

TI SimpleLink™ Sub-1GHz CC1310 Wireless MCU

Ultra-low power, city-wide long range networks

Introduction

4Q15


Sub-1GHz



Where does Sub-1GHz fit?

Target Markets

Home Automation



Lighting control
Door locks
White goods

Logistics



Tollroad tags
Asset Tracking

Retail



ESL / Price Tags
Locationing
Cold chain mgmt

Alarm & Security



Security alarms
Smoke/CO2 alarms
Security sensors

Smart Grid



Flow Meters
E-Meters
Heat cost allocators

Factory Automation



Monitoring sensors
Cable replacement

Agriculture



Irrigation systems
Rodent traps
Animal tracking

Other

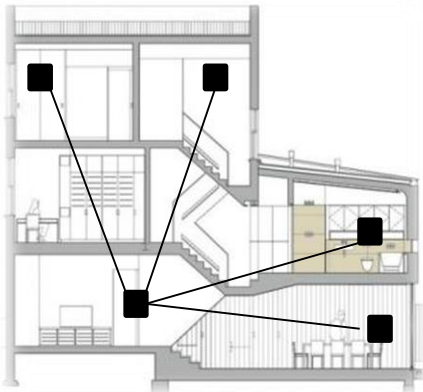


Rescue tracking
RC toys

Why Sub-1 GHz: Long range, Robust link

Home Automation

Star network with full house coverage



Applications:

- Home Alarm, Security and Fire systems
- Home Automation
- Smart Door Locks
- HVAC control

Building Automation

Mesh (routers) or multiple gateways

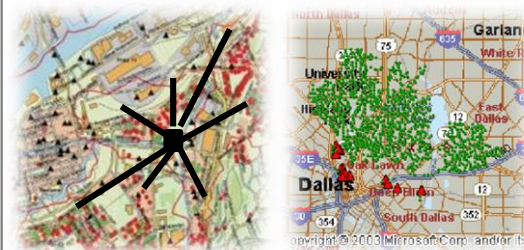


Applications:

- Commercial building fire, security and automation
- Factory Automation
- Asset Tracking

Outdoor Wide Area Network

Mesh network, Point to Point, or long range star network



Applications:

- Long range star: Flow meters, environmental sensors, Whole city coverage using few concentrators
- Mesh: Electric meters, powered industrial sensors, Large network up to 10k nodes

TI Sub-1GHz, long range Product Portfolio

Narrowband Transceivers

- Industry's highest RF performance
- ETSI Category 1-capable RF platform

CC112x
CC120x

SimpleLink Ultra-low Power Wireless MCUs

- Ultra-Low power consumption
- Small size and high integration
- CC1350 (Sub-1GHz + BLE)
Coming soon!

CC1310
CC1350



CC110L
CC115L
CC113L
CC1110

Value Line

- Lowest system cost
- Pin compatible one-way and two-way systems
- Transceivers and Wireless MCUs

Range Extender

- 850–950MHz RF front end
- Suits any competitive RF parts

CC1190

SimpleLink ULP CC1310/50 Platform

RTM September 30



CC1310: Sub-1 GHz only

- Pin-to-pin compatible with SimpleLink ULP Platform
- Various flash sizes: 32KB, 64KB, 128KB
- Ultra-low power, long range networks up to 15 km
- Operation in 315 MHz, 433 MHz, 470 MHz, 500 MHz, 868 MHz, 915 MHz and 920 MHz ISM bands
- Software: 6LoWPAN, wM-Bus, GFSK



CC1350: Dual-band

- Most versatile & integrated radio for 2.4 GHz and Sub-1 GHz operation on the same chip
- Enables ultra-low power long range Sub-1 GHz networks utilize Bluetooth Smart for easy cloud connectivity
- Supports: Sub-1 GHz, Bluetooth Smart, 6LoWPAN, & GFSK modes up to 4Mbps
- **Coming soon!!**

CC1310

Improving the three key challenges for a *Sub-1 GHz Wireless MCU*:

Lowest Power



- 5.5 mA Radio RX current
- 22.6 mA @ +14 dBm , 12.9 mA @ +10 dBm, Radio TX peak current
- 51 μ A / MHz ARM Cortex M3
- 0.6 μ A sleep current w/RTC + full memory retention

