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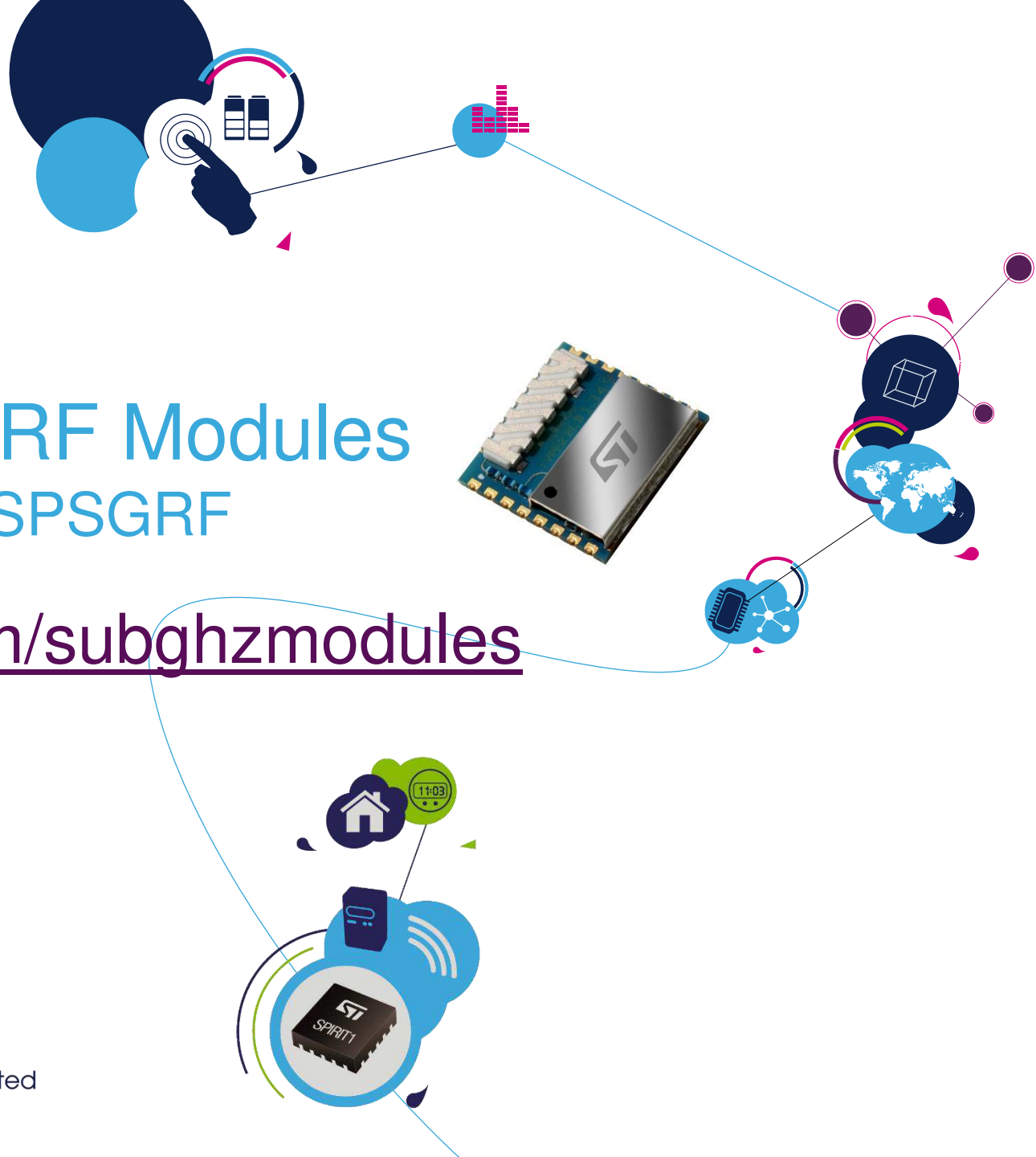
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Sub-GHz RF Modules SP1ML and SPSGRF

www.st.com/subghzmodules



Why an RF Module?

