CLRC663 *plus*

BEST PERFORMANCE AT LOWEST POWER CONSUMPTION

JORDI JOFRE
NFC READERS
NFC EVERYWHERE

21/06/2017

SECURE CONNECTIONS
FOR A SMARTER WORLD

CLRC663 *plus* product positioning

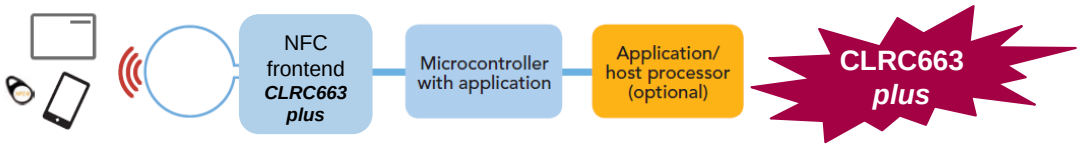
NFC product portfolio

Connected NFC tag solutions

Our connected NFC tag solutions include a NFC Forum RF interface, an EEPROM, and a field-detection function (NTAG F) or a field- detection function with an I²C interface (NTAG I²C *plus*).

NFC frontend solutions

Our stand-alone frontends, which work seamlessly with the NFC Reader Library, are the most flexible way to add NFC to a system.

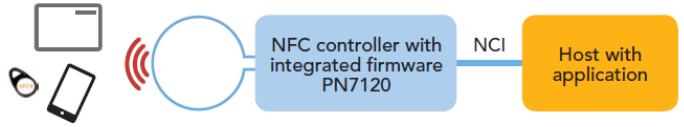


NFC controller solutions

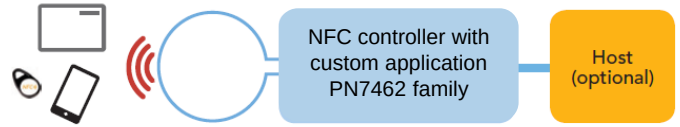
Our NFC controller solutions enable higher integration with fewer components combining an NFC frontend with an advanced 32-bit microcontroller.

Options include integrated firmware, for an easy, standardized interface, or a freely programmable microcontroller with the ability to load fully-custom applications.

Integrated Firmware



Customizable Firmware



Training Mobile Knowledge

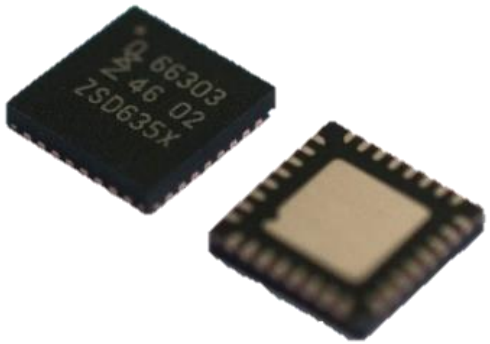
CLRC663 *plus* – Push your design further

EMVCo 2.6 ready (analog & digital compliance)

Longer battery life: Power-saving modes and extended LPCD options.

Compatible with all NXP smartcard products

Industrial / Automotive temperature range (-40 ºC – 105º C)



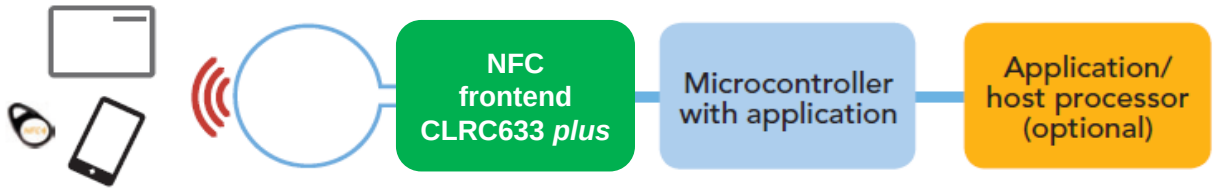
Full RF standard compliance
(ISO/IEC 14443, ISO/IEC 15693, FeliCa and ISO18000-3M3 compliant)

Multiple interfaces and support for high-security reader implementations

CLRC663 *plus*
High performance multi-protocol frontend

High performance and more flexible antenna design

Compact package
(HVQFN32 with wettable flanks)



Training Mobile Knowledge

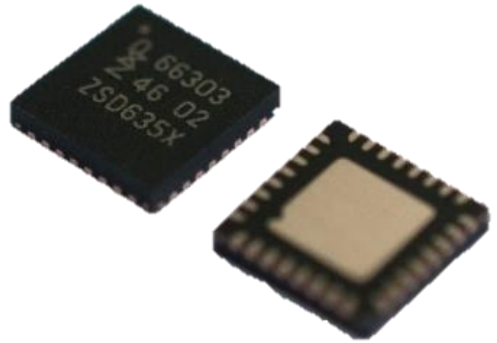
CLRC663 *plus* key benefits

Best performance at lowest power consumption
Extended Low Power Card Detection range with new configuration options
low supply voltage for battery support down to 2.5V

Design flexibility
Max. operating transmitter current of 350mA with limiting value of 500mA
broad temperature range from -40°C to +105°C

Backward compatible to CLRC663
Pin-to-pin and software compatible to CLRC663

Faster time-to-market
Complete support package including EMVCo compliant NFC SW library and NFC Cockpit with VCOM interface and easy antenna configuration

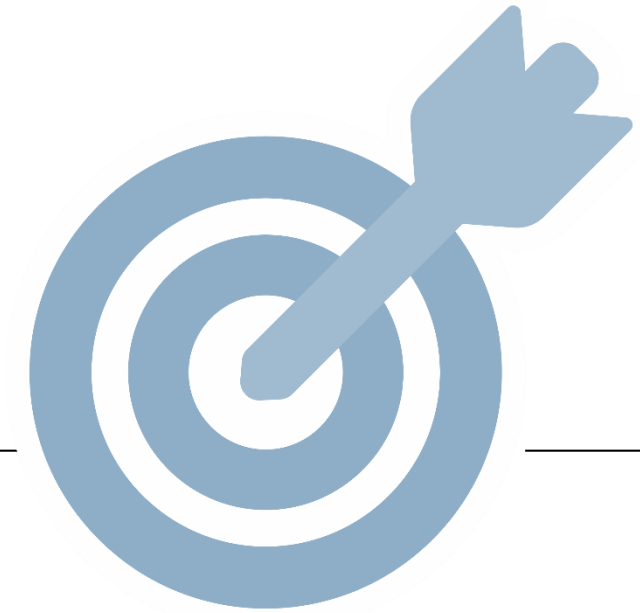


Training Mobile Knowledge

CLRC663 *plus* target markets

ACCESS CONTROL & INDUSTRIAL

- Broad temperature range
- Pin-to-pin and SW compatible to CLRC663



PAYMENT TERMINALS

- Highest transmitter current
- EMVCo 2.6 L1 analog and digital compliant

GAMING

- Extended Low Power Card Detection range with new configuration options
- Low supply voltage for battery support down to 2.5 V

