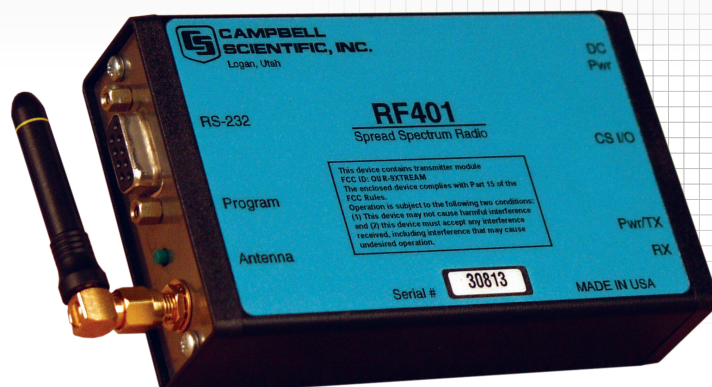# CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

RF401-Series and RF430-Series
Spread Spectrum Radios

Overview

The RF401-series and RF430-series radios can be used for general purpose wireless data communications and support point-to-point and point-to-multipoint datalogger communications. Spread spectrum radios can serve as a field modem/radio while connected to the datalogger or as a base station modem/radio while connected to a PC. They can also serve as a standalone RF router/repeater.

Spread spectrum radios spread the normally narrowband information signal over a relatively wide band of frequencies. This allows the communications to be more immune to noise and interference from RF sources such as pagers, cellular phones and multipath.[a] The RF401-series and RF430-series radios reduce susceptibility to RF interference from other spread spectrum devices by providing user-selectable frequency hopping patterns.

Benefits and Features

› Rugged, low-cost transceivers
› Can be used in the field as a transceiver or in the office as the base station
› Individual FCC license not required[b]
› Transmits up to one mile with omnidirectional antenna; up to 10 miles with higher gain directional antennas at ideal conditions (line-of-sight obstructions and RF interference will affect transmission distance)
› Settings stored in non-volatile memory
› Frequency-hops over 25 channels avoids interference from other spread spectrum radios
› Ability to have stand-alone RF router/repeaters (up to 8 repeaters)

› Faster communication due to elimination of some small "link state packets"
› Greater immunity to interference and RF collisions by using RF retries
› Reduced power consumption by the datalogger, as the radios perform "packet address filtering"
› Designed for use in PakBus networks
› Built-in setup menus allow access to advanced functionality
› Compatible with all contemporary dataloggers
› Transmit distance can be increased by combining with multi-drop modems, telephone modems, or short haul modems

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

[b] *Spread spectrum 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.*

Model Description

The RF401-series and RF430-series spread-spectrum radios are similar. The models in these two series differ in their ports used for connecting to computers/dataloggers and in their frequencies. Refer to the following table for specifics.

Model	Where Used	Frequency	Communication Ports	Communicates With	Typically Serves As
RF401	U.S., Canada	910 to 918 MHz	CS I/O, RS-232	RF401, RF430, CR206X, AVW206	Field modem/radio while connected to the datalogger or base station modem/radio while connected to a PC's RS-232 port
RF411	Australia, New Zealand	920 to 928 MHz	CS I/O, RS-232	RF411, RF431, CR211X, AVW211	Field modem/radio while connected to the datalogger or base station modem/radio while connected to a PC's RS-232 port
RF416[c]	many countries worldwide	2.450 to 2.482 GHz	CS I/O, RS-232	RF416, RF432, CR216X, AVW216	Field modem/radio while connected to the datalogger or base station modem/radio while connected to a PC's RS-232 port
RF430	U.S., Canada	910 to 918 MHz	USB, RS-232	RF430, RF401, CR206X, AVW206	Base station modem/radio while connected to the PC's USB port[d.]
RF431	Australia, New Zealand	920 to 928 MHz	USB, RS-232	RF431, RF411, CR211X, AVW211	Base station modem/radio while connected to the PC's USB port[d.]
RF432[c]	many countries worldwide	2.450 to 2.482 GHz	USB, RS-232	RF432, RF416, CR216X, AVW216	Base station modem/radio while connected to the PC's USB port[d.]

[c] *Purchase of this product is not recommended for new networks deployed in the European Union (EU) that may require future expansion. This and other RF compatible products will not be available for sale in Europe after 1/1/2015 due to changes in EU legislation.*

[d] *The RF430-series radios may also serve as a field modem by connecting to the datalogger's RS-232 port. This non-standard use requires the 18633 null modem cable and the 14291 field power cable.*

Right End

Typically, the RF401-series radios connect to the datalogger via the CS I/O port, and connect to a PC via the RS-232 port.

Right End

The RF430-series radios have a USB port instead of a CS I/O port. They were developed for use with laptops or PCs that do not have an RS-232 port.

Ordering Information

Spread Spectrum Radios

RF401   900 MHz Spread Spectrum Radio with CS I/O and RS-232 ports. Supports communications in US/Canada. Need to choose a temperature range option (see below).

RF411   922 MHz Spread Spectrum Radio with CS I/O and RS-232 ports. Supports communications in Australia/New Zealand. Need to choose a temperature range option (see below).

