

友讯达科技  
Friendcom

# FC-301/D

## USER MANUAL



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## SPECIFICATION

### GENERAL

Equipment Type.....	Data Radio
Performance Specification.....	TIA/EIA-603 & ETS 300-113
Band .....	UHF/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 UHF: 400 – 470 MHz VHF: 136 – 174 MHz

.....TX UHF: 400 – 470 MHz 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.....±2.5 ppm

Frequency Deviation:

25kHz Channel Spacing.....≤ ±5.0kHz,

12.5kHz Channel Spacing.....≤ ±2.5kHz,

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 >= 10:1 VSWR all  
phase angles and suitable antenna  
No destroy at >= 20:1 all phase angle

**RECEIVER**

Sensitivity(12dB Sinad) .....UHF <-117 dBm,  
VHF<-118dBm@Nom.Condition

Amplitude Characteristic.....<±3dB

Adjacent Channel Selectivity:

25 kHz Channel Spacing .....≥70dB @ Nom.

12.5kHz Channel Spacing.....≥60dB@Nom.

Spurious Response Rejection.....70dB

Image Response.....> 70 dB

IF Response .....>70 dB

Others.....> 70 dB

Intermodulation Response Rejection.....≥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
<b>Specified@Extreme</b>	
Storage .....	-40°C to +80°C

Recharging ..... -10 to +55

ESD..... 20kV (C-MIC  $\geq$  15kV)

Vibration..... MIL STD 810 C Procedures I,II,V  
and IEC68 26

*• Due to continuing researching and development the company reserves the right to alter these specifications without prior notice.*

## FC-301/D CIRCUIT DIAGRAM

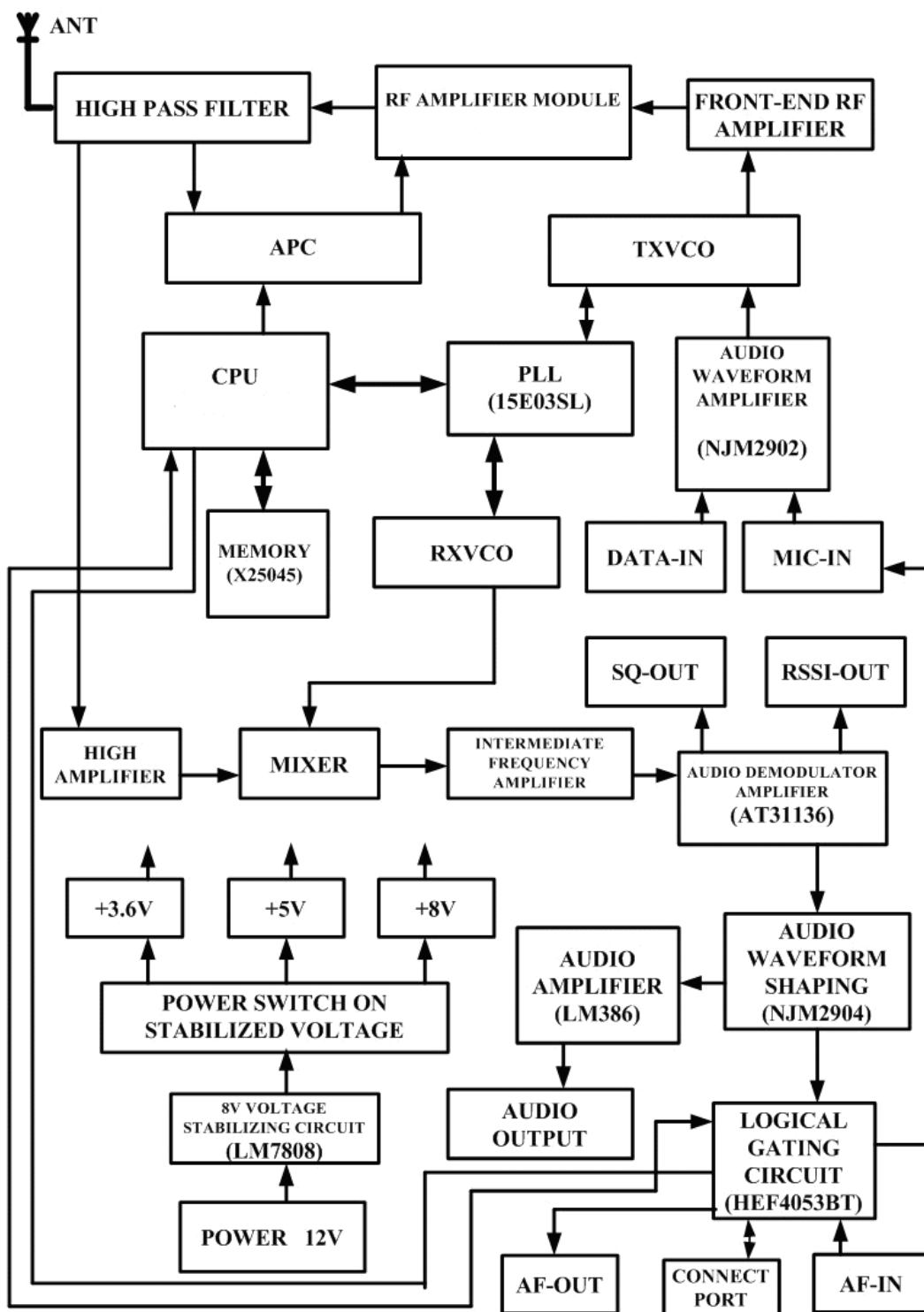


Fig.1. Circuit diagram



## INTRODUCTION

The FC-301/D Series of RF Link Modules from Friendcom utilizes the latest technology in its design and manufacturing. Both the UHF and VHF models are PLL (Phase Lock Loop Synthesizer) / microprocessor controlled, and offer 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 these fully programmable wide bandwidth RF Link Module units.

## FEATURES

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

## TROUBLE SHOOTING GUIDE

Table 1: Trouble shootings

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>

## WIRING DIAGRAM

The standard FC-301/D is shown as below picture. The pins of CON1, CON2 and CON3 are all connected via the bridge board (As shown in Fig.2 and Fig.3).

