Operational Description

TR-65 UHF Reader Module

Thinkify

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Product name: Insight

Model Number: TR-65

Thinkify TR-65

The TR-65 is a Radio Frequency Identification (RFID) reader module manufactured by Thinkify. RFID is a technology used to identify objects at a distance by the wireless reading of tags. These tags contain data about the object to which they are attached. A full RFID system will contain tags, readers and an infrastructure data base linking all this information together. The TR-65 and the identification system it helps complete operates in the following manner.

The TR-65 will transmit a source of RF energy in the 915 MHz ISM band that the tag uses to rectify as a source of power. The reader does this by transmitting this RF energy through an antenna. The tag collects this energy for its' use through its' own antenna. Most all tags in this UHF band rectify this RF energy with voltage multipliers to create a source of energy sufficient for the tag to run its' state machine and power its' memory access. Upon being parasitically powered the tag is enabled to exchange information with the reader. This either happens automatically or through instructions transmitted from the reader. In the TR-65's case this communication method is called backscatter. The tag will selectively change its' reflective characteristics usually in response to the contents of the tags memory. Simply put, the tag sends information back to the reader by selectively modulating its' antenna's reflective characteristics. Those reflections are decoded to determine communication contents of the tag.

The reader is able to detect these changes in reflection and “read” the tags data by comparing the outgoing and the received RF wave. The received data is usually information about the object to which the tag is attached. For example, the primary use of the TR-65 is with supply chain tags which contain the identifier of the object or box to which the tag is attached. As the tag passes the reader antenna attached to the TR-65, the reader is transmitting RF energy which the tag gathers with its antenna and uses to power up its' internal state machine. The tag begins reflecting back its' identification data upon reaching field strengths of about 1.4 V/m or less and receiving the proper instructions. Usually at this point the reader determines the identity of the tag and thus the object to which the tag is attached.

The TR-65 reader then sends information along to a network to be used and shared.

TR-65

The TR-65 operates in the 902 MHz to 928 MHz UHF ISM band. It supports the EPCglobal Generation 2 (ISO 18000-6C) as one mode of operation.

The TR-65 contains an autonomous mode, a programmable state machine that enables the reader to operate independently based on external I/O triggers, timing or software inputs. This allows end users to precisely control the parameters for timing, power, antenna usage and other critical variables without network latency.

The TR-65 provides the added simplicity of a single antenna port design, which provides a smaller footprint than some previously existing readers. Only one antenna per read point is required, reducing system cost and complexity. Active noise cancellation accomplished by digitally controlled antenna matching makes for a very sensitive reader compared to any other system.

The TR-65 offers several methods for interference mitigation that provide a powerful solution to the challenge of noisy environments.

Frequency hopping and frequency selection:

By either enabling frequency hopping for or enabling a specific set frequency over network instructions the TR-65 is able to operate with a minimum of interference.

EPC Gen 2 Dense Reader Mode:
The TR-65 is compliant by design with the EPC Gen 2 Dense Interrogator specification, which may reduce reduce interference impact on other readers.

Interference Rejection:
The powerful, dynamically adjustable signal processing architecture of the TR-65 ensures strong interference rejection in the presence of other readers or devices.

Event-triggered operation and Autonomous Mode:
The Autonomous Mode functionality enables the reader to collect tag data when triggered by external events detected by electric eyes and other sensors. In this mode, readers are activated only when needed, thereby reducing the ambient signal level.

Conducted output power is user-adjustable up to near .5 Watts maximum for FCC Part 15 unlicensed operation. The transmitter has been optimized to handle the demanding requirements of dense reader modes. These optimizations include the use of phase shift keying and filtering to reduce out-of-band emissions to well below industry standards.

The reader contains a transmitter section, receiver section, synthesizer section and I/O. The receiver section is made up of amplifiers, I/Q demodulator, filtering and analog/digital converter. The transmitter section contains a digital/analog converter, I/Q modulator, filtering, power amplifier and the passive coupling circuit. The synthesizer section contains a variable oscillator and phase-locked loop. The digital board includes the microprocessor, DSP, and the input/output communication interfaces.

The reader transmits a signal in the 902-928 MHz band through one of its' three available antennas. This range of the system is from contact to about 100 inches.

To minimize radio interference, and extend reader life, the reader can be idle until an event triggers the reader to begin transmission. While the RF carrier is transmitted, the reader is monitoring the return signal for detected backscatter indicating the presence of a tag.

While in EPC G2 mode or ISO-18000-6C mode the reader is able to request any empowered tag to respond under a distinct set of circumstances. If a tag is present it may have the ability to respond depending upon the query parameters. If the tag meets these parameters it will begin to backscatter data allowing the eventual reading of the tag's ID information by the reader.

In any mode, the TR-65 transmits energy that is used by the tag to respond in a reflective manner. The reader then demodulates the reflection from the tag to determine at least the identity of the device.