Wireless Solutions

Texas Instruments Broad Array of Wireless Connectivity Solutions
Session 5 – Rochester Tech Day

Chris Yorkey, DFAE, Upstate-NY
November 13, 2015
Agenda

• Introduction to TI Embedded Processing Portfolio
• NFC/RFID
• BT/BLE
• Sub 1GHz
• Zigbee / 802.15.4
• 6LoWPAN / IP Mesh
• Wi-Fi / 802.11
• WiLink Combo Devices
Connected Devices: a Growing Market

24 BILLION CONNECTED DEVICES Anticipated by 2020

- Wearables
- Home automation
- Lighting
- Appliances
- Sports equipment
- Telehealth
- Industrial
- Automotive
- Electronic shelf
- Remote control toys

Texas Instruments
# Texas Instruments Wireless Connectivity

## Wireless Connectivity Portfolio

<table>
<thead>
<tr>
<th>Proximity</th>
<th>Personal area networks</th>
<th>Local area networks</th>
<th>Neighborhood area networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC RFID Identification</td>
<td>Bluetooth® LE Personal Connection</td>
<td>ZigBee® RF4CE Mesh</td>
<td>Wi-Fi® Existing Infrastructure</td>
</tr>
<tr>
<td>Up to 848Kbps</td>
<td>No battery to coin cell</td>
<td>Up to 1Mbps Coin cell</td>
<td>Up to 16Mbps (UDP) AA battery</td>
</tr>
<tr>
<td>Up to 3Mbps Coin cell to AAA</td>
<td>Up to 1Mbps AAA battery</td>
<td>Up to 1Mbps</td>
<td>Up to 110Mbps (UDP) Co-existence</td>
</tr>
</tbody>
</table>

## Key Differences

- **Up to 848Kbps**
- **No battery to coin cell**
- **Up to 3Mbps**
- **Coin cell to AAA**
- **Up to 1Mbps**
- **Coin cell**
- **Up to 1Mbps**
- **AAA battery**
- **Up to 1Mbps**
- **AAA battery**
- **Up to 16Mbps (UDP)**
- **AA battery**
- **Up to 110Mbps (UDP)**
- **Co-existence**

## Key Attributes

- **• Low / no power**
- **• Diverse apps**
- **• IOP**
- **• Large install base**
- **• In mobile devices**
- **• Customizable to application**
- **• Robust RF**
- **• Standardized mesh**
- **• Large area coverage**
- **• Redundancy**
- **• IPv6 stack**
- **• Mesh**
- **• Ultra low power**
- **• IoT platform**
- **• Existing infrastructure**
- **• High throughput**
- **• Longest range**
- **• Multi-Radio Co-existence**
- **• Robust RF**

## Range

- **cm**
- **Up to 100m**
- **km**
TI Wireless Connectivity Portfolio: The Broadest in the Industry

**THE Largest Selection**
Support for all key technologies and standards for industrial, automotive and consumer
A solution for any application. Future proof. Leverage your investment

**THE Lowest Power**
Use a coin cell for multi-year, always-on operation or go battery-less with energy harvesting
Ultra-low power by design

**Strong Design Support**
Quick learning-curve and fast development time with full broad market ecosystem
Software, tools, E2E, certified TI modules, TI Designs, SensorTag

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Connect More with TI
## Portfolio Positioning

<table>
<thead>
<tr>
<th>Smart RF Transceivers</th>
<th>Wireless Network Processors (WNPs)</th>
<th>Wireless Microcontrollers (MCUs)</th>
<th>Wi-Fi Combo Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Smart RF transceivers" /></td>
<td><img src="image" alt="Wireless network processors" /></td>
<td><img src="image" alt="Wireless microcontrollers" /></td>
<td><img src="image" alt="WiLink™ Combo Wi-Fi + Bluetooth/BL" /></td>
</tr>
</tbody>
</table>