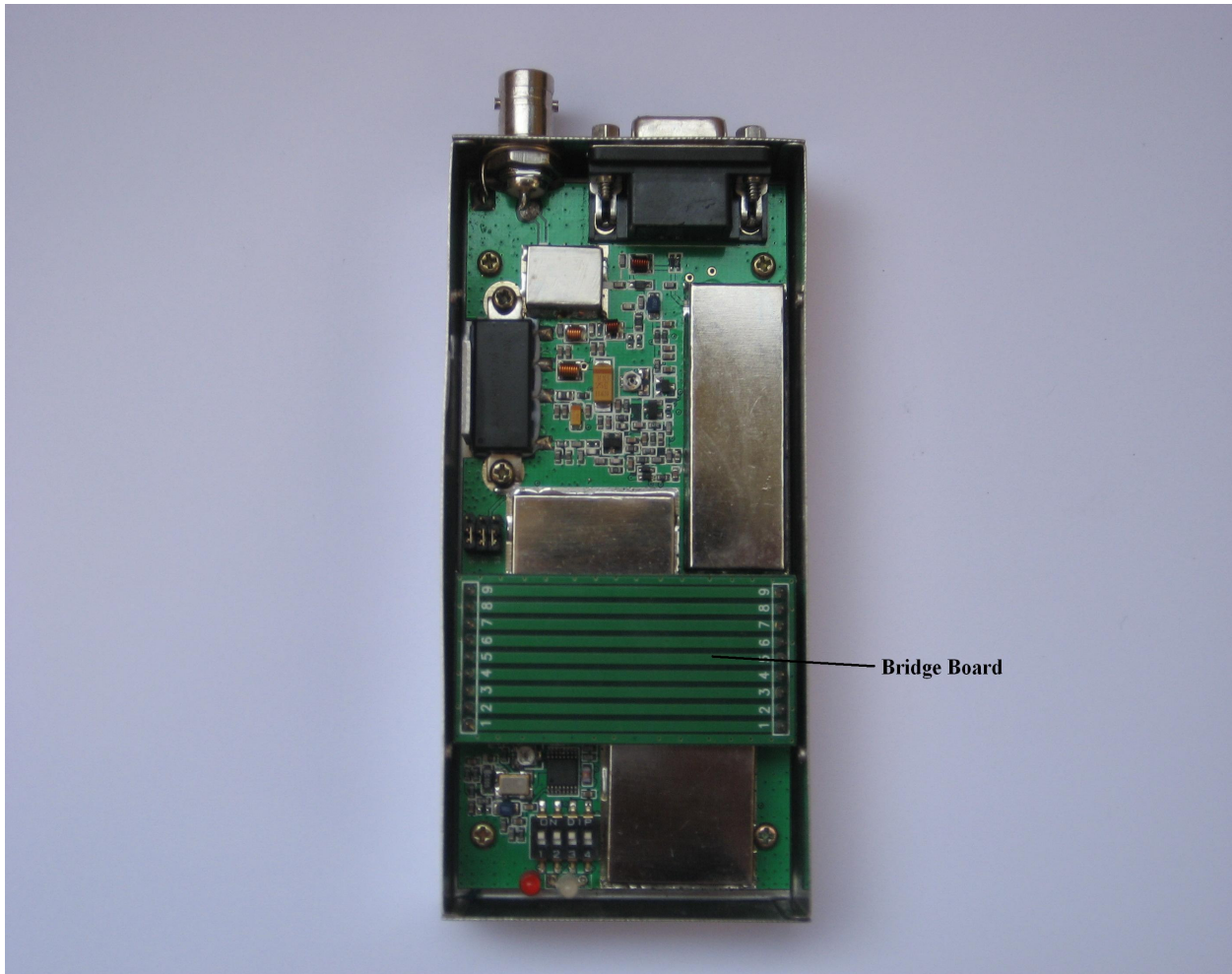


Fig.2. FC-301/D with bridge board

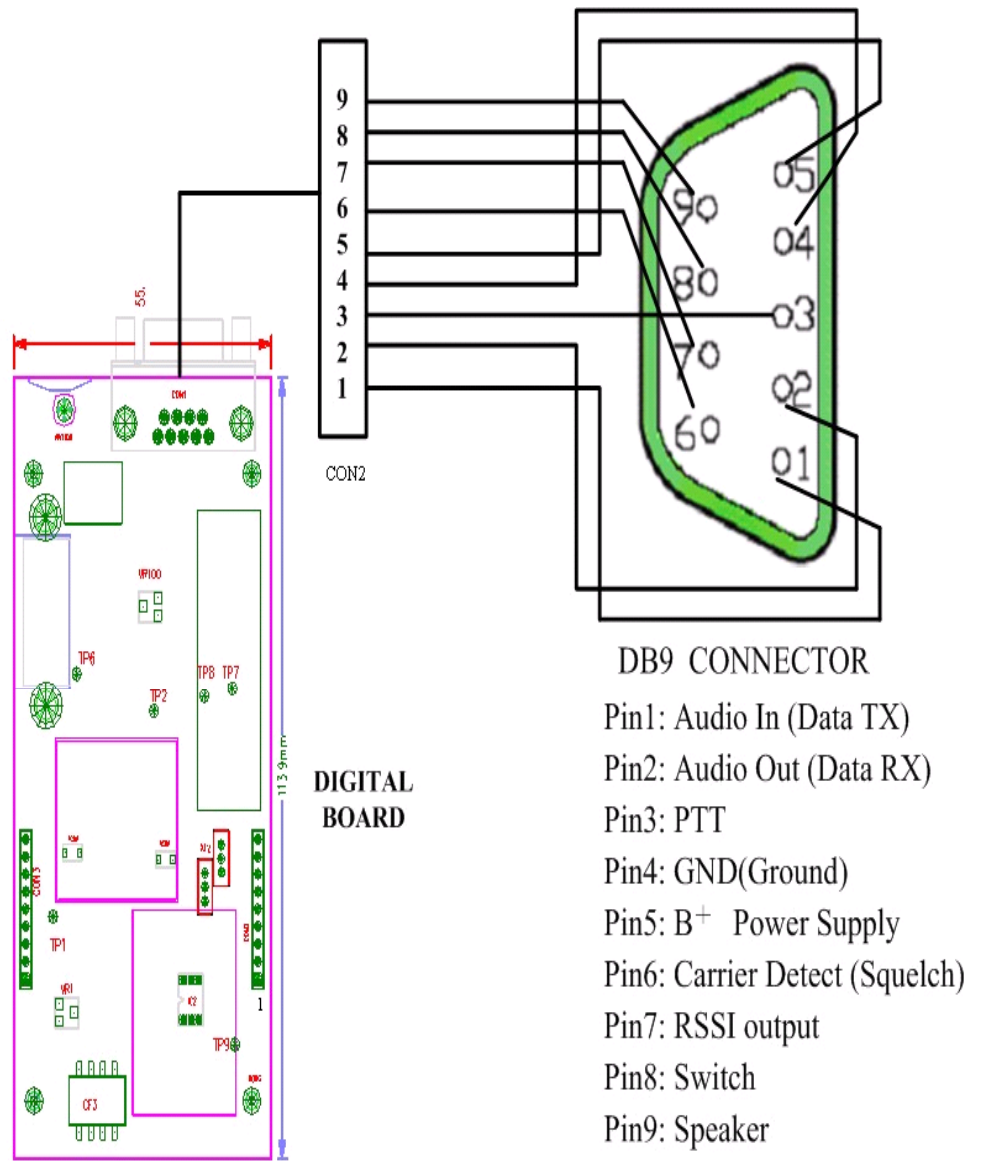


Fig.3. Wiring diagram

Table2 : Pin Description

Pin	Function	Type	Range	Description
Pin 1	Audio in(Data TX)	Input	200mVP-P ----- 300mVP-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	

## PROGRAMMING

When you want to program FC-301/D, you should connect the radio with the program cable (TTL to RS-232) to PC as shown in below Fig. 4.:

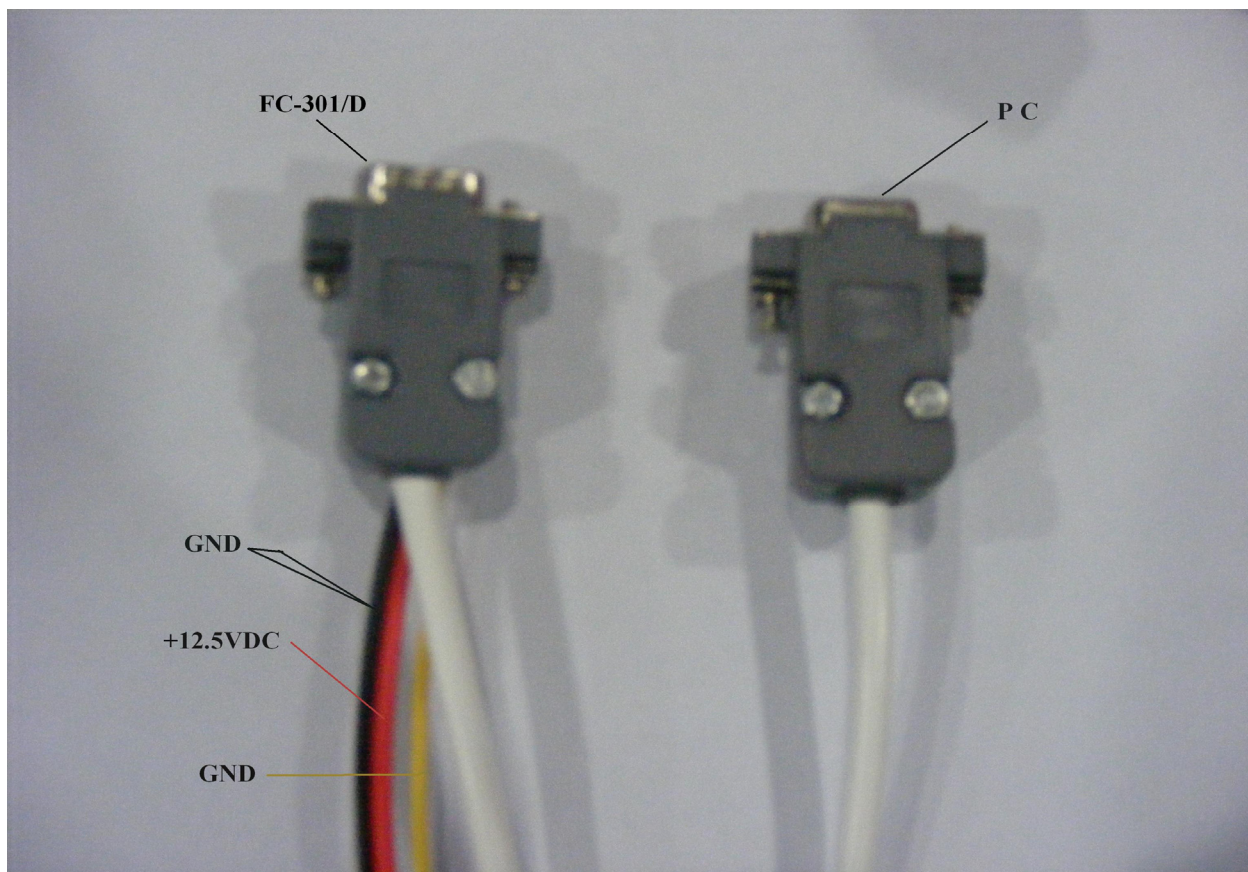


Fig.4. Program cable of FC-301/D

And the radio should be connected with the bridge board as shown in Fig.2. FC-301/D should be connected with PC via program cable as Fig.4. when in program mode. The detailed description as below:

Red wire (Pin 5): Power supply +12.5V,

Black wire (Pin 4): Power negative (GND).

Yellow wire(Pin 8): GND. (Yellow wire to GND for program, hung for

normal work mode).

Run program software 'QuickSet.exe' for FC-301/D to program the radio. The detailed procedures on programming FC-301/D as following:

I . To start FC-301/D Program Software and read the parameters of FC-301/D RF Link Module

Step 1: Make sure the radio FC-301/D is in program status (pin8 SW of CON1(DB9) in low level-GND) and the connection is ready between FC-301/D and PC via program cable.

