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TRACKLABEL BLUETOOTH LOW ENERGY (BLE) PRINTABLE ASSET LABELS

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INTRODUCTION

The emergence of Bluetooth low-energy (BLE) real-time location services (RTLS) is transforming the field of asset tracking. Historically, smart label implementation was limited by the substantial infrastructure costs associated with radio frequency identification (RFID) solutions. However, this paradigm is shifting as BLE RTLS, a more cost-effective alternative, becomes increasingly prevalent in item-tracking applications.

BLE beacons operate similarly to barcode and RFID systems by uniquely identifying assets in a format that can be quickly read. Unlike barcode systems, a BLE RTLS system does not require direct device-to-sticker interaction. It also does not need a clear line of sight between the scanner and the tag; instead, the tag and its related inventory data are read by a remote wireless reader. The BLE sensor network extends the range of wireless data networks for data collection purposes.

Monitoring is conducted by stationary access points or mobile scanners, removing the need for warehouse staff to manually scan labels or log into terminals to retrieve or manage inventory data. In contrast to RFID tagging systems, this approach does not require costly readers that must be operated by personnel or integrated with line-of-sight conveyor mechanisms.

Wireless BLE tracking systems offer significant advantages over legacy alternatives, including increased productivity, reduced human error, enhanced inventory accuracy and improved end-to-end visibility. These benefits deliver long-term value that offset the initial investment.

The TrackLabel BLE Printable Asset Label from Molex is a thin, flexible, seamlessly activated solution that is suitable for attachment to numerous materials and items, including curved surfaces. The label face can be printed with user-specific data at the point of use, utilizing either inkjet or thermal transfer printers to achieve accurate and customized results.

Battery-powered (active) devices will eventually deplete their batteries. Molex has carefully engineered TrackLabel to maximize the operational lifetime of this advanced smart label device.

SAFETY NOTES

- The TrackLabel device's integrated battery is designed without lithium, to be safely used with assets transported by air.
- TrackLabel devices contain no user-serviceable parts and should not be disassembled or opened.
- TrackLabel devices are not intended to be adhered directly to human or animal skin.
- Intentional submersion of TrackLabel devices in liquid is not recommended.

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TYPICAL APPLICATIONS

Indoor Asset Labeling

The TrackLabel system is commonly used in indoor environments, securely attached to containers. Its utility makes it ideal for settings such as warehousing, shipping, logistics and inventory management, where exposure to extreme temperature, humidity, sunlight or liquids is minimal.

Cold-Chain Tracking

For cold-chain applications, the label is affixed to containers stored in refrigeration. The TrackLabel battery operates reliably down to -30°C, though cold temperatures may affect the overall operating life. Additionally, the label can be equipped with an optional temperature sensor that complies with cold-chain tracking requirements.

Outdoor and Automotive Use

When applied to outdoor or automotive assets, the TrackLabel device is exposed to a wide range of environmental factors including temperature fluctuations, increased humidity, liquid contact, physical stress and sunlight exposure. Industry-standard test methods have been used to validate its durability for these demanding conditions.

Monitoring Human or Animal Movement

The TrackLabel system may also be used for tracking the location and movement of people or animals. In such cases, the label is mounted to a lanyard or wearable patch to ensure safe, effective monitoring.

TRACKLABEL SYSTEM KEY FEATURES

The TrackLabel device from Molex is a battery-operated, low-profile, BLE tag intended for asset identification and location tracking. This device operates using BLE advertising protocols, transmitting asset data to gateways or directly to compatible smart devices. The thin, flexible, adhesive-backed design permits attachment to various types of assets, from shipping pallets to medical devices.