### Existing Products – proven foundation of millions of devices shipped in the market

- **SimpleLink™**: Broad offering of RF transceiver, wireless network processors and wireless microcontrollers
- **WiLink™**: High performance Wi-Fi + Bluetooth/BLE combo devices

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[Company Logo]"
# NFC – Near Field Communications
Short Range, Low Cost, Low Data Throughput

## Value Propositions
- **Flexibility to design with:** proven and robust deployed solutions: static tags, Reader/Writer, NFC Transceiver, Dynamic tag and Sensor Tag (integrated with MSP430 microcontroller), low cost tools
- **Ideal Short Range solution:** up to 10cm or so
- Deep roadmap with more integration, lower power, MCU core, FRAM storage/datalogger memory

## Products
- **NFC Solutions**
  - TRF796x Reader/Writer
  - TRF797x NFC Xcvr
  - RF430CL33x Dynamic Tag
  - RF430FRL15x Sensor Tag
  - RI/RF-xxx Static Tags
- **Apps developer tools**
- **Broad TI Designs portfolio**

## Features
- **Active and Passive Mode Operation:** Peer-to-Peer, Reader/Writer, Card Emulation
- **Frequency Band:** 13.56MHz (ISM Band)
- **Data Rates:** 106-424Kbps
- **NFC Spec standard ISO/IEC, ETSI, ECMA**
- **ISO14442A/B, ISO18092, ISO21481**

## Applications
- **Consumer, POS**
- **Health & Medical**
- **Automotive, Industrial**
PaLFI – Passive Low Frequency Interface
Short Range, Low Throughput, Completely Battery-less Operation

<table>
<thead>
<tr>
<th>Value Propositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>eZ430-TMS37157 evaluation kit</td>
</tr>
</tbody>
</table>

- **Technology Summary**: PaLFI Passive Low Frequency Interface Device enables short-range two-way communication without the need of a battery by harvesting the RF energy transmitted from a nearby RF base-station.
- **Integration**: combines a LF RFID transponder with EEPROM memory and SPI interface to connect to external microcontroller.

### Products
- **PaLFI Solutions**
  - TMS37157 Transponder
  - Interface device
  - TMS3705 Transceiver IC
  - Base Station
- **Apps developer tools**
- **Broad TI Designs portfolio**

### Features
- **Active and Passive Mode Operation**:
  - Frequency Band: 134.2KHz
  - Range: up to ~1 meter
  - Ultra low power: 70uA active, 50nA standby
  - Data Rates: 8Kbps
  - 16-pin QFN package type

### Applications
- **Battery**
- **Health & Medical**
- **Industrial**
**Single Mode – Bluetooth Smart (BLE)**
**Low Power, Low Latency, Low Throughput**

<table>
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<th>Value Propositions</th>
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<tbody>
<tr>
<td>Large Tools and ref designs Ecosystem</td>
</tr>
<tr>
<td>• Easiest to design with: proven and robust BT 4.1 compatible stack with over the air capability (100 Million devices shipped), RTOS and low cost tool</td>
</tr>
<tr>
<td>• The lowest power: multi-year operation on smaller coin-cell</td>
</tr>
<tr>
<td>• The most Integrated: single chip wireless MCU, integrated flash, small package, strong roadmap with more integration, lower power, Cortex M</td>
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<table>
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<tr>
<th>Products</th>
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<tbody>
<tr>
<td>• SimpleLink™ Wireless MCU</td>
</tr>
<tr>
<td>• Flash based wireless MCU</td>
</tr>
<tr>
<td>• CC2540 (USB interface)</td>
</tr>
<tr>
<td>• CC2541 (I2C interface)</td>
</tr>
<tr>
<td>• CC2540T (up to 125°C)</td>
</tr>
<tr>
<td>• CC2640 (ARM core)</td>
</tr>
<tr>
<td>• Apps developer tools</td>
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<td>• Broad TI Designs portfolio</td>
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<table>
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<th>Features</th>
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<tr>
<td>• Lowest Power down to 1/10th of BT Classic</td>
</tr>
<tr>
<td>• Run BT stack and application on one single chip down to 6x6mm QFN package</td>
</tr>
<tr>
<td>• Bluetooth 4.1 compatible</td>
</tr>
<tr>
<td>• Industrial and ext temp range: -40 to 85°C and 125°C + Auto qual. option</td>
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<th>Applications</th>
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<tr>
<td>• Home &amp; Building</td>
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<tr>
<td>• Health &amp; Medical</td>
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<tr>
<td>• Remote</td>
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</table>
# Dual-mode Bluetooth (Classic + BLE)

