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ST25R3916B/17B/19B

NFC readers for consumer, industrial, & charging applications

ST25

ST25R3916B/17B/19B at a glance

What it does

- ST25R acts as initiator and provides power: phone readout with empty battery
- Communication with NFC-enabled mobile phones (>70% adoption rate) for iOS or Android

Above 1.6W power for excellent interaction range

Enables small antenna designs

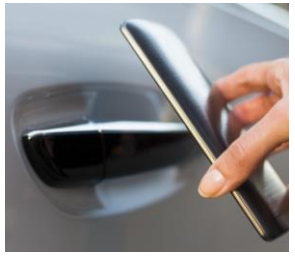
Advanced features & simplified electromagnetic immunity

Fast time to market

Providing a smooth user experience

Access (car, building…), gaming, consumables, authentication, interaction, data transfer…

www.st.com/st25r


Readers 13.56MHz or Bank

ST25R main markets

NFC charging, Ki-kitchen

Power & data transfer

Consumer / gaming

Pairing
Power & data transfer

Industrial

Tracking & inventory
Data transfer & programming

Payment

EMVCo® 3.1a
Pairing

Qi wireless charging protection

Card or phone identification
Authentication

eGovernment, medical, access control

Authentication

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ST25R3916B/17B/19B 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 wave shaping

Fast time to market

- EMVCo®, NFC Forum, and ISO 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

ST25R3916B/17B/19B readers differences

Features	ST25R3916B	ST25R3917B	ST25R3919B	ST25R3918
ISO/IEC 14443 Type-A	Yes		Yes	Yes
ISO/IEC 14443 Type-B	Yes		Yes	Yes
ISO/IEC 15693	Yes		Yes	Yes
FeliCa™	Yes		No	No
NFC Tag read support	NFC Type 1 Tag NFC Type 2 Tag NFC Type 3 Tag NFC Type 4 Tag NFC Type 5 Tag		NFC Type 1 Tag NFC Type 2 Tag NFC Type 4 Tag NFC Type 5 Tag	NFC Type 1 Tag NFC Type 2 Tag NFC Type 4 Tag NFC Type 5 Tag
ISO/IEC 18092 Passive Initiator mode	Yes		No	Yes
ISO/IEC 18092 Passive Target mode	Yes	No	No	Yes
ISO/IEC 18092 Active Initiator and Target mode	Yes	No	No	No
Card Emulation	Yes	No	No	Yes
Automatic antenna tuning (AAT)	Yes	No	No	No
Capacitive sensor wakeup	No	No	No	No
Inductive sensor wakeup	Yes		Yes	Yes
Waveshaping	Excellent			Good
Amb Temp Range	-40 to +105°C		-40 to +105°C	-40 to +85°C
R(on)	2 Ohm		2Ohm	8Ohm
Max current (LDO//external)	350mA//500mA		350mA//500mA	85mA//125mA

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The choice for EMVCo® 3.1a

ST25R3916B family
the market-leading NFC readers for contactless payment

- A trusted partner for **more than 10 years**
- Fully **EMVCo® 3.1a compliant**
- Smooth experience with LCD screens
- Small antenna designs
- EMVCo® 3.1a reference kit & software available

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ST25R3916B
high-perf. NFC universal device & EMVCo® reader

ST25R3916B

Reader Writer	ISO14443 ISO15693 FeliCa	RAM BUFFER	SPI/I²C
AP2P PP2P Card emulation	NFC 848kb/s	512bytes	2.4/5.5V 3.4Mb/s 10Mb/s
1.6W	DPO: dynamic power output IWU: inductive wake-up (LPCD) AWS: active wave shaping NSR: noise suppression receiver AAT: automatic antenna tuning DSO: driver slope adjustment EMD: automatic EMD error handling		

Thin QFN32

WLCSP

Use cases

- Ideal for **payment** applications with CE mode for additional functions
- FeliCa, Apple ECP, access control, gaming, IOT, and pairing

Key features

- NFC Forum universal device (with CE mode)
- **1.6W** output power with **dynamic power output**
- **EMVCo® 3.1a** certification without external power amplifier
- Improved **active wave shaping, noise suppression receiver**
- **Automatic antenna tuning**
- -40°C to **105°C** ambient temperature range (QFN)

Key benefits

- Low power operation & standby mode (low power card detection)
- Works in challenging environment like noisy LCD displays.
- Ideal for passing the newest EMVCo® standards

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ST25R3917B
cost efficient - performant NFC & EMVCo® reader

ST25R3917B

Reader Writer	ISO14443 ISO15693 FeliCa	RAM BUFFER	SPI/I²C
PP2P Initiator	NFC	512bytes	2.4/5.5V
	848kb/s		3.4Mb/s 10Mb/s
1.6W	DPO: dynamic power output IWU: inductive wake-up AWS: active wave shaping NSR: noise suppression receiver DSO: driver slope adjustment EMD: automatic EMD error handling		

Thin QFN32

Use cases

- Ideal for **payment** applications with the need of FeliCa
- Apple ECP, access control, gaming, consumer

Key features

- NFC Forum reader device
- **1.6W** output power with **dynamic power output**
- **EMVCo® 3.1a** certification without external power amplifier
- Improved a**ctive wave shaping v2, noise suppression receiver**
- -40°C to **105°C** ambient temperature range

Key benefits

- Low power operation & standby mode (low power card detection)
- Works in challenging environment like noisy LCD displays
- Ideal for passing the newest EMVCo® standards

ST25R3919B
cost efficient and performant NFC reader

ST25R3919B

Reader Writer	ISO14443 ISO15693	RAM BUFFER	SPI/I²C
	NFC	512bytes	2.4/5.5V
	848kb/s		3.4Mb/s 10Mb/s
1.6W	DPO: dynamic power output IWU: inductive wake-up AWS: active wave shaping NSR: noise suppression receiver DSO: driver slope adjustment EMD: automatic EMD error handling		

Thin QFN32

Use cases

- Ideal for **payment** applications
- Apple ECP, access control, gaming, consumer

Key features

- NFC Forum reader device
- **1.6W** output power with **dynamic power output**
- Improved a**ctive wave shaping v2, noise suppression receiver**
- -40°C to **105°C** ambient temperature range

Key benefits

- Low power operation & standby mode (low power card detection)
- Works in challenging environment like noisy LCD displays
- Ideal for passing the newest EMVCo® standards

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ST25R3918
Multi-purpose NFC transceiver

ST25R3918

Reader Writer	ISO14443 ISO15693	RAM BUFFER	SPI/I²C
PP2P	NFC	512bytes	2.4/5.5V
CE	848kb/s		3.4Mb/s 10Mb/s
0.5W	DPO: dynamic power output IWU: inductive wake-up AWS: active wave shaping NSR: noise suppression receiver DSO: driver slope adjustment EMD: automatic EMD error handling		

Thin QFN32

Use cases

- Ideal for **reader & tag**
- Access control, gaming, consumer
- Apple AppClip; Android Instant App

Key features

- **0.5W** output power with **dynamic power output**
- **active wave shaping, noise suppression receiver**
- -40°C to **105°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

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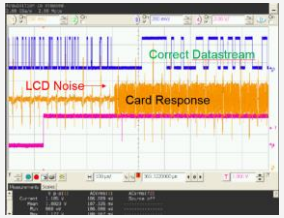
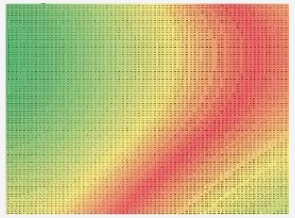
A closer look at the enabling features

Noise suppression receiver



- **Robustness** against noise
- Up to **19.3dB better SNR.**
- Noisy LCD possible for EMVCo® POS terminals.

