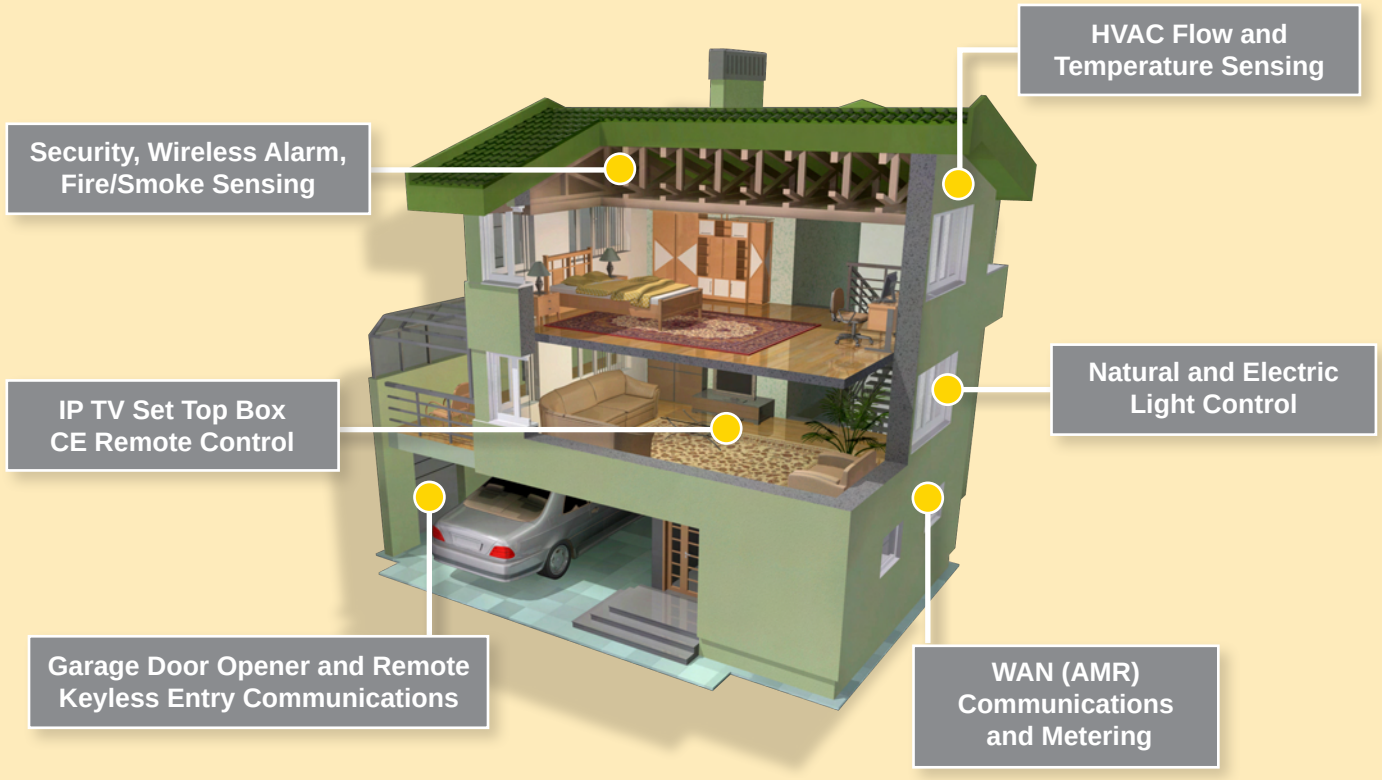
ISM Selector Guide

SEMTECH ADVANCED COMMUNICATIONS & SENSING

RF Solutions

Making the World Simpler, Greener, Smarter



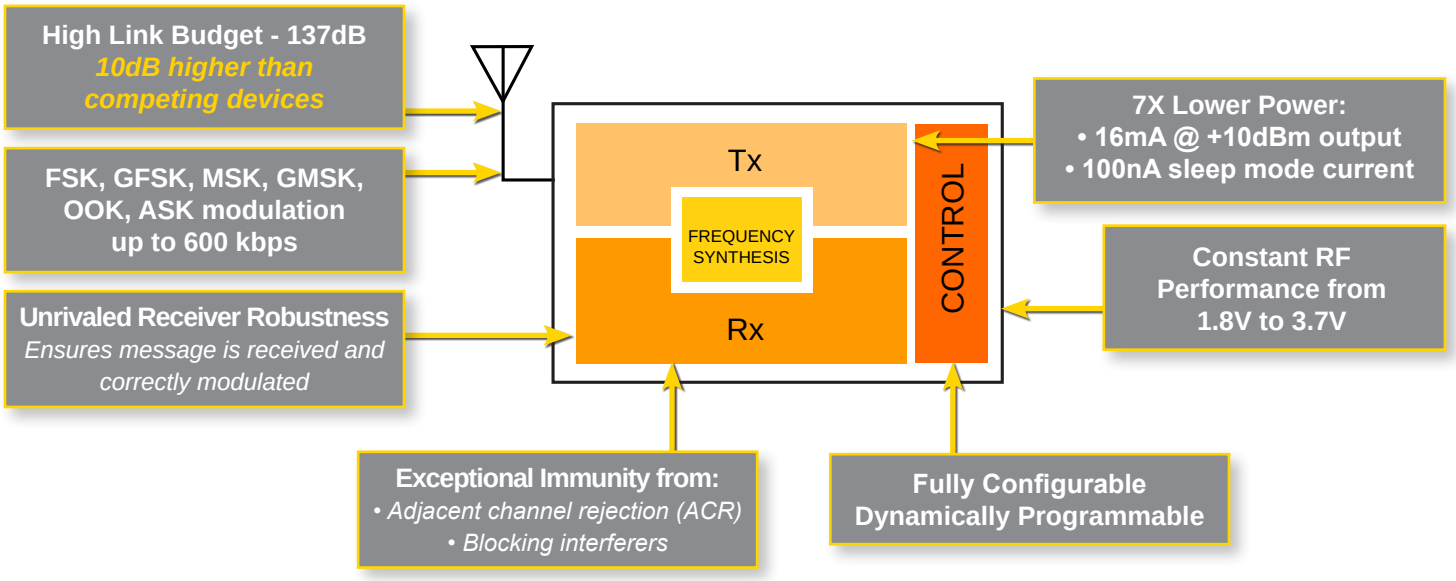
- **Unrivaled RF Link Robustness**
- **Ultra-Low Power Consumption**
- **Turn-Key Design Tools**