- **Plug & play solution** does not require in-depth RF know-how
- **Certified solution:** FCC or CE (ETSI) certified
- **Flexible solutions** for easier software and hardware integration in an existing system

Applications for RF Sub-GHz Modules

- Gas / Water smart metering
- Remote control
 - Garage doors
 - Window blinds
 - Industrial remote systems
- Wireless alarm systems
- Heat cost allocators



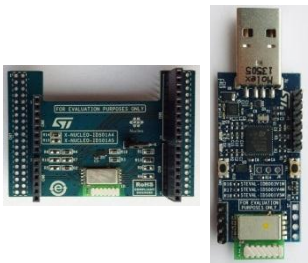
ST Sub-GHz RF Modules and evaluation boards



RF module	Based on	Features
SP1ML-868	STM32L1+SPIRIT1+Balun	868 MHz ETSI-certified module
SP1ML-915	STM32L1+SPIRIT1+Balun	915 MHz FCC-certified module
SPSGRF-868	SPIRIT1+Balun	868 MHz ETSI-certified module
SPSGRF-915	SPIRIT1+Balun	915 MHz FCC-certified module

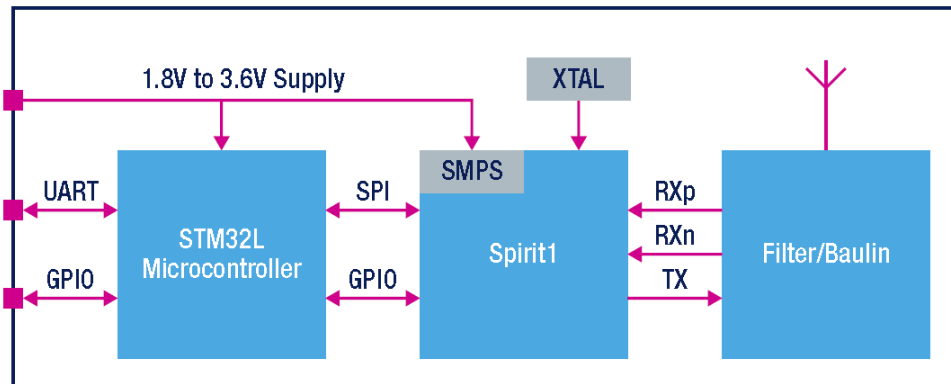
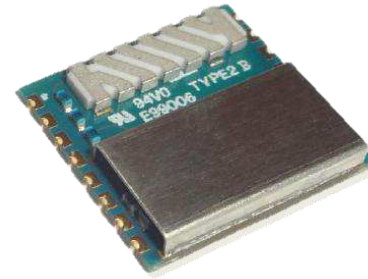
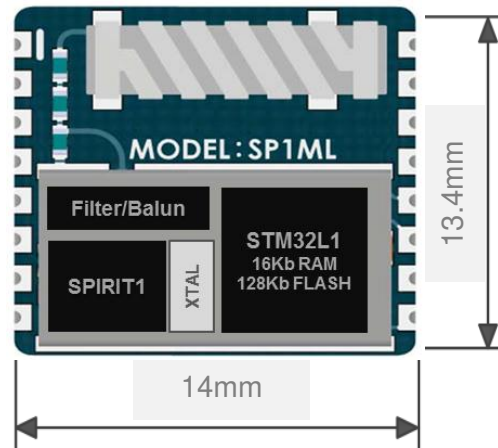


Evaluation board	Features
STEVAL-SP1ML-868	SP1ML-868 USB Dongle (863 to 870 MHz)
STEVAL-SP1ML-915	SP1ML-915 USB Dongle (902 to 928 MHz)
X-NUCLEO-IDS001A4	SPSGRF-868 STM32 Nucleo expansion board
STEVAL-IDS001V4M	SPSGRF-868 USB dongle
X-NUCLEO-IDS001A5	SPSGRF-915 STM32 Nucleo expansion board
STEVAL-IDS001V5M	SPSGRF-915 USB dongle



SP1ML – 868/915 Structure

SP1ML-868 and SP1ML-915 are low-power RF modules based on the SPIRIT1 low-power transceiver and integrate an STM32L151 ultra-low-power MCU



