

Taixin **AH** performance test method



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Revision history

date	Version	describe	Revised by
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1 Overview

This article introduces how to test the Tx/Rx of the AH module on the solution board without a test instrument for the AH protocol.

Is the performance normal? The test results can be used as a basis for improving the performance of the solution board.

2 Test methods

2.1 Serial port settings

Serial port configuration is as shown below.

端口(O):	COM7	流控 <input type="checkbox"/> DTR/DSR <input type="checkbox"/> RTS/CTS <input type="checkbox"/> XON/XOFF
波特率(B):	115200	
数据位(D):	8	
奇偶校验(A):	None	
停止位(S):	1	

Figure 2-1 Serial port parameter configuration

In addition, please pay attention to selecting the new line mode, taking SecureCRT as an example:

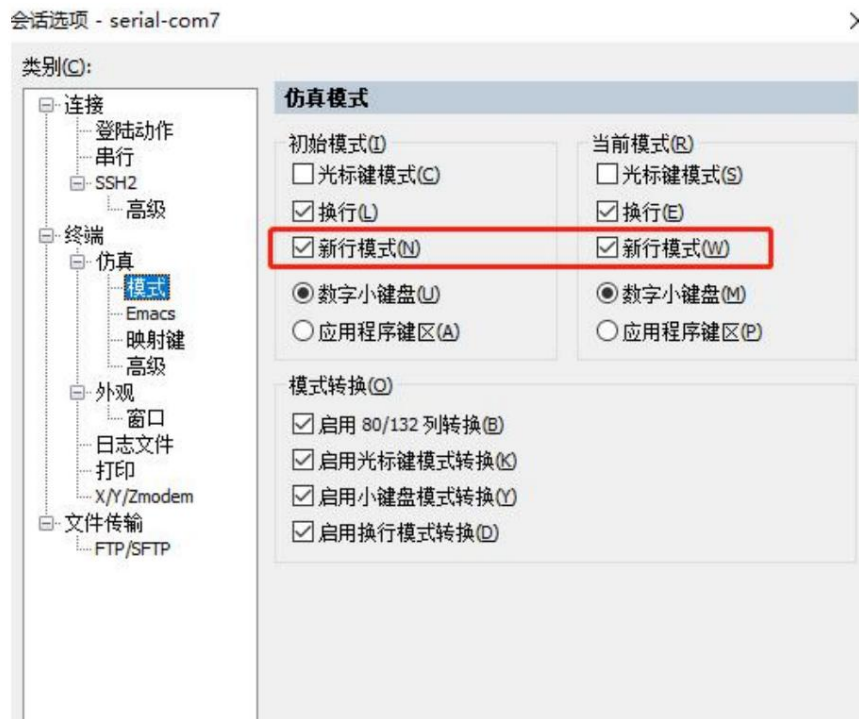
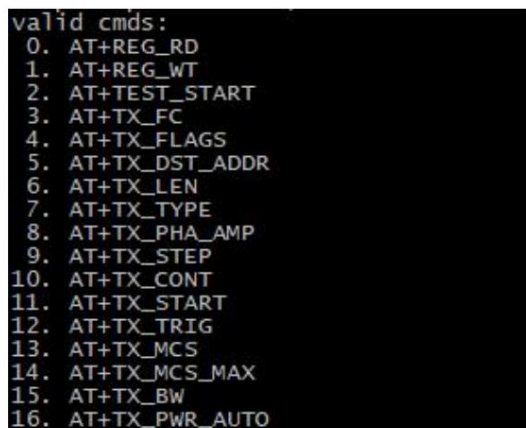


Figure 2-2 Select New Line Mode

To test whether the serial port is normal, enter AT+, and it will print as shown below:



```
valid cmds:
0. AT+REG_RD
1. AT+REG_WT
2. AT+TEST_START
3. AT+TX_FC
4. AT+TX_FLAGS
5. AT+TX_DST_ADDR
6. AT+TX_LEN
7. AT+TX_TYPE
8. AT+TX_PHA_AMP
9. AT+TX_STEP
10. AT+TX_CONT
11. AT+TX_START
12. AT+TX_TRIG
13. AT+TX_MCS
14. AT+TX_MCS_MAX
15. AT+TX_BW
16. AT+TX_PWR_AUTO
```

Figure 2-3 Echo of inputting AT+

If there is no such print, it means that the serial port input is incorrect and you need to contact our FAE.

