# RDA5807HP 编程指南 V2.5

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# 一. 控制接口:

RDA5807HP 提供了 I2C 作为控制接口，控制模式如下描述:

(一)、I2C 控制接口:

I2C 接口与 I2C-Bus Specification 2.1 兼容,包含 2 个信号:SCLK 和 SDIO。I2C 接口是由 START，命令字节，数据字节，及每个字节后的 ACK 或 NACK 比特，和 STOP 组成，命令字节包括一个 7 比特的 chip 地址（0010000b）和一个读写 r/$\overline{w}$命令比特。ACK（或 NACK）由接收器发出。

在该接口下，有两中读写方式，分别是连续读写方式和带寄存器地址的标准 I2C 方式，两种方式通过 I2C 的器件地址来区分实现，读写方式和器件地址详细描述如下:

1、连续读写方式: 在该模式下，寄存器的地址是不可见的，即有一个固定的起始寄存器地址（写操作时为 02H，读操作时为 0AH），并有一个内部递增计数器，I2C 器件地址为 0010000B，加上读写标志，即 I2C 器件地址为 0x20(写操作)和 0x21(读操作)

(1)、写操作: 写操作默认起始寄存器为 02H，即所有写操作都是默认从 02H 开始，即使只写如 03H 或者 05H，都必须从 02H 写起，MCU 写入寄存器的顺序如下: 02H 的高字节，02H 的低字节，03H 的高字节，……，直到结束。芯片在 MCU 写入每个字节后都会返回一个 ACK。MCU 会给出 STOP 来结束操

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作。

(2)、读操作: 读操作默认起始寄存器为 0AH，即所有写操作都是默认从 0AH 开始。在对芯片进行读操作时，MCU 给出命令字节后，RDA5807HP 会送出数据字节，顺序如下：0AH 高字节，0AH 低字节，0BH 高字节，……，直到芯片接收到从 MCU 发出的 NACK， MCU 送出 STOP，读操作结束。除了最后一个字节，MCU 在读到每个字节后都要给出 ACK，在读到最后一个字节后，MCU 给出 NACK，使芯片把总线交给 MCU，然后 MCU 发出 STOP，结束整个操作。

(3)、连续读写方式时续图:

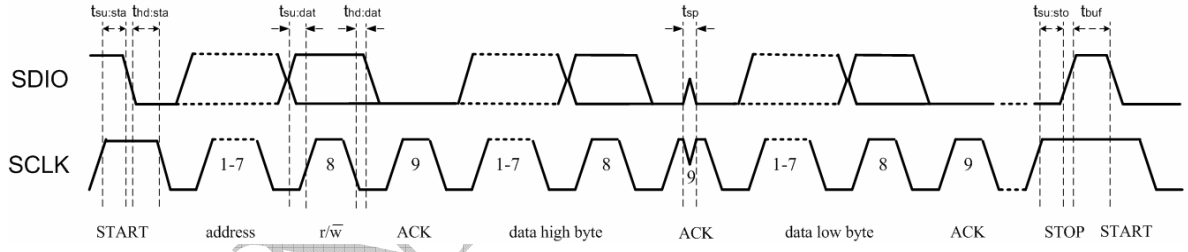


图 1 写数据时序

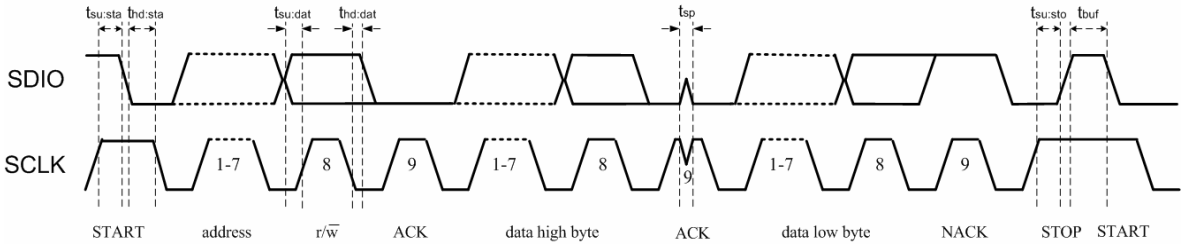


图 2 读数据时序

I2C Timing Characteristics

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| SCLK Frequency | fscl | | 0 | - | 400 | KHz |
| SCLK High Time | thigh | | 0.6 | - | - | us |
| SCLK Low Time | tlow | | 1.3 | - | - | us |

