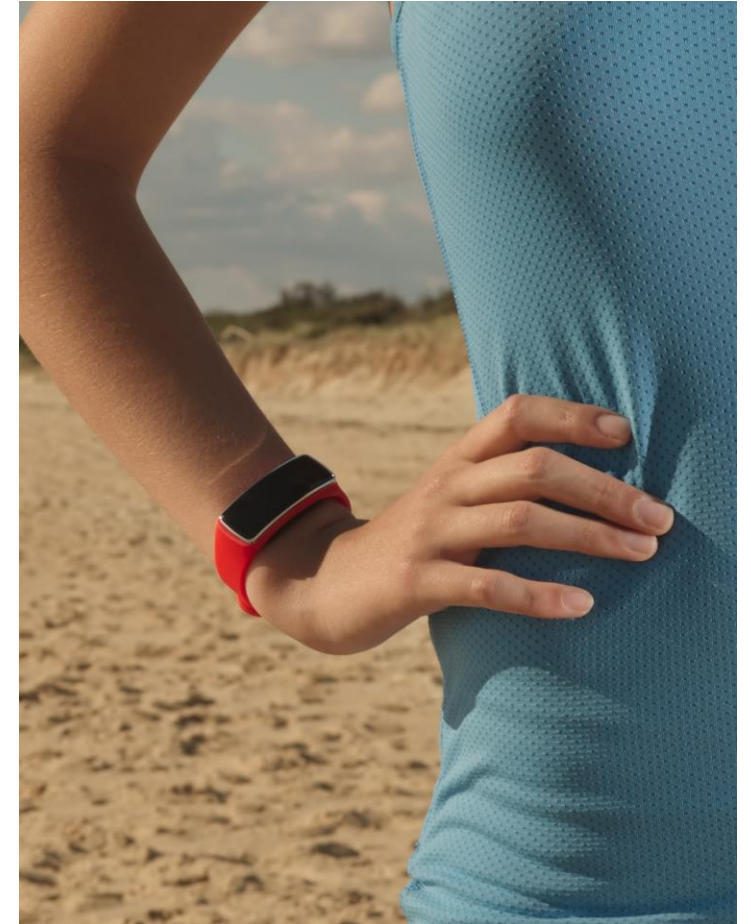**NFC Wireless Charging**

**ST25**
Simply more connected

NFC Wireless Charging

- Inductive wireless charging using existing NFC technology

- NFC used for **communication and power transfer**
  - Pairing, authentication, parameter setting, …
  - **Wireless charging** with up to 1 W

- Ideally suited for **small size and battery powered** devices
  - Wearables, Accessories, IoT devices, small consumer electronics

- Standardized by NFC Forum
  - NFC WLC (**W**ire**L**ess **C**harging) specification v2.0 released in October 2021
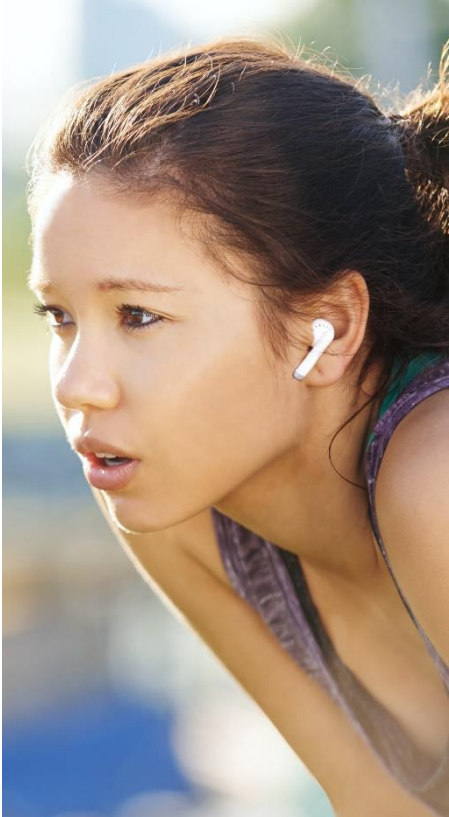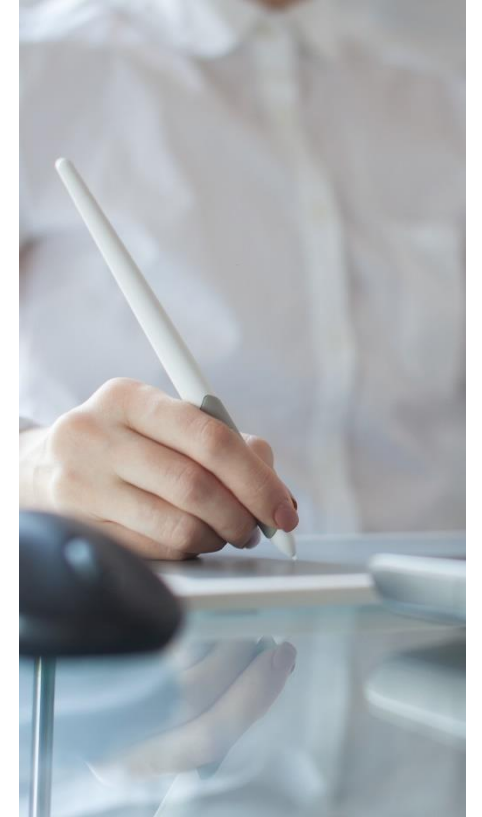
Earbuds & Hearing aids

