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ST25R3920B
product presentation

NFC Automotive Reader – Key messages

What it does

CARCONNECTIVITY consortium® EMVCo

- ST25R is the Master device and provides power: phone readout with empty battery
- Communication with NFC enabled mobile phone (>70% adoption rate) for iOS or Android

Near Field Communication CERTIFIED

>1.6W **power** for excellent interaction range and **smallest** **antenna** sizes, combined with **advanced** **features** **faster** **time to market** and **simplified** electromagnetic immunity and **best** **customer experience** by **tapping** a phone to the car.

Payment, Car access, Car start, …

www.st.com/st25r

ST25R3920B use cases

Car access

Compliant to CCC DK2.0 specs

NFC card protection

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

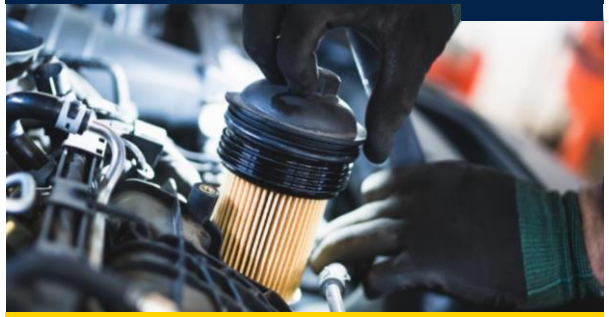
Car start

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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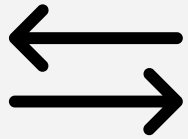
ST25R Key Performance Parameters

Good range Consistent experience
DPO: Dynamic Power Output



- High output power
- Adjusted automatically to optimize power transfer and stay within certification limits.

Low power consumption
CIWU: Capacitive & Inductive Wakeup

- Increase battery lifetime during key detection
- Capacitive and Inductive wakeup allow for low power consumption while in card detection mode.

Noise immunity
NSR: Noise Suppression Receiver

- Increased immunity to interference from noise sources
- simplifies electro-magnetic immunity and eases certification.

Distinguish phone from NFC card
Heartbeat algorithm

- Highest detection rate of phones for NFC card protection with Qi chargers

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ST25R NFC / HF readers product family

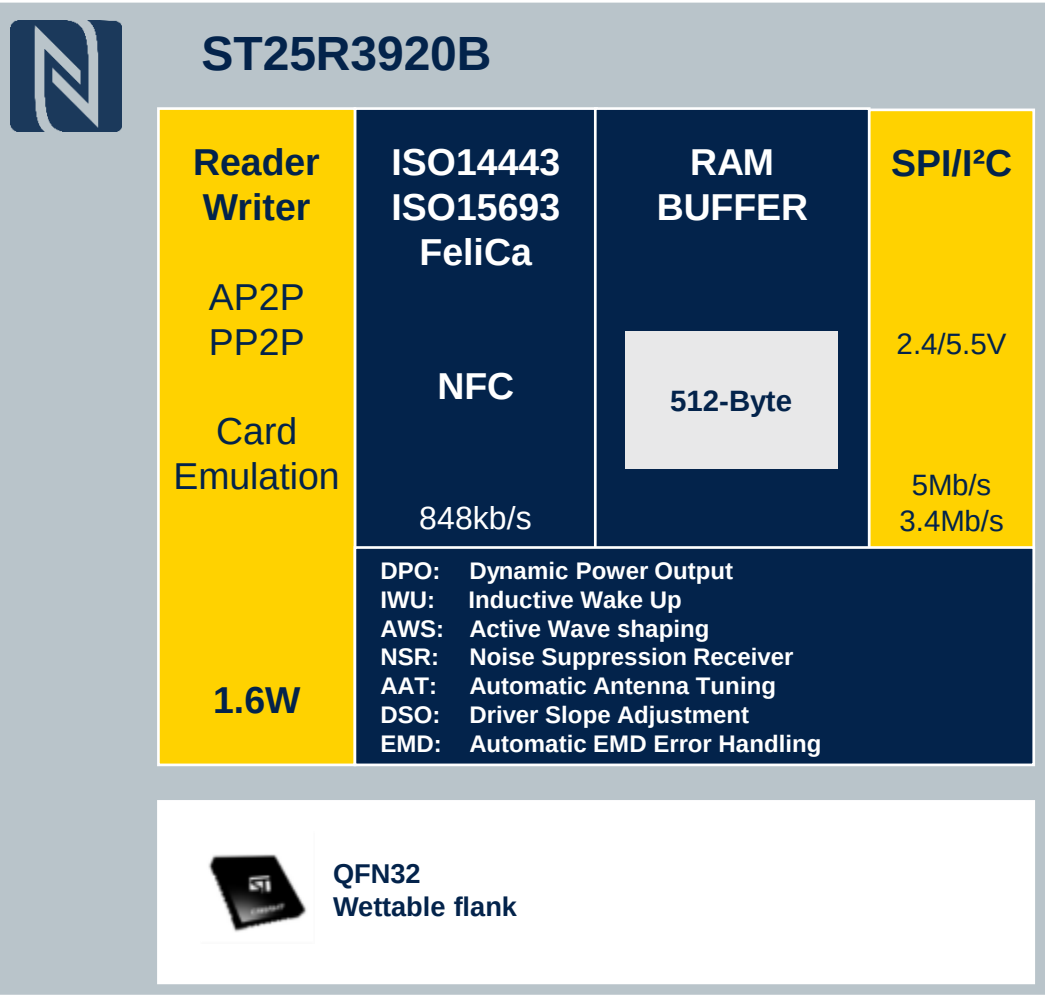
	ST25R95	ST25R3911B	ST25R3912	ST25R3914/15	ST25R3916B	ST25R3917B	ST25R3920B
Description	Entry-Level NFC Reader	High-Performance NFC Forum Reader	Mid-Range NFC Forum Reader	Automotive Grade Reader	High-performance NFC Universal Device & EMVCo Reader	High-performance NFC & EMVCo Reader	Automotive Grade NFC Forum CR13 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 3.1, Industrial, Consumer	Payment EMVCo 3.1, Industrial, Consumer	CCC & Automotive AEC-Q100 grade 2
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

ST25R3920B
CCC digital key and car center console



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 Universal Device and CR13 CCC Reader device
- **AEC-Q100 grade 1** -40°C to **105°C** ambient temperature range
- **1.6W** output power with **Dynamic Power Output**
- Improved **Active Waveshaping, Noise Suppression Receiver**
- **EMVCo 3.1** compliant for EV charging and in car payment
- Unique **Heartbeat** algorithm for NFC card/phone detection

Key Benefits

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

ST25R3920B benefits

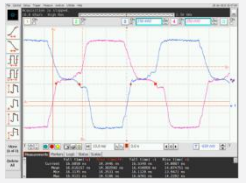
NSR: Noise Suppression Receiver

- More robust against noise
- Decoding at high noise level with up to 19.3dB better SNR.
- Cheap/noisy LCD possible for EMVCo POS terminals.