SP1ML-868/915 Key Features

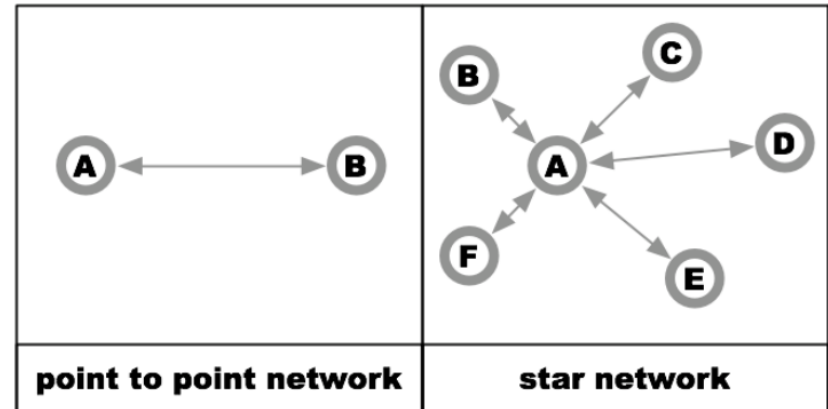
SPIRIT1 RF modules for 868 MHz and 915 MHz applications

- Module based on:
 - **SPIRIT1** low-power sub-GHz transceiver
 - **STM32L151RBH6** ultra-low-power ARM Cortex-M3 MCU - 16 Kbytes of RAM – 128 Kbytes of Flash memory
 - **BALF-SPI-01D3** 868/915 MHz IPD balun and filter
- Supports **868 MHz** SRD and **915 MHz** ISM bands
- Surface mount antenna
- 1.8 V to 3.6 V supply - **Low power consumption**
- **Output power** up to +11.6 dBm
- Air data rates up to **500 kbit/s**
- Modulation schemes: 2-FSK, GFSK, MSK, GMSK, OOK, ASK
- Operating temperature: **-40 °C to 85 °C**
- **CE compliant**
- SP1ML-915 is **FCC certified** (FCC ID S9NSP1ML)
- Standard firmware with **AT Command** set interface **via UART** for configuration and cable replacement model

- **AT commands**
- **Network configurations supported**
- **Evaluation tools**

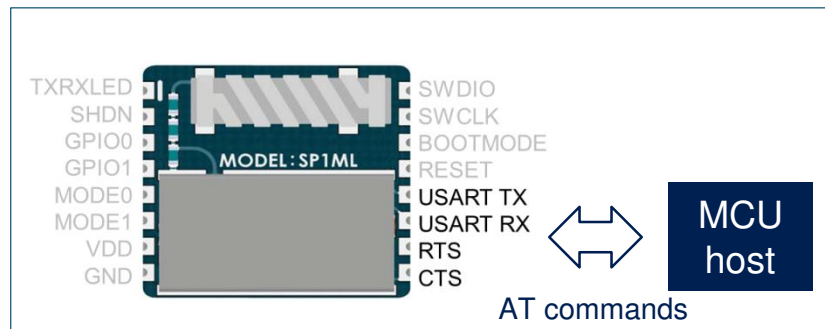
SP1ML - AT Commands

	Command reference
ATO	Enter operating mode
AT/V	Read module version information
ATIn	Read an information register
ATSnn?	Read a configuration register(*)
ATSnn=x	Write a configuration register(*)
AT/S	Read all configuration registers
AT/C	Store the current configuration
ATZ	Restart the module
AT/SRnn?	Read a SPIRIT1 radio register
AT/SRnn=xx	Write a SPIRIT1 radio register
AT/Tn	Set RF test mode



