RF450

900 MHz, 1 W Spread Spectrum Radio/Modem

CAMPBELL SCIENTIFIC®

WHEN MEASUREMENTS MATTER

The RF450 900 MHz radio provides a solution for wireless network communications over distances up to 60 miles. Designed specifically for our PakBus® dataloggers, the RF450 consists of a radio module manufactured by FreeWave Technologies and a Campbell Scientific interface board.

The radio's transmission distance is ideal for point-to-multipoint networks. In point-to-multipoint networks, data is collected from one or more data-logger(s) and then transmitted to a central site. The central site typically contains a PC running LoggerNet software, but may contain a datalogger, instead.

Spread Spectrum Technology

Spread spectrum radios spread the normally narrow-band information signal over a relatively wide band of frequencies. This process makes communications more immune to noise and interference from RF sources such as pagers, cellular phones, and multi-path.[1] User-selectable frequency hopping patterns reduce the radios' susceptibility to RF interference from other spread spectrum devices.

Powering the Radio

At the computer site, the radio is typically powered by the #15966 wall charger. At the field station, the radio is typically powered by the datalogger through its CS I/O port. The #14291 Field Cable can also be used to connect the radio to an appropriate 12 Vdc power supply. The field cable is required when the datalogger was purchased before December 1997 or when the radio is connected to the datalogger's RS-232 port instead of the CS I/O port.

Features

- Individual FCC license not required[2]
- Maximum transmission distance of 60 miles, and realistic reliable transmission distance of approximately 13 miles. All transmission distances assume line-of sight and appropriate antenna (line-of-sight obstructions, RF interference, and antenna type will affect transmission distance).
- Low current drain (6 mA sleep, 86 mA while receiving, 500 mA while transmitting)
- High noise immunity—superior performance in noise congested environments

- Wide operating temperature range (-40° to +75°C)
- High Speed—115.2 kbps continuous throughput
- Error Free Communications—32 bit Cyclical Redundancy Checking (CRC) with automatic retransmission
- Separate diagnostic port—real time remote diagnostics and setup, transparent to network communications
- Ability to have standalone RF router/repeaters (up to 8 repeaters)

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

[2]The RF450 radio, like all FCC Part 15 devices, is not allowed to cause harmful interference to licensed radio communications and must accept any interference that it receives. 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.

The 20644 has adhesive backing to allow it to adhere to a wall, rear-view mirror, or other suitable flat non-conductive surface.

The 14221 is suitable for base station use where it needs to communicate with multiple stations located in different directions.

The 14201 Yagi antenna has a narrow beam width, so precise aiming is mandatory. This directional antenna is useful for longer transmission distances and when communicating only with one other station.

Antennas

Call one of our Applications Engineers for help in choosing an antenna. Only the following FCC approved antennas can be used.

Indoor, Low-Gain Antennas

Below are inexpensive antennas that can transmit short distances. They must reside in an environmental enclosure or building:

- **19512**—0 dbd, ½-wave, whip antenna with SMA connector that attaches directly to the radio; no antenna cable is needed.
- **20644**—1 dBd, dipole antenna with window or wall mount. Antenna is supplied with a 10-ft RG-174 cable that attaches to the radio.

Outdoor, Higher-Gain Antennas

Below are higher gain, outdoor antennas. Their type N female connector attaches to an antenna cable that's purchased separately (see *Antenna Cables*):

- **14221**—3 dBd omnidirectional antenna with mounting hardware. The 14221 is suitable for base station use where it needs to communicate with multiple stations located in different directions.
- **14201**—9 dBd, Yagi antenna with mounting hardware. Please note that because the FCC limits EIRP to 36 dBm, use of this antenna may require a reduction of the RF450's transmit power (consult manual for details).

Antenna Cables/Surge Protectors for Outdoor Antennas

Recommended for cable lengths less than 10 ft

- **COAXSMA-L**—LMR195 antenna cable with SMA connector and type N male connector. Specify length, in feet, after the L.

Recommended for cable lengths greater than 10 ft and/or use with lightning protection

- **COAXNTN-L**—Low-loss RG8 antenna cable with type N male to type N male connectors. It requires the 19533 surge protector (see below). Specify cable length, in feet, after the -L.
- **19533**—Surge suppressor kit for RF450 or other SMA devices. It is recommended when the length of the antenna cable is greater than 10 feet. The surge suppressor helps protect the radio from electrical discharge being conducted down the antenna cable. It includes a COAXSMA-L1.5 cable and requires the COAXNTN-L antenna cable.

Demo Kit

The 21108 provides a two week rental of an RF450 demo kit. The kit includes two RF450 radios, several types of antennas, and a power supply. It allows customers to test our RF450 Spread Spectrum Radios prior to purchase, and ensure that the radios will work in their system's environment. Customers can also determine the best antenna options for their system. Contact Campbell Scientific for more information.

