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ST25RU3993 RAIN RFID Reader

Product Presentation

MMY Division

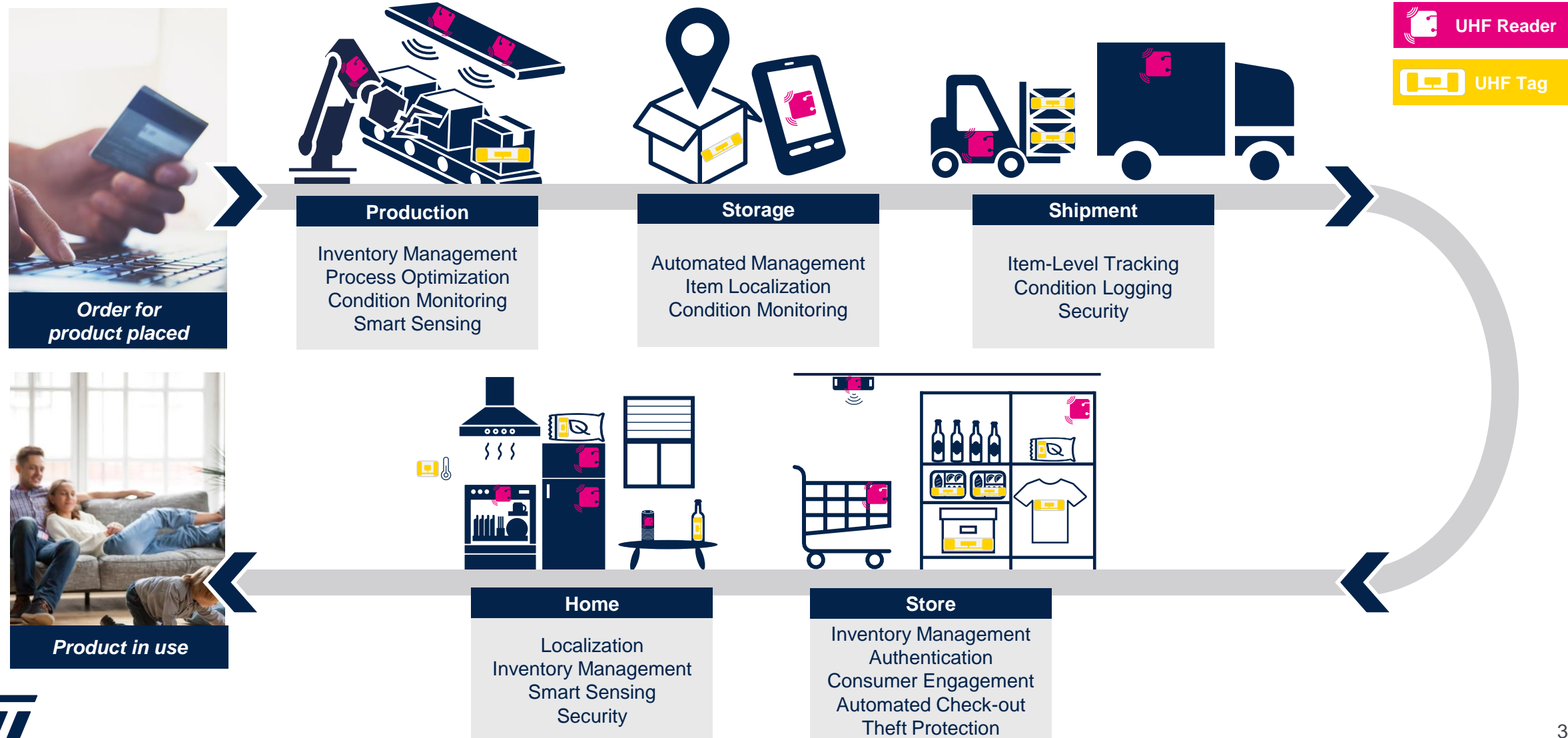


ST25RU3993 main markets





UHF in a product life cycle





Manufacturing



Tools & Inventory Management

Ensure availability of tools and planning certainty by automated tracking of tools and machinery as well as of the stock of inventory and goods.



Process Optimization

Monitor manufacturing processes and supply routes to optimize machine usage or downtimes and to prevent traffic jams and bottlenecks within the factory.



Condition Monitoring

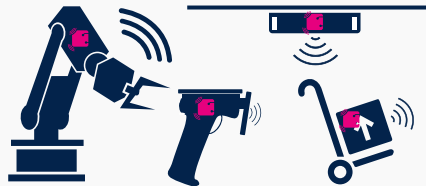
Track and record environmental conditions of your products at production and in storage to ensure a correct handling.