Bluetooth connection across any end point; bridge between BLE and Classic

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<tr>
<td><strong>Tools/Modules/TI Designs</strong></td>
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</table>

- **Best Performance**: reliable connection over a long range (100m) with optimized power consumption
- **Flexible**: connect to any host (MCU or processor)
- **Most proven solution**: 300 millions devices shipped, robust royalty free SW, solution available for broad market
- **FCC, IC, CE & Bluetooth SIG Fully Certified module**

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<tbody>
<tr>
<td>Smart RF transceivers</td>
</tr>
<tr>
<td>• CC2560 (Classic only)</td>
</tr>
<tr>
<td>• CC2564 (Classic + BLE)</td>
</tr>
<tr>
<td>• Pin-to-pin compatible</td>
</tr>
<tr>
<td>TI modules</td>
</tr>
<tr>
<td>• CC2564MODN</td>
</tr>
<tr>
<td>3 Parties Modules</td>
</tr>
<tr>
<td>Audio TI Designs (sink and source)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Features</th>
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<tbody>
<tr>
<td><strong>Performance</strong> over long range (100m) with throughput up to 3Mbps</td>
</tr>
<tr>
<td><strong>Connect</strong> to any MCU or processor</td>
</tr>
<tr>
<td><strong>BT stack</strong> runs on external host</td>
</tr>
<tr>
<td>Bluetooth 2.1 +EDR/ BT 4.0</td>
</tr>
<tr>
<td>Fully cert.module (FCC, IC, CE, BT)</td>
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<th>Applications</th>
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<tr>
<td><strong>Embedded audio</strong></td>
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<tr>
<td>• Heath and medical care</td>
</tr>
<tr>
<td><strong>Mobile accessories</strong></td>
</tr>
<tr>
<td><strong>Toys</strong></td>
</tr>
</tbody>
</table>
# Sub-1 GHz Performance and Value RF Products

## Industrial 169/ 315/ 433/ 470/ 868/ 915/ 920 MHz solutions

## Value Propositions

- **Longest real-world range**: Beyond 25km range, full-building to city-wide RF coverage
- **Robust low-power communication**: Less retransmissions of RF packets means less power consumption in the application
- **Supports more standards**: 6LoWPAN, 802.15.4g, WiSun, wM-Bus, ETSI Cat 1, FCC Part 90 and more

## Products

- Smart RF transceiver
  - [CC1120, CC110L](#)
- Smart RF transceiver for 802.15.4g
  - [CC1200, CC13xx](#)
- Wireless MCUs
  - [CC430, CC1110, CC1111](#)
- Software stacks
  - Free SimpliciTI software stack
  - wM-Bus software

## Features

- High sensitivity & narrowband support, the de facto standard for long range communication
- Advanced wavematch receiver gives best selectivity and blocking including low power sniff mode
- Low-power RX sniff mode enable automatic duty-cycling of the receiver
- SmartRF tools enable fast RF testing

## Applications

- Wireless meter reading
- Alarm and security
- Home, building and industrial automation

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[CC1120, CC110L](#): Link to the product page

[CC1200, CC13xx](#): Link to the product page

[CC430, CC1110, CC1111](#): Link to the product page

Free SimpliciTI software stack: Link to the product page

wM-Bus software: Link to the product page
## ZigBee / 802.15.4
Lowest power, large secure mesh network, easiest to use