http://www.semtech.com/wireless-rf/ Technical hotline: support_rf@semtech.com

SEMTECH

Robust, Low-Power Communications for Next-Generation ISM-Band Applications

SX123x, SX124x Multi-Band Transceivers, Transmitters, Receivers

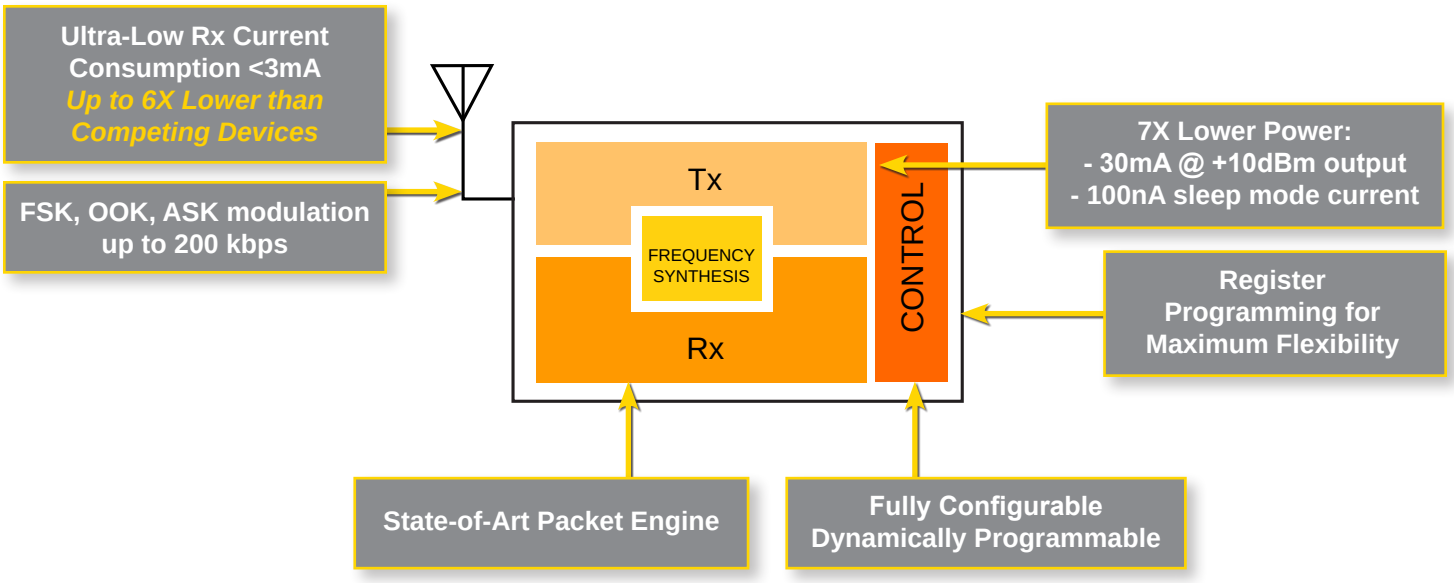


Complete Line of Semtech RF ICs

Part Number	Tx/Rx	Band (MHz)	Tx Power (dBm)	Modulation	Max Bit Rate	Rx Sensitivity (dBm)	Link Budget (dB)	Tx Current (mA)	Rx Current (mA)
SX1230	Tx	**290 – 1000**	**-20 ~ 17**	G/F/MSK & OOK	300 kbps (FSK) 32.7 kbps (OOK)	-	-	33 @ 10dBm	-
New SX1242	Tx	**345**	**12**	OOK	10 kbps	-	-	22	-
SX1239	Rx	**290 – 1000**	**-20 ~ 17**	G/F/MSK & OOK	300 kbps (FSK) 32.7 kbps (OOK)	**-120**	-	-	16
New SX1231	TxRx	**290 – 1000**	**-20 ~ 17**	G/F/MSK & OOK		**-120**	**137**	33 @ 10dBm	16
New SX1233	TxRx	**290 – 1000**	**-20 ~ 17**	G/F/MSK & OOK	600 kbps (FSK) 32.7 kbps (OOK)	**-120**	**137**	33 @ 10dBm	16
SX1211	TxRx	862 – 960	-8.5 ~ +12.5	FSK/OOK/ASK	200 kbps (FSK) 32.7 kbps (OOK)	-107	120	25 @ 10dBm	**3**
SX1212	TxRx	310 – 510	-8.5 ~ +12.5	FSK/OOK/ASK		-108	121	25 @ 10dBm	**3**
SX1210	Rx	862– 960	-8.5 ~ +12.5	FSK/OOK/ASK		-107	-	-	**3**
SX1213	Rx	310 – 510	-8.5 ~ +12.5	FSK/OOK/ASK		-108	-	-	**3**
New SX1240	Tx	433 & 868	0 & 10	FSK/OOK/ASK	150 kbps	-	-	16 @ 10dBm	-
SMI7030	Tx	2300 – 2700 3300 – 3900	-20 to 0	RF Only	>30 Mbps	-102	144	400	360
New SMI7335	Tx	1100 – 2000 2300 – 3900	-20 to 0	2x2 MIMO RF Only	>30 Mbps	-102	144	280	290

Smaller, Lower Power Wireless Just Got Easier

SX121x Multi-Band
Transceivers and Receivers



Semtech RF Companion Chips

Part Number	Description
SX8644	Power, Capacitive Button and Slider Touch Controller (12 Sensors) with Enhanced LED Drivers