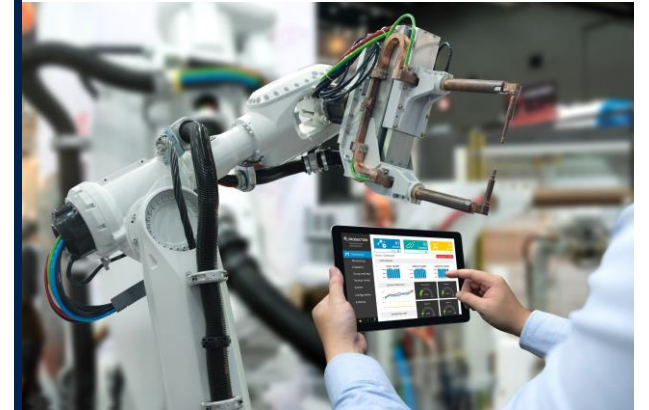
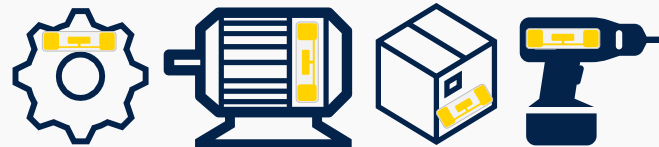
Smart Sensing

Use battery- and wireless sensor tags to monitor various parameter and conditions of tools, goods or machinery with a simple and quick setup.

UHF reader
with ST25RU



UHF tags
third party





Logistics



Automated Inventory Management

Use automated processes for check-in/check-out, priority setting (e.g. frozen food) and safety measures to improve storage speed, accuracy and quality.



Process Optimization

UHF allows the handling of hundreds of tags per second over long distances and enables a significant increase in turnover rates.



Condition Monitoring

Track and record environmental conditions of your products during manufacturing and in storage to ensure a correct handling.



Tamper Protection

Secure your sensitive products from tampering or altering with an UHF enabled protection and recognize a broken seal automatically at the next reader point.

UHF reader
with ST25RU



UHF tags
third party





Inventory Control & Security

Make sure you always have your items on stock and automatically sync your inventory with your online shop. Prevent losses or theft with minimum effort.



Process Optimization

Improve the customer experience by providing UHF enabled fast check-out and minimum waiting times at the register by automated items scanning.



Customer Interaction Tracking

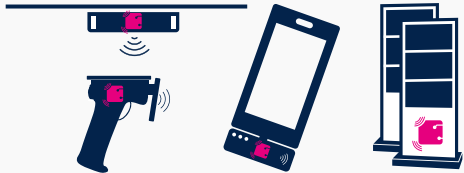
Track your customer's interactions with items and gain vital information for improving product placement and other marketing activities.



Authentication

Allow immediate authentication of brands of products and goods.

UHF reader
with ST25RU



UHF tags
third party





Inventory & Asset Management

Manage the inventory of your storage room or even of your fridge. Get notifications, if something is expiring or check what is left via phone.



Smart Sensing

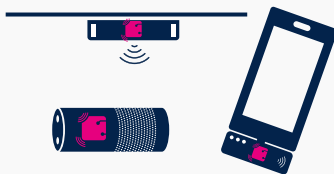
UHF sensing tells you, what is going in your house. Sense temperatures, liquid breakage or if your plant needs water. Detect window breakage. Wireless. Batteryless.



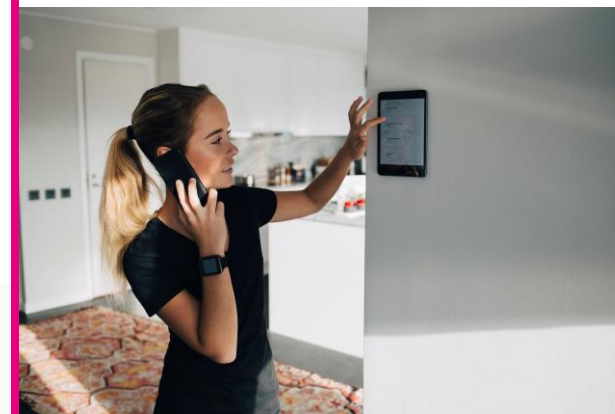
Localization

Lost your keys again? Track and locate your keys and other devices with UHF localization capabilities and spend less time and nerves on searching for it.

UHF reader
with ST25RU



UHF tags
third party





Healthcare



Inventory Management

Manage the check-out and replenishment of medication. Automate processes and ensure stock of critical inventory.



Safer Patient Care & Tracking

Avoid incompatible cross medication with UHF enabled safeguards. Track the movement and location of patients with special needs to ensure their safety.



Access Control

Secure critical premises like storage or emergency rooms while ensuring automatic and remote opening of doors for patient beds or medical equipment.



Asset Management

Manage storage, maintenance, utilization tracking and access to assets.





Gaming



User Experience

Integrate new features and innovative ways to interact with your gaming platform.



Device Pairing

Improve and simplify the pairing process of your control devices, smartphone connections or other devices. Make a simple distant pairing possible.



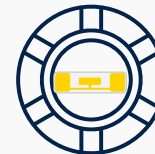
Item Detection

Detect tokens or figurines in the gaming environment, no matter if it's casino tokens or action figures on a board game. Enable add-on functionalities tailored to items.

UHF reader
with ST25RU



UHF tags
third party



UHF capabilities





UHF capabilities



Identification

identify, access & track goods and assets with unique ID, electronic product code, user memory and password protection of UHF reader and tag combination.



Localization

localize people, goods and assets by analyzing, which tags are within reader range. limited measurement of distance and direction of item via RSSI also possible.



