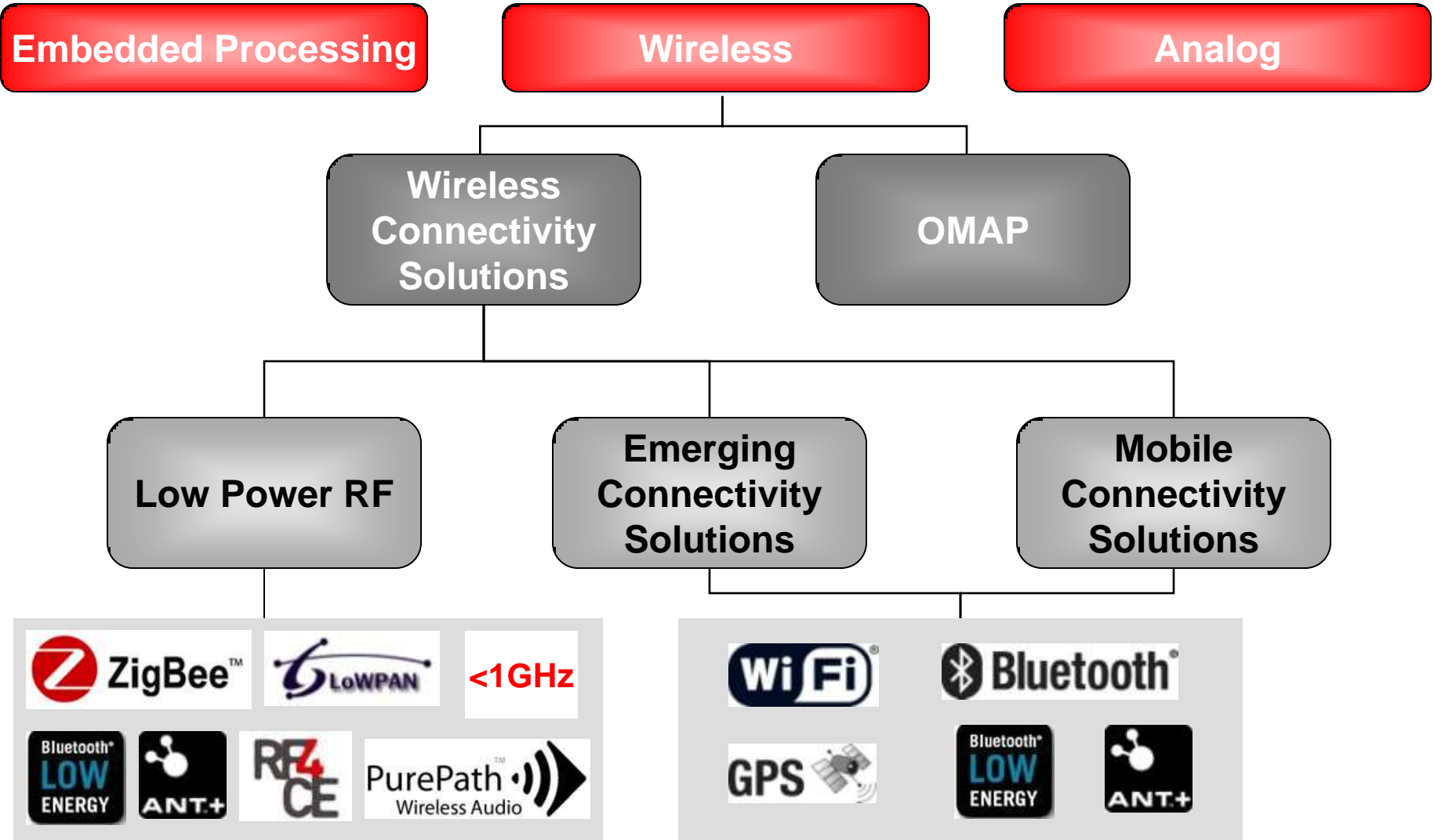


The TI Wireless Story

TI Wireless Business Unit



TI leading in Wireless Connectivity



More than 1 billion connectivity chips shipped to date



Scalable, flexible product line:

- Stand-alone solutions
- Dual-mode solutions
- Combo devices

TI's wireless connectivity portfolio: The industry's broadest

Supported standards

| 13.4KHz /13.56MHz | Sub 1GHz | 2.4GHz to 5GHz | | | | Satellite |
|--|---------------------------------|----------------------------------|-----------------------------|--|---|-----------|
| RFID NFC ISO14443A/B ISO15693 | SimpliciTI 6LoWPAN W-MBus | SimpliciTI PurePath™ Wireless | ZigBee® 6LoWPAN RF4CE | Bluetooth® technology Bluetooth® low energy ANT™ | Wi-Fi 802.11a/b/g/n Wi-Fi + Bluetooth® technology | GPS |

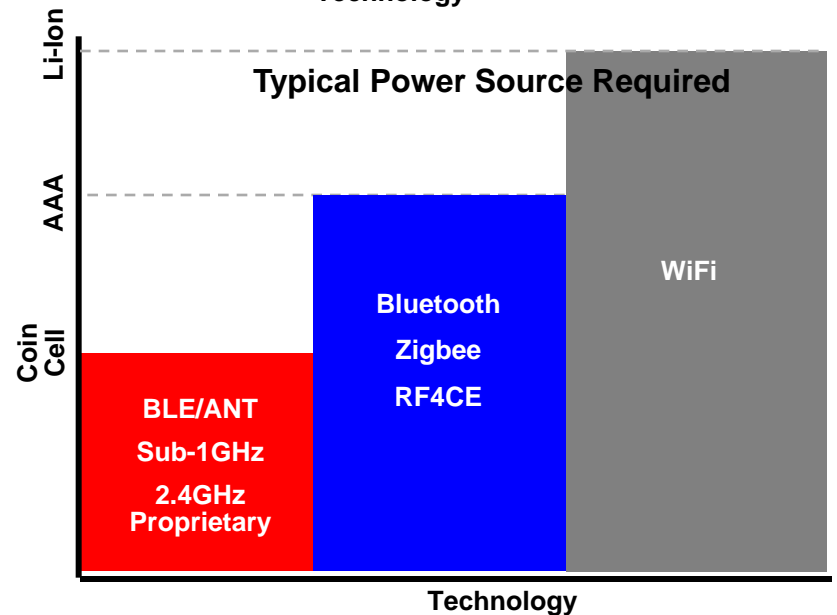
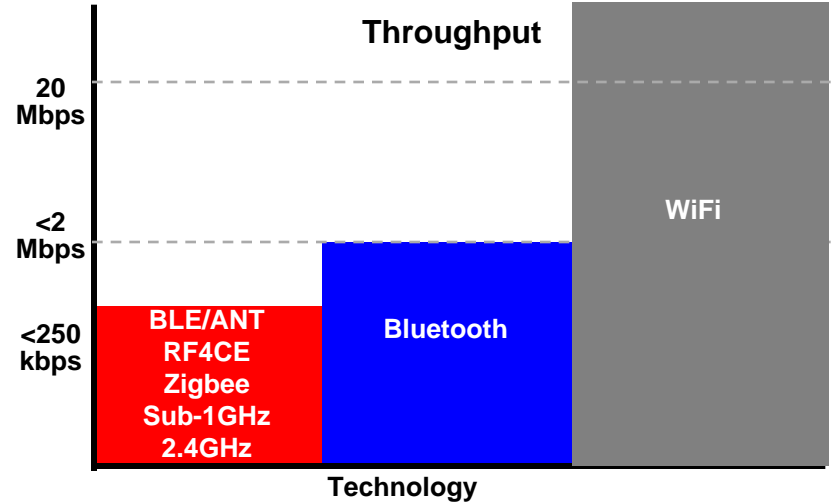
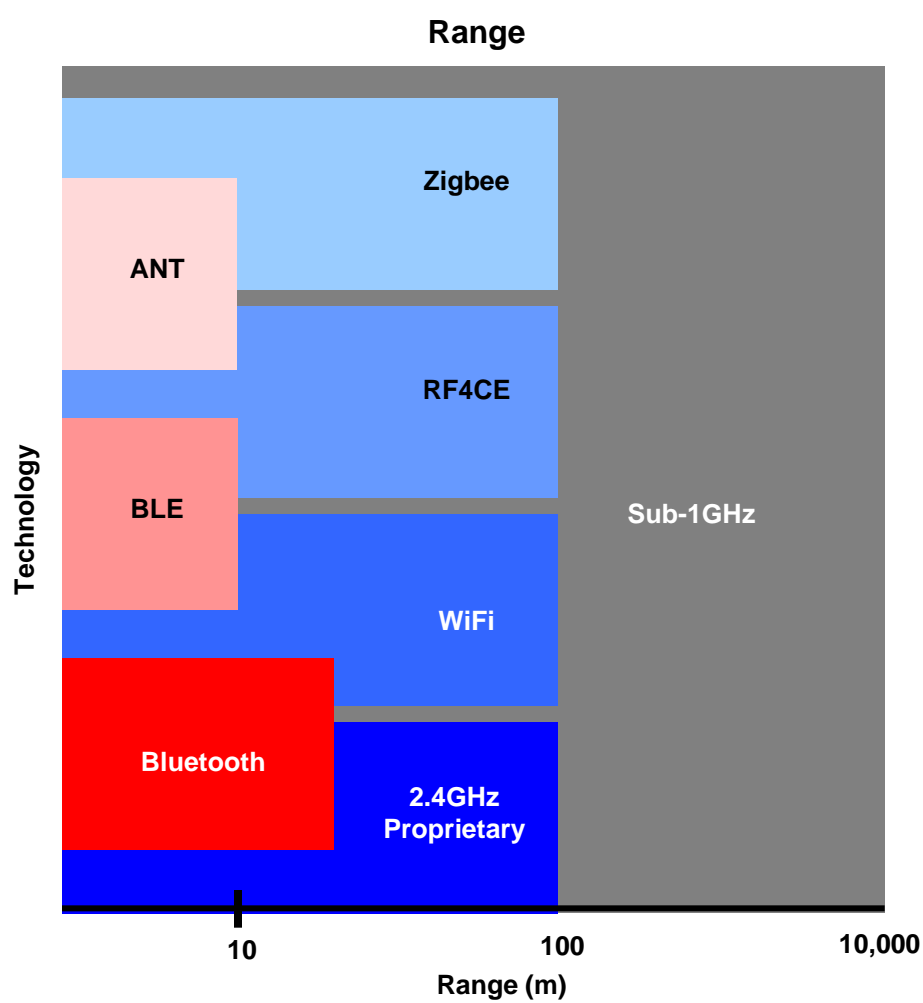
Example applications



Product line up

| | | | | | | |
|--------------------------------|---|---|---|--------------------------------------|------------|------------|
| TMS37157 TRF796x TRF7970 | CC1101 CC1110 CC430 CC1190 CC11xL CC1120 | CC2500 CC2510 CC2590 / 91 CC8520 / 21 CC8530 / 31 | CC2520 CC2530 CC2530ZNP CC2531 CC2533 | CC2560 / 67 CC2540 CC2570 / 71 | WL1271 / 3 | WL1271 / 3 |
|--------------------------------|---|---|---|--------------------------------------|------------|------------|

