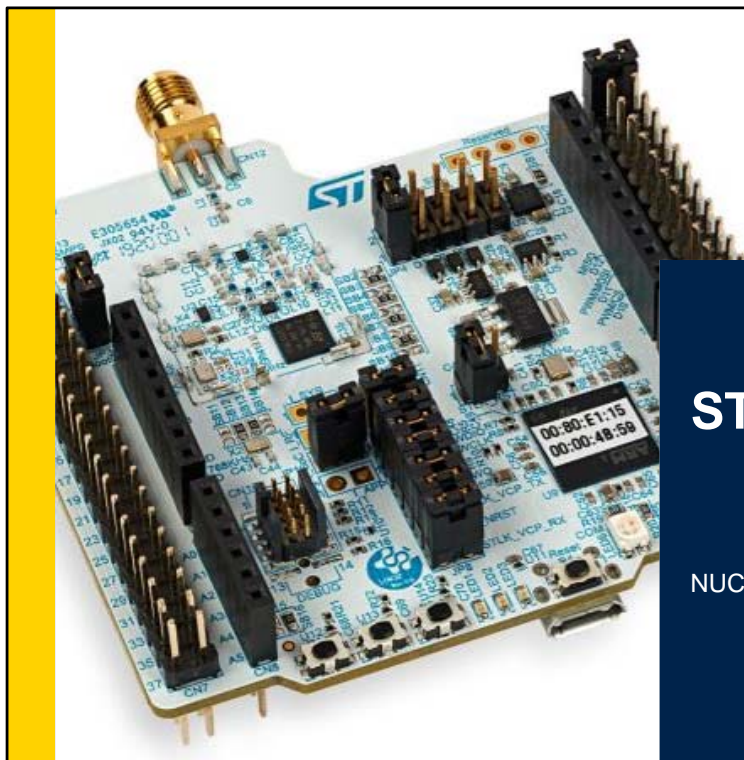




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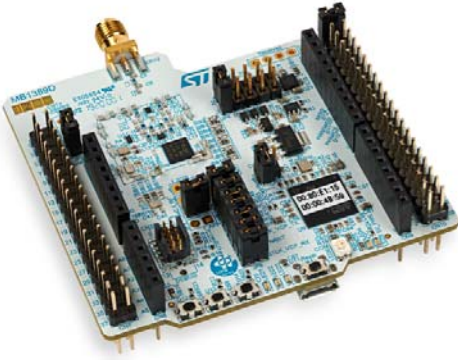
STM32WL55JC boards

NUCLEO-WL55JC boards

Hello, and welcome to the presentation of this STM32 Nucleo-64 board: NUCLEO-WL55JC .

It covers the main features of this Nucleo board dedicated to the STM32WL series. The demonstration software included with this Nucleo board will allow you to become more familiar with this new low-consumption and wireless communication microcontroller.

Overview



- Discover our ultra-low-power wireless communication STM32WL55 Nucleo boards
 - 2 versions based on the STM32WL55 microcontroller
 - High-frequency band (from 865 to 928 MHz)
 - Low frequency band (from 433 to 510 MHz)
 - Enables a wide diversity of applications
 - Comes with various packaged software examples

Application benefits

- Designed for low-power, wireless communication use cases
- Turnkey demonstration firmware
- Develop your own application



2

The STM32WB55 Nucleo boards offers everything required for users to get started quickly and develop applications easily.

This pack consists of 2 boards both with an STM32WL55 microcontroller enabling a wide range of wireless applications.