- Form Factor: 76.5 by 4.2mm (3.0 by 2.9") nominal
- Thickness: ≤0.90mm (≤0.035")
- Advertisement Format: BLE
- Read Range: Up to 100m (outdoor, line of sight)
- Transmission Interval: 10s standard (configurable, e.g., 1 second to 10 minutes)
- Active Lifetime: 6 months standard (configurable, depending on transmission interval)
- Battery: Integrated, disposable (non-lithium)
- Mounting Adhesive: General-purpose acrylic, pressure-sensitive adhesive (PSA)
- Facestock: Polyethylene terephthalate, thermal-transfer printable label
- Packaging Format: Fan-folded labels, 240 per box
- Operating Temperatures: -30 to +60°C
- Certifications and Compliance: FCC, ISED, CE, REACH, RoHS

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TRACKLABEL SYSTEM DIAGRAM

TrackLabel is nominally 76.5 by 74.2 by 0.89mm (3.0 by 2.9 by 0.035") and is delivered on a continuous web of release liner 79mm (3.1") wide, with perforations every 81mm (3.2") in a fan-fold stack. See Figures 1 and 2 below for representative product details.

Refer to drawings available at www.molex.com for specific product information.
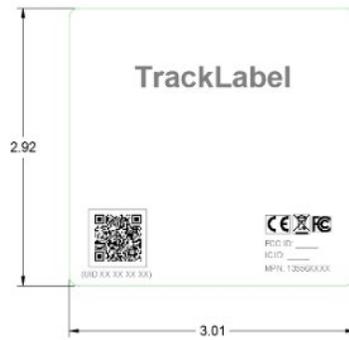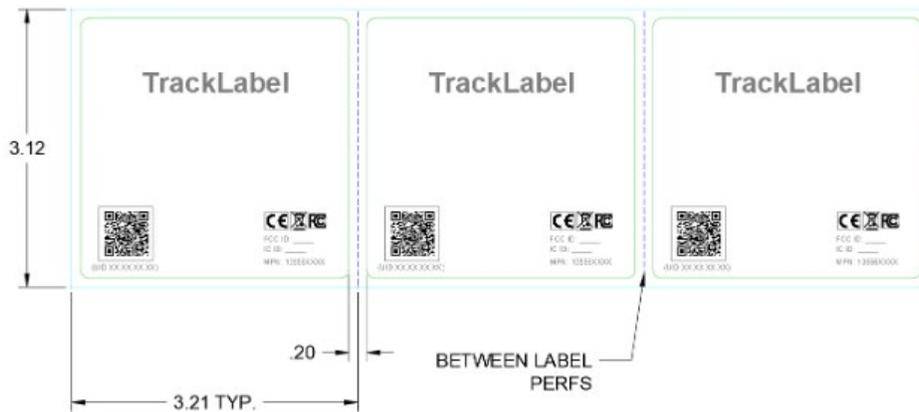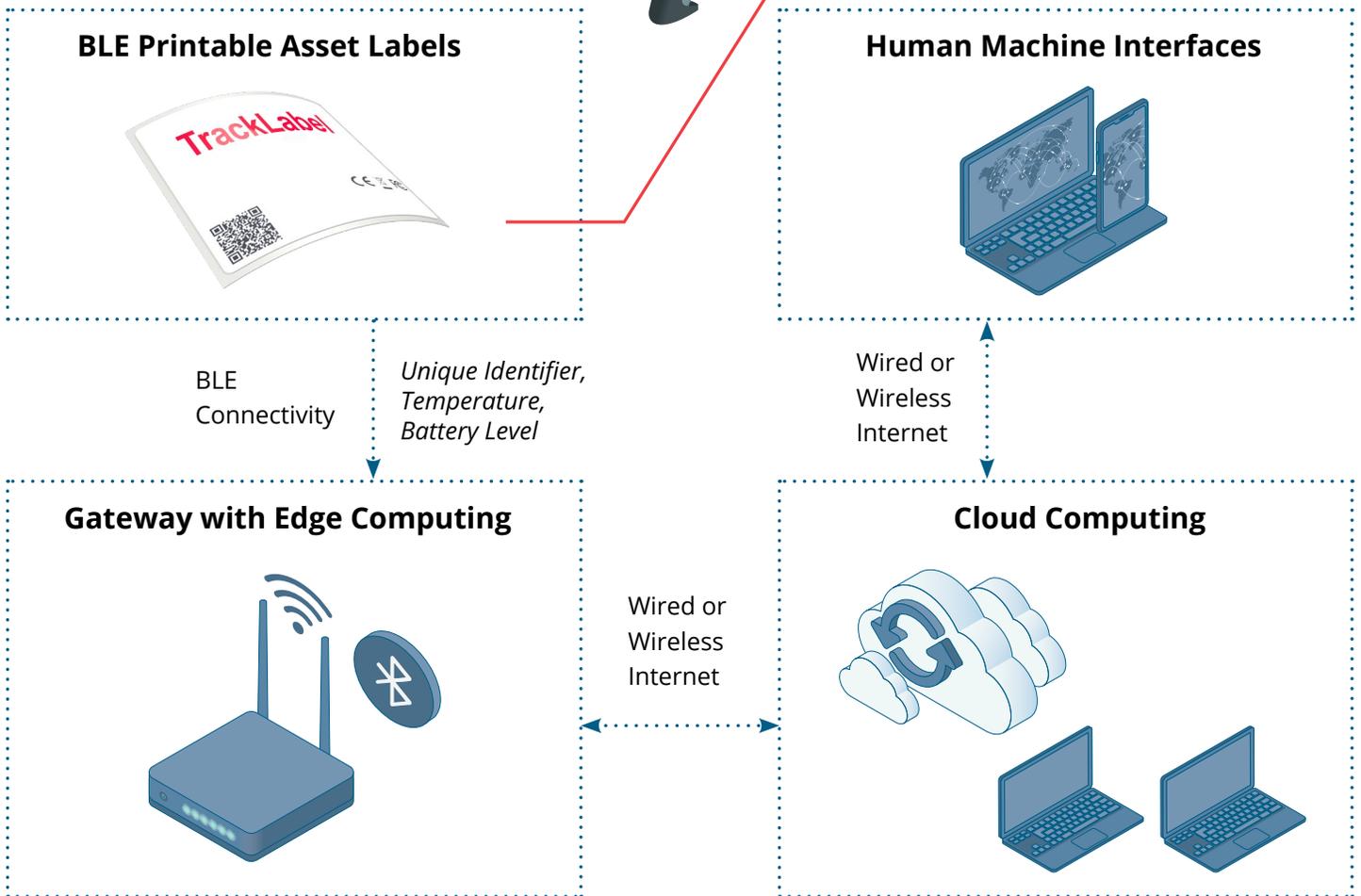

