

*Primex Smart-Sync™ Solution
using Bluetooth®
Low Energy Wireless Technology*

*Discover how Primex leveraged Bluetooth Low Energy and mesh technology
into a smart-synchronized wireless clock system*



INTRODUCTION:

Primex has been a leader in synchronized wireless clocks systems for more than 20 years. And now with our Smart-Sync synchronized time solution, we have revolutionized wireless clock system technology by offering the most advanced solution available today.

The Smart-Sync solution simplifies the management of a wireless clock systems by equipping the system devices with Bluetooth® Low Energy (BLE) technology and Primex, Inc.'s, proprietary clock mesh. By leveraging BLE and mesh technology, the system devices are not dependent on Wi-Fi networks and clocks do not consume network bandwidth.

This white paper summarizes how the Primex Smart-Sync synchronized time solution leverages BLE and mesh technology.

PRODUCT OVERVIEW:

The Primex Smart-Sync wireless clock system uses Bluetooth® Low Energy technology 4.1 (also referred to as Bluetooth 'smart') as the physical layer of wireless communication.

The system devices, including the Smart-Sync bridges, clocks and repeaters, are equipped with Bluetooth Low Energy (BLE) wireless technology that uses the 2.4 GHz ISM band and Adaptive Frequency Hopping.

The Smart-Sync bridge acquires NTP time and passes the time and configuration information to Smart-Sync clocks and repeaters using the system's self-healing, proprietary mesh that is created on top of the BLE physical layer.

The system is bi-directional, which allows the Smart-Sync bridge to receive individual device information over the mesh and then send the information to the Primex OneVue cloud-based application using the HTTPS data encryption protocol. From OneVue, device information can be viewed and device settings can be managed at any time from a web browser on a computer or mobile device.

The system's mesh is a group of Primex Smart-Sync devices communicating and passing information from one device to another till the intended recipient is reached – a Smart-Sync Bridge.

The Smart-Sync Bridge is the only device that connects to an Ethernet network resulting in very low network bandwidth consumption.

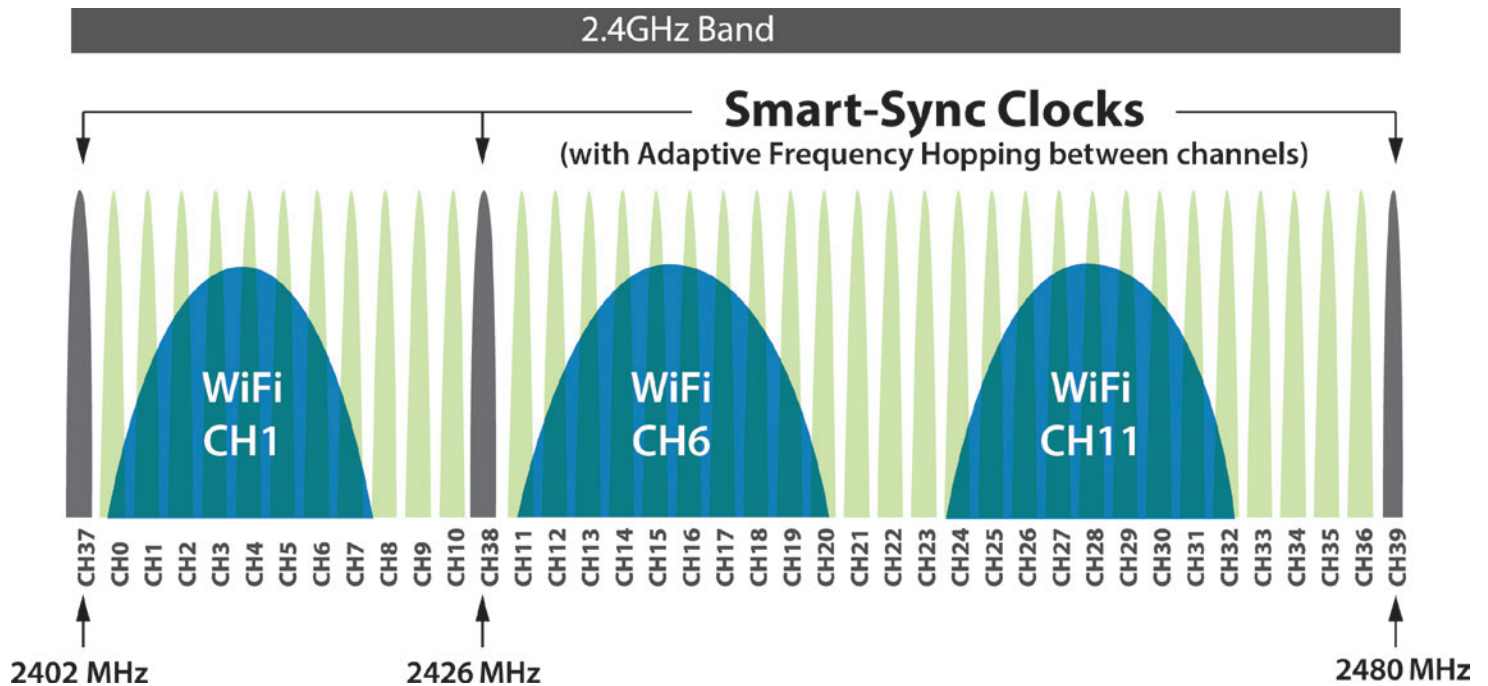
The Smart-Sync Repeater is a low cost system device that extends coverage of the system's mesh when needed.

