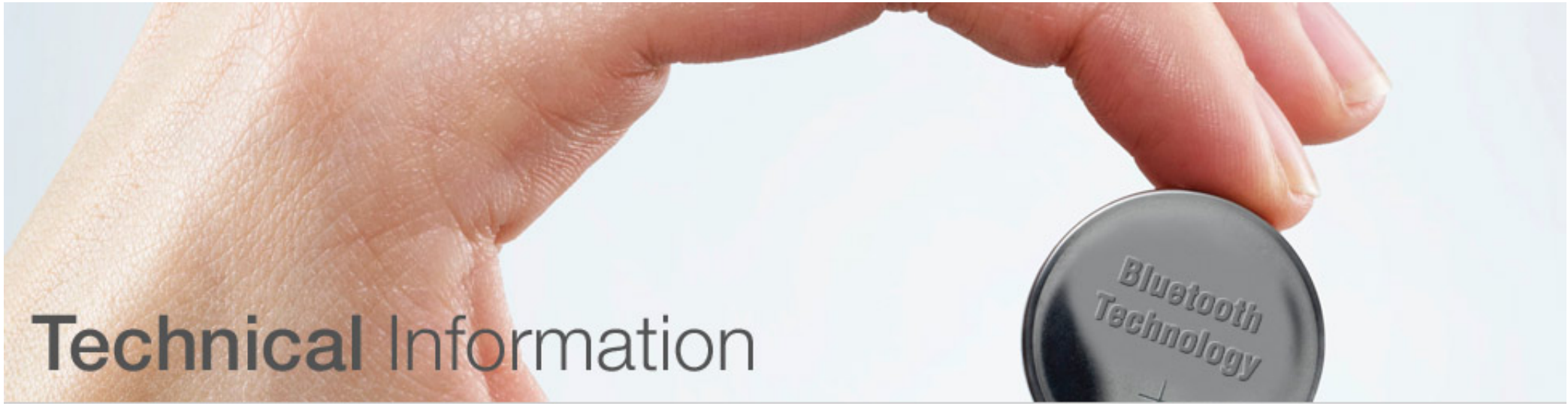

The Low Energy Technology Behind Bluetooth Smart

Thanks to its innovative design, *Bluetooth*® Smart technology consumes only a fraction of the power of Classic Bluetooth radios. Bluetooth Smart extends the use of Bluetooth wireless technology to devices that are powered by small, coin-cell batteries such as watches and toys. Other devices such as sports & fitness, health care, keyboards and mice, beacons, wearables and entertainment devices are enhanced by this version of the technology. In many cases, it makes it possible to operate these devices for more than a year without recharging.

As with previous versions of the specification, the range of the radio may be optimized according to application. The majority of Bluetooth devices on the market today include the basic 30 foot, or 10 meter, range of the Classic Bluetooth radio, but there is no limit imposed by the Specification. With Bluetooth Smart, manufacturers may choose to

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Bluetooth

optimize range to 200 feet and beyond, particularly for in-home sensor applications where longer range is a necessity.

Bluetooth Smart features provides:

- Ultra-low peak, average and idle mode power consumption
- Ability to run for years on standard coin-cell batteries
- Lower implementation costs
- Multi-vendor interoperability
- Enhanced range

This enhancement to the Bluetooth Core Specification allows two types of implementation, dual-mode and single-mode. In a dual-mode implementation, Bluetooth low energy functionality is integrated into an existing Classic Bluetooth controller. The resulting architecture shares much of Classic Bluetooth technology's existing radio and functionality resulting in a minimal cost increase compared to Classic Bluetooth technology. Additionally, manufacturers can use current Classic Bluetooth technology (*Bluetooth* v2.1 + EDR or Bluetooth v3.0 + HS) chips with the new low energy stack, enhancing the development of Classic Bluetooth enabled devices with new capabilities.

Single-mode chips, which will enable highly integrated and compact devices, will feature a lightweight Link Layer providing ultra-low power idle mode operation, simple device discovery, and reliable point-to-multipoint data transfer with advanced power-save and secure encrypted connections at the lowest possible cost. The Link Layer in these controllers will enable Internet connected sensors to schedule Bluetooth low energy traffic between Bluetooth transmissions.

Registered members of the Bluetooth SIG can access in-depth technical information about Bluetooth low energy technology. (You must be on-line and logged in as a registered member of the SIG to access this link). If you're not a member, register today.

Technical Details

- Data Transfers – Bluetooth Smart (low energy) supports very short data packets (8 octet minimum up to 27 octets maximum) that are transferred at 1 Mbps. All connections use advanced sniff-sub rating to achieve ultra low duty cycles
- Frequency Hopping – Bluetooth Smart (low energy) uses the adaptive frequency hopping common to all versions of Bluetooth technology to minimize interference from other technologies in the 2.4 GHz ISM Band. Efficient multi-path benefits increase the link budgets and range
- Host Control – Bluetooth Smart (low energy) places a significant amount of intelligence in the controller, which allows the host to sleep for longer periods of time and be woken up by the controller only when the host needs to perform some action. This allows for the greatest current savings since the host is assumed to consume more power than the controller
- Latency - Bluetooth Smart (low energy) can support connection setup and data transfer as low as 3ms, allowing an application to form a connection and then transfer authenticated data in few milliseconds for a short communication burst before quickly tearing down the connection
- Range – Increased modulation index provides a possible range for Bluetooth Smart (low energy) of over 100 meters
- Robustness – Bluetooth Smart (low energy) uses a strong 24 bit CRC on all packets ensuring the maximum robustness against interference
- Strong Security – Full AES-128 encryption using CCM to provide strong encryption and authentication of data packets
- Topology – Bluetooth Smart (low energy) uses a 32 bit access address on every packet for each slave, allowing billions of devices to be connected. The technology is optimized for one-to-one connections while allowing one-to-many connections using a star topology.

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