Smart watches & Fitness tracker

Smart glasses & VR/AR products

Remotes & Sensors

Digital accessories

- **Easy integration** into small sized applications through tiny antenna footprints
  - Targeted antenna dimension range down to below 0.15 in² (1 cm²)

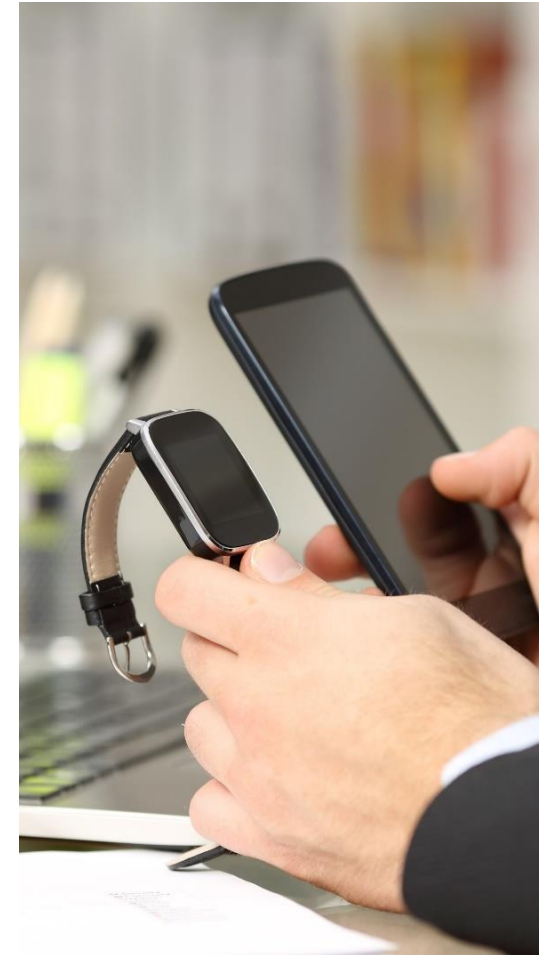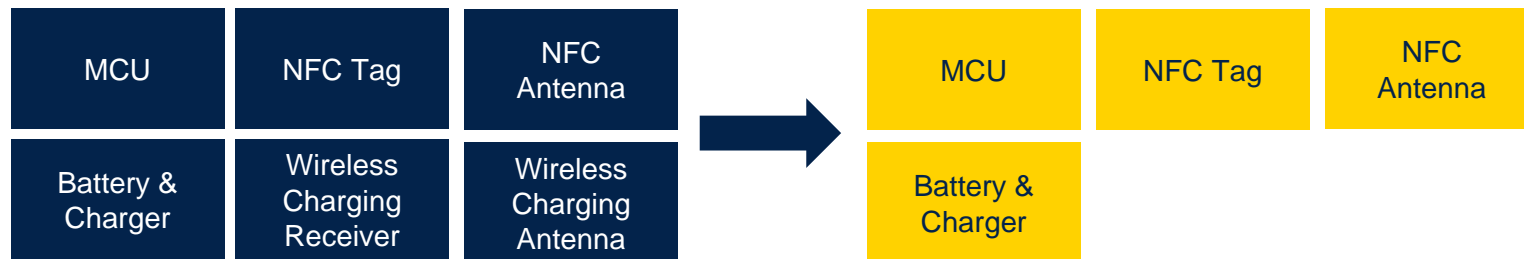- **Ideal fit** for complex form factors by using PCB or flex-PCB antennas

Leverage existing NFC implementation on products for charging

- **Easy implementation** by only adding few components to existing NFC circuit

- **BOM cost optimization** by using NFC implementation for charging

- **Optimized system size** by benefiting from low NFC solution footprint

- **System simplification** by using only one technology for communication & charging

MCU	NFC Tag	NFC Antenna
Battery & Charger	Wireless Charging Receiver	Wireless Charging Antenna

→

MCU	NFC Tag	NFC Antenna
Battery & Charger		

Benefits of using NFC WLC

- **Increased mobility** for devices through **charging on-the-go** and **back-up** with smartphone