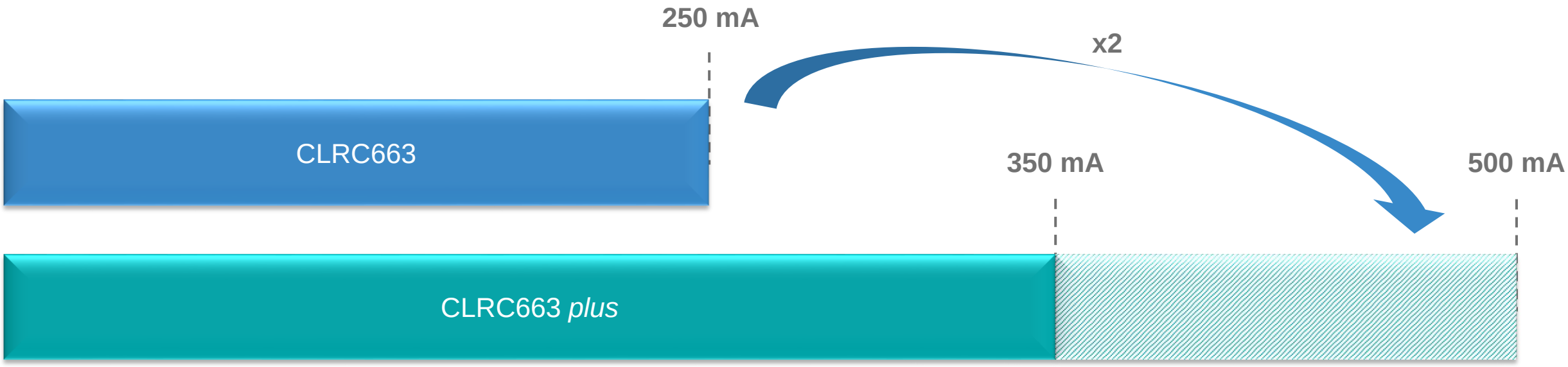
Training Mobile Knowledge

CLRC663 *plus* vs PN5180 and PN7462

Feature	CLRC663 *plus*	PN5180	PN7462	Comment
Package	HVQFN32	HVQFN40 TFBGA64	HVQFN64	CLRC663 *plus* is pin-to-pin compatible with CLRC663
RF transmitter supply voltage	2.5 to 5.5V	2.7 to 5.5V	3 to 5.5V	CLRC663 *plus* enables better support for battery powered systems
General Purpose Input/Output pins (e.g. to drive LEDs)	4 up-to 8	up-to 7 outputs only	12 up-to 21	PN5180 has up-to 7 general purpose outputs on TFBGA64 package only
Max. operating transmitter current	350mA (lim. 500mA)	250mA with DPC	250mA with DPC	CLRC663 *plus* enables more flexibility in the antenna design
Temperature range	-40 to +105°C	-30 to +85°C	-40 to +85°C	CLRC663 *plus* has an automotive or industrial temperature range
Low power card detection	range: very good power: best	range: best power: good	range: best power: good	CLRC663 *plus* offers the lowest power consumption
Complete set of field proven software libraries	NFC & EMVCo	Full NFC & EMVCo	Full NFC & EMVCo	Full NFC forum certified library; EMVCo 2.6
Waveform Control	Yes	Yes (adaptive)	Yes (adaptive)	Adaptive Waveform Control improves wave shape stability under detuned conditions
Adaptive Range Control	No	Yes	Yes	Adaptive Range Control increases sensibility and robustness under detuned conditions
Freely programmable MCU (flash)	No	No	Cortex M0 (160kB)	PN7462 enables an 1-chip reader solution
Host interfaces	SPI, I²C, UART	SPI	USB, HSUART, SPI, I²C	PN7462 has also two master interfaces (SPI, I²C) and one contact reader interface
SAM Interface	Yes with X-mode	No	Yes	The SAM interface allows to store keys in a secure container

CLRC663 *plus* compared to CLRC663

Higher operating transmitter current



Maximum operating transmitter current increases by 40% for CLRC663 *plus* with 2x the limiting value of the CLRC663

Training Mobile Knowledge

Larger operating temperature range

CLRC663 *plus* has an automotive or industrial operating temperature range: -40 to +105°C

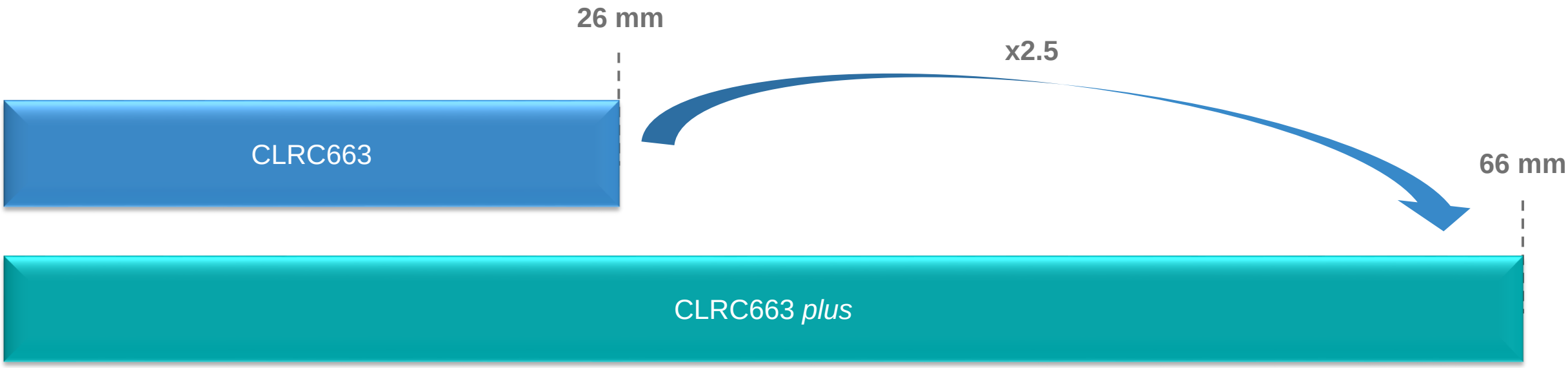
Training Mobile Knowledge

Lower supply voltage for battery-based systems

CLRC663 *plus* enables better support for battery powered systems

Training Mobile Knowledge

New LPCD configuration options enabling up to 2.5x detection range*



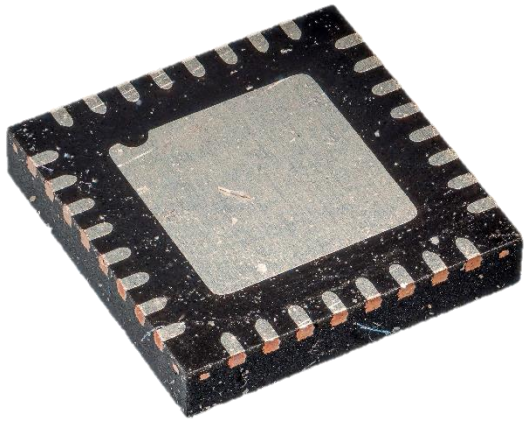
NEW

Charge Pump: increases the RF field strength during the RF-on time.
LPCD Filter: reduces the risk of fail detections, especially in case of spike noise.

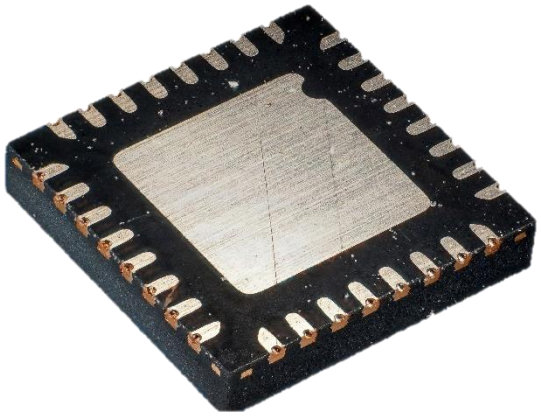
* New LPCD configuration options are Charge Pump (enabled/disabled) and LPCD Filter (enabled/disabled).
** Results obtained using a EMVCo Ref PICC with standard CLRC663 vs CLRC663 *plus* with Charge Pump and LPCD_Filter enabled.

Training Mobile Knowledge

New wettable flank IC package



CLRC663



CLRC663 *plus*

The CLRC663 *plus*, with wettable flank HVQFN package, enables 100% automatic visual inspection post-assembly ensuring higher quality of assembly

Training Mobile Knowledge

Technical details

CLRC663 *plus* – High performance multi-protocol reader

Characteristics

- 350mA maximum operating transmitter current with limiting value of 500mA
- Power supply voltage: 2.5 to 5.5V
- Extended operating temperature range: -40 to +105°C
- 512byte FIFO buffer for highest transaction performance
- Flexible and efficient power saving modes including hard power down, standby and low-power card detection
- Integrated PLL provides external system clock from 27.12MHz RF crystal

Licenses and supported standards

- Includes NXP ISO/IEC14443-A, NXP MIFARE® and Innovatron ISO/IEC14443-B licenses
- Crypto 1 intellectual property licensing rights
- Hardware supports for MIFARE Classic encryption
- EMVCo 2.6 analog compliancy on RF level and digital compliancy with NXP NFC reader library

Supported RF protocols

Reader and Writer mode

- ISO/IEC 14443A/MIFARE
- ISO/IEC 14443B
- JIS X 6319-4 (comparable with FeliCa1 scheme)
- ISO/IEC 15693 (ICODE-SLI)
- ICODE EPC UID/ EPC OTP
- ISO/IEC 18000-3 mode 3/ EPC Class-1 HF (ICODE-ILT)

Peer to Peer mode

- Passive-Initiator according to ISO/IEC 14443A (106kbit/s) and FeliCa (212 and 424kbit/s)

Allows to read and write

- All MIFARE® family: Ultralight, Classic 1K & 4K, DESFire EV1 & EV2 and Plus EV1
- All NTAG® family incl. NTAG I²C *plus*
- All SmartMX® family incl. SmartMX2 P40 & P60