Heartbeat Algorithm

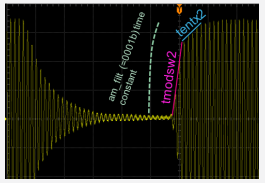
- Highest detection rate of phones for NFC card protection with Qi chargers

DSA: Driver Slope Adjustment



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

AWS: Active Waveshaping



- Adjustment of waveshape to remove under/overshoot simply by parameter setting and no need to redo matching
- Faster/easier EMVCo analog approval

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ST25R3920B 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.

Low power card detection

- Use of 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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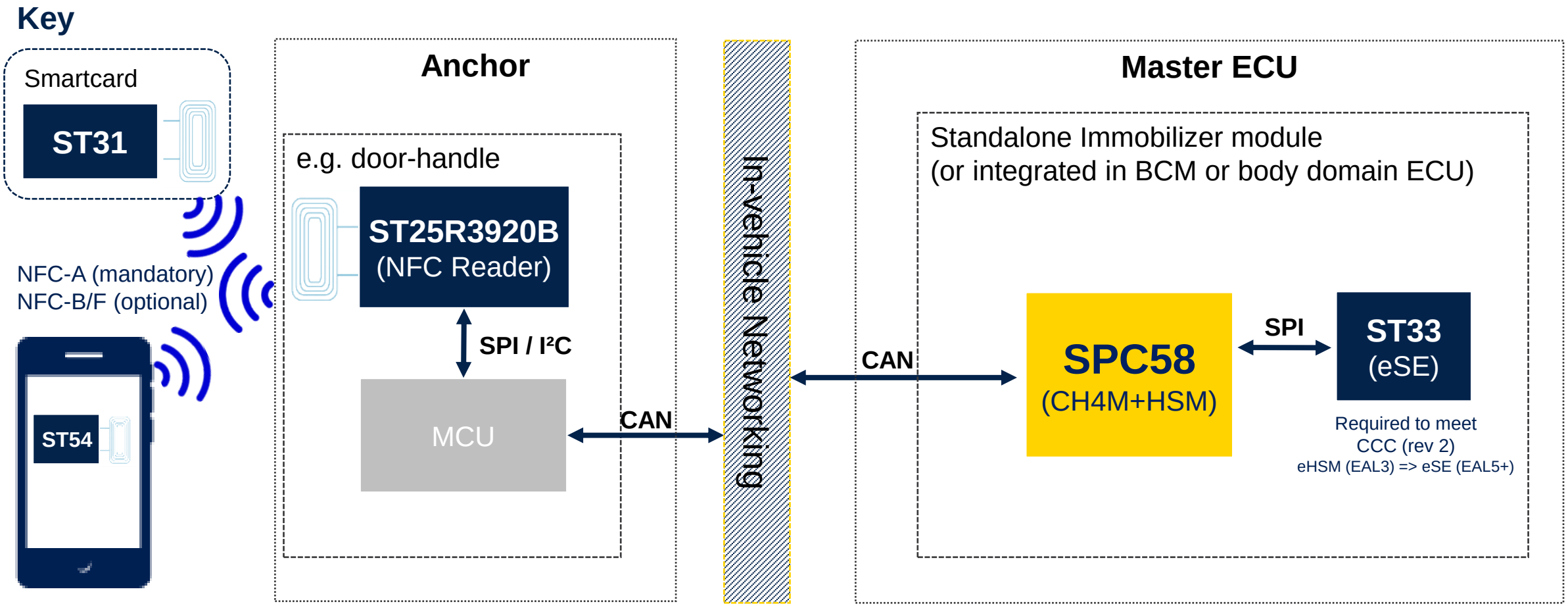
Digital Key

Master and Anchor Architecture



ST25 Reader DPO: Dynamic Power Output

- Achieve min/max power limits easier

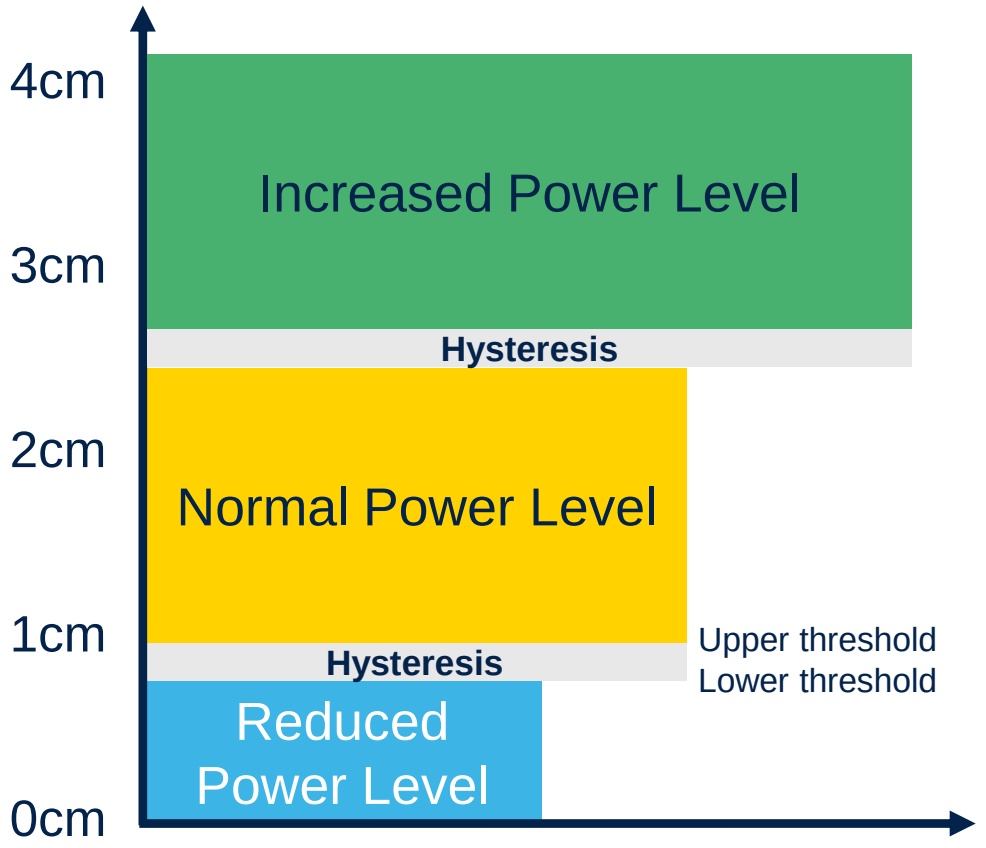
  The ST25R series allows to adjust the output power dynamically via Dynamic Power Output