Up to 20 year battery life for sensor nodes and flow meters

Long Range



- High sensitivity
 - -110 dBm @ 50 kbps
 - -124 dBm @ 0.625 kbps
- Strong co-existence
 - Up to 90 dB blocking
- +14 dBm output power

Full building to city-wide RF coverage

Most Integrated



- Sensor Controller Engine (SCE)
- 4x4 QFN
- Integrated DCDC
- On-Chip Flash
- TI-RTOS + RF Driver

Complete 315 / 433 / 470 / 500 / 868 / 915 / 920MHz wireless MCU on a finger-tip size

SimpleLink™ Sub-1 GHz

CC1310 wireless MCU

Quick Facts

- **Lowest power** – Up to 20 year battery life for flow meters and sensor nodes utilizing the integrated ULP sensor controller
- **Longest Range** – Full-building to city-wide RF coverage with high sensitivity and strong coexistence
- **Most integrated wireless MCU** – Less board space, more possibilities, single-chip Flash-based, 4x4 QFN, software configurable radio

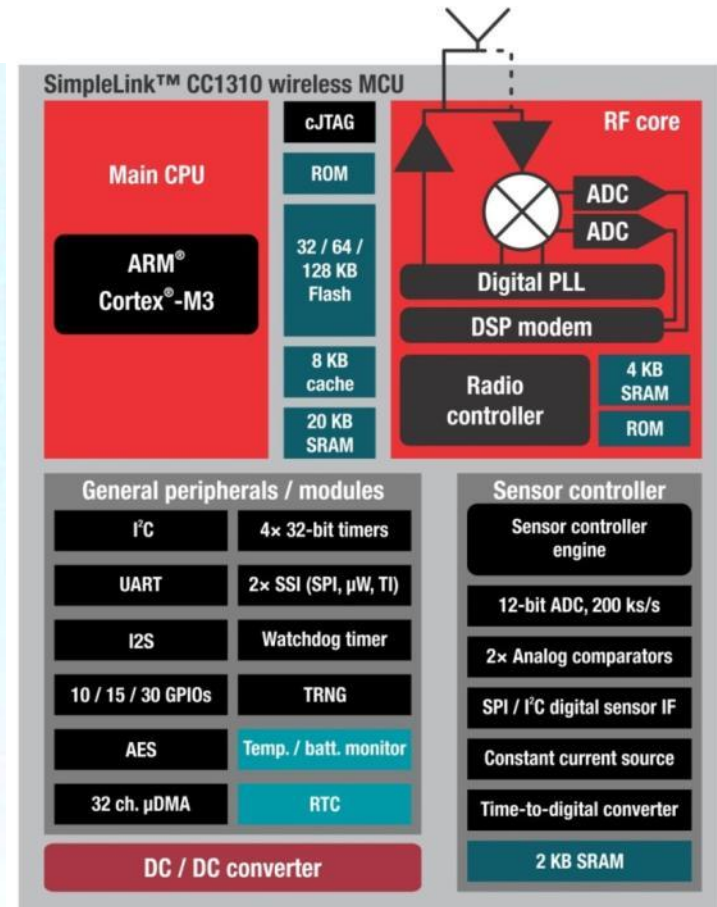
Target applications

- IoT – Long Range Cloud Connected devices
- Home and Building Automation - Security systems, HVAC control, lighting
- Smart Grid – Battery operated devices, flow meters, heat cost allocators
- Factory Automation- Asset tracking, sensor networks
- Retail – Electronic Shelf Labels, Locationing

Design Kits/EVMs



CC1310DK
CC1310EMK
Advanced
development platform



Dev Tools & Software

- SmartRF Studio, SmartRF Flash Programmer 2.0
- Sensor Controller Studio
- SimpleLink TI-RTOS with RF Drivers
- TI-RTOS SW examples, Open Source Contiki, and wM-Bus