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| | | | | | | |
|---|---|---|---|---|---|---|
| Setup Time for START Condition | tsu:sta | | 0.6 | - | - | us |
| Hold Time for START Condition | thd:sta | | 0.6 | - | - | us |
| Setup Time for STOP condition | tsu:sto | | 0.6 | - | - | us |
| SDIO Input to SCLK ↑ Setup | tsu:dat | | 100 | - | - | ns |
| SDIO Input to SCLK ↓ Hold | thd:dat | | 0 | - | 900 | ns |
| STOP to START Time | tbuf | | 1.3 | - | - | us |
| SDIO Output Fall Time | tf:out | | 20+0.1Cb | - | 250 | ns |
| SDIO Input, SCLK Rise/Fall Time | tr:in<br>tf:in | | 20+0.1Cb | - | 300 | ns |
| Input Spike Suppression | tsp | | - | - | 50 | ns |
| SCLK, SDIO Capacitive Loading | Cb | | - | - | 50 | pF |

2、标准 I2C 读写方式：该模式是与标准 I2C 读写方式一致，即带寄存器地址的方式，I2C 器件地址为 0010001B，加上读写标志位，即为 0x22(写操作)和 0x23(读操作)，读写方式的格式如下：

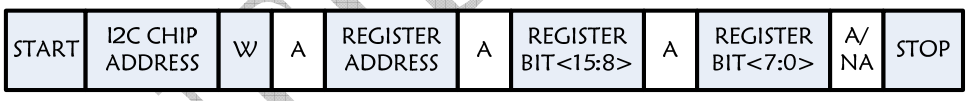
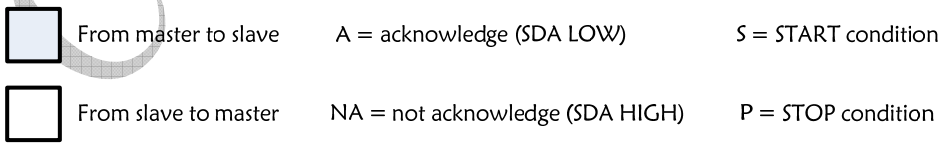



图 3 标准 i2c 写格式


图 4 标准 i2c 读格式

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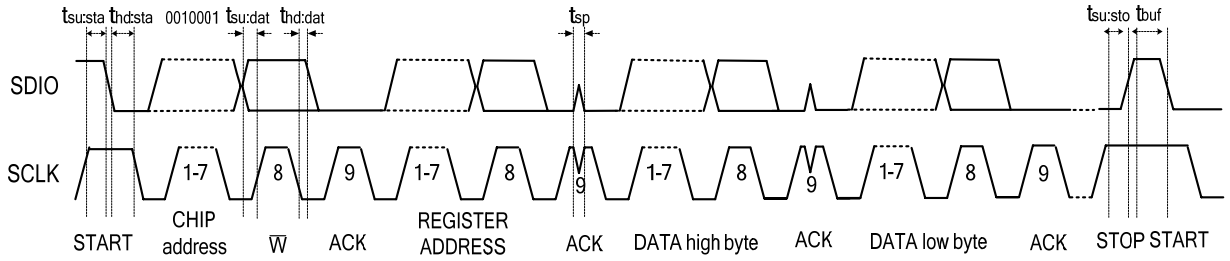