- 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



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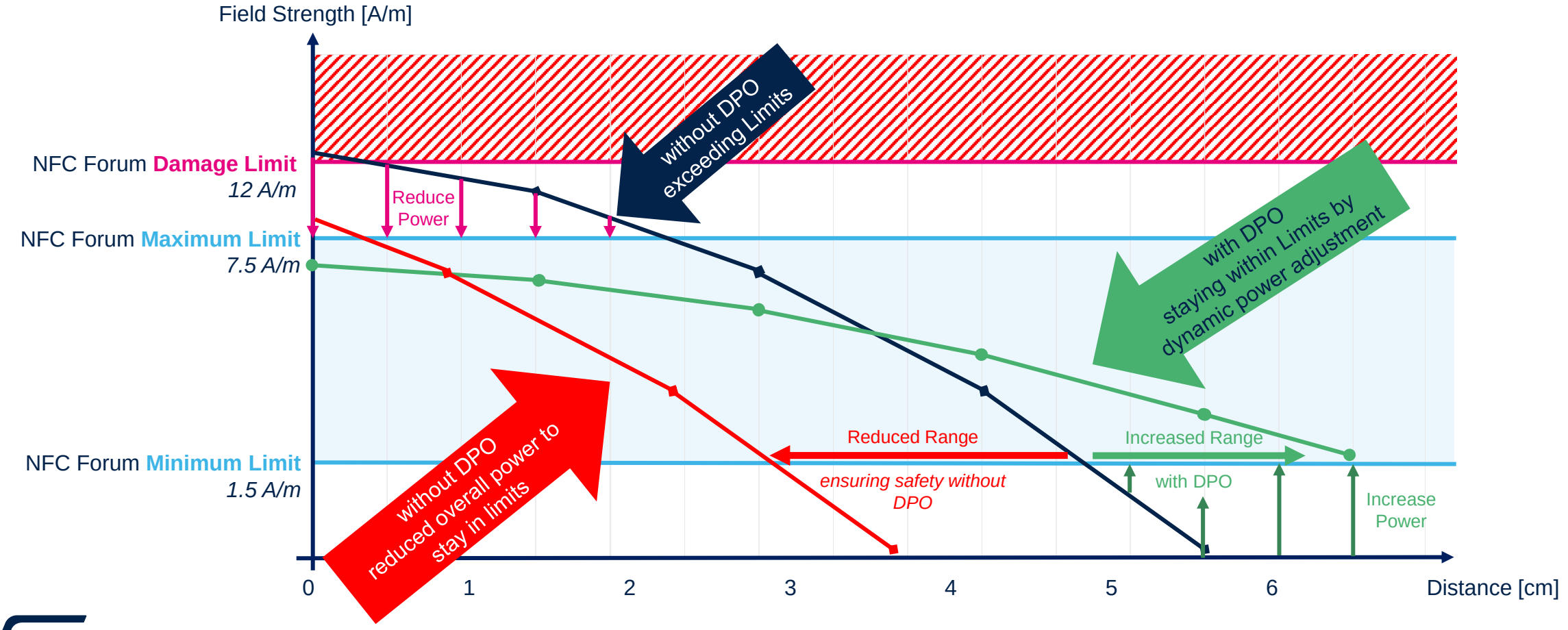
ST25 Reader DPO: Dynamic Power Output

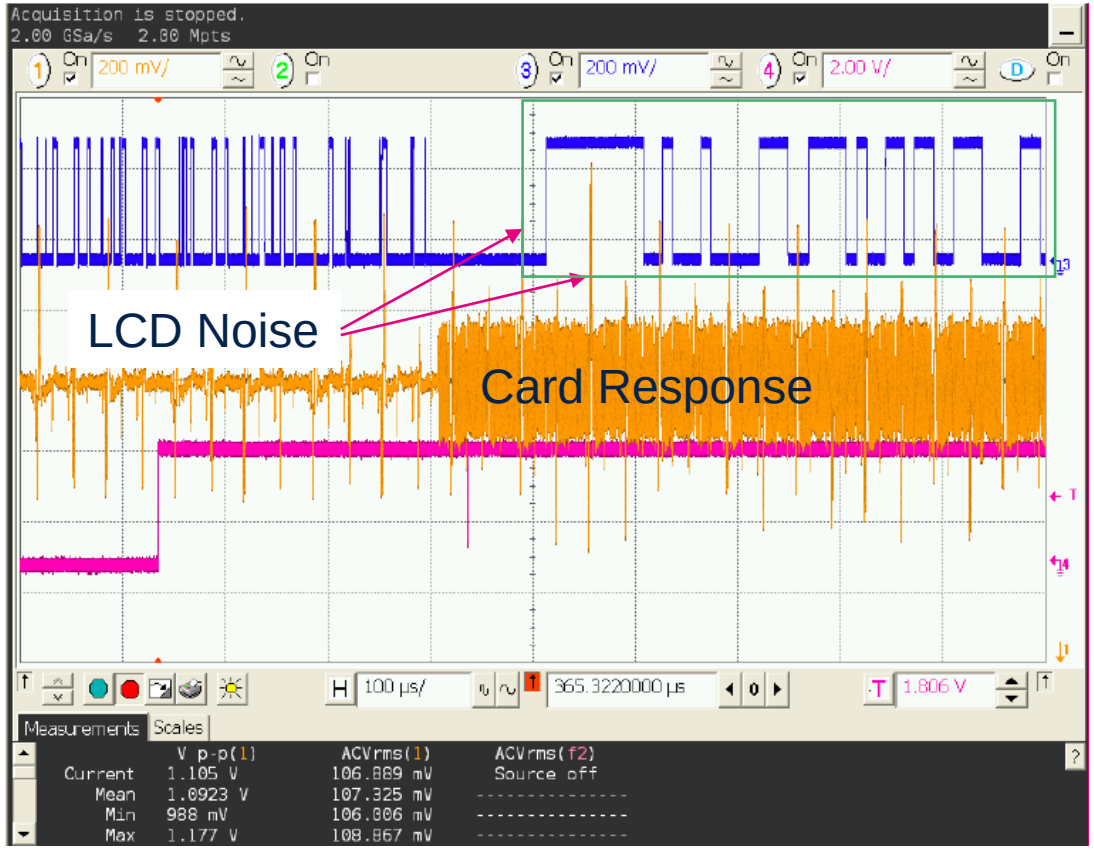
DPO of reader will keep power levels within requirements & limits