Wireless Technologies Comparison



TI Low Power RF *at a glance*

2.4 GHz

Sub 1 GHz

Alarm and Security

CC11xL

Sub-1GHz RF Value Line

Low cost family for
Uni- and Bi-directional RF

CC1110 /1111

Sub-1GHz SoC

32KB Flash / USB 2.0
0.3 uA sleep current

CC1101

Sub-1 GHz Transceiver

+ MSP430 MCU,
500 Kbps
-112dBm sensitivity



Remote Controls

CC2533 /2531

RF4CE

IEEE 802.15.4 compliant
System on Chip
USB on CC2531
RemoTI RF4CE SW

CC2500

2.4 GHz Transceiver

+MSP430 MCU
Proprietary solution



Smart Metering

CC2530/ 2533

ZigBee

System on Chip
IEEE 802.15.4 compliant

CC1120

Narrowband Transceiver

12.5 KHz channel spacing
-123dBm sensitivity

CC1190

850-950 MHz Range Extender

CC2590 /2591

2.4 GHz Range Extender

CC2520

802.15.4 Transceiver

15.4 MAC or ZigBee
MSP430 or Stellaris host



Low Power RF

Wireless Audio

CC85xx

PurePath™ Wireless

Complete family of
high quality wireless audio

CC2590

2.4 GHz Range Extender



Medical, Health & HID

CC2570 /2571

ANT Network Processor

ANT / ANT+ compliant

CC2540

Bluetooth low energy

BLE compliant SoC

CC2510 /2511

2.4 GHz Radio

Complete SoC,
32 KB Flash / USB



CC1180

6LoWPAN Network Processor

Standards based
3P Software Stack

CC430

Sub-1GHz SoC

+ MSP430 MCU

CC2530

ZigBee

IEEE 802.15.4 SoC
Supporting ZLL

CC2530ZNP
ZigBee Network Processor
fully certified ZigBee Pro
Software Stack



Home Automation & Lighting



Recent advancements in the Low Power RF product line up



Sub-1GHz Internet
connectivity
Launched at ESC Boston



Achievement of ZigBee®
Alliance Smart Energy™ 1.1
profile certification

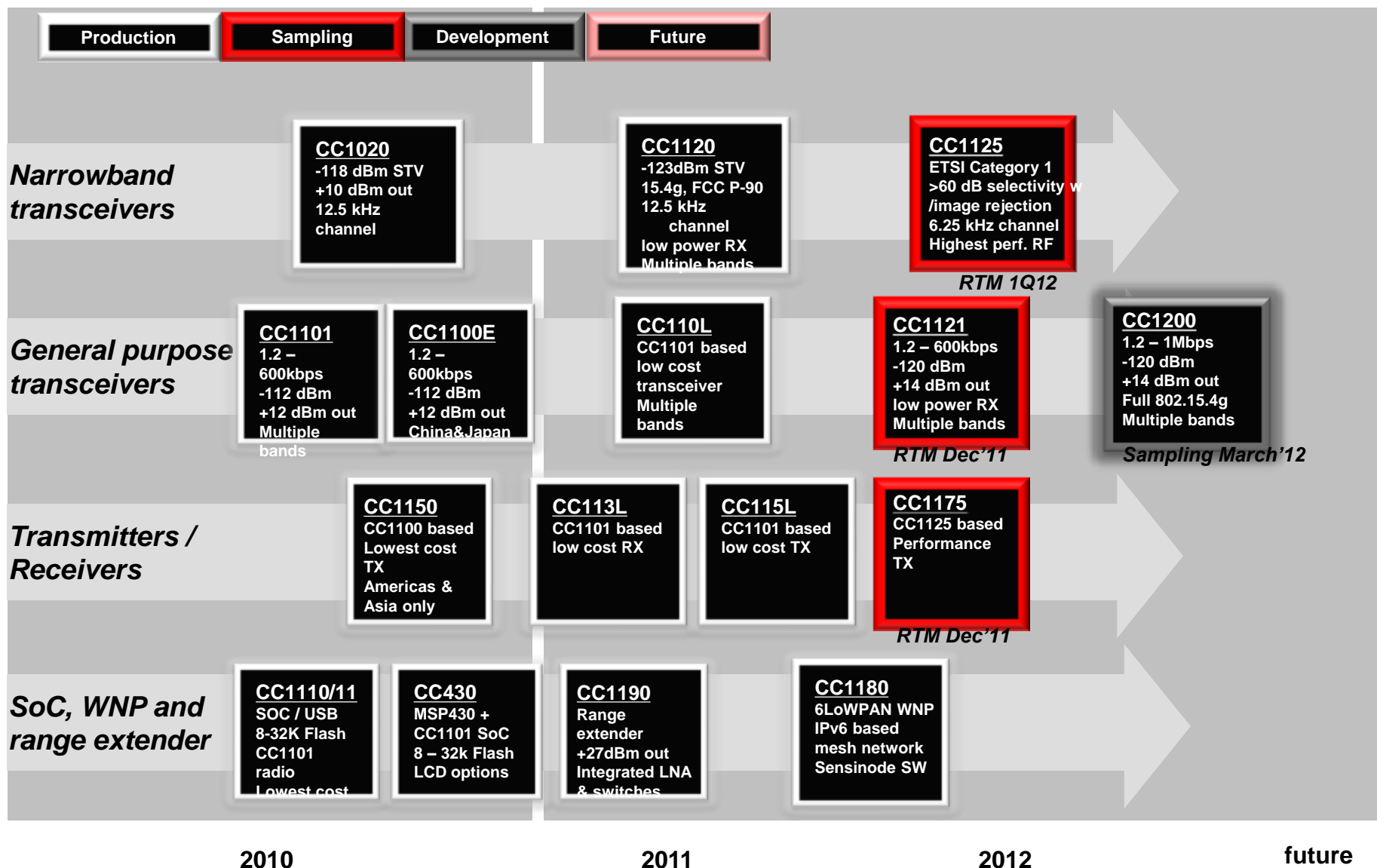


Introduction of
sub-1GHz value and
performance lines



Launch of 10 new *Bluetooth*®
low energy profiles, updated
BLE-Stack and dev kit

Low Power RF – Industrial sub-1GHz Roadmap



LPRF Industrial Products

New 6LoWPAN solutions

- **What they are:** Gateways for remote, low-cost wireless sensors to connect to the Internet and a wireless extension of wired IPv6 infrastructures
- **Key benefits:** Plug and play, longer wireless range, lower power levels, smaller footprint
- **Target markets:** Smart Grid, security, home and building automation, street lighting, other wireless sensor networks



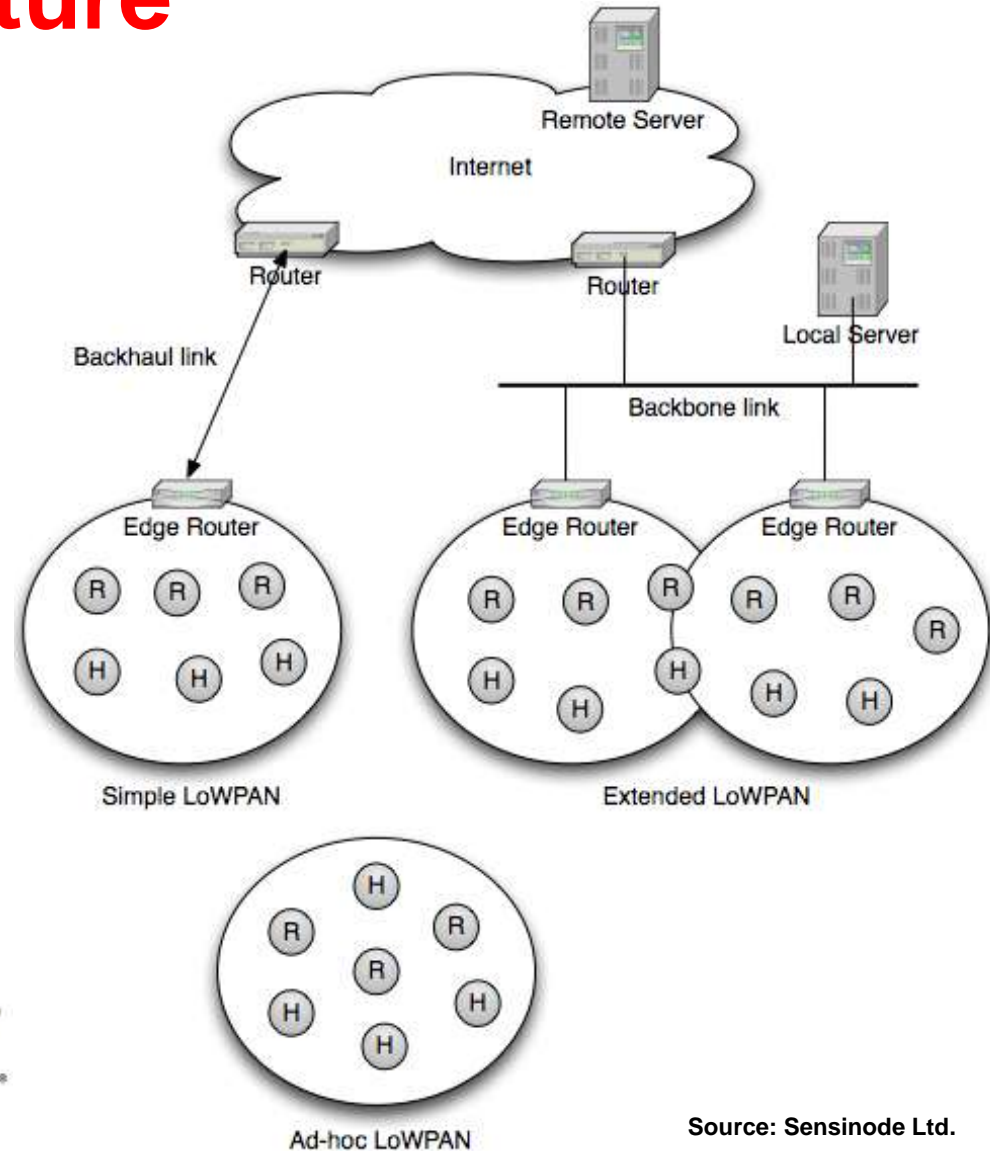
Real-life application: Lights on!