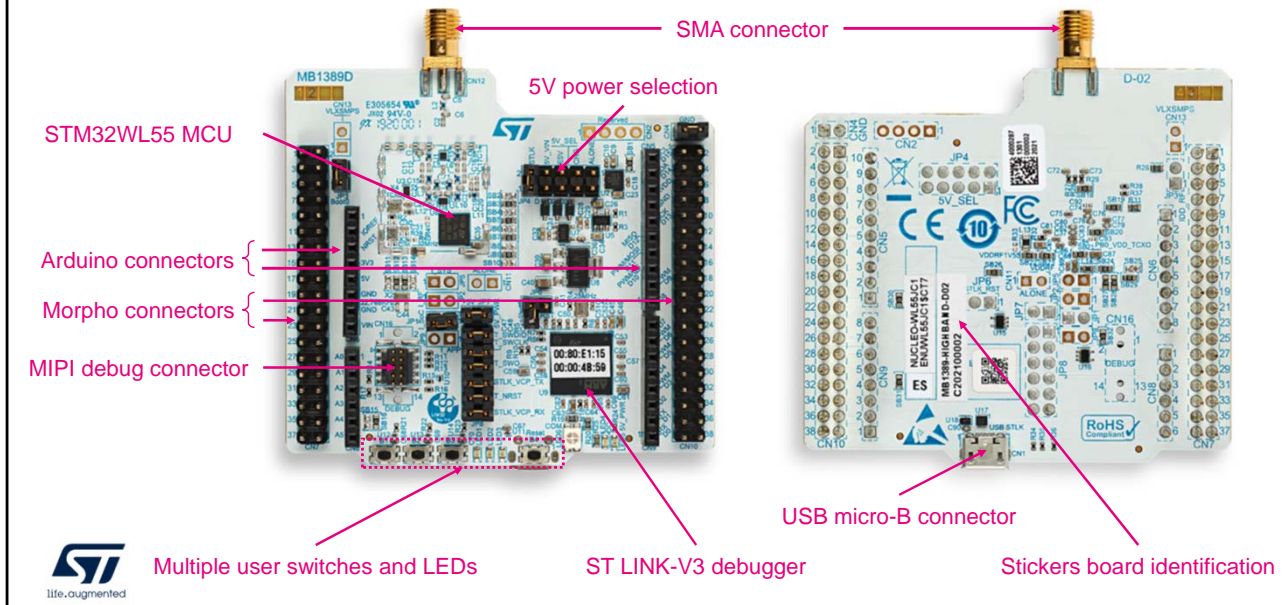
One board (NUCLEO-WL55JC1) is dedicated for high frequency band, from 865 to 928 MHz.

One board (NUCLEO-WL55JC2) is dedicated for low frequency band, from 433 to 510 MHz.

It comes with the comprehensive STM32 software HAL library together with various packaged software examples.

It also embeds a debugger that helps you develop your own applications from the existing examples.

STM32WL nucleo board



This is the STM32WL55 Nucleo board. It offers several connectors for power and 1 USB peripheral. Multiple user switches and LEDs are also available. Support for Arduino connectivity ensures unlimited expansion capabilities with a large choice of specialized add-on boards.

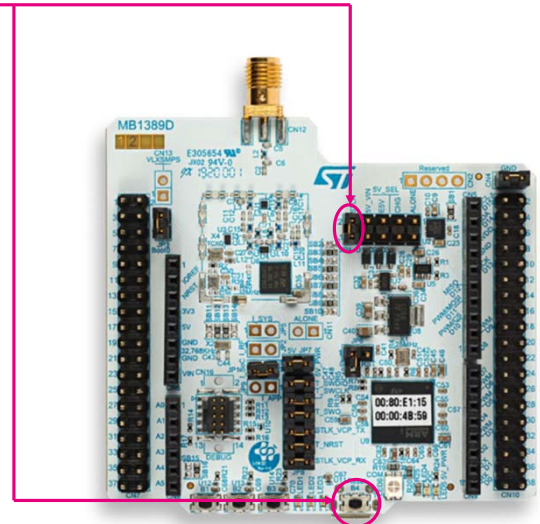
All pins of the STM32WL55 MCU are also available on the ST Morpho connectors.

The STM32WL55 Nucleo board also embeds a ST LINK-V3 debugger that helps you develop and test your own applications from the existing examples.

The STM32WL55 Nucleo board has many power supply options, either through the ST-LINK USB connector or via external sources.