NSR: noise suppression receiver

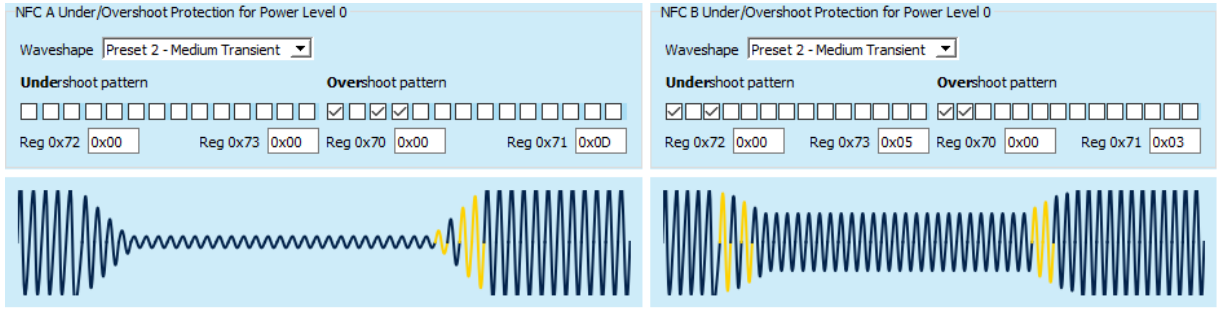
- Proper decoding
  - Proper decoding still possible even though LCD noise level exceeds card signal strength
  - ANS jumps in as soon as the receiver locks on a card response.
- Noise immunity compared to non NSR
  - Type A 106 display noise immunity improved by a factor of 3.3 vs ST25R3911B
  - Type B 106 display noise immunity improved by a factor of 9.2 vs ST25R3911B

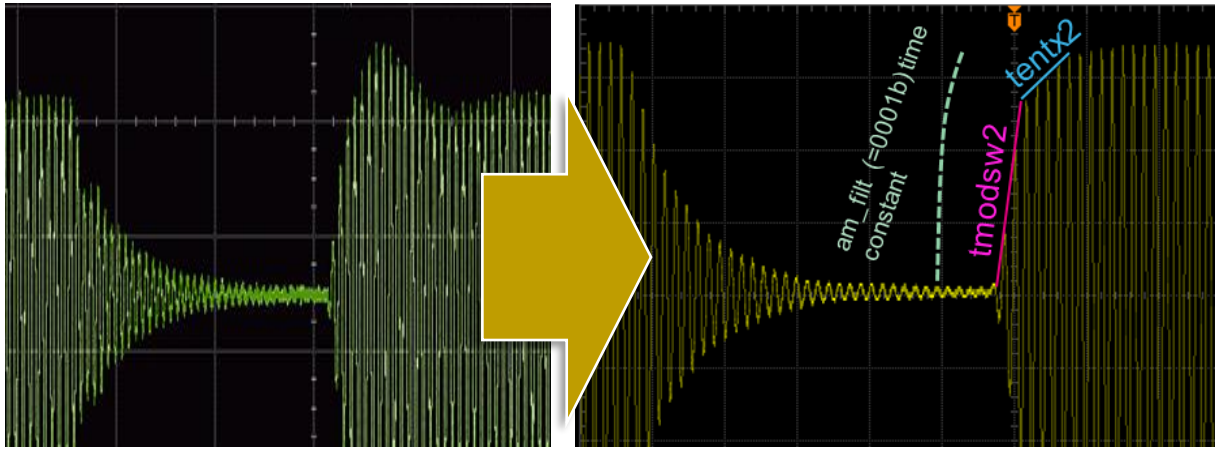
Correct Datastream



AWS: active waveshaping

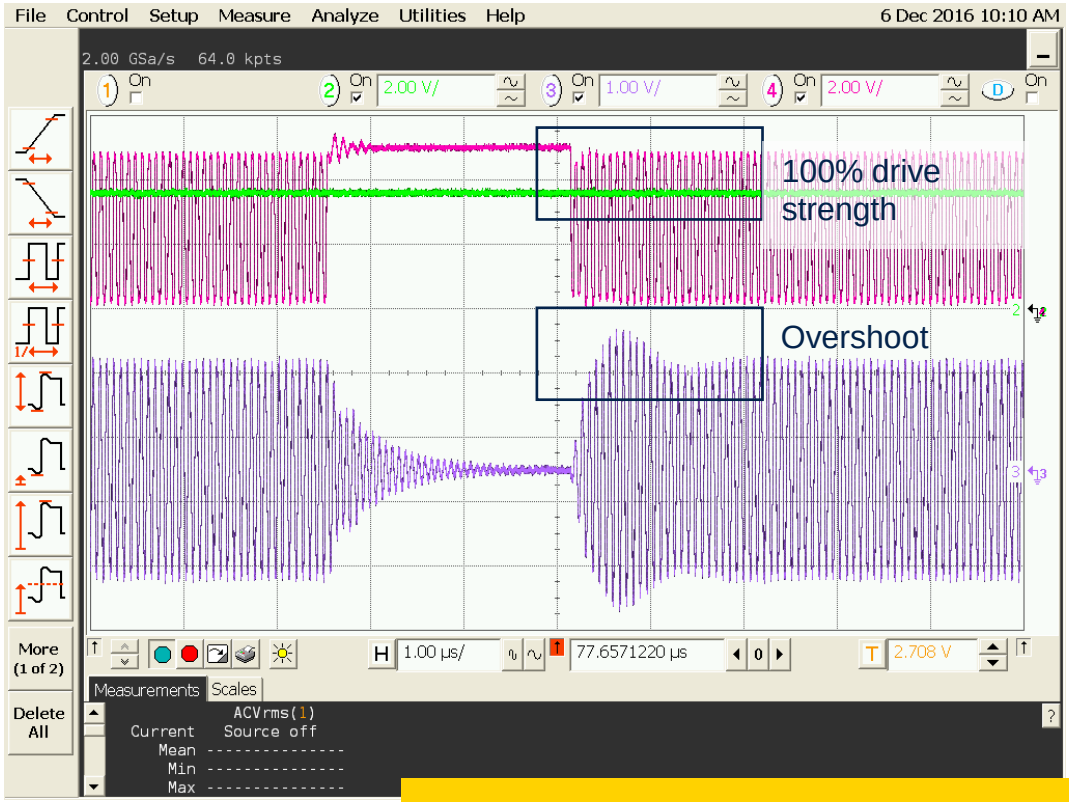
- The improved active waveshape (AWS) function will reduce over- and undershoots even easier than before.
- The function is easily enabled by using the bits in the corresponding registers.
  - 2 register and 14 bits for each over and under shoot protection are available and allow for easy adjustment
- to an acceptable level in challenging designs



