FC-302 Data Radio

User Manual

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FCC RF Exposure Compliance Requirements

The Federal Communications Commission (FCC), with its action in General Docket 93-62, November 7, 1997, has adopted a safety standard for human exposure to Radio Frequency (RF) electromagnetic energy emitted by FCC regulated equipment. Friendcom subscribes to the same safety standard for the use of its products. Proper operation of this radio will result in user exposure far below the Occupational Safety and Health (OSHA) and Federal Communications Commission limits.

About your FC-302 Series Data Radio

FC-302 is a PLL synthesized 5-watt FM transceiver module, which is designed for data transmission and voice communication. It can support pre-emphasis, squelch CTCSS/DCS and audio amplifier. Two-point modulation technology makes good low frequency response and POCSAG application possible. The radio has fast start-up time and makes it a competitive choice for 1200-19200bps rate data application. Compact dimension and wide range DC support make it flexible to use.

Should you have questions regarding the operation of the radio, please consult us.

Features

- CE, FCC& AS/NZS 4295: 2015 certified

- Programmable 16 channels

- Configurable power save feature

- FSK, 4FSK& GMSK modem option

- Frequency step 6.25KHz

- CTCSS/DCS

- Support maximum RF data rate: 19200bps

- Fast start-up time: 5ms

- SQ programmable via PC

- POCSAG Modulation

- PC programmable & Software tune & Calibration

Applications

- Industrial telemetry & wireless remote control or Paging system

- Gas and oil flow monitoring

- Electricity, water and gas utilities

- Earthquake, weather, environmental protection

- Vehicle tracking and asset tracking systems

- Water monitoring, waste water management and irrigation control

- Railway, police, army automation system

- Aerial defense and fire alarm system

- Urban lighting control

Specifications

GENERAL

Working Frequency	V:　136-174MHz U0: 400-440MHz U1: 430-470MHz U2: 450-490MHz
Channel Spacing	12.5KHz/25KHz Programmable
Modulation Type	F3D/F3E
Number of Channels	16
Nominal Working Voltage	12V DC
Extreme Working Voltage	9.6 V ~ 16V DC
Storage Temperature	-40℃ ~ +80℃
Operating Temperature	-30℃ ~ +65℃
Current Consumption	Standby	< 100mA
	Transmit 5 watts RF Power	< 1.5A
	Transmit 1 watt RF Power	< 1A
TX to RX Attack Time		< 5ms
RX to TX attack time		< 5ms
Frequency Error		< 2.5ppm
Antenna Connector		BNC 50Ω
External interface		DB15 Female

TRANSMITTER Specification

RF Power		1W/2W/3W/4W/5W Programmable
Frequency Deviation	25KHz Channel Spacing	< 5KHz
	12.5KHz Channel Spacing	< 2.5KHz
	Subsonic	0.5KHz
Audio Response	25KHz Channel Spacing	300Hz～3KHz　+1/-3dB
	12.5KHz Channel Spacing	300Hz～2.55KHz　+1/-3dB
Adjacent Channel Power	25KHz Channel Spacing	< -70dBc
	12.5KHz Channel Spacing	< -65dBc
Conducted Spurious Emission		< 1GHz, < -36dBm > 1GHz, < -30dBm
Modulation Sensitivity	Voice	8~15mV
	Data	80~130mV
TX SNR	25KHz Channel Spacing	> 45dB
	12.5KHz Channel Spacing	> 40dB

RECEIVER Specification

RX Sensitivity (12dB SINAD)	25KHz Channel Spacing	< -119dBm　Extreme < -115dBm
	12.5KHz Channel Spacing	< -119dBm　Extreme < -115dBm
Adjacent Channel Selectivity	25KHz Channel Spacing	> 70dB
	12.5KHz Channel Spacing	> 60dB
Image Rejection		> 70dB

IF Rejection		> 70dB
Spurious Rejection		> 70dB
Intermodulation Suppression		> 65dB
Conducted Spurious Emission		< -57dBm
Receiving Audio Distortion		< 5%
RX SNR	25KHz Channel Spacing	> 45dB
	12.5KHz Channel Spacing	> 40dB
Audio Output Power		0.5W @ 8Ωload

Exterior View

Description of radio components

① DB15 Female connector

② BNC Antenna connector

③ LED(Red for TX, Green for RX)

FC-302 External DB15 female Pin Assignment

FC-302 is manufactured by default with modem, if the radio does not have a built-in modem; the corresponding pin is defined as empty.

