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

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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
SP1ML-868/915 Support

- AT commands
- Network configurations supported
- Evaluation tools
## SP1ML - AT Commands

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<td>Enter operating mode</td>
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<td>AT/V</td>
<td>Read module version information</td>
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<tr>
<td>ATIn</td>
<td>Read an information register</td>
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<td>ATSnn?</td>
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<td>AT/S</td>
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<tr>
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<tr>
<td>ATZ</td>
<td>Restart the module</td>
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<tr>
<td>AT/SRnn?</td>
<td>Read a SPIRIT1 radio register</td>
</tr>
<tr>
<td>AT/SRnn=x</td>
<td>Write a SPIRIT1 radio register</td>
</tr>
<tr>
<td>AT/Tn</td>
<td>Set RF test mode</td>
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(*) **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)

![Diagram of Point-to-point network](image)

### 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

![Diagram of Star network](image)
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.

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

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)
SPGRF Support

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

Sub-GHz expansion board based on SPIRIT1 SPSGRF 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 SPSGRF-868 (868 MHz ETSI-certified module)

**X-NUCLEO-IDS01A5** based on SPSGRF-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

ST stands for life.augmented