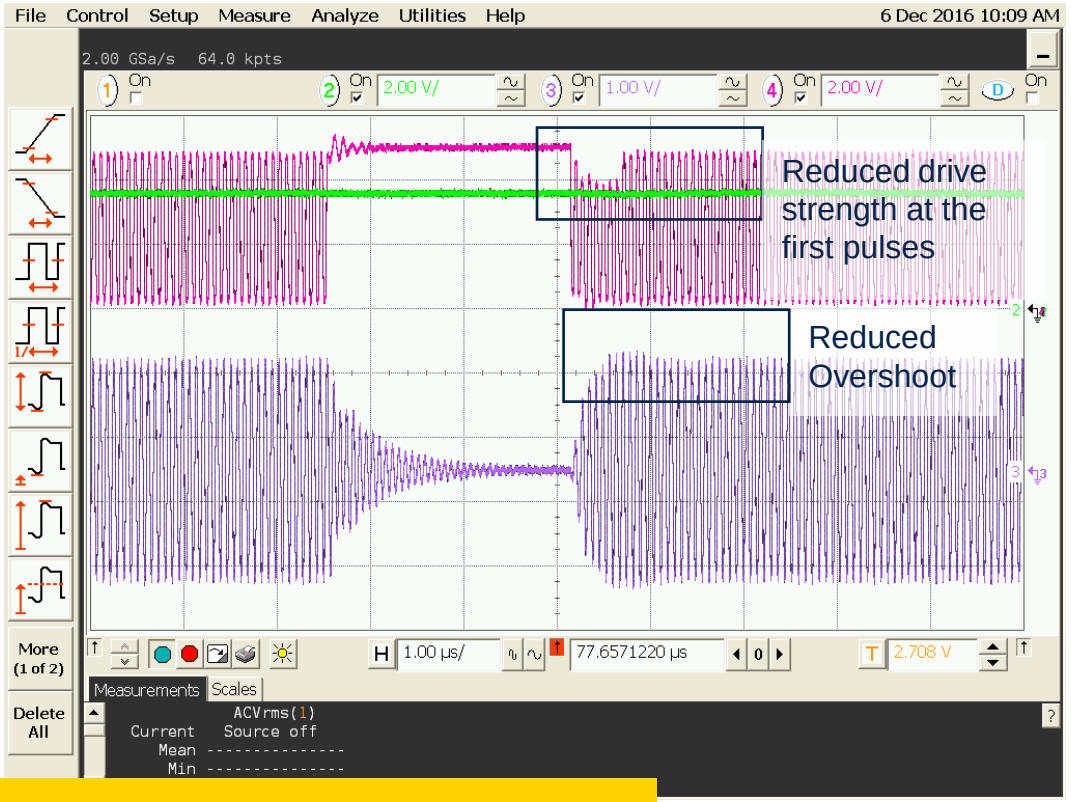


AWS: active waveshaping

- 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

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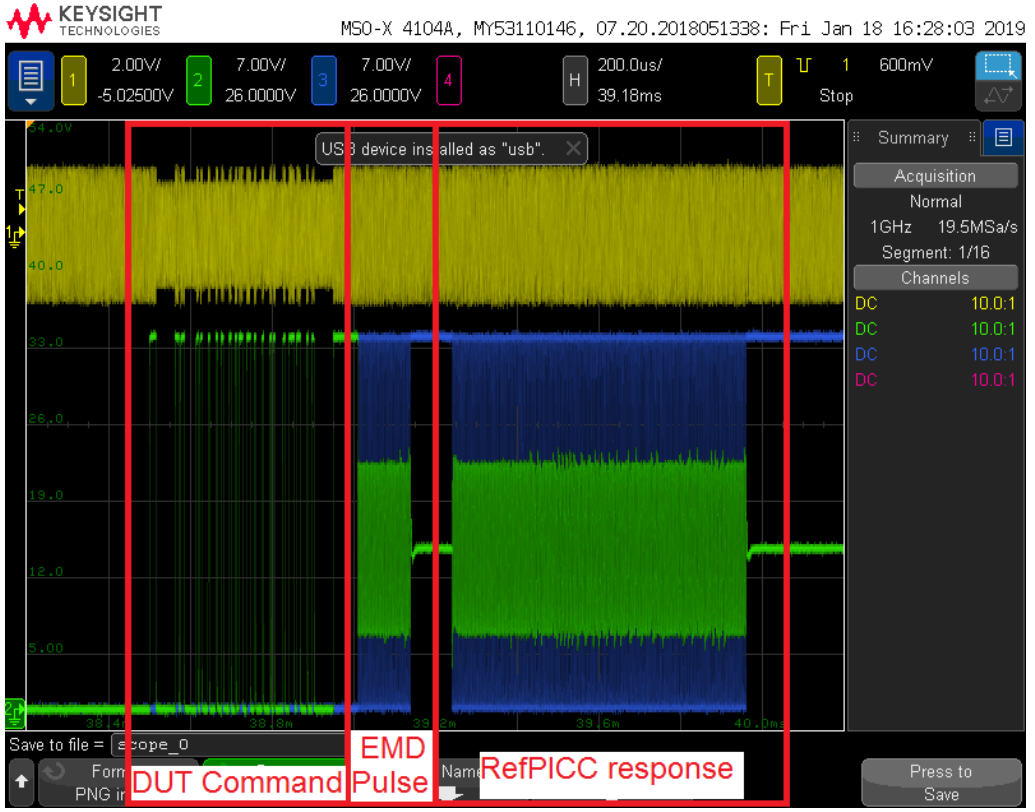
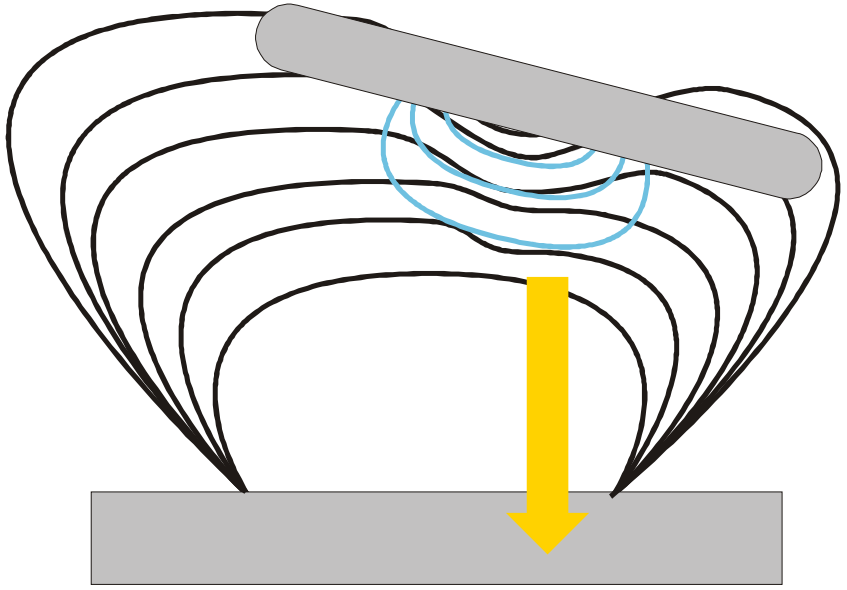
EMD: automatic EMD suppression

- Automatic PCD EMD handling
  - When the ST25R3916B 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 ST25R3916B/17B and the PICC against PICC generated electromagnetic disturbance (EMD)



Low power card detection

- Internal wakeup circuitry
  - The ST25R3916B/17B includes a fully programmable wakeup scheme based on inductive sensing. All relevant parameters like cycle time & sensitivity can be programmed.