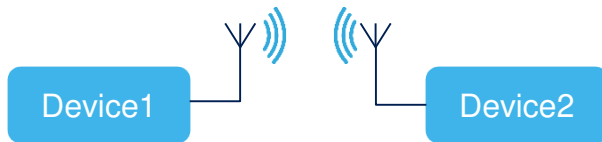
(*) **Configuration registers**

- S00 BAUD_RATE
- S01 FREQUENCY
- S02 DATA_RATE
- S03 MODULATION
- S04 OUTPUT_POWER
- S05 FREQ_DEVIATION
- S06 RX_FILTER
- S07 CS_MODE
- S08 RSSI_THRESHOLD
- S09 PREAMBLE_LEN
- S10 SYNC_LENGTH
- S11 SYNC_VALUE
- S12 CRC_MODE
- S13 WHITENING
- S14 FEC
- S15 SOURCE_ADDR
- S16 DESTINATION_ADDR
- S17 MULTICAST_ADDR
- S18 BROADCAST_ADDR
- S19 FILTER_xxx
- TXRX_LED
- HW_FLOW_CTRL
- ESCAPE_SEQ



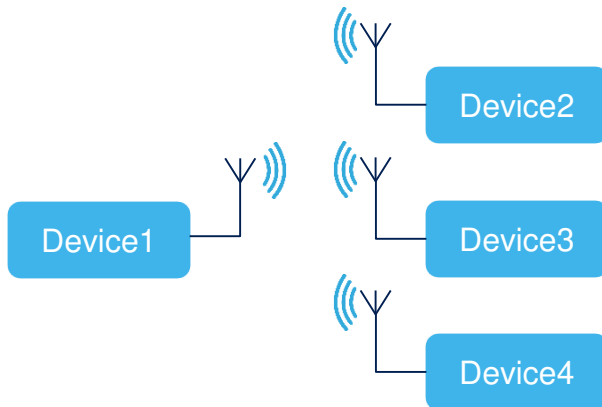
SP1ML – Network Configurations

Point-to-point



- Same RF and packet configuration for device 1 & 2
- Filtering conditions defined so that device 1 will only receive packet from device 2 (and reciprocally)

Star network: Point-to-point, multicast or broadcast



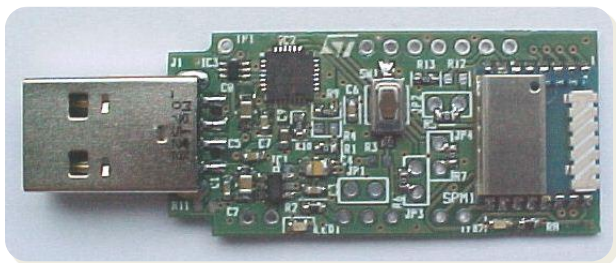
- Same RF and packet configuration for devices 1, 2, 3 and 4
- Filtering conditions for data to be sent
 - Point-to-point: e.g. Device 1 sends data to Device 2 only
 - Multicast: e.g. Device 1 sends data to Device 2 and 3 only
 - Broadcast: e.g. Device 1 sends data to Devices 2, 3 and 4

SP1ML – Evaluation Tools

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STEVAL-SP1ML868 and STEVAL-SP1ML915 USB dongles

- STEVAL-SP1ML868 and 915 demonstration board allows to evaluate SP1ML-868 and 915 modules in a quick and simple way.

