

# FC-301/D RF Link Module USER MANUAL

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## MANDATORY SAFETY INSTRUCTIONS TO INSTALLERS AND USERS

- Use Only manufacturer or dealer supplied antennas.
- Antenna minimum safe distance: 35 cm.
- Antennas used for this transmitter must not exceed an antenna gain of 3 dBi.

The FCC (Federal Communications Commission) has adopted a safety standard for human exposure to RF energy which is below the OSHA (Occupational Safety and Health Act) limits.

- Antenna mounting: The antenna supplied by the manufacturer or radio dealer must not be mounted at a location such that during radio transmission, any person can come closer than the above indicated minimum safe distance to the antenna (i.e. 35cm).
- To comply with current FCC RF Exposure limitations, the antenna must be installed at or exceeding the minimum safe distance indicated above, and in accordance with the requirements to the antenna manufacturer or supplier.
- Vehicle installation: The antenna can be mounted at the center of a vehicle metal roof or trunk lid if the minimum safe distance is observed.

Antenna substitution: Don't substitute any antenna for the one supplied or recommended by the manufacturer or radio dealer. You may be exposing person(s) to excessive radio frequency radiation. You may contact your radio dealer or the manufacturer for further instructions.

Warning



**Warning**

Maintain a separation distance from the antenna to person(s) at least 35cm.

“This transmitter is authorized to operate with a maximum duty factor of 50%, in a typical push-to-talk mode, for satisfying FCC RF exposure compliance requirements.”

### Caution:

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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## INTRODUCTION

The FC-301/D RF Link Modules from Friendcom utilizes the latest technology in its design and manufacturing. It's PLL (Phase Lock Loop Synthesizer) / microprocessor controlled, and offers one to five watts of power with 16 channel capability. Multiple functions including AC audio coupling, 1200 to 9600 baud rates GMSK and FSK modulation capability are standard in this fully programmable wide bandwidth RF Link Module units.

## FEATURES

- 16 Channels
- 1 - 5 Watt Programmable RF Output
- 12.5 / 25 kHz Programmable Channel Spacing

## SPECIFICATIONS

### GENERAL

Equipment Type.....Data Radio

Frequency Band .....VHF

Channel Spacing.....25KHz,12.5KHz programmable

**RF Output Power.....1W - 5W Programmable**  
**Modulation type .....16K0F3E,8K5F3E**  
**Intermediate Frequency..... 45.1MHz & 455KHz**  
**Number of Channels.....16**  
**Frequency Source .....Synthesizer**  
**Operation Rating.....Intermittent**  
**5:5:90 ( TX: RX: Standby )**  
**Power Supply .....12.5V DC Nominal Voltage**  
  
**Temperature Range**  
**Storage.....from -40°C to +80°C**  
**Operating.....from -30°C to +60°C**  
  
**Current Consumption**  
**Standby (Muted) .....≤40mA**  
**Transmit 5 Watts RF Power .....< 1.5A**  
**Transmit 1 Watt RF Power.....<0.8A**  
  
