



Taixin AH-RF EMC Certification Guide



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珠海泰芯半导体有限公司
TaiXin Semiconductor Co., Limited

珠海市高新区港湾一号科创园港 11 栋 3 楼

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珠海泰芯半导体有限公司
TaiXin Semiconductor Co., Limited

3rd Floor, Gang 11 Building, 1st Jin Tang Road, Hi-tech Zone, Zhuhai China.

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Table of Contents

Taixin AH-RF EMC Certification Guide	1
1. Overview	1
1.1. Document Purpose	1
1.2. Module Model Description	1
1.3. Serial Port Configuration	1
1.4. AT Command Explanation	2
1.5. Serial Port Alternative Solutions	2
1.5.1. Ethernet	2
1.5.2. Main Controller Serial Port	3
1.6. Handling Sleep Devices	3
1.7. EMC Standard Configuration Instructions	3
1.7.1. FCC	3
1.7.2. CE	5
1.7.3. MIC (Japan)	6
1.8. Precautions	7
Appendix	9
TaiXin AH Module FCC Certification	9
TaiChip AH Module CE Certification	9
TaiXin AH Module Japan MIC Certification	9



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1. Overview

1.1. Document Purpose

This document introduces the test modes of AH-RF and the configuration methods for common EMC certifications.

1.2. Module Model Description

Select the module according to the certification region:

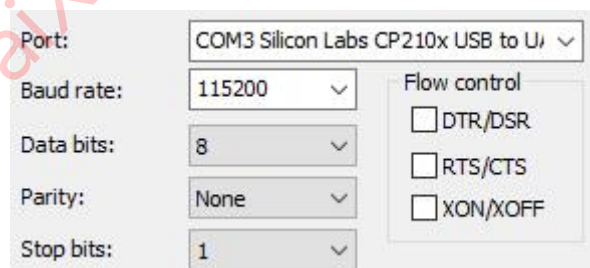
- 1) **Modules for FCC certification:** TX-AH-R900PNR / TX-AH-R900P.
- 2) **Modules for CE certification:** TX-AH-R900PNR-860M / TX-AH-R900P.
- 3) **Modules for Japan MIC certification:** TX-AH-R900PNR / TX-AH-R900P.

1.3. Serial Port Configuration

Testing requires using the AH test mode, which is accessed and configured via AT+ commands. These commands include setting frequency points, bandwidths, and other parameters.

AT+ commands are accessed through the AH serial port. AT+ commands are case-insensitive, but please use English characters.

Serial Port Configuration Instructions:



Port:	COM3 Silicon Labs CP210x USB to U
Baud rate:	115200
Data bits:	8
Parity:	None
Stop bits:	1
Flow control	
	<input type="checkbox"/> DTR/DSR
	<input type="checkbox"/> RTS/CTS
	<input type="checkbox"/> XON/XOFF

Ensure that the "New Line Mode" is selected; otherwise, AT commands cannot be entered.

To test if the serial port is functioning correctly, input AT+, and the following output should be displayed:

```
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
```

If this output is not displayed, it indicates an incorrect serial port input, and you should contact our FAE for assistance.

1.4. AT Command Explanation

1. `At+test_start=1` // Enter test mode
2. `At+lo_freq=866000` // Set the center frequency to 866M as an example
3. `At+bss_bw=4` // Set the working BSS bandwidth to 4M as an example
4. `At+tx_cont=1` // To send continuous signals, set `tx_cont=1`; for normal packet transmission, set `tx_cont=0` (default is 0)
5. `At+tx_start=1` // Enable transmission
6. `At+Tx_type=S` // To send a non-modulated signal (single tone), set `Tx_type=S`; for modulated signals, set `Tx_type=N` (N means normal, default is N)
7. `At+Tx_mcs=255` // To set the modulation MCS, choose from 0~7, 10 (MCS10 for 1M), or 255 (default auto-adjust)
8. `At+Txpower=20` // To modify transmission power, set `Txpower` (maximum 20, default); recommended not less than 14 to avoid performance degradation
9. `at+delay=100` // Set the delay between two packets to 100ms

1.5. Serial Port Alternative Solutions

Other interfaces can be utilized to control and test the AH module due to difficulties in accessing the serial port of AH modules.

1.5.1. Ethernet

The `netat/netlog` tools can be used to control AH devices through a network bridge solution. For details, please consult FAE.

1.5.2. Main Controller Serial Port

In solutions with a Linux main controller, the AH module can usually be accessed via the main controller's serial port. The access method is as follows:

- 1) `iwpriv hg0 set dbginfo=1` // Redirects the AH module's printouts to the main controller's prints
- 2) `iwpriv hg0 set atcmd=xxx` // xxx is the desired at+ command to be entered, refer to section 1.3

For main controllers with other operating systems, it is currently not possible to access the AH module via the main controller's serial port, and the AH module's serial port must be directly accessed.