Automatic antenna tuning



- Easiest environmental/ lifetime compensation
- Automatic **adjustment of the tuning resonance and matching impedance**

ST25R3916B only

Driver slope adjustment

- **Easier FCC approval**
- **Minimizes high frequency EMC noise**

Enhanced active wave shaping

- **Easier EMVCo® analog approval**
- Under/Overshoot can be reduced to **achieve required wave shaping** easily and faster than before.

A closer look at the enabling features

Large FIFO; automatic EMD

- **Faster SW integration**
- **Complete frames can be transmitted and received** without SW interaction
- Time-critical **EMD suppression 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 mode

- Low power consumption
- Inductive wakeup allows for low power consumption

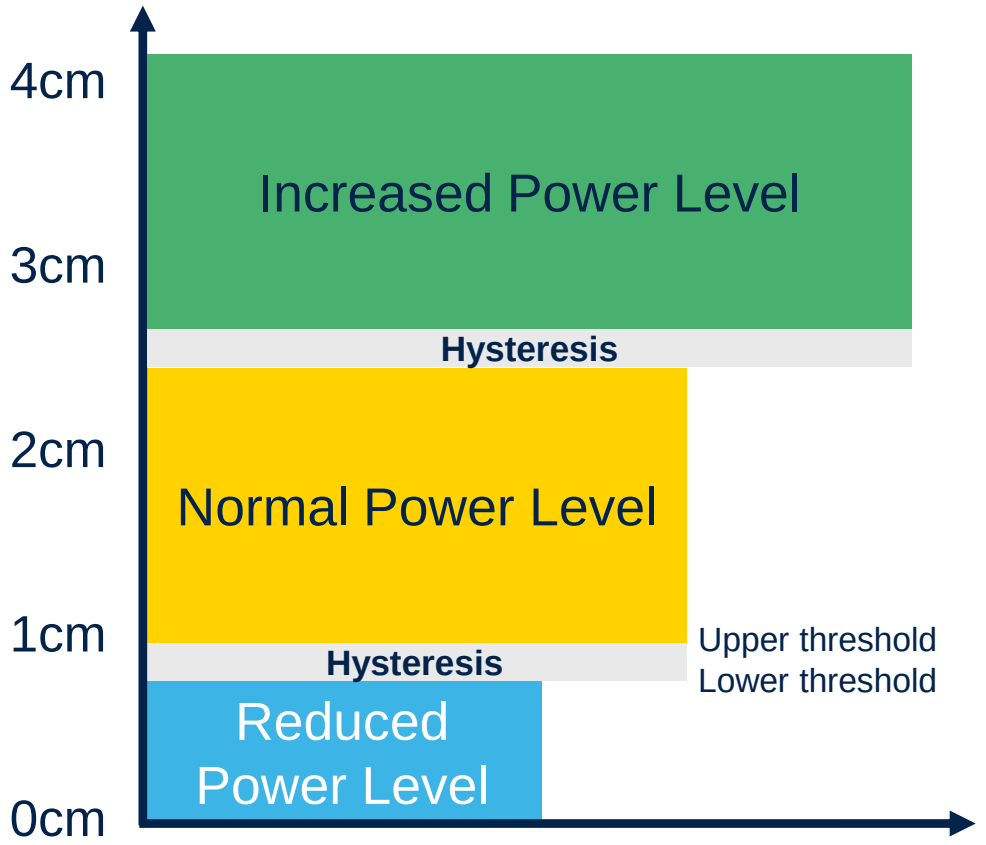
ST25R3916B only

Dynamic power output

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

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 you to adopt to different power levels of card responses via active Gain Control.
- Improved noise immunity
  - Squelch feature allows you to scale the signal level to have improved immunity against noise.



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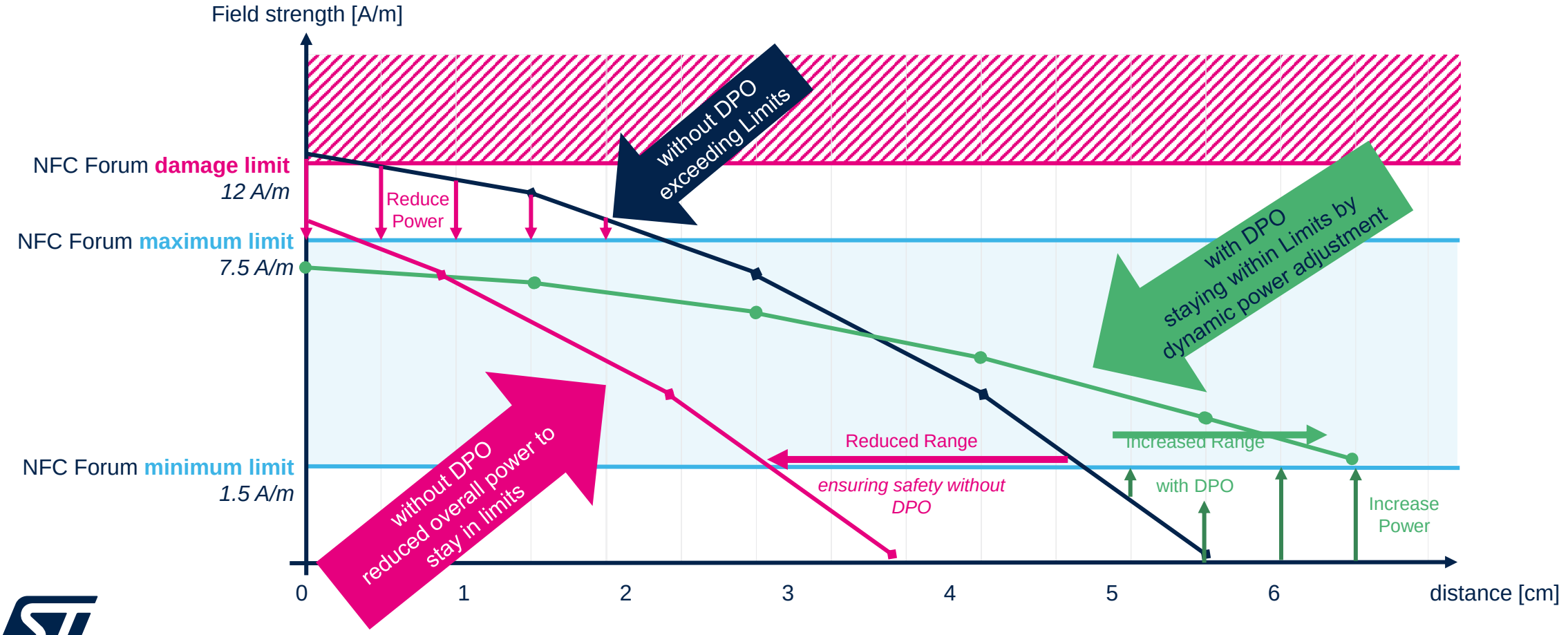
ST25 Reader DPO: Dynamic Power Output