**Frequency Bands .....RX VHF: 136 – 174 MHz**  
**.....TX VHF: 136 – 174 MHz**  
  
**Dimensions.....(120mm)L x (60mm)W x (20mm)H**  
**Weight.....≤150 grams**

**TRANSMITTER**

**Sustained Transmission..... Nominal conditions**

**Time: 5 10 30 sec**

**Power: >95% >95% >90%**

**Frequency Error..... $\pm 2.5$  ppm**

**Frequency Deviation:**

**25kHz Channel Spacing..... $\leq \pm 5.0$ kHz,**

**12.5kHz Channel Spacing..... $\leq \pm 2.5$ kHz,**

**Audio Frequency Response..... Within +1/-3dB of 6dB octave**

**@300Hz to 2.55kHz for 12.5kHz C.S**

**@300Hz to 3.0kHz for 25kHz C.S**

**Adjacent Channel Power**

**25kHz.....< 70 dBc @ Nominal Condition**

**<65 dBc @ Extreme Condition**

**12.5kHz .....< 60 dBc @ Nominal Condition**

**< 55 dBc @ Extreme Condition**

**Conducted Spurious Emission .....< -36 dBm**

**Modulation Sensitivity..... 100mV RMS@60% peak Dev.**

**Hum & Noise:**

**25kHz Channel Spacing.....>40 dB (with no PSOPH)**

**12.5kHz Channel Spacing.....>36 dB (with POSPH)**

**Modulation Symmetry .....<10% Peak Dev@1kHz input  
for nominal dev +20dB**

**Load Stability.....No osc at  $\geq 10:1$  VSWR all  
phase angles and suitable antenna**

**No destroy at  $\geq 20:1$  all phase angle**

### **RECEIVER**

**Sensitivity(12dB Sinad) .....UHF <-117 dBm,**

**VHF<-118dBm@Nom.Condition**

**Amplitude Characteristic.....< $\pm 3$ dB**

**Adjacent Channel Selectivity:**

**25 kHz Channel Spacing ..... $\geq 70$ dB @ Nom.**

**12.5kHz Channel Spacing..... $\geq 60$ dB@Nom.**

**Spurious Response Rejection.....70dB**

**Image Response..... > 70 dB**

**IF Response ..... >70 dB**

**Others.....> 70 dB**

**Intermodulation Response Rejection..... $\geq 65$  dB**

**Conducted Spurious Emission @ Nominal Conditions.....<-57 dBm**

**AF Distortion .....<5% @ Nom.,**

**<10%@ Extreme Condition**

**RX Hum & Noise:**

**25.0kHz CP.....< 40dB No PSOPH**

**12.5kHz CP .....< 40dB with PSOPH**

**Receiver Response Time .....< 20ms**

**Squelch Opening sensitivity: .....-118dBm**

**Squelch Closing sensitivity ..... -121dBm**

**Squelch Attack Time:**

**RF Level at Threshold ..... <40ms**

**RF Level at Threshold +20dB.....<30ms**

**L.O. Frequency Temperature Stability.....1 st <2.5 ppm,**

**2 nd <10 ppm for -30°C to +60°C**

**L.O. Frequency Aging Rate.....±2 ppm/year**

**REFERENCE CRYSTAL**

**Frequency..... 13MHz**

**Temperature Characteristic.....+/- 2.5PPM**

**from -30°C to +60°C**

**Aging Rate.....< 2ppm/year in 1 st year**

**<1ppm/year thereafter**

**Lock Time .....<10 ms**

**TX to RX ..... < 20 ms**

**RX to TX ..... < 25 ms**

**ENVIRONMENTAL ( performance without degradation unless stated)**

**Temperature..... deg C**



**Operating.....-30° to +60°C**

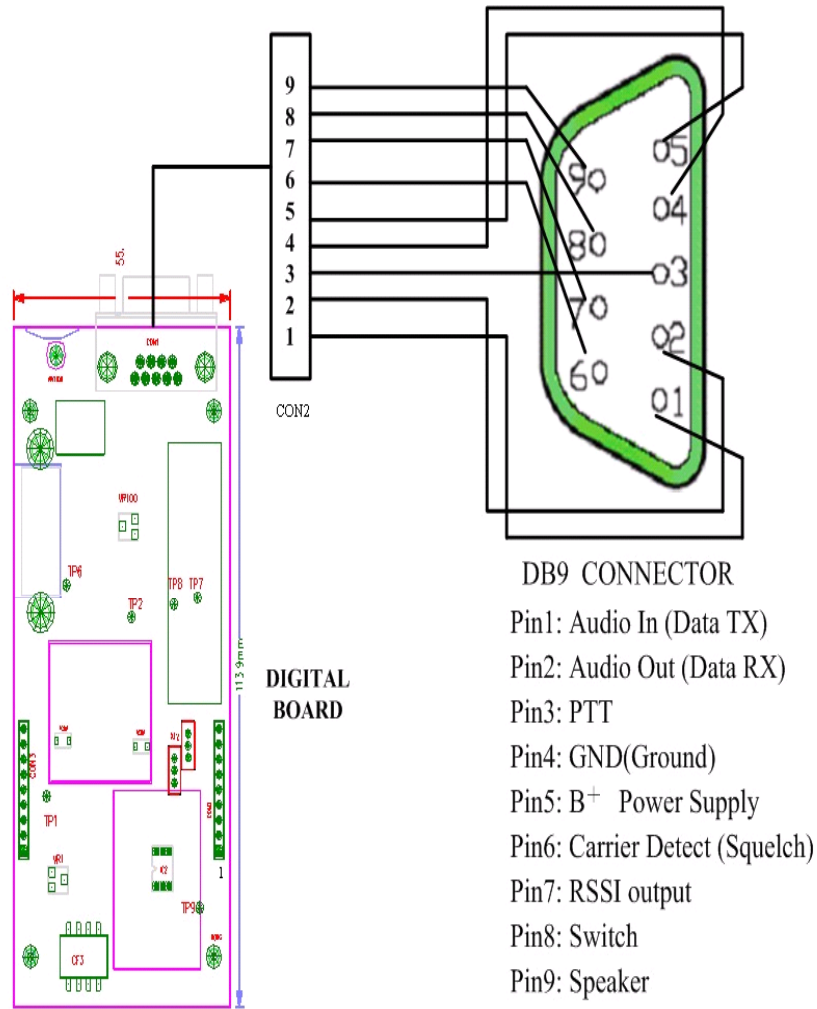
**Degradation Specified@Extreme**

**Storage ..... -40°C to +80°C**

**Recharging ..... -10 to +55**

**ESD..... 20kV (C-MIC >= 15kV)**

## WIRING DIAGRAM



Pin	Function	Type	Range	Description
Pin 1	Audio in(Data TX)	Input	200VP-P ----- 300VP-P	External Modulation Input
Pin 2	Audio out (Data RX)	Output	150mV-250mV	Demodulation Output
Pin 3	PTT	Input	0 V/+5V	Transmit Enable 0V - Radio in Transmit status 5V - Radio in receive status(Default)
Pin 4	GND	GND	0V	GND
Pin 5	B+	V+	10-15V	Power Supply(+12.5V typical)
Pin 6	SQ	Output	Open/Short	RF Carrier Detect Open -- low level, Short -- high level (Default).
Pin 7	RSSI	Output	0.8V-2.2V	
Pin 8	Switch	Input	0V/5V	Programming Enable 0V - Radio programmable 5V - Radio work (Default)
Pin 9	Speaker	Output	8ohm /0.5W	