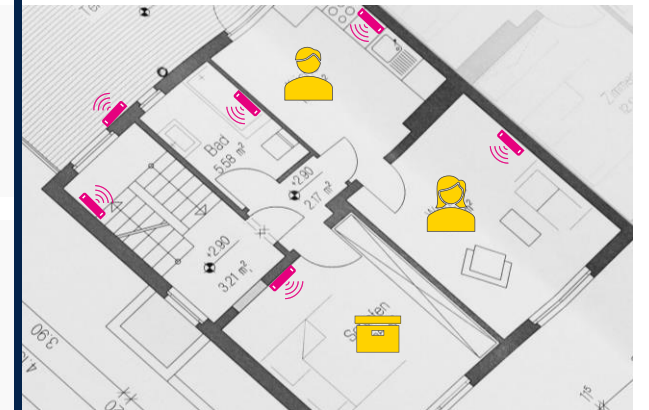
Sensing

smart sensor tags for temperature, humidity, chemicals and many more measurands simplify setup and allow condition tracking and monitoring.



Actuating

wireless actuation through switching of relays and powering LEDs or buzzers (battery assisted) enables new and innovative use cases in many areas.



Benchmarking UHF technology





wireless technologies compared

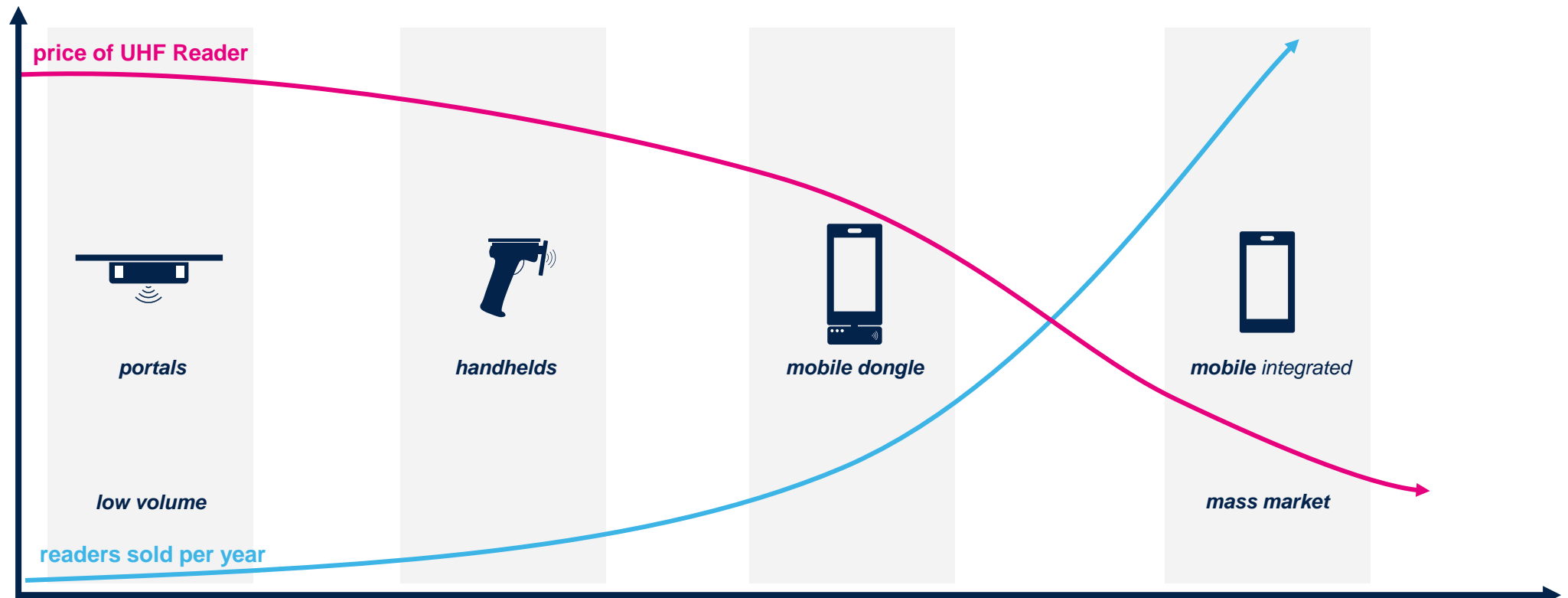
UHF is **cost-effective** solution for **high volume applications**

Feature	NFC	UHF	BTLE	Wifi	ZigBee
Base station cost (incl. reader)	\$\$	\$\$\$\$	\$\$\$	\$\$\$	\$\$\$
Receiver cost (tag)	\$\$	\$	\$\$\$	\$\$\$	\$\$\$
Passive receiver	Yes	Yes	No	No	No
Current consumption receiver	<0.1mA <i>passive</i>	<0.1mA <i>passive</i>	15mA	>100mA	15mA
Multipoint connection	No	Yes	No	Yes	Yes
User setup required	No	No	Yes	Yes	Yes
Typical number of receivers	1~5	>1000	~7	1~1000	32
Typical range	0.1m	1-15m	1-10m	1-100m	1-300m



UHF reader market trend

Integration of UHF readers in mass market applications has **significant impact on price**



Technology overview





UHF at a glance



UHF – ultra high frequency

wireless RFID (radio frequency identification) technology.
frequency range of 840 MHz to 930 MHz.



energy transfer

UHF reader (antenna) emits RF field and powers tags.
no active power supply for tags necessary.