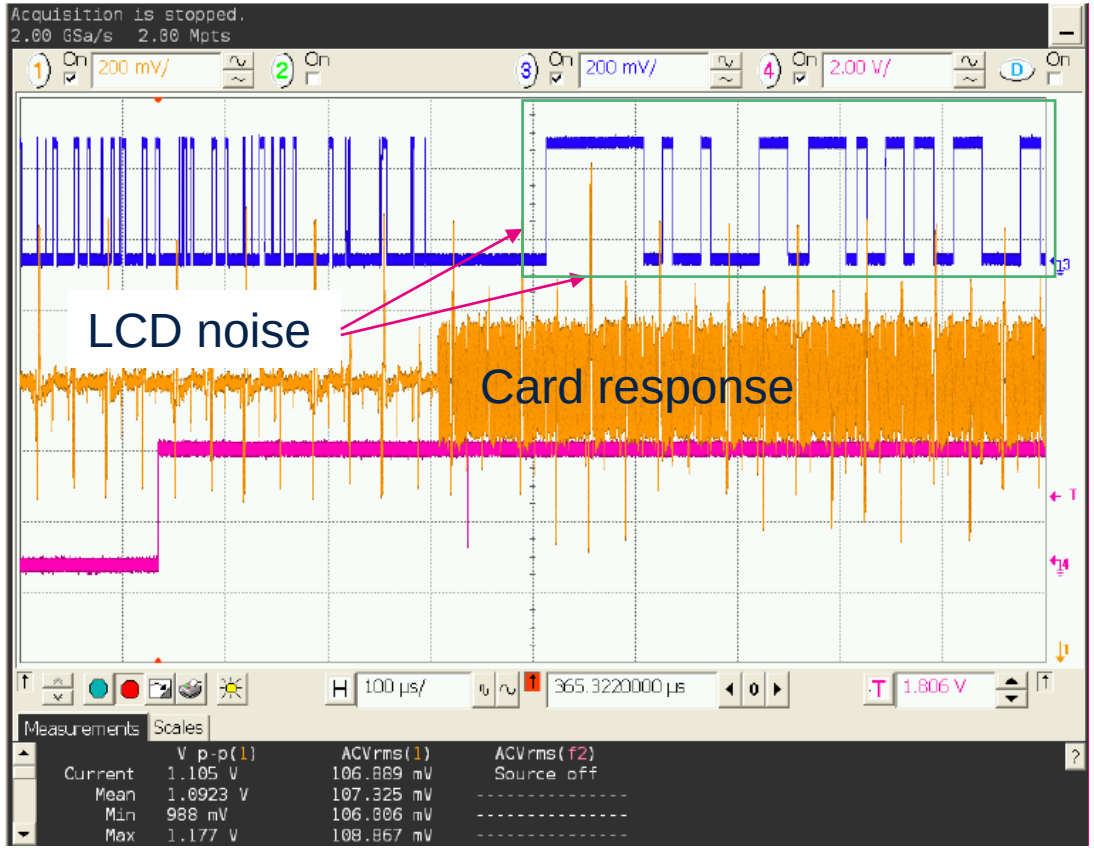
- DPO of reader will keep power levels within requirements & limits



NSR: noise suppression receiver

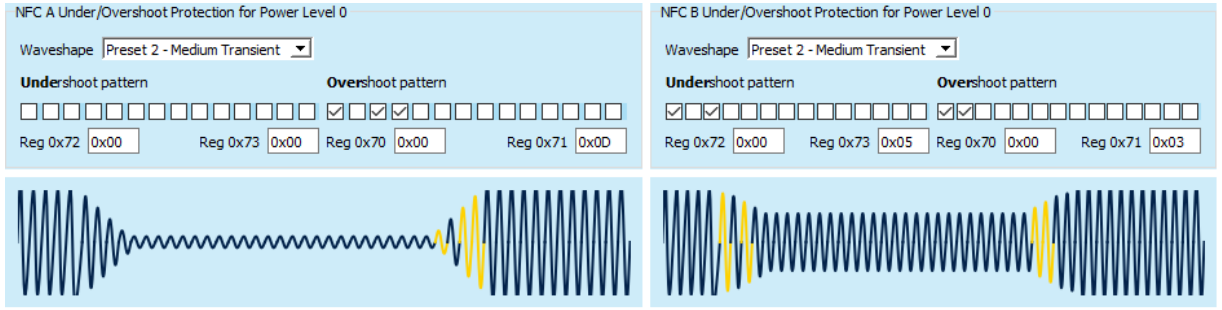
- Proper decoding
  - Proper decoding still possible even though LCD noise level exceeds card signal strength
  - ANS jumps in as soon as the receiver locks on a card response.
- Noise immunity compared to non NSR
  - Type A 106 display noise immunity improved by a factor of 3.3 vs ST25R3911B
  - Type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

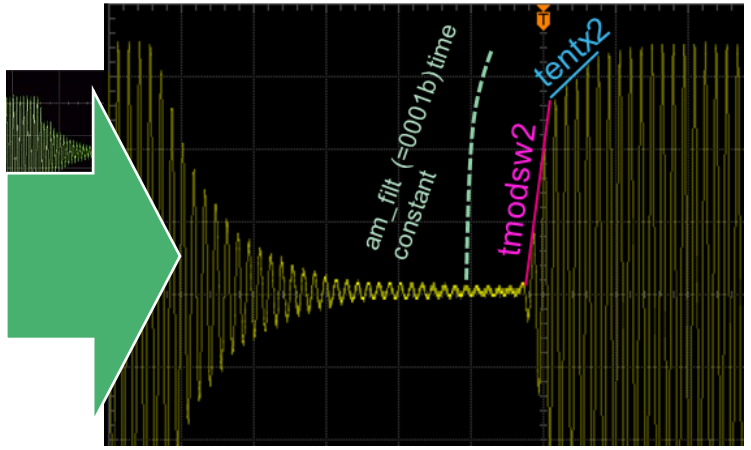
Correct datastream



AWS: active wave shaping

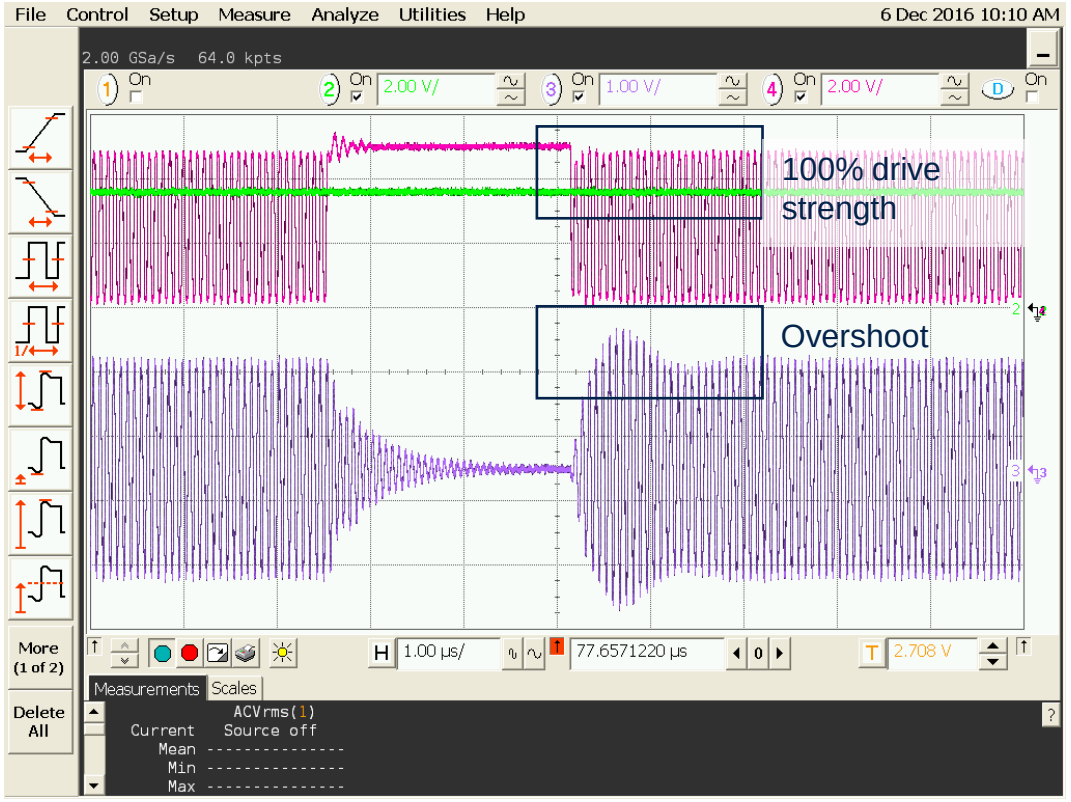
- The improved active wave shape (AWS) function will reduce over- and undershoots even easier than before.
- The function is easily enabled by using the bits in the corresponding registers.
  - 2 register and 14 bits for each over- and undershoot protection are available and allow for easy adjustment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