Wireless charger / base station at home
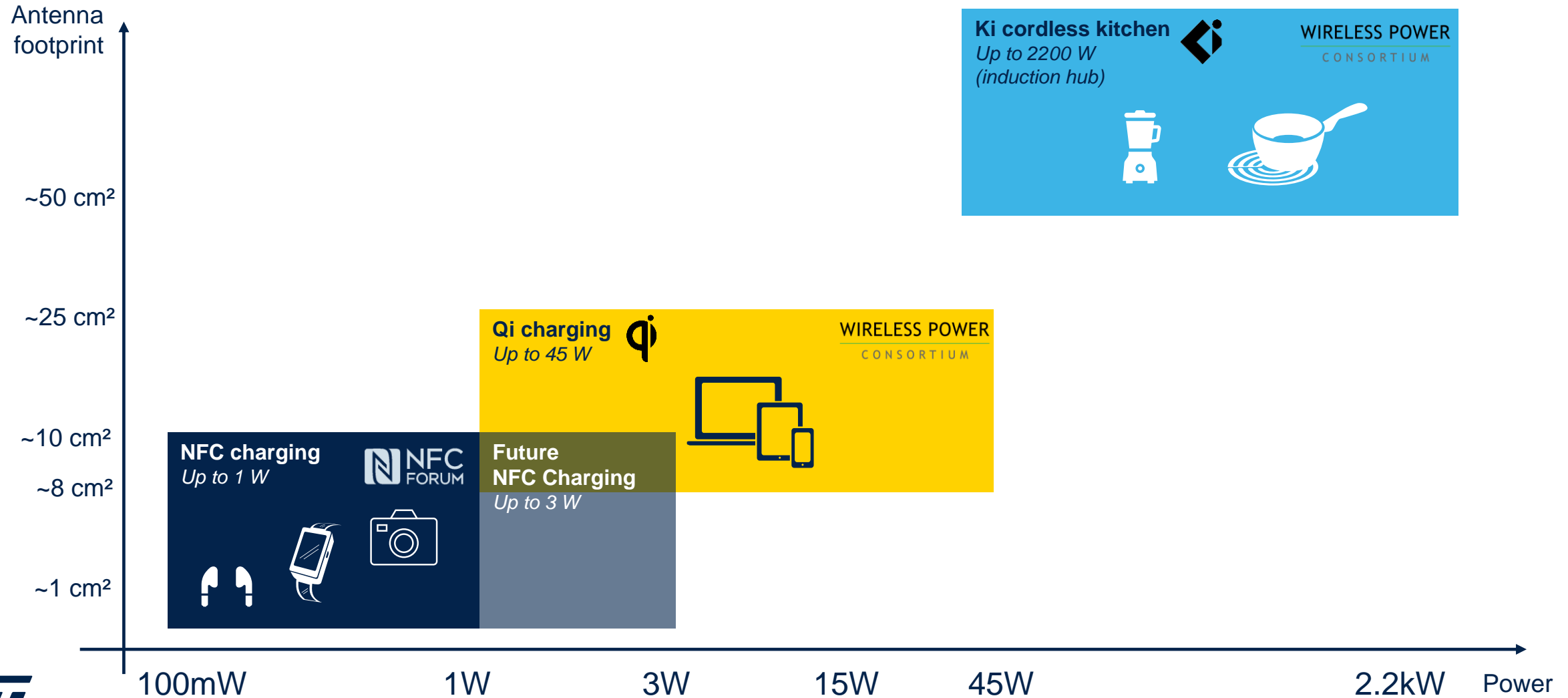
Integrated protection for bank cards, passport, …

Charging via phone as back-up

Integrated protection for bank cards, passport, …

- **Integrated protection** for other RF and contactless devices (e.g. bank cards, passports, …)
- **Interoperability** through standardization by NFC Forum

Wireless charging in perspective

Antenna footprint

Ki cordless kitchen
Up to 2200 W
(induction hub)

WIRELESS POWER
CONSORTIUM

~50 cm²

~25 cm²

Qi charging
Up to 45 W

WIRELESS POWER
CONSORTIUM

~10 cm²

~8 cm²

NFC charging
Up to 1 W

NFC FORUM

Future NFC Charging
Up to 3 W

~1 cm²

100mW   1W   3W   15W   45W   2.2kW   Power

life.augmented

NFC Forum WLC standard

- **NFC Forum standardization**
  - ST is active participant of standardization workgroup
  - NFC WLC (**W**ire**L**ess **C**harging) specification v2.0 released October 2021
    - New „Class 7" reference antenna for smaller IOT devices
    - More charging status information (battery voltage, temp…)
  - Certification program expected in 2022