Step 2: Double click 'QuickSet.exe' for FC-301/D. It will enter into program interface of FC-301/D as following:

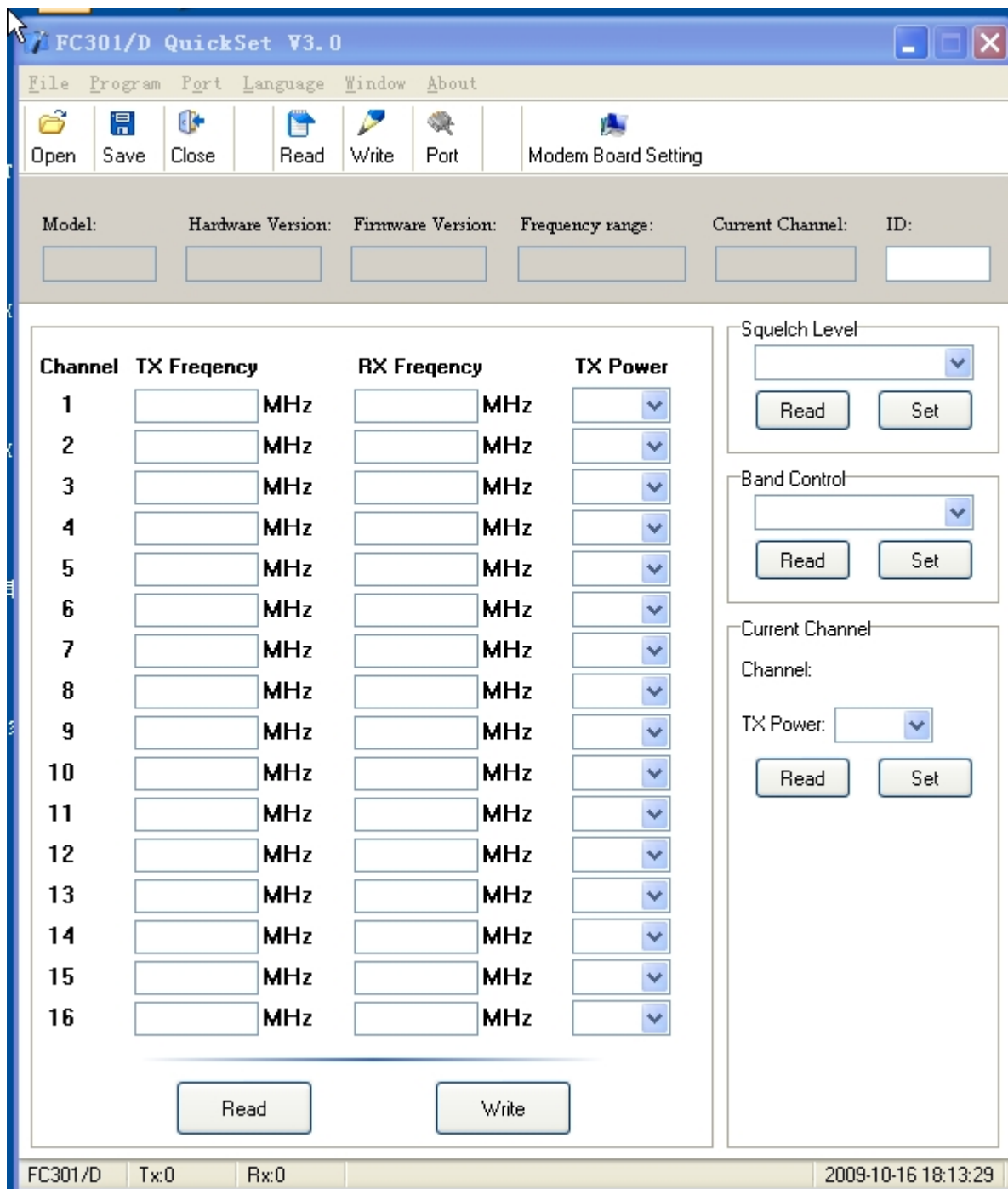


Fig.5.

Step 3: Click Icon 'Port' , choose and open the right serial port of PC.



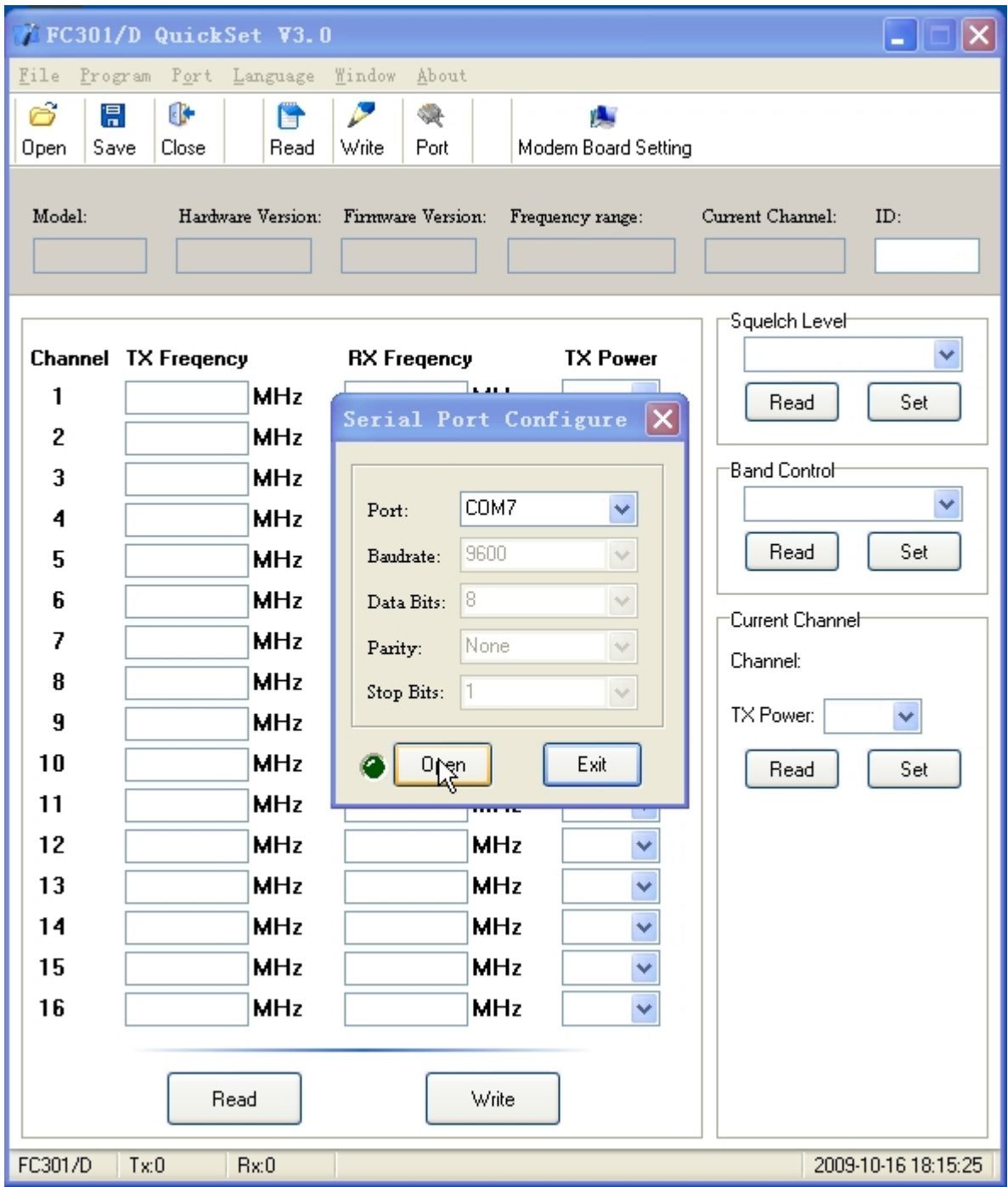


Fig.6.

Step 4: Click Icon ‘Read’, the software will automatically detect and read the parameters of FC-301/D as shown in Fig.7.