**When Pin 8 is connected to GND(0V), the radio is in program mode. The parameters of the radio can be changed in this mode. When Pin 8 is connected to 5V voltage, the radio works normally in transmission or receiving status.**

## TROUBLESHOOTING GUIDE

SYMPTOM S	CAUSES	COUNTERMEASURES
<b>Unit does not work</b>	<ol style="list-style-type: none"> <li>1.No power incomplete connection</li> <li>2. No input voltage of 5V or 8V</li> <li>3. CPU does not work</li> <li>4. EEPROM fail</li> <li>5. Channel error</li> <li>6. PLL error</li> </ol>	<ol style="list-style-type: none"> <li>1.Check COM1 connection</li> <li>2. Check IC500、 IC504</li> <li>3. Check IC510</li> <li>4. Check IC502</li> <li>5. Check CF3</li> <li>6. Check TCXO、 VCO、 PLL IC</li> </ol>
<b>Bad RX Sensitivity</b>	<ol style="list-style-type: none"> <li>1.Antenna signal short-circuit</li> <li>2.Antenna signal open-circuit</li> <li>3. Bad electronic tuner</li> <li>4. Defective high frequency amplifier</li> <li>5. Bad mixer</li> <li>6. Local signal amplitude become small</li> <li>7. Bad 1<sup>st</sup> and 2<sup>nd</sup> intermediate frequency</li> </ol>	<ol style="list-style-type: none"> <li>1. Check D106 D107</li> <li>2. Antenna loose weld</li> <li>3. Check L23 L24 L25 L26</li> <li>4. Replace Q15</li> <li>5. Check IC3 T3 T4</li> <li>6. Check D103 Q111</li> <li>7. Check XF1 XF2 IC2</li> </ol>
<b>Defective RX</b>	<ol style="list-style-type: none"> <li>1. No output signal</li> <li>2. Bad signal waveform</li> <li>3. Bad stability of VCO</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace IC801</li> <li>2. Check U2 c412 c404</li> <li>3. Check component of VCO</li> </ol>
<b>PLL Error</b>	<ol style="list-style-type: none"> <li>1. TCXO frequency error</li> <li>2. Bad stability of VCO</li> <li>3. PLL can't be locked</li> </ol>	<ol style="list-style-type: none"> <li>1.Check crystal oscillator of TCXO</li> <li>2.Check the component of TX/RXVCO</li> <li>3. IC301 Q321 Q320 C327</li> </ol>
<b>Low TX Power</b>	<ol style="list-style-type: none"> <li>1. Bad amplifier circuit</li> <li>2. Bad APC circuit</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace IC102</li> <li>2. Check D102 IC1</li> </ol>
<b>No TX Power</b>	<ol style="list-style-type: none"> <li>1. No power on TX</li> <li>2. No signal on driver</li> <li>3. Bad amplifier circuit</li> <li>4. Bad APC circuit</li> </ol>	<ol style="list-style-type: none"> <li>1. Check Q502 Q503</li> <li>2. Check Q1 Q2 D101</li> <li>3. Check IC102 D102</li> <li>4. Check IC1</li> </ol>
<b>No Modulation</b>	<ol style="list-style-type: none"> <li>1. No input signal</li> <li>2. No TX signal</li> </ol>	<ol style="list-style-type: none"> <li>1. Check IC801</li> <li>2. Check U1 R403 R404</li> </ol>

## FACTORY DEFAULT SETTING

### FC-301/D VHF RF Link Module

Channel	RX Frequency	RX Tuning Value (TV)	TX Frequency	TX Tuning Value (APC)
1	136.1250MHZ	0	136.1250MHZ	185
2	138.1250MHZ	0	138.1250MHZ	185
3	140.1250MHZ	0	140.1250MHZ	185
4	143.1250MHZ	0	143.1250MHZ	185
5	145.1250MHZ	0	145.1250MHZ	185
6	147.1250MHZ	0	147.1250MHZ	185
7	150.1250MHZ	0	150.1250MHZ	182
8	153.1250MHZ	0	153.1250MHZ	182
9	155.1250MHZ	0	155.1250MHZ	182
10	157.1250MHZ	0	157.1250MHZ	182
11	160.1250MHZ	0	160.1250MHZ	178
12	163.1250MHZ	0	163.1250MHZ	178
13	165.1250MHZ	0	165.1250MHZ	170
14	167.1250MHZ	0	167.1250MHZ	170
15	170.1250MHZ	0	170.1250MHZ	170
16	174.1250MHZ	0	174.1250MHZ	170

**From above diagram, TX Tuning Value is based on 5W normal output power, please refer to FC-301/D Program Software if you need other Tuning value based on other output power.**