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

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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Evaluation boards & ecosyste

ST25

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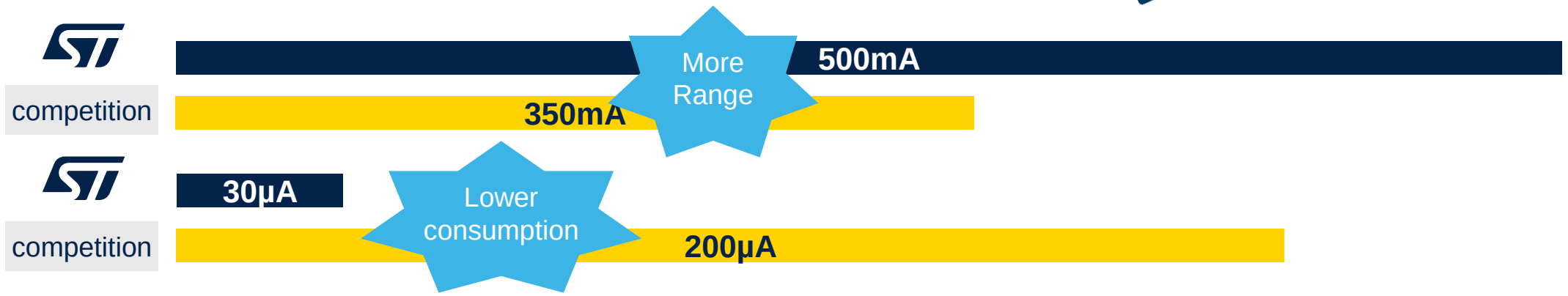
Competitor analysis

ST25R3920B vs. Competition



Features	AAT	NSR	AWS	DPO
ST	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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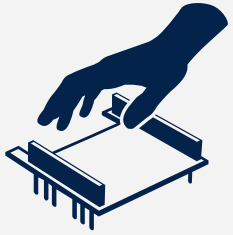
ST25R3920B rich eco-system



- 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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ST25R3916B* family evaluation boards

STEVAL-25R3916B

ST25R3916B discovery kit

- **ST25R3916B** High perf NFC universal device and EMVCo reader
- 66x66mm 2 turns antenna etched on PCB
- STM32L476 ULP 32-bit MCU
- Micro-USB connector
- Additional UART / I²C Host interfaces, as well as NFC SPI and JTAG/SWD points

X-NUCLEO-NFC08A1

ST25R3916B Nucleo shield

- **ST25R3916B** High perf NFC universal device and EMVCo reader
- 47x34mm 4 turns antenna etched on PCB
- Compatible with STM32 Nucleo boards
- Equipped with Arduino™ UNO R3 connector

ST25R3916B-EMVCO

ST25R3916B EMVCO kit

- **ST25R3916B** High perf NFC universal device and EMVCo reader
- 51x27mm 3 turns antenna etched on PCB
- STM32L476 ULP 32-bit MCU
- Micro-USB connector
- Comprehensive Device Test Environment (DTE) for EMVCo Level 1 FW control

*Discovery kit and Nucleo shield are also valid for ST25R3917B and **ST25R3920B**

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SW ecosystem for ST25 HF Readers

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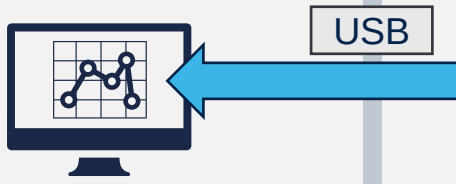
ST25R software overview

Software development tools for ST25R HF Reader IC

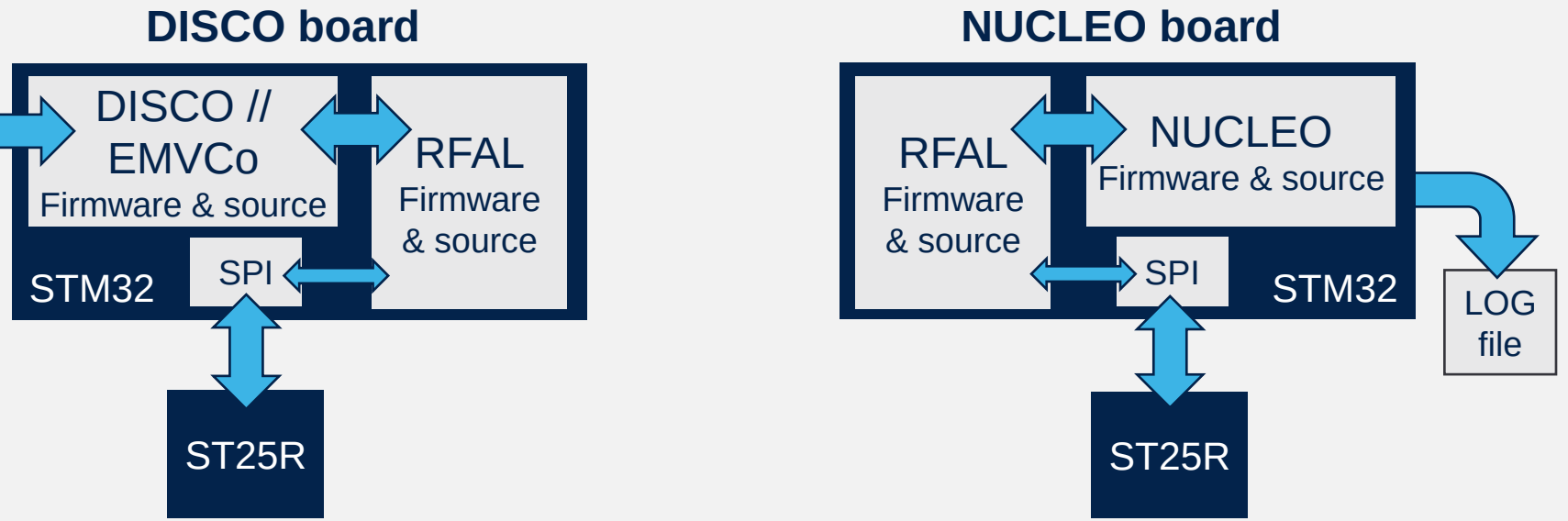
Graphical User Interface (GUI)