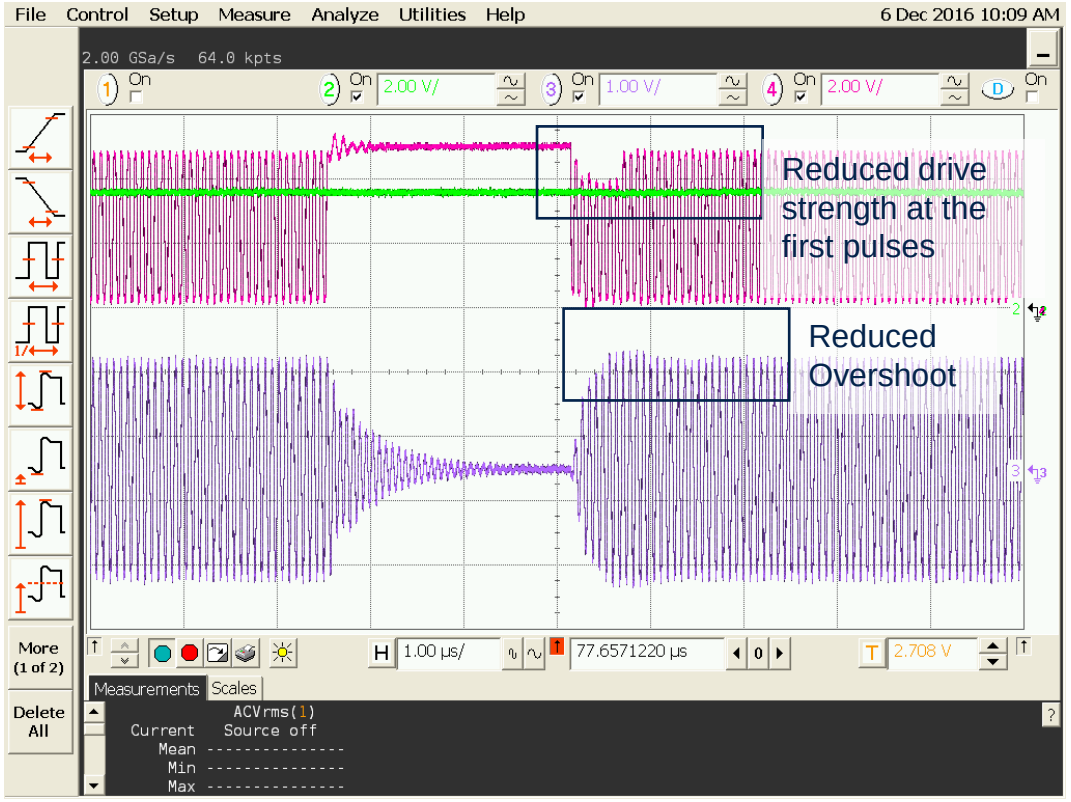


AWS: active wave shaping

- Traditional A 106 modulation pulse



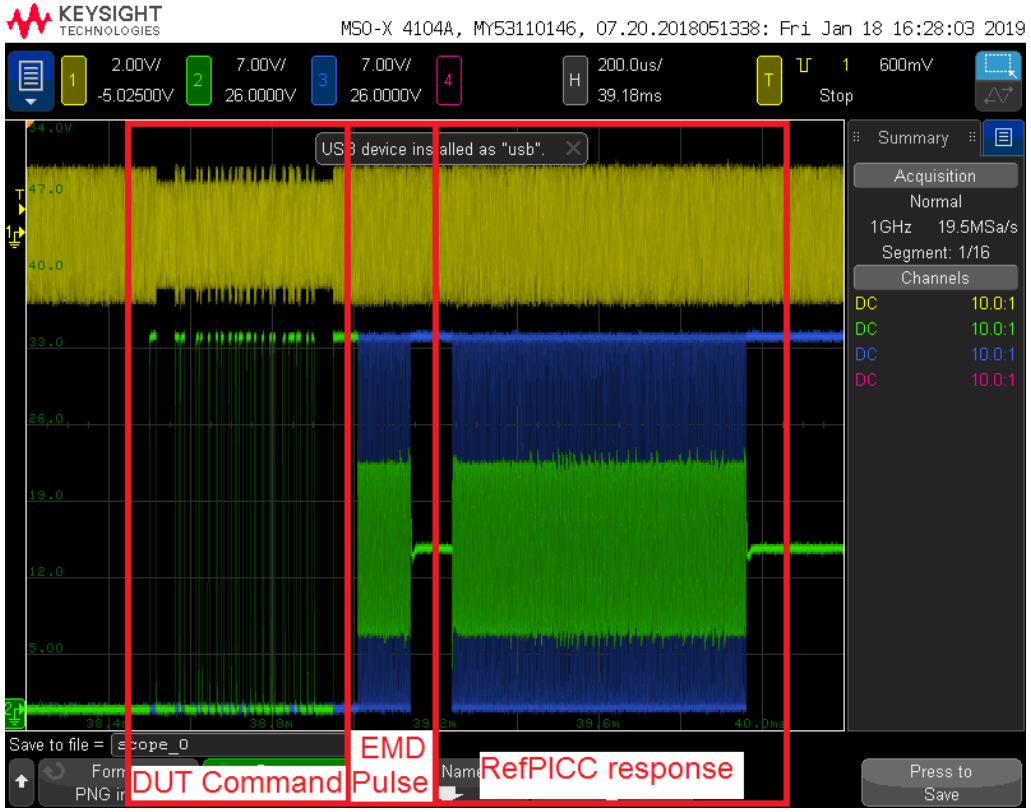
- Improved A106 modulation pulse with Over/Undershoot protection