Additional Accessories

- **18663**—Null modem cable used to connect the radio to the RS-232 port on a datalogger.
- **CM230**—Adjustable Angle Mounting Kit that secures an outdoor antenna to a mast or pipe with a 1.3-in to 2.1-in outer diameter.
- **20625**—FreeWave Diagnostics cable and Software CD. These items allow advanced users to perform Network Diagnostics.
- **14413**—Data cable that connects the radio to an SRM-5A Short Haul Modem, SDS-122 Serial Data Switch, or another 25-pin DTE RS-232 port.

Compatible Devices

The RF450 radios are compatible with all of our contemporary dataloggers and most of our retired dataloggers. However, the internal radio of a CR206(X), CR211(X), or CR216(X) datalogger should not be used with the RF450.

To increase transmission distance, the RF450 radio can be combined with our COM220 phone modems, MD485 Multidrop Modem, and SRM-5A Short Haul Modem. At the non-datalogger site, an A100 adapter fastened to a PS100 or CH100 is required.

Campbell Scientific does not recommend using RF450 radios in networks containing RF401-series or RF430-series spread spectrum radios.

The 14413 is a RS-232 DB9 male-to-DB25 male cable typically used to connect the RF450 to an SRM-5A Short Haul Modem. It has a 6 ft length.

The 18663 null modem cable connects the radio to the datalogger's RS-232 port. This cable is the only option available for connecting the radio to a CR200(X)-series datalogger.

The A100 Null Modem Adapter fastens onto a PS100 Power Supply or CH100 Regulator. The null modem ports allow the RF450 and another device to talk to each other without a datalogger in between.

A CM230 supporting a Yagi antenna is attached to the mast of a CM110 tripod. Only the first cross element of the Yagi antenna is shown.

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Specifications

Operating Frequency:	902 to 928 MHz
Type:	Frequency Hopping Spread Spectrum (FHSS) Transceiver
FCC ID:	KNY-6231812519
Canada ID:	2329B-DGR09RAS
Ships with:	SC12 CS I/O cable, 10873 RS-232 cable, screws, grommets

Power Requirements

Input Voltage:	7 to 28 Vdc

Average Current Drain @ 12 Vdc

Sleep:	7 mA
Idle:	22 mA
Receiving:	76 mA
Transmitting:	500 mA

Transmit

Power Output:	5 mW to 1 W, user-selectable
Range:	Maximum transmission distance of 60 miles, and realistic reliable transmission distance of ~13 miles. All transmission distances assume line-of sight and appropriate antenna (line-of-sight obstructions, RF interference, and antenna type will affect transmission distance).
Modulation:	GFSK, 120 or 170 kbps
Occupied Bandwidth:	230 kHz at 60 dB
Channel Spacing:	230 kHz
Hopping Patterns:	15 per band, 105 total, user selectable
Hopping Channels:	50 to 112, user selectable
Hopping Bands:	7, user selectable
Frequency Zones:	16 zones, 7 channels per zone

Receive

Sensitivity

10^{-6} **Bit Error Rate:**	-108 dBm
10^{-4} **Bit Error Rate:**	-110 dBm
Selectivity:	-20 dB at Fc ±115 kHz; -60 dB at Fc ±145 kHz
System Gain:	140 dB

Data Transmission

Error Detection:	32-bit CRC, retransmit on error
Data Encryption:	Substitution, dynamic key
Link Throughput:	115.2 kbps, maximum

Data Interface

Protocol:	RS-232, DCE, CS I/O, ME, and SDC; user selectable
RS-232 Baud Rate:	1200 bps, 4800 bps, 9600 bps, 19.2 kbps, 34.4 kbps, 57.6 kbps, or 115.2 kbps
RS-232 Connector:	9-pin D Female (4 wire: Tx, Rx, CTS, GND)
CS I/O Connector[1]:	9-pin "D" Male
Antenna Connector:	SMA
Power Connector:	Barrel plug, center positive 12 V; used to connect the 14291 Field Power Cable or 15966 AC adapter

Environmental

Operating Temperature:	-40° to +75°C
Relative Humidity:	0 to 95% RH non-condensing

Physical

Dimensions:	1.44" x 3.17" x 5.70" (3.66 x 8.05 x 14.48 cm)
With Mounting Plate:	1.44" x 3.17" x 7.5" (3.66 x 8.05 x 19.05 cm)
Weight:	0.7 lb (0.3 kg)

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[1]*Newer dataloggers provide power to the RF450 radio on this connector. Dataloggers purchased before December 1997 require the #14291 Field Power Cable.*