- **NFC WLC operating volumes (depending on reference class)**

Class 7 reference

s1 = 1.5 mm

d = 3 mm

Class 6 reference

s1 = 5 mm

d = 10 mm
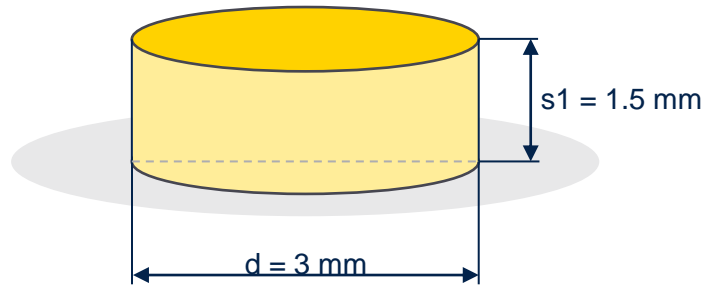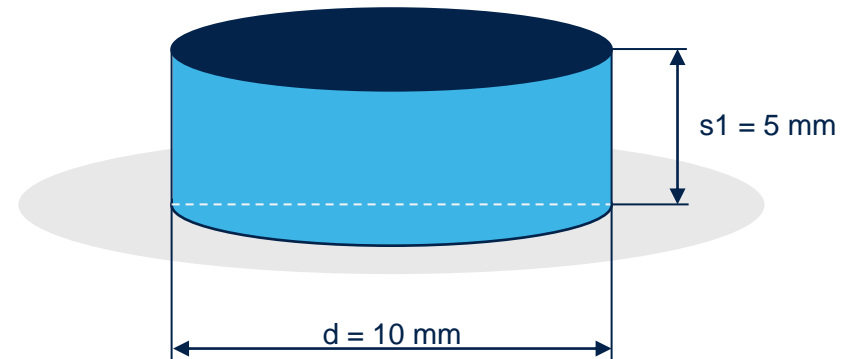
A glance at NFC WLC technology

- Specified by NFC Forum

- WLC Listener (WLC-L) receives power from WLC Poller (WLC-P)

- Based on NDEF message exchange between poller and listener

- Two possible operation modes of power transfer
  - **Static mode** (Easy implementation)
    - Operates at a single power level (no power transfer negotiation)
    - Low maximum power (~ 100mW), no FOD required as field remains within existing limits defined for NFC communication
  - **Negotiated mode** (Higher power)
    - Power transfer parameter negotiation to control power level for charging
    - Supports 4 power classes (0.25, 0.5, 0.75 or 1W usable power at the receiver)
    - FOD required (reader generates field strengths exceeding existing limits)

WLC-L

WLC-P

Charging setups of NFC WLC

Charge pad
(ST25R NFC Reader)

Accessories
(ST25D Dynamic NFC Tag + Charging IC)

Phone
(ST54 NFC Controller)

WLC-Poller

WLC-Listeners

WLC-Poller

|		Main NFC advantages	Charging setup
Smart Bands		Small footprint, smartphone interaction, Pairing, authentication	
Smart Glasses		Small footprint, wireless firmware update On-the-go charging with phone	
Earbuds		Small footprint, pairing On-the-go charging with phone	
Hearing aids		Charging, authentication Parameter setting and upgrade	
Wellness wearables		Charging, authentication Communication with NFC phone	

ST25 PoC (Proof-of-Concept) v2.0

Complete WLC-Poller + WLC-Listener
Dedicated solution
Listener antenna : 9x9mm
Poller antenna : 12x12mm

6.8 cm
(2.67 in)

6.1 cm
(2.40 in)

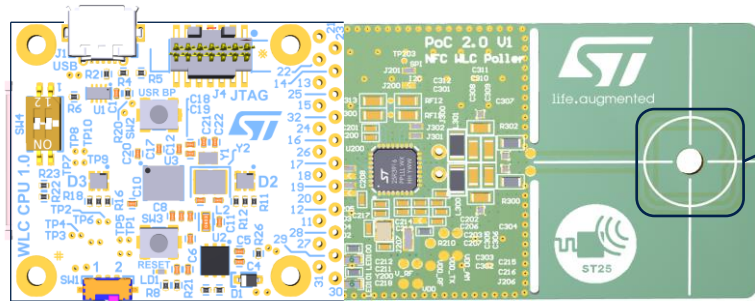3.7 cm
(1.45 in)