BLUETOOTH LOW ENERGY TECHNOLOGY RADIO FREQUENCY (RF) DETAILS:

The 2.4 GHz ISM band extends from 2402 MHz to 2480 MHz. Bluetooth Low Energy devices advertise on channels 37, 38 and 39. Wi-Fi (IEEE 802.11) uses a different channel/modulation scheme and typically uses channels 1, 6, and 11. The diagram on the following page illustrates both the BLE channels (green) and Wi-Fi channels (blue).

BLE technology also employs Adaptive Frequency Hopping, which is built into the Nordic chipset used in Smart-Sync devices, to detect any potential Radio Frequency (RF) conflicts and transmit on a free channel. Adaptive Frequency Hopping minimizes interference from other technologies in the 2.4 GHz ISM band.

Broadcast traffic for the Smart-Sync devices consists of advertising packets on channels 37, 38 and 39. Bridges and some repeaters advertise continuously. Clocks advertise every 5 minutes. These advertisements allow new Smart-Sync devices to connect to the system. Data communication occurs once a day for up to 12 minutes. The rest of the time, the clocks' Bluetooth radios are off with no RF energy being transmitted.



WHAT MAKES THE SMART-SYNC SOLUTION WITH BLUETOOTH LOW ENERGY TECHNOLOGY UNIQUE:

The Primex Smart-Sync solution with Bluetooth Low Energy and mesh technology is secure, dynamic, and self-healing. Our solution has one of the easiest deployment and system management process available in the wireless clock system market today.

- **Mesh:** The system's mesh is proprietary and is based on a Nordic mesh that does not provide for internet protocol (IP) transmission.
- **Device Power Consumption:** Bluetooth Low Energy focuses on wireless data transfer with ultra-low power consumption. This low power consumption is achieved by shorter communication times and quick connections managed by scheduled communication, and lower output power when transmitting data. The BLE radio within Smart-Sync clocks and repeaters has a maximum output power of +4 dBm (2.5 mW), typical is 0 dBm. When at rest, the BLE radio is powered off to conserve battery life.
- **No Single Point of Failure:** One crucial advantage the system's mesh holds over comparable technologies is that there is no Single Point of Failure - the mesh is self-healing. In that, if one device fails other devices will "find their way home" to the strongest BLE signal. Primex Smart-Sync devices intelligently reroute to form their communication path to another device within the mesh.
- **Plug-and-Play:** Smart-Sync clocks and repeaters are easy to install. They do not require network wiring or setting configuration to connect to the system, resulting in a genuine "plug-and-play" solution.
- **Scheduled Communication:** Once a day, the system's mesh builds - lasting up to 12 minutes, but it is typically much quicker. Before the daily mesh build, the bridge automatically connects to OneVue to download Smart-Sync device configuration data, allowing devices to receive configuration data during the mesh build. After the mesh build, the bridge then automatically sends received device statuses and diagnostic information to OneVue. Customers cannot request a specific mesh build schedule, as Primex must manage and balance device data load across the entire OneVue cloud-based platform.

BLUETOOTH LOW ENERGY TECHNOLOGY IN HEALTHCARE:

One of the advantages of Bluetooth Low Energy technology over other wireless technologies is the very low power aspect of the technology. The BLE low power consumption allows devices to be powered by very small batteries or ensure very long intervals between battery changes for devices using standard form factor batteries. In addition, the RF power output of BLE devices is low relative to other widely adopted technologies such as Wi-Fi.

The significance of this in the healthcare and fitness industry is that a number of new products are entering the market that eliminate cables or provide battery operated solutions. Some examples of Bluetooth Low Energy technology-enabled medical and health products include the 3M Littmann® Electronic Stethoscope Model 3200; iHealth Gluco-Monitoring System; Onyx II wireless pulse oximeter from Noni, and Withings Wireless Scale. These and other devices can automatically transmit the data to a smartphone, tablet or computer.

SUMMARY:

Smart-Sync from Primex is a cost-effective, wireless clock system riding on the Bluetooth Low Energy wireless technology standard that dramatically improves every aspect of the user experience. The advantages of the Smart-Sync solution are vast. The system's mesh is proprietary - specific to Primex Smart-Sync devices. While Smart-Sync devices use the 2.4 GHz frequency band, there are no conflicts with Wi-Fi or other devices because of the channels used combined with Adaptive Frequency Hopping technology. Smart-Sync devices connect to the mesh once per day for up to 12 minutes and once every 5 minutes for 1.5 seconds to search for and add new devices to the system. When awake, the RF output is extremely low at only +4 dBm (2.5 mW) - the remainder of the time the system is off with no RF energy being transmitted.

ABOUT BLUETOOTH® WIRELESS TECHNOLOGY:

Bluetooth technology is the global wireless standard for simple, secure connectivity. Propelled by a global community of nearly 30,000 companies, Bluetooth serves to unify, harmonize, and drive innovation in the vast range of connected devices all around us. Through collective creation and shared technical standards, Bluetooth simplifies, secures and enriches the technology experience of users worldwide. Find out more at www.bluetooth.com.

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