



CINCINNATI
TECHNOLOGIES

Ultra-Long-Range, General Purpose 900MHz Radio Telemetry Module

12 April-2011

Revision 1.1

Cincinnati Technologies
4700 Duke Dr. Suite 200
Mason, OH 45040



900 MHz Radio Telemetry Module Description

This document describes the features and architecture for a general purpose 900 MHz telemetry transceiver module with exceptionally long range and reliable communications.

Architecture

Radio Standard and IC Selection

The module is designed around the Atmel AT86RF212 802.15.4 transceiver IC. The 802.15.4 radio standard is an especially good choice as it provides for operation under the FCC CFR 15.247 spread spectrum rules, at significantly higher transmit power levels than would otherwise be allowed. The engineers at Cincinnati Technologies have engaged in the development of spread spectrum radio products and technologies for two decades, beginning with the design and manufacture of the first spread spectrum residential cordless telephone in 1992.

Transmit Power Level

For small, low duty cycle battery-powered applications transmitters operating at 50-100 milliwatts have been found to work well. It is high enough to achieve excellent range and coverage but low enough in DC power consumption to work well with AA cells.

Data Rate and Receiver Sensitivity

The AT86RF212 transmitted data rate is software selectable from 20 kbits/second to 1000 kbits/second. Higher data rates will yield longer battery life due to shorter transmitter on times. Lower data rates yield better receiver sensitivity and longer range. This tradeoff is easily optimized for each application.

Integrated Diversity Antennas

The benefits gained by use of two antennas are twofold. First, in environments rich in RF reflections, a phenomenon known as multi-path fading will frequently reduce the received signal level. A second antenna with different radiation characteristics will have different fades.

The second benefit is based on the fact that antennas do not perform equally in all directions. By using two antennas with pattern nulls in different directions the module can choose to operate with the antenna with the lowest path loss to the far end.



Frequency Agility

Incorporation of automatic ability to change operating frequency helps the radio pair avoid disruption due to on-channel interference. FCC rules mandate that products must tolerate occasional interference. One of the best strategies for doing so is avoidance.

Radio Control

It is desirable that integration of this module into various products be as simple as possible. This is achieved by use of the microcontroller to manage many basic radio and network functions.

Interface

Pin #	Pin	Type	Description
1	GND	P	Ground
2	VCC	P	Power supply
3	SLEEP	I	Sleep mode input
4	SCK	I	SPI clock
5	SDI	DI	SPI data input
6	SDO	DO	SPI data output
7	CS	I	SPI chip select
8	TX	DO	UART Tx
9	RX	DI	UART Rx
10	RESET	I	Reset
11	INT	O	Interrupt request output
12	GPIO	I/O	May be used for standalone applications

Electrical Specifications

Transmit Current	200mA	max
Receive Current	15 mA	max
Sleep Current	5 uA	max
Radiated Transmit Power	22.97 dBm	EIRP typical
Radiated Receive Sensitivity	50 dBuV/m	typical at 40 kbits/second



FCC STATEMENT:

1. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
 - (1) This device may not cause harmful interference, and
 - (2) this device must accept any interference received, including interference that may cause undesired operation.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device, for example, USB dongle like transmitters is forbidden.

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: DI2CTLM901"

when the module is installed inside another device, the user manual of this device must contain below warning statements;

1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:



**CINCINNATI
TECHNOLOGIES**

- (1) This device may not cause harmful interference.
 - (2) This device must accept any interference received, including interference that may cause undesired operation.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.