Power supply modes

Input power	Connector pin	Voltage range	Jumper
5V_USB_STLK	CN1 pin 1	4.75 - 5.25 V	JP5 [1-2] ON
5V_VIN	CN6 pin 8 CN7 pin 24	7 -12 V	JP5 [3-4] ON
E5V	CN7 pin 6	4.75 - 5.25 V	JP5 [5-6] ON
5V_USB_CHG	CN1 pin 1	4.75 - 5.25 V	JP5 [7-8] ON
STD_ALONE_5V	CN11 pin 1	4.75 - 5.25 V	JP5 [9-10] ON Used when ST LINK-V3 is not powered
3V3	CN6 pin 4 CN7 pin 16 JP1 pin 1	3 V to 3.6 V	Used when ST LINK-V3 is not used, when we want to supply directly the STM32MCU



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The STM32WL55 Nucleo board has 6 possible power supply sources.

- 5 Volt can be provided by the host computer connected through the USB cable plugged on the ST LINK-V3 connector. Jumper JP5 [1-2] must be present.
- 7 to 12 Volt power supply can be connected to CN6 pin 8 and CN7 pin 24. Jumper JP5 [3-4] must be present.
- External 5 Volt power supply can be connected to CN7 pin 6. Jumper JP5[5-6] must be present.
- 5 Volt can be provided by an USB charger. Jumper JP5[7-8] must be present.
- Standalone 5 Volt power supply can be connected to CN11 pin 1. Jumper JP5[9-10] must be present. This is used when ST LINK-V3 is not powered.
- 3.3 Volt power supply can be used provided that the

ST LINK-V3 part is not powered. In this case, the STM32WL55 MCU is directly supplied by the 3.3 volt. The figure highlights the first possibility: powering the MCU board via the USB connector from the host computer connected to ST LINK-V3 and shows the location of Jumper 5 [1-2]. This is the default setting.

Default board configuration

Jumper	Definition	Default position	Comment
JP1	I_SoC	ON	For STM32WL current measurements
JP2	I_RF	OFF (SB28 ON)	For STM32WL current measurements (RF part)
JP3	BOOT0	ON	Allows to disconnect PH3/ BOOT0 pull-down resistor and to use it as an I/O if the software BOOT0 is used, thanks to the option bytes.
JP4	5 V power-source selection	51-2] (default)	5V_USB_STLK (from ST-LINK)
JP5	I_SYS	OFF (SB27 ON)	For STM32WL current measurements (Digital part)
JP6	STLK-RST	OFF	STLINK-V3E reset
JP7	5V_PWR	ON	5V power source
JP8	Signals between STLINK-V3E and MCU target	All 6 jumpers ON	ST LINK-V3 connected to the STM32WL55 MCU
JP9	I_APP	OFF (SB32 ON)	For U3 and U4 DC switches current measurement



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This slide describes the default settings of the STM32WL55 Nucleo board.

5 Volt is the default power supply, provided by the host computer through the USB cable.

The reset input of the ST-Link is by default disconnected (JP6 OFF). Note that the ST Link-V3 implements an autonomous power-up reset circuitry.

The JP1 Jumper, labeled I_SoC, allows the consumption of the STM32 Microcontroller to be measured by removing the jumper and connecting an ampere-meter. By default, the jumper is present and therefore the STM32 MCU is powered.

In addition, in order to evaluate the power consumption of RF part, or digital part or the DC switches, some jumpers are also available (respectively JP2, JP5 and

JP9). Those jumpers are not fitted but a dedicated SB is placed in parallel of the jumpers in order to supply the RF part, the digital part and the DC switches.

STM32WL55 nucleo board insert card (1/2)

More Inside

Fully open cores and multiprotocol: LoRaWAN, Sigfox, W-MBUS, proprietary protocols and more.

