# Extending 2.4 GHz without Compromising Performance in a Connected World



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In a world where just about everything is connected, design engineers are always looking for new ways to enable wireless technology without compromising range or performance. Many thermostats or heating, ventilation and air-conditioning (HVAC) controllers have built-in wireless technology, enabling homeowners to communicate with their smart home by simply using their cellphone.

The same principle applies in the industrial space, where business owners or factory operators want the ability to continuously monitor the health and status of their HVAC and other connected systems. This can be achieved using a long-range wireless link rather than expensive and inflexible wired deployments. The 2.4 GHz band uses shorter waves and typically has a shorter transmission range unlike Sub-1 GHz technology.

### Achieving long range

One way to extend range in a 2.4 GHz wireless application is to use a power amplifier (PA) to increase the power at which that the system is transmitting, which in return increases the application's total link budget. To put this in perspective, each +6-dBm increase in link budget doubles the total range of the system in free-space at ideal conditions.

The SimpleLink™ CC2652P microcontroller (MCU) provides an integrated +20-dBm PA, which approximately quadruples the range at 2.4 GHz compared to solutions currently available on the market without an integrated PA which makes it a good fit for industrial settings. This enables the deployment of sensors in remote locations and decreases the number of gateways/routers in your network.

### Flexible design with wireless multiprotocol

Bluetooth-connected devices can extend their connectivity to communicate with and control the latest smart devices but may no longer be sufficient in this age. Many new applications like Thermostats now runs on multiple wireless protocol stacks concurrently to enable support to communicate with cellphones and various smart home devices at the same time.

The SimpleLink CC2652P MCU supports Bluetooth® 5.1 Low Energy, Zigbee, Thread, TI SimpleLink 15.4 (2.4 GHz) and additional simultaneous protocol combinations through a dynamic multiprotocol manager found in the SimpleLink™ CC13x2 and CC26x2 software development kit without the need for additional hardware. The ability to use various combinations of wireless technologies to address system needs can help eliminate wires and enable more flexible system deployments.

#### Low power is essential

Extending a battery-operated device like a wireless temperature and humidity sensor can be vital when you want to ensure years of operation versus just a few months. This example of battery-powered wireless sensor periodically samples and transmits data. A long battery life for such a sensor is especially important in cases where the battery is nonreplaceable or is located in an inaccessible location.

The CC2652P MCU is optimized to power off of a single coin-cell battery with a peak transmission current of 22 mA at +10 dBm. The CC2652P MCU also offers a low-power integrated PA capable of achieving up to +20-dBm output (Tx = 85 mA at 2.4 GHz). Additionally, the CC2652P consumes only 5  $\mu$ A of current at 85°C for low-power industrial applications.

The CC2652P MCU ultra-low-power sensor controller engine is a programmable CPU to create smart sensing applications. The sensor controller engine consumes about 1 µA of system current for a 1-Hz analog-to-digital converter sampling application.

As you can see in Figure 1, all of these factors combine to enable you to meet power-consumption requirements without sacrificing performance across the industrial temperature range.

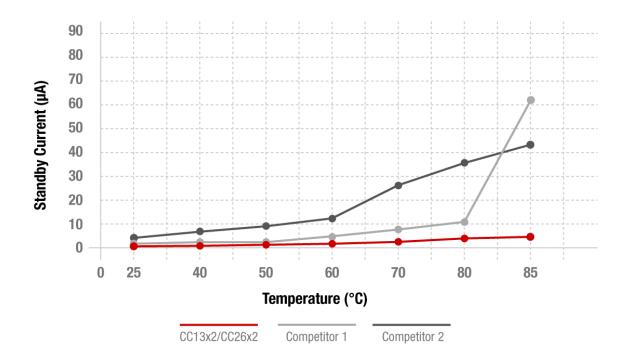


Figure 1. SimpleLink MCU diagram showing standby current consumption



#### Conclusion

As you can see, it is possible to extend range while maintaining solid performance and low power in your wireless design. Wires are expensive, inflexible and in many instances antiquated in our connected world. The SimpleLink CC2652P MCU can help you jump-start your design and achieve a flexible solution with both low power and long range.

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