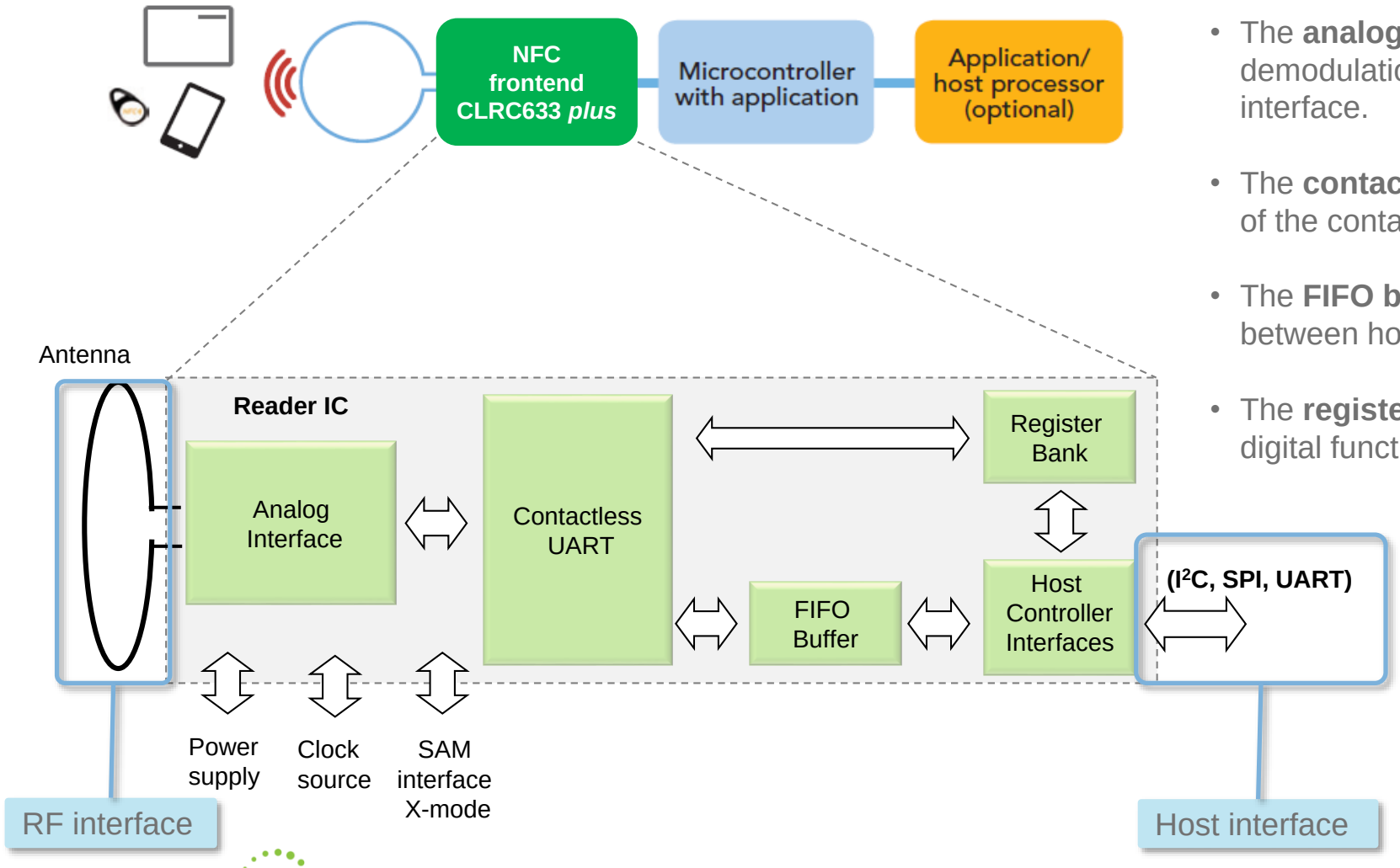
Interfaces

- Host interfaces: SPI (10Mbit/s), I^2C (1000kbit/s) and UART (1228.8kbit/s)
- SAM interface in X-mode
- Up-to 8 general purpose inputs/outputs

Packages

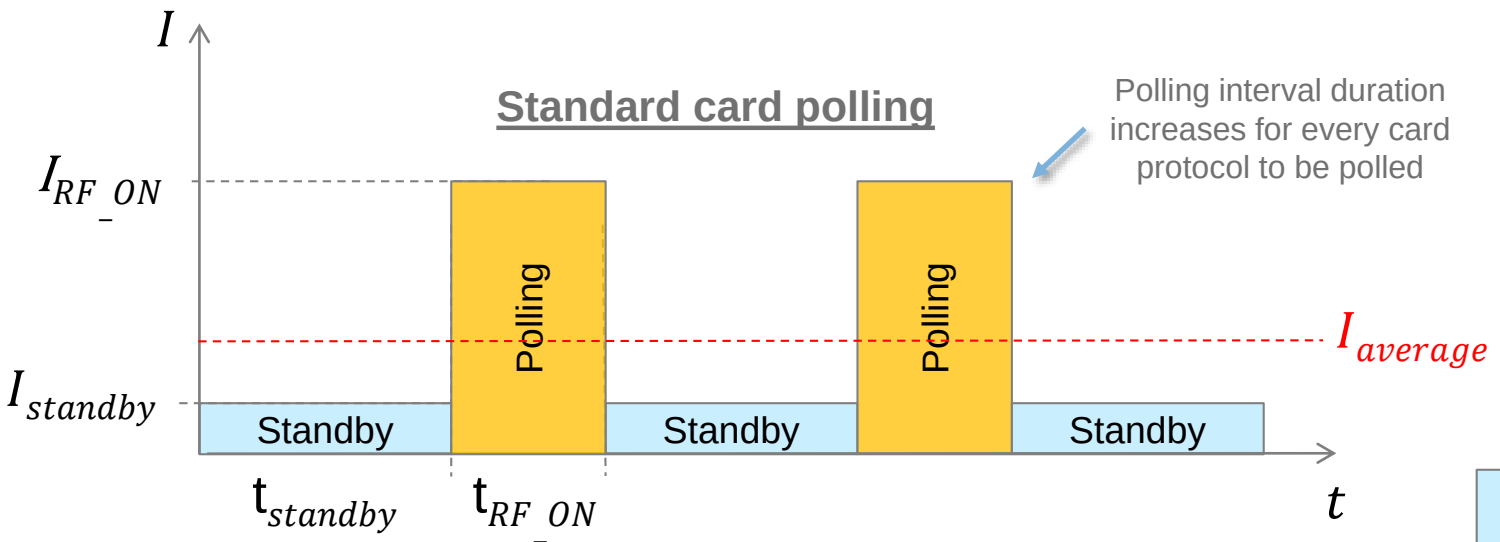
- HVQFN32
- Wettable flanks

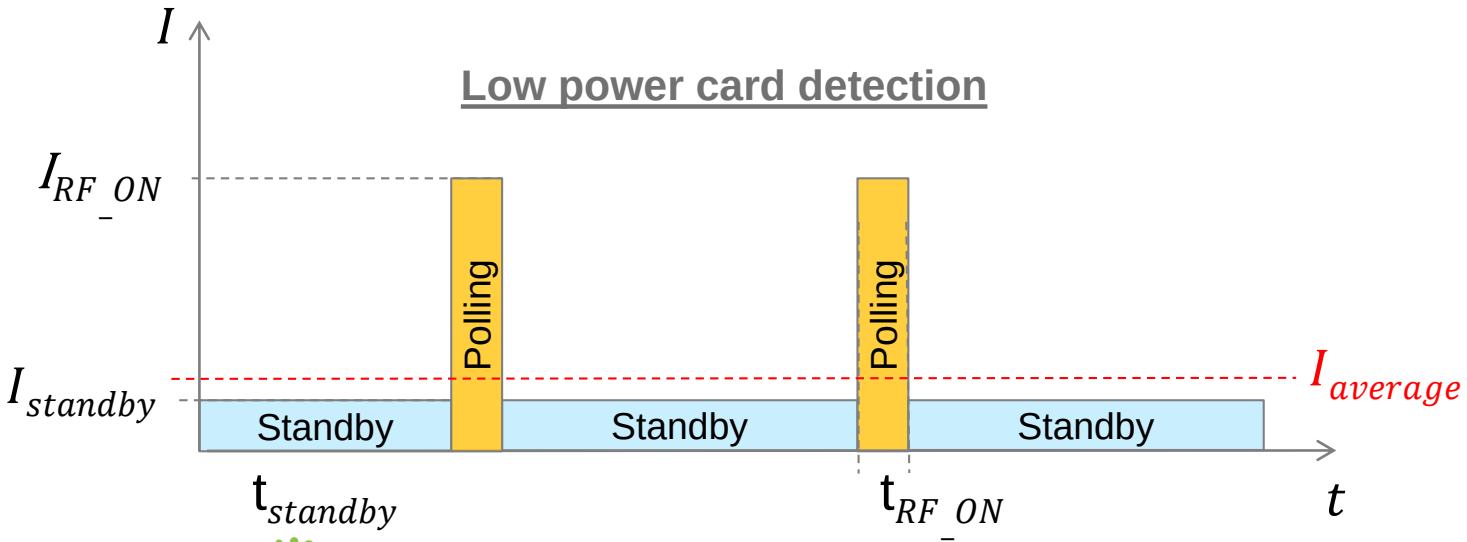
CLRC663 *plus* simplified block diagram



- The **analog interface** handles the modulation and demodulation of the antenna signals for the contactless interface.
- The **contactless UART** manages the protocol dependency of the contactless interface settings managed by the host
- The **FIFO buffer** ensures fast and convenient data transfer between host and the contactless UART
- The **register bank** contains the settings for the analog and digital functionality