CC1310 Features

The lowest power: Go battery-less



Designed for low-power operation

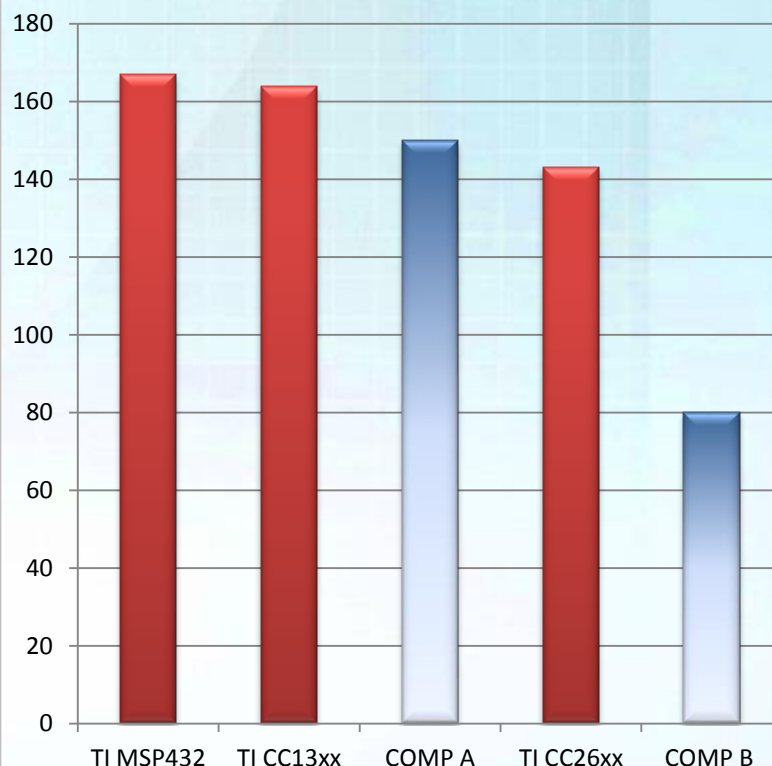
- Multi-year on a coin cell
- Faster processing
- Optimized radio
- Ultra low sleep current
- Less than 0.15 μA in shutdown
- Unique integrated Sensor Controller Engine (SCE)

Ultra-low power

When	Parameter @ 3V	Value
While processing	$\mu\text{A}/\text{MHz}$ on ARM® Cortex®-M3	51 $\mu\text{A}/\text{MHz}$
	Coremark/mA	48.5
	Coremark @ 48MHz CPU	142
While communicating	Peak current RX	5.5 mA
	Peak current TX @ +10 dBm	12.9 mA
While sleeping	$\mu\text{A}/\text{MHz}$ on SCE	8.2 $\mu\text{A}/\text{MHz}$
	Sleep mode with RTC and full memory retention	0.6 μA