RF416   2.4 GHz Spread Spectrum Radio with CS I/O and RS-232 ports. Supports communications in Europe. Temperature range is -25° to +50°C.

RF430   900 MHz Spread Spectrum Radio with USB and RS-232 ports. Supports communications in US/Canada. Need to choose a temperature range option (see below).

RF431   922 MHz Spread Spectrum Radio with USB and RS-232 ports. Supports communications in Australia/New Zealand. Need to choose a temperature range option (see below).

RF432   2.4 GHz Spread Spectrum Radio with USB and RS-232 ports. Supports communications in Europe. Temperature range is -25° to +50°C.

Temperature Range Options for RF401, RF411, RF430, RF431

-ST   -25° to +50°C.

-ET   -55° to +85°C. *The push button that allows customers to check/edit programmable settings while the radio is connected to a computer may not operate at temperatures colder than -25°C.*

Enclosure Mounting Bracket

14162   Mounting Kit includes hardware for securing the radio to an enclosure backplate.

Ordering Information Continued

Charger, Power Cable, Null Modem Cable

15966   Wall Charger is required for ac power to serve as the power source for the radio. Typically it is used when an RF401-series radio is connected to a PC at the base station.

14291   Field Power Cable is required at the field site if an RF401-series radio is connected to the datalogger's RS-232 port instead of the CS I/O port (also requires the 18663 null modem cable); if an RF430-series radio is used (also requires the 18663 null modem cable); or if the datalogger was purchased before December 1997.

18663   Null Modem Cable is used to connect a spread spectrum radio to the datalogger's RS-232 port.

## Antennas for RF401, RF411, RF430, or RF431 (choose one)

Only the FCC-approved antennas listed in this document can be used with the RF401-series and RF430-series radios. Call one of our Applications Engineers for help in choosing an antenna.

14310   0-dbd, ¼-wave, whip antenna with 8.1 cm (3.2 in) length. RPSMA connector attaches directly to the radio; no antenna cable is needed. This antenna can transmit short distances.

14204   0-dbd, ½-wave, whip antenna with joint that's adjustable from 0° to 90°. RPSMA connector attaches directly to the radio; no antenna cable is needed. This antenna can transmit short distances.

15970   1 dBd, dipole antenna with window or wall mount. Antenna comes with a 3 m (10 ft) cable that has an RPSMA connector, which attaches to the radio; an additional cable is not needed. This antenna can transmit short distances.

15730   0 dBd, ¼ wave whip antenna with joint that's adjustable from 0° to 90°. RPSMA connector attaches directly to the radio; no antenna cable is needed. This antenna can transmit short distances.

15731   Straight, 0 dBd, ¼ wave whip, antenna with 7.6 cm (3 in) length. RPSMA connector attaches directly to the radio; no antenna cable is needed. This antenna can transmit short distances.

14221   3 dBd omnidirectional antenna with mounting hardware. This higher gain antenna is suitable for base station use where it needs to communicate with multiple stations located in different directions. This antenna's type N female connector attaches to an antenna cable that's purchased separately (see right column).

14201   9 dBd, Yagi antenna with mounting hardware. This directional antenna is intended for longer transmission distances. Its type N female connector attaches to an antenna cable that's purchased separately (see right column).

Antennas for RF416 or RF432 (choose one)

Only the FCC-approved antennas listed in this document can be used with the RF416 and RF432 radios. Call one of our Applications Engineers for help in choosing an antenna.

16005   0 dBd, ½-wave whip antenna with joint that's adjustable from 0° to 90°. RPSMA connector attaches directly to the radio; no antenna cable is needed. This antenna can transmit short distances.

17480   1 dBd, dipole antenna with window or wall mount. Antenna comes with a 3 m (10 ft) cable that has an RPSMA connector, which attaches to the radio; an additional cable is not needed. This antenna can transmit short distances.

30411   8 dBd omnidirectional antenna that uses the 13906 mounting hardware. This higher gain antenna is suitable for base station use where it needs to communicate with multiple stations located in different directions. This antenna's type N female connector attaches to an antenna cable that's purchased separately (see right column).

16755   13 dBd Yagi antenna with mounting hardware. This directional antenna is intended for longer transmission distances. Its type N female connector attaches to an antenna cable that's purchased separately (see right column).
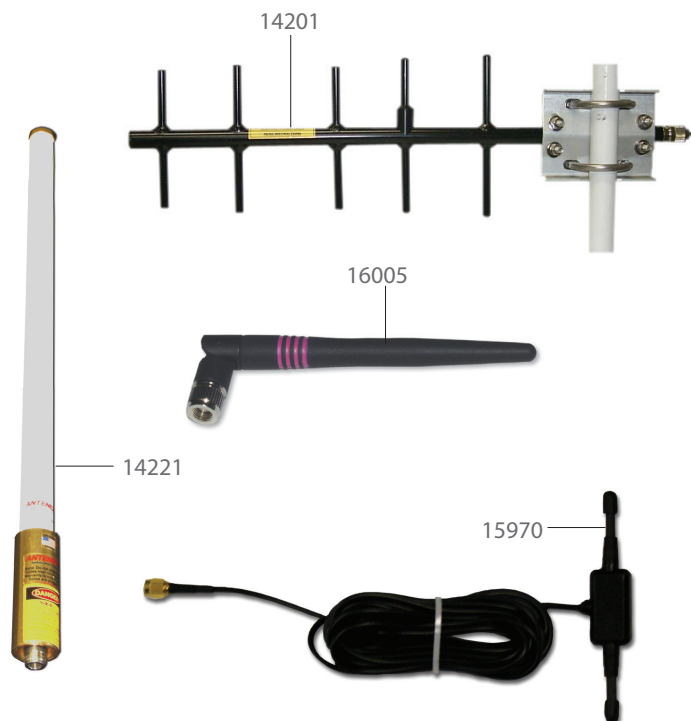
Above are a variety of the antennas available for these the radios.