Low Power Card Detection concept





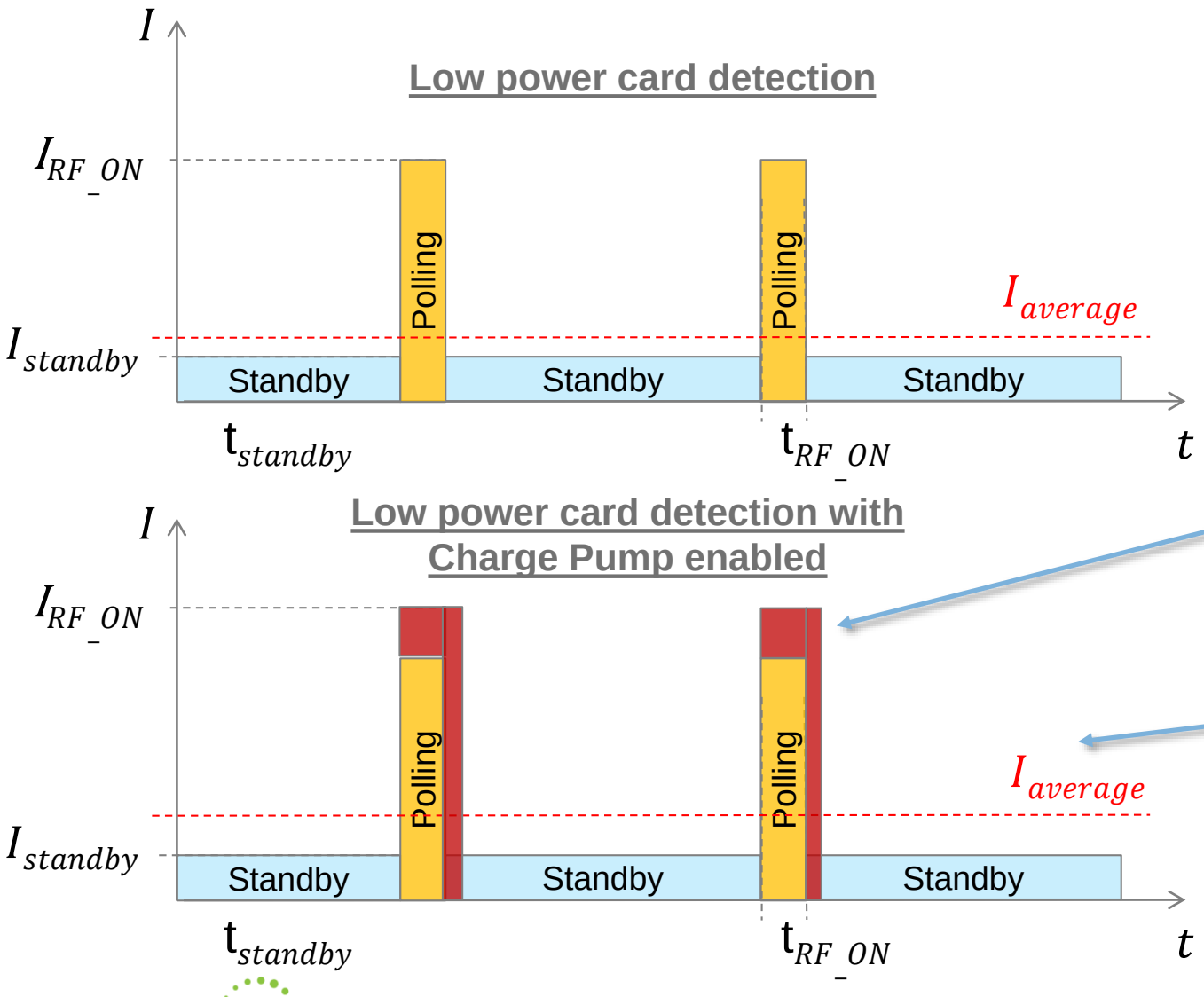
The contactless readers periodically activates the RF field to poll for the cards

$$I_{average} = \frac{I_{standby} \cdot t_{standby} + I_{RF\_ON} \cdot t_{RF\_ON}}{t_{standby} + t_{RF\_ON}}$$

The LPCD reduces the average current consumption by providing a much shorter RF_ON interval for the card detection

Training Mobile Knowledge

Low Power Card Detection – Charge Pump option



Ideal for applications where the detection range might be more important

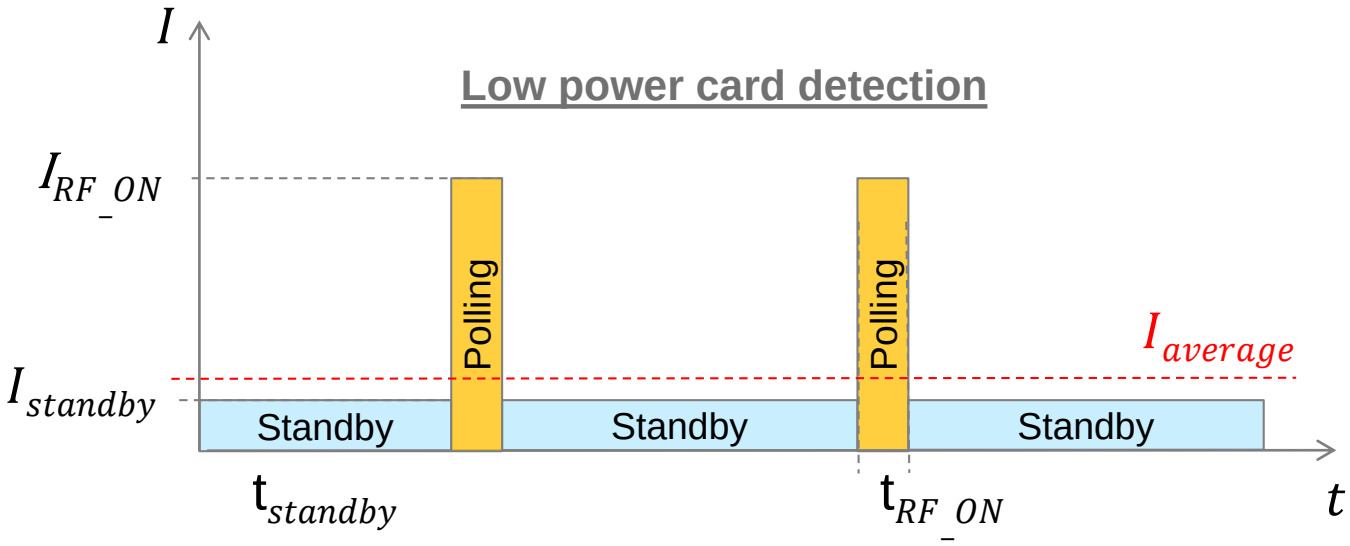
The charge pump increases the output power at TX pins (i.e RF field strength) during the RF on time.

Up to 2.5 higher detection range

Increase current consumption

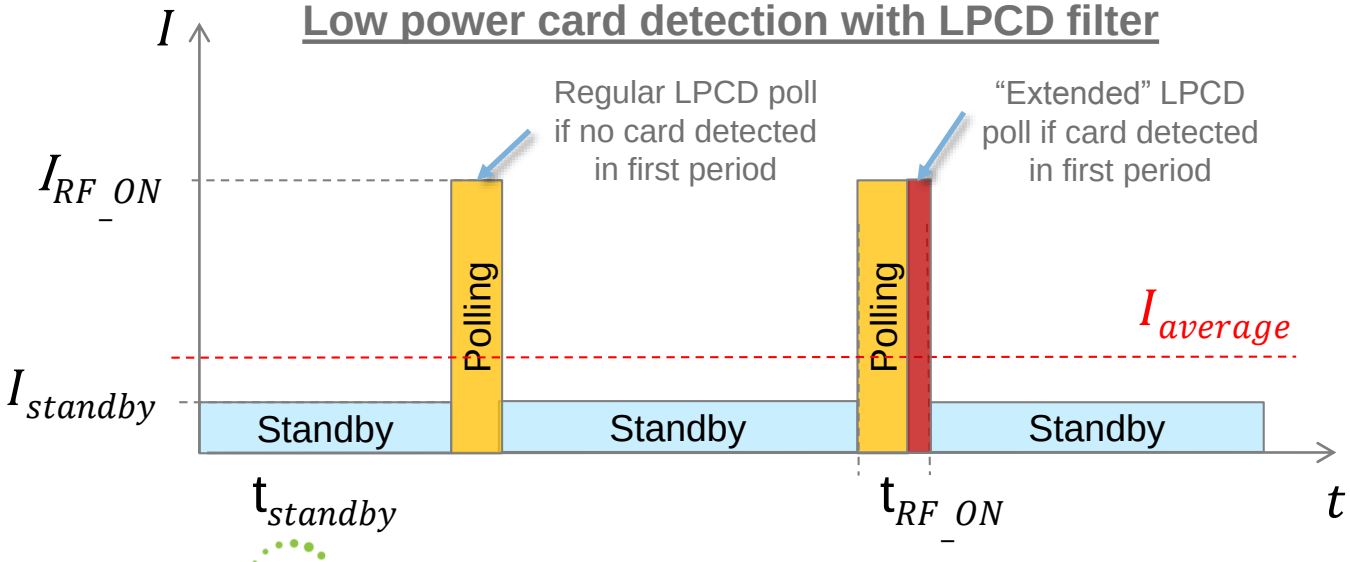
Training Mobile Knowledge

Low Power Card Detection – LPCD filter



First period	Second period	Third period	Duration	Result
No wake up	-	-	Rfon	Return to LPCD
Wake up detected	No wake up	-	Rfon + 32 tc	Return to LPCD
Wake up detected	Wake up detected	No wake up	Rfon + 64 tc	Return to LPCD
Wake up detected	Wake up detected	Wake up detected	Rfon + 64 tc	Wake up

tc = 1/13.56MHz → 32 tc ≈ 2.5µs



The LPCD filter improves the card detection robustness:

- Reduces the risk of fail detections, specially the case of spike noise
- Increases average current consumption

Training Mobile Knowledge

Product support package

CLRC663 *plus* product support package content

CLRC663 *plus* NFC frontend development kit (OM26630FDK)