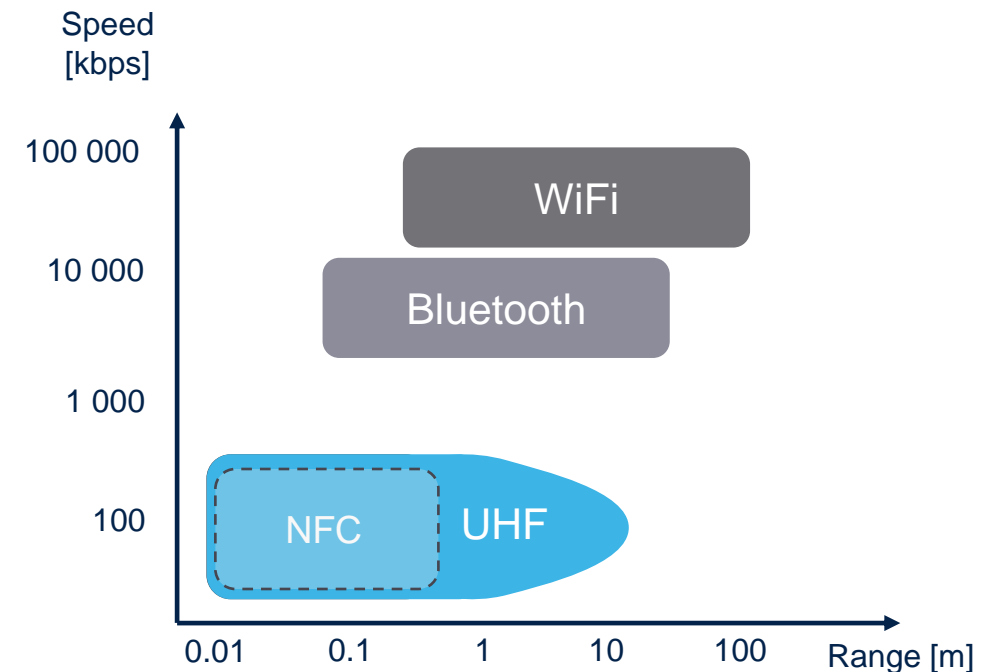
data transfer

wireless data transfer via passive backscatter.
UHF tags modulate RF reader signal to a response.



key benefits

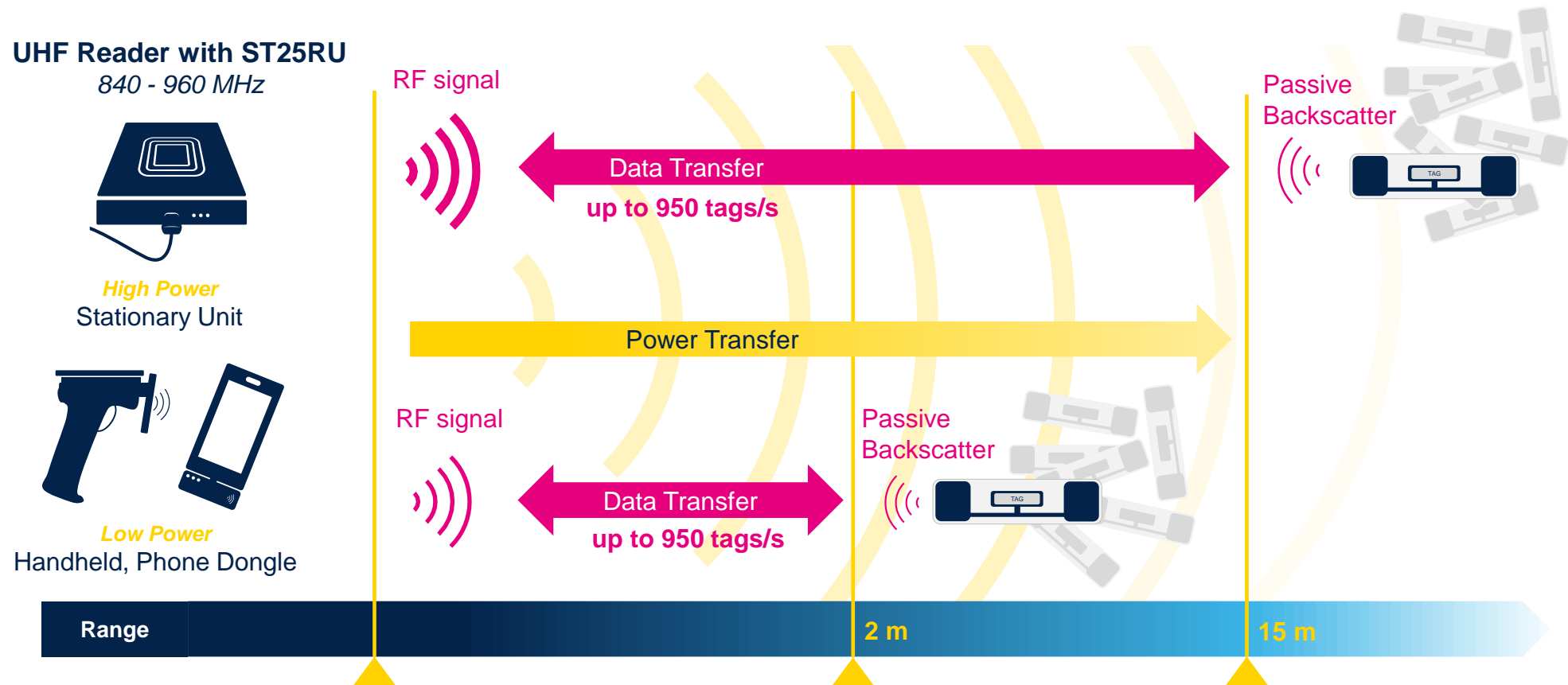
fast tag bulk reading over long distance.
tags are **cost-efficient**.