- Light poles wirelessly connected and managed using one gateway
- Self-healing network always maintains connectivity
- City planners monitor bulb replacements or outages, ensure proper lighting if weather changes



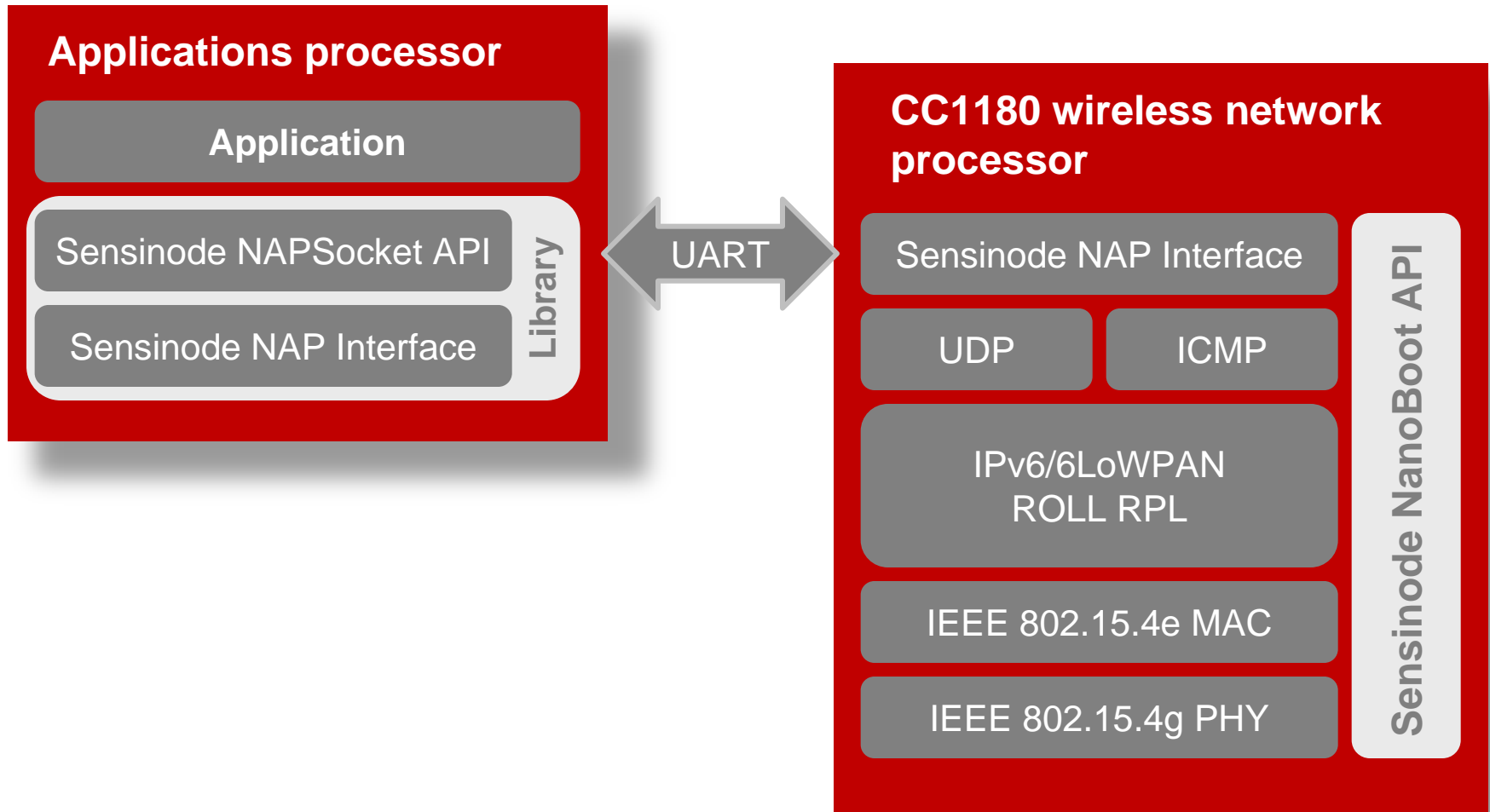
Network Architecture

- 6LoWPANs are stub networks
- Simple 6LoWPAN
 - Single Edge Router
- Extended 6LoWPAN
 - Multiple Edge Routers
- Ad-hoc 6LoWPAN
 - No route outside the 6LoWPAN
- Internet Integration Issues
 - Max Transmission Unit (MTU)
 - Application Protocols
 - IPv4 interconnectivity
 - Firewalls and NATs
 - Security

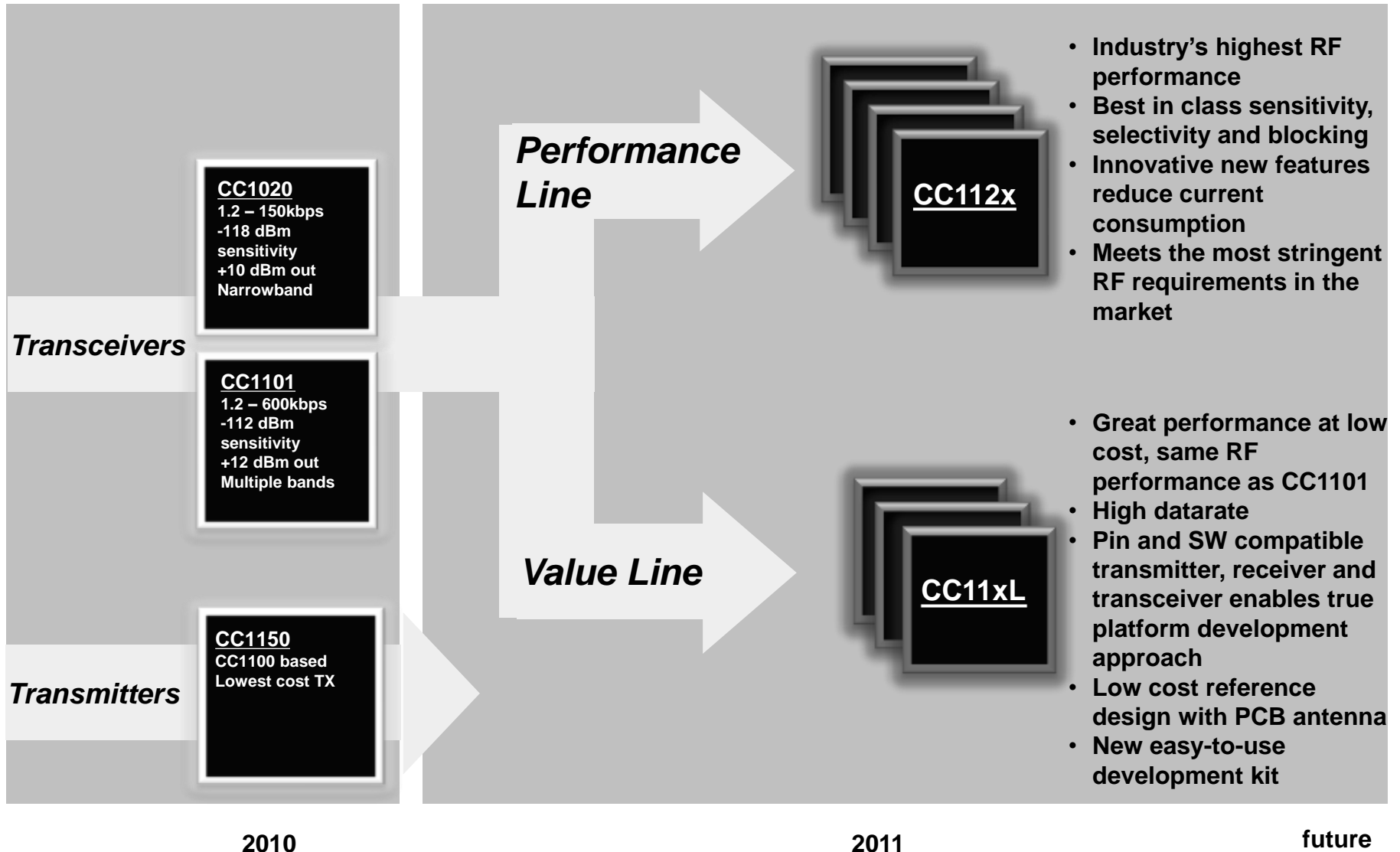


Plug-and-play 6LoWPAN solution

Using standard IP socket programming



Sub1-GHz Industrial LPRF products



Sub-1GHz RF solutions for every application



Sub-1GHz Performance Line

Providing the industry's highest RF performance

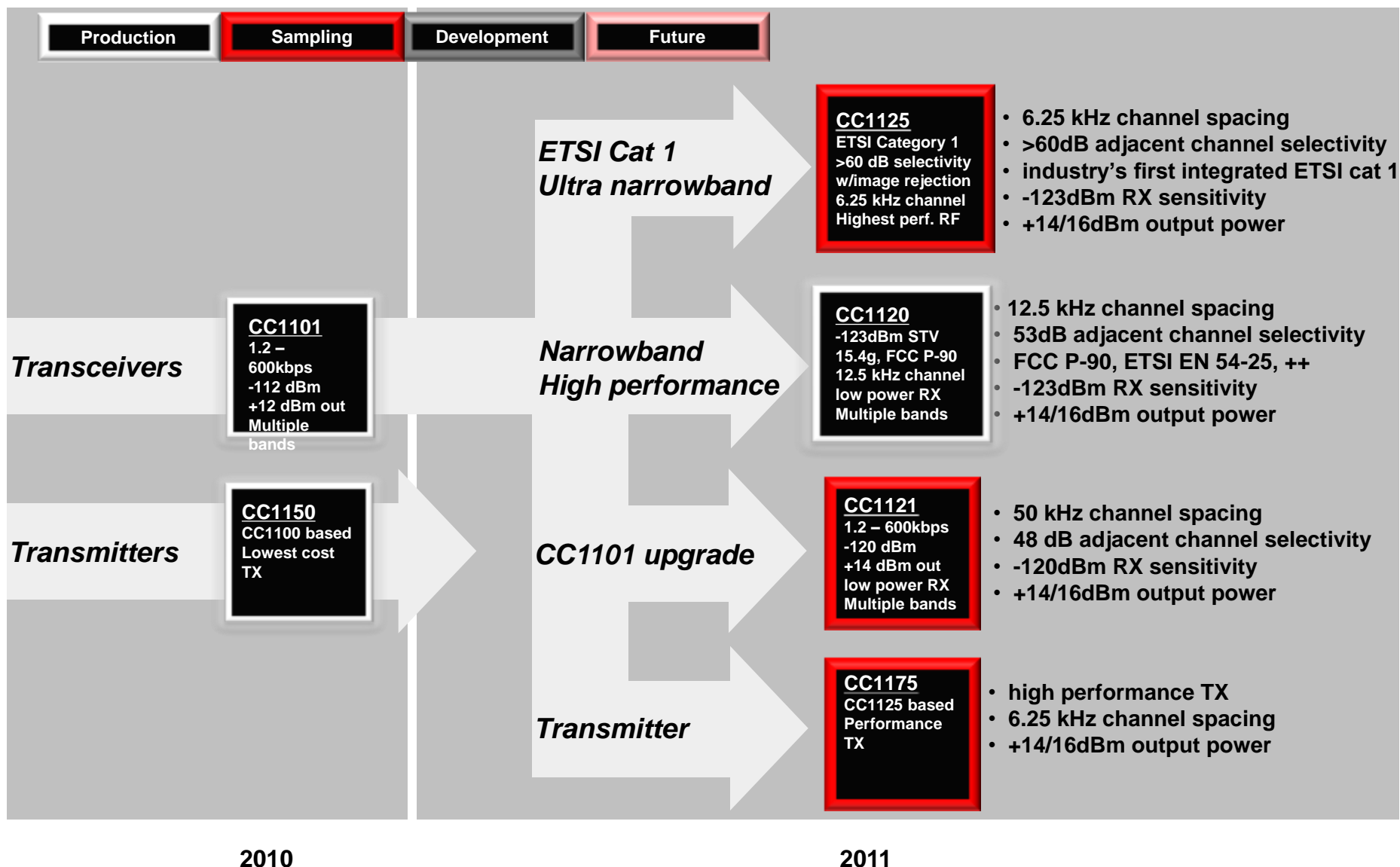
- More robust, reliable wireless connectivity for metering, security and industrial automation are target applications
- Meets more RF regulations than any other comparable solution