1.6. Handling Sleep Devices

For devices that will enter sleep mode, the AH module must be configured to `ps_mode=0` (no sleep) during testing, and ensure the main controller does not reconfigure the AH module to sleep mode.

If configuring directly via the module's serial port, use the following command:

`at+ps_mode=0` (early versions use `at+psmode=0`)

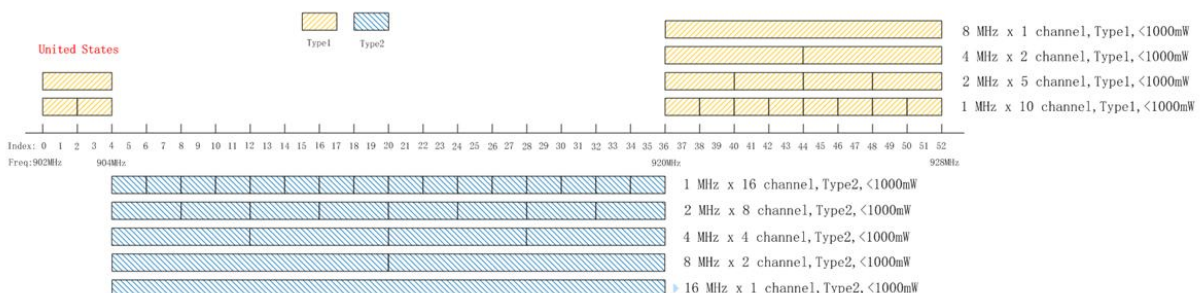
If configuring through a Linux main controller, it is recommended to contact the driver manager to ensure the no-sleep mode is implemented by sending the command to the module through the interface. The command is:

`iwpriv hg0 set ps_mode=0`

1.7. EMC Standard Configuration Instructions

1.7.1. FCC

For the United States, the EMC standard for AH is:



The FCC certification allows Txpower to be set to 20.

-
- 1) **BSS_BW=8M**, total of 3 channels, center frequencies are 908M/916M/924M;

Command sequence:

```
At+test_start=1      // Enter test mode
At+lo_freq=908000    // Example with 908M
At+bss_bw=8          // Set bss_bw to 8M
At+tx_start=1        // Enable tx
At+tx_cont=1         // For continuous signal transmission, set tx_cont=1
```

- 2) **BSS_BW=4M**, total of 6 channels, center frequencies are 906M/910M/914M/918M/922M/926M;

Command sequence:

```
At+test_start=1      // Enter test mode
At+lo_freq=906000    // Example with 906M
At+bss_bw=4          // Set bss_bw to 4M
At+tx_start=1        // Enable tx
```

- 3) **BSS_BW=2M**, total of 11 channels, center frequencies are 905M/907M/909M/911M/913M/915M/917M/919M/921M/923M/925M;

Command sequence:

```
At+test_start=1      // Enter test mode
At+lo_freq=905000    // Example with 905M
At+bss_bw=2          // Set bss_bw to 2M
At+tx_start=1        // Enable tx
```

Note: Due to insufficient guard interval at the frequency boundaries, channels 903M/927M may not meet the test standards. It is recommended to exclude these two channels.

- 4) **1M case**, total of 24 channels, center frequencies are 903.5/904.5~/926.5M (spaced every 1M);

Command sequence:

```
At+test_start=1      // Enter test mode
At+lo_freq=903500    // Example with 903.5M
At+bss_bw=1          // Set bss_bw to 1M
At+tx_start=1        // Enable tx
```

Note: Due to insufficient guard interval at the frequency boundaries, channels 902.5M/927.5M may not meet the test standards. It is recommended to exclude these two channels.

1.7.2. CE

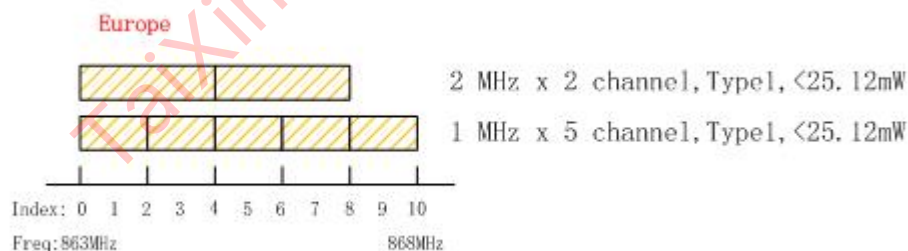
AH complies with the following EMC standards in the EU region:
ETSI EN 300 220-2 V3.2.1 (2018-06) Annex B