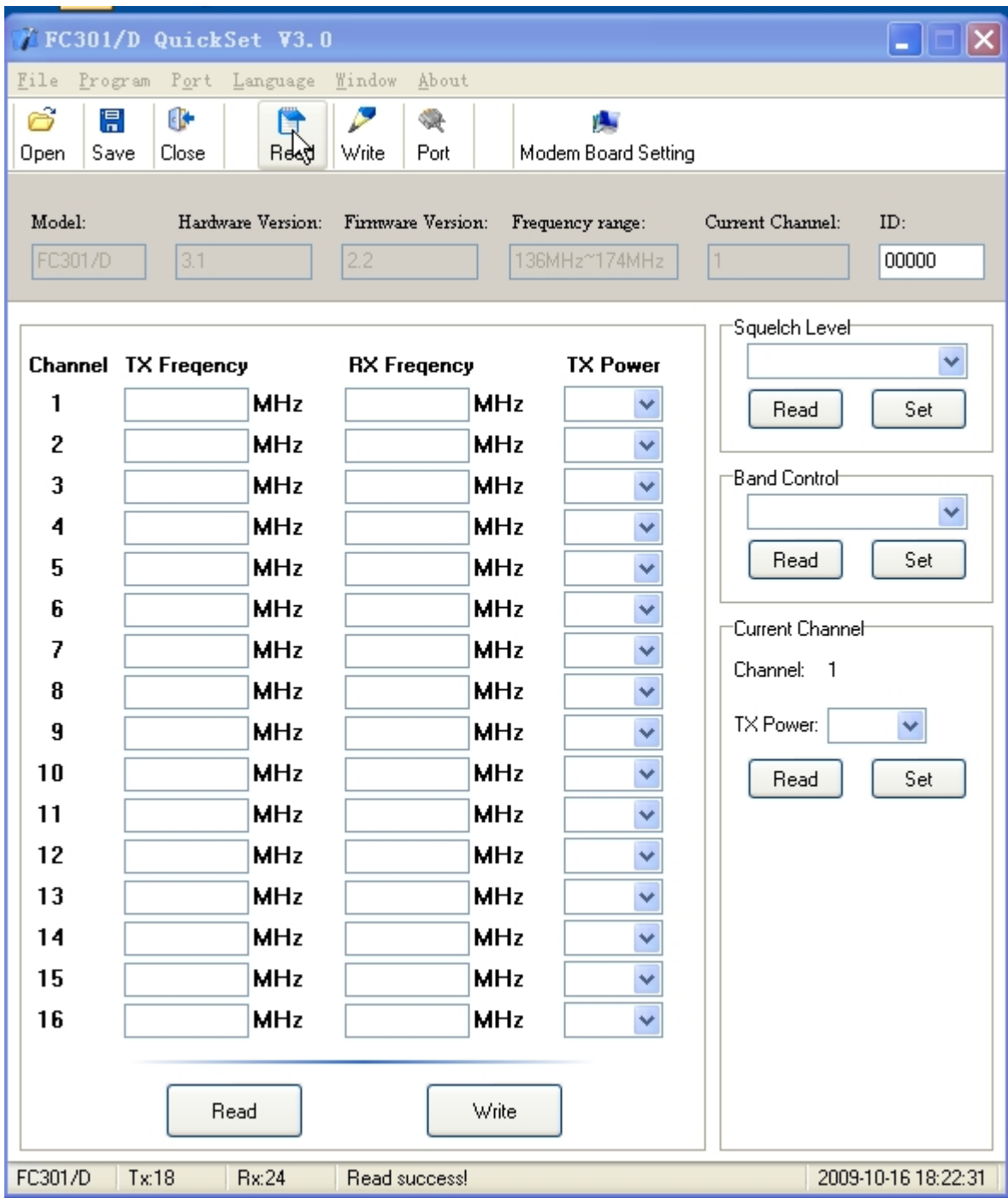


Fig.7.

The basic information about the radio will be displayed:

Model: FC-301/D

Hardware version: Indicates the hardware version.

Firmware version: Indicates the software version of the radio.

Frequency range: Indicates the frequency range.

Current channel: the default current channel 1.

ID: User can Input 5 digits(decimal) for ID code(for example 12345) (range from 0 to 65535). Zero will be added to the front.. You can set an ID for different FC-301/D. It can be changed by ‘Write’ as fig.8.

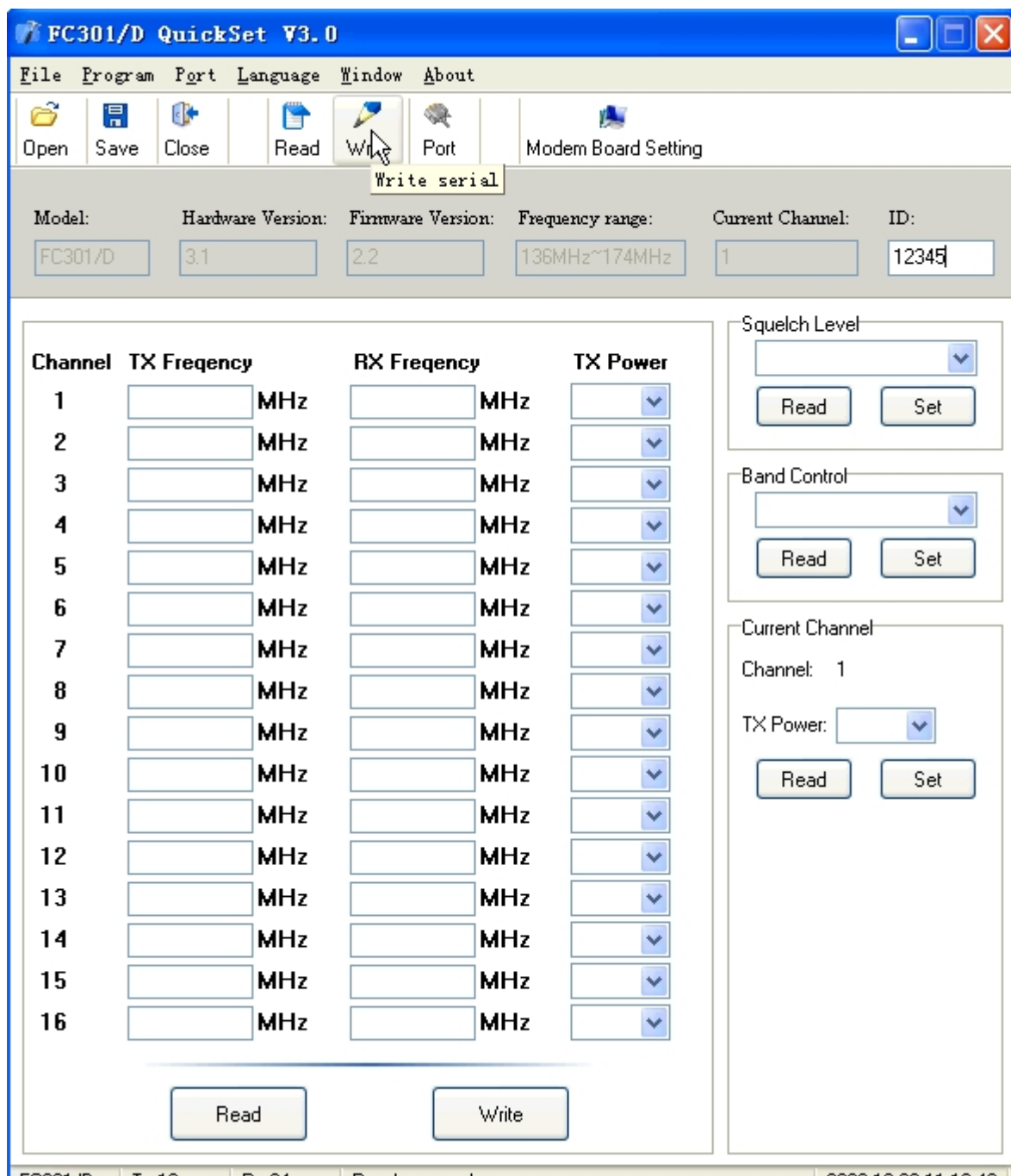


Fig.8.

II . To read / write the frequency and the Tx power of each channel

Click ‘Read ’, the frequency and the Tx power of each channel from 1 to 16 will be displayed on the screen as shown in Fig.9.

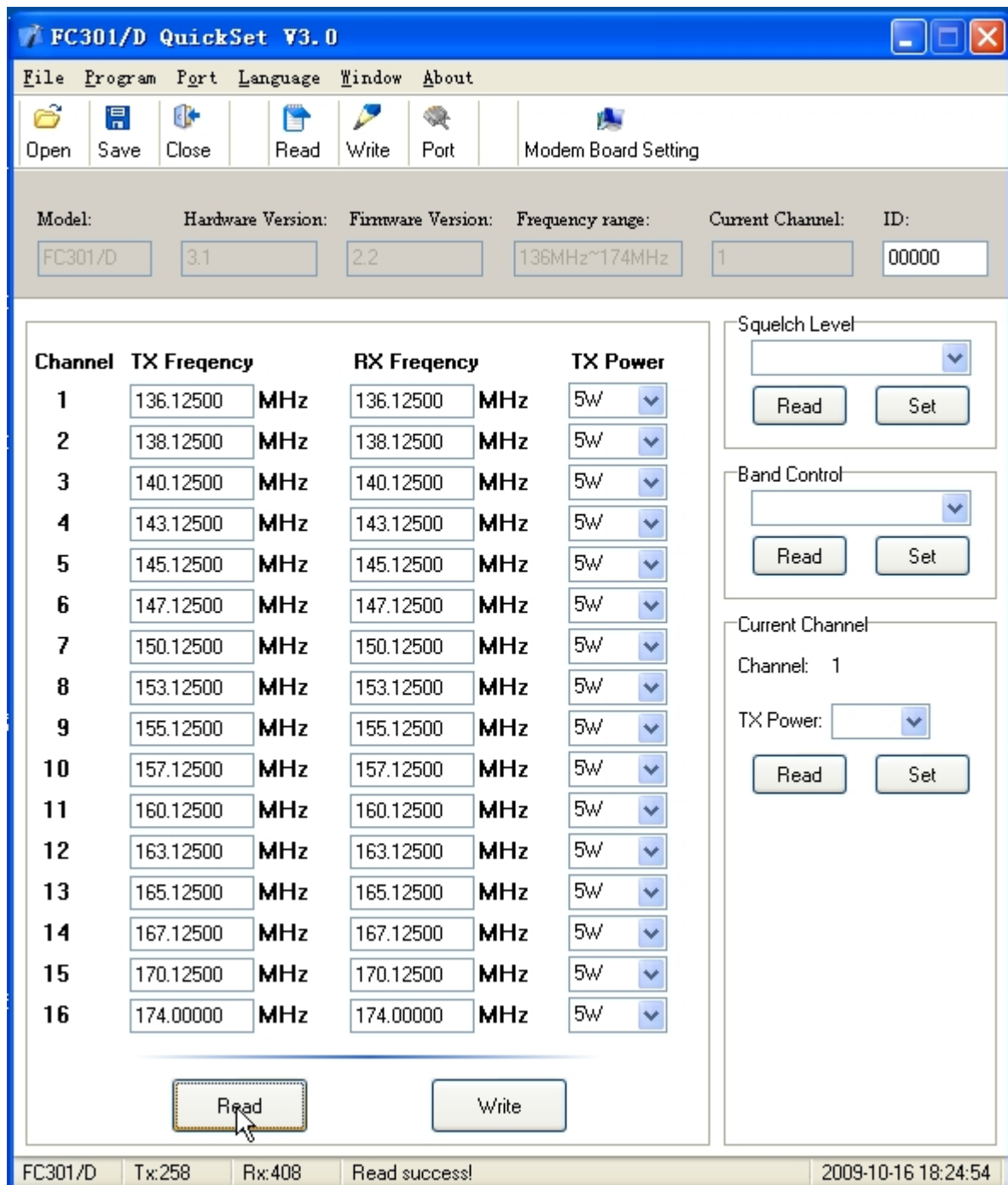


Fig.9.