2.2 Introduction to serial port commands

(1) Enter/exit test mode

at+test_start=1 or 0

After entering test mode, the default is rx mode;

(2) Set the center frequency point

at+lo_freq=908000

The unit is Khz, 908000 means 908M, 921500 means 921.5M;

This command will not be saved after power off;

(3) Set bandwidth

at+bss_bw=8 or 4 or 2 or 1

The four supported bandwidths are 8M, 4M, 2M, and 1M. It is recommended that the setting values be consistent with the actual situation of the solution;

(4) Set entry/exit Tx mode

at+tx_start=1 or 0

(5) Set MAC address

at+mac_addr=0

Entering test mode to do Rx testing requires setting mac_addr to 0;

(6) at+tx_mcs=255 or any value from 0 to 7

By default, tx_mcs=255 means automatically switching mcs according to channel conditions; set to any one from 0 to 7

The value representation is fixed to this mcs;

In test mode, 255 will be sent using mcs7. When doing Tx/Rx testing, it is recommended to set mcs=1, which is fixed to 1, to avoid

mcs7 cannot solve the problem when Rx performance is poor, resulting in incorrect test results;

This command will be saved after power off. Please be careful to restore mcs to 255 after the test is completed to avoid fixing it to mcs1 in actual use.

Fixing it to mcs1 will affect actual use;

(7) Set up Channel list

at+chan_list=9080y9160y9240

This command is to set the channel list to be used, the unit is 100Khz, 9080 means 908M; according to the actual plan

situation setting;

The configuration result of this command will be saved after power off. Please note that it will be restored to the original value after testing;

(8) Start background noise scanning

at+acs_start=1 This

command starts automatic scanning of background noise. You can see the minimum value (min), average value (avg), and maximum value (max) of the background noise (bgr, backgroundrssi) of each channel;

2.3 Test items

2.3.1 Tx-Rx test

In the absence of AH dedicated test equipment, in order to facilitate the testing of the solution board and troubleshoot the problem of poor Tx and Rx performance, you can consider using two solution boards Tx-Rx for testing.

It is recommended to make sure that the Rx side is ok when testing the Tx side, and vice versa. If the Tx-Rx side is connected through a radio frequency cable, it is recommended to use an attenuator of about 50db in the middle. If no attenuator is connected, the received energy will be too large and the test will be inaccurate. If the Tx-Rx side is connected to an antenna, it is recommended to use two prototypes. The distance is more than 1 meter to avoid being too close and causing too much received energy.

The Tx side test command sequence is as

follows: a) at+test_start=1 //Enter test mode b) at+lo_freq=908000 //

Take 908M as an example here, subject to the actual supported frequency of the AH module c) at+bss_bw=8 //The bandwidth here is

8M and the distance is subject to the actual bandwidth used by the solution d) at+mac_addr=0 //Clear the mac address to 0 //

Enable tx and enter tx mode e) at+tx_start=1 //Set mcs =1 f)

at+tx_mcs=1

The Rx side test command sequence is as

follows: a) at+test_start=1 //Enter test mode b) at+lo_freq=908000 //

Take 908M as an example here, subject to the supported frequency of the actual module c) at+bss_bw=8 //Here is an example

of bandwidth 8M, subject to the actual bandwidth used by the solution d) at+mac_addr=0 //Clear the mac address to 0

Result analysis:

(1) If the reception and transmission of both Tx-Rx parties are normal, the printing will be as shown in Figure 2-4a and 2-4b.

```

----- tx模式
test mode: tx
LO: 908000 KHz freq_dev= -1197
chip-temperature:46, vcc:3.34

tx subfrm = 853 发送的包数
tx fail= 11
tx PER = 1% per误包率<5%表示对方收包和我方收应答都正常
tx mcs = 1
tx bw = 8M

rx subfrm = 966 收到对方包数, 主要是应答包
rx err = 0
rssi = -31
agc = 7731 rssi和evm的情况
evm = -30
-----
local: 0: 0: 0: 0: 0: 0: 0: 0 mac地址清成0了

```

Figure 2-4a Tx side printing when Tx-Rx are both normal

```

----- rx模式
test mode: rx
LO: 908000 KHz freq_dev= 1150
chip-temperature:45, vcc:3.43

tx subfrm = 0
tx fail= 0
tx PER = 0%
tx mcs = 0
tx bw = 2M

rx subfrm = 948 收到的对方的包
rx err = 0
rssi = -33
agc = 7312 rssi和evm的情况
evm = -31
-----
local: 0: 0: 0: 0: 0: 0: 0: 0 AID=0

```

Figure 2-4b Rx side printing when Tx-Rx are both normal

(2) If the number of packets received by the Rx side is very small, it may be that the transmission of the Tx side is

abnormal; (3) If the packets received by the Rx side are normal, but the response packets received by the Tx side are very few, it means that the transmission of the Rx side is

abnormal. There may be problems with sending; (4) If one party's sending can be confirmed, there is no problem, but the other party's rssi and evm are not good, it may be that there is a problem with the receiving performance of this party; you can even use this method to simply test the receiving party's Sensitivity

(you may need to use a variable attenuator and a shielding box, or move the transmitter far away to see the relationship between the signal rssi and evm at

the receiver); When testing sensitivity, first let the Rx side RSSI be around -40dbm and record a printing cycle The number of received packets (under normal circumstances should all be correct), then increase the attenuator and see how small the RSSI is. When the number of correct packets (received packets -

incorrectly received packets) decreases to the level when the signal is large, record it 90% of the number of packets received, observe rssi and evm; Figure 2-5 is

the cable sensitivity test value of the AH module. The condition of the air interface will usually deteriorate by several db. If it deteriorates too much, it is

recommended to optimize the hardware design.

测试频点 900MHz

BW	1M	2M	4M	8M
MCS				
0	-106	-103	-99	-96
1	-103	-100	-97	-94
2	-102	-99	-96	-93
3	-99	-96	-93	-90
4	-96	-93	-90	-87
5	-94	-90	-87	-83
6	-93	-89	-86	-82
7	-91	-87	-84	-81
10	-108	-	-	-

Figure 2-5 Sensitivity test value of AH module

2.3.2 Background noise scanning

You can use the at+acs_start=1 command to scan the background noise bgr brought by the solution board emi. Usually the antenna is connected to scan the bgr, because the antenna can receive the emi noise of the solution board, and the radio frequency cable will be shielded emi noise, resulting in much better results than the antenna.

When testing, try to stay away from external interference sources, such as interference from base stations and interference from other boards. It would be better if there is a shielding box. Enter at+acs_start=1, and you can see the serial port echo as shown in Figure 2-5.

All frequencies in the Channel list will be scanned. The number of scans for each frequency is determined by the bandwidth, such as 8M. The bandwidth will be scanned 8 times, the 4M bandwidth will be scanned 4M, etc.;

You can see the min / avg / max columns in the Bgr scan results. It is recommended to focus on avg, followed by max; usually under 8M bandwidth, bgr-avg is considered ok if it is <-90. If it is >-90, it is recommended to consider rectifying the EMI of the hardware; The situation of 4M should be viewed at -3db on 8M, that is, bgr-avg is relatively ok at <-93. If >-93, it is recommended to consider rectification; the situation of 2M should be viewed at -6db on 8M, that is, bgr-avg is at <-96 is relatively ok. If >-96, it is recommended to consider rectification; for 1M, it is necessary to look at -9db on 8M, that is, bgr-avg is relatively ok at <-99. If >-99, it is recommended to consider rectification.