Development kit with integrated NXP LPC1769 MCU

NFC cockpit v3.10

Supports PN5180, PN7462 and CLRC663 *plus*

NFC Reader Library

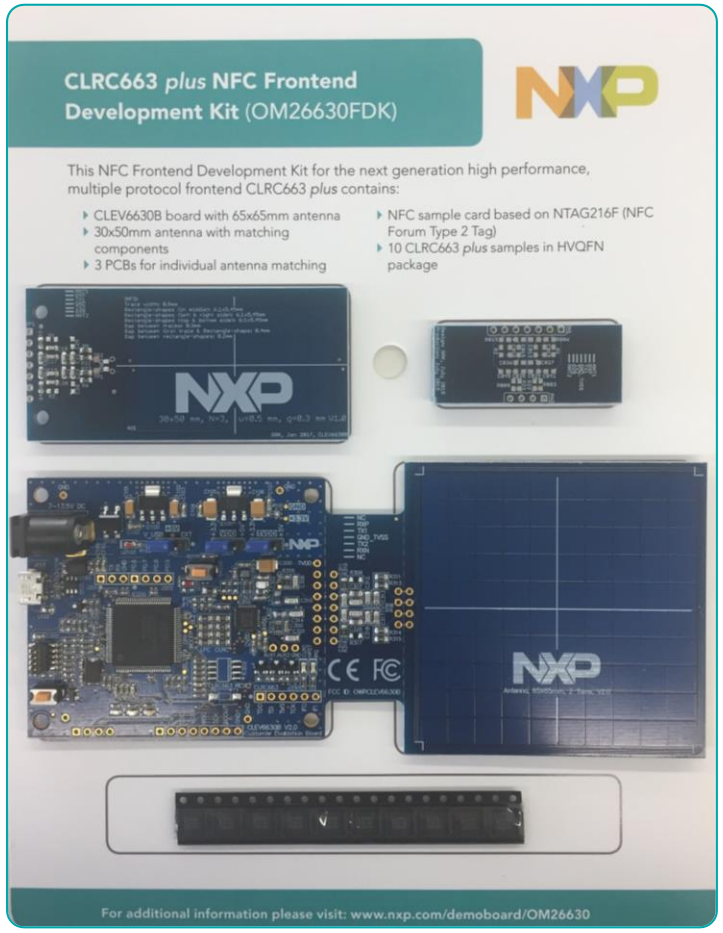
Feature complete software support library for NFC Frontend ICs

Documentation

Datasheets and application notes for an easy ramp-up.

Training Mobile Knowledge

CLRC663 *plus* NFC frontend development kit (OM26630FDK)



OM26630FDK contents

- Development kit with integrated NXP LPC1769 MCU
- Straightforward antenna design with NFC Cockpit tool
- Different antenna PCBs for easy antenna matching
- Easy application development with NFC Reader Library
- CE / FCC certified CLEV6630B board

OM26630FDK features

- Development kit with integrated NXP LPC1769 MCU
- Straightforward antenna design with NFC Cockpit tool
- Different antenna PCBs for easy antenna matching
- Easy application development with NFC Reader Library
- CE / FCC certified CLEV6630B board

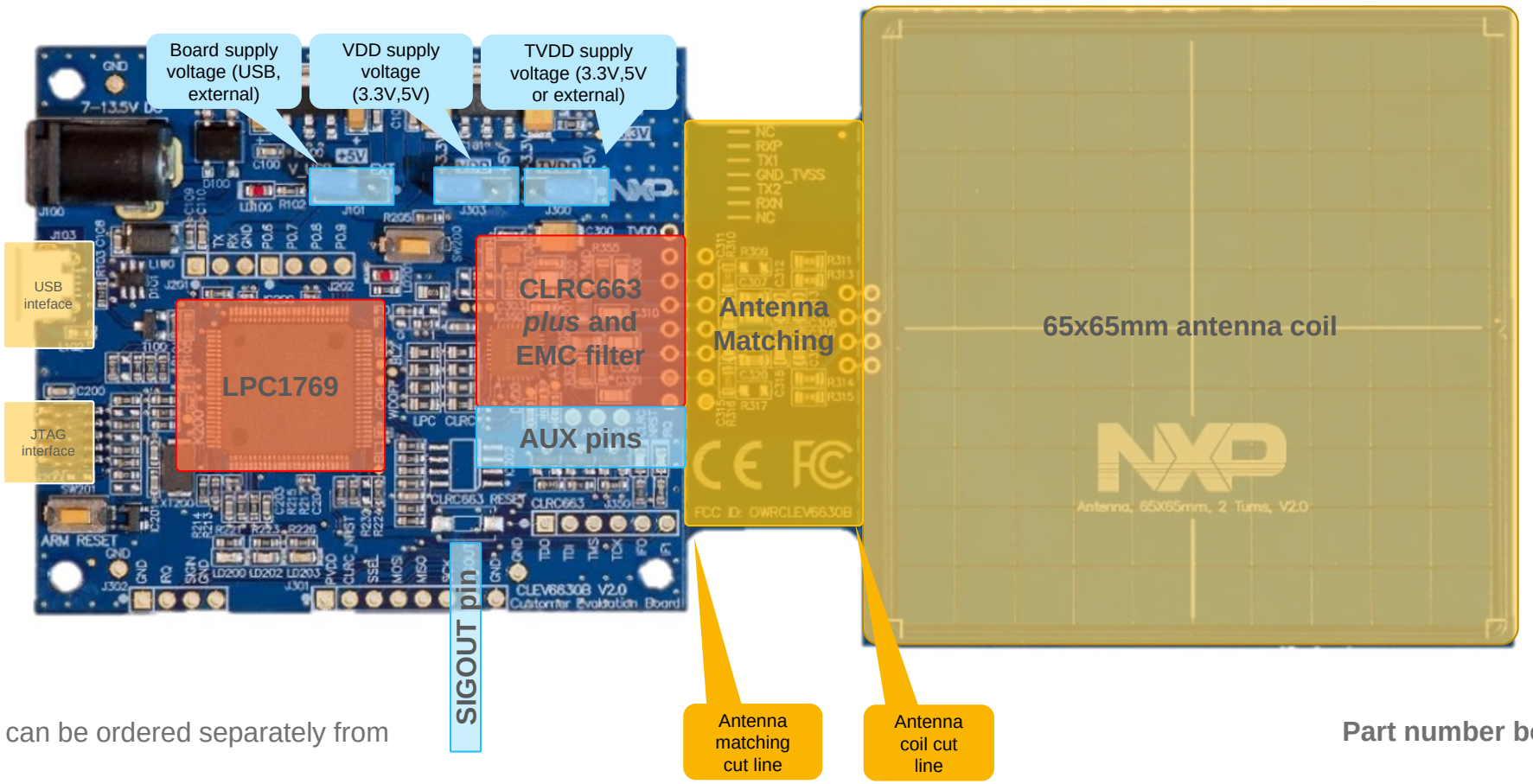
For additional information please visit: www.nxp.com/demoboard/OM26630