Pin No.	Function	Description	Note
①	AUDIO_IN (MOD IN)	Audio input, 3Khz LPF, Modulation sensitivity is 100mV.	AUDIO_IN is effective only when Pin7 (MIC) is vacant or with +5V high level. 3KHz LPF filter existed in audio channel.
②	AUDIO_OUT (AF OUT)	Audio output, 3Khz LPF. Output level at 60% frequency deviation is 250±50mV. This line has an internal pull-up resistor to +5V.	
③	PTT	TX control, active low, only when PTT is active AUDIO_IN and MIC IN are effective. This line has an internal pull-up to 5V.	
④	B+ (9.6～16V DC)	Positive pole input from DC power, nominal +12V.	
⑤	PROG (DATA OUT)	Programming data output, 5V TTL	
⑥	BUSY	Logical level output to indicate whether there is a carrier or not. Low lever means carrier, high level means no carrier. This line has a pull-up to +5V.	
⑦	MIC IN/RSSI	MIC IN: Microphone input. RSSI: To detect the air signal strength. Jumper selectable.	Can directly connect to electrets MIC, the DC voltage of this pin should lower than 3.5V, then MIC transmission can be activated.

⑧	PROG (DATA IN)	Programming data input, 5V TTL	
⑨	SPK/POCSAG	SPK: Audio output from the audio amplifier, @ 8Ω. POCSAG: To transmit POCSAG code. Jumper selectable.	AUDIO_IN is effective only when PIN7 (MIC) is vacant or with +5V high level. 3KHz LPF filter existed in audio channel.
⑩	RXD (MODEM)	The serial data is input to modem through this pin. Default is RS232.	The hardware is one of RS232, RS485 or TTL/5V when delivery.
⑪	TXD (MODEM)	Serial data is output from modem via this pin. Default is RS232.	The hardware is one of RS232, RS485 or TTL/5V when delivery.
⑫	CD_OUT (MODEM)	Logical level output to indicated whether a carrier or not. Low lever for carrier, high level for no carrier.	
⑬	NC	No connection	
⑭	GND	Ground	
⑮	NC	No connection	

Antenna installation

Fasten the antenna to the radio by turning the antenna connector clockwise into the receptacle on right of radio when looking at front of radio.

Powering the data radio

FC-302 accepts many sources of DC power to permit more versatile use. This radio operates from 9.6V to 16V DC and standard voltage for test is 12V DC. The 4th pin of DB15 female connector for radio's power input pin.

FC-302 Function

Channel Spacing

The radio is capable of programmable channel spacing, having 12.5KHz or 25KHz channel spacing.

SQ (Squelch) Level

Five SQ levels are set in the radio and can be selected by PC software.

Level 0 is for fully open mute. The audio signal will continuously transmit. Other levels are shown as below:

Level 1 : 0.15uV

Level 2 : 0.25uV

Level 3 : 0.35uV

Level 4 : 0.45uV

Level 5 : 0.55uV

CTCSS/DCS

To help to block out unwanted calls to your radio, FC-302 can be programmed by software to set CTCSS/DCS code. When enabled, receiver only can receive useful RF signal with the same CTCSS/DCS code of the transmitter to avoid interference from useless signal. For fast lock time, the CTCSS/DCS is not available for high speed data transmission.

Channel Scan

The radio enables to detect the channels by initiate scanning mode. Scanning mode is optional and programmable. This PC software allows user to decide scan mode and establish channel scanning sequence. Four scan modes are provided in "Option" and shown as below:

0 ---------normal scan with carry only

1 ---------normal scan, Carry with tone

2 ---------priority scan, Carry only

3 ---------priority scan, carry with tone

Channel Select

FC-302's 16 channels can be selected by inner dip (4) switch (HW) on power board or serial command inputted from our PC software (SW). Only in SW control mode, channel can be selected by PC software in "Channel" feature. It is recommended to change it via SW.