Setup of an UHF system

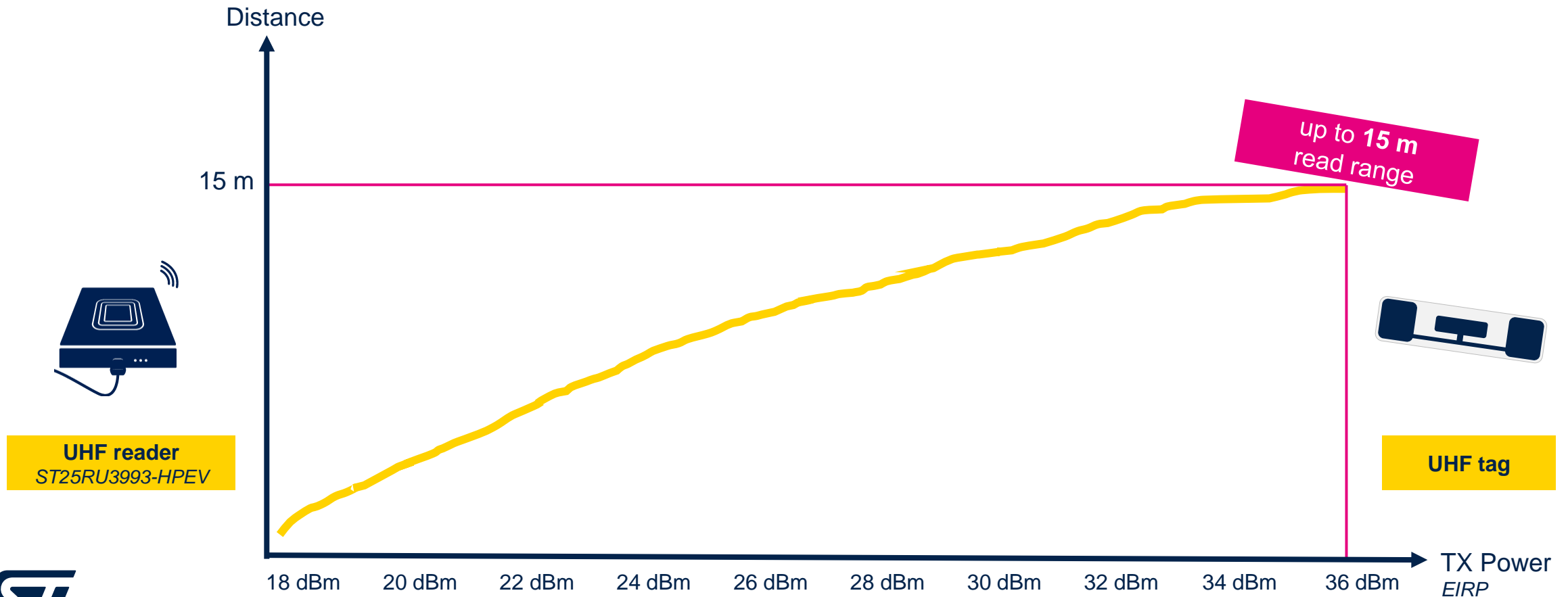
A UHF system typically comprises a **few readers** and **many tags**