Part number complete kit: OM26630FDK
12NC: 9353 391 51699

Training Mobile Knowledge

CLEV6630B details

CLEV6630B schematics and layout available

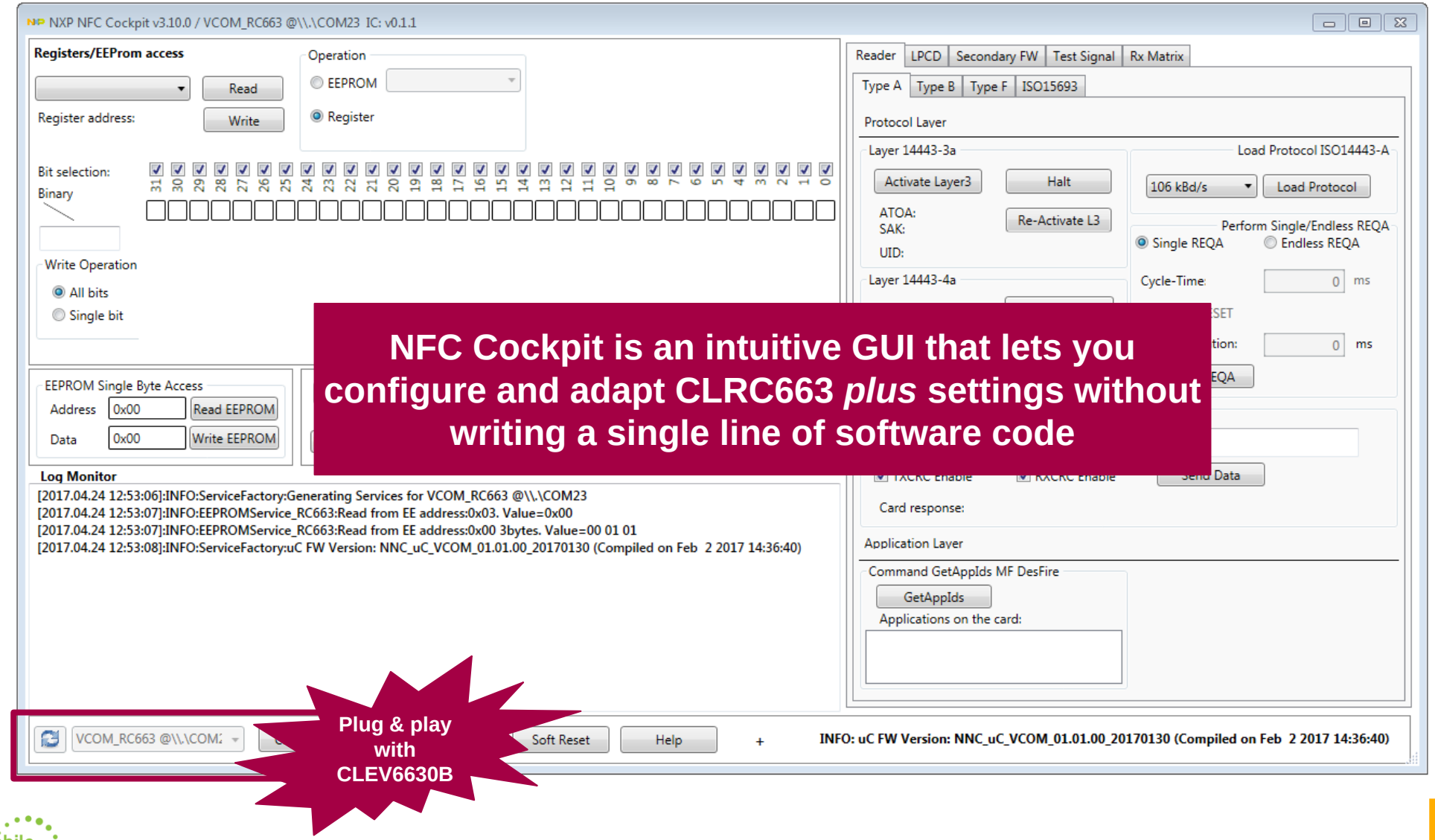


*The CLEV6630B board can be ordered separately from the OM26630FDK kit

Part number board only: CLEV6630B
12NC: 9353 391 49699

Training Mobile Knowledge

NFC Cockpit

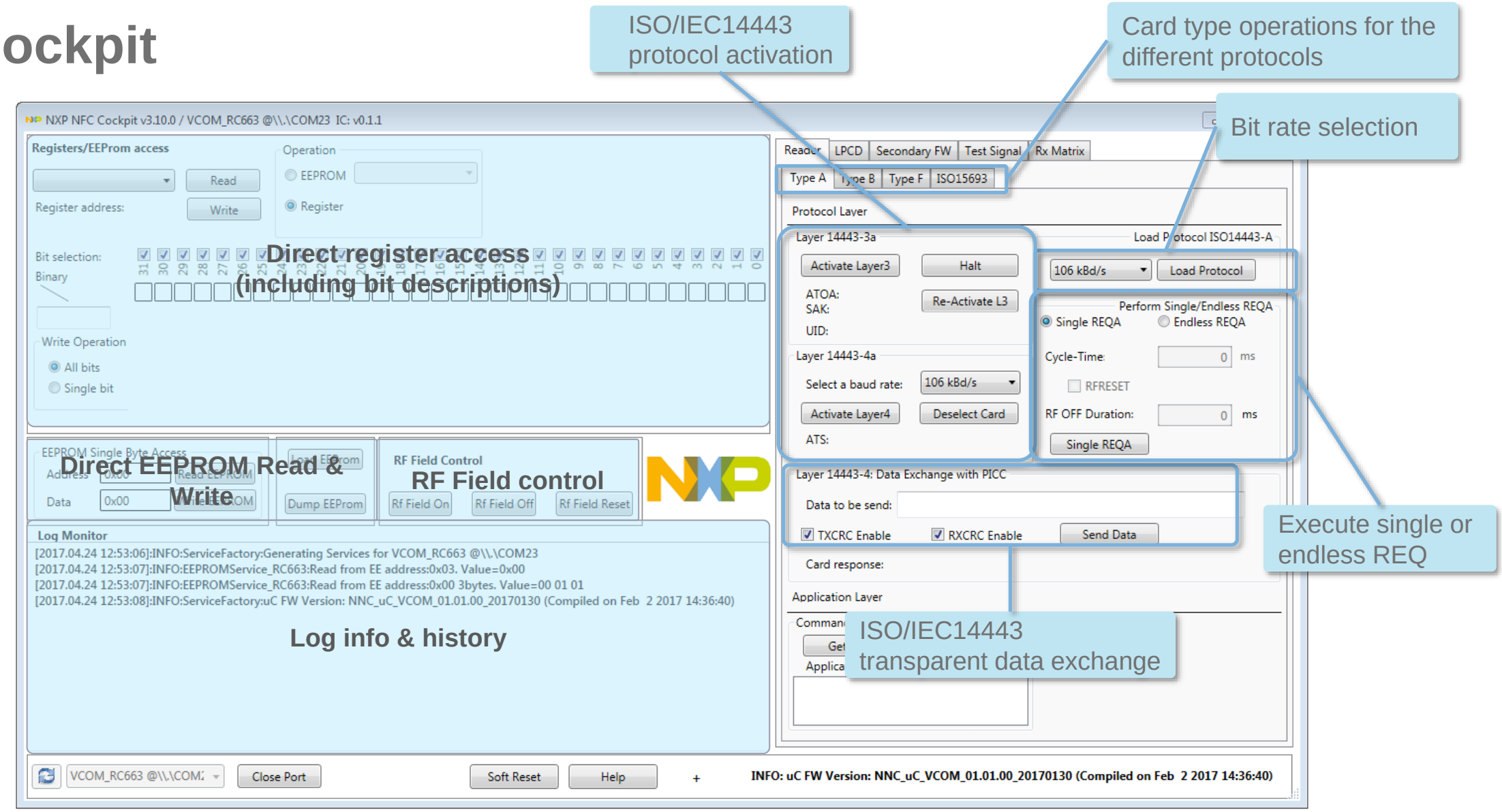


NFC Cockpit is an intuitive GUI that lets you configure and adapt CLRC663 *plus* settings without writing a single line of software code