K	863 MHz to 865 MHz	25 mW e.r.p.	$\leq 0,1\%$ duty cycle or polite spectrum access	The whole band except for audio & video applications limited to 300 kHz	46a
L	865 MHz to 868 MHz	25 mW e.r.p.	$\leq 1\%$ duty cycle or polite spectrum access	The whole band	47

- **K Band:** For audio and video applications, the bandwidth is limited to 300 KHz. For other applications, the duty cycle must be $\leq 0.1\%$ or comply with polite spectrum access requirements. Thus, AH cannot be used for audio and video applications, only for other applications.
- **L Band:** Across the entire band, the duty cycle must be $\leq 1\%$ or comply with polite spectrum access requirements. AH can be used for both audio and video as well as other applications. For audio and video applications, the duty cycle often exceeds 1%, necessitating certification testing for polite spectrum access.

For details on polite spectrum access, refer to: ETSI EN 300 220-1 V3.1.1 (2017-02) section 5.21.

Specific CE Certification Bands are as follows:



- 1) **BSS_BW=2M**, total of 2 channels, center frequencies: 864M/866M (Note: Only the 866M channel can be used for audio and video applications).

Command sequence:

```
At+test_start=1 // Enter test mode
At+lo_freq=866000 // Example with 866M
At+bss_bw=2 // Set bss_bw to 2M
At+tx_start=1 // Enable tx
At+tx_cont=1 // For continuous signal transmission, set tx_cont=1
```

- 2) **1M case**, total of 5 channels, center frequencies: 863.5/864.5/865.5/866.5/867.5M (spaced every 1M).

Command sequence:

```
At+test_start=1 // Enter test mode
At+lo_freq=863500 // Example with 863.5M
At+bss_bw=1 // Set bss_bw to 1M
At+tx_start=1 // Enable tx
```

3) CCA Testing

Command sequence:

```
At+test_start=1 // Enter test mode
At+bss_bw=2 // Set bss_bw to 2M
At+lo_freq=866000 // Example with 866M
at+delay=100 // Set transmission interval to a minimum of 100ms
At+tx_start=1 // Enable tx
```

Note: The permissible power in the EU is relatively low. Before testing, ensure that the transmission power of the scheme does not exceed the EMC standard requirements.

1.7.3. MIC (Japan)

	新基準			(参考) 現行基準※1		
	周波数	920.5-923.5MHz	920.5-928.1MHz	920.5-923.5MHz	920.5-928.1MHz	
無線チャネル占有周波数帯幅	200kHz×n (n=1~15)	200kHz×n (n=1~20)		200kHz×n (n=1~5)		
空中線電力	20mW以下 (13dBm)			20mW以下 (13dBm)		
空中線利得	3dBi以下			3dBi以下		
隣接チャネル漏洩電力	-15dBm以下			-15dBm以下		
帯域外不要発射	周波数帯	不要発射の強度の評価値 (平均電力)	参照帯域幅	周波数帯	不要発射の強度の評価値 (平均電力)	参照帯域幅
	710MHz以下	-36dBm	100kHz	710MHz以下	-36dBm	100kHz
	710MHzを超え900MHz以下	-55dBm	1MHz	710MHzを超え900MHz以下	-55dBm	1MHz
	900MHzを超え915MHz以下	-55dBm	100kHz	900MHzを超え915MHz以下	-55dBm	100kHz
	915MHzを超え930MHz以下 (無線チャネルの中心からの離間が(200+100×n) kHz以下を除く。)	-36dBm	100kHz	915MHzを超え930MHz以下 (無線チャネルの中心からの離間が(200+100×n) kHz以下を除く。)	-36dBm	100kHz
	930MHzを超え1GHz以下 1GHzを超え1.215GHz以下 1.215GHzを超えるもの	-55dBm -45dBm -30dBm	100kHz 1MHz 1MHz	930MHzを超え1GHz以下 1GHzを超え1.215GHz以下 1.215GHzを超えるもの	-55dBm -45dBm -30dBm	100kHz 1MHz 1MHz
周波数共用方式	キャリアセンス			キャリアセンス		
キャリアの受信時間	5ms以上	128μs以上		5ms以上	128μs以上	
送信時間	4s以内※2	400ms以内		4s以内※2	400ms以内	
休止時間	50ms以上※3	2ms以上※3		50ms以上※3	2ms以上※3	
送信時間の総和 (無線設備あたり)	-	360s/h以下 (Duty 10%) <small>(複数の無線チャネルを切り替えて使用する場合に限り、720s/h以下)</small>		-	360s/h以下 (Duty 10%) <small>(複数の無線チャネルを切り替えて使用する場合に限り、720s/h以下)</small>	
送信時間の総和 (チャネルあたり)	-	360s/h以下		-	360s/h以下	