### Value Propositions

- **The lowest power**: Multi-year operation on small coin-cell
- **Robust and standardized mesh network**: Connect up to 100s of nodes in industrial setting
- **Easiest to design with**: Proven and robust ‘copy paste’ kits, reference designs together with Golden Unit software stack

### Products

- Wireless MCUs
  - **CC2530 + CC2531** (with USB)
  - **CC2538** (Large memory)
  - **CC2630** (ARM Core)
- Range extender
  - **CC2592** (Extends range)
- **Z-Stack**: Royalty-free and robust TI ZigBee stack

### Features

- Run Z-Stack and application on one single chip
- USB interface
- Over-the-air software update capability
- Industrial temp range: -40 to 125 C
- Golden unit software as part of the standard for ZigBee Home Automation and ZigBee Lighting

### Applications

- Home automation
  - Comfort
  - Security
  - Energy efficiency
- Lighting networks
  - Lights
  - Switch/sensor
- Mesh / IP-to-ZigBee gateways
6LoWPAN / IP Mesh
IP cloud connection, largest network, longest range

Value Propositions

- **IP cloud connection:** Complete solution from end nodes through edge router to the cloud
- **Large and secure mesh network:** Connect up to 1000s of nodes
- **Longest range:** Sub-1 GHz solution for city-wide network

Products

- Wireless MCUs
  - **CC2538** (high performance 2.4GHz)
  - **CC1200** (Sub-1 GHz long range)
  - **CC2630/CC1330** (ARM Core)
- Range extender
  - **CC2592** (Extends range)
- Contiki software: Open source solution

Features

- Complete solution for both 2.4 GHz and Sub-1GHz
- An edge router connects the 6LoWPAN network to IP applications. No gateway needed
- Robust Mesh routing (self-healing)
- Can achieve multi-year operation on a coin-cell battery

Applications

- Internet of Things (IoT)
- Home and building automation
- Safety and security
- Low-power sensor networks
# SimpleLink™ Wi-Fi® Platform

Lowest power, programmable wireless MCU, easiest to use

## Value Propositions

- **The lowest power**: Run for over a year on two AA batteries
- **First single chip programmable Wi-Fi solution**: Add Wi-Fi to any system
- **Easiest to design with**: No Wi-Fi experience needed; HW designs, 30+ software examples, extensive documentation and TI E2E support forum all readily available

## Products

<table>
<thead>
<tr>
<th>CC3200 (Wireless MCU)</th>
<th>CC3100 (Internet-on-a-chip Wi-Fi network processor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Integrated ARM Cortex-M4 MCU + Wi-Fi network processor</td>
<td>• Embedded TCIP/IP stack</td>
</tr>
<tr>
<td>• First programmable single chip Wi-Fi solution</td>
<td>• Connect any MCU to the Internet of Things</td>
</tr>
</tbody>
</table>

## Features

- On-chip Internet & Wi-Fi security
- Wireless MCU separate from TCP/IP Stack, free for customer applications, Cloud support
- Flexible provisioning such as SmartConfig, WAC, & AP Mode
- FCC/CE/ETSI certified modules
- SDK for development (CCS / IAR)

## Applications

- Internet of Things (IoT)
- Home automation & appliance
- Safety and security
- Smart energy
- Industrial M2M communication
- Wireless audio streaming
**WiLink™ Combo RF Solutions**  
High-performance Wi-Fi + Classic Bluetooth/BLE RF transceivers

### Value Propositions

- **Tools/modules for easy development**
  - RF transceivers
    - WL18xx transceivers
  - TI modules
    - WL1801MOD
    - WL1805MOD
    - WL1831MOD
    - WL1835MOD
    - WL1837MOD
  - 3rd party modules