SX8650	Ultra-Low Power, Small Footprint 4-Wire I^2C Resistive Touchscreen Controller with On-Chip 15kV ESD, in Small 1.5x2.0mm WLCSP Package
SX1507B	4-Channel, Low Voltage (1.2V to 3.6V) Level Shifting GPIO with LED Driver and Keypad Engine
SC120	Low Voltage Synchronous Boost Converter Steps Up Inputs from as Low as 0.7V, in Ultra-Thin 1.5x2.0x0.6mm MLPD Package

Break the Cost and Quality of Service Entry Barriers for Smart, Green Buildings

Semtech helps you break the cost and quality of service entry barriers for smart, energy-efficient residential and commercial buildings with 7X lower power consumption and unrivaled RF link robustness compared to alternative solutions – absolutely the widest communication range using the least amount of energy.

Semtech transceivers offer an unrivaled link budget up to 137dB – 10dB more than competing devices. Products include point-to-point, star network and mesh network solutions for smart, green building applications.

Design Support Tools and Partner Solutions

Semtech/Virtual Extension wireless mesh chipset for smart lighting applications

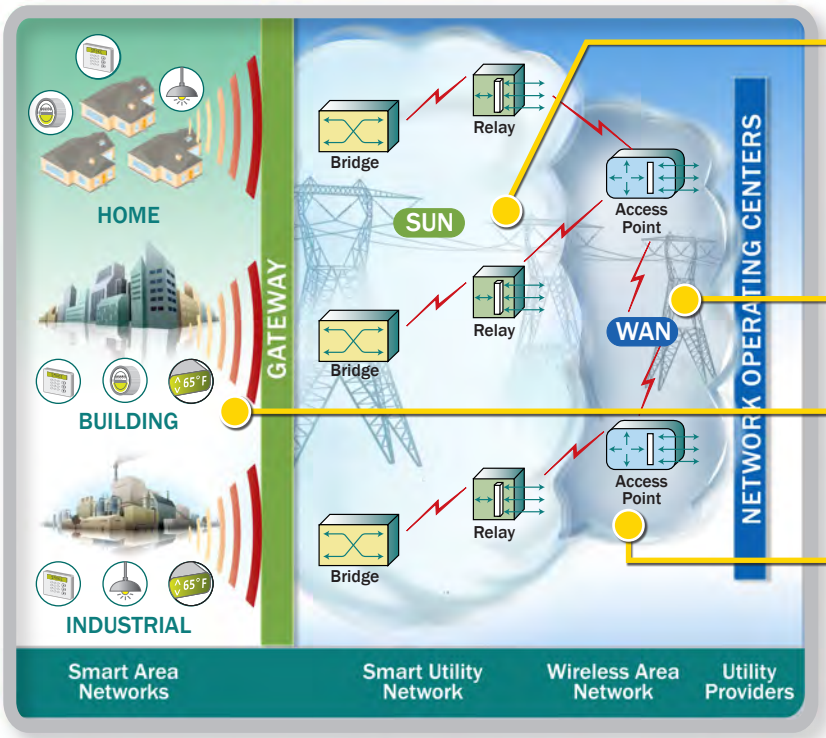
- 2-chip solution for wireless mesh sensing networks
  - Semtech SX1211 ISM-band transceiver; Virtual Extension VE209 mesh controller
- Low-power, high-performance with no single point-of-failure, very robust signal processing
- Full bi-directional communications
- Built-in unicast and broadcast capabilities
- Farthest range in class; fastest response in class: lowest, most predictable latency
- Turn-key mesh networking evaluation kit (see page 10)