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

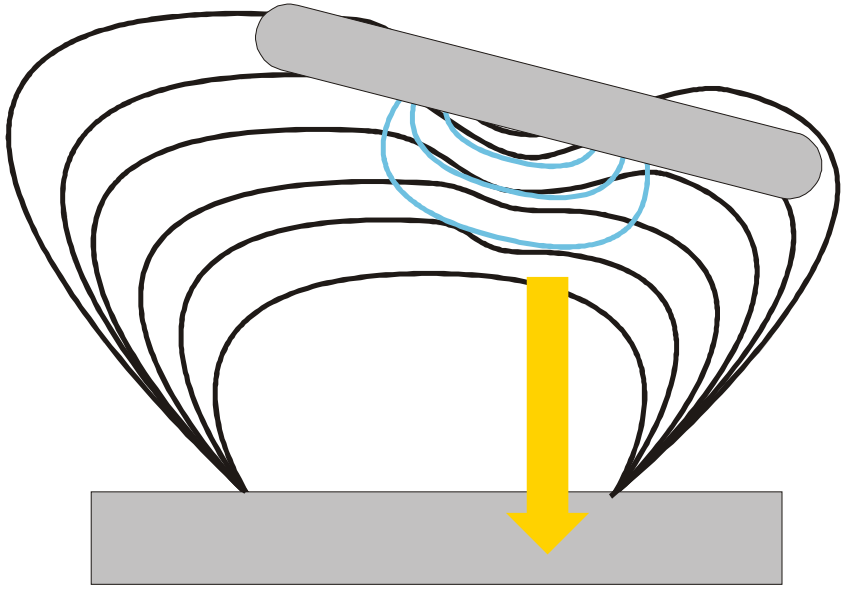
EMD: automatic EMD suppression

- Automatic PCD EMD handling
  - When the ST25R3916B receives a PICC frame, it is checked for transmission errors.
  - Transmission errors are detected in real time.
  - If the number of bytes received when a transmission error is detected is below 4, the PCD ignores the transmission and is ready to receive a new PICC frame.
- Increased robustness
  - EMD handling makes the contactless communication between ST25R3916B/17B and the PICC more robust 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.



Evaluation boards & ecosystem

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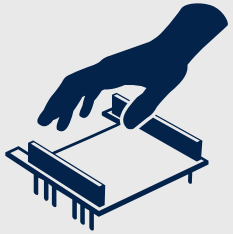
ST25R3916B/17B/19B rich ecosystem



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

- Antenna e-design tool
- Schematic, BOM, Gerber
- Applications notes

- PC software tool ST25
- MCU driver firmware
- Evaluation boards

- Documentation
- e2e community
- Webinar
- MOOC

STEVAL-25R3916B discovery kit

- The STEVAL-25R3916B consists of the ST25R3916B high performance NFC universal device controlled by a STM32L476 ultra-low-power Arm Cortex-M4 MCU with 512Kbytes flash memory.
- It can operate in standalone mode via the LCD display or can be connected via USB to a Windows PC and controlled via the ST25R3916 GUI.
- Onboard 66 x 66 mm, 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 kb/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.

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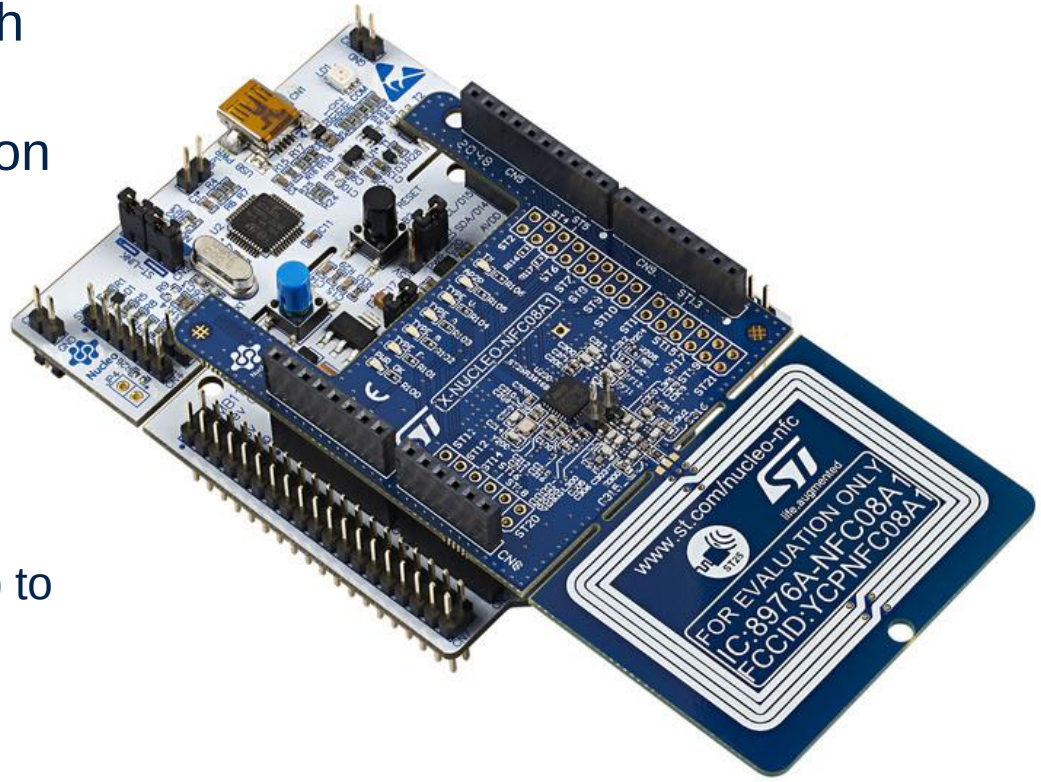
X-NUCLEO-NFC08 development kit

- The X-NUCLEO-NFC08 is a Nucleo shield based on the ST25R3916B high performance universal HF/NFC & EMVCo® frontend.
- Thanks to its Arduino U3 connector, it is compatible with the STM32 Nucleo, Raspberry Pi, and other platforms.
- Onboard 47 x 34 mm, 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 kb/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 Raspberry Pi Linux driver



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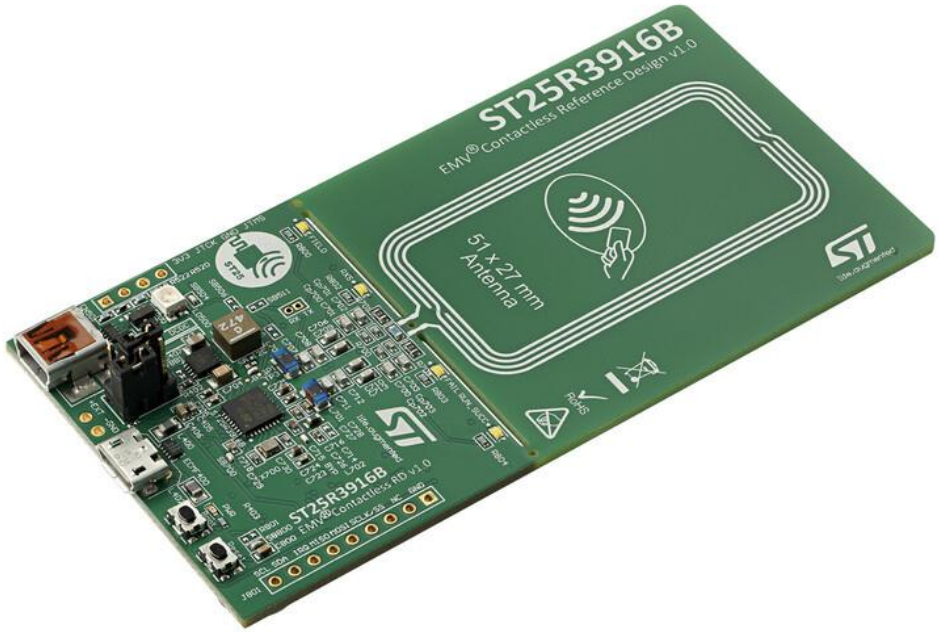
ST25R3916B-EMVCO
EMVCo® 3.1 development kit