Plug & play with CLEV6630B

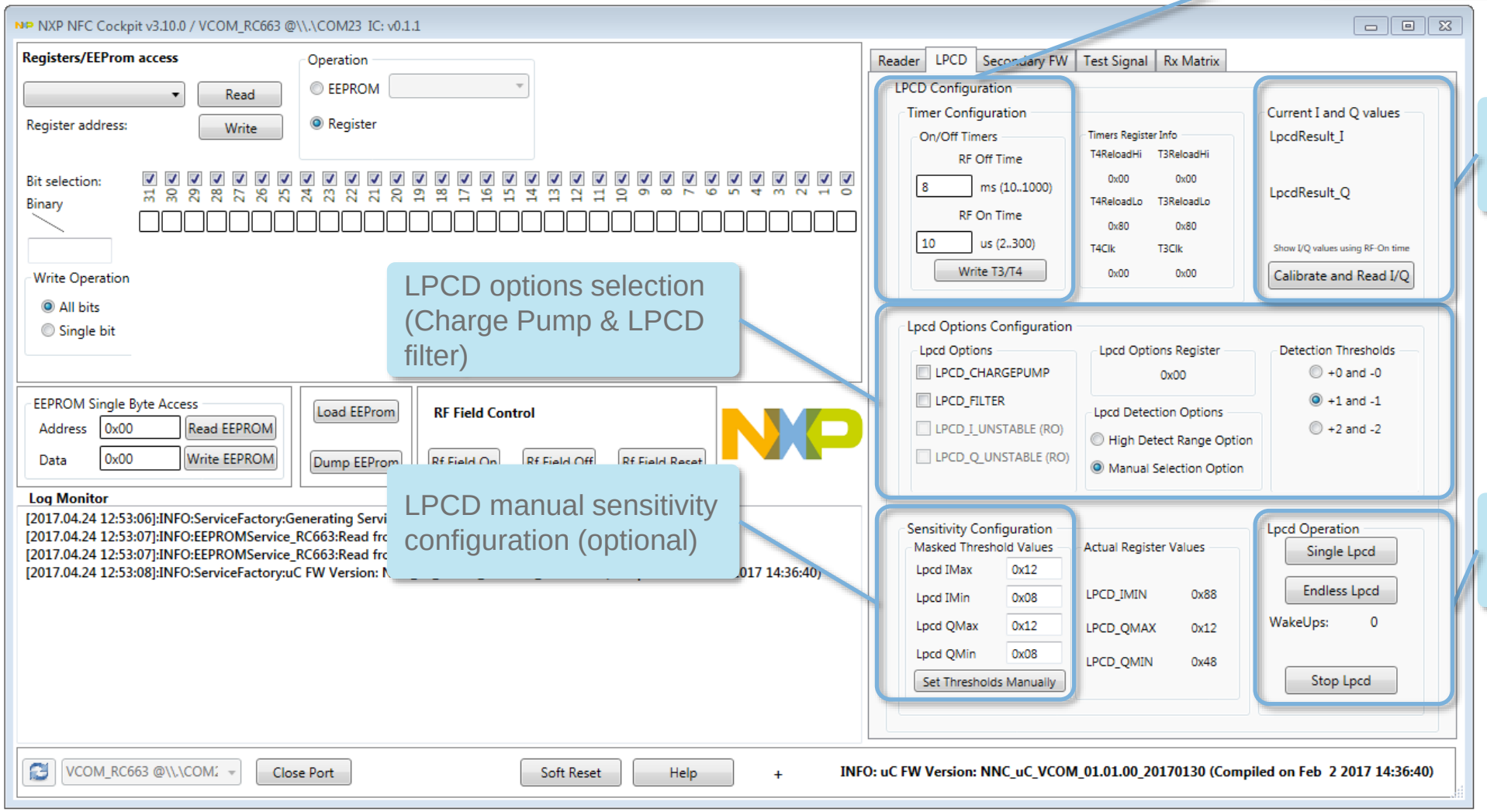
Training Mobile Knowledge

NFC Cockpit



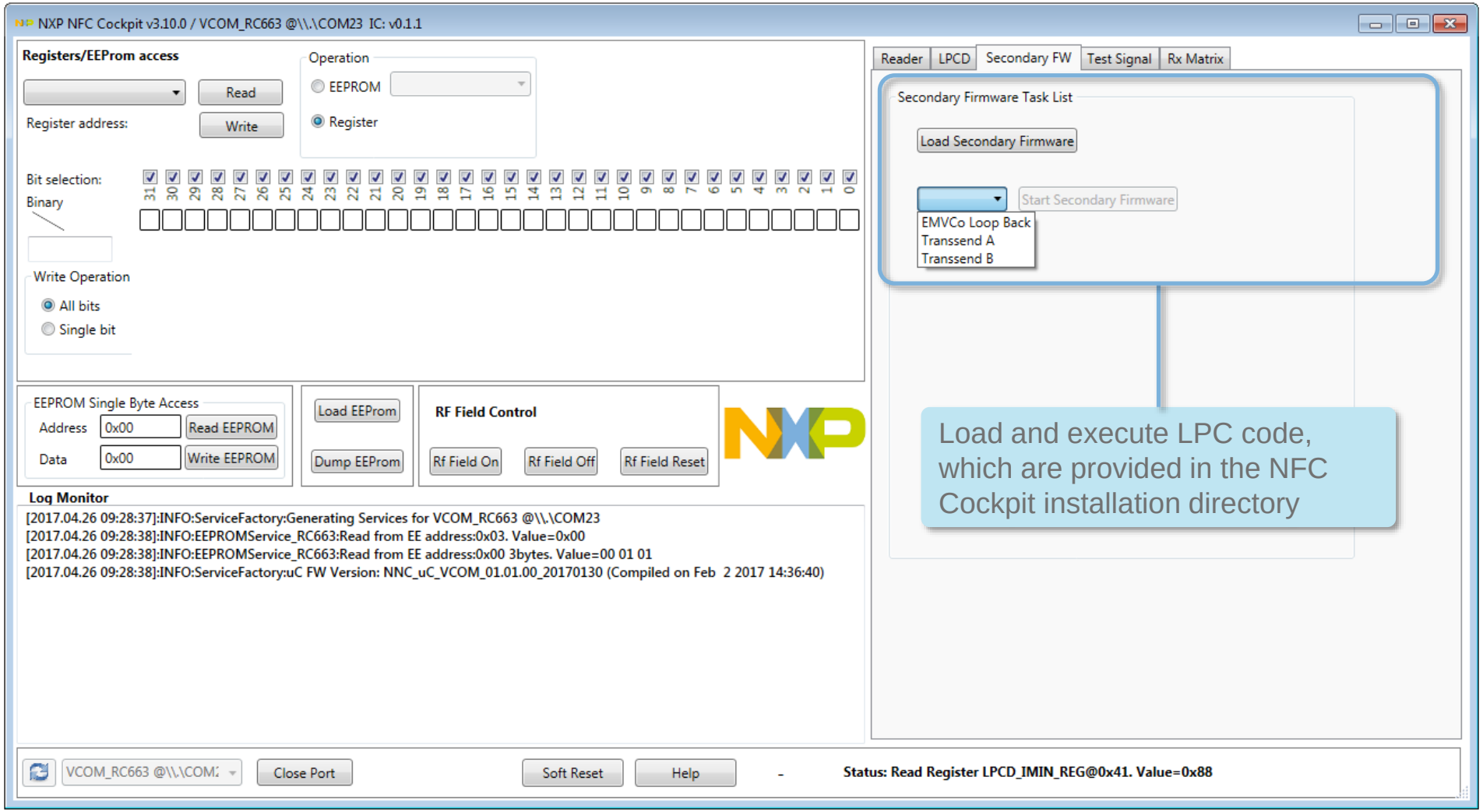
Training Mobile Knowledge

NFC Cockpit - LPCD



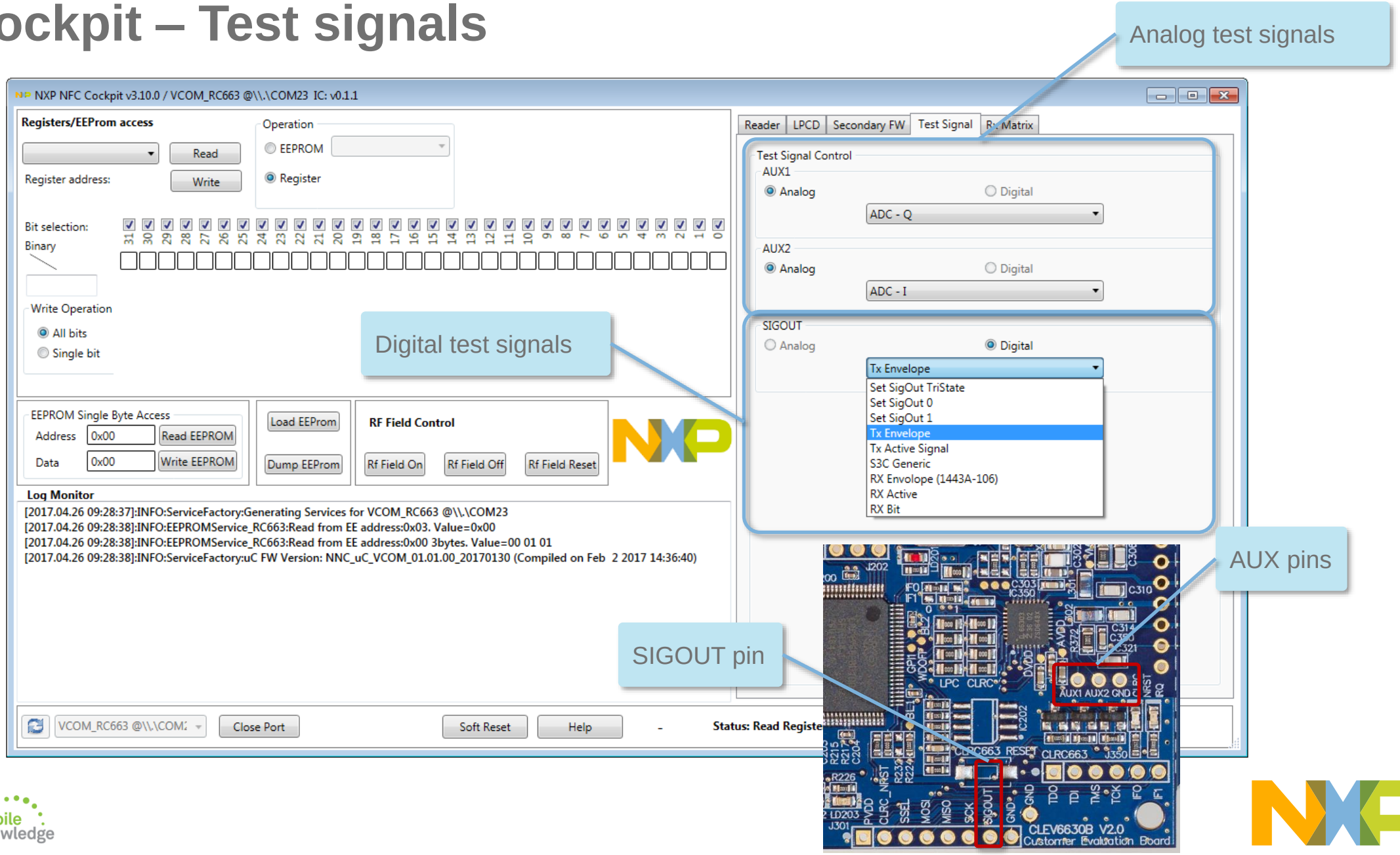
Training Mobile Knowledge

NFC Cockpit – Secondary FW



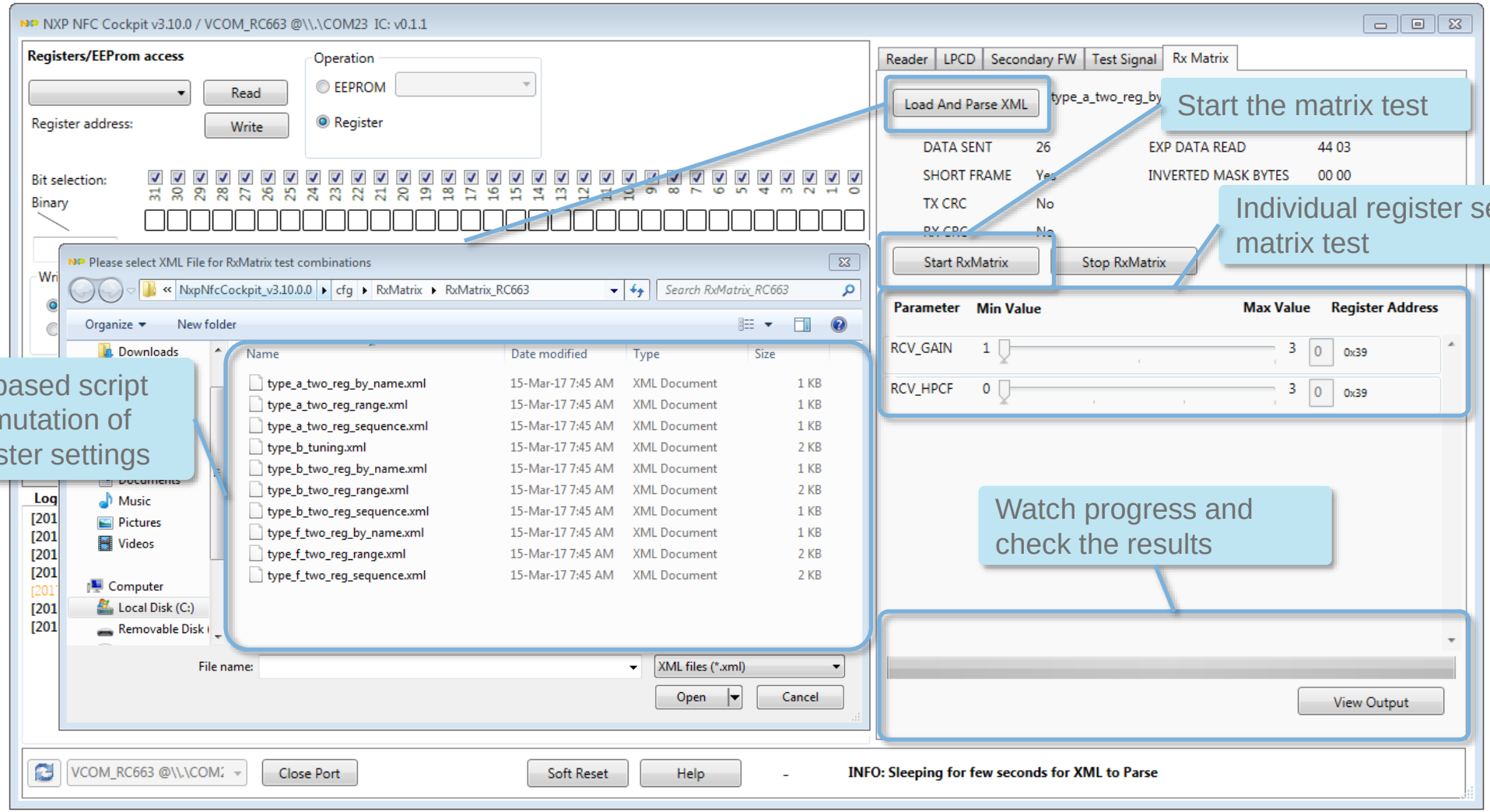
Training Mobile Knowledge

NFC Cockpit – Test signals



Training Mobile Knowledge

NFC Cockpit – Rx matrix

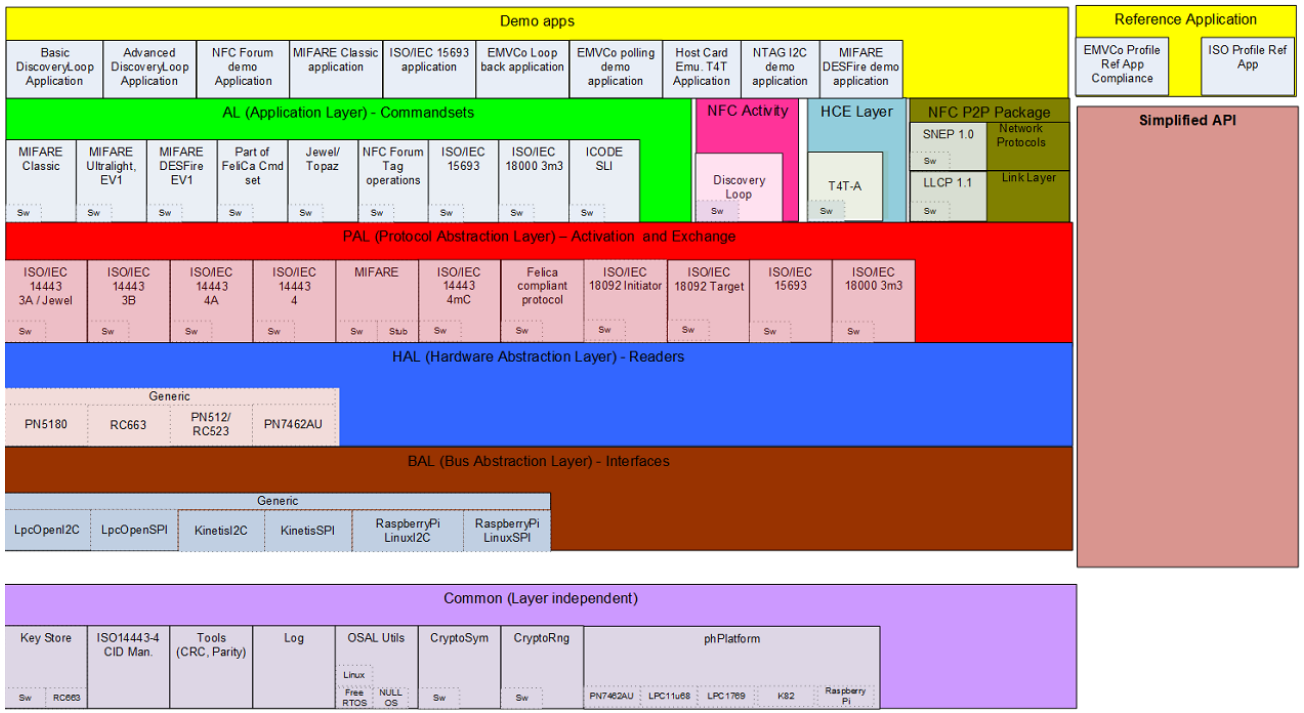


Allows to easily optimize RX settings without requiring extensive test signal debugging know how

Training Mobile Knowledge

NFC Reader Library

NFC Reader Library



Software examples

Example 1: BasicDiscoveryLoop
Example 2: AdvancedDiscoveryLoop
Example 3: NFCForum
Example 4: MIFARE Classic
Example 5: ISO15693
Example 6: EMVCo Loopback
Example 7: EMVCo Polling
Example 8: HCE T4T
Example 9: NTAG I2C
Example 10: SimplifiedAPI_EMVCo
Example 11: SimplifiedAPI_ISO

For additional information and source code, please visit: www.nxp.com/pages/:NFC-READER-LIBRARY

The NFC Reader Library is everything you need to create your own software stack and application for a contactless reader

Training Mobile Knowledge

Documentation

High-performance multi-protocol NFC frontend CLRC663 and CLRC663 *plus*

Product data sheet

AN11873 – CLRC663 *plus* Low Power Card Detection

Describes the principle of the Low Power Card Detection (LPCD), how to use it and how to optimize the related settings.

AN11022 – CLRC663 evaluation board quick start guide

Describes the CLEV6630B board and how to use it together with the NFC Cockpit.

Updated

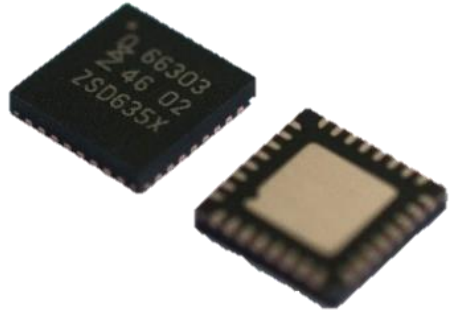