SOFTWARE TOOLS

- STM32CubeMX
- STM32CubeMonitor
- STM32CubeProg

By using or installing (as applicable) this evaluation kit you accept all the terms of the EVALUATION LICENSE AGREEMENT available at: www.st.com/eval

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STM32WL55
Wireless, Long-Range
Nucleo-64

Ultra-low-power Sub-GHz MCU

STM32WL55JC17 73 PINS

- Arm® Cortex®-M4 / M0+ core at 48/48 MHz
- 256 Kbytes of Flash memory, 64 Kbytes of SRAM
- Ultra-low-power MCU, Sub-GHz multi-modulation radio: LoRa®, (G)FSK, (G)MSK, and BPSK
- RF optimized from 865 MHz to 930 MHz band
- High RF performance
- Two extension types:
 - ARDUINO® Uno V3 connectivity
 - ST morpho extension pin header footprints for full access to all STM32 I/Os
- Embedded STLINK-V3 high-speed debugger/programmer

NUCLEO-WL55JC1

■ ARDUINO® Uno ■ ST morpho

NUWL55JC18CT1

Order code: NUCLEO-WL55JC1

ST part number: NUCLEO-WL55JC1

www.st.com

Here are the front and back sides of the STM32WL55 Nucleo board insert card.

STM32WL55 Nucleo board insert card (2/2)

STM32 Nucleo-64 for STM32WL55: wireless, long-range and ultra-low-power Sub-GHz MCU

GETTING STARTED

- 1/ Check jumper positions on board. JP4 (power source) on STLK side, JP1 (L_S0C) on JP3 (Boot) on JP7 (5V_PWR) on JP8 (6 jumpers) all on.
- 2/ Connect the STM32WL Nucleo board to a PC with a standard USB cable through USB connector CN1 to power the board. Then the green LED LED5 (PWR) and the LED LED6 (COM) light up, the three LEDs LED1, LED2 and LED3 are blinking.
- 3/ On the PC, connect a UART terminal to the board using the following settings:
 - UART terminal: new line receive = auto; new line transmit = Line Feed.
 - Serial port setup: select COM port number, 9600 baud rate, 8-bit data, parity none, 1 stop bit, no flow control.
- 4/ Press on the reset button (B4) of the STM32WL Nucleo board.
 - The STM32WL Nucleo board remains silent until it gets command from the connected PC to start sending beacon on one of beacon frequencies.
 - The frequency is selected depending on region.
 - After version check, the first three commands to send to PC should set region, subregion and start the beacon. (AT+REGION=<n>, AT+SUBREGION=<n> and AT+BEACON_ON). The first two commands will select format of the transmitted beacon. The third command will start sending the beacon.
 - For a list of available regions run AT+LIST_REGIONS.
- 5/ Then the concentrator starts blinking (green LED) on each time slot of the network.
- 6/ To get the demo fully up and running, up to 14 Nucleo Demo Sensors should be programmed and placed against a Nucleo Demo Concentrator.
- 7/ This demo application software is available at www.st.com/en/evaluation-tools/nucleo-wl55jc.html

SYSTEM REQUIREMENTS

- Windows® OS (7, 8 and 10), Linux® 64-bit or macOS®
- USB Type-A or USB Type-C® to Micro-B cable

DEVELOPMENT TOOLCHAINS

- IAR Systems - IAR Embedded Workbench®
- Keil® - MDK-ARM®
- STMicroelectronics - STM32CubeIDE

1. On Windows® only

EMBEDDED SOFTWARE
STM32CubeWL MCU Package
featuring LL & HAL drivers, RTOS
and examples for this board.



Here is the inside part of the STM32WL55 Nucleo board insert card.

Key features (1/2)

- STM32WL55JC microcontroller multiprotocol LPWAN dual-core 32-bit (Arm® Cortex®-M4/M0+ at 48 MHz) in UFBGA73 package featuring:
 - Ultra-low-power MCU
 - RF transceiver (150 MHz to 960 MHz frequency range) supporting LoRa®, (G)FSK, (G)MSK, and BPSK modulations
 - High-frequency band (from 865 to 928 MHz)
 - Low frequency band (from 433 to 510 MHz)
 - 256-Kbyte Flash memory and 64-Kbyte SRAM
- 3 user LEDs, 3 user buttons and 1 reset push-button
- 32.768 kHz LSE crystal oscillator & 32 MHz HSE on-board oscillator
- Board connectors:
 - USB with Micro-B
 - MIPI® debug connector
 - ARDUINO® Uno V3 expansion connector
 - ST morpho extension pin headers for full access to all STM32WL I/Os