图 5 标准 i2c 写时序图

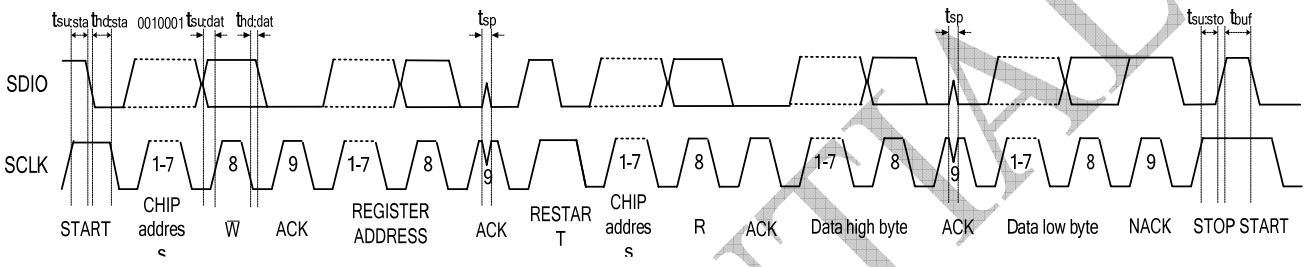


图 6 标准 i2c 读时序图

3、另外，RDA5807HP 还有另外一组未使用的 I2C 器件地址 1100000B，加上读写标志，即为 0xC0 和 0xC1，即 RDA5807HP 总共有三组 I2C 器件地址，分别是 0x20 和 0x21，0x22 和 0x23，0xC0 和 0xC1，在硬件设计时，如果 RDA5807HP 与其他 I2C 器件共用 I2C 总线时，请注意避免 I2C 器件地址冲突的问题。

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# .二、状态转换

RDA5807HP 中有 5 种状态: 复位初始化(Reset&Initial),设置频点(Tune),搜台(Seek),工作(Working),休眠(Sleep)。

在芯片上电和复位后,软件通过编写 ENABLE(02H, bit 0)寄存器,将其置为 1,即可使 RDA5807HP 进入上电状态。软件通过编程相应寄存器,即可使 RDA5807HP 进入 Tune 或 Seek 状态,这些操作之后,RDA5807HP 进入正常工作状态(Working)。软件通过将 ENABLE 置为 0,可使 RDA5807HP 进入睡眠状态,此时所有寄存器值保持不变(与未睡眠之前相同)。在睡眠状态时,软件可通过编写 ENABLE 为 1,即可将 RDA5807HP 回到正常工作(Working)状态。

