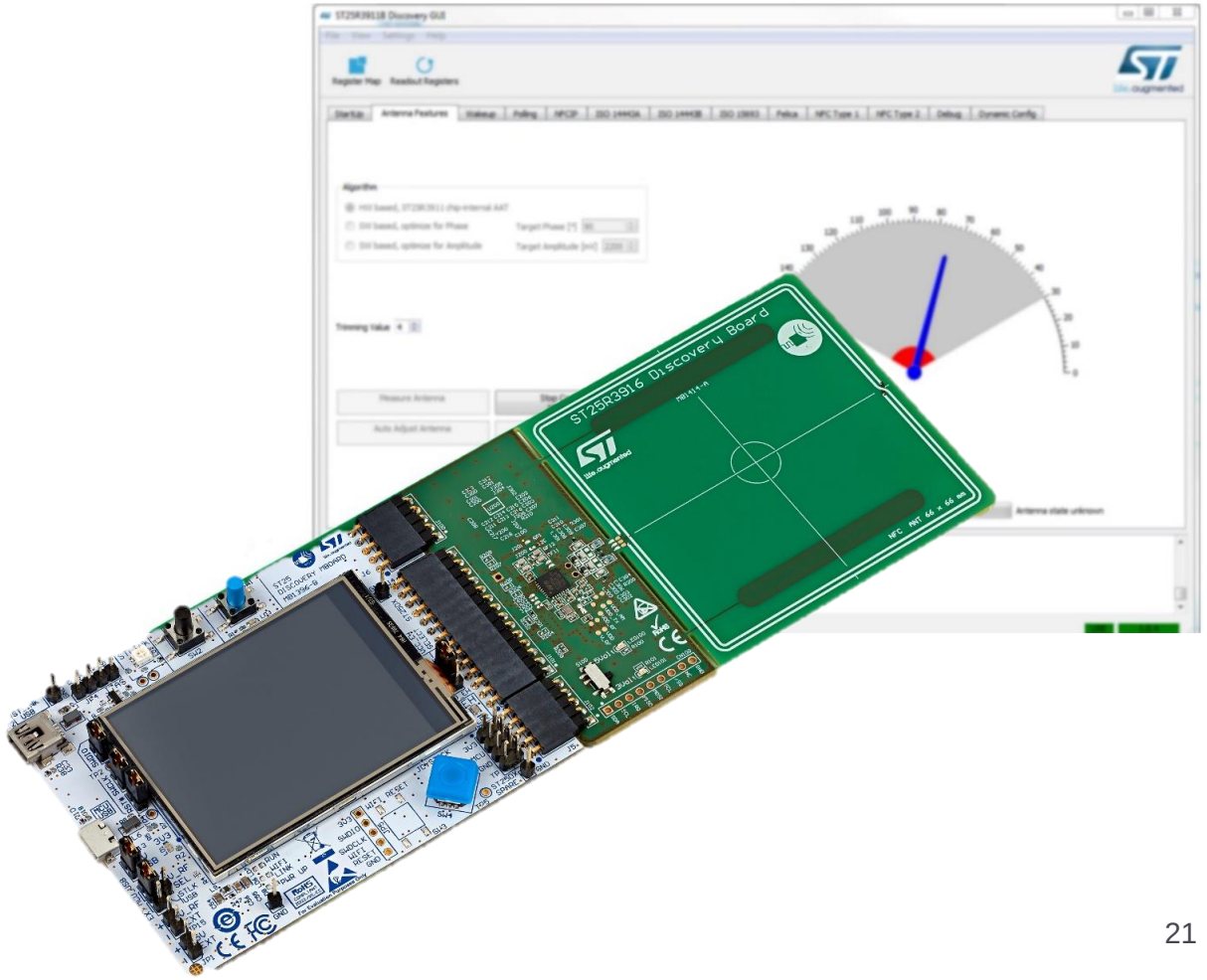
ST25R3916-DISCO kit

ST25R3916-DISCO kit being the evaluation kit of ST25R3920

The ST25R3916-DISCO consists of the ST25R3916 high performance NFC universal device controlled by a STM32L476 ultra-low-power ARM Cortex-M4 MCU with 512Kbytes flash.
It can be operated in stand alone mode via the LCD display or can be connected via USB to a Windows PC and controlled via the ST25R3916 GUI.