RF ICs for Residential and Commercial Building Applications

Part Number	Status	Description	Application	Package	Evaluation Kit
SX1230	Production	290MHz–1GHz FSK/OOK/ASK RF Transmitter	1-way remote control (MCU-less mode)	QFN 4x4mm	SX1230SKA433/868/915
SX1240	Production	433MHz & 868MHz 8 channels FSK/OOK/ASK RF Transmitter	1-way remote control	SOP8	SX1240SKA433
SX1239	Production	290MHz–1GHz FSK/OOK/ASK RF Receiver	1-way remote control	QFN 5x5mm	SX1231SKB433/868/915
SX1231	Production	290MHz–1GHz FSK/OOK/ASK RF Transceiver	2-way remote control	QFN 5x5mm	SX1231SKB433/868/915
SX1233	Production	290MHz–1GHz FSK/OOK/ASK RF Transceiver	2-way remote control	QFN 5x5mm	SX1231SKB433/868/915
SX1211	Production	862MHz–960MHz FSK/OOK/ASK RF Transceiver	2-way ultra-low current	QFN 5x5mm	SX1211SKA868/915
SX1212	Production	310MHz–510MHz FSK/OOK/ASK RF Transceiver	2-way ultra-low current	QFN 5x5mm	SX1212SKA433
SX1210	Production	862MHz–960MHz FSK/OOK/ASK RF Receiver	1-way ultra-low current	QFN 5x5mm	SX1211SKA868/915
SX1213	Production	310MHz–510MHz FSK/OOK/ASK RF Receiver	1-way ultra-low current	QFN 5x5mm	SX1212SKA433

Transform the Power Grid with High Link Budget, High Rx Sensitivity Solutions for Smart Meters, Smart Sensors

With over 20 years of experience providing RF communications and sensing ICs for battery-operated water and gas meter readers, Semtech offers the widest range of RF ICs for ultra-narrow-band and wide-band machine-to-machine (M2M) communications in smart energy and smart sensor meters.



High Link Budget
- 10dB higher than competing devices

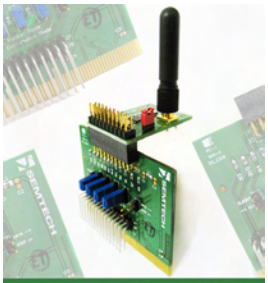
7X Lower Power Consumption
- 30mA @ 10dBm output
- 100nA sleep mode current

Support for All Major Wireless Communications Protocols
- IEEE 802.15.4g
- Part 90 Mask C and D
- Wireless M-BUS
- WiMAX™

Ultra-low Rx Current Consumption <3mA
- Up to 7X lower than competing devices

Design Support Tools and Partner Solutions

- Development kit for SX1211 transceiver used with PIC® MCUs for smart energy meters, smart sensors, wireless alarm and security networks, automatic meter readers
- Turn-key mesh networking evaluation kit for smart lighting (see page 10)



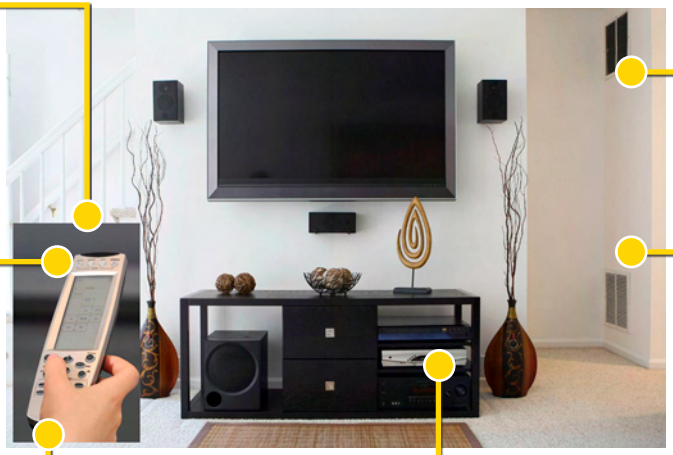
Development Kit: SX1211 Transceiver Using PIC® MCUs