※1 キャリアセンス不要 (ローデューティサイクル及び周波数ホッピング方式) のシステムの基準については省略。

※2 4s以内の再送信 (当該時間内に停止する再送信に限る。) の場合は特定の休止時間は不要。

※3 再送信等に関する特例あり。

Refer to the new standard on the left. The new standard supports two types of products: one with no duty cycle limit and one with a duty cycle limit, as detailed below:

-
- 1) No Duty Cycle Limit (920.5-923.5), module support:
BW 2M: 922Mhz
BW 1M: 921.5, 922.5Mhz
 - 2) With Duty Cycle Limit (920.5-928.1):
BW 4M: 924Mhz
BW 2M: 922, 924, 926Mhz
BW 1M: 921.5, 922.5, 923.5, 924.5, 925.5, 926.5Mhz

Example Test Command Sequence

- 1) BSS_BW=2M, frequency set to 922 MHz.

Command sequence:

```
At+test_start=1 // Enter test mode
At+lo_freq=922000 // Example with 922M
At+bss_bw=2 // Set bss_bw to 2M
At+txpower=10 // Default is 20, range 1~20, step 1 dB
At+tx_start=1 // Enable tx
At+tx_delay=10 // Default is 5, set the interval between two packets, unit ms, used
to adjust duty cycle
At+tx_cont=1 // For continuous signal transmission, set tx_cont=1
```

1.8. Precautions

1. The power setting for EMC certification is closely related to the antenna, and the radiation efficiency of the antenna is tied to its design. Therefore, it may be necessary to adjust the transmission power so that the radiated power at the antenna end approaches the upper limit of the test standard. Please note that the set transmission power affects the coverage range of the scheme. The performance of the scheme should be evaluated based on the actual transmission power that passes EMC certification.
2. The EMC certification for the module uses fixed frequency testing and requires the test mode. For full system testing, it may be necessary to test during normal operation rather than in test mode. In normal mode, "superpower" is enabled by default, with average power up to 25 dBm (when transmitting MCS0/1/2), whereas in test mode, "superpower" is disabled by default, with average power at 20 dBm. The peak power difference between enabling and disabling "superpower" is minimal, only 1-2 dB. If "superpower" is enabled, the Txpower adjustment for maximum power will be ineffective. The command to toggle "superpower" is `at+tx_pwr_super=1/0`.
3. In the EU region, it is crucial to distinguish between audio/video applications and IoT applications (low duty cycle scenarios).
 - 1) **For audio/video applications**, the EU band can use BSS_BW=2M and BSS_BW=1M:

-
- a) BSS_BW=2M: Only one channel is available.
CHAN_LIST=[8660], with a center frequency of 866M.
 - b) BSS_BW=1M: Three channels are available.
CHAN_LIST=[8655,8665,8675], with center frequencies of 865.5M, 866.5M, and 867.5M respectively.
- 2) For IoT applications, the EU band can use BSS_BW=2M and BSS_BW=1M:
 - a) BSS_BW=2M: Two channels are available.
CHAN_LIST=[8640, 8660], with center frequencies of 864M and 866M.
 - b) BSS_BW=1M: Five channels are available.
CHAN_LIST=[8635,8645,8655,8665,8675], with center frequencies of 863.5M, 864.5M, 865.5M, 866.5M, and 867.5M respectively.

Since 863-865M allows only narrowband use (up to 300 kHz) for audio/video applications, AH transmission cannot be used in this range.

1. FCC radiated spurious emission testing precautions.

The radiated spurious emission test is conducted in two parts:

- a) 30MHz~1GHz

During this test, due to the high power of the AH module, it is essential to ensure that the receiver does not overload. If the receiver overloads, the harmonics in the low-frequency band will appear higher than actual. **A band-stop filter (900M~930M) should be added in front of the receiver to attenuate the main tone energy.** If there is no overload, normal configuration can be used.

- b) 1GHz~25GHz

During this test, since the main tone is close to 1 GHz, the preamp on the laboratory horn antenna (1GHz~6GHz) may saturate due to high signal reception, causing nonlinear effects and higher measured harmonic energy than actual. A band-stop filter (900M~930M) should be added in front of the preamp to attenuate the main tone energy.

Appendix

TaiXin AH Module FCC Certification

<https://fccid.io/2AXPI>

FCC ID applications by 2AXPI (Zhuhai Huge ic Co.,Ltd.)	
FCC ID Application Date	Product Purpose Application Type
2AXPI-R900 2021-02-26	802.11ah WIFI module Original Equipment
2AXPI-TX-AH-R900ATR 2020-10-19	802.11ah WIFI module Original Equipment

TaiChip AH Module CE Certification

[TaiXin AH Module CE Certification Declaration](#)

TaiXin AH Module Japan MIC Certification

[Japan Certification Link for TaiXin Modules](#)

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