Campbell SCIENTIFIC

RF451

900 MHz 1 W Spread-Spectrum Radio

Overview

The RF451 is a powerful 900 MHz serial radio that is well suited for wireless networking with PakBus data loggers that are located miles apart. The RF451 is a 902 to 928 MHz frequency-hopping spread-spectrum radio. The radio features high noise immunity, fast serial data transfer speeds, and the maximum transmit power allowed by the FCC in an effort to provide reliable, hassle-free operation.

Constructing a network using RF451 radios is a simple, easy-to-do configuration process. To construct a network, connect one radio to a PC and configure it as the gateway radio. Then connect a second radio to a data logger. The link can be treated as a high-speed, multi-drop serial connection.

Benefits and Features

- Does not require individual operational license in several regions around the world
- Long-distance, high-speed, serial communication with battery-operated stations
- Each radio capable of performing gateway, remote, or repeater role
- Remote diagnostics and setup possible with diagnostics cable and software
- Compatible with existing RF450 and FreeWave FGR radio networks

Detailed Description

The RF451 is a frequency-hopping spread-spectrum radio, capable of operating between 902 to 928 MHz and transmitting up to 1 Watt (30 dBm). The specific frequencies used may be selected when operating outside the US and Canada to meet local regulations. Additionally, the RF power output may be adjusted to as low as 10 mW via software.

Typical communication distances are greater than 4 miles with up to 60 miles achievable under ideal conditions. Extended communication distances are possible using repeaters.

The operating frequency band of this radio modem may be shared with other non-licensed services such as cordless telephones and with licensed services including emergency broadcast and air-traffic control.

The RF451 consists of a radio module manufactured by FreeWave Technologies and a Campbell Scientific interface board. It reduces susceptibility to RF interference from other spread-spectrum devices by providing user-selectable frequency hopping patterns. Spread-spectrum radios spread the normally narrowband information signal over a relatively wide band of frequencies. This process allows communications to be more immune to noise and other interference.

RF451 radios, like all FCC Part 15 devices, are not allowed to cause harmful interference to licensed radio communications and must accept any interference that they receive. Most Campbell Scientific users operate in open or remote locations where interference is unlikely. If there is a problem, interference can be reduced using methods such as moving the device, reorienting or using a different type of antenna, or adding RF shielding.

Powering the Radio

At least two radios are required to create a link. The radio may be powered through the dc barrel connector or via a CS I/O connection. When ac power is available, the 15966 wall charger is commonly used. At remote sites, the RF451 typically is powered through the CS I/O or the 14291 field cable.

Antennas

Campbell Scientific offers a variety of antennas for this radio. The 14204 is a 0 dBd, 1/2 wave omnidirectional whip antenna that connects directly to the radio (no cable required) and can transmit short distances (up to 1 mile). The 15970 dipole antenna includes adhesive for window or wall mounting and a cable for connecting to the radio.

Our higher gain 14221 omnidirectional and 14205 Yagi antennas require a cable to connect them to the radio. The 31314 surge protector is available for radios susceptible to lightning or electrostatic buildup or when the cable length needs to be longer than 3 m (10 ft), as measured between the transceiver and the antenna.

Specifications

Radio Type	Frequency Hopping Spread Spectrum (FHSS)
Frequency	902 to 928 MHz
Country Used In	US, Canada, Australia
Power Output	10 to 1,000 mW (user-selectable)
Transmission Distance	❱ 20.92 to 96.56 km (13 to 60 mi) depending on antenna and line-of-sight ❱ *-Note- Transmission distance assumes line-of-sight and appropriate antenna. Line-of-sight obstructions, RF interference, and antenna type will affect transmission distance.*
Modulation	2 level GFSK
RF Data Rate	115.2 or 153.6 kbps (selectable speeds)
Occupied Bandwidth	142 kHz (applicable to FCC ID KNYAMM0921TT)
Hopping Patterns	15 per band, 105 total (user-selectable)
Hopping Channels	50 to 111 (user-selectable) applicable to FCC ID KNYAMM0921TT
Frequency Zones	16
Receiver Sensitivity	❱ -103 dBm at 153.6 kbps (for 10^{-4} BER) ❱ -108 dBm at 115.2 kbps (for 10^{-4} BER)
IF Selectivity	40 dB (at fc ± 230 kHz)
Receiver Selectivity	50 dB (at 896 MHz, 935 MHz)
Error Detection	32-bit CRC (retransmit on error)
Data Encryption	proprietary spread-spectrum technology
Link Throughput	115.2 kbps (maximum)
RF Connector	Reverse Polarity SMA (RPSMA) jack (external antenna required)
CS I/O	DB9 M, SDC 7/8/10/11 device
RS-232	DB9 F, DCE
Operating Temperature Range	-40° to +85°C
Relative Humidity	0 to 95% RH (non-condensing)
Compliance Information	❱ 2329B-AMM0921TT (Industry Canada ([IC]) ❱ KNYAMM0921TT (FCC ID)
Average Current Drain (@ 12 Vdc)	❱ 15 mA (idle) ❱ 6 mA (sleep) ❱ 650 mA (transmit) ❱ 40 mA (receive)
Communication Ports	❱ USB Type B jack

	❱ CS I/O 9 pin D male ❱ RS-232 9 pin D female
Service Requirements	Shares frequency with other devices. Must not cause harmful interference to licensed radios. Requires line-of-sight.
Dimensions	13.61 x 2.74 x 7.01 cm (5.36 x 1.08 x 2.76 in.)
Weight	0.18 kg (0.4 lb)

Power

Input Voltage	7 to 28 Vdc
Powered Over	CS I/O or barrel plug
Connector	Barrel plug, center positive 12 V (used to connect the 14291 Field Power Cable or 15966 ac adapter)

USB

-NOTE-	*Used for connection to computer for network communications or device configuration. Does not supply enough power for normal operation; RF451 must be powered through dc barrel plug or CS I/O.*
Type	USB standard B (device only)

For comprehensive details, visit: www.campbellsci.com/rf451

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