3.1 cm
(1.22 in)
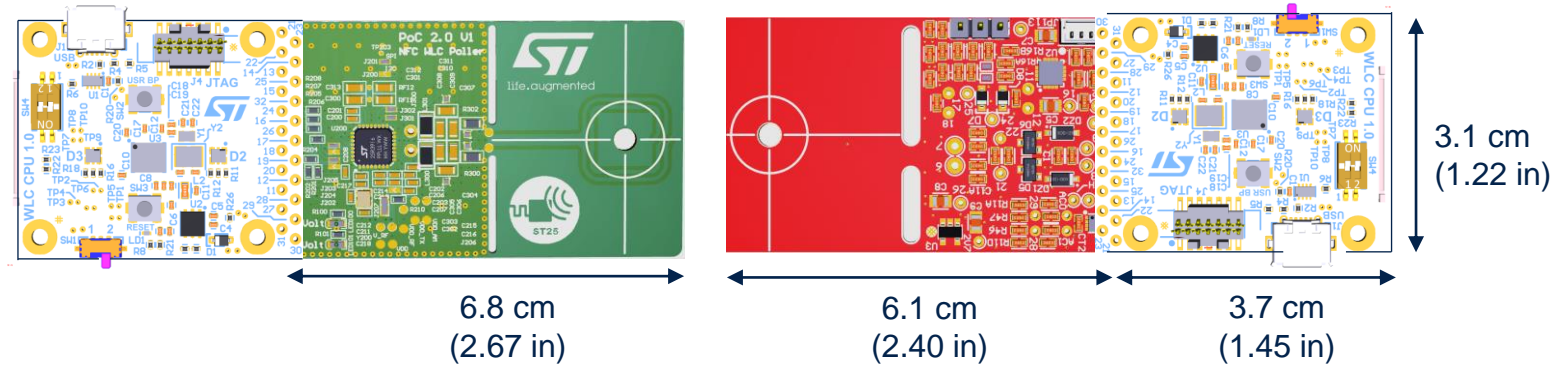
Main features	Support of **static mode and negotiated mode** **>500 mW** delivered to listener within class 7 operating volume (1.5 mm / 0.59 in) Tiny antenna dimensions with 12x12 mm on poller and 9x9 mm on listener Foreign Object Detection (FOD)

ST25 PoC (Proof-of-Concept) v2.0 cont'

WLC-Poller

12x12 mm antenna

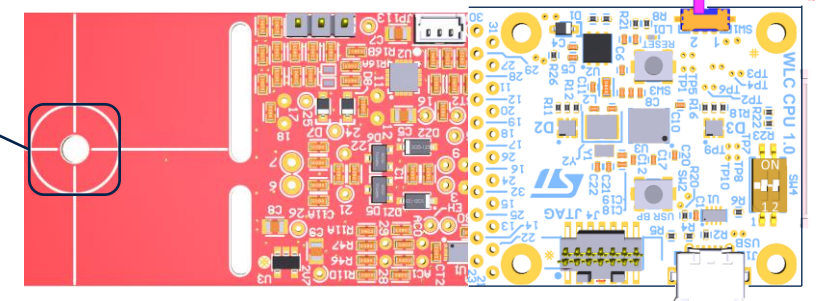## WLC-Listener

9x9 mm antenna

Motherboard
Based on STM32L476
Stlink V3 for debugging & programming
LED indicators for charging process

Daughterboard
ST25R3916 (NFC Reader)
12x12mm antenna
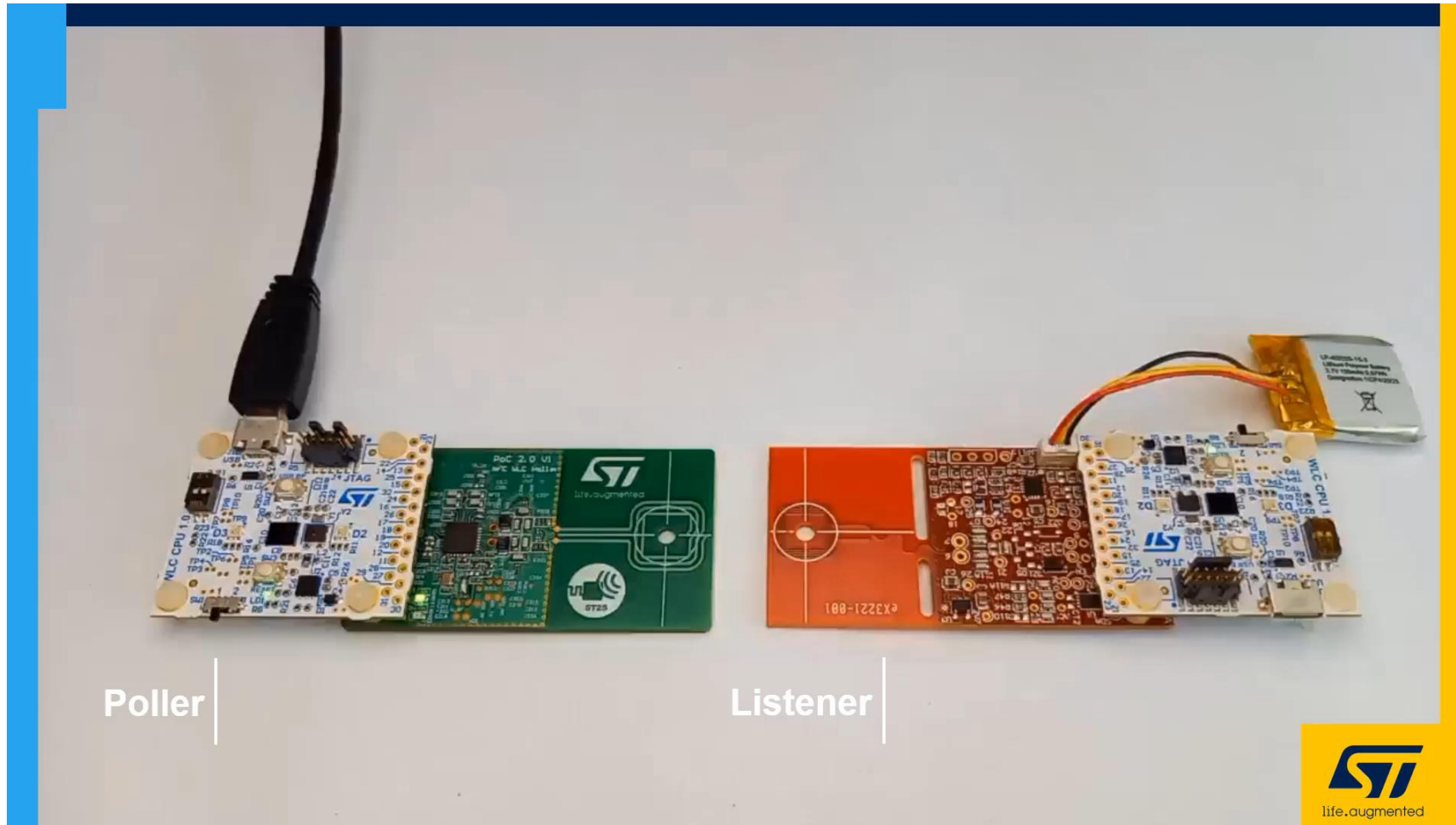fixed matching