The frequency and Tx power of each channel be changed by clicking the ‘Write’ button as shown in Fig.10.

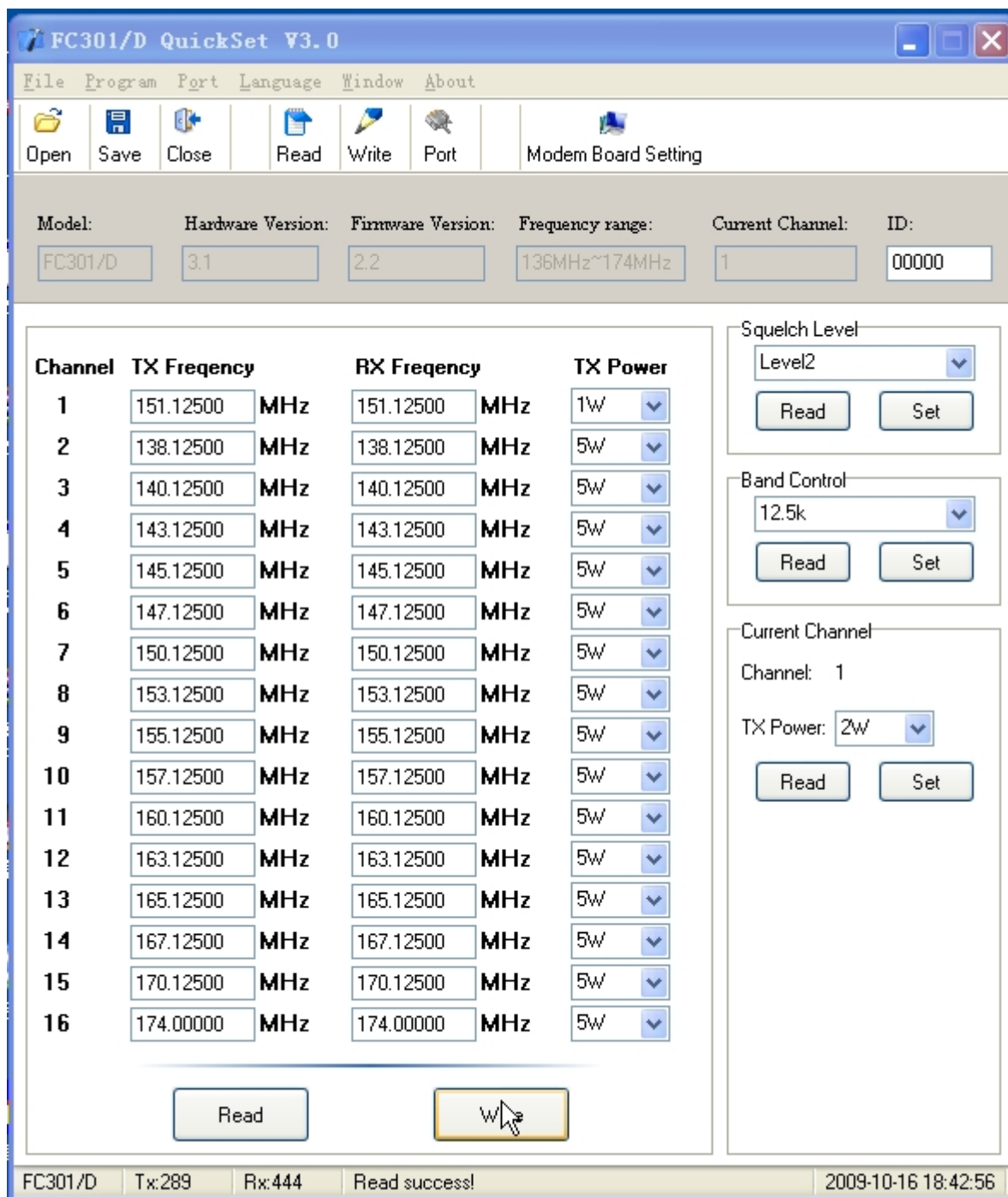


Fig.10.

III. To Read/Set squelch level.

Click 'Read' in the column of 'Squelch Level' as shown in Fig.11.

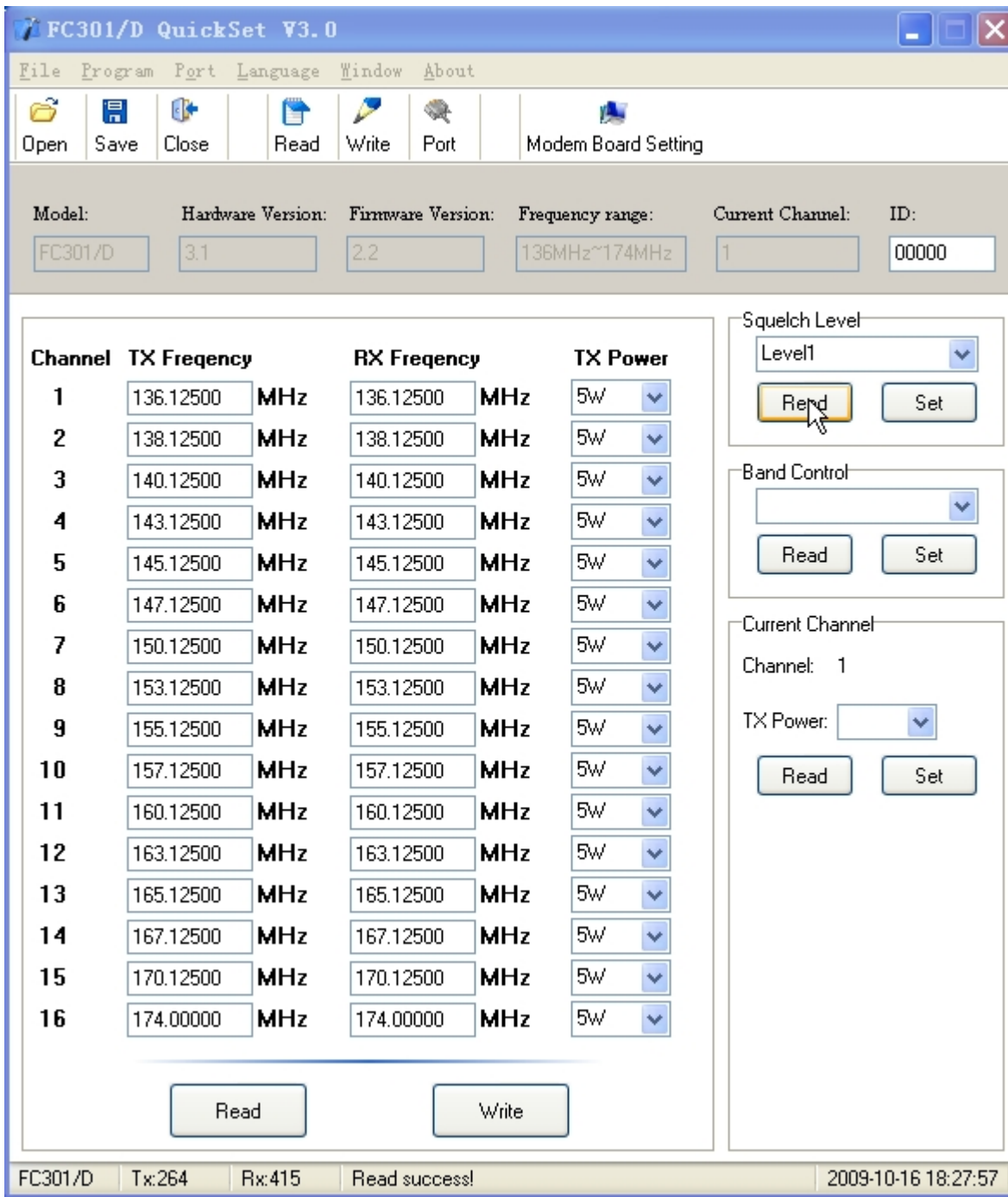


Fig.11.