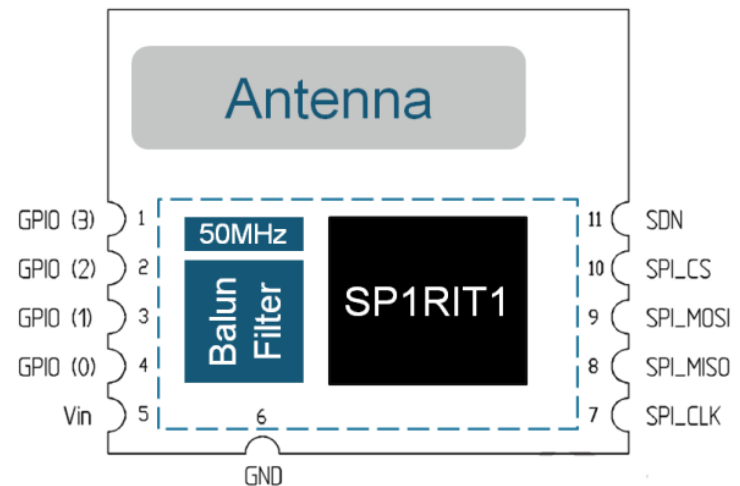
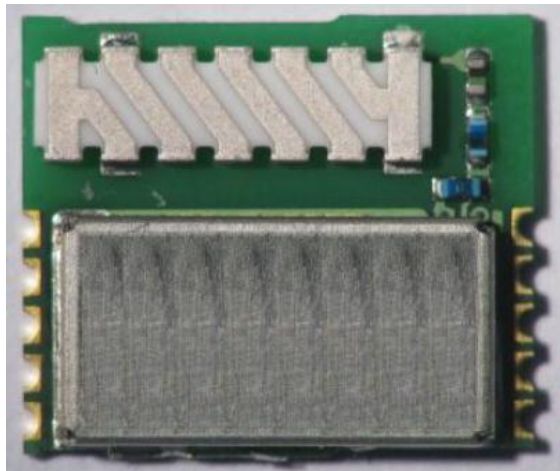


```
COM4:115200baud - Tera Term V1
File Edit Setup Control Window KangiCode Help
+++OK
00:BAUD_RATE=115200
01:FREQUENCY=868000000
02:DATA_RATE=80000
03:MODULATION=0
04:OUTPUT_POWER=11.6
05:FREQ_DEVIATION=40
06:RX_FILTER=100
07:CS_MODE=0
08:RSSI_THRESHOLD=-130
09:PREAMBLE_LEN=6
10:SYNC_LENGTH=4
11:SYNC_VALUE=0x88888888
12:CRC_MODE=2
13:WHITENING=1
14:FEC=0
15:SOURCE_ADDR=0x00
16:DESTINATION_ADDR=0x01
17:MULTICAST_ADDR=0xff
18:BROADCAST_ADDR=0xff
19:FILTER_CRC=0
20:FILTER_SOURCE=0
21:FILTER_DESTINATION=0
22:FILTER_MULTICAST=0
23:FILTER_BROADCAST=0
24:TX_RX_LED=1
25:HW_FLOW_CTRL=1
26:ESCAPE_SEQ=1
27:SOURCE_FILTER_MASK=0x00
28:PAYLOAD_SIZE=32
```

- USB connector is used to connect the dongle with a PC, to access the sub-GHz RF module and to supply the dongle
- User manual UM1889 - SP1ML modules getting started guide with firmware upgrade and simple communication setup

SPSGRF Structure

SPSGRF-868 and SPSGRF-915 are low-power RF modules based on the SPIRIT1 low-power transceiver



SPSGRF Key Features

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SPSGRF-868 and SPSGRF-915 low-power programmable RF transceiver modules for 868 MHz and 915 MHz applications

- Module based on:
 - **SPIRIT1** low-power sub-GHz transceiver
 - **BALF-SPI-01D3** balun and filter
 - Surface mount antenna
- Tiny size: **13.5 x 11.5 mm**
- 500 Kbits/s data rate
- Temp. range from -40 to 85 °C
- Receiver sensitivity: **-118 dBm**
- Output power up to **+11.6 dBm**
- **RX: 9 mA, Tx: 21 mA @ +11 dBm**
- **Shutdown: 2.5 nA**
- **SPI** host interface
- **CE compliant**
- SPSGRF-915 is an **FCC certified** module (FCC ID: S9NSPSGRF)

- **STM32 Nucleo expansion board**
- **USB dongle**

STM32 Nucleo expansion board

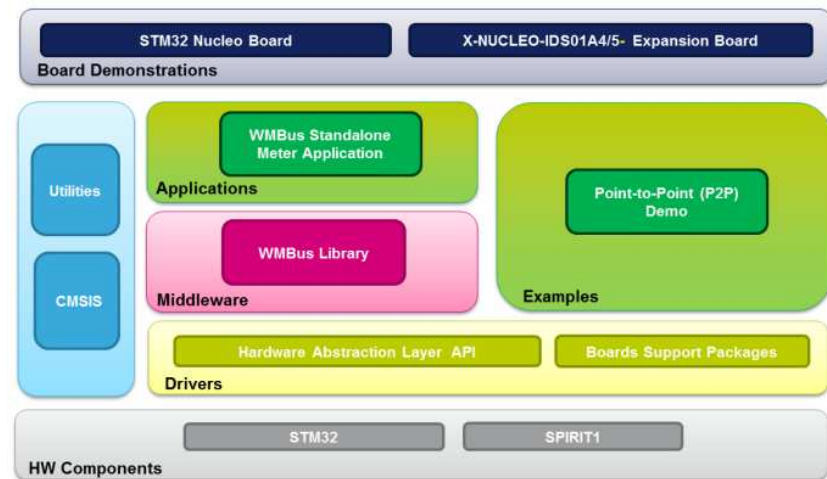
Sub-GHz expansion board based on SPIRIT1 PSGRF module