Best-in-class ULP Bench score of 164

ULP Bench scores for MCUs running at 24 MHz or higher

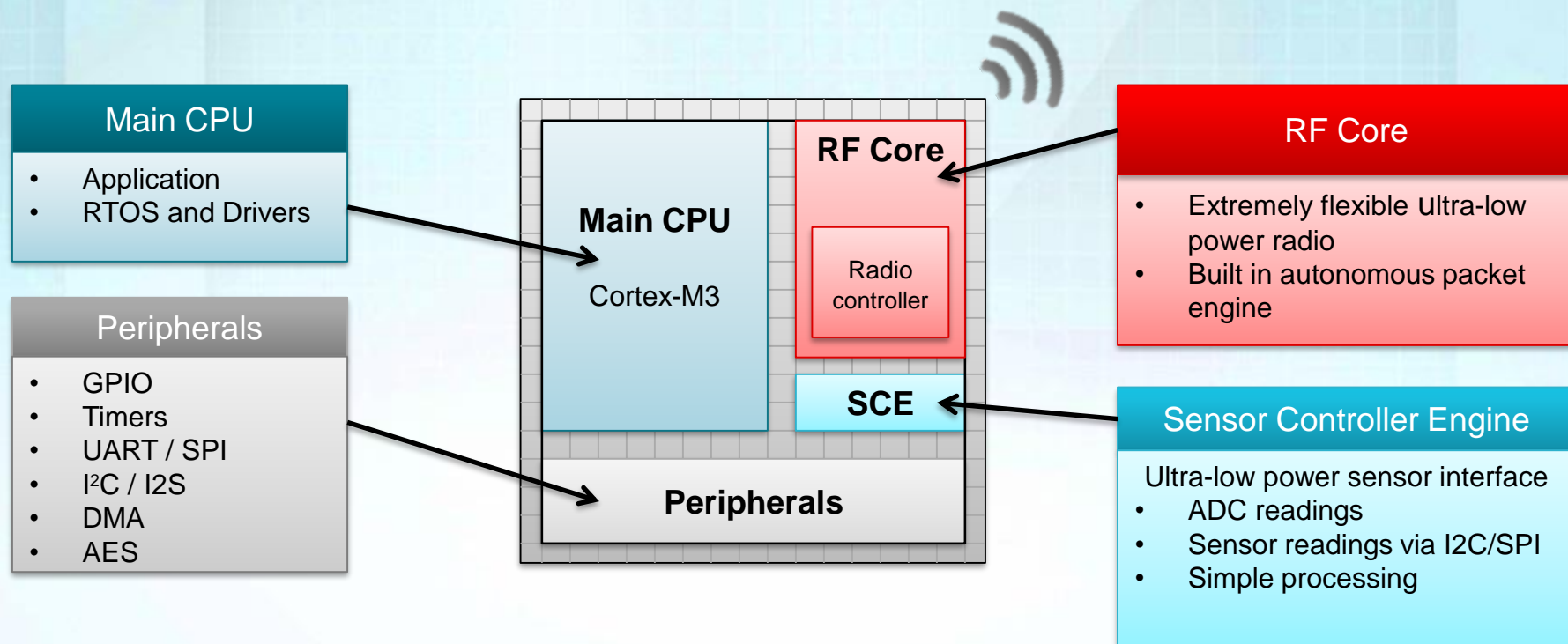


TEXAS INSTRUMENTS

CC1310 Overview

ULP Wireless MCU

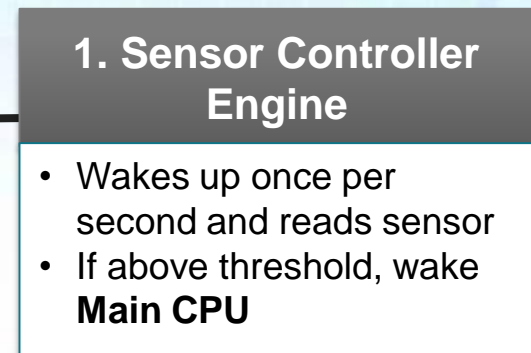
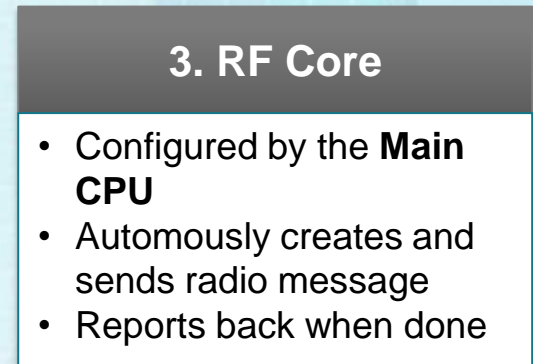
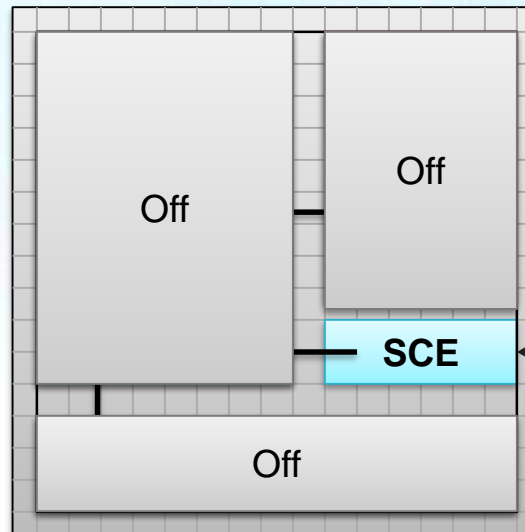
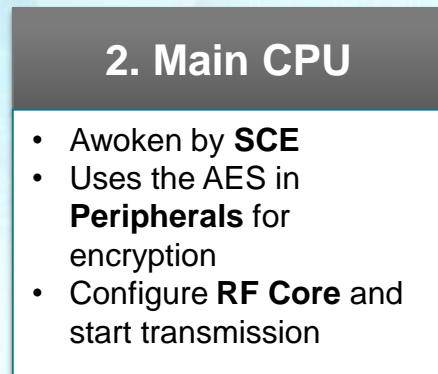
- Dedicated processors for dedicated tasks:
 - ARM Cortex-M3 Main Application CPU
 - RF Core Radio Controller
 - Sensor Controller Engine (SCE)



CC1310 How does it work?