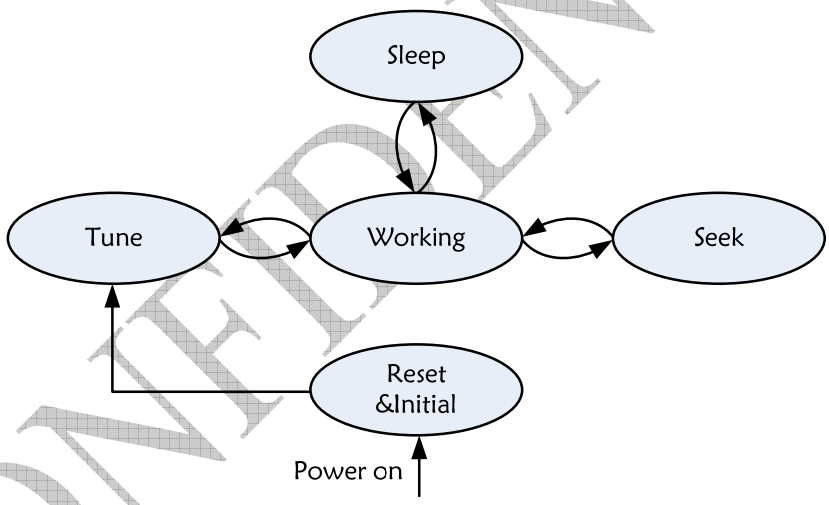


图 9 RDA5807HP 状态转移图

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## 三、复位及初始化（Reset&Initial）

上电过程中，RDA5807HP 需要正确的 Reset 和初始化过程来进行上电。

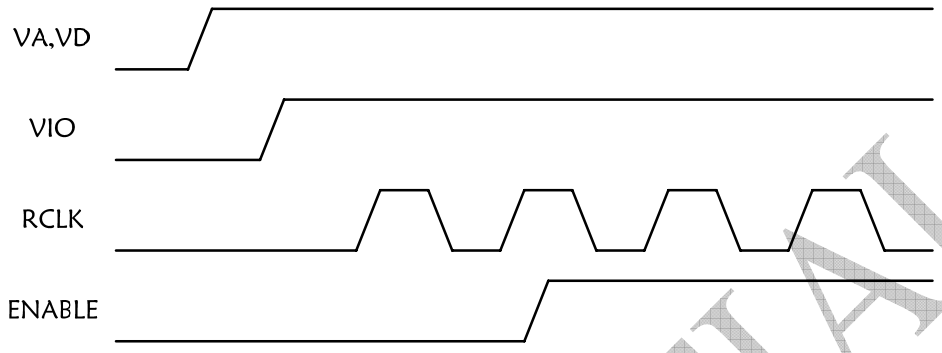


图 10 Reset&Initial 时序图

RDA FM 系列芯片的初始操作顺序：复位 → 上电 → 写初始化数据。

### (一)、复位及上电操作

1、复位操作通过写 0x0002 到 02H 来实现；

2、当使用 RDA5807HP 带晶振模块，或者单独给 RDA5807HP 供 32.768KHz 晶振时，需要执行上电操作，这一操作通过写 0xC001 到 02H 来实现。

3、编程伪程序：

```
Supply VA and VD.
Supply VIO
Provide 32.768KHz crystal clock. (optional, if use TCXO)
(or 12MHz/24MHz/13MHz/26MHz/19.2MHz/38.4MHz clk)
Wait 1ms
Mov 0x0002, 02H  //write Soft_Reset=1
```

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```
Delay 50ms          //optional, for wait RCLK stable if use DCXO
Mov 0xC001, 02H  //write enable=1
Delay 600ms
```

(二)、芯片 ID 读取方法

当进行复位及上电操作后，可读取芯片的 ID:

1、连续读写方式读 ID 操作需连续读取 10 byte 数据，即读取 0AH、0BH、0CH、0DH，0EH;

2、采用标准 I2C 读写方式读 ID 则直接读 0CH、0DH、0EH。

读出来的值为: 0CH: 0x5803; 0DH: 0x5804; 0EH: 0x5801。

(三)、初始化操作

初始化操作通过 I2C 或 3 线 SPI 接口把初始化参数写到芯片内部来实现，而编程及调试时，需要注意的是 02H 的初始值:

1、当使用 RDA5807HP 带晶振模块，或者单独给 RDA5807HP 供 32.768KHz 晶振时，02H 的初始值为 0xC001;

2、当 RDA5807HP 与其他器件供用晶振时，需要按照晶振的频率来设置 02H 的初始值，具体为设置 02H 的 CLK_MODE(Bit[6:4])，并且同时把 02H 的 Bit 10 置 1。

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例:

当共用 12MHz 晶振时，02H 的初始值为 0xC411;

当共用 24MHz 晶振时，02H 的初始值为 0xC451;

3、初始化参数列表(如有需要请联系我司当地 FAE 获取最新初始化参数列表)

RDA5807HP 初始化列表如下：

```
0xC001,//0xC411//0xC451    //02H: //请注意按照 1 和 2 中所描述进行设置
0x0000,
0x0400,
0x86BF,   //05H
0x4000,
0x46C6,
0x0000,
0x0000,
0x0000,   //0AH
0x0000,
0x0000,
0x0000,
0x0000,
0x0000,
0x0006,   //10H
0x0019,
0x2A11,
0x002E,
0x2A30,
0xB83C,   //15H
0x9000,
0x2A91,
0x8412,
0x00A8,
0xC400,   //1AH
0xE000,
0x241D,
0x816A,
0x4608,
0x1086,
0x1661,   //20H
```

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```
0x0000,
0x109E,
0x254A,
0x0408,
0x0608,    //25H
0xE105,
0x3B6C,
0x2BEC,
0x090F,
0x3414,    //2AH
0x1450,
0x096D,
0x2D96,
0x01DA,
0x2A7B,
0x0821,     //30H
0x13D5,
0x4891,
0x00bc,
0x076D,     //34H
```