- Expansion board for STM32 Nucleo development boards
- Scalable solution, can cascade multiple boards for larger systems
- Equipped with Arduino UNO R3 connectors
- RoHS compliant
- X-CUBE-SUBG1 example firmware:
- Point-to-point simple communication demo
- WMBus standalone application for automatic meter reading system



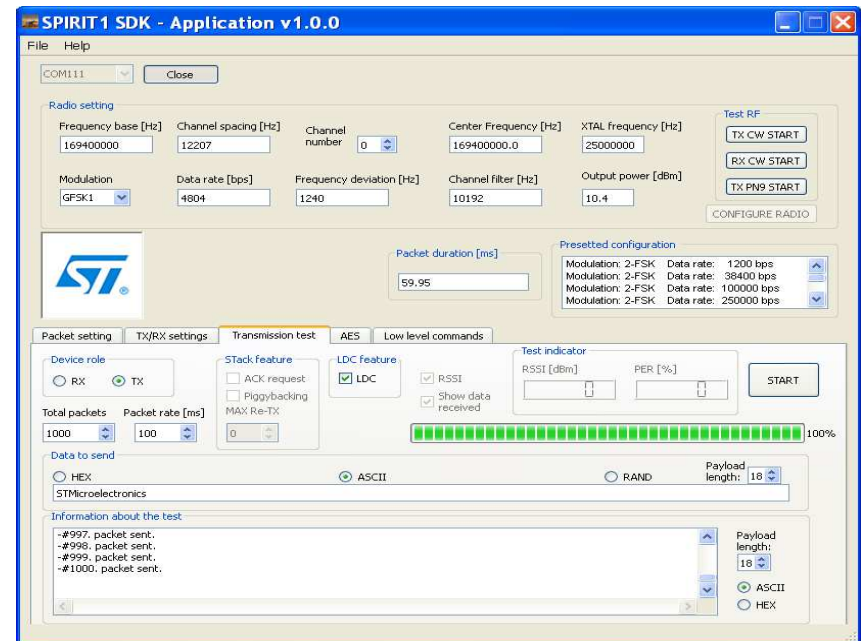
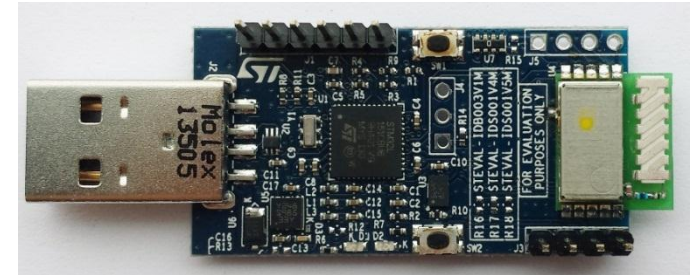
X-NUCLEO-IDS01A4 based on PSGRF-868 (868 MHz ETSI-certified module)

X-NUCLEO-IDS01A5 based on PSGRF-915 (915 MHz FCC-certified module)



Sub-GHz RF USB Dongle

- USB dongle with on-board SPSGRF
 - Modulation: 2-FSK, GFSK, MSK, GMSK, OOK and ASK
 - Air data rate: from 1 to 500 kbits/s
- Full compliance in terms of firmware and GUI with the SPIRIT1 development kits: STSW-CONNECT009
- On-board:
 - STM23L low-power MCU
 - Debug connector
 - USB interface
- RoHS compliant