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Each Nucleo board has an STM32WB55 microcontroller. This device (in a UFBGA73 package) features an ARM® Cortex®-M0+ and an ARM® Cortex®-M4 cores running at up to 48 MHz, with 256 kilobytes of Flash memory and 64 kilobytes of RAM. This device embeds a powerful and ultra-low-power radio module including a RF transceiver (150 MHz to 960 MHz frequency range) supporting LoRa®, (G)FSK, (G)MSK, and BPSK modulations.

The Nucleo board also features the following peripherals:

- 3 user LED, 3 user buttons and 1 reset push-button
- 32.768 kHz LSE crystal oscillator and 32 MHz HSE on-board oscillator

Several connectors are also available on the Nucleo

board:

- An USB with Micro-B to supply the board,
- A MIPI® debug connector for debug,
- An ARDUINO® Uno V3 expansion connector so that many expansion boards compatible with Arduino specification can be plugged onto the STM32WL55 Nucleo board
- A Morpho connector enabling the user to access all STM32 I/Os

The board expansion connectors enabling the user to access all STM32 I/Os

Key features (1/2)

- Delivered with SMA antenna (one for high band, one for low band).
- Flexible power-supply options: ST-LINK, USB VBUS, or external sources
- On-board STLINK-V3 debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Comprehensive free software libraries and examples available with the STM32CubeWL MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE
- Suitable for rapid prototyping of end nodes based on LoRaWAN®, Sigfox™, wM-Bus, and many other proprietary protocols
- Fully open hardware platform



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One board (NUCLEO-WL55JC1) is dedicated for high frequency band, from 865 to 928 MHz with a dedicated high band SMA antenna which is provided.

One board (NUCLEO-WL55JC2) is dedicated for low frequency band, from 433 to 510 MHz with a dedicated SMA low band antenna which is also provided.

The Nucleo board embeds a flexible power-supply options: ST-LINK, USB VBUS, or external sources.

The Nucleo board includes also an on-board STLINK-V3 debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port.

The board comes with comprehensive free software libraries and examples available with the STM32 Cube MCU package.

The following IDEs are supported: IAR, Keil, GCC-based and ARM MBED.

Firmware package

- The STM32WL55 Nucleo examples, applications and demonstration firmware are provided in one single .zip file
- The extraction of the .zip file generates one folder, STM32Cube_FW_WL_VX.Y.Z, which contains the following subfolders:

Directory	Contents
Applications	Includes a set of applications ready to be run
Demonstration	Includes the demonstration firmware ready to be run
Example project	Includes toolchain projects for each peripheral ready to be run
Template project	Pre-configured project with empty main function to be customized by the user

- ▼ STM32Cube_FW_WL_V1.0.0
 - _htmresc
 - Documentation
 - > ▫ Drivers
 - > ▫ Middlewares
 - > ▫ Projects
 - ▼ ▫ NUCLEO-WL55JC

Applications	> ▫ Applications
	▼ ▫ Demonstrations
Demonstration	▼ ▫ LocalNetwork
	> ▫ LocalNetwork_Concentrator
	> ▫ LocalNetwork_Sensor
	> ▫ Examples
Example Project	> ▫ Examples_LL
	> ▫ Examples_MIX
	▼ ▫ Templates
Template Project	> ▫ DualCore
	> ▫ SingleCore
	> ▫ Templates_LL
	> ▫ Utilities



SOFTWARE TOOLS

- STM32CubeMX
- STM32CubeMonitor
- STM32CubeProg



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Once unzipped, the file containing the Nucleo project examples has a directory named STM32Cube_FW_WL_VX.Y.Z.

This directory contains the projects that can be run on the NUCLEO-WL55JCx boards. These projects are ready to be run.

The applications subfolder includes a set of applications. The demonstration subfolder includes the demonstration firmware.