Daughterboard
ST25DV-I2C (NFC Dynamic Tag)
9x9mm antenna
Single antenna for
Charging & Communication

Motherboard
Based on STM32L476
Stlink V3 for debugging & programming
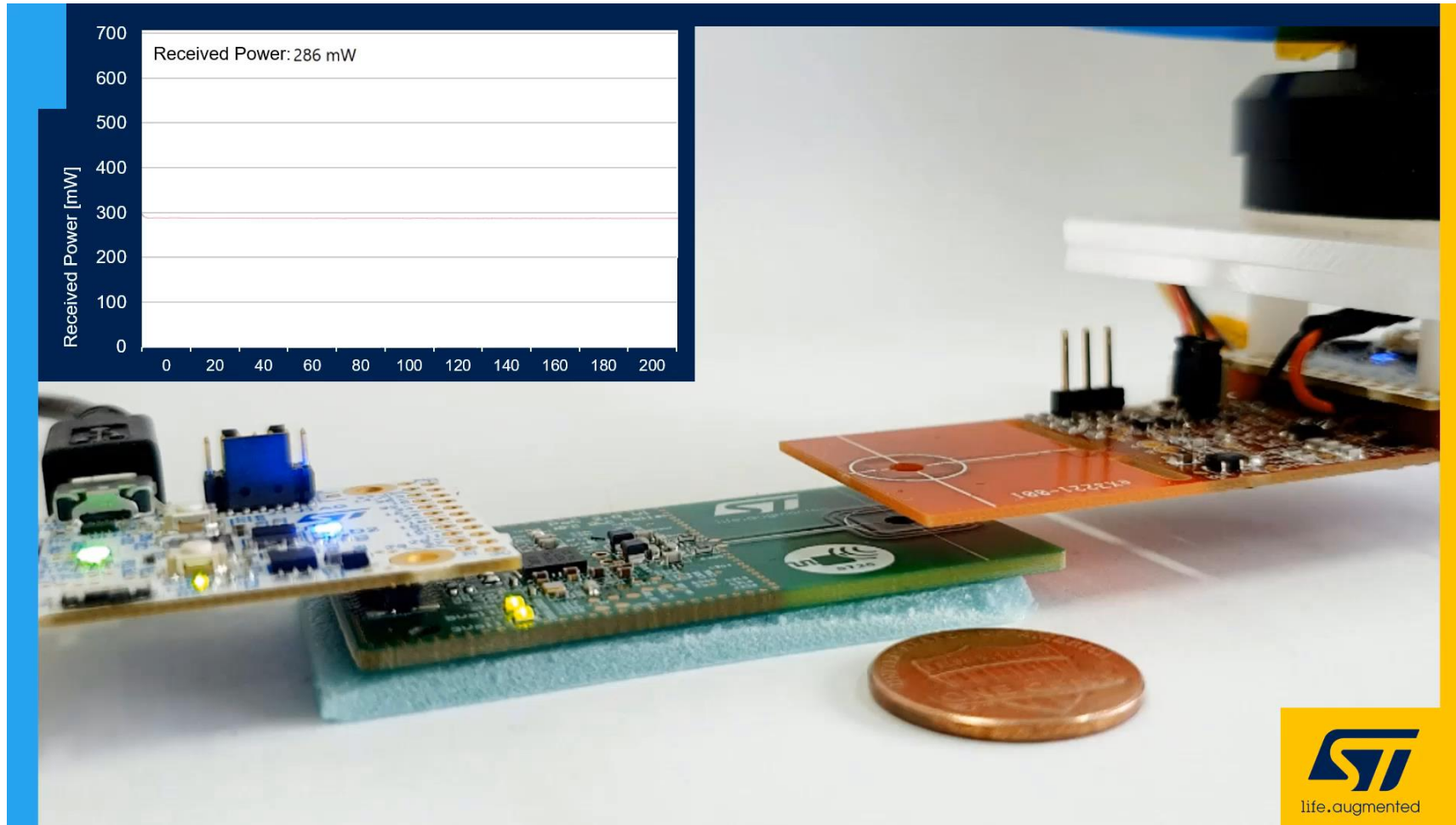LED indicators for charging process