- The ST25R3916B-EMVCO includes the ST25R3916 high-performance NFC universal device & EMVCo® reader controlled by an STM32L476 ultra-low-power Arm Cortex-M4 MCU with 512Kbytes flash memory.
- It connects via USB to a Windows PC and can be controlled via the provided EMVCo® L1 software fo the EMVCo® 3.1 standard.
- Features:
  - Onboard 51 x 27 mm, three turn antenna.
  - Possibility to connect custom build and smaller antennas
  - Free EMVCo® L1 software and sources
  - Free schematics, layout, and Gerber files
- Kit available on request



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ST25R3916B evaluation boards

ST25R3916B discovery kit

STEVAL-25R3916B

- **ST25R3916B** High perf NFC universal device and EMVCo® reader
- 66 x 66 mm 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

ST25R3916B Nucleo shield

X-NUCLEO-NFC08A1

- **ST25R3916B** High perf NFC universal device and EMVCo® reader
- 47 x 34mm 4 turns antenna etched on PCB
- Compatible with STM32 Nucleo boards
- Equipped with Arduino® UNO R3 connector

ST25R3916B EMVCo® kit

ST25R3916B-EMVCO

- **ST25R3916B** High perf NFC universal device and EMVCo® reader
- 51 x 27mm 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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Software ecosystem for ST25 HF readers

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ST25R software overview

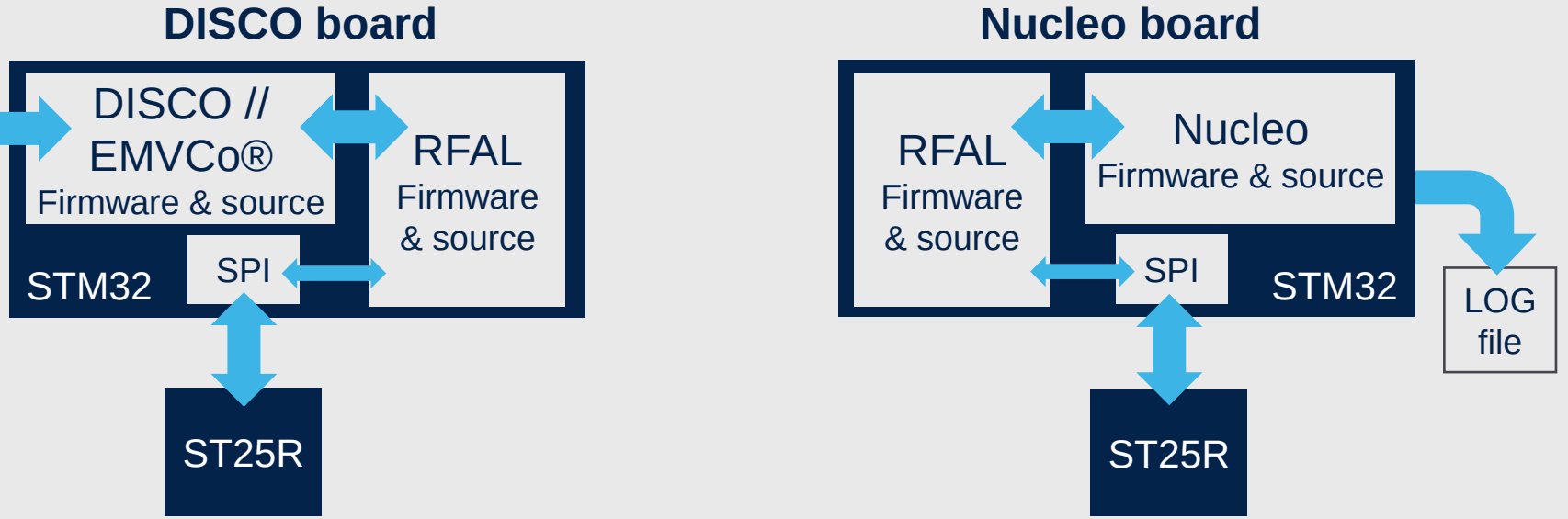
Software development tools for ST25R HF reader IC

Graphical user interface (GUI)

GUI for ST25R
PC software for Windows

On request:
GUI for ST25R EMVCo®
PC software for Windows

Firmware

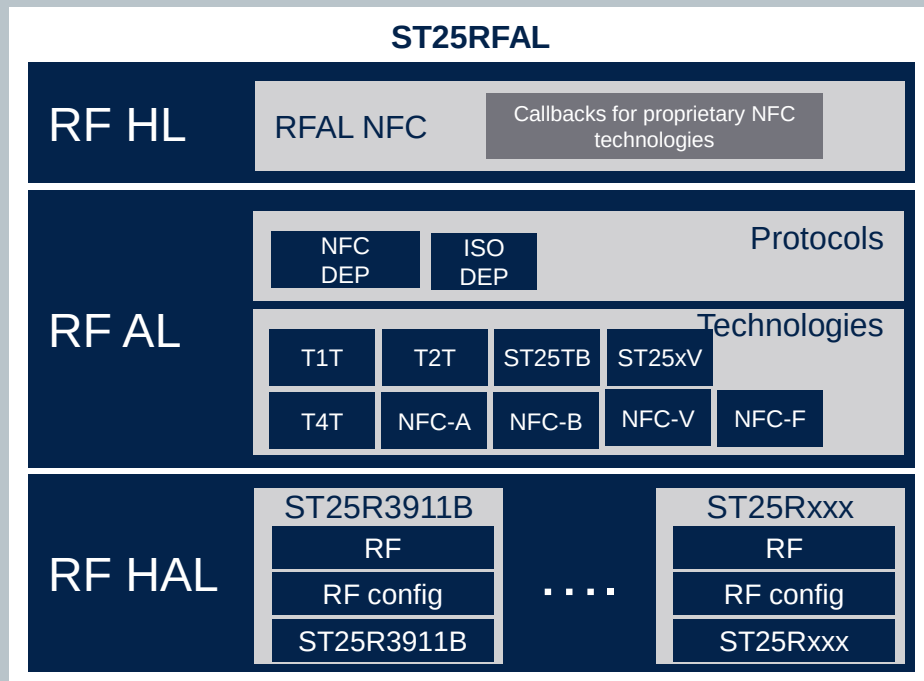


ST solutions

- 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(B) RFAL SW (*STSW-ST25RFAL002*) and ST25R3911B RFAL SW (*STSW-ST25RFAL01*)

ST solutions

- ST25 HF reader

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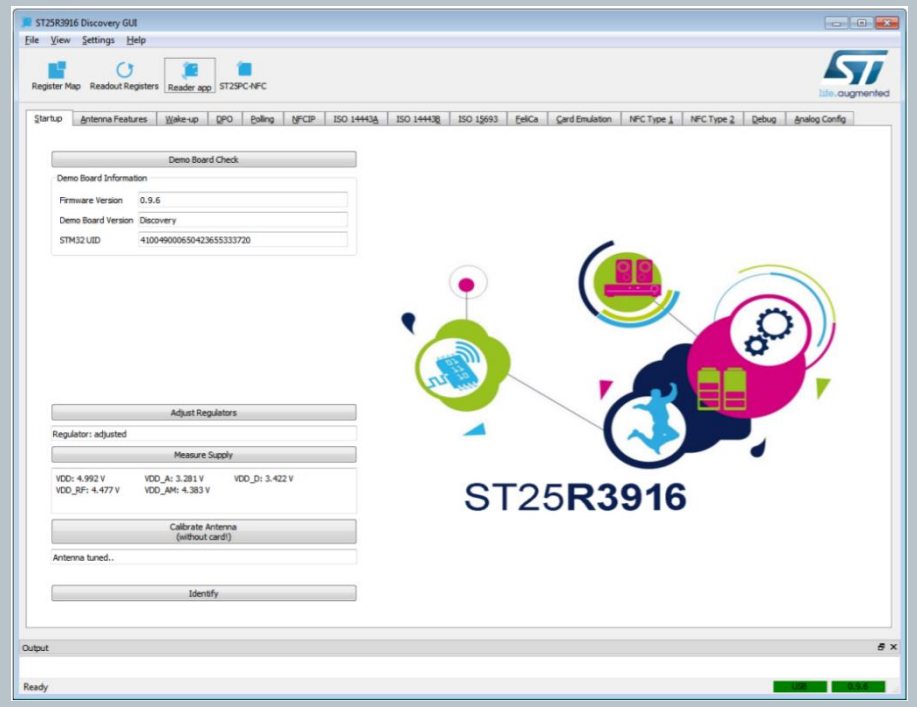
ST25R PC GUI software