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## 四、设置频点（Tune）

软件可以通过配置 03H 寄存器来选择 FM 频道。步进长度（100KHz，200KHz，50KHz 或 12.5KHz）由 SPACE 来选择，频道由 CHAN[9:0]来选择，频率范围（76MHz_91MHz，87MHz_108MHz，76MHz_108MHz）由 BAND[1:0]来选择。

当软件写 03H 寄存器的 TUNE 位为 1 时，RDA5807HP 会自动开始 Tune。在 Tune 结束时（如果 STCIEN 设为 1，会产生一个中断信号 INT 由 GPIO2 送出），STC 会被置 1，软件可以通过读 0AH 和 0BH 寄存器来得到当前频点的状态值（ST，FM_TRUE，FM_READY，RSSI，READCHAN 等）。整个 Tune 过程要持续 50ms。

频点计算方法见寄存器 CHAN 和 READCHAN 的换算公式。

编程伪程序:

```
Mov 0x1A10, 03H     //Set channel number to 97.4MHz, space to 100KHz, band to 87_108MHz
Delay 50ms
*Wait for GPIO2=0    //optional, wait for tune complete, if use interrupt
*Wait for STC=1      //optional, wait for tune complete, if use polling method
Read 0A, 0BH         //read stauts
Stop Tune
```