- **Features**
  - Combo dual-mode Bluetooth + Wi-Fi on a single chip
  - Performance over long range
  - Connect to processors (high level OS) and MCUs running the stack
  - Industrial temp -40 to 85 C
  - 2.4 GHz and 5 GHz support
  - Fully-cert.module(FCC, IC, CE, BT)

- **Applications**
  - Embedded wireless audio
  - Gateways
  - Industrial panel/ HMI
  - Remote control
  - Professional camera
  - Wearable

### Products

- RF transceivers
- TI modules
- 3rd party modules

- **Features**
  - Performance and low power: 100Mbps with the lowest power (800uA IDLE)
  - Certified and easy to use: Pre-integrated, certified, production ready solutions, software downloadable. Open documentation (Wiki), forums (E2E), TI and 3rd party network
  - Integrated and scalable: Single chip, multi-combo with pin-to-pin compatible variants, consumer, industrial and automotive grade (Q100)
TI Value Proposal per technology and targeted applications

**Bluetooth low energy (BLE):**
- Easiest to use, Low power, Integration
  - Control applications through smartphone/tablet
  - Moving to industrial, automotive markets, extended temp
- Cortex M MCU integrated, Easiest to use, Low Power
  - Home and enterprise, audio, wearable, Internet of Things (IoT), home automation, security

**WiFi:**
- Longest Range, Robust, Low Power
  - Proprietary and open, protocols (e.g. 6LoWPAN)
  - Metering, security systems, home automation

**Sub-1GHz:**
- Lowest Power, Robust and standardized mesh network, easiest to design with
  - Home automation, Lighting Networks, Generic mesh Ip-to-ZigBee Gateways
- IP cloud connection, Large and secure mesh network, Longest range
  - IoT, Home and building automation, Safety and security, Low power sensor networks

**ZigBee™:**
- Easiest to use, Low power, Integration

**6LoWPAN:**
- Longest Range, Robust, Low Power

**And More…**
- IEEE 802.15.4
- NFC
- GPS
- RFID
- 6Mesh
## Wireless Connectivity TI Designs per Technology

<table>
<thead>
<tr>
<th>Bluetooth® Smart / Bluetooth® Dual Mode</th>
<th>WiFi®</th>
<th>ZigBee®</th>
<th>Sub-1 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485 Light Harvesting</td>
<td>Wi-Fi® Camera</td>
<td>Network Range Extender</td>
<td>RF Layout Reference Design for 420-470 MHz</td>
</tr>
<tr>
<td>Mini Broadcaster</td>
<td>Audio Streaming</td>
<td>Home Automation Gateway</td>
<td>RF Layout Reference Design for 868-930 MHz</td>
</tr>
<tr>
<td>Heart Monitor</td>
<td>USB Dongle</td>
<td>Light Link Development Kit</td>
<td></td>
</tr>
<tr>
<td>Optical Heart Rate</td>
<td>Audio Sink/Source</td>
<td>Low End In-Home Display</td>
<td></td>
</tr>
<tr>
<td>Pulse Oximeter</td>
<td>CC256x EM</td>
<td>CC2538 EM</td>
<td></td>
</tr>
</tbody>
</table>
Wireless Focus Technologies

Bluetooth low energy-CC2541/CC2640
Easiest way to connect to iOS and smartphones

- TI SensorTag
- Smartphone w/BLE
- TI App

Get TI's SensorTag + App on your phone today!
www.ti.com/sensortag

Wi-Fi / CC3100/3200 SimpleLink
Wi-Fi connect any product in one day

- Dev Kit
- Any Smartphone

Self-contained wifi solution, SmartConfig for pairing
Easiest way to deploy wifi in a product
www.ti.com/wifi

Bluetooth + Bluetooth low energy CC256x Family
new module CC2564MODN
Flexible, Best in class performance, low cost
Bluetooth dual mode – Audio and Long Range
www.ti.com/bluetooth

Sub1-GHz / CC1200, CC110L
Low-cost full house RF coverage

- Smart RF Studio, Packet Sniffer, Link Test
- Tools to make RF development easy
www.ti.com/rfvalueline