Set squelch level: Select the SQ level in the column of 'Squelch Level', for example, select 'Level 2' then click 'Set' as shown in Fig.12

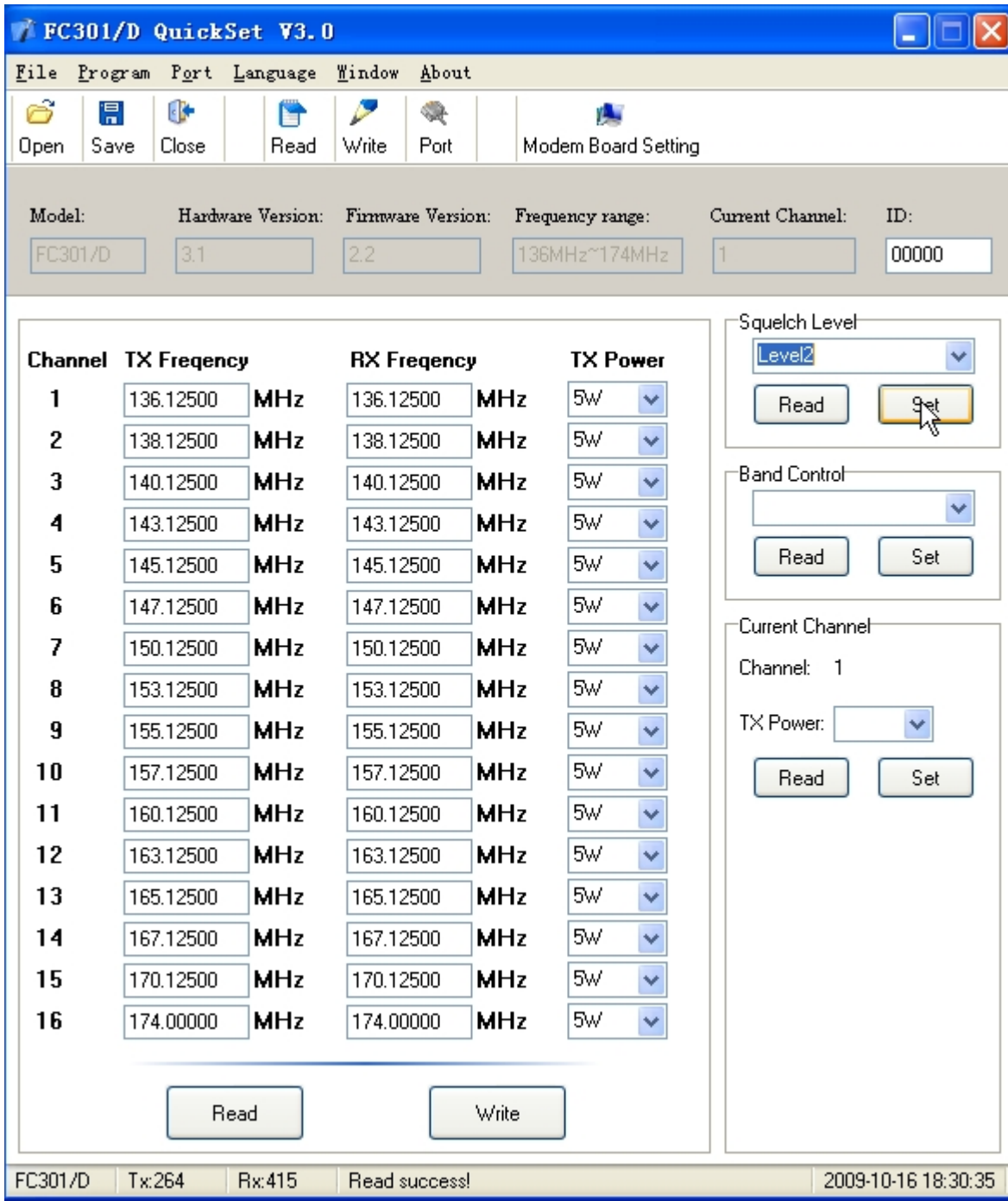


Fig.12.

IV. To choose channel spacing between 12.5kHz and 25kHz

In the 'Band Control' column, Click 'Read', the current channel spacing 25kHz can be read out as shown in Fig.13.

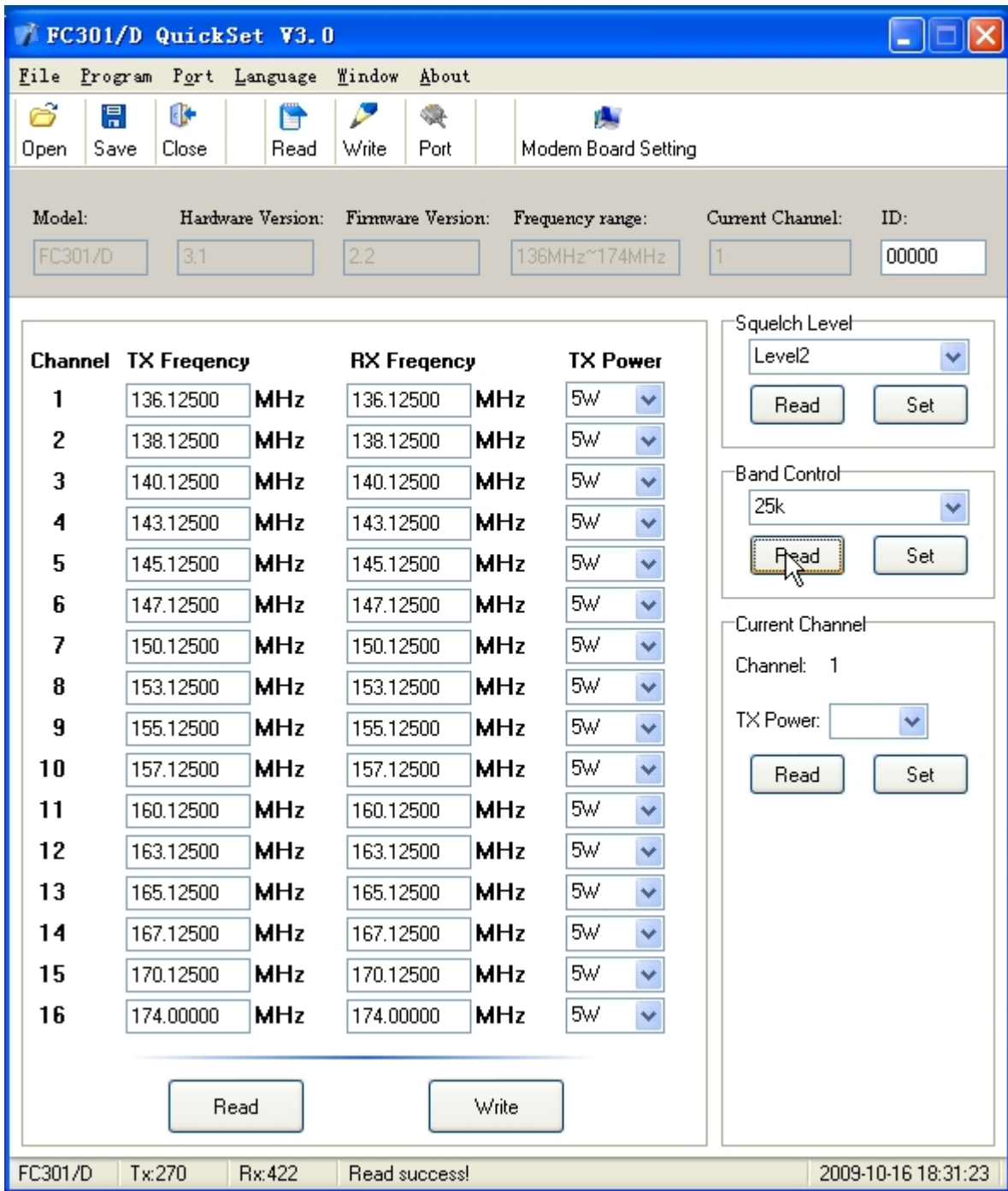


Fig.13.

Click ‘Set’, the selected channel spacing 12.5kHz can be written into FC-301/D as shown in Fig.14.