Channel dip switch chart
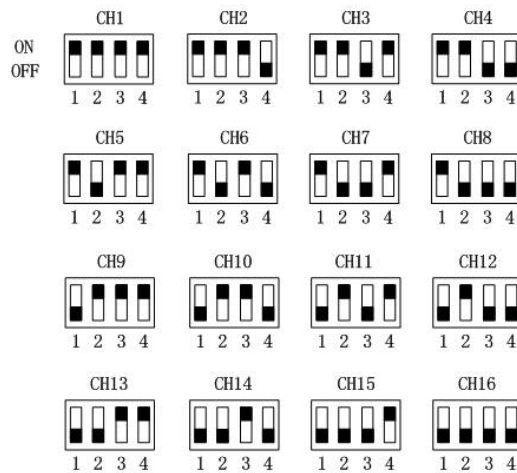
TX Protection

This feature, when enabled, limits the amount of time that the radio can continuously transmit for protecting the radio from block of the channel and damage on radio which is caused by sustained transmission. In TX mode, if PTT is effective all through and exceed set time, radio will stop transmitting automatically until restart the PPT again. The time can be set by PC software.

Volume

The radio output voice via SPK Pin with 10 level volumes. Users are able to choose appropriate volume for the connected speaker in this feature by PC software. The default volume is 6. The minimal volume is 0 and the maximum is 9.

Power save mode

When user enables the function, FC-302 will work into beat status to save the energy. If detect useful signal, the radio will start to work normally. If no useful signal detected, the radio will get into beat status. Heartbeat interval can be programmed via PC. However, real time communication will be slightly affected.

Side tone

This feature, when enabled, transmitted MIC signal will be output from SPK port after partly power amplifier and user can hear his or her own voice. The feature can also be set via PC software.

RSSI Detection

In TX mode, the radio can quickly detect the strength of useful RF signal and show the strength by analog voltage after calculation and analysis of MCU. Stronger signal means higher output voltage. User can also read the field strength by serial command.

LED Status Indicator

The LED indicator gives real time status of the radio's operation, Red for TX and green for RX.

Parameter programming

FC-302 is configured before leave factory, the user can directly use. If the user needs to modify FC-302 parameters, Please use FC-302 programming software and refer to the software manual.

Modem option for data communication

DTE: Data Terminal Equipment

Available Baud rate for FSK modem

Channel Space	DTE Baud Rate(bps)	Modem Baud Rate(bps)
Narrow (12.5KHz)	1200	1200
Wide (25KHz)	1200	1200

Available Baud rate for GMSK modem

Channel Space	DTE Baud Rate(bps)	Modem Baud Rate(bps)
Narrow (12.5KHz)	9600	9600
Wide (25KHz)	9600	9600

Available Baud rate for 4FSK modem

| Channel Space	DTE Baud Rate (bps)	Modem Baud Rate (bps)
Narrow (12.5KHz)	9600	9600
Wide (25KHz)	9600 or 19200	9600 or 19200

Communication between DTE and modem

The internal option-modems (FSK, GMSK, 4FSK) are applied to the FC-302 to increase capability for data applications. The goal of an internal modem is to improve the efficiency for data transmission and provide maximum flexibility for user applications. Our internal modem options consist of MCU, Modem IC, and extra circuitry. These option-boards directly communicate with DTE to send and receive meaningful data through the DB15 female connector of the FC-302. These modems are designed to accept RS232, RSTTL or RS485 serial data format and are also capable of high speed wireless data-transmission between two or more devices.

AT command of modem (Only for GMSK or 4FSK)

Mode	Command	Return	Remark
Querying radio channel	AT+CHN=?\r	\r\nCHN=N\r\n	The range of N is from 1 to 16, means channel number.
Setting channel	AT+CHN=N\r	\r\nOK\r\n or \r\nERROR\r\n	
Querying baud rate	AT+WORKMODE=?\r	\r\nWORKMODE=N\r\n	N is M9600 or M19200, M9600 means 9600bps…
Setting baud rate	AT+WORKMODE=N\r	\r\nOK\r\n or \r\nERROR\r\n	
\r stand for carriage return (ASCII is 0XOD)			
\n stand for line feed(ASCII is 0X0A)			
Only 4FSK modem can be set to 19200bps.			

For more information about the AT command, please contact us.