Figure 2-5 acs scan results

An example of a situation where EMI leads to a bad solution board: the frequency sweep of the screen machine when the screen is turned on and when the screen is turned off. The results vary greatly, as shown in Figure 2-6a and Figure 2-6b.


```

sta_list: no sta
acs started, scan time= 10ms
[855456]acs...
[855457]freq pri_chn bg_min bg_avg bg_max rxsync_cnt => noise factor
[855492]905000 0 -102 -95 -84 0 => -116
[855525]905000 1 -101 -96 -82 0 => -116
[855557]907000 0 -102 -97 -76 0 => -116
[855590]907000 1 -101 -97 -82 0 => -117
[855622]909000 0 -102 -94 -85 0 => -115
[855655]909000 1 -101 -94 -82 0 => -114
[855688]911000 0 -101 -96 -82 0 => -116
[855720]911000 1 -103 -96 -83 0 => -116
[855753]913000 0 -102 -97 -84 0 => -118
[855785]913000 1 -102 -97 -83 0 => -117
[855818]915000 0 -102 -97 -83 0 => -117
[855851]915000 1 -101 -97 -84 0 => -118
[855883]917000 0 -103 -98 -82 0 => -118
[855916]917000 1 -103 -99 -88 0 => -121
[855949]919000 0 -102 -98 -82 0 => -118
[855981]919000 1 -102 -97 -82 0 => -117
[856014]921000 0 -101 -96 -80 0 => -116
[856046]921000 1 -102 -96 -82 0 => -116
[856079]923000 0 -101 -96 -60 0 => -111
[856112]923000 1 -102 -98 -80 0 => -118
[856144]925000 0 -103 -98 -81 0 => -118
[856177]925000 1 -102 -98 -82 0 => -118
[856182]acs result: freq=917000, prichn=0 nf=-239
[856187]acs done
[857819]response bootd1 cmd:0, check:fd

```

屏幕不关背光

Figure 2-6a Frequency scanning situation when the screen lights up

```

sta_list: no sta
acs started, scan time= 1[833656]acs...
[833657]freq pri_chn bg_min bg_avg bg_max rxsync_cnt => noise factor
[833692]905000 0 -103 -100 -99 0 => -124
[833725]905000 1 -103 -101 -99 0 => -125
[833757]907000 0 -103 -101 -100 0 => -126
[833790]907000 1 -103 -101 -99 0 => -125
[833822]909000 0 -103 -100 -99 0 => -124
[833855]909000 1 -103 -100 -99 0 => -124
[833888]911000 0 -103 -100 -99 0 => -124
[833920]911000 1 -103 -101 -99 0 => -125
[833953]913000 0 -103 -100 -99 0 => -124
[833985]913000 1 -103 -101 -99 0 => -125
[834018]915000 0 -104 -101 -98 0 => -125
[834051]915000 1 -104 -101 -96 0 => -125
[834083]917000 0 -103 -100 -99 0 => -124
[834116]917000 1 -104 -101 -100 0 => -126
[834149]919000 0 -105 -101 -99 0 => -125
[834181]919000 1 -105 -101 -99 0 => -125
[834214]921000 0 -103 -100 -99 0 => -124
[834246]921000 1 -103 -100 -89 0 => -122
[834279]923000 0 -103 -100 -99 0 => -124
[834312]923000 1 -103 -100 -73 0 => -118
[834344]925000 0 -103 -100 -99 0 => -124
[834377]925000 1 -103 -100 -88 0 => -122
[834382]acs result: freq=907000, prichn=0 nf=-251
[834387]acs done
[834829]
MAC STATUS:

```

屏幕关背光

Figure 2-6a Frequency scanning situation with the screen turned off

In this case, the value of bgr-avg is not very different when the screen is turned on and off, but the value of bgr-max is very different.

Nearly 15db, the actual Rx sensitivity of the board tested with instruments is also 15db worse, which is basically consistent with the difference in bgr-max. Therefore, in this case, it is recommended to find

the source of EMI when the screen is turned on and how to avoid it.