The example project subfolder includes toolchain projects for each peripheral.

The template project subfolder contains pre-configured projects with empty main function.

The demo application software is available at
www.st.com/en/evaluation-tools/nucleo-wl55jc.html

Getting started

- Check jumper positions on board, JP4 (power source) on STLK side, JP1 (I_SoC) on, JP3 (Boot0) on, JP7 (5V_PWR) on, JP8 (-6 jumpers) all on.
- Connect the STM32WL Nucleo board to a PC with a standard USB cable through USB connector CN1 to power the board. Then the green LED LED5 (PWR) and the LED LED6 (COM) light up, the three LEDs LED1, LED2 and LED3 are blinking.
- On the PC, connect a UART terminal to the board using the following settings:
 - UART terminal: new line receive = auto; new line transmit = Line Feed.
 - Serial port setup: select COM port number, 9600 baud rate, 8-bit data, parity none, 1 stop bit, no flow control.
- Press on the reset button (B4) of the STM32WL Nucleo board.
 - The STM32WL Nucleo board remains silent until it gets command from connected PC to start sending beacon on one of beacon frequencies.
 - The frequency is selected depending on region.
 - After version check, the first three commands to send to PC should set region, subregion and start the beacon. (AT+REGION=x, AT+SUBREGION=x and AT+BEACON_ON). The first two commands will select format of the transmitted beacon. The third command will start sending the beacon.
 - For a list of available regions run AT+LIST_REGIONS.
- Then the concentrator starts blinking (green LED) on each time slot of the network.
- To get the demo fully up and running, up to 14 Nucleo Demo sensors should be programmed and placed against a Nucleo Demo Concentrator.



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This slide describes the way to proceed in order to run the demonstration application SW on the Nucleo-WL55JC board.

- Check jumper positions on board, JP4 (power source) on STLK side, JP1 (I_SoC) on, JP3 (Boot0) on, JP7 (5V_PWR) on, JP8 (-6 jumpers) all on.
- Connect the STM32WL Nucleo board to a PC with a standard USB cable through USB connector CN1 to power the board. Then the green LED LED5 (PWR) and the LED LED6 (COM) light up, the three LEDs LED1, LED2 and LED3 are blinking.
- On the PC, connect a UART terminal to the board using the following settings:
 - UART terminal: new line receive = auto; new line transmit = Line Feed.

- Serial port setup: select COM port number, 9600 baud rate, 8-bit data, parity none, 1 stop bit, no flow control.

- Press on the reset button (B4) of the STM32WL Nucleo board.

- The STM32WL Nucleo board remains silent until it gets command from connected PC to start sending beacon on one of beacon frequencies.

- The frequency is selected depending on region.

- After version check, the first three commands to send to PC should set region, subregion and start the beacon.

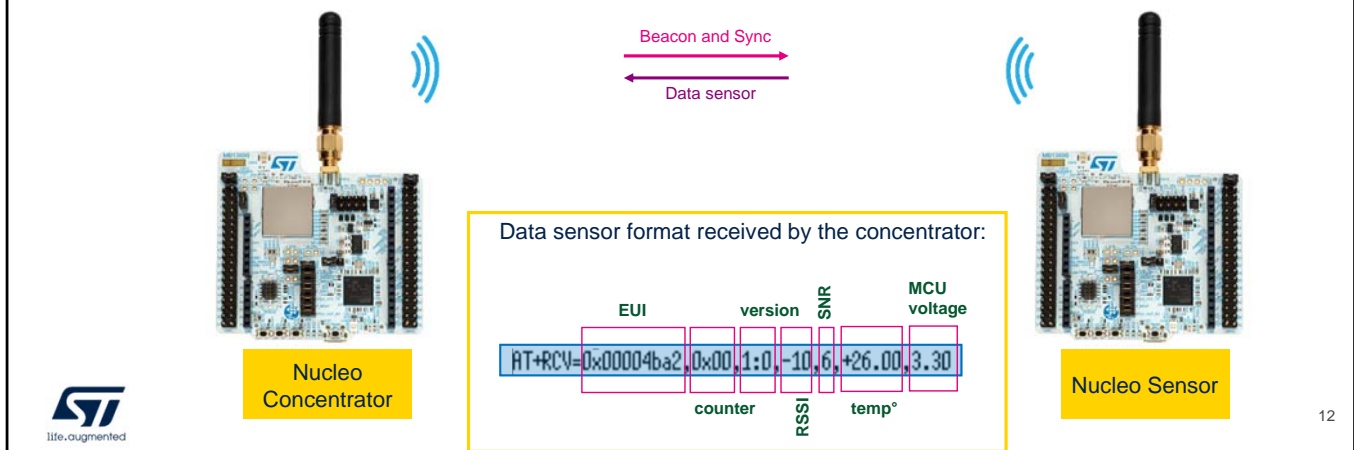
(AT+REGION=x, AT+SUBREGION=x and AT+BEACON_ON). The first two commands will select format of the transmitted beacon. The third command will start sending the beacon.