Dimensions
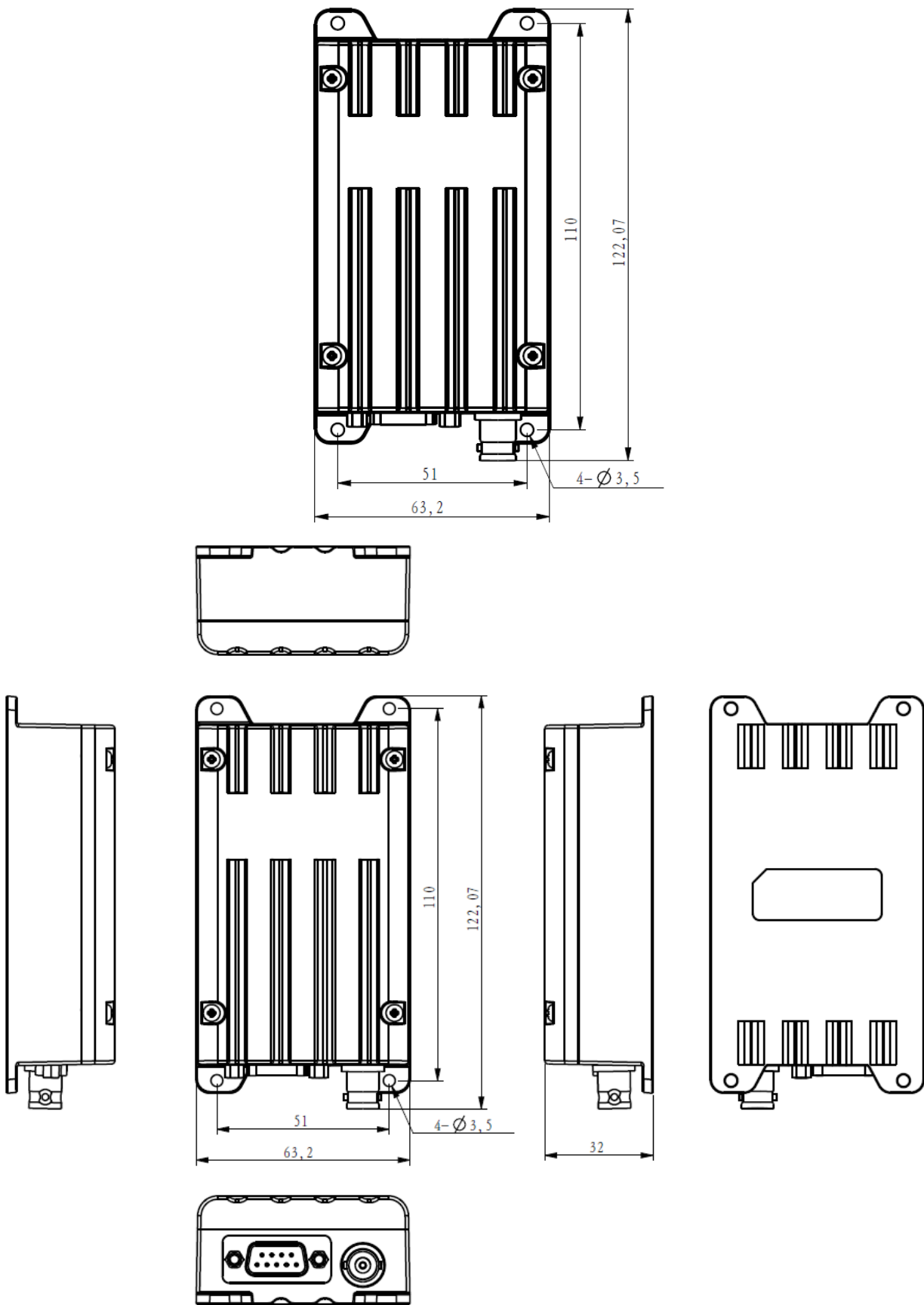
Compatible accessory list

These accessories are purchased independently according to user's request.

Accessory	Description
FSK modem	1200 baud
GMSK modem	9600 baud
4FSK modem	9600 or 19200 baud
Programming board	FC-302 only
Power Adapter	12V, 2A
RS232 Extended cable	DB9 female to DB9 male
USB to RS232 cable	If the computer does not have a serial port
Rod antenna	BNC;50Ω Antenna and radio frequency must be matched
Sucker antenna	
Fiberglass Omni antenna	
Yagi antenna	
φ7 coaxial-cable	50Ω;Length according to the user's demand
Arrester	50Ω;The lightning areas only