Figure 1 - TrackLabel Overall Dimensions

Figure 2 - TrackLabel Strip View

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SYSTEM OVERVIEW

Process for Labeling or Tagging of Package or Asset

BLE Printable Asset Labels

Human Machine Interfaces

BLE Connectivity

Unique Identifier, Temperature, Battery Level

Wired or Wireless Internet

Gateway with Edge Computing

Cloud Computing

Wired or Wireless Internet

- TrackLabel BLE devices affixed to assets
- Bluetooth gateways strategically placed for signal capture
- Edge computing units for preliminary data processing
- Cloud-based centralized data storage, processing and analytics
- User interfaces, mobile apps and dashboards for monitoring and control

HOW TO USE TRACKLABEL SOLUTIONS

Printing

In its standard configuration, each TrackLabel device comes preprinted with its media access control address both as a QR code and in a human-readable format, facilitating straightforward identification and seamless integration into asset management systems. Alternatively, the TrackLabel device may be configured in a "blank" format, allowing the end user to customize it with graphics or data of their choice. See Figure 3 below for a definition of acceptable user-printable areas.
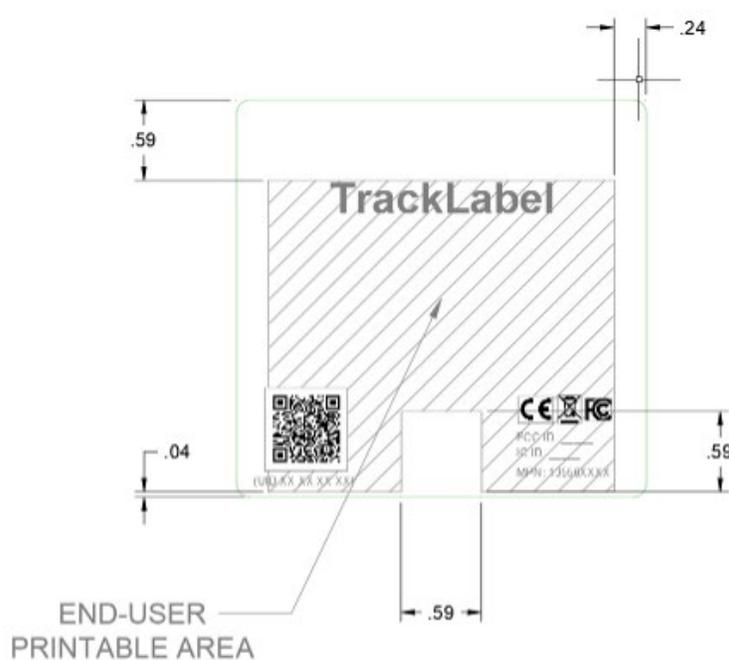