Sub-1GHz Value Line

Connecting cost-sensitive consumer applications

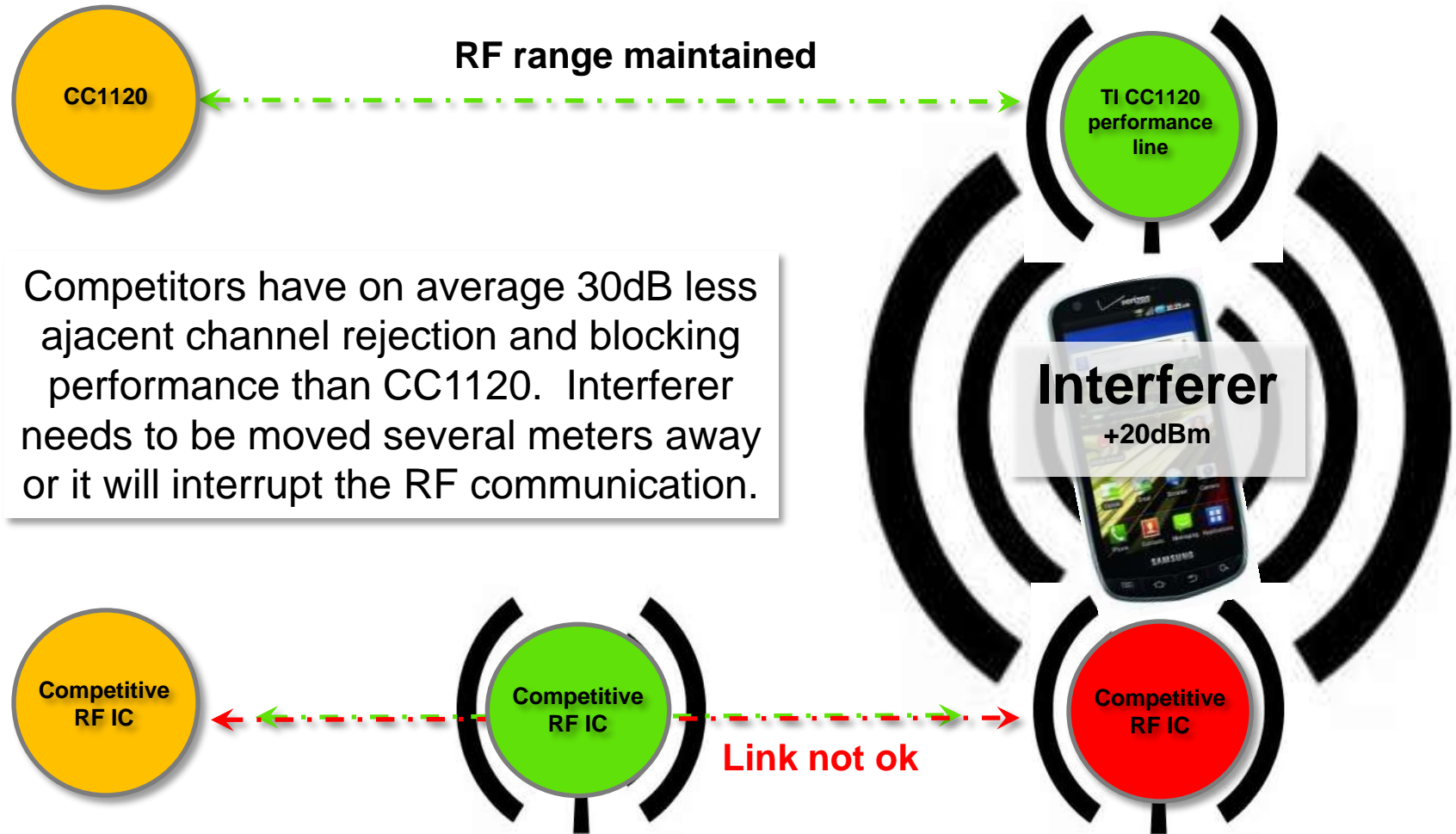
- Replacing IR in remote controls, toys, and consumer electronics
- Two-chip, one-way RF link for less than USD \$1.00

Sub-1GHz RF Performance Line



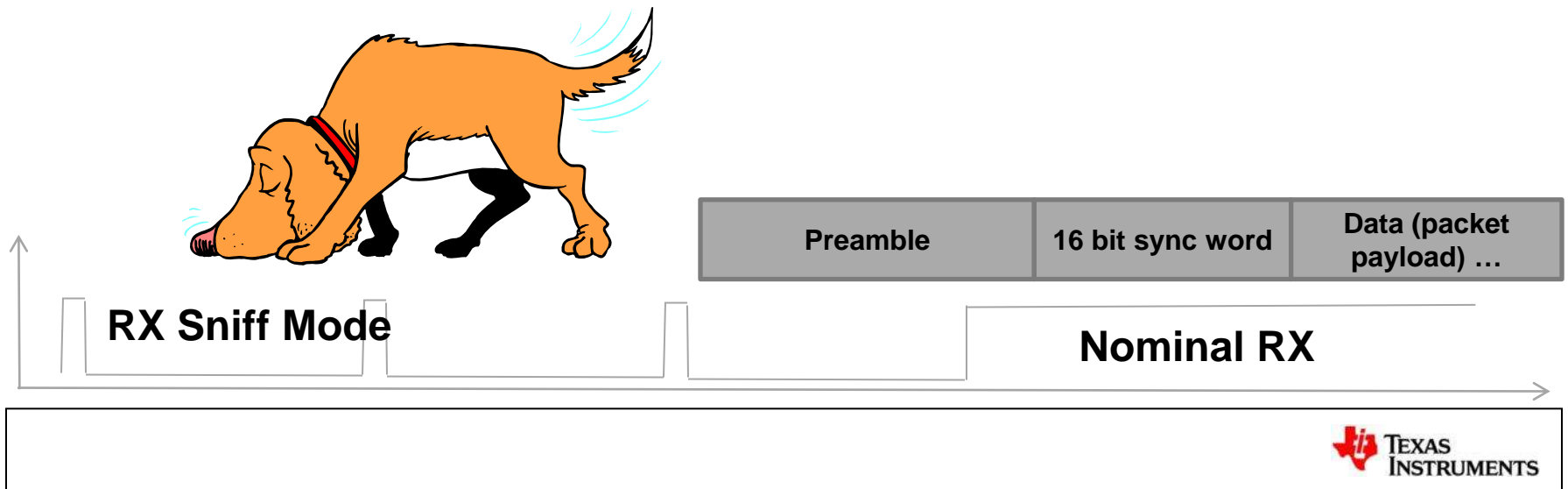
Why is RF selectivity important?

Poor selectivity require interfering RF systems to be physically moved away



Sub-3mA RX current - RF Sniff Mode

- Receiver requires only a **4 bit** preamble for settling including frequency offset compensation (AFC) and automatic gain control (AGC)
- RF Sniff Mode is enabled by using **autonomous** WOR together with **automatic** RX termination based on fast carrier sense detection
- Range, sensitivity, selectivity and robustness of the link **not impacted**
- Significantly reduced average power consumption to as low as **3mA**, exact value depending on duty cycle, data rate and preamble length



New ultra high performance RF parts:



CC1120: Transceiver with down to 12.5kHz channel spacing, 52dB adjacent channel selectivity and -123dBm sensitivity



CC1121: Transceiver with down to 50kHz channel spacing, 48dB adjacent channel selectivity and -120dBm sensitivity

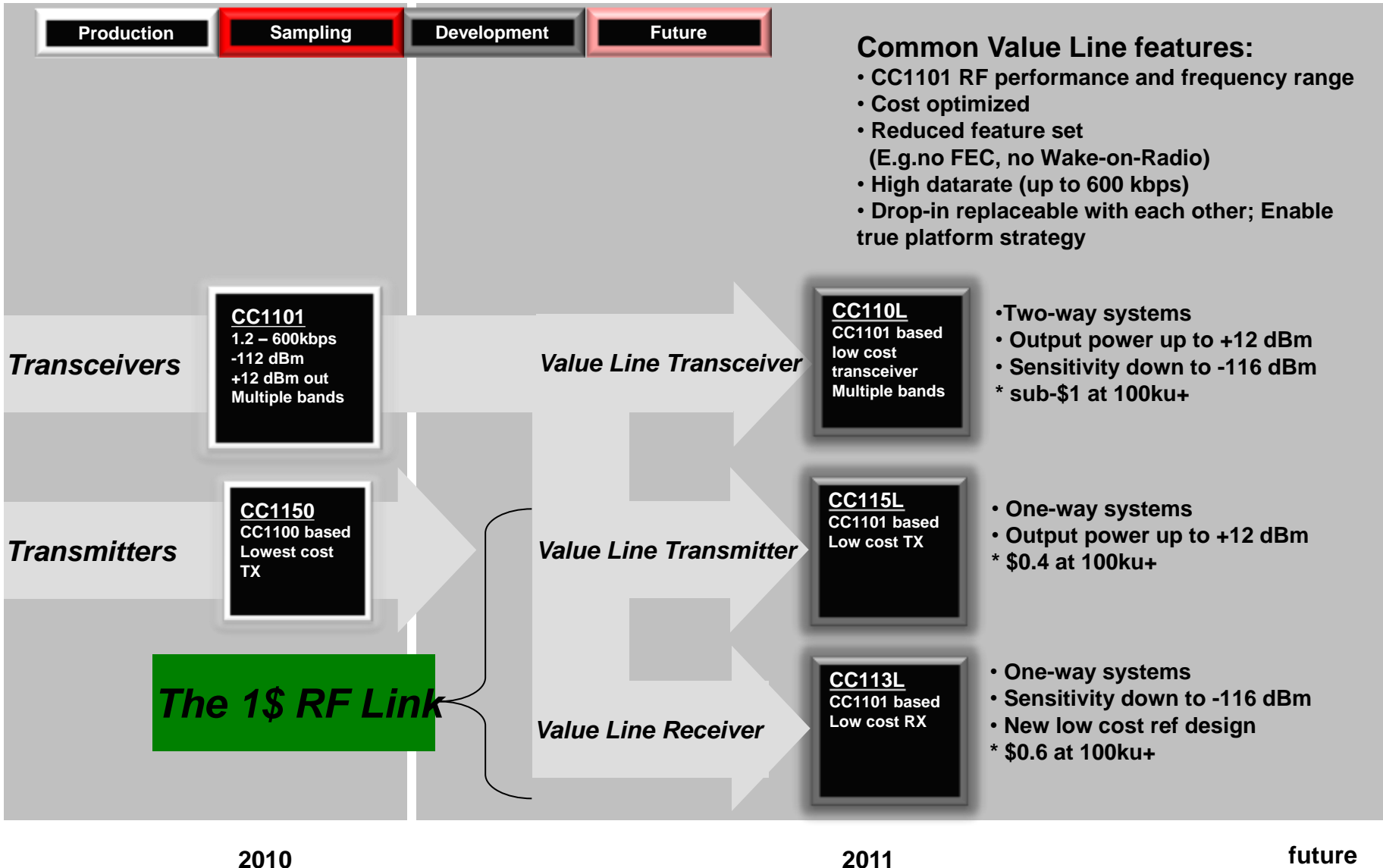


CC1125: Transceiver with down to 6.25kHz channel spacing, >60dB adjacent channel selectivity and -124dBm sensitivity. RF performance previously only found in discrete systems