RF ICs for Smart Energy Meters, Smart Sensors

Part Number	Status	Description	Application	Package	Evaluation Kit
SX1230	Production	290MHz–1GHz FSK/OOK/ASK RF Transmitter	1-way remote control (MCU-less mode)	QFN 4x4mm	SX1230SKA433/868/915
SX1239	Production	290MHz–1GHz FSK/OOK/ASK RF Receiver	1-way remote control	QFN 5x5mm	SX1231SKB433/868/915
SX1231	Production	290MHz–1GHz FSK/OOK/ASK RF Transceiver	2-way remote control	QFN 5x5mm	SX1231SKB433/868/915
SX1233	Production	290MHz–1GHz FSK/OOK/ASK RF Transceiver	2-way remote control	QFN 5x5mm	SX1231SKB433/868/915
SX1211	Production	862MHz–960MHz FSK/OOK/ASK RF Transceiver	2-way ultra-low current	QFN 5x5mm	SX1211SKA868/915
SX1212	Production	310MHz–510MHz FSK/OOK/ASK RF Transceiver	2-way ultra-low current	QFN 5x5mm	SX1212SKA433
SX1210	Production	862MHz–960MHz FSK/OOK/ASK RF Receiver	1-way ultra-low current	QFN 5x5mm	SX1211SKA868/915
SX1213	Production	310MHz–510MHz FSK/OOK/ASK RF Receiver	1-way ultra-low current	QFN 5x5mm	SX1212SKA433
SMI7030	Production	2.3–2.7 GHz, 3.3–3.8 GHz Transceiver	Point-to-Multipoint ODUs	QFN 7x7mm	SMI7030EVB
SMI7335	Sampling	1.1–2.0 GHz, 2.3–3.9 GHz Transceiver	Point-to-Multipoint ODUs	QFN 8x8mm	SMI7335EVB

Give Next-Generation Consumer Applications More Advanced Features and Simpler Controls

Turn-key solutions for TV remote control and set top box front panel applications, including RF ICs and touch button sensors, provide advanced features, better performance and simpler control.



Support for IRda to RF Transition of Remote Control Designs

Single AA or AAA Solutions, Including RF and IRda Combo Remote Designs

High Immunity to In-Band Interference in the 433MHz, 868MHz and 915MHz Bands

RX-X10 NEC Protocol for Remote in the 433MHz Worldwide Band

Multi-Channel Radio with Unique Receiver Selectivity for Immunity to Interference from:
- **WiFi®**
- **Bluetooth®**
- **ZigBee®**
- **Other 2.4GHz sources**

Set Top Box with Transceiver Enables Easy Upgrade to Next-Generation Two-Way Remote Controllers with Feedback and Advanced Data and Audio Communications

Design Support Tools

- Combination IRdA/RF remote control hardware and software
- PCB antenna design customization (1 layer / 2 layers PCB FR4, XPC, CEM, others)
- Software with standard RF protocol (RF-X10)
- Turn-key reference designs, including hardware and software

RF ICs for Consumer Applications

Part Number	Part Status	Description	Application	Package	Evaluation Kit
SX1230	Production	290MHz–1GHz FSK/OOK/ASK RF Transmitter	1-way remote control (MCU-less mode)	QFN 4x4mm	SX1230SKA433/868/915
SX1242	Production	345MHz OOK RF Transmitter	1-way remote control	SOP8	Available Soon
SX1240	Production	433MHz & 868MHz 8 channels FSK/OOK/ASK RF Transmitter	1-way remote control	SOP8	SX1240SKA433
SX1239	Production	290MHz–1GHz FSK/OOK/ASK RF Receiver	1-way remote control	QFN 5x5mm	SX1231SKB433/868/915
SX1231	Production	290MHz–1GHz FSK/OOK/ASK RF Transceiver	2-way remote control	QFN 5x5mm	SX1231SKB433/868/915

Design Ultra-Low Power, Highly Secure RKE and Active RFID Systems

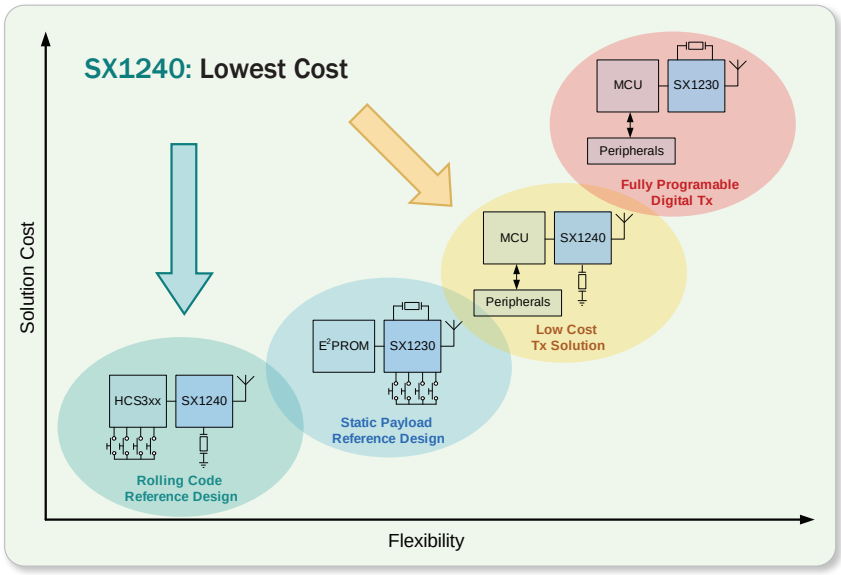
Semtech offers highly integrated, cost-effective, turn-key RF solutions for emerging wireless applications requiring ultra-low power consumption, very high link budgets and secure data transmission.