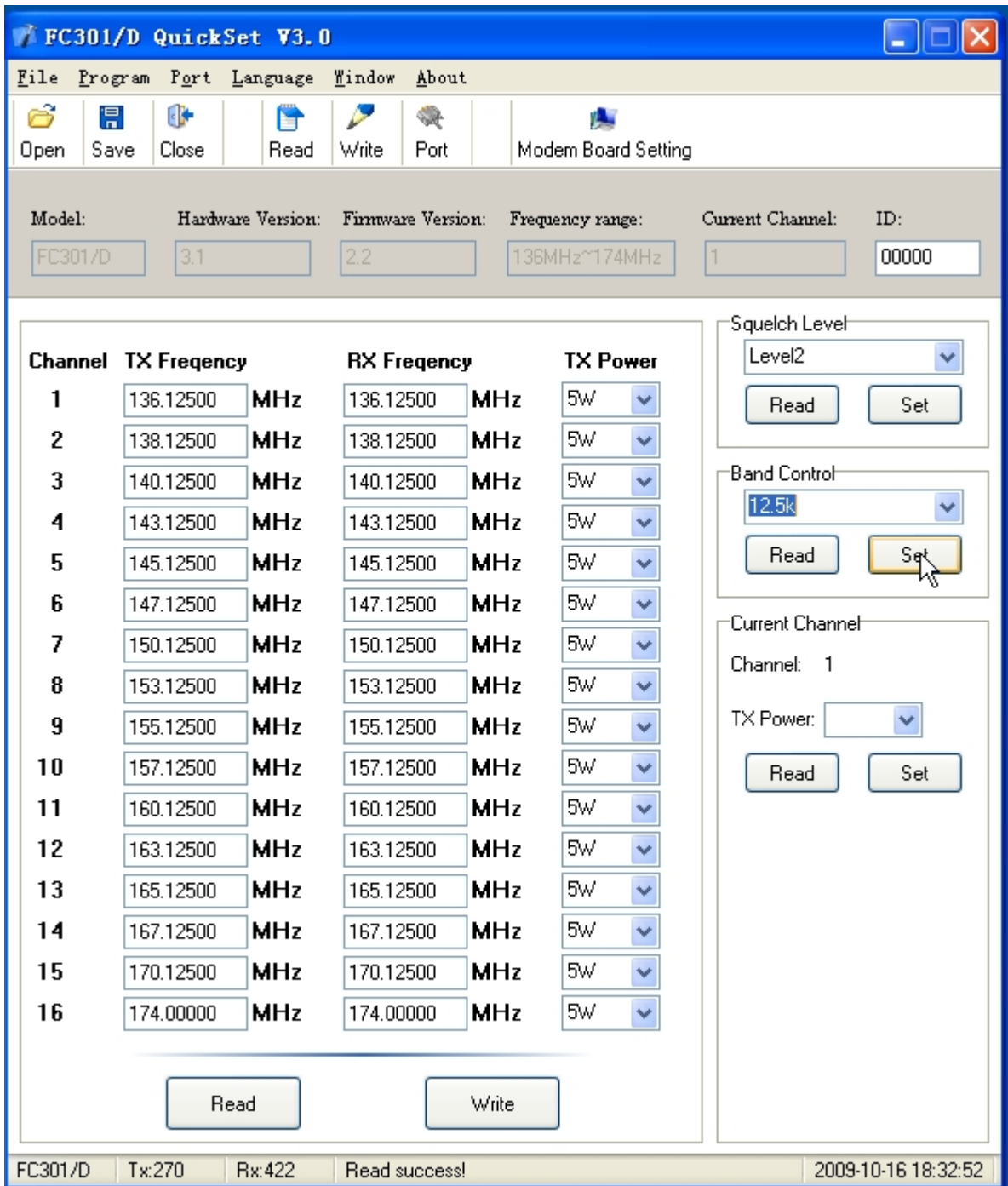


Fig.14.

V. To Read/set Tx power of the current channel.

When you just want to read the Tx power of current channel, Click the ‘Read’ as fig. 15. The Tx power of current channel will be displayed.

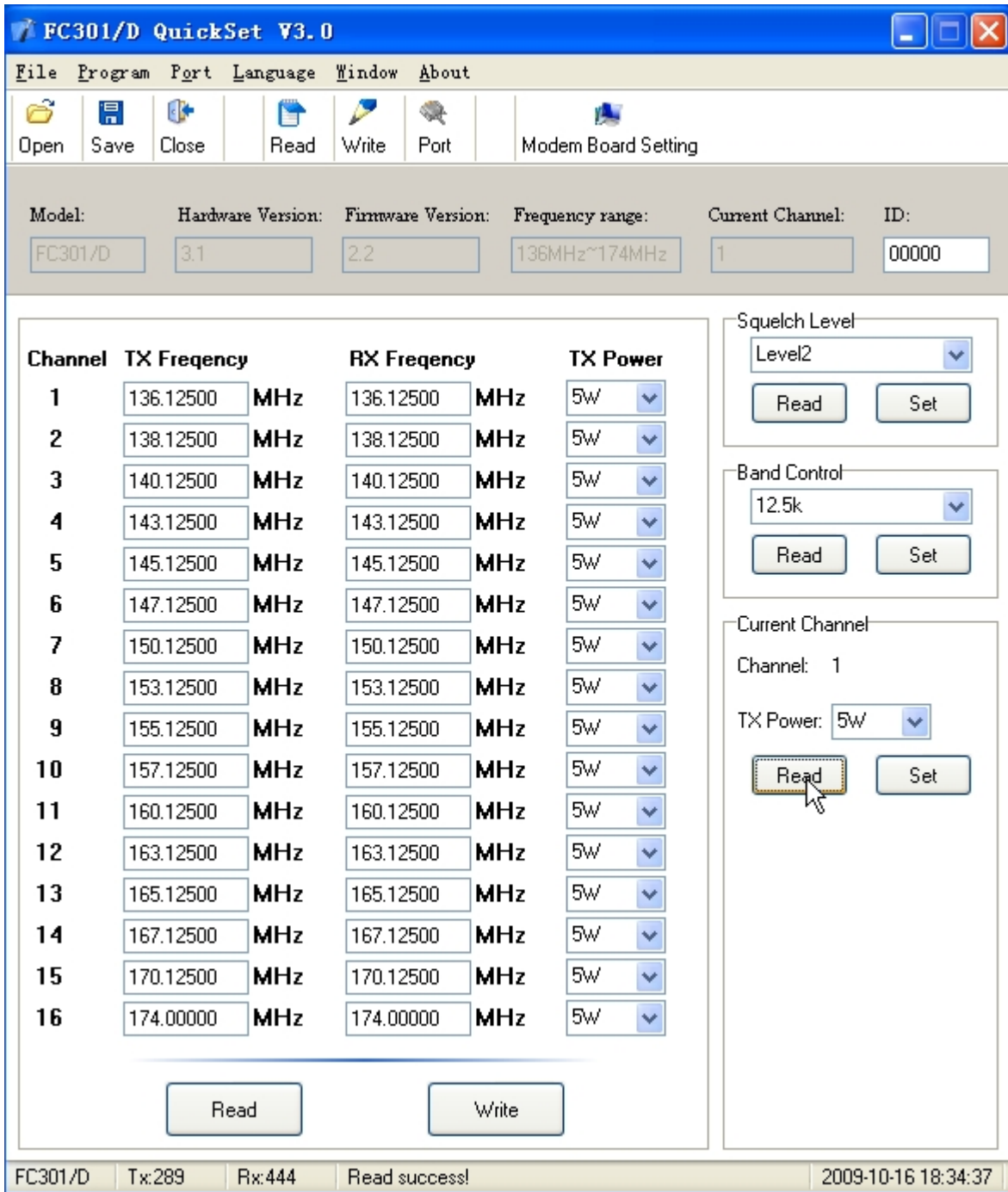


Fig.15.

When you just want to change the Tx power of current channel, choose the required Tx power (such as 2W) and click the ‘Set’ as fig. 16. The Tx power of current channel will be changed to 2W.