CC1175: Transmitter with +14dBm output power and -120dBc phase noise at 10kHz

Low Power RF sub-1GHz Value Line Introduction



Sub-1GHz RF Boosterpack @ \$19



Make your MSP430 LaunchPad wireless with 430BOOST-CC110L plug-in-board

Order Now

<http://www.ti.com/ww/en/RF-BoosterPack/>

Launched November 30th – price \$19



Module and BoosterPack boards mount on 2 launch pads



All documentation is both online and available in the box for a 15 minute set up time

CC110L Boosterpack



Kit Contains:

- The AIR BoosterPack kit includes the following:
- Two AIR BoosterPack modules
- Two MSP430G2553 devices (preloaded with a sample program)
- Quick Start Guide
- CD containing AIR BoosterStack demo application software, USB UART device driver and supporting documentation

AIR BoosterPack Hardware Features:

- 1.8 to 3.6 V operation
- Low Power Consumption
- SPI Interface
- Prototyping area
- Footprints for adding a microcontroller, pushbutton switch, and LED for standalone operation
- ROHS Compliant
- A110LR09A embedded dual band module included on assembly

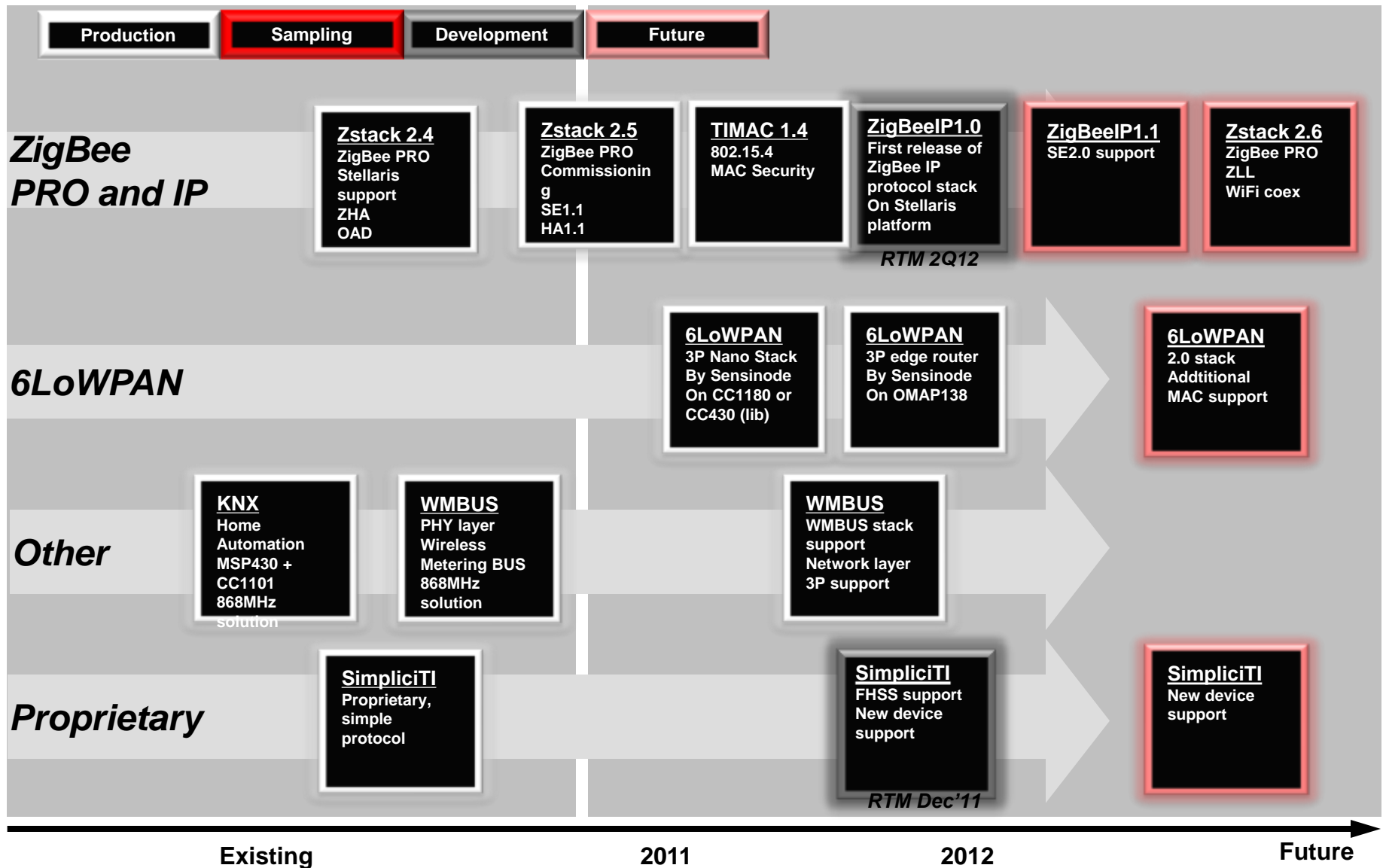
AIR BoosterStack Software Features:

- Low-power temperature sensor application
- Star network topology with one hub node and up to four sensor nodes
- Graphical User Interface provides network control and displays key radio parameters
- Ability to change radio settings locally and/or remotely
- Remote control feature to turn on/off LaunchPad green LED
- Node ID, operating state, and radio settings restored at power-up



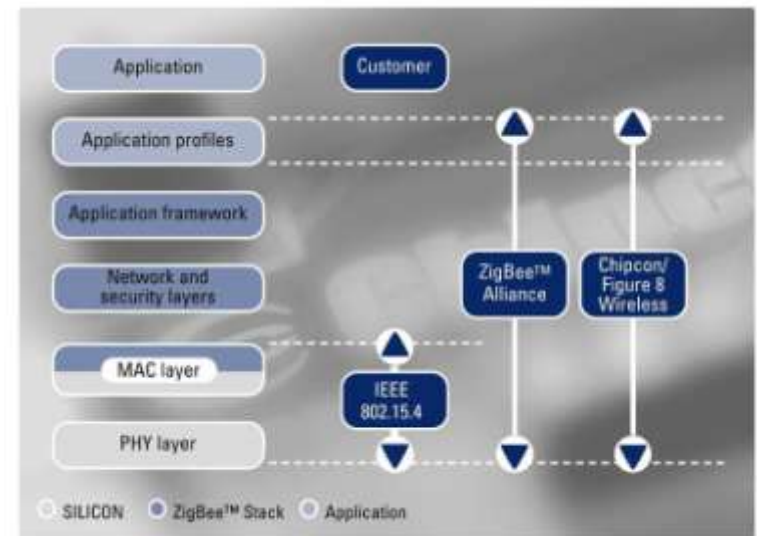
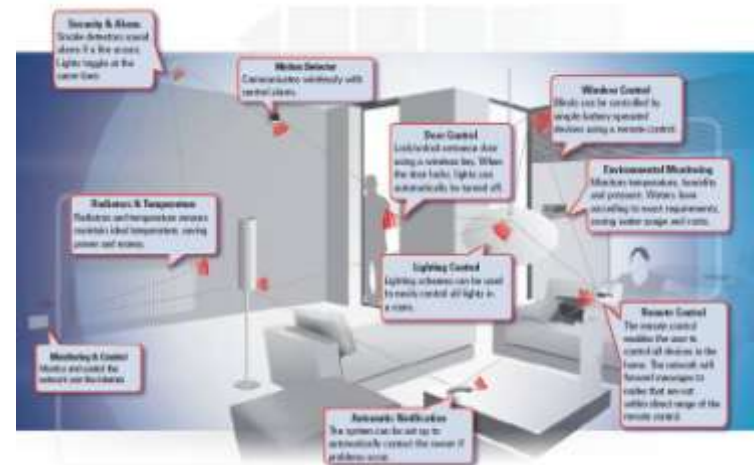
Anaren[®]
What'll we think of next?®

Low Power RF – Industrial Roadmap SW



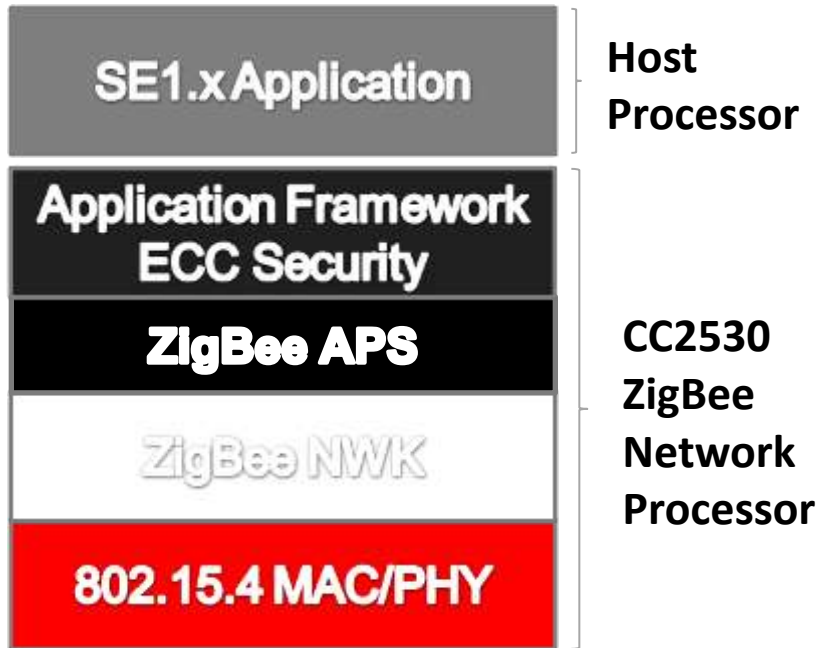
CC2530 for ZigBee and ZigBee PRO

- ZigBee / ZigBee PRO
 - Z-Stack 2.2.0 core stack
 - Proprietary sample apps
 - Smart Energy (SE) support
 - Home Automation support
- Additional Features
 - Over Air Download
 - Peripheral / Driver support
 - Supports CC259x RF front end

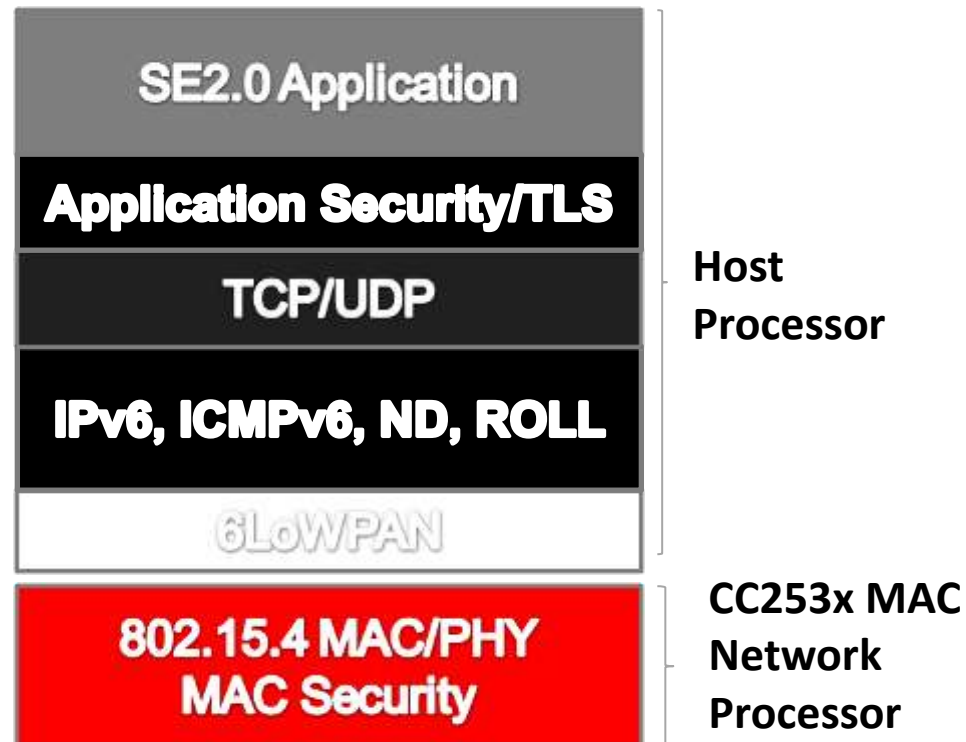


CC253x-based Solution Architecture

SE1.x Solution shipping now!