Whole system example

- Requirement:
 - Sample value of external sensor once per second
 - Send encrypted radio alarm if the value is above the threshold



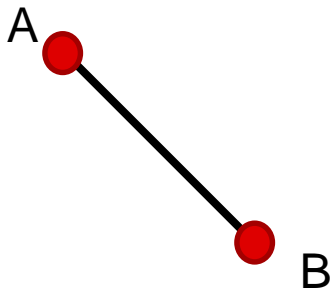
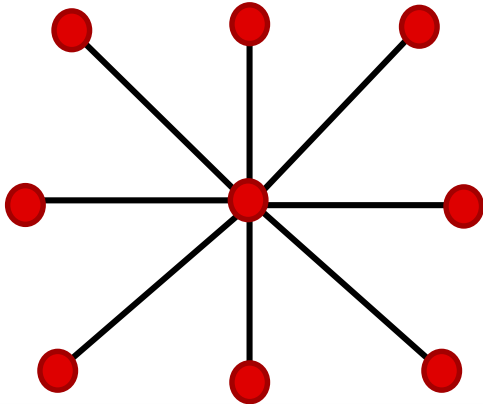
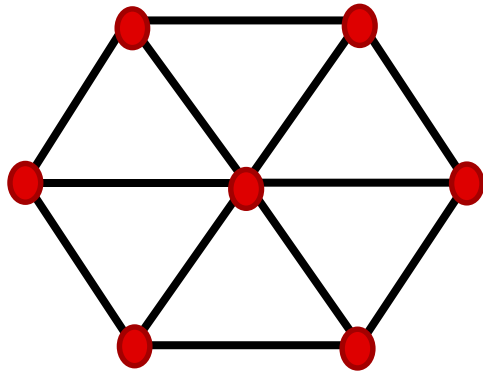
Current power consumption:



12.9 mA

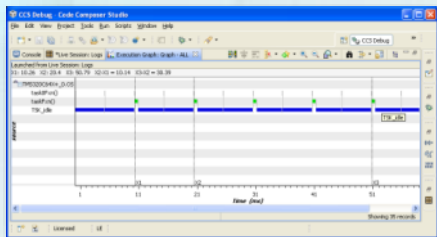
Using 100 kHz

CC1310 What software should I use?

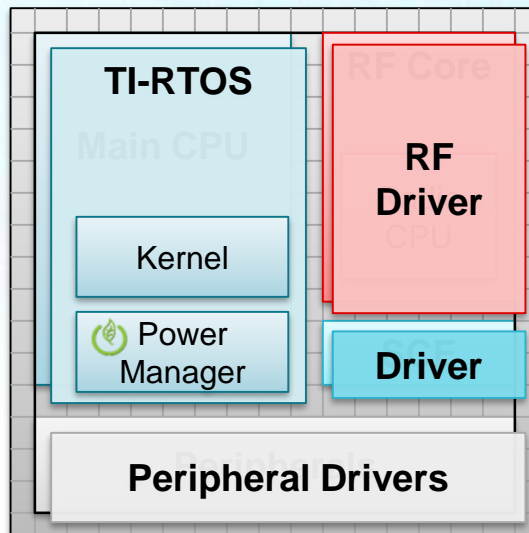
What does the end wireless network look like?		
point-to-point	star	mesh
		
software protocol	software protocol	software protocol
TI-RTOS Range Test	Contiki-6LoWPAN wM-Bus (EMEA metering) TI-MAC 2.0, TI-RTOS	TI-RTOS Contiki-6LoWPAN
use cases	use cases	use cases
Long Range Test for RF Performance Measurements, Simple Point-to-Point Network	Home & Building Automation, Metering, WAN, Long Range Cloud Connections	Long Range Cloud Connections, Metering, Home & Building Automation