注意：对 I2C 接口而言，RDA5807HP 的寄存器设置是由一连串的写操作来完成的，所以软件要注意写寄存器的顺序。对 3 线接口而言则只需写相应寄存器即可。

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## 五、搜台（Seek）

RDA5807HP 搜台模式编程流程如下图所示。

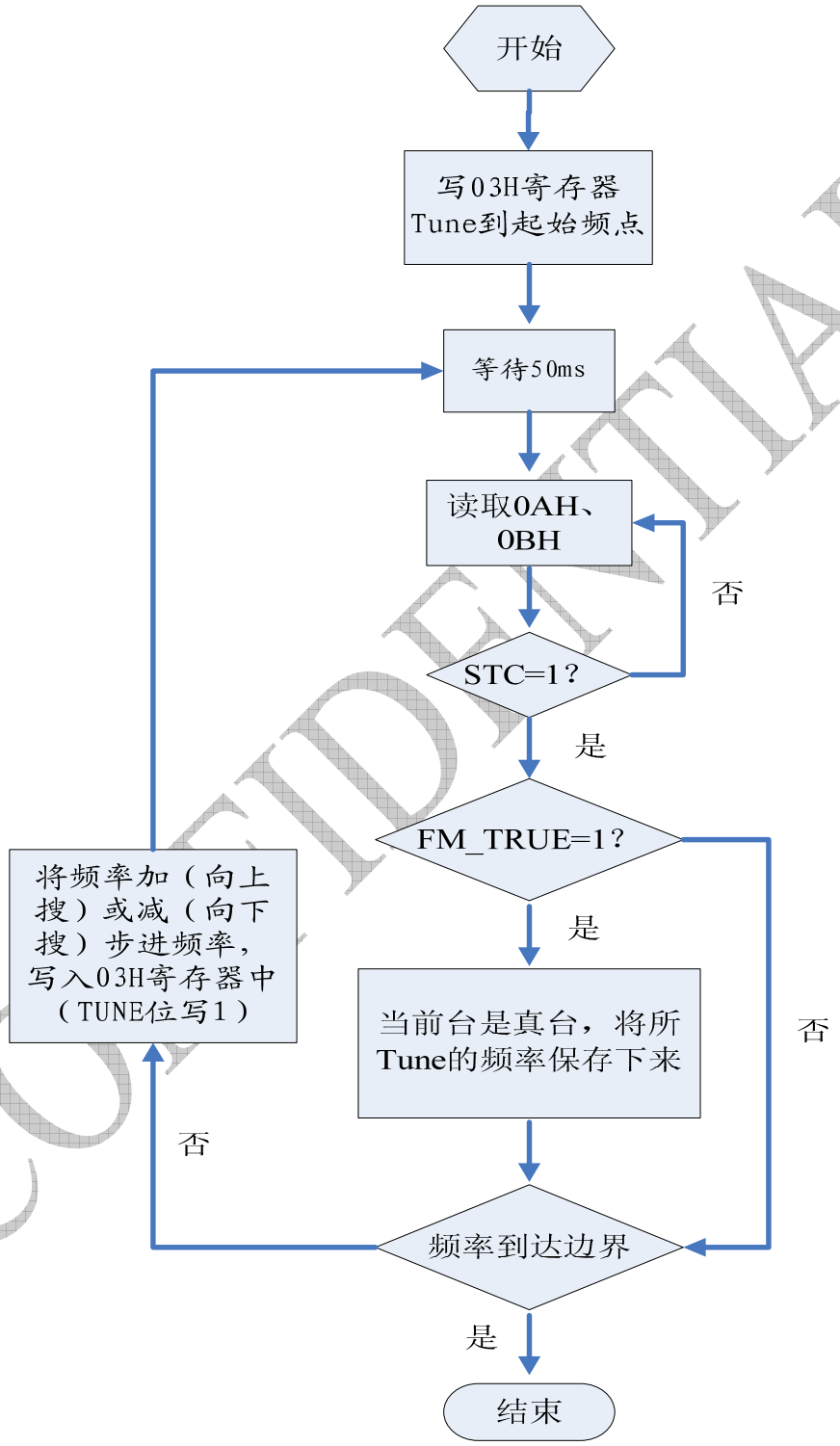


图 11　RDA5807HP 搜台模式编程流程图

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编程伪程序:

Step1:

CHAN=0x0005;

VALUE=(CHAN<<6)+0x0010;

Mov VALUE, 03H //Set channel number to 87.5MHz, space to 100KHz, band to 87_108MHz

Step2:

Wait 50ms //minus 35ms

Read 0A, 0BH //read stauts

If freq beyond band limit, go to Step4. Else go to Step3.

Step3:

If STC=1 and FM_TRUE=1, memorize READCHAN.

CHAN=CHAN+1;

VALUE=(CHAN<<6)+0x0010;

Mov VALUE, 03H

Go to Step2.

Step4:

Stop Seek.

注意: 对 I2C 接口而言, RDA5807HP 的寄存器设置是由一连串的写操作来完成的, 所以软件要注意写寄存器的顺序。对 3 线接口而言则只需写相应寄存器即可。

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## 六、休眠（Sleep）

在空闲时，软件可以通过编程 RDA5807HP 中 ENABLE（置 0）使 RDA5807HP 进入睡眠模式，以便减小功耗。在睡眠模式，RDA5807HP 模拟和数字模块电源都被关掉，但各寄存器值保持不变，SPI 和 I2C 接口依然可以工作。

软件可以通过编程 ENABLE（置 1）使 RDA5807HP 进入工作模式。进入工作模式后，软件需要重新设置所需要的频点，即重新进行一次 Tune 操作。

编程伪程序:

```
Enter Sleep Mode:
    Mov 0x0000, 02H     //clear ENABLE bit low to bring RDA5807HP into sleep mode
Exit Sleep Mode:
    Mov 0xC001, 02h       //set ENABLE bit high to bring RDA5807HP into working mode
    //0xC411//0xC451    //02H: //请注意按照初始化操作章节中 1 和 2 中所描述进行设置
    Wait 0.5s           //optional, wait RCLK stable, if in DCXO mode
    Mov 0x0150, 03h     //Set channel number to 87.5MHz, space to 100KHz, band to
87_108MHz
    *Wait for GPIO2=0   //optional, wait for tune complete, if use interrupt
    *Wait for STC=1       //optional, wait for tune complete, if use polling method
    Read 0A, 0BH        //read stauts
    Stop Tune
```