Long range with the right tool

range test with the **ST25RU3993-HPEV** evaluation board



ST25RU3993 - the core of your UHF product



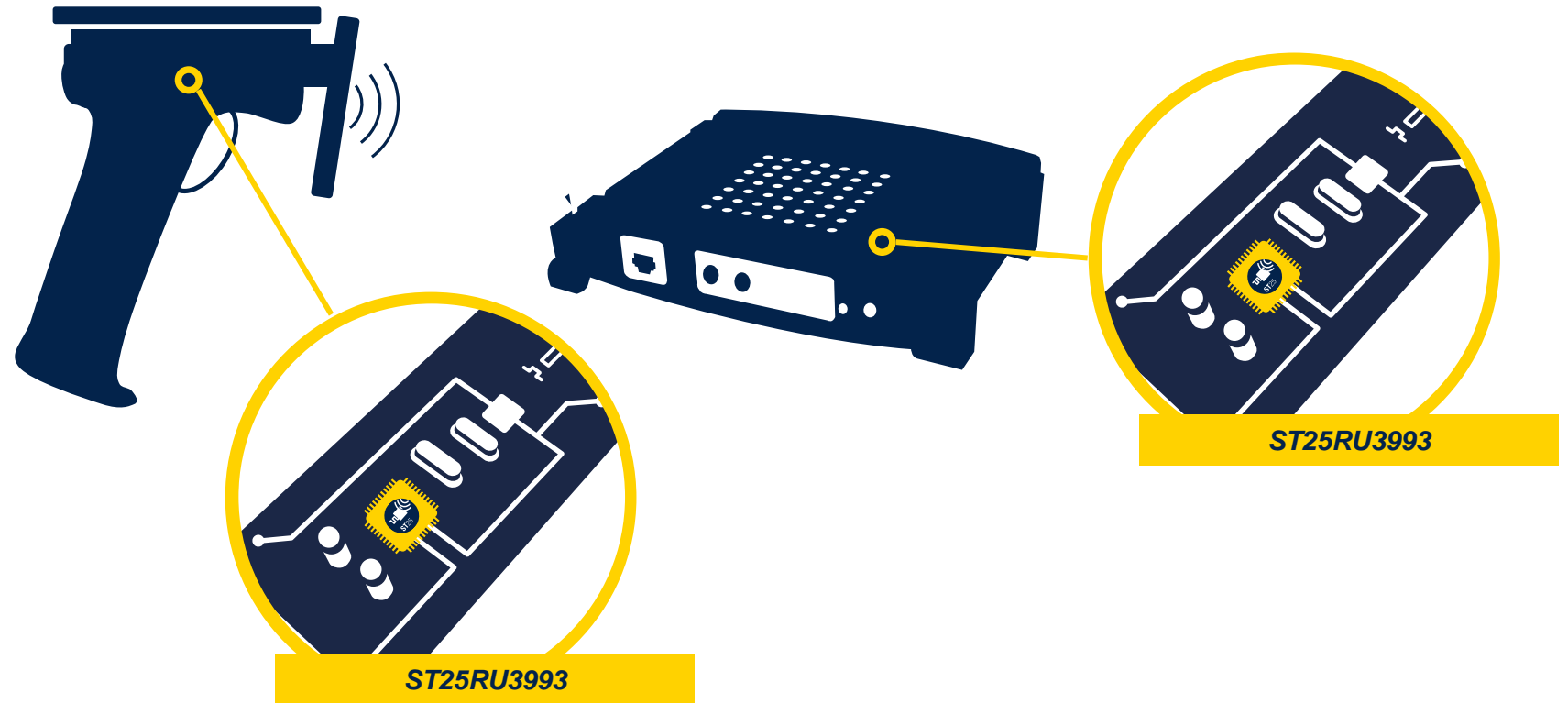
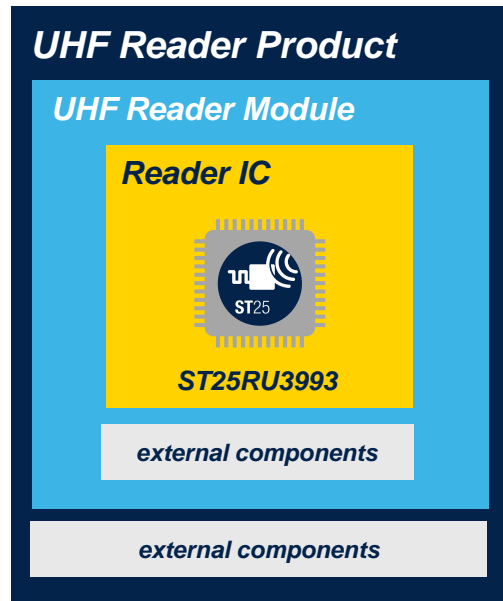
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ST25RU3993 UHF reader IC



ST25RU3993 provides a perfect **integration into your solution**


- supported by a sophisticated and comprehensive ecosystem





ST25RU3993 UHF RFID reader

UHF Reader IC Receive Sensitivity -90 dBm Two Output Types Linear: 0 dBm PA: 20 dBm	EPC Class1 Gen2 ISO18000-62 ISO18000-63 GB/T 29768 	FIFO  24-Byte	SPI 5 Mb/s 1.65/5.5V
	<ul style="list-style-type: none">• Internal VCO (Voltage Controlled Oscillator)• Dense Reader Mode• Linear RSSI & Phase Bit• Automatic PSRR regulation• Auto ACK		
	digital debug outputs		



QFN48
7x7mm

Key Features

- Tuneable frequency 840 to 960 MHz
- Support of **all regions** worldwide
- Output configurations
 - Adjustable linear output: 0 dBm for external amplification
 - Adjustable **internal power amplifier**: 20 dBm
- Single ended and differential RX input options
- Receive sensitivity of **-90dBm**
- Power consumption down to 65mA
- **Power Down Mode** with 3.3 µW
- **950 tags/s** single tag read speed @ 2 bytes EPC length, 640 kHz, FM0
- Temperature Range: -40 to 85°C