- Onboard 66x66mm, two turns, 13.56 MHz inductive antenna and possibility for external antenna
- RF Operation
  - NFC-A/B / ISO14443A/B up to 848 kbit/s
  - NFC-F / Felica™ up to 424 kbit/s
  - NFC-V / ISO15693 up to 53 kbit/s
  - NFC-A / ISO14443A and NFC-F / FeliCa™ card emulation
  - Active & passive peer to peer initiator and target modes, up to 424 kbit/s
- Free comprehensive development library and schematics / Gerber files available



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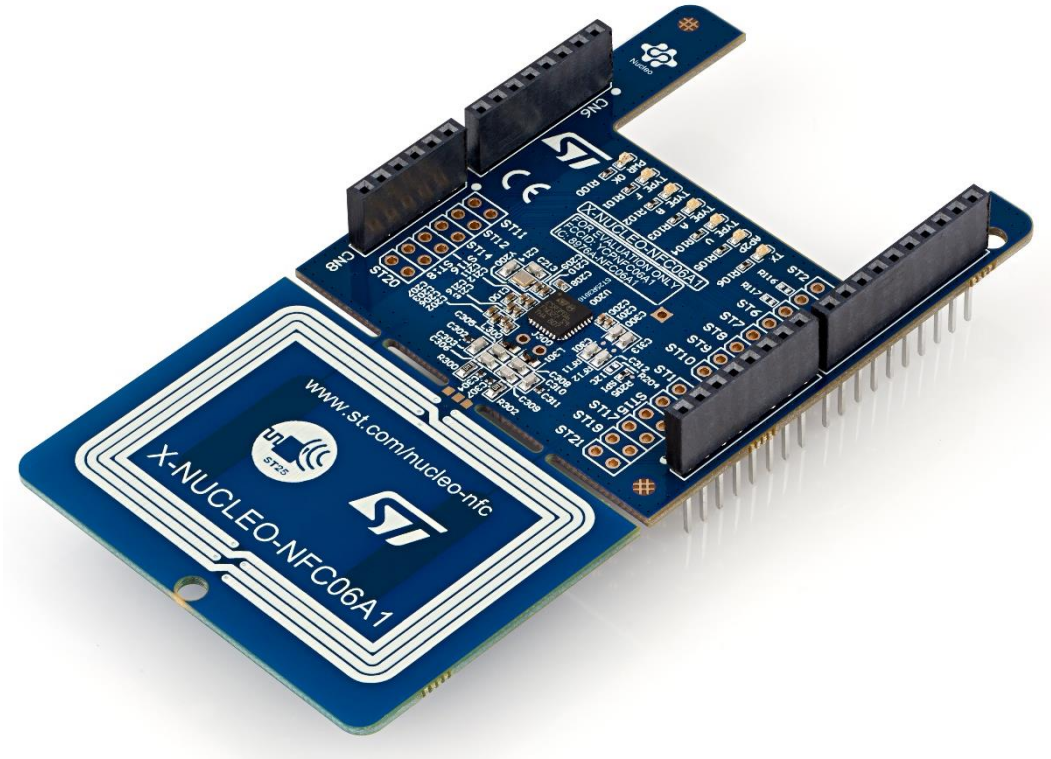
X-NUCLEO-NFC06

X-NUCLEO-NFC06 board being the Nucleo shield of ST25R3920t

The X-NUCLEO-NFC06 is a Nucleo shield based on the ST25R3916 high performance Universal HF/NFC & EMVCo frontend.
With its Arduino U3 connector it fits to the STM32 Nucleo, Raspberry Pi and other platforms.

- Onboard 47mm x 34mm, four turns antenna with connection point for external antennas
- RF Operation
  - NFC-A/B / ISO14443A/B up to 848 kbit/s
  - NFC-F / Felica™ up to 424 kbit/s
  - NFC-V / ISO15693 up to 53 kbit/s
  - NFC-A / ISO14443A and NFC-F / FeliCa™ card emulation
  - Active and passive peer to peer initiator and target modes, up to 424 kbit/s
- Free comprehensive development library and schematics/Gerber files available.
  Free Rasbperry Pi Linux driver



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Solutions for NFC / RFID Tags & Readers

ST25

ST25 SIMPLY MORE CONNECTED

Thank you

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