ZigBee Light Link / CC2530/8, CC2630
Complete solution for wireless lighting
Wireless Lighting with TI is winning the market!
www.ti.com/zigbee

All technologies support Internet-of-Things!
2015 Platform Roadmap
Two platforms support all 5 major standards

**BLE, <1GHz, ZigBee, 6LoWPAN**
- **CC13xx**
  - <1GHz Smart RF with integrated ARM M3 MCU
  - Proprietary, 6LoWPAN
- **CC26xx**
  - 2.4GHz Smart RF with integrated ARM M3 MCU
  - BLE, 6LoWPAN

Launched Q1/2015

**Wi-Fi**
- **CC3100**
  - Smart Wi-Fi solution
  - Low power, easy connection to an MCU
- **CC3200**
  - Smart solution
  - Wi-Fi with integrated ARM M4 MCU

Launched Q3/2014
CC26xx / CC13xx Multi-Core RF SoC

Ultra-low Power Consumption
- 70 μA/MHz ARM Cortex M3
- 1 μA sleep with retention
- 2.4 GHz:
  - 6.5 mA RX
  - 6.5 mA T.X @ 0 dBm
- Sub-1GHz:
  - 5.5 mA RX
  - 12 mA TX @ +10 dBm
- Sub-1mA RX SniffMode

SoC Key Features
- Autonomous Sensor Controller
- 4x4 mm to 7x7 mm QFN
- Flash-based
- 1.65 - 4.2V Supply Range

RF Key Features
- 2.4 GHz (CC26xx)
  - +5 dBm output power
- 315-950 MHz (CC13xx)
  - +14 dBm output power
## Introducing CC2630

TI introduces the next generation platform for low power mesh networks and IoT applications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Easiest cloud connectivity** | - End to end solution from sensor to cloud  
- Get-Started Documentation and reference design  
- Integrated Design Kits  
- Low-cost Tools  

*Plug-in connectivity to the cloud in 10 minutes* |
| **Lowest Power** | - ~6.1 mA Radio peaks and 1uA Sleep  
- 61µA/MHz ARM Cortex M3  
- <30 mAms avg. charge for polling operation  
- Sensor Controller Engine (SCE)  

*Average system current consumption 2x better than competition* |
| **Easiest mesh plug-in** | - 4x4 QFN  
- On-Chip Flash  
- Network processor  
- Integrated DCDC  
- Cross-platform portable SW framework  

*Compact system design for bolted-on wireless connectivity* |
Introducing CC1310
TI introduces the next generation sub-1GHz family

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

<table>
<thead>
<tr>
<th>Longest Range</th>
<th>Lowest Power</th>
<th>Most Integrated</th>
</tr>
</thead>
</table>
| • High sensitivity  
  • -110dBm @ 50kBit  
  • -121dBm @ 2.4kBit  
  • Strong co-existence | • ~6mA Radio RX peak current  
  • 61µA/MHz ARM Cortex M3  
  • 700nA sleep current w/RTC + full retention  
  • Sensor Controller Engine (SCE) | • 4x4 QFN  
  • On-Chip Flash  
  • Single Ended Output  
  • Integrated DCDC |

| Full-building to city-wide RF coverage | Up to 20 year battery life for flow meters and sensor nodes | Complete 315 / 433 / 470 / 868 / 915 / 920MHz wireless MCU on a finger-tip size |

«Exceptional combination of low power and high RF performance in a tiny package»
Deep dive into CC3100 & CC3200

Two pin compatible products based on the same Wi-Fi network processor

**CC3100 Internet on a chip**
Wi-Fi Network Processor
Embedded TCP/IP stack for systems using external low-cost MCU

**CC3200 Internet on a chip + MCU**
Wireless MCU
80MHz ARM® Cortex™-M4 integrated + Wi-Fi network processor

Same Core
Bringing Wi-Fi power to a new low

Always Connected
- 120uA sleep current while connected to the network
- 37 mA Rx listen current for beacon reception
- Long Sleep Intervals up to 2 seconds (typical wake up is every 100mSec)