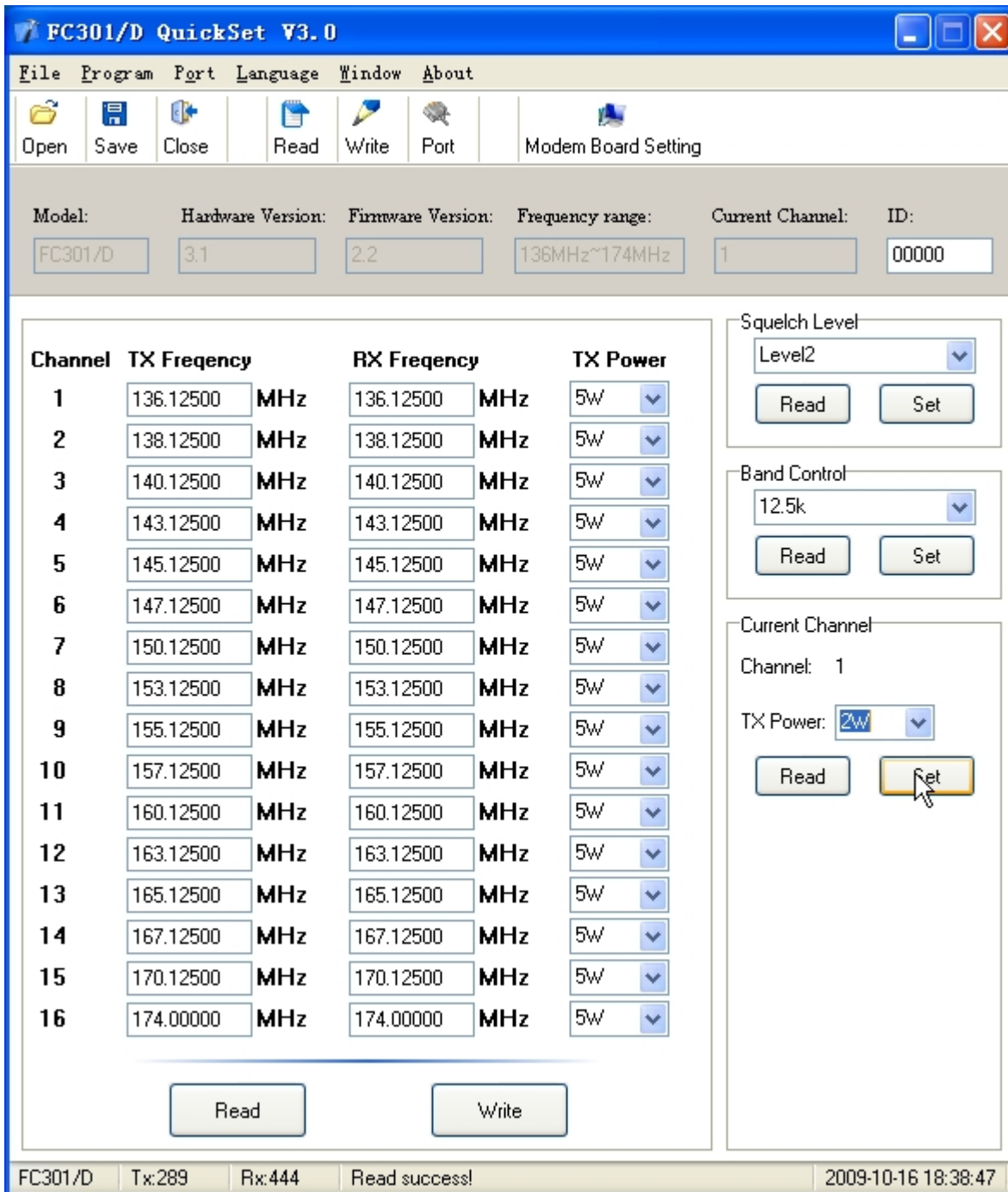


Fig.16.

## FACTORY DEFAULT SETTING

The hardware default setting:

S1,S2,S3: The default position of S1,S2,S3 are all down(Data\_out, Data\_in, Audio) as figure 17.

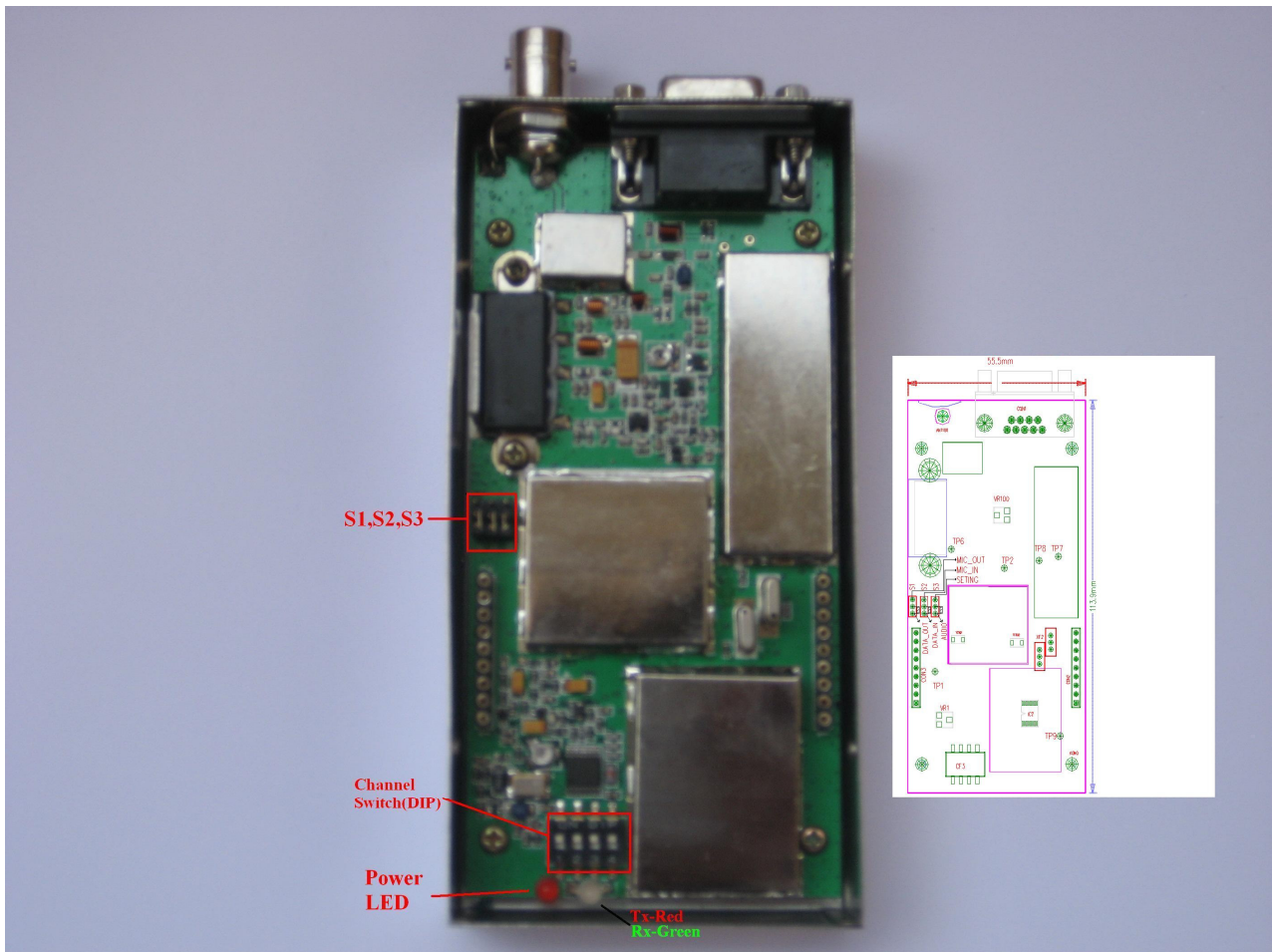


Fig.17.

Channel Switch (DIP): The default channel is channel 1. All the four DIP switches are at the ON side as the figure 17.

You can choose other channel as your working channel according to figure 18.

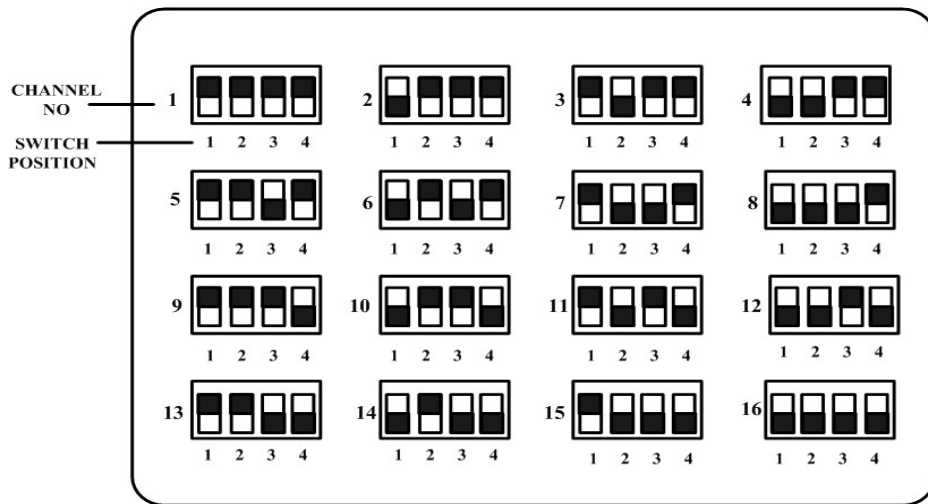


Fig.18.

Table 3: FC-301/D UHF Default Frequency and Tx Power

Channel	RX Frequency	TX Frequency	TX Power
1	400.1250MHZ	400.1250MHZ	5W
2	405.1250MHZ	405.1250MHZ	5W
3	410.1250MHZ	410.1250MHZ	5W
4	415.1250MHZ	415.1250MHZ	65
5	420.1250MHZ	420.1250MHZ	5W
6	425.1250MHZ	425.1250MHZ	5W
7	430.1250MHZ	430.1250MHZ	5W
8	435.1250MHZ	435.1250MHZ	5W
9	436.1250MHZ	436.1250MHZ	5W
10	440.1250MHZ	440.1250MHZ	5W
11	445.1250MHZ	445.1250MHZ	5W
12	450.125MHZ	450.1250MHZ	5W
13	455.1250MHZ	455.1250MHZ	5W
14	460.1250MHZ	460.1250MHZ	5W
15	465.1250MHZ	465.1250MHZ	5W
16	469.9750MHZ	469.9750MHZ	5W

Table 4: FC-301/D VHF Default Frequency and Tx Power

<b>Channel</b>	<b>RX Frequency</b>	<b>TX Frequency</b>	<b>TX Power</b>
1	136.1250MHZ	136.1250MHZ	5W
2	138.1250MHZ	138.1250MHZ	5W
3	140.1250MHZ	140.1250MHZ	5W
4	143.1250MHZ	143.1250MHZ	5W
5	145.1250MHZ	145.1250MHZ	5W
6	147.1250MHZ	147.1250MHZ	5W
7	150.1250MHZ	150.1250MHZ	5W
8	153.1250MHZ	153.1250MHZ	5W
9	155.1250MHZ	155.1250MHZ	5W
10	157.1250MHZ	157.1250MHZ	5W
11	160.1250MHZ	160.1250MHZ	5W
12	163.1250MHZ	163.1250MHZ	5W
13	165.1250MHZ	165.1250MHZ	5W
14	167.1250MHZ	167.1250MHZ	5W
15	170.1250MHZ	170.1250MHZ	5W
16	174.1250MHZ	174.1250MHZ	5W

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