ST NFC reader “discovery” software suite



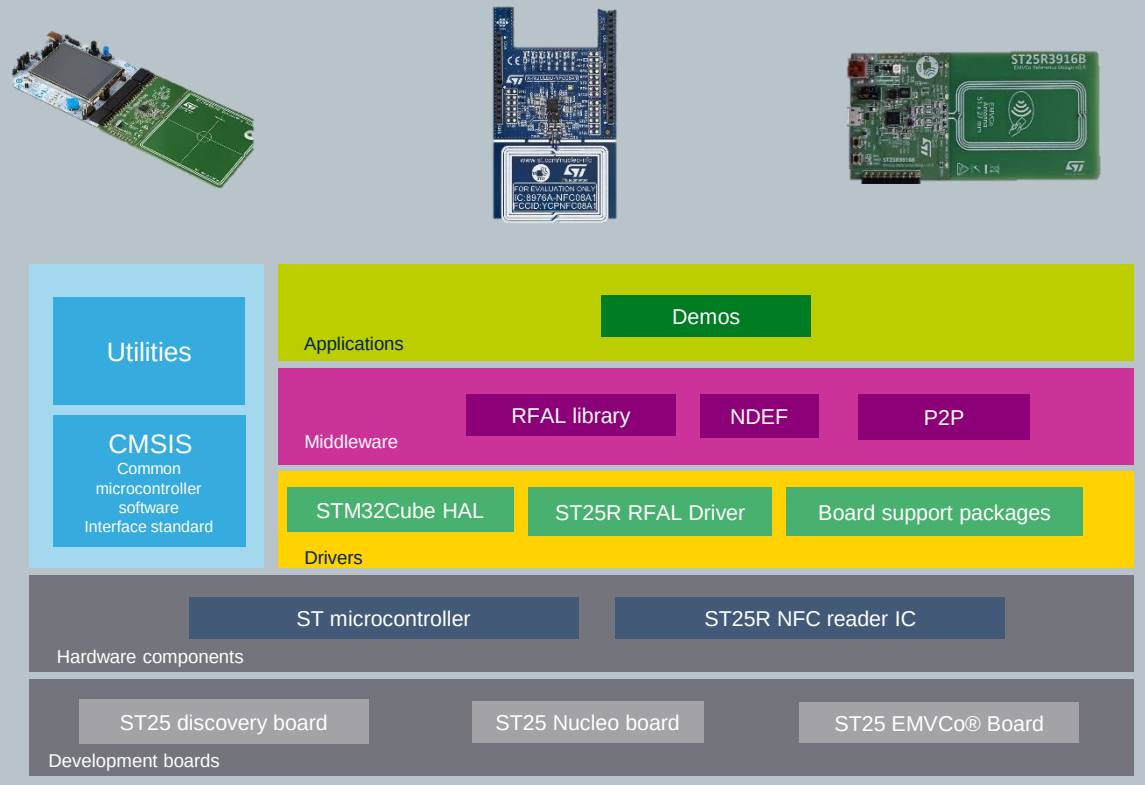
- Supports several RF protocols (ISO14443-A / NFC-A, ISO14443-B / NFC-B, FeliCa™ / NFC-F and ISO15693 / NFC-V)
- Active P2P (peer to peer) according to ISO18092, including SNEP
- Card emulation in NFC-A (106kbps) and NFC-F (212 and 424kbps)
- Wakeup feature, analog configuration, and register access 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(B) 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…).

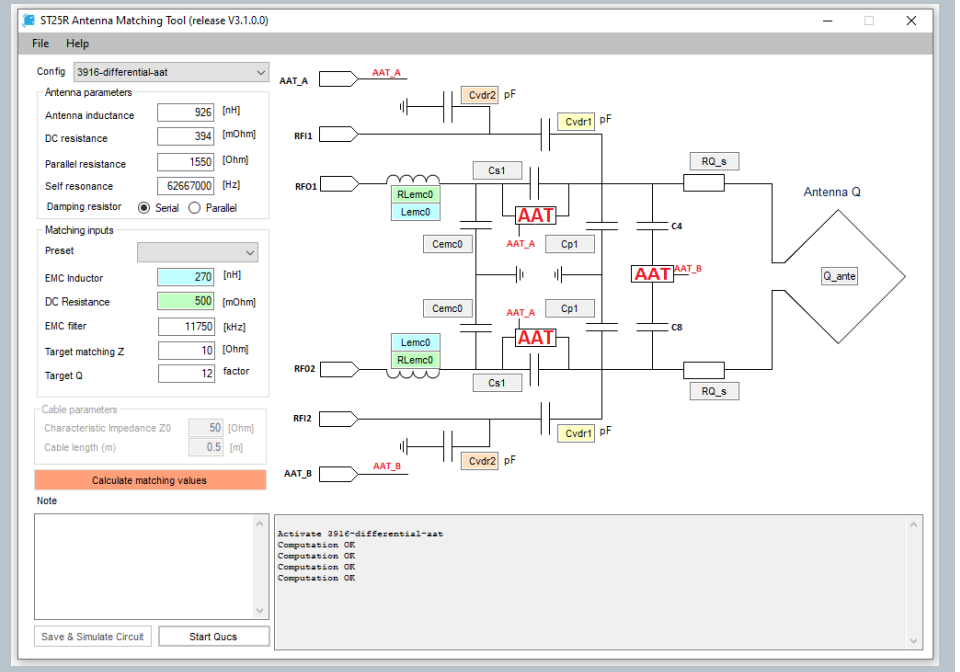
- Reader / writer demonstration
  - Tag inventory, read, and write (all NFC standard protocols supported)
  - Dynamic power output
  - NFC Forum NDEF messages
- Card emulation demonstration
  - NFC type 4A tag emulation (all tag types supported in USB mode).
  - NFC Forum NDEF messages
  - Can be written by a reader or by a smartphone
- Peer to peer (P2P) demonstration
- EMVCo® Layer 1 support FW, on request
- STEVAL-25R3916B FW (*STSW-ST25R018*)
- ST25R3916B Nucleo board FW (*X-CUBE-NFC6*)
- ST25R3911B Disco kit FW (*STSW-ST25R002*)

