

COFDM Bidirectional FDD module

Parameter configuration instructions

Version 1.0

Version update record:

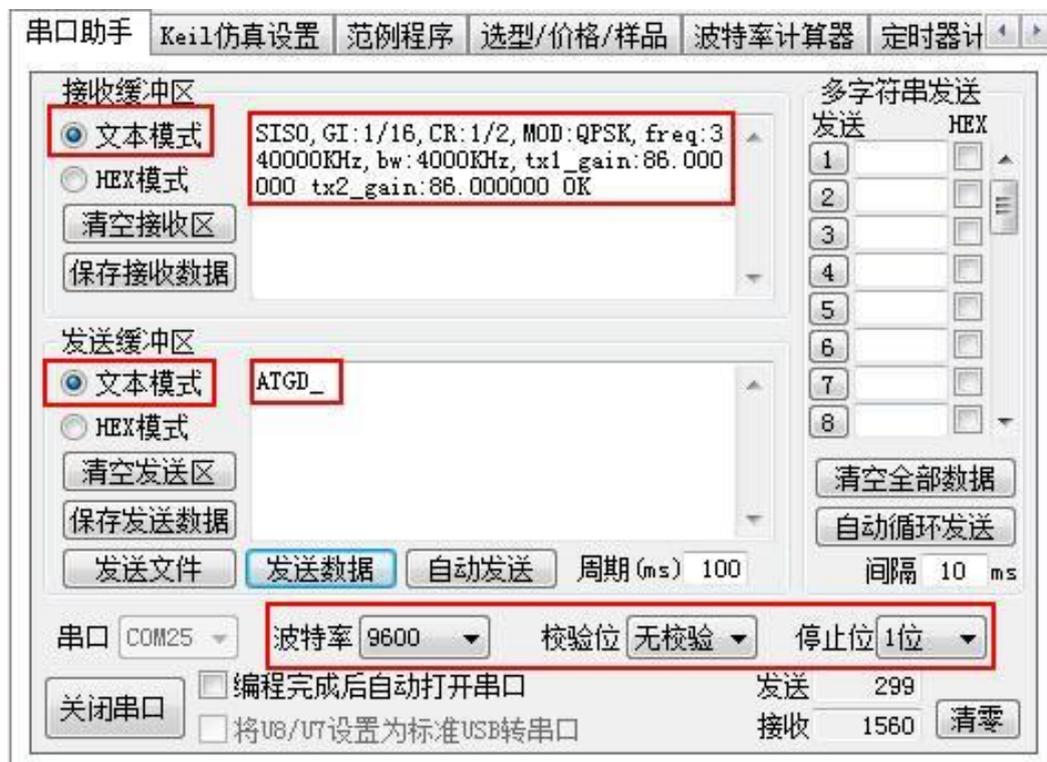
Version	Updated	describe
1.0	2024-7-1	initial version

When using the COFDM bidirectional FDD transceiver module, users may need to modify the configuration parameters of the module. To simplify the user's operation, we designed the parameter configuration into a few simple AT commands. The user only needs to use the specified AT command and pass the corresponding parameters to complete the parameter setting of the COFDM module.

1.1 Command introduction

The AT command to configure COFDM module parameters starts with "AT" and ends with an underscore "_". Each AT command has several or no parameters, and each AT command has a return value. Please see the introduction of the following commands for details.

Users can configure the serial port of the COFDM module (TTL level, 3.3V)Configure the parameters of the module. For detailed serial port configuration, refer to the figure below. please use "Serial debugging assistant" and other tools to send AT commands to the COFDM module, pay attention to use text mode,For example:



1.2 Command classification

AT commands for configuring COFDM module parameters are mainly divided into the following two categories:

Query command	ATGD、ATGR、ATGT、ATGB
Setup instructions	ATSD、ATSR、ATSP、ATST

1.3 Command details

1.3.1 set device command

Format	ATSD\$(mimo), \$(gi), \$(code_rate), \$(constellation), \$(freq(KHz)), \$(bw(KHz)), \$(tx1_gain), \$(tx2_gain)_ For example: ATSD0,1,0,0,800000,8000,86.0,86.0_																																																																																																																																																									
parameter	Single antenna/dual antenna mimo: 0 mimo disable; 1 mimo enable																																																																																																																																																									
	Guard interval GI: 0 1/32; 1 1/16; 2 1/8; 3 1/4																																																																																																																																																									
	Convolution code rate code rate: 0 1/2; 1 2/3; 2 3/4; 3 5/6; 4 7/8;																																																																																																																																																									
	Constellation constellation: 0 QPSK; 1 QAM16; 2 QAM64;																																																																																																																																																									
	RCB carrier center frequency freq (KHz) 200000~2700000 (200MHz~2.7GHz, 1KHz step) RC900 carrier center frequency freq (KHz) 750000~930000 (750MHz~930MHz, 1KHz step)																																																																																																																																																									
	RCB channel bandwidth bw (KHz) 2000~8000 (2MHz~8MHz, 1KHz step) RC900 channel bandwidth bw (KHz) 2000~8000 (2MHz~8MHz, 1KHz step)																																																																																																																																																									
	Transmitting antenna 1 gain tx1_gain 0.0~89.75dB, 0.25dB step																																																																																																																																																									
	Turn off antenna 2 gain tx2_gain 0.0~89.75dB, 0.25dB step																																																																																																																																																									
use	Used to set various parameters of the device (sender)																																																																																																																																																									
return value	For example: ATSD0,1,0,0,800000,8000,86.0,86.0_ SISO,GI:1/16,CR:1/2,MOD:QPSK,freq:800000KHz,bw:8000KHz,tx1_gain:86.000000 tx2_gain:86.000000 OK																																																																																																																																																									
Remark	<p>Set the command and save it after power off.</p> <p>Data rate calculation formulas corresponding to different bandwidths, guard intervals, convolutional code rates, and constellations</p> <p>Air interface rate Rate(MBps) = (BandWidth(MHz) * 8.0/7.0) / (1+GI) * 1512/2048*log2(constellation point) * code_rate * 188/204.</p> <p>Taking 8MHz bandwidth as an example, different guard intervals, convolutional code rates, constellation corresponding data rates and required receiving signal-to-noise ratios</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="5">Required C/N (dB) for BER = 2 x 10⁻⁴ after Viterbi QEF after Reed-Solomon (see note 2)</th> <th colspan="4">Bitrate (Mbit/s) (see note 3)</th> </tr> <tr> <th>Constellation</th> <th>Code rate</th> <th>Gaussian Channel (AWGN)</th> <th>Ricean channel (F₁)</th> <th>Rayleigh channel (P₁)</th> <th>ΔT_U = 1/4</th> <th>ΔT_U = 1/8</th> <th>ΔT_U = 1/16</th> <th>ΔT_U = 1/32</th> </tr> </thead> <tbody> <tr><td>QPSK</td><td>1/2</td><td>3.5</td><td>4.1</td><td>5.9</td><td>4.98</td><td>5.53</td><td>5.85</td><td>6.03</td></tr> <tr><td>QPSK</td><td>2/3</td><td>5.3</td><td>6.1</td><td>9.6</td><td>6.64</td><td>7.37</td><td>7.81</td><td>8.04</td></tr> <tr><td>QPSK</td><td>3/4</td><td>6.3</td><td>7.2</td><td>12.4</td><td>7.46</td><td>8.29</td><td>8.78</td><td>9.05</td></tr> <tr><td>QPSK</td><td>5/6</td><td>7.3</td><td>8.5</td><td>15.6</td><td>8.29</td><td>9.22</td><td>9.76</td><td>10.05</td></tr> <tr><td>QPSK</td><td>7/8</td><td>7.9</td><td>9.2</td><td>17.5</td><td>8.71</td><td>9.68</td><td>10.25</td><td>10.56</td></tr> <tr><td>16-QAM</td><td>1/2</td><td>9.3</td><td>9.8</td><td>11.8</td><td>9.95</td><td>11.06</td><td>11.71</td><td>12.06</td></tr> <tr><td>16-QAM</td><td>2/3</td><td>11.4</td><td>12.1</td><td>15.3</td><td>13.27</td><td>14.75</td><td>15.61</td><td>16.09</td></tr> <tr><td>16-QAM</td><td>3/4</td><td>12.6</td><td>13.4</td><td>18.1</td><td>14.93</td><td>16.59</td><td>17.56</td><td>18.10</td></tr> <tr><td>16-QAM</td><td>5/6</td><td>13.8</td><td>14.8</td><td>21.3</td><td>16.59</td><td>18.43</td><td>19.52</td><td>20.11</td></tr> <tr><td>16-QAM</td><td>7/8</td><td>14.4</td><td>15.7</td><td>23.6</td><td>17.42</td><td>19.35</td><td>20.49</td><td>21.11</td></tr> <tr><td>64-QAM</td><td>1/2</td><td>13.8</td><td>14.3</td><td>16.4</td><td>14.93</td><td>16.59</td><td>17.56</td><td>18.10</td></tr> <tr><td>64-QAM</td><td>2/3</td><td>16.7</td><td>17.3</td><td>20.3</td><td>19.91</td><td>22.12</td><td>23.42</td><td>24.13</td></tr> <tr><td>64-QAM</td><td>3/4</td><td>18.2</td><td>18.9</td><td>23.0</td><td>22.39</td><td>24.88</td><td>26.35</td><td>27.14</td></tr> <tr><td>64-QAM</td><td>5/6</td><td>19.4</td><td>20.4</td><td>26.2</td><td>24.88</td><td>27.65</td><td>29.27</td><td>30.16</td></tr> <tr><td>64-QAM</td><td>7/8</td><td>20.2</td><td>21.3</td><td>28.6</td><td>26.13</td><td>29.03</td><td>30.74</td><td>31.67</td></tr> </tbody> </table> <p>NOTE 1: Figures in italics are approximate values. NOTE 2: Quasi Error Free (QEF) means less than one uncorrected error event per hour, corresponding to BER = 10⁻¹¹ at the input of the MPEG-2 demultiplexer. NOTE 3: Net bit rates are given after the Reed-Solomon decoder.</p>	Required C/N (dB) for BER = 2 x 10 ⁻⁴ after Viterbi QEF after Reed-Solomon (see note 2)					Bitrate (Mbit/s) (see note 3)				Constellation	Code rate	Gaussian Channel (AWGN)	Ricean channel (F ₁)	Rayleigh channel (P ₁)	ΔT _U = 1/4	ΔT _U = 1/8	ΔT _U = 1/16	ΔT _U = 1/32	QPSK	1/2	3.5	4.1	5.9	4.98	5.53	5.85	6.03	QPSK	2/3	5.3	6.1	9.6	6.64	7.37	7.81	8.04	QPSK	3/4	6.3	7.2	12.4	7.46	8.29	8.78	9.05	QPSK	5/6	7.3	8.5	15.6	8.29	9.22	9.76	10.05	QPSK	7/8	7.9	9.2	17.5	8.71	9.68	10.25	10.56	16-QAM	1/2	9.3	9.8	11.8	9.95	11.06	11.71	12.06	16-QAM	2/3	11.4	12.1	15.3	13.27	14.75	15.61	16.09	16-QAM	3/4	12.6	13.4	18.1	14.93	16.59	17.56	18.10	16-QAM	5/6	13.8	14.8	21.3	16.59	18.43	19.52	20.11	16-QAM	7/8	14.4	15.7	23.6	17.42	19.35	20.49	21.11	64-QAM	1/2	13.8	14.3	16.4	14.93	16.59	17.56	18.10	64-QAM	2/3	16.7	17.3	20.3	19.91	22.12	23.42	24.13	64-QAM	3/4	18.2	18.9	23.0	22.39	24.88	26.35	27.14	64-QAM	5/6	19.4	20.4	26.2	24.88	27.65	29.27	30.16	64-QAM	7/8	20.2	21.3	28.6	26.13	29.03	30.74	31.67
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1.3.2 get device status command