注意: 对 I2C 接口而言，RDA5807HP 的寄存器设置是由一连串的写操作来完成的，所以软件要注意写寄存器的顺序。对 3 线接口而言则只需写相应寄存器即可。

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# 七.寄存器说明

| REG | BITS | NAME | FUNCTION | DEFAULT |
|---|---|---|---|---|
| 02H | 15 | DHIZ | Audio Output High-Z Disable.<br>*0 = High impedance; 1 = Normal operation* | 0 |
| | 14 | DMUTE | Mute Disable.<br>*0 = Mute; 1 = Normal operation* | 0 |
| | 13 | MONO | Mono Select.<br>*0 = Stereo; 1 = Force mono* | 0 |
| | 12 | BASS | Bass Boost.<br>*0 = Disabled; 1 = Bass boost enabled* | 0 |
| | **11** | **RCLK NON-CALIBRATE MODE** | **0=RCLK clock is always supply<br>1=RCLK clock is not always supply when FM work ( when 1, RDA5807HP can't directly support -20℃~70℃ temperature. Only suppory ±20℃ temperature swing from tune point)** | 0 |
| | **10** | **RCLK DIRECT INPUT MODE** | **1=RCLK clock use the directly input mode** | 0 |
| | 8 | RESEVED | Must be 0 | 0 |
| | 7 | RESEVED | Must be 0 | 0 |
| | 6:4 | CLK_MODE[2:0] | 000=32.768kHz<br>001=12Mhz<br>101=24Mhz<br>010=13Mhz<br>110=26Mhz<br>011=19.2Mhz<br>111=38.4Mhz | 000 |
| | 1 | SOFT_RESET | Soft reset.<br>If 0, not reset;<br>If 1, reset. | 0 |
| | 0 | ENABLE | Power Up Enable.<br>*0 = Disabled; 1 = Enabled* | 0 |
| 03H | 15:6 | CHAN[9:0] | Channel Select.<br>BAND *= 0*<br>*Frequency = Channel Spacing (kHz) x* CHAN*+ 87MHz*<br>BAND *= 1*<br>*Frequency = Channel Spacing (kHz) x* CHAN *+ 76.0 MHz*<br>CHAN *is updated after a seek operation.* | 0x00 |
| | 5 | RESERVED | Must be 0 | 0 |

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| REG | BITS | NAME | FUNCTION | DEFAULT |
|---|---|---|---|---|
| | 4 | TUNE | Tune<br>0 = Disable<br>1 = Enable<br>The tune operation begins when the TUNE bit is set high. The STC bit is set high when the tune operation completes.<br>The tune bit is reset to low automatically when the tune operation completes.. | 0 |
| | 3:2 | BAND[1:0] | Band Select.<br>00 = 87~108 MHz (US/Europe)<br>01 = 76~91 MHz (Japan)<br>10 = 76~108 MHz (Japan wide) | 00 |
| | 1:0 | SPACE[1:0] | Channel Spacing.<br>00 = 100 kHz<br>01 = 200 kHz<br>10 = 50kHz<br>11 = 12.5KHz | 00 |
| 04H | 14 | STCIEN | Seek/Tune Complete Interrupt Enable.<br>0 = Disable Interrupt<br>1 = Enable Interrupt<br>Setting STCIEN = 1 will generate a low pulse on GPIO2 when the interrupt occurs. | 0 |
| | 12 | RESERVED | Must be 0 | 0 |
| | 11 | DE | De-emphasis.<br>*0 = 75 μs; 1 = 50 μs* | 0 |
| | 9:7 | RESERVED | Must be 000 | 000 |
| | 6 | I2S_ENABLED | I2S bus enable<br>If 0, disabled;<br>If 1, enabled. | 0 |
| | 5:4 | GPIO3[1:0] | General Purpose I/O 3.<br>*00 = High impedance*<br>*01 = Mono/Stereo indicator (ST)*<br>*10 = Low*<br>*11 = High* | 00 |
| | 3:2 | GPIO2[1:0] | General Purpose I/O 2.<br>*00 = High impedance*<br>*01 = Interrupt (INT)*<br>*10 = Low*<br>*11 = High* | 00 |
| | 1:0 | GPIO1[1:0] | General Purpose I/O 1.<br>*00 = High impedance*<br>*01 = Reserved* | 00 |