ST solutions

- ST25 HF reader

ST25R antenna matching software kit

ST NFC reader “antenna matching” software kit



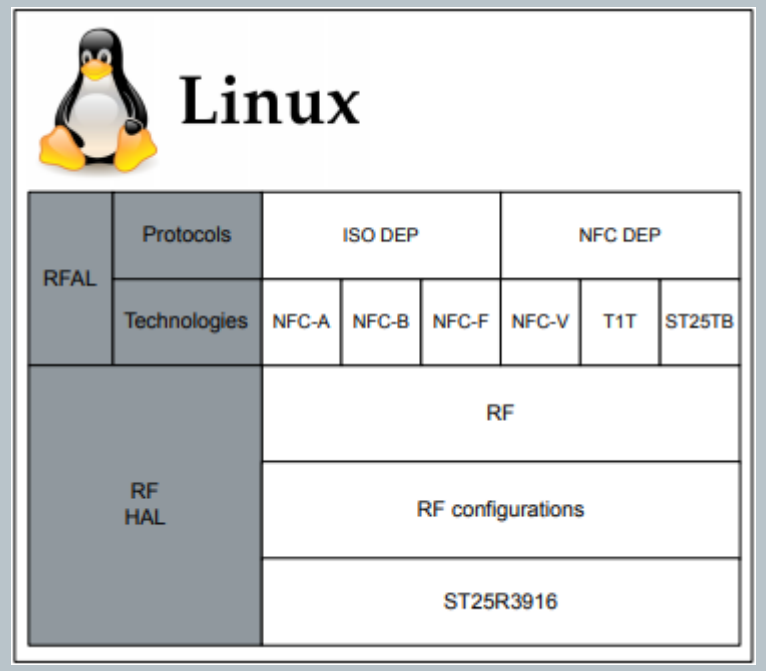
- Comprehensive antenna matching tool with GUI to find the right external component values for a chosen configuration
- Available for the entire ST25R HF reader product line
- Allows configuration with or without AAT functionality
- Integrates circuit simulator (QUCS), automatic component value selection 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

ST25R Linux software kit

ST NFC reader “Linux” software kit



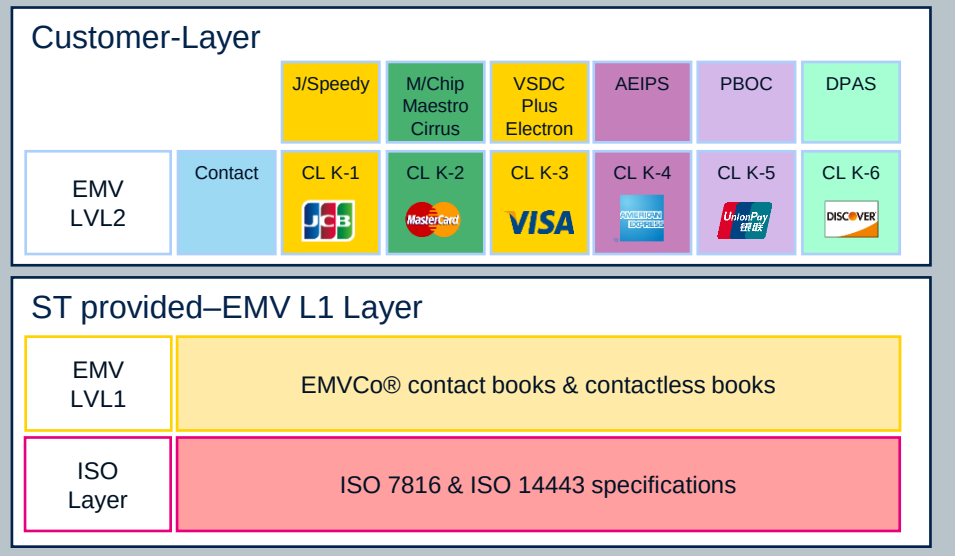
- Provides a pure user space port of the RFAL onto Raspberry Pi 3 and 4
- Support ST25R HF Readers
- Sample applications demonstrating Poller (R/W-mode) and Listener (Card emulation)
- Linux host communication through SPI
- Free, user-friendly license terms
- Linux for ST25R3916 Raspberry Pi using X-NUCLEO-NFC06A1 (*STSW-ST25R013*) and Linux for ST25R3911B Raspberry Pi using X-NUCLEO-NFC05A1 (*STSW-ST25R009*)

ST solutions

- ST25 HF reader

ST25R EMVCo® software kit

ST NFC reader “EMVCo®” software Kit



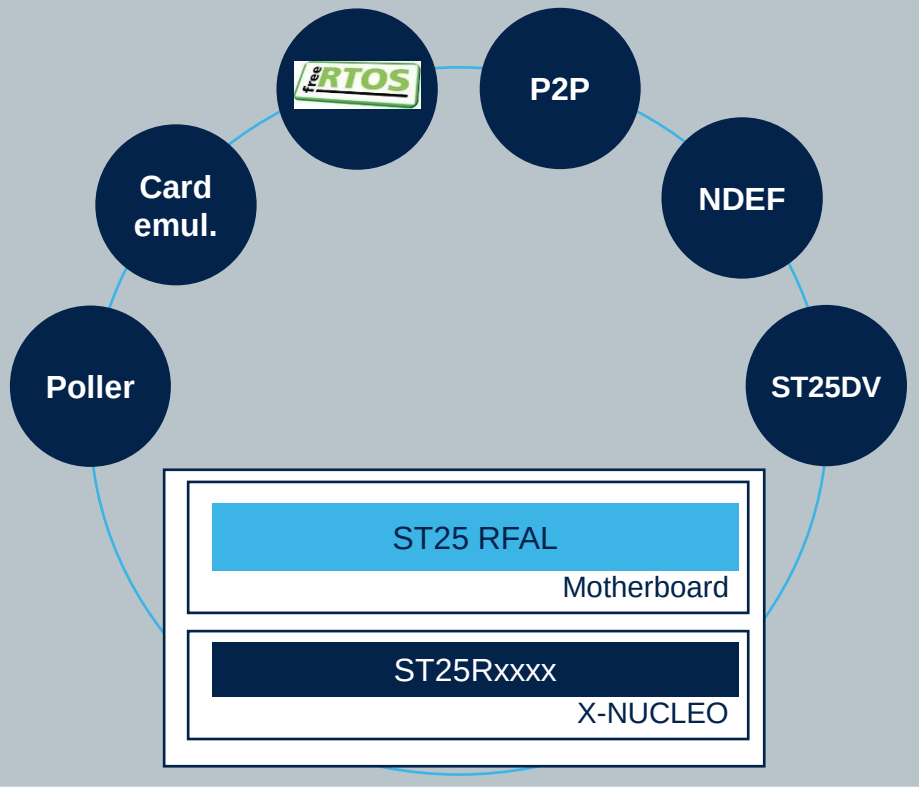
- ST provides EMVL1 firmware stack for contact-less products, as is
- Stack accessible under NDA for usage with ST25R series and available as source code
- Firmware accompanied by a GUI, which allows easy configuration the device as well as active wave shaping and dynamic power output
- Written in pure ANSI C based on RFAL
- EMV L1 layer prevalidated (kept up to date)
- Portable on various architectures thanks to the abstraction layers, which are integrated in the delivery
- Stack available with our POS demo kits on request

ST solutions

- ST25 HF reader

ST25R embedded NFC library software kit

ST NFC reader “NFC Lib” software kit



- Collection of middleware to build advanced NFC enabled applications such as
  - NFC poller
  - NDEF reader / writer
  - FreeRTOS™ poller
  - Proprietary active peer-to-peer & card emulation
- Support for ST25 tag and dynamic tag features
- ST25 Fast transfer mode (for ST25 readers and dynamic tags)
- Easy portability across different platforms (MCUs / RTOSs / OSs)
- Available for all ST25R HF readers, on request (free and user-friendly license terms)

ST solutions

- ST25 HF reader

Our technology starts with You

Find out more at www.st.com/st25r

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