Technical data overview



Description	RAIN UHF RFID reader
Protocols	EPC Class1 Gen2 , ISO18000-62 & -63 , ISO29143 GB/T 29768 transparent mode: custom protocols possible
Modulation Modes	Double Side Band (DSB) transmit modulation Phase Reversal Amplitude Shift Keying (PR-ASK) transmit modulation
Tuneable frequency	840 to 960 MHz
Power Supply	1.65 V –3.6 V
Power Consumption <i>normal</i>	210 mW
Power Consumption <i>standby / power-down</i>	9.9 mW / 3.3 μ W
Communication Interface	Serial Peripheral Interface (SPI) 5Mb/s
Sensitivity (IC)	-90 dBm
Output Power <i>linear for external PA / internal PA</i>	0 dBm / 20 dBm
Output Power Adjustment	1 dB steps
Read Speed <i>single / unique</i>	950 tags/s , 440 tags/s
Operating temperature	-40 to +85°C
Package	48-pin QFN (7x7mm)
Advanced Features	Dense Reader Mode Internal Voltage Controlled Oscillator (VCO) Linear Received Signal Strength Indication (RSSI) & Phase Bit Automatic Power Supply Rejection Ratio (PSRR) regulation Auto Acknowledge (ACK) Transparent Mode



Commitment to continuous improvement

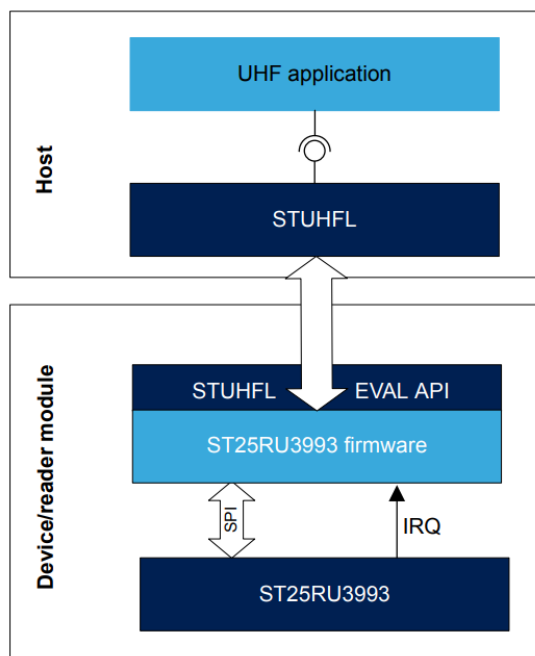




Software: ST25RU3993 ST UHF library (STUHFL)

The STSW-ST25RU-SDK library is a comprehensive middleware software stack written in ANSI C programming language, which helps users build RAIN® RFID-enabled applications for reader devices based on the ST25RU3993 reader IC. A complete **demonstration source code** is included in this software package to provide examples on how to use the ST **UHF library for Windows® and Linux®** platforms.

The software stack is **ANSI C- and POSIX-compliant** and enables **fast and straightforward porting** to other operating systems and/or toolchains.



Features

- Comprehensive middleware to build RAIN® RFID enabled applications for reader devices based on ST25RU3993.
- Mirrored "host and device" library API
- Written in pure ANSI C
- POSIX compatible
- Straightforward portability across different platforms (MCUs/RTOSs/OSs)
- Compliant with main UHF standards
 - EPC UHF Gen2v2
- Source code example implementation available
 - Windows®
 - Linux® (Raspberry Pi 3B)
 - Embedded (STM32L4 device)
- **New software wrappers:** Java, C# and Python

Product page: <https://www.st.com/en/development-tools/st25-development-tools.html>



Benefits of ST25RU3993



minimized power consumption

best in class power consumption and standby as well as a power down mode. ideal choice for battery powered devices to ensure a **long battery lifetime**.



high tag read speed

outstanding read speed of up to 950 single tag reads per second. unique tag read speed up to 440 tags per second.



dense reader mode

enabling communication in environments with many fixed and mobile readers. **essential for reader products** in warehouses, stores and similar infrastructure.



performance/power ratio

high reader sensitivity at low power consumption. ideal choice for UHF reader solutions in mobile and handheld applications as well as in stationary readers.



Feature set of ST25RU3993



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Additional features of ST25RU3993



dense reader mode (DRM)

a mode using a set of signaling parameters to allow communication with minimized interference in environments with many fixed and mobile readers.



power supply rejection ratio regulation (PSRR)

power management in IC adapts to decreases in supply voltage to ensure proper function. Enables extension of device operability in battery-powered applications



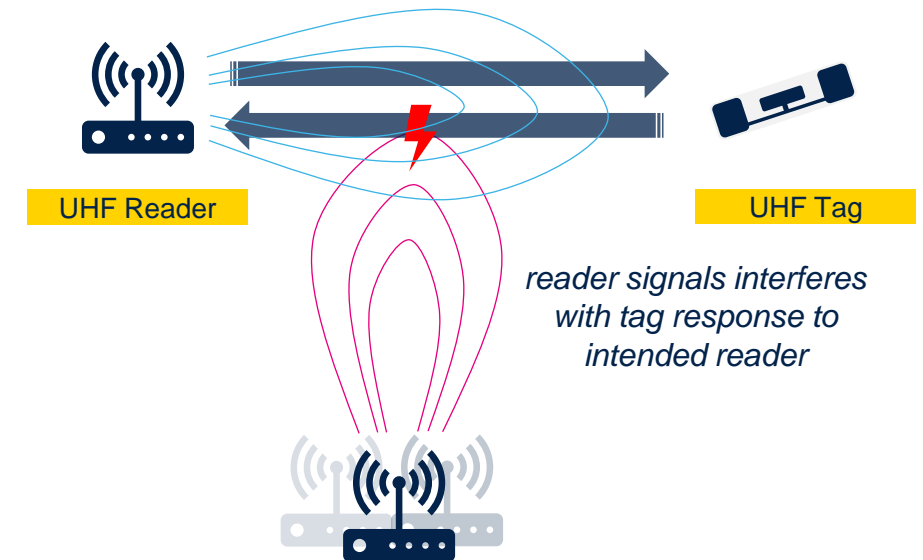
carrier cancellation ready

measurement and processing of reflected power reduces self-jamming effects and, in that way, increases reader sensitivity with a high output power level at the same time



automatic acknowledge (Auto ACK)

automatically performs the inventory command sequence for one transponder. relieves the MCU of performing time critical tasks.