GUI for ST25R
PC software for Windows

On request:
GUI for ST25R EMVCo
PC software for Windows

Firmware

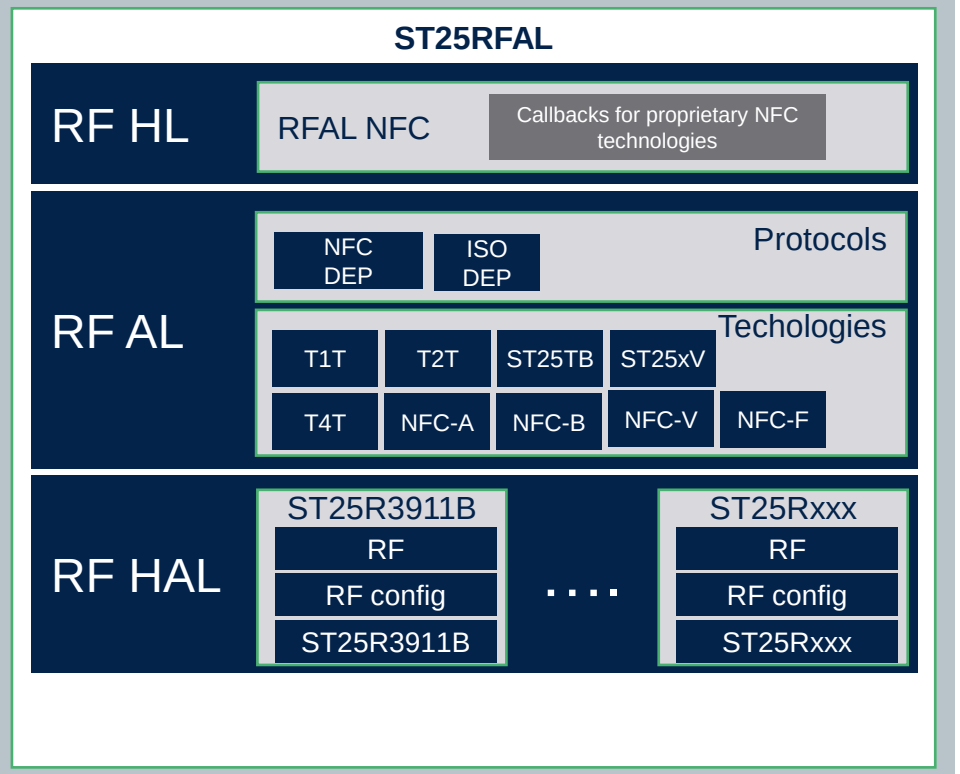


ST solutions

- ST25 HF Reader

ST25R RFAL SW suite

ST NFC Reader “RFAL” software suite



- Comprehensive device driver and middleware to build NFC enabled applications for reader devices based on ST25R NFC Readers
- Written in pure ANSI C
- Straightforward portability across different platforms (MCU/RTOS/OS) with non-blocking API
- Compliant with main HF/NFC standards (NFC Forum, ISO)
- Source code example implementations available: embedded (STM32, STM8 device, SPC5 on request) and Linux® (Raspberry Pi)
- Easy callback function for proprietary NFC technologies on application layer like Apple™ Mfi (delivered under Mfi conditions) and other technologies
- ST25R3916 RFAL SW (*STSW-ST25RFAL002*) and ST25R3911B RFAL SW (*STSW-ST25RFAL01*)

ST solutions

- ST25 HF Reader

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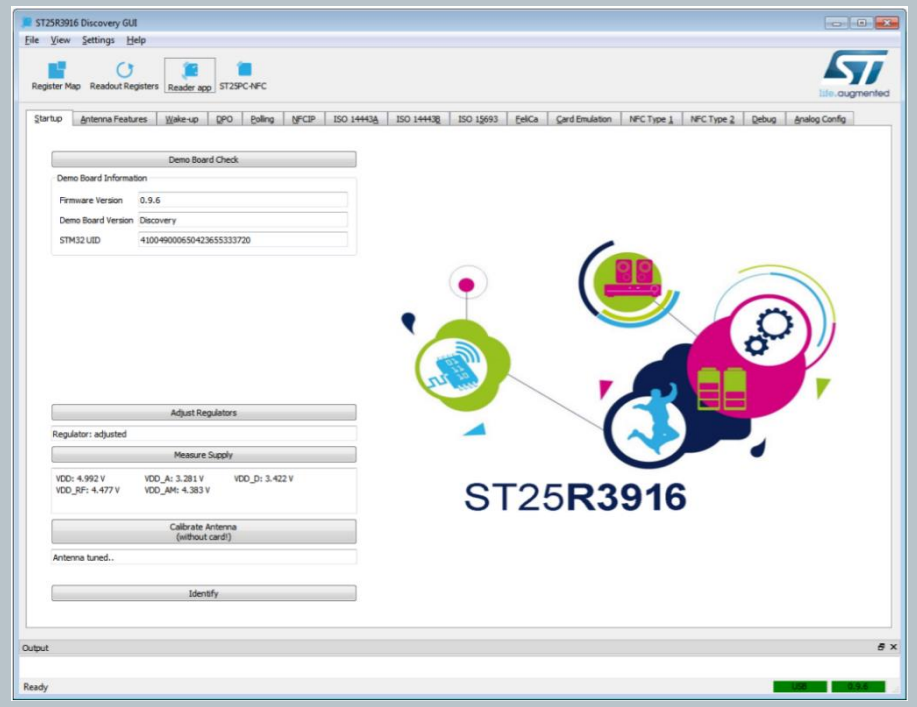
ST25R PC GUI software