TI-RTOS Flexible Software Solution

- Real Time Operating System (RTOS)
 - Pre-emptive multi-threading
 - Deterministic scheduler
 - Tailored TI-RTOS Kernel
 - Completely integrated Power Manager
- Extensive toolbox
 - Semaphores
 - Mutexes
 - Mailboxes and more
- RF driver
 - Fully integrated with power module
- Peripheral Drivers
 - GPIO, I2C, SPI, UART, LCD



Powerful RTOS tools



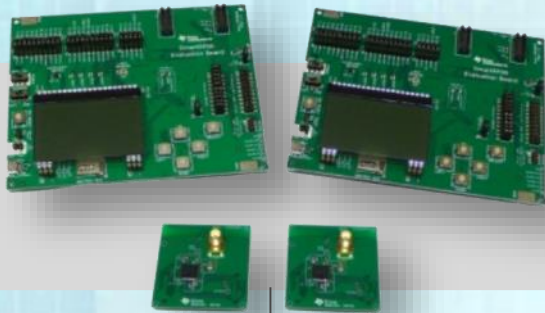
Whole system RTOS solution



- Power Manager
 - Easy to get ultra-low power with no configuration
 - Fully integrated with drivers

Get started fast: Development kit offering

Available now!



CC1310 Development Kit

- Full-feature emulator for development and debugging
- For Evaluation of Sub-1 GHz RF Networks
- \$299 through the TI Store and distribution
- Additional EMKs (with CCS license) available for \$99
- **Available online now!**

Coming Soon!



CC1310, CC1350 Launchpad

- CC1310 Launchpad – Sub-1 GHz: Can be bundled with LCD screen boosterpack
- CC1350 Launchpad - Dualband : sub-1 GHz + 2.4GHz
- Low-cost MCU evaluation kits and plug-in modules for quick development
- Leverages existing TI MCU ecosystem

Coming Soon!



CC1350 SensorTag kit

- Sensor-based DK for IoT and Long Range applications
- Get connected to the cloud in 3 minutes
- Easy programming and prototyping with add-on JTAG daughter card
- Free app for iOS & Android
- \$29 through the TI Store and distribution

Low Power Connectivity Support



Web:

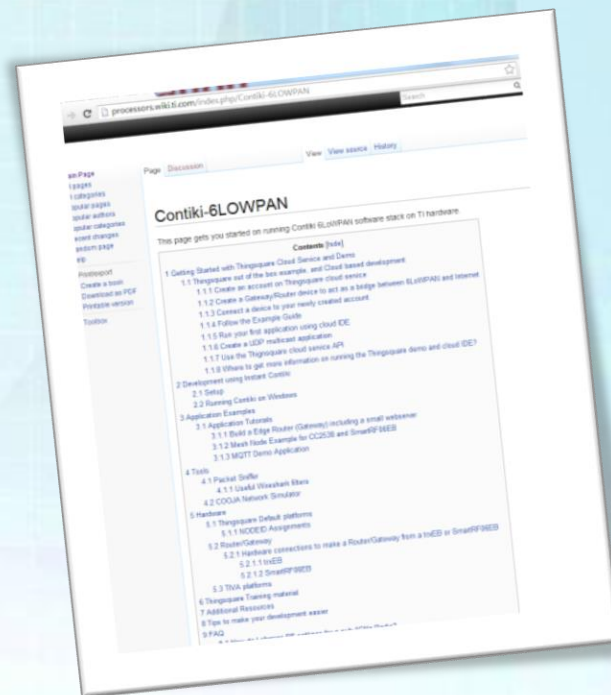
- <http://www.ti.com/product/CC1310>
- Application notes
- Software & tools downloads and updates
- Order evaluation and development kits
- www.ti.com/6lowpan - general 6LoWPAN information

Wiki's:

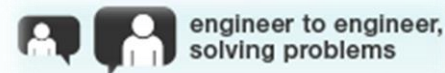
- [CC13xx Internal wiki](#)
- [TI Contiki 6LoWPAN wiki](#)

Engineer 2 Engineer Community, Support Forums:

- [Wireless Connectivity Forum](#)



For latest CC13xx schedule information, please see the CC1310 intro deck located on the internal [wiki](#).



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