Intermittently Connected
- 4 uA hibernate current, with multiple wake up sources
- 95 mSec wake up time from hibernate till secure Wi-Fi connection
- 200 mSec TLS connection time

*battery life can vary significantly depending on use case and system design*
TI has all of the IoT system building blocks

- **Nodes**
  - MCUs
  - Processors
  - Wired & Wireless Connectivity
  - Sensors
  - Power Management
  - Analog Signal Chain

- **Gateway, Bridge or Router**
  - MCUs
  - Processors
  - Wired & Wireless Connectivity
  - Analog Signal Chain
  - Power Management

- **Cloud**
  - Multicore Processors
  - Analog Signal Chain
  - Power Management
# Texas Instruments Wireless Connectivity

## Wireless Connectivity Portfolio

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<td>ZigBee® RF4CE</td>
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<td>Identification</td>
<td>Personal Connection</td>
<td>Customizable</td>
<td>Mesh</td>
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<td>Up to 848Kbps</td>
<td>Up to 3Mbps</td>
<td>Up to 1Mbps</td>
</tr>
<tr>
<td></td>
<td>No battery to coin cell</td>
<td>Coin cell to AAA</td>
<td>Coin cell</td>
</tr>
</tbody>
</table>

### Key Attributes

- **Proximity**
  - Low / no power
  - Diverse apps

- **Personal area networks**
  - IOP
  - Large install base
  - In mobile devices

- **Personal area networks**
  - Customizable to application
  - Robust RF

- **Local area networks**
  - Standardized mesh
  - Large area coverage
  - Redundancy

- **Local area networks**
  - IPv6 stack
  - Mesh
  - Ultra low power
  - IoT platform

- **Neighborhood area networks**
  - Existing infrastructure
  - High throughput
  - Robust RF

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**Range**

- cm
- Up to 100m
- km

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[Texas Instruments Wireless Connectivity Logo]
TI Embedded Processing Portfolio

TI Embedded Processors

Code Composer Studio® IDE

Microcontrollers (MCUs)

16/32-bit ultra-low power MCUs
- MSP430/2™
  Up to 25 MHz
  Measurement, sensing, general purpose

32-bit Real-time MCUs
- C2000™
  40 MHz to 300 MHz
  Motor control, digital power, lighting, renew. energy

32-bit ARM® MCUs
- Tiva™ C Series
  ARM Cortex-M4F
  Up to 120 MHz
  Industrial Communication, MicroPLC, IOT, Network Controller, Applications Processor

32-bit ARM® Safety MCUs
- Hercules™
  ARM Cortex-R4F
  Up to 220 MHz
  Safety, transportation, industrial & medical

ARM®-Based Processors

32-bit ARM® Processors
- Sitara™
  ARM Cortex-A8 ARM9™
  Up to 1.35 GHz
  Consumer, industrial, connected home, POS, smart grid, medical

Digital Signal Processors (DSPs)

Singlecore DSPs
- C5000™
  C6000™
  Up to 800 MHz
  Patient monitoring, biometric security, smart e-meter, industrial drives

Multicore processors
- C6000™ DSP and ARM Cortex-A15+
  Up to 10 GHz
  Telecom, medical, mission critical, base stations
Learn More

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

• Wireless on ti.com
  www.ti.com/wireless

• E2E Forum
  www.ti.com/wiconforum

• TI Connectivity Wiki
  www.ti.com/connectivitywiki

• Local Training Offerings
  – 2015 TI Mini Tech Day @ RIT Nov 13th
  – 2016 Technical Seminars @ RIT TBD
  – 2016 TI Power Seminar in Rochester Fall 2016
  – Onsite Trainings available upon request
THANK YOU