Remote Keyless Entry (RKE) Systems

- One-way and two-way, non-line-of-sight systems
- Garage door openers
- Car alarms and remote starters

DASH7 Support for Active RFID Systems

- Container shipment and asset tracking systems
- Patient monitoring systems
- Social alarms



Semtech Turn-Key RF Solutions Balance Design Cost and Flexibility Needs

Design Support Tools and Partner Solutions

- Semtech/Microchip turn-key RKE reference design (see page 10)
- Semtech wireless remote control energy harvesting reference design (see page 10)

RF ICs for Remote Keyless Entry and Active RFID Systems

Part Number	Status	Description	Application	Package	Evaluation Kit
SX1230	Production	290MHz–1GHz FSK/OOK/ASK RF Transmitter	1-way remote control (MCU-less mode)	QFN 4x4mm	SX1230SKA433/868/915 SX1230-13RKEA433
SX1242	Production	345MHz OOK RF Transmitter	1-way remote control	SOP8	Available Soon
SX1240	Production	433MHz & 868MHz 8 channels FSK/OOK/ASK RF Transmitter	1-way remote control	SOIC8	SX1240SKA433
SX1239	Production	290MHz–1GHz FSK/OOK/ASK RF Receiver	1-way remote control	QFN 5x5mm	SX1231SKB433/868/915
SX1231	Production	290MHz–1GHz FSK/OOK/ASK RF Transceiver	2-way remote control	QFN 5x5mm	SX1231SKA433
SX1212	Production	310MHz–510MHz FSK/OOK/ASK RF Transceiver	RFID DASH7	QFN 5x5mm	SX1212SKA433 SX1230-13RKEA433

RF Evaluation Kits for ISM-Band Applications

Semtech offers a wide selection of development kits to help designers easily get started developing low-power ISM-band RF systems and get to market fast.

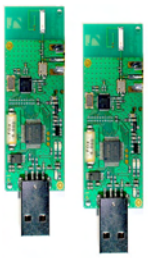
Starter Kits

Semtech Starter Kits contain the basic hardware needed to demonstrate and evaluate RF product performance, providing a quick tool for testing and evaluating product capabilities from a PC – with very minimal effort. Starter Kits contain either one or two RF evaluation modules (with processors), antennas and USB cables. Many Starter Kits also offer an out-of-the-box, plug-and-play range testing (ping-pong) demo.

Evaluation Module Kits

Semtech Evaluation Module Kits are small kits containing an RF module and an antenna. These modules provide exactly the same hardware used to characterize the radio, so designers will get the same performance from the modules as stated in the datasheet for the part. Evaluation Module Kits are ideal for starting development of the application (power supply, software) before the actual PCB is ready and stabilized.

SX1211SKA and SX1212SKA Transceiver Starter Kits



These kits are available with or without range testing capability (ping-pong demo) and contain:

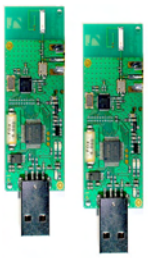
- SX1211 RF evaluation modules
  - 1 module (no range testing)
  - 2 modules (for range testing)
- Embedded antennas:
  SX1211: 868MHz or 915MHz
  SX1212: 433MHz
- 1 or 2 USB cables
- Software and documentation

SX1231SKB Transceiver Starter Kit

This starter kit can also be used as a design facilitator to develop an application (power supply, software) before the actual PCB is ready and stabilized. It comes with range testing capability (ping-pong demo) and contains:

- 2 SX1231 RF evaluation modules
- 2 USB bridge modules
- 2 x ¼ wave monopole antennas:
  433MHz, 868MHz or 915MHz
- 2 USB cables
- Software and documentation

SX1230SKA Transmitter Starter Kit



This starter kit comes with or without range testing capability (ping-pong demo) and contains:

- SX1230 RF evaluation modules
  - 1 module (no range testing)
  - 2 modules (for range testing)
- Embedded antennas:
  433MHz, 868MHz or 915MHz
- 2 USB cables
- CR2032 cell for operation in standalone mode with the companion E^2PROM
- Software and documentation

SX1240SKB Transmitter Starter Kit

This starter kit can also be used as a design facilitator to develop an application (power supply, software) before the actual PCB is ready and stabilized. It comes with range testing capability and contains:

- SX1240 RF evaluation modules
- Antennas: 433MHz, 868MHz or 915MHz
- USB cables
- Software and documentation

RF Starter Kits

Part Number	Frequency Band (MHz)	RF Evaluation	Design Facilitator	Ping-Pong Demo	No. Boards & USB Cables Included	Antenna	Starter Kit Order No.
SX1210	Use SX1211 Starter Kit						
SX1211	868	✓			1	Embedded	SX1211SKA868
	915	✓			1	Embedded	SX1211SKA915
	868	✓		✓	2	Embedded	SX1211-11SKA868
	915	✓		✓	2	Embedded	SX1211-11SKA915
SX1212	433	✓			1	Embedded	SX1212SKA433
		✓		✓	2	Embedded	SX1212-12SKA433
SX1213	Use SX1211 Starter Kit						
SX1230	433	✓			1	Embedded	SX1230SKA433
	868	✓			1	Embedded	SX1230SKA868
	915	✓			1	Embedded	SX1230SKA915
SX1230 with SX1212 Transceiver	433	✓		✓	2	Embedded	SX1230-12SKA433
SX1230 with SX1211 Transceiver	868	✓		✓	2	Embedded	SX1230-11SKA868
	915	✓		✓	2	Embedded	SX1230-11SKA915
SX1231	433	✓	✓	✓	2	Yes	SX1231-31SKB433
	868	✓	✓	✓	2	Yes	SX1231-31SKB868
	915	✓	✓	✓	2	Yes	SX1231-31SKB915
SX1233	Use SX1231 Starter Kit						
SX1239	Use SX1231 Starter Kit						
SX1240	433	✓	✓		1	Embedded	SX1240SKA433
	868	✓	✓		1	Embedded	SX1240SKA868