13

Poller | Listener |

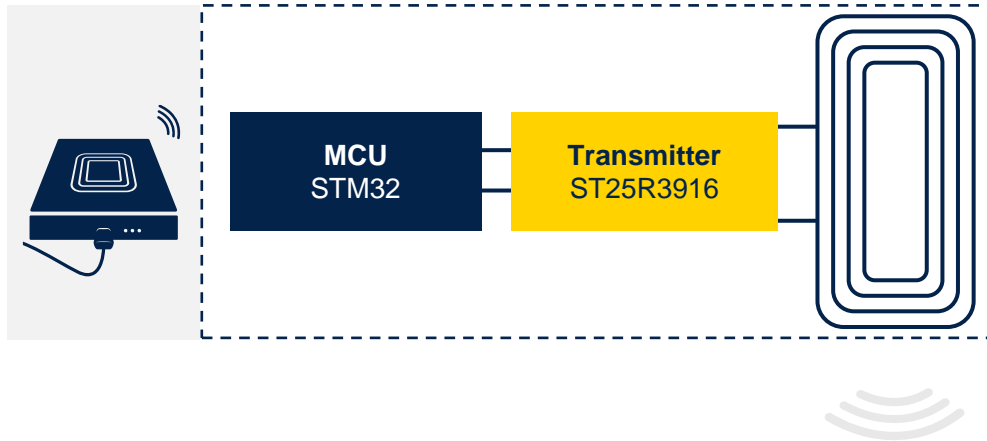# NFC WLC system architecture

Charging transmitter (WLC-Poller)

Charging receiver (WLC-Listener)

ST25R3916

Reader Writer	ISO14443 ISO15693 FeliCa	RAM BUFFER	SPI/I²C
AP2P PP2P			2.4/5.5V
Card Emulation	NFC	512-Byte	
	848kb/s		3.4Mb/s 10Mb/s

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

1.6W
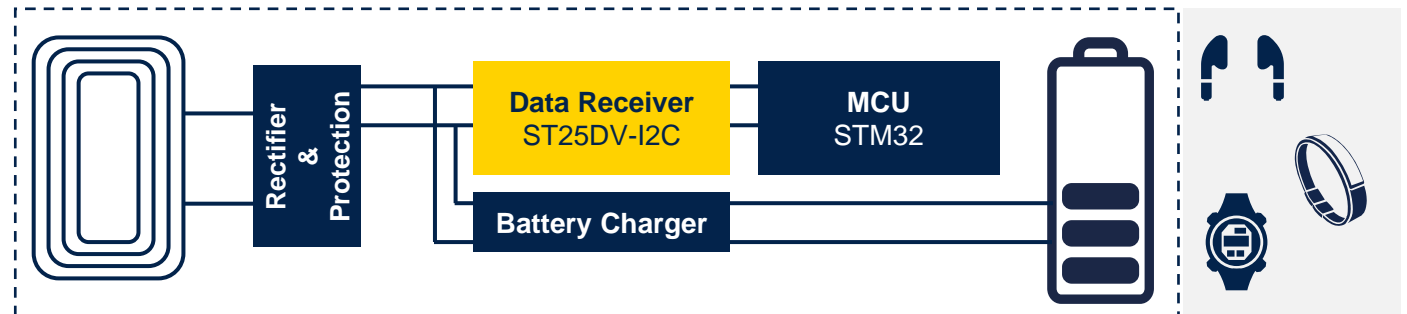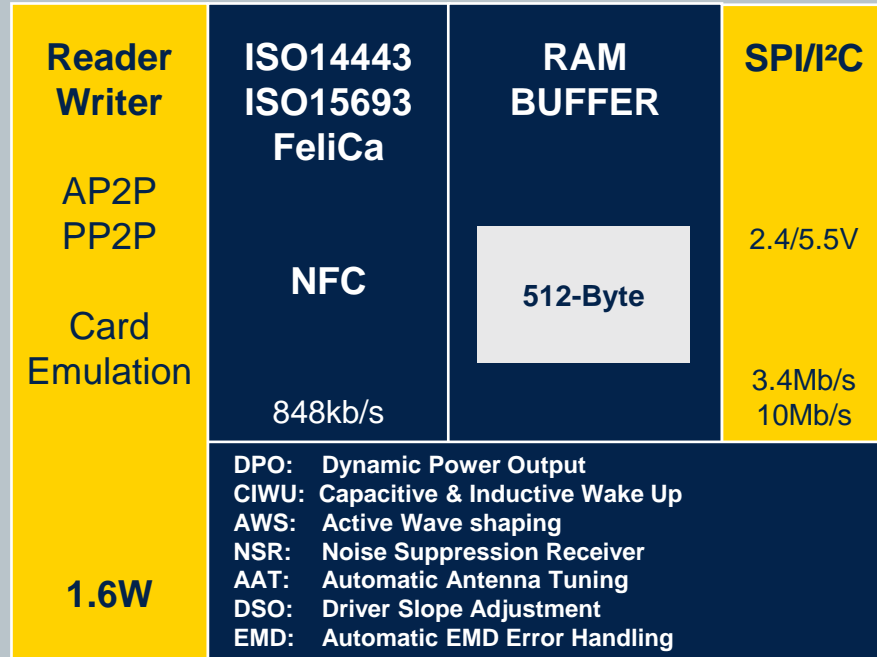
QFN32 Wettable flank