Dense Reader Mode ensures interference-proof communication in a dense reader environment e.g. in warehouses



Additional features of ST25RU3993



received signal strength indication (RSSI)

measurement of power level of an incoming transponder signal or detection of external RF signal levels in the vicinity of the carrier frequency.



internal VCO

on-board generation of RF signal with integrated voltage-controlled oscillator (VO). reduction of BOM costs and development efforts.



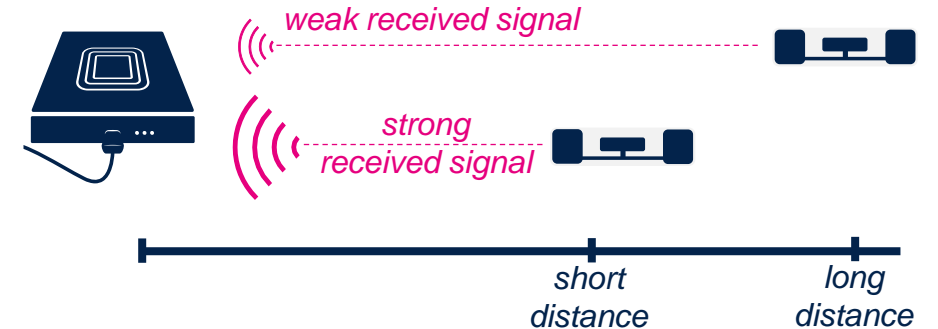
full access to chip registers

optimized functionality and debugging capabilities with full access to all chip registers.

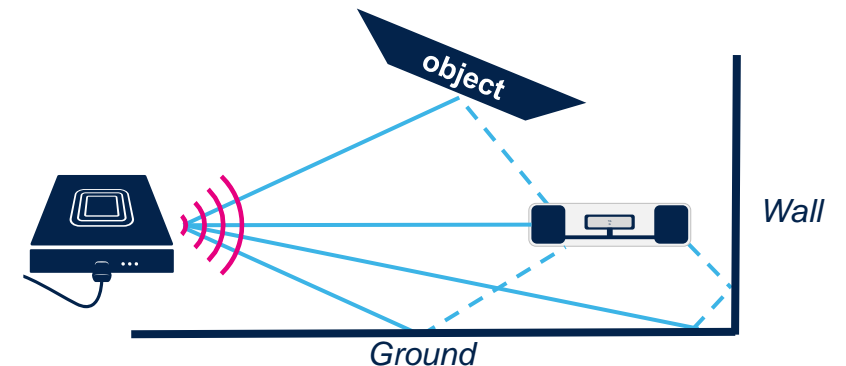


ST open source approach

free access to source code, examples for various platforms like Linux, Raspberry Pi, Beaglebone and libraries.



RSSI is used for measuring the **signal strength of tag responses**. Challenging for a correct measurement are reflections of the environment (**multipath propagation**).



Development guide





Debugging & development support

Hardware



Evaluation kit
ST25RU3993-HPEV

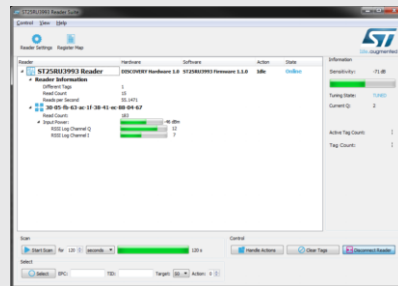


Software Tools



GUI

Register access
Mode selection
Parameter read-out
Tag access
Evaluation



Documentation



Documentation

Datasheets
Application Notes
Open Source Libraries
Examples (Linux, RPi, ...)



Support



e2e community

Trainings



Community



ST25RU3993-HPEV kit

ST25RU3993-HPEV High Power Evaluation Board

- Based on the ST25RU3993 high performance **RAIN (UHF) RFID reader IC** and an STM32L476 MCU
- Included kit content
 - Near field antenna for communications <10 cm
 - 1 x ETSI far field antenna
 - 1 x FCC far field antenna
 - SMB / SMA antenna cable
 - USB Cable, 2 x UHF RFID tags
- Features
 - External PA: 30 dBm max TX power
 - Internal PA: 17.5 dBm max TX power
 - Differential RX input
 - Max. RX sensitivity: -80dBm @ 90% Read Success, one sideband of tag response (ISO18046-3: 2012)
-77dBm @ 90% Read Success, both sidebands of tag response (ISO18046-3: 2020)
 - Frequency: 840 MHz – 960 MHz
 - Two antenna connectors: SMB (F)





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