SE2.0 Solution PREVIEW



Host processor code size footprint ~ 30k (ESI)

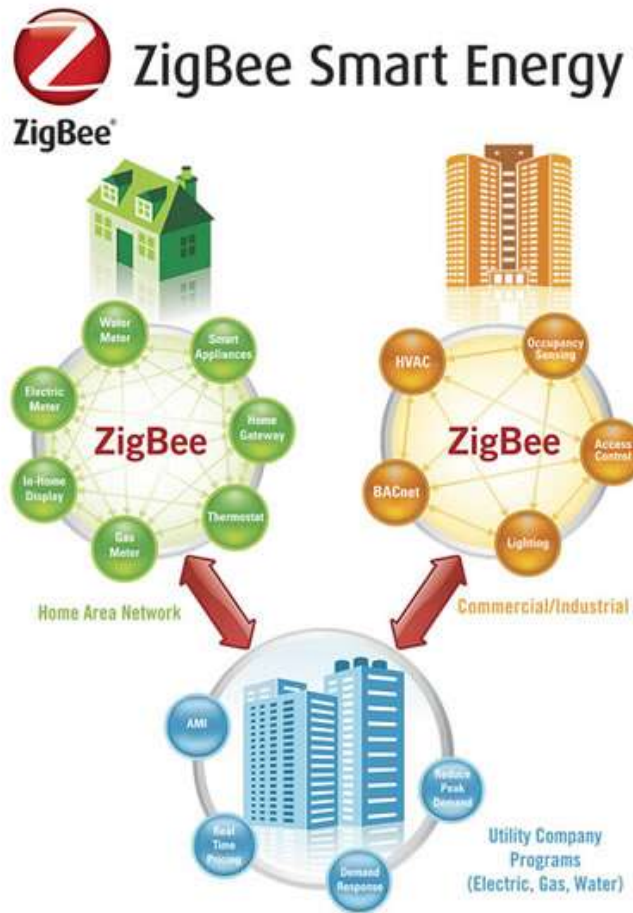
Host processor code size footprint ~ 120k (excluding TLS)
A future proof SE 2.0 implementation will require at least 16 KB RAM at stack layer

Entry level ZigBee tool: CC2530ZNP Mini Development Kit

- Lowest cost ZigBee PRO Development Kit
 - 3 ZigBee nodes for \$99
 - 1 USB dongle and 2 battery nodes
 - Free IAR MSP430 kickstart compiler
 - 4Kbyte code size limitation
 - HW Emulator Support
 - No need for 8051 compiler
- Includes 30+ educational MSP430 wireless sensor applications
 - Accelerometer, Light, Voltage
 - Simple ZigBee functions
- The perfect introduction to wireless sensor networks



ZigBee® Smart Energy™ 1.1 products for home area networks



TI's Z-Stack™ 2.5.0 supports ZigBee Smart Energy 1.1

Helps developers easily, efficiently unleash a wider range of interoperable, consumer-friendly home area network products

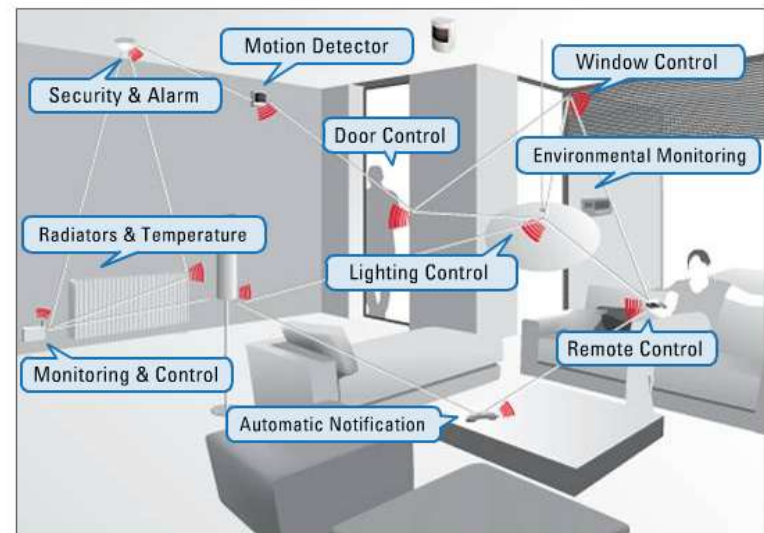
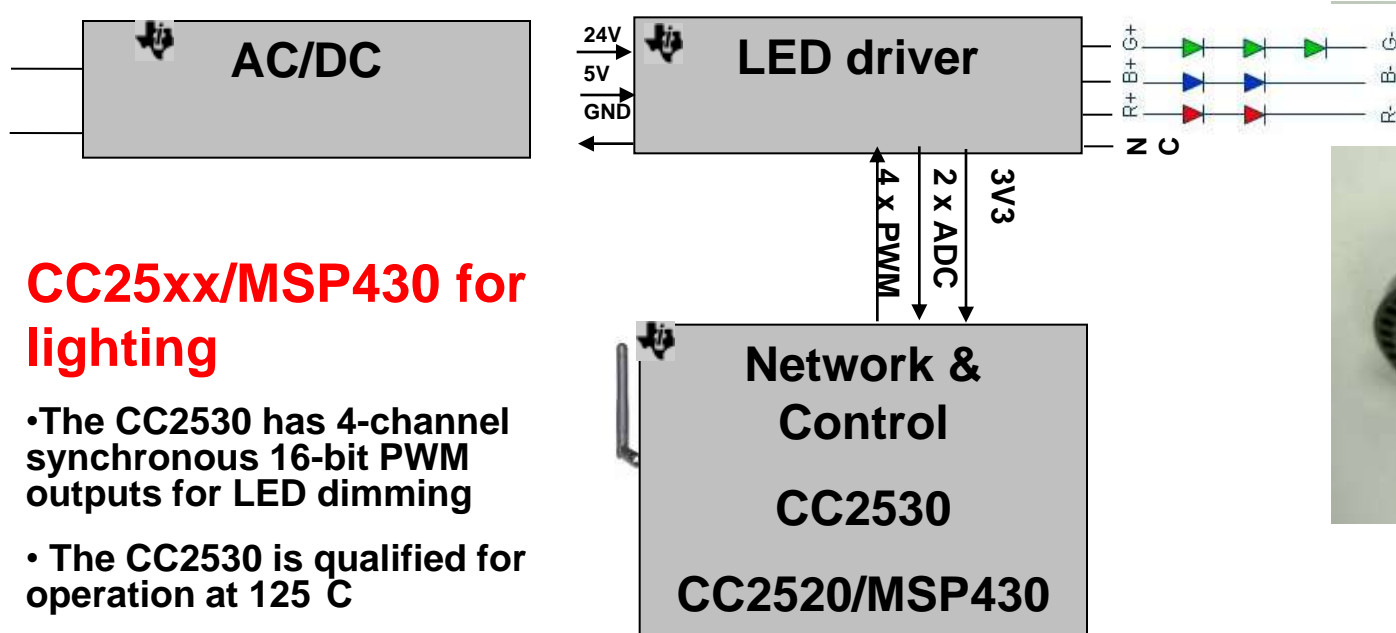


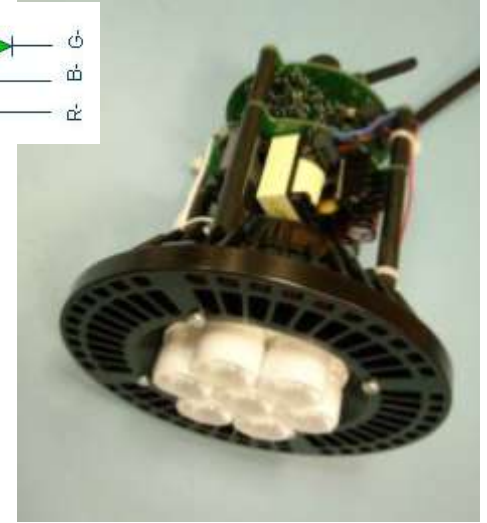
Image source: ZigBee Alliance Web site

Complete LED control reference design for IEEE 802.15.4



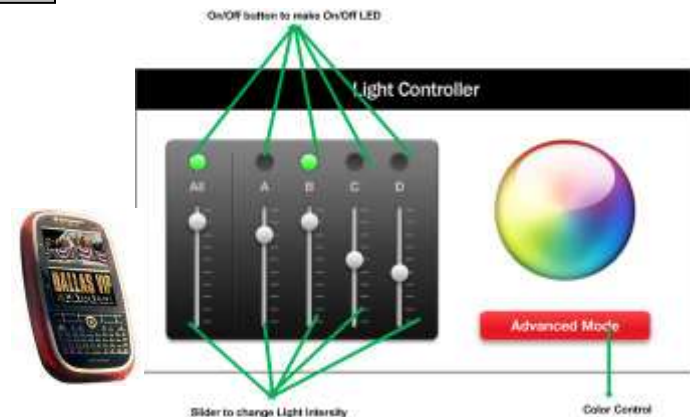
CC25xx/MSP430 for lighting

- The CC2530 has 4-channel synchronous 16-bit PWM outputs for LED dimming
- The CC2530 is qualified for operation at 125 °C



Android Remote App

- Android user interface on TI OMAP Blaze development platform with CC2531 USB dongle



RF Remote Control

Pin compatible System on-chip(SOC)

- CC2530, ZigBee, IP
- CC2531, USB
- CC2533, RF4CE
- CC2540, BLE



Industry leading Software Stacks

- BLE Stack
- RemoTI RF4CE stack
- Z-stack
- Golden Unit testing platform

Advantages

- Industry's best RF performance
- Long battery life with lowest power remote controls
- Low cost solutions
- High reliability
- Best-in-Class WiFi co-existence

Complete Remote Control Systems

Out of the Box

- Complete remote control application examples
- Advanced 6-axis pointing functionality
- Plug-and-play USB HID support
- FCC/ETSI approved low power reference designs

Development tools and reference designs



What is BLE/Bluetooth SMART?