ST NFC Reader “Discovery” software suite



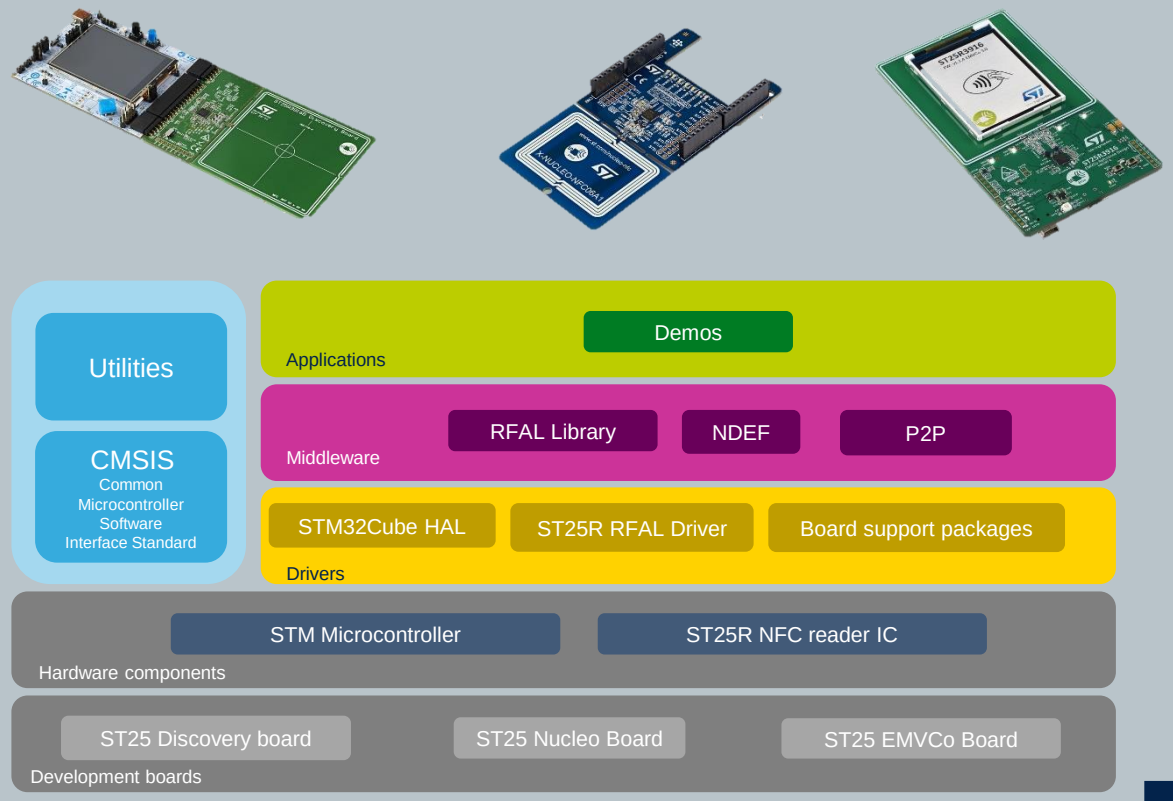
- Supports several RF protocols (ISO14443-A / NFC-A, ISO14443-B / NFC-B, FeliCa™ / NFC-F and ISO15693 / NFC-V)
- Active P2P (peer to peer) according to ISO18092, including SNEP
- Card emulation in NFC-A (106kbps) and NFC-F (212 and 424kbps)
- Wakeup feature, analog configuration and register access of ST25R3916
- Support of Automatic Antenna Tuning (AAT) & Dynamic Power Output (DPO)
- Access to all ST25 Tag features thanks to ST25PC NFC SW (*STSW-ST25PC001*)
- ST25R3916 PC GUI SW (*STSW-ST25R010*) and ST25R3911B PC GUI SW (*STSW-ST25R001*)

ST solutions

- ST25 HF Reader

ST25R Firmware for MCU

Firmware for ST25R Discovery, Nucleo & EMVCo boards



Complete set of source files to compile firmware for development boards (Discovery, Nucleo…)

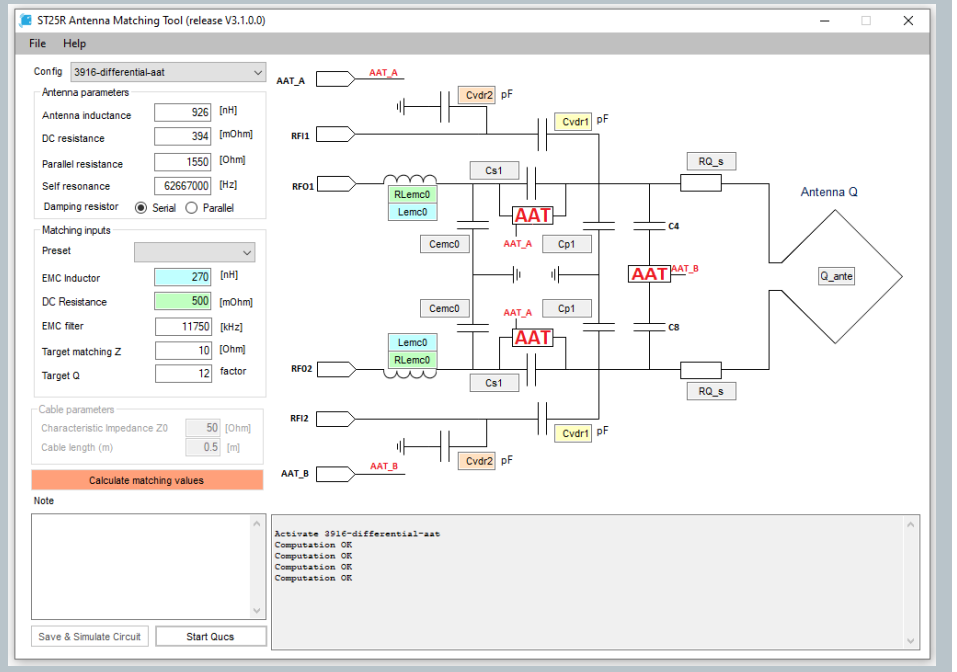
- Reader / Writer demonstration
  - Tag inventory, read and write (all NFC standard protocols supported)
  - Dynamic power output
  - NFC Forum NDEF messages
- Card emulation demonstration
  - NFC Type 4A Tag emulation (all tag types supported in USB mode)
  - NFC Forum NDEF messages
  - Possibility to be written by a reader or by a smartphone
- Peer to peer (P2P) demonstration
- EMVCo Layer 1 support FW, on request
- ST25R3916 Disco kit FW (*STSW-ST25R011*), ST25R3916 Nucleo board FW (X-CUBE-NFC6) and ST25R3911B Disco kit FW (*STSW-ST25R002*)

ST solutions

- ST25 HF Reader

ST25R antenna matching software kit

ST NFC Reader “Antenna Matching” software kit



- Comprehensive antenna matching tool with GUI to find the right external component values for a chosen configuration
- Available for the entire ST25R HF Reader product line
- Allows configuration with or without AAT functionality
- Integrates circuit simulator (QUCS), automatic component value selection and generates the Smith Chart
- Standalone version for Windows PC and online tool available
- Antenna Matching tool for ST25R NFC/HF Reader (*STSW-ST25R004)*

ST solutions

- ST25 HF Reader

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Solutions for NFC / RFID Tags & Readers

ST25

ST25 SIMPLY MORE CONNECTED

Thank you

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