AN11019 – CLRC663, MFRC631, SLRC610 Antenna design guide

Describes the principles of antenna tuning for CLRC663 product family

Updated

Training Mobile Knowledge

Ordering details



Part number	12NC		MOQ
CLRC66303HN reel	9353 062 08518	CLRC663 *plus* ICs on reel	6000
CLRC66303HN single tray	9353 062 08551	CLRC663 *plus* ICs on multiple trays	490
OM26630FDK	9353 391 51699	CLRC663 *plus* frontend development kit containing a CLEV6630B development board and - an 30*50mm² antenna with matching components and 3 PCBs for individual antenna matching - NTAG216F and MIFARE DESFire EV2 sample cards and 10 CLRC663 *plus* samples	1
CLEV6630B	9353 391 49699	CLRC663 *plus* frontend development board with 65*65mm² antenna	1

Product samples and development boards can be ordered directly from the websites via buy direct.

Training Mobile Knowledge

MobileKnowledge

Software development in Android and iOS
Embedded software for MCUs
JCOP, Java Card operating Systems
Hardware design and development
Digital, analog, sensor acquisition, power management
Wireless communications WiFi, ZigBee, Bluetooth, BLE
Contactless antenna RF design, evaluation and testing

MIFARE applications
End-to-end systems, readers and card-related designs
EMVco applications
Readers, cards, design for test compliancy (including PCI)
Secure Element management
GlobalPlatform compliant backend solutions
Secure services provisioning OTA, TSM services

We help companies leverage the mobile and **contactless revolution**

MobileKnowledge

Roc Boronat 117, P3M3
08018 Barcelona
(Spain)

Get in touch with us
www.themobileknowledge.com
mk@themobileknowledge.com