RF Evaluation Module Kits

Part Number	Description	Frequency Band (MHz)	Evaluation Module Order No.
SX1211	SX1211 Evaluation Module	868	SM1211E868
	SX1211 Evaluation Module	915	SM1211E915
SX1212	SX1212 Evaluation Module	433	SM1212E443
SX1230	SX1230 Evaluation Module	433	SM1230E433
		868	SM1230E868
		915	SM1230E915
SX1231	SX1231 Evaluation Module	433	SM1231E433
		868	SM1231E868
		915	SM1231E915
SX1240	SX1240 Evaluation Module	433	SM1240E433A
		868	SM1240E868A

Application-Specific RF Evaluation Kits for ISM-Band Applications

Remote Keyless Entry Reference Design with Code-Hopping Encryption
Order Number: SX1230–13RKE433 (433MHz)

- Turnkey hardware and software RKE reference design, including:
  - Hardware: integrated RF ICs (SX1230 transmitter, SX1210 or SX1212 receivers/transceivers), antenna, PIC® MCUs (PIC16F631 or PIC16F677)
  - Software: KEELOQ® code-hopping technology software
- Highly secure:
  - Encrypts all RF packets before sending, no plain text sent over air
  - Code-hopping encryption produces unique RF transmission each time
- Saves design cost and time – same design supports multi-band (315, 434, 868, 915MHz) and multiple modulation formats (FSK, OOK, ASK)
- No tuning for lower production costs
- Long range: programmable P_{OUT} up to +17dBm

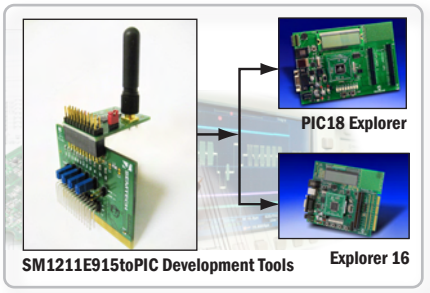
Wireless Remote Control Reference Design Using Energy Harvesting
Order Number: SX1230EH868A (868MHz)

- Uses SX1230 RF transmitter in E²PROM mode and EnOcean® ECO 100 energy harvester
- Saves design cost and time – same design supports multi-band (434, 868, 915MHz) and multiple modulation formats (FSK, OOK)
- Transmits ON/OFF and UP/DOWN messages (9 bytes each) at 100kbps in FSK
- RF output power up to +12dBm
- Integrated dual-band printed antenna
- Demonstrated range of up to 2,600 ft (800m) in free space
- Receiver platforms include SX1211, SX1212 and SX1231

Wireless Mesh Reference Design for Smart Lighting
Order Numbers: SX1211MESH-868 (868MHz), **SX1211MESH-915** (915MHz)

- Uses SX1211 RF transceiver and Virtual Extension VE209S wireless mesh controller
- Fully bi-directional, supports 868MHz, 915MHz bands and FSK, OOK modulation formats
- Built-in unicast and broadcast capabilities
- Farthest range and fastest response in class – lowest and most predictable latency
- Secure (frequency diversity) and resistant (space diversity) to multipath fading and propagation changes
- No knowledge, no training, installation and maintenance, no software to manage
- Instant addition and removal of nodes, with no network downtime
- Practically unlimited number of hops, thousands of nodes per network
- Highly scalable: robustness and network range increase when the network expands