Figure 3 - End-User Printable Area

The TrackLabel system is qualified for thermal transfer printing in the above areas using a Zebra ZT411 desktop printer. Other printer models or printing methods may perform differently and must be evaluated by the end user.

Activation

To activate a TrackLabel device, simply peel it from its release liner. Starting from a corner is suggested for optimal results. After activation, the TrackLabel device broadcasts data packets via BLE, which can be detected by gateways or smart devices. At initial activation, it transmits a special packet for identification and registration; then, after several seconds, it switches to beaconing every 10 seconds. Verifying that the TrackLabel device is active and beaconing before affixing it to an item is advised.

Asset Tagging

After activation, affix the TrackLabel device to the desired item for monitoring. The standard configuration TrackLabel device uses a general-purpose permanent acrylic PSA, making it suitable for a range of surfaces, including coated and uncoated cardboard, plastic, glass and wood. However, it is not designed for use on metal or items with high water content, and Molex does not guarantee optimal performance on these surfaces.

The TrackLabel device's flexible construction allows it to be installed on curved surfaces with a minimum diameter of 75mm (3"). For best results, apply the label to a clean, dry surface at temperatures above +10°C (+50°F). Although surface preparation is not usually required, for difficult surfaces or specific scenarios, cleaning with a residue-free solution such as isopropanol is recommended to ensure maximum adhesion.

Operation

The TrackLabel product is intended for use on the exterior surfaces of devices exposed to standard road, rail or air transportation conditions. This label has been tested in accordance with the operating conditions specified in the technical specifications. In its standard configuration, the TrackLabel system transmits a BLE packet every 10 seconds and operates for up to six months under typical indoor warehouse conditions. The device can function continuously at temperatures as low as -30°C, although this will reduce operational life.

The TrackLabel device is not puncture proof and to prevent damage it should be protected from contact with sharp edges or corners.

Disposal

The built-in battery of the TrackLabel device is not lithium-based and typically does not require special disposal procedures. TrackLabel devices should be removed from recyclable cartons prior to recycling. In the US, the TrackLabel device is usually not classified as hazardous waste and can be disposed of with regular household waste streams; however, local regulations should be followed when discarding TrackLabel devices.

CUSTOMIZING THE TRACKLABEL SYSTEM

The TrackLabel system is offered in a standard configuration to facilitate easy evaluation and integration with both new and existing asset-tracking platforms. For advanced users seeking enhanced capabilities or unique integration specifications, Molex can provide support for customized device configurations, including:

- Static graphics (such as customer logos or regulatory information)
- Dynamic graphics (including device ID, manufacturing date, specific machine-readable formats and more)
- Adjustable beacon intervals (to optimize between tracking resolution and device lifespan)
- Specialized mounting adhesives (for clean removal, application at low temperatures or use on challenging surfaces)
- BLE payload customization
- Packaging options

The TrackLabel system natively supports the iBeacon protocol, with this software available separately; customization beyond this protocol will require production-level modifications.

For further information regarding available customizations, please contact a Molex representative.

Regulatory and Environmental Compliance

The TrackLabel BLE label complies with FCC, ISED, CE, REACH and RoHS requirements; its long battery life and low power use improve efficiency and reduce waste.

Ordering Information

Refer to the technical specifications (available at **www.molex.com**) for standard TrackLabel configurations available for purchase. Contact a Molex representative for purchasing information.

Technical Support

For further details, consult the Molex TrackLabel BLE technical specifications, integration guide and developer resources at **www.molex.com**.

Molex standard terms and conditions apply.