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)
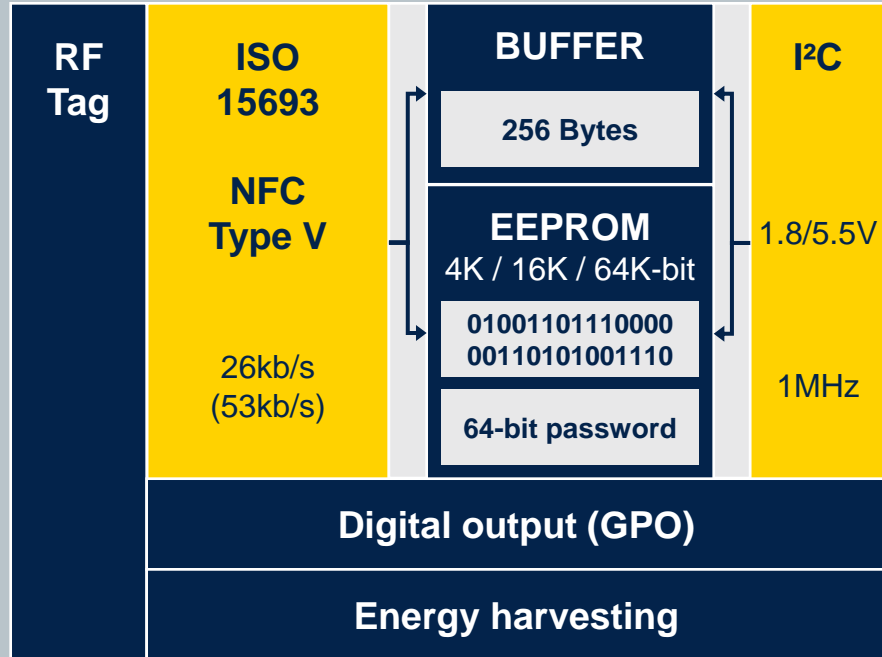- Works in challenging environment like noisy LCD displays

MCU   ST25R3916

Rectifier & Protection   ST25DV-I2C   MCU   Battery Charger

ST25DV04KC / 16KC / 64KC

RF Tag	ISO 15693 NFC Type V	BUFFER 256 Bytes	I²C
		EEPROM 4K / 16K / 64K-bit	1.8/5.5V
	26kb/s (53kb/s)	01001101110000 00110101001110	1MHz
		64-bit password	

Digital output (GPO)

Energy harvesting

SO8   FPN8   WLCSP10
TSSOP8   FPN12

Use cases

- Fast data exchange with NFC phones / HF readers
  - Fast data transfer for MCU FW upgrade, fast data exchange
  - Parameters settings and update, with in-the-box programming
  - Data log download

Key Features

- **ISO15693** and **NFC Type V**
- **Fast data transfer** thanks to 256 Bytes buffer
- I2C write on **16-Byte page**
- Low Power mode, < 1µA power consumption in Standby
- -40 to **+125°C** (I2C) industrial Grade 8 temperature range
- **Energy harvesting** function through RF
- I2C enhanced features (write time improved, address configurable, access priority…)

Key Benefits

- Smart applications using a **flexible interrupt GPO**
- Enhanced protection with multiple **64-bit passwords**
- Same 28.5pF internal RF tuning capacitor, as in ST25DV-I2C & M24LR

LONGEVITY 10 YEARS COMMITMENT

MCU   ST25R3916

ST25DV-I2C   MCU
Rectifier & Protection   Battery Charger

- ## What NFC WLC is
  - Ideal for communication and charging of small battery-operated devices
  - Ideal for devices that can only accommodate small antennas.

- ## What NFC WLC is not
  - Not for devices that require more than 1w of charging power
  - Not for devices that require fast charging.
  - Not ideal for charging multiple devices at once (although possible).

Our technology starts with You

🌐 Find out more at www.st.com/nfc-charging

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