Bluetooth standard



- Part of Bluetooth Spec 4.0, July 2010
- BLE is not directly compatible with BR/EDR Bluetooth
- Bluetooth SMART device
 - Peripheral device that supports Bluetooth 4.0 and communicates with Smart-ready devices
- Bluetooth SMART ready device
 - "Hub" device that supports the Bluetooth 4.0 spec
 - Often BR/EDR + LE support (Dual mode device)

Low Power



- Targeted for low power applications
- Coin cell operation > 1y

Bluetooth Device Types

Low Energy Single Mode



CC 254x

Low Power, little data

Dual Mode



CC 2564 / WLink 128x

Gateway, storage

Classic



CC 2560

Streaming, file transfer

Bluetooth SMART

Happening now!



Apple iPhone 4S Bluetooth 4.0 paving way for mobile health devices

Posted by [Mark Lyall](#) on October 14, 2011, filed in: [Health News](#), [iHealth](#)



From Microsoft BUILD conference...

- Windows 8 to offer native *Bluetooth* low energy support
- Both static and portable computing devices

TI launches 10 new Bluetooth® low energy profiles for rapid design of consumer medical, fitness, alert applications and more



Motorola Droid Razr with *Bluetooth* 4.0
Launched November 2011



Markets & Applications Areas

- HID
- Consumer Wellness
- Sports & Fitness
- Security & Proximity
- Home Automation
- Entertainment
- Automotive



RECON READY



Typical Ecosystem – Scenario

Stand-alone (sensor) devices



Sports & fitness

- Heart rate belt
- Foot pod



Healthcare

- Blood pressure meter
- Glucose meter



Home & entertainment

- Remote control
- Home sensor



Mobile & office accessories

- Mobile keyboard
- Identification systems



Automotive

- Tyre pressure monitor
- Parking assistant



Watch/wrist wearable device

- Call remote mgmt
- Out of range alert

Dual-mode host devices

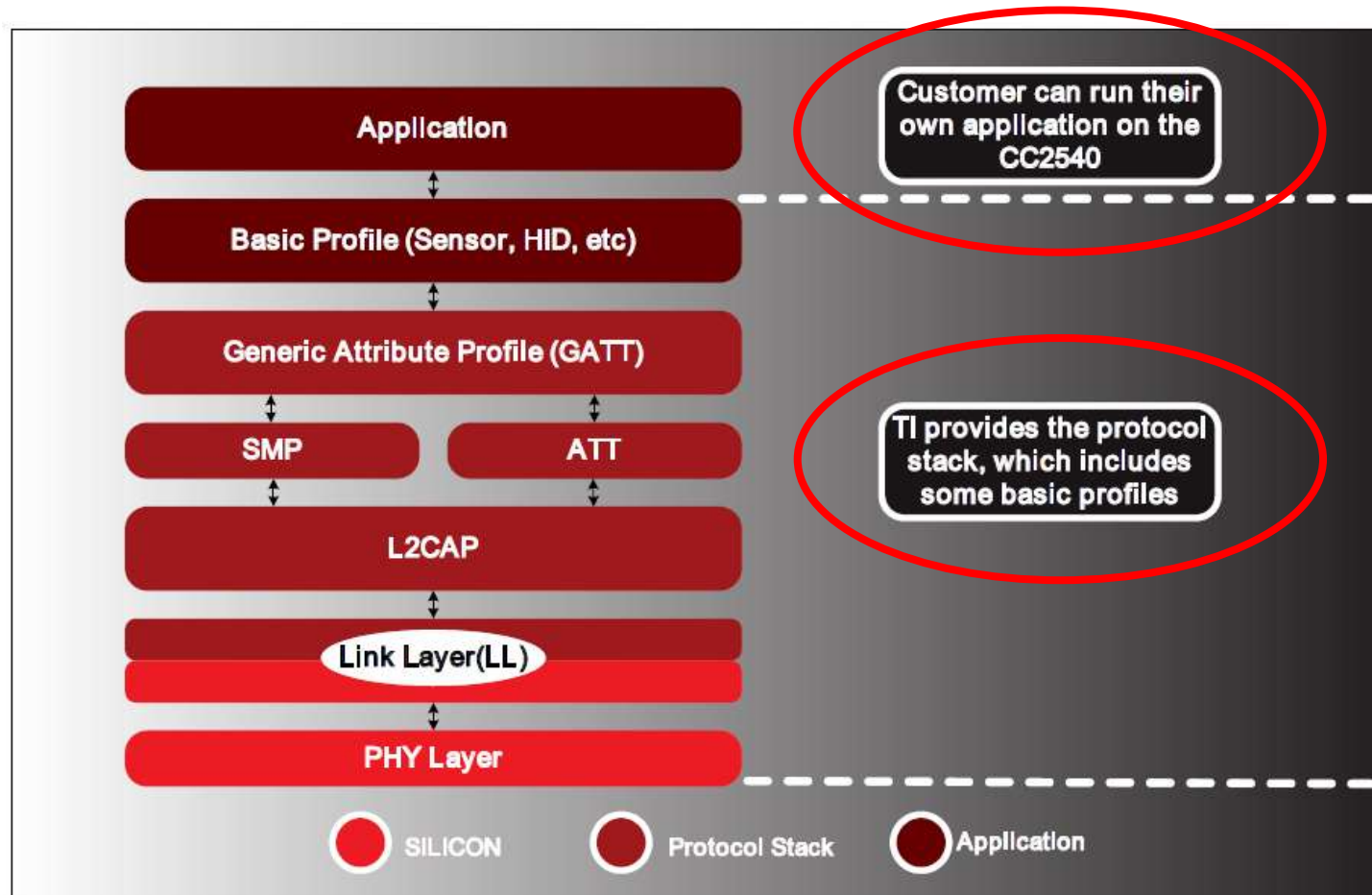


Web & tele services

Weigh loss and fitness coaching
Adventure sports team room
Telehealth services
Elderly monitoring service
Gaming community
Car repair service

Tracking service

SOC approach for the CC2540 - BLE



Qualified tools for *Bluetooth®* low energy technology designs

“TI's profiles have been qualified and are ready to be built into products. It is great to see a company like TI investing this many development resources into helping low energy products come to market...I think we'll see a lot of products with low energy technology by the end of this year.”

Mike Foley, Bluetooth SIG

Low Energy



What TI offers:

- Royalty free, full BLE-stack
- CC2540 *Bluetooth* low energy SoC
- CC2540DK and DK-MINI development kits
- Broadest range of certified profiles
- Dual- and single-mode products for full testing
- Always-there support via E2E community



Bluetooth LE Apps development kit

- Miniature Coin cell sensor board
- Phone adapter for Apple/Android
- Including App framework for App developers



Android

μUSB
adapter

Apple

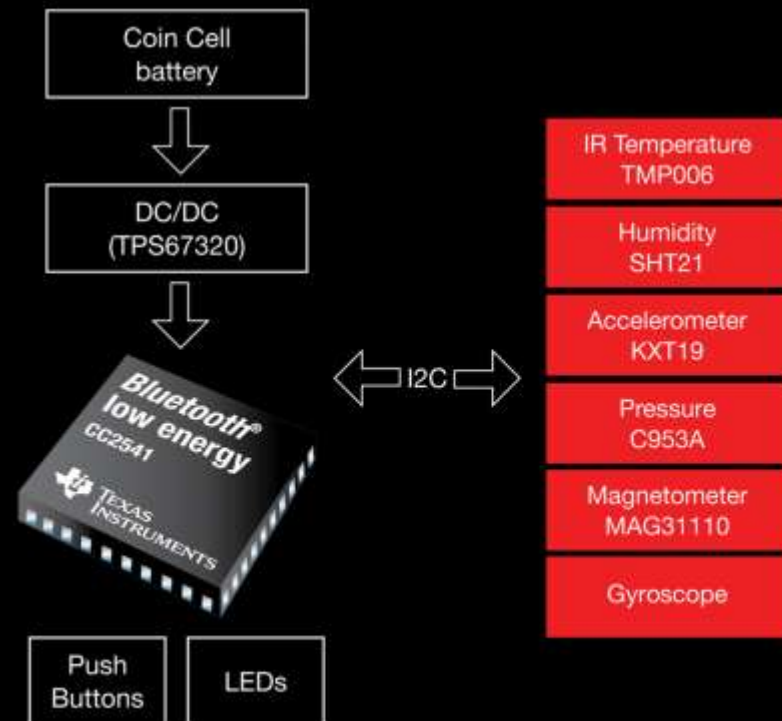
iPhone
adapter



Bluetooth® low energy Sensor Tag

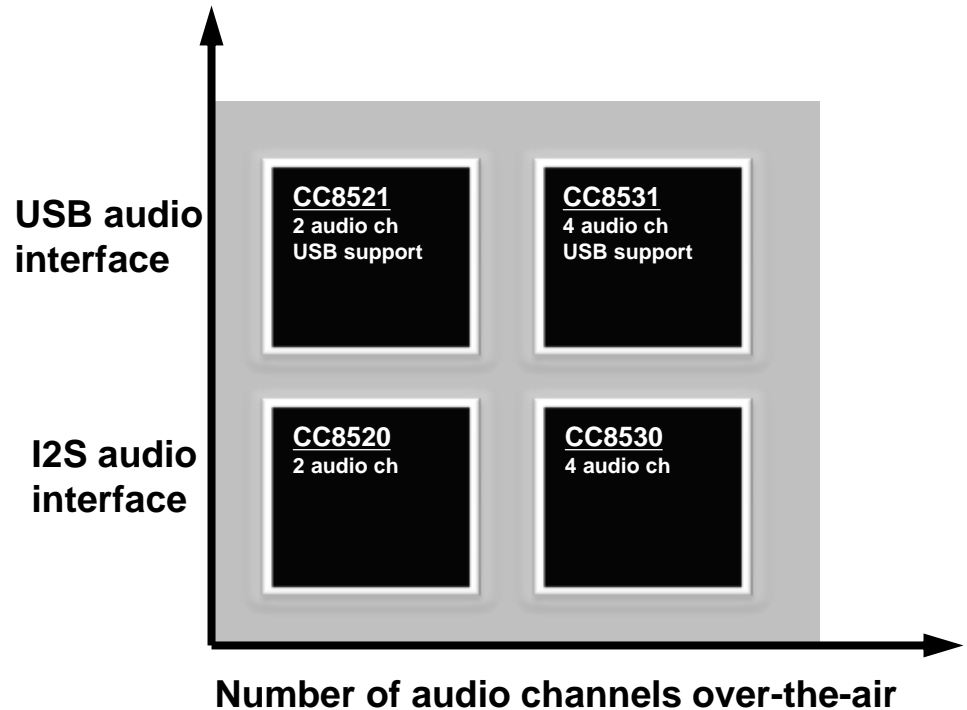


Multi-sensor apps development kit for Android and iOS.