- For a list of available regions run AT+LIST_REGIONS.

- Then the concentrator starts blinking (green LED) on each time slot of the network.
- To get the demo fully up and running, up to 14 Nucleo Demo sensors should be programmed and placed against a Nucleo Demo Concentrator.
- This demo application software is available at www.st.com/en/evaluation-tools/nucleo-wl55jc.html

STM32WL55 demo

- The local network demonstration features a non LoRaWAN® local network with one concentrator and up to 14 sensors that can connect and send sensors' data to the concentrator.
- A concentrator sends one beacon frame and one sync frame every 16 seconds to administrate a network of up to 14 sensors and receives each connected sensor data. The concentrator can be connected to STM32CubeMonitor to configure the geographical area and display the list of sensors detected and connected sensor data.



The local network demonstration features a non LoRaWAN® local network with one concentrator and up to 14 sensors that can connect and send sensors' data to the concentrator.

Concentrator behavior:

A concentrator sends one beacon frame and one sync frame every 16 seconds to administrate a network of up to 14 sensors and receives each connected sensor data. The concentrator can be connected to STM32CubeMonitor to configure the geographical area and display the list of sensors detected and connected sensor data.

The concentrator is silent until it gets command from connected PC to start sending beacon on one of beacon frequencies. The frequency is selected depending on

region.

After version check, the first three commands to send to PC to start Concentrator (MB1389D) should set region, subregion and start the beacon. For European Union it is AT+REGION=0, AT+SUBREGION=0 and AT+BEACON_ON. The first two commands will select format of the transmitted beacon. The third command will start sending the beacon. For a list of available regions refer to annex “Regulations applicable to the Demo” or run AT+LIST_REGIONS.

Then the concentrator starts flashing green LED on each time slot of the network. When the concentrator transmits beacon or sync packet, it lights up the red LED for the duration of the transmit. When the concentrator receives something, it flashes blue LED at the end of the received packet.

PC software is only a user interface. All radio management is done in the concentrator.

Sensor behavior:

Sensor packets are sent between sync and the next beacon. Sensor could transmit only if it successfully received beacon and sync of the current period. The default coding is the same as the concentrator beacon uses.

Sensor starts in scan state. In this state, the sensor flashes red LED quickly. Once it finds one beacon, it can never return to scan state except for reset.

In sync state, the sensor tracks beacons, but is not connected. It can transmit in random empty slot. In this state, any activity (receive or transmit) makes the blue LED flash.

In lost state, the sensor is unable to track beacons. It periodically switches between long sleep period and long

receive, trying to find a beacon while saving battery. In this mode, the activity is reported by red LED.

In connected state, the sensor is fully connected and transmits measured data in one constant slot. In this state any activity flashes green LED.

Reference material

- Refer to www.st.com
 - Ordering information
 - Getting started manual, user manual and application notes
 - Board schematics
 - Application development environment support
 - Demonstration firmware sources



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For more information on the STM32WL55 Nucleo boards, go to www.st.com. You can also watch our videos on our YouTube channel.

Thank you

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Thank you.