Application-Specific RF Evaluation Kits for ISM-Band Applications



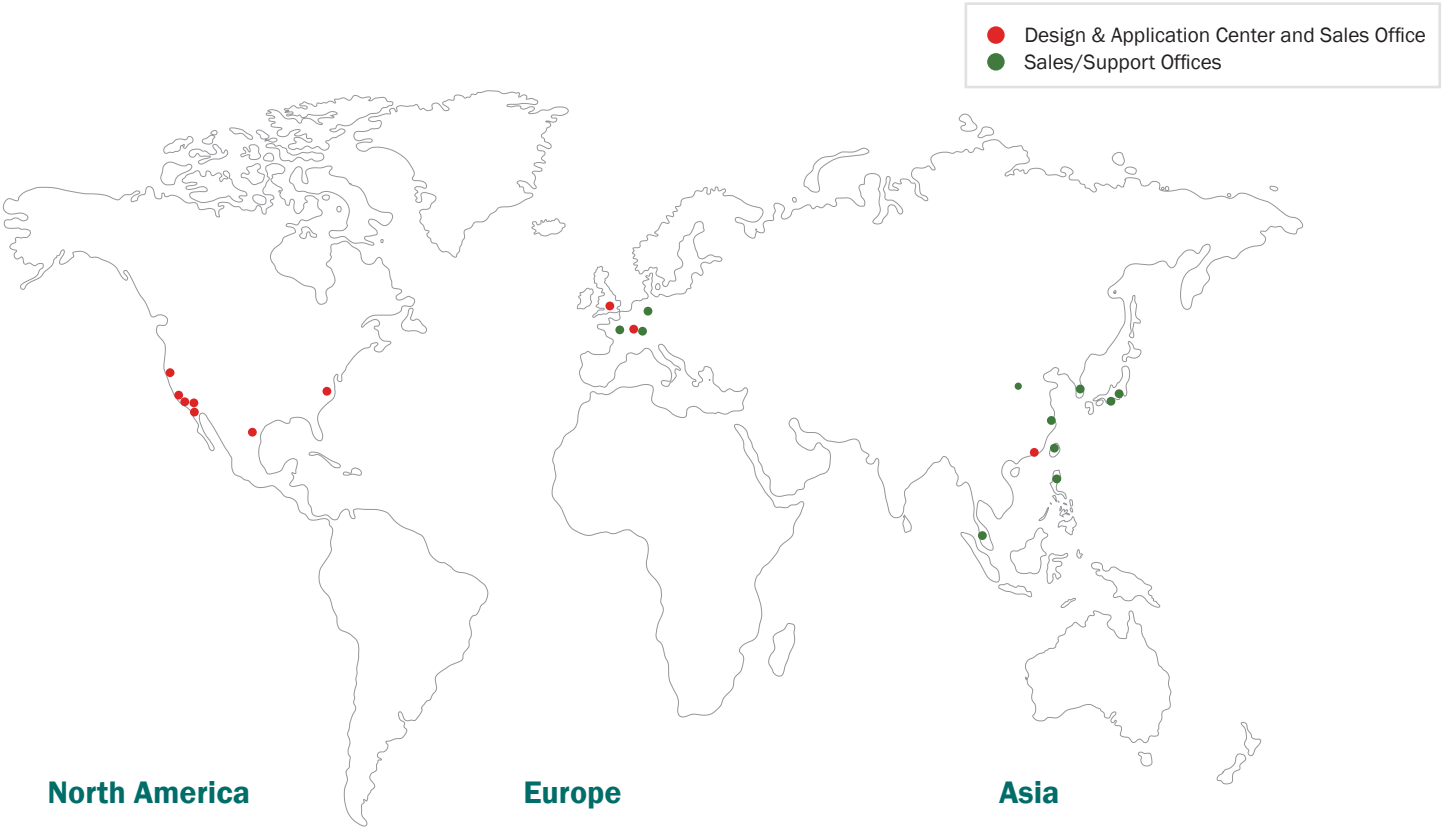
Semtech SX1211 Plug-and-Play Development Kit for Microchip MCUs
Order Number: SM1211E915TOPIC-ND(1)

- Jump-start low-power ISM-band RF link development on PIC18 or PIC24 MCUs
- Includes:
  - PICtail™ or PICtail™ Plus extension board (also compatible with SX1230, SX1210, SX1212, SX1213)
  - SM1211 RF module
  - 915MHz antenna
- Connects to Microchip PIC18 Explorer and Explorer 16 development boards
- Includes software and documentation

Application-Specific Evaluation Modules / Reference Designs

Kit	Frequency Band (MHz)	RF Evaluation	Design Facilitator	Antenna	Description	Evaluation Module Order No.
Wireless Mesh Networking Reference Design for Smart Lighting	868	✓	✓	Embedded	Integrates SX1211 transceiver and Virtual Extension VE209S wireless mesh controller on a single board. Fully bi-directional, supports 868MHz, 915MHz bands and FSK, OOK modulation formats. Built-in unicast and broadcast capabilities.	SX1211MESH-868
	915	✓	✓	Embedded		SX1211MESH-915
Semtech/Microchip Turn-Key Remote Keyless Entry Reference Design	433	✓	✓	Yes	Demonstrates suitability of SX1230 transceiver in a low-cost remote keyless entry system key chain unit. Uses SX1210, SX1212 in the receiver, KEELOQ® encryption software and PIC® MCUs (PIC16F631 or PIC16F677).	SX1230-13RKE433
Wireless Remote Control Reference Design Using Energy Harvesting	868	✓	✓	Embedded	Demonstrates energy harvesting capabilities of the SX1230 for wireless remote control applications (e.g. lighting control, garage door opener, shutter control). Operation is 100% battery free, reliable and has potentially unlimited lifetime. Uses EnOcean® ECO 100 energy harvester.	SX1230EH868A
Semtech SX1211 Plug-and-Play Development Kit for Microchip MCUs	915	✓	✓	Yes	RF link development on PIC18 or PIC24 MCUs. Includes PICtail™ or PICtail™ Plus extension board (also compatible with SX1230, SX1210, SX1212, SX1213). Connects to Microchip PIC18 Explorer and Explorer 16 development boards.	SM1211E915TOPIC-ND(1)

(1) Digi-Key part number. Order through Digi-Key



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