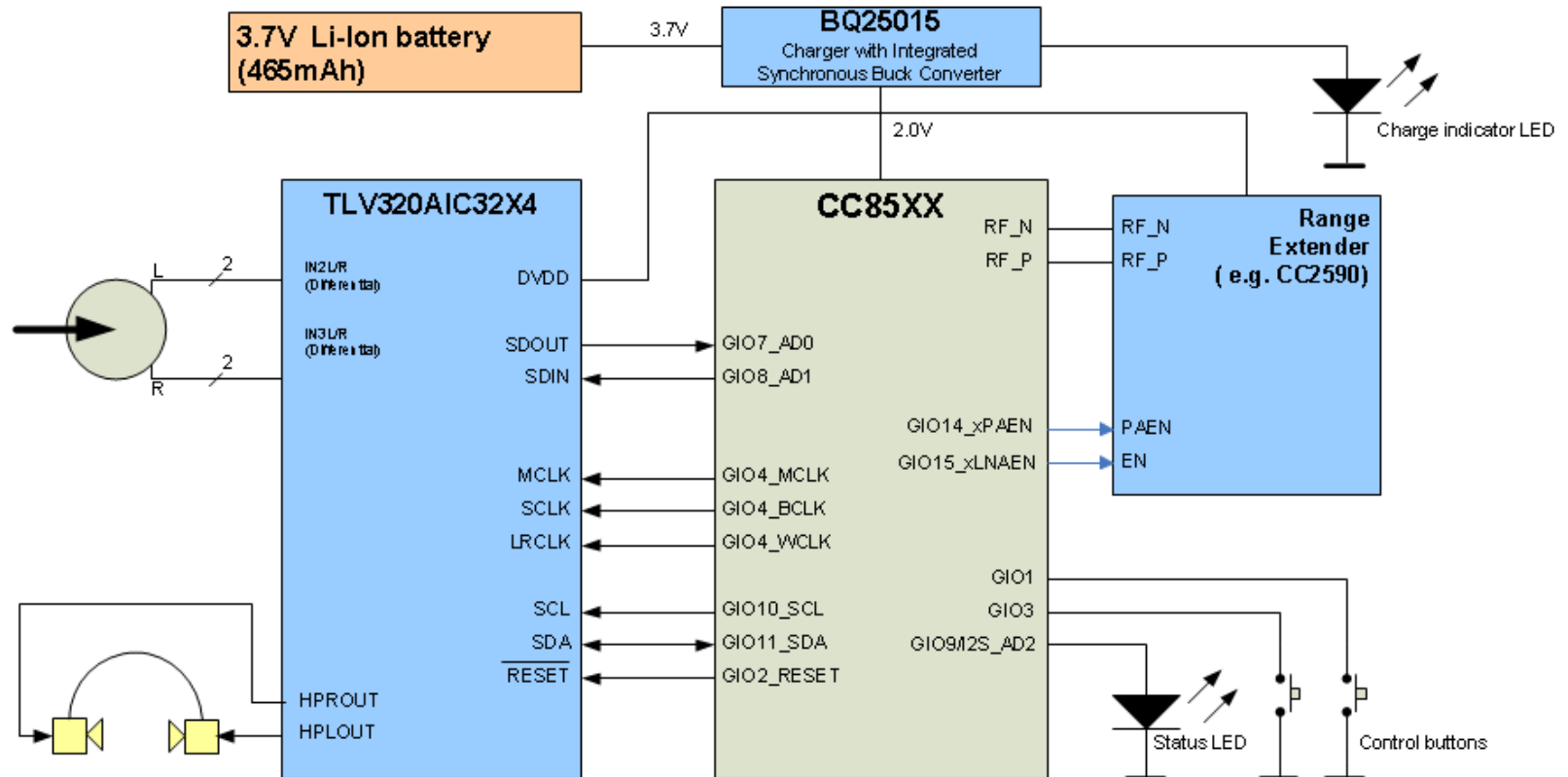
PurePath Wireless family overview

- New CC8521 and CC8531 add USB audio to the PurePath Wireless family
- New firmware (FW1.2.0) released together with the two new RF devices
- No code development or in-depth understanding of USB standard needed for development
- Configuration of USB parameters done in [PurePath Wireless Configurator PC software](#)
- Support for Basic Audio Devices 1.0 Headset and Headphone topology (HT1 and HS1). See help menu in PurePath Wireless Configurator for more details



PurePath Wireless Headphones

Cost-Optimized Block Diagram



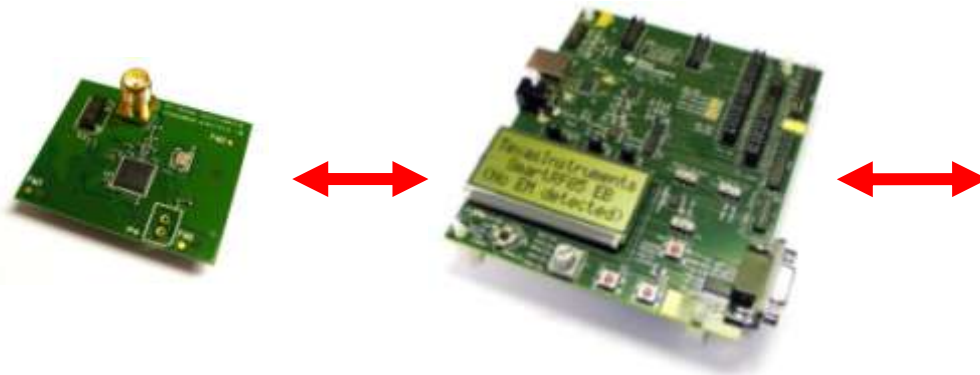
PurePath Wireless CC85xx

Headset Reference Design

- ◆ Demonstrates wireless headset with rechargeable Li-Ion battery
- ◆ Power consumption stereo headphone: 22mA RX slave / 30mA TX master (@3.7V seen from battery. Operating voltage 2.0V for CC8520/CC2590)
- ◆ Board size: 5x3cm with components on 1 side only
- ◆ 22h battery life with 465mah 3.7v Li-Ion battery
- ◆ Electronic bill-of-material for headset board:
 - ◆ [CC8520](#) – wireless audio SoC
 - ◆ [CC2590](#) – integrated LNA and PA
 - ◆ [TLV320AIC3204](#) - Low Power Stereo Audio Codec for Portable use
 - ◆ [BQ25015](#) - Dual Input Charger with Integrated Synchronous Buck Converter



The LPRF Tools Concept



Evaluation Module (EM)

Complete hardware assembly with the reference design for the radio device, ensuring maximum performance.

Evaluation Board (EB)

Contains sockets for the EM. Platform for testing the performance of the radio and for development of prototype software

PC Tools

Connect the EB to the PC and use available tools to test, configure and debug software running on the chip.

The LPRF Tools Concept (Mini Kits)



Application Board

Complete application specific, small form factor prototype board with all you need for experimenting with the device.

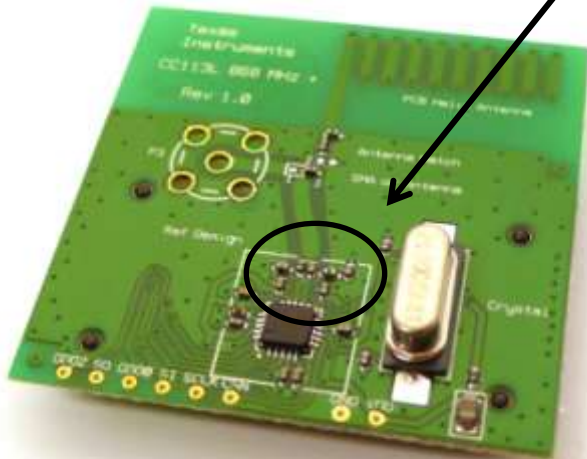
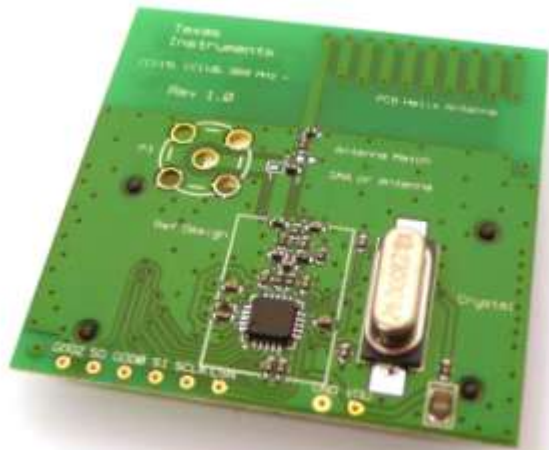
CC Debugger

Debug, Test and Programming probe for the 8051-based SoCs and some selected transceivers

PC Tools

Connect the Debugger to the PC and use available tools to test, configure and debug software running on the chip.

868/915 MHz ref design with antenna



New reference designs for low cost and high performance

RX only design with reduced component count

Very compact PCB antenna optimized for use with Value Line. Full report with 3D radiation patterns and efficiency measurements available

Same layout type PCB antenna also on 433 MHz ref design

Antenna Evaluation Kit



CC-ANTENNA-DK
Price \$49

Antenna reference designs (PCB, Chip and Wire antennas)

13 low cost antennas and 3 calibration boards.

Frequency ranges from 136 MHz to 2.48 GHz.

See also DN031

www.ti.com/lit/swra328

TPS62730

100mA DC/DC solution with Bypass Mode



Features

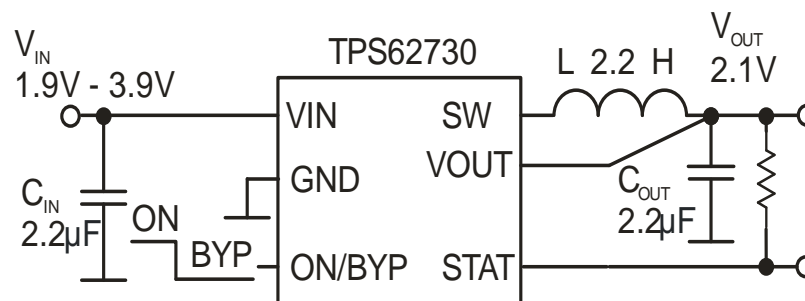
- Selectable or Automatic Transition from DC/DC to bypass mode
- Up to 95% Efficiency, 25uA (typ.) Quiescent Current and 30nA (typ.) Shutdown Current
- Excellent low Output Voltage Ripple
- DCS-Control™ topology
- Package: 1mm x 1.5mm QFN and 0402 caps, 0603 inductor

Applications

- Any RF application like BLE (Bluetooth low energy), ZigBee, proprietary, etc
- MSP430 and alike controller supply
- HVAC (Heating, Ventilating, and Air Conditioning)
- Metering
- Smoke Detectors

Benefits

- Extends application run time by up to 20%
- Support reduction of total power consumption from battery
- Makes this device ideal for RF applications
- Enables seamless transition into Power Save Mode and excellent transient and AC load regulation
- Small external components and small IC package allow for solution size of <12mm²



TPS62730EVM-726

Getting Started

To learn more information about the **industry's broadest wireless portfolio**, please see:

- Wireless Connectivity Selection Guide
www.ti.com/wirelessconnectivityguide
- Ask an engineer:
<http://e2e.ti.com/forums>
- TI Connectivity Wiki:
www.ti.com/connectivitywiki
- TI Wireless Connectivity Portal
www.ti.com/wireless