Format	ATGD_
parameter	none
use	Used to query the current number of transmitting antennas, guard interval, convolutional code rate, number of constellations, transmitting frequency, bandwidth, and gain parameters (transmitter)
return value	For example: ATGD_ SISO,GI:1/16,CR:1/2,MOD:QPSK,freq:800000KHz,bw:8000KHz,tx1_gain:86.000000 tx2_gain:86.000000 OK
Remark	Query command

1.3.3 set receiver command

Format	ATSR\$(freq), \$(bw) _ For example: ATSR320000,6000 _
parameter	Carrier center frequency freq (KHz) 200000~860000 (200MHz~860MHz, 1KHz step) Channel bandwidth bw (KHz) 2000~8000(2MHz~8MHz, 1KHz step)
use	Used to set receiver parameters
return value	For example: ATSR320000,6000 _ ATSR320000,6000 OK
Remark	1、 Set the command and save it after power off.

1.3.4 get receiver command

Format	ATGR_
parameter	none
use	Used to query the receiving end parameters
return value	For example: ATGR_ ATGR320000,6000, aes:0 OK
Remark	1、 Query command 2、 The aes parameter indicates the current encryption status: 0 disable; 1 enable

1.3.5 get bit error rate命令

Format	ATGB_
parameter	none
use	Used to query the bit error rate and signal strength of the dual antennas at the receiving end
return value	For example: ATGB_ ATGB ber1:0.00% ber2:0.00% RSSI1:54 RSSI2:53 Lock1:1 Lock2:1 OK
Remark	1、 Query command 2、 ber1 and ber2 respectively represent the bit error rate of each antenna, ranging from 0.0% to 100.0%

	<p>3、RSSI1 and RSSI2 respectively represent the signal strength of each antenna, ranging from 0 to 100.</p> <p>4、Lock1 and Lock2 respectively represent the signal locking status of each antenna (1 represents signal locking)</p>
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1.3.6 set password command

Format	ATSP\$(password), \$(password) _ For example: ATSP123456,123456_
parameter	AES key password: 6-digit password (ASCII) AES key password: 6-digit password (ASCII) (repeat to confirm)
use	Used to set the AES key of the transceiver and receiver
return value	For example: ATSP123456,123456_ ATSP123456 OK
Remark	1. When the password is all 0, turn off AES encryption. 2. Set the command and save it after power off.

1.3.7 set data transfer command

Format	ATST\$(baud rate), \$(parity) _ For example: ATST115200,0_
parameter	baud rate: 1200、2400、4800、9600、19200、38400、57600、115200 Check parity: 0: None; 1:Odd; 2:Even
use	Used to set the baud rate and parity bit of the data transparent transmission serial port
return value	For example: ATST115200,0_ ATST115200,0 OK
Remark	Set command

1.3.8 get data transfer command

Format	Traffic safety_
parameter	none
use	Used to query the baud rate and check digit of the data transparent transmission serial port
return value	For example: Traffic safety_ ATGT115200,0 OK
Remark	Query command