Cables/Surge Suppressors for 14221, 14201, 30411, or 16755

COAXRPSMA-L   Low-loss RG58 antenna cable with reverse polarity SMA (RPSMA) connector and type N male connector. Specify length, in feet, after the L. This cable is recommended for lengths less than 10 ft.

COAXNTN-L   Low-loss RG8 antenna cable with type N male to type N male connectors (requires 14462 or 16982). Specify length, in feet, after the L. This cable is recommended for lengths greater than 10 ft and/or use with lightning protection.

14462   Surge suppressor kit for 900 or 922 MHz RPSMA radios. It includes one COAXRPSMA-L1.5 cable. The COAXNTN-L cable is required (see above).

14462   Surge suppressor kit for 2.4 GHz RPSMA radios. It includes one COAXRPSMA-L1.5 cable. The COAXNTN-L cable is required (see above).

Mounting Hardware

CM230   Adjustable Angle Mounting Kit allows a Yagi antenna to be aimed at the service provider's antenna. It attaches to a mast or pipe with a 1.3 to 2.1 in. OD.

CM230XL   Adjustable Angle Mounting Kit with Extended Length. Provides the same functionality as the CM230, but the CM230XL places the antenna further from the pole or crossarm.

13906   Antenna mounting hardware for the 30411 antenna.

Demonstration Kits

21107   900 MHz Spread Spectrum Demo Kit Rental for 2 weeks allows customers to test their radio communications onsite. Contact Campbell Scientific for more information.

21109   Additional Weeks of Demo Kit Rental. The time period of the demo kit's rental starts when Campbell Scientific ships the kit and ends when Campbell Scientific receives the kit. Each week, or a portion thereof, past the original two week rental will be charged an additional amount.

Specifications

❯ Type: Frequency Hopping Spread Spectrum (FHSS) Transceiver

❯ RS-232 Baud Rate: 38.4k, 19.2k, 9600, 4800, or 1200 bps

❯ USB Baud Rate[e] (RF430-series only): 38.4k, 19.2k, 9600, 4800, or 1200 bps

❯ Channel Capacity: 65,000 Network Identifiers share 25 hop channels

❯ Frequency Hopping Patterns: Six different selectable patterns

❯ Frequency Control: Direct FM

❯ Receiver Sensitivity[f]
  RF401, RF411, RF430, RF431: -110 dBm at 10^{-4} bit error rate
  RF416, RF432: -104 dBm at 10^{-4} bit error rate

❯ Interference Rejection: 70 dB at pager and cellular phone frequencies

❯ Transmitter Power Output
  RF401, RF411, RF430, RF431: 100 mW nominal
  RF416, RF432: 50 mW nominal

❯ Power: 9 to 16 Vdc

❯ Average Current Drain

	RF401	RF411	RF416	RF430	RF431	RF432
Stand-by	<1 mA (power-saving options used)					
Receiving	24 mA		36 mA	26 mA		40 mA
Transmitting	<75 mA		75 mA	78 mA		

❯ LEDs: Power on, TX, RX, diagnostics

❯ FCC ID
  RF401, RF411, RF430, RF431: OUR9XTREAM
  RF416, RF432: OUR-24XSTREAM

❯ Antenna Connector: Reverse polarity SMA (RPSMA)

❯ RS-232 Connector: 9-pin D female (4 wire: Tx, Rx, CTS, GND)

❯ CS I/O Connector[g] (RF401-series radios only): 9-pin D male

❯ Power Connector: Barrel plug, center positive 12 V; used to connect the 14291 Field Power Cable or 15966 AC adapter

❯ Dimensions: 11.4 x 7.0 x 2.9 cm (4.9 x 2.8 x 1.2 in)

❯ Weight: 227 g (8 oz)

---

[e] *If an RF430-series radio has an operating system prior to OS 2, its USB port will only communicate at 38.4 kbps. Therefore, the operating system of the radio may need to be updated to a newer version if the network will contain dataloggers that do not support 38.4 kbps (e.g., CR200(X), CR510, CR10X).*

[f] *Campbell Scientific protocols will issue retries wherever a bit error occurs.*

[g] *Newer dataloggers provide power to the RF401-series radio on this connector. Dataloggers purchased before December 1997 require the 14291 Field Power Cable (see Ordering Information).*