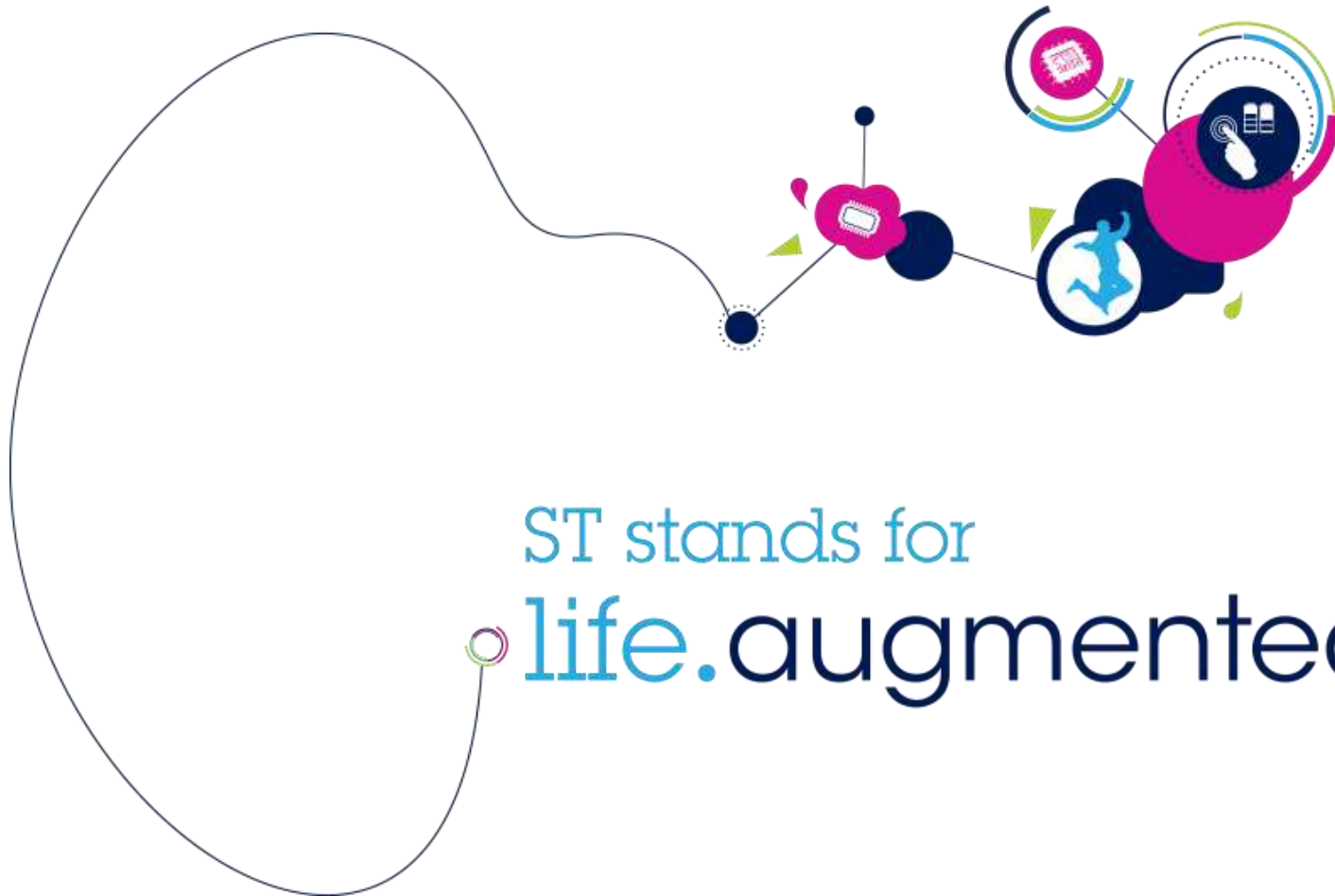


STEVAL-IDS001V4M based on SPSGRF-868
(868 MHz ETSI-certified module)

STEVAL-IDS001V5M based on SPSGRF-915
(915 MHz FCC-certified module)

Thank You

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