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| REG | BITS | NAME | FUNCTION | DEFAULT |
|---|---|---|---|---|
| | | | *10 = Low*<br>*11 = High* | |
| 05H | 15 | INT _MODE | If 0, generate 5ms interrupt;<br>If 1, interrupt last until read reg0CH action occurs. | 1 |
| | 14:8 | SEEKTH[6:0] | Seek Threshold. RSSI scale is logarithmic.<br>0000000 = min RSSI | 0001000 |
| | 7:6 | LNA_PORT_SEL[1:0] | LNA input port selection bit:<br>00: no input<br>01: LNAN<br>10: LNAP<br>11: dual port input | 10 |
| | 5:4 | LNA_ICSEL_BIT[1:0] | Lna working current bit:<br>00=1.8mA<br>01=2.1mA<br>10=2.5mA<br>11=3.0mA | 10 |
| | 3:0 | VOLUME[3:0] | DAC Gain Control Bits (Volume).<br>*0000=min; 1111=max*<br>*Volume scale is logarithmic* | 1000 |
| **06H** | **14** | **Open_mode** | **Open test register mode.**<br>**0=only open behind registers reading function**<br>**1=open behind registers writing function** | 0 |
| | **12** | **I2s_mode_select** | **If 0, master mode;**<br>**If 1, slave mode.** | 0 |
| | **7:4** | **I2s_ws_cnt[4:0]**<br>**Only valid**<br>**in master mode** | **4'b1000: WS_STEP_48;**<br>**4'b0111: WS_STEP=44.1kbps;**<br>**4'b0110: WS_STEP=32kbps;**<br>**4'b0101: WS_STEP=24kbps;**<br>**4'b0100: WS_STEP=22.05kbps;**<br>**4'b0011: WS_STEP=16kbps;**<br>**4'b0010: WS_STEP=12kbps;**<br>**4'b0001: WS_STEP=11.025kbps;**<br>**4'b0000: WS_STEP=8kbps;** | 0000 |
| 0AH | 15 | RESERVED | | 0 |
| | 14 | STC | Seek/Tune Complete.<br>0 = Not complete<br>1 = Complete<br>The seek/tune complete flag is set when the seek or tune operation completes. | 0 |
| | 13 | SF | Seek Fail.<br>*0 = Seek successful; 1 = Seek failure*<br>*The seek fail flag is set when the seek operation fails to find a channel with an* RSSI *level greater than* SEEKTH[5:0]*.* | 0 |
| | 12 | RESERVED | | 0 |
| | 11 | RESERVED | | |

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| REG | BITS | NAME | FUNCTION | DEFAULT |
|---|---|---|---|---|
| | 10 | ST | Stereo Indicator.<br>*0 = Mono; 1 = Stereo*<br>*Stereo indication is available on* GPIO3 *by setting* GPIO1[1:0] *=01.* | 1 |
| | 9:0 | READCHAN[9:0] | Read Channel.<br>BAND = 0<br>Frequency = Channel Spacing (kHz) x READCHAN[7:0]+ 87 MHz<br>BAND = 1<br>Frequency = Channel Spacing (kHz) x READCHAN[7:0]+ 76.0 MHz<br>READCHAN[7:0] is updated after a tune or seek operation. | 8'h00 |
| 0BH | 15:9 | RSSI[6:0] | RSSI.<br>000000 = min<br>111111 = max<br>RSSI scale is logarithmic. | 0 |
| | 8 | FM_TRUE | 1 = the current channel is a station<br>0 = the current channel is not a station | 0 |
| | 7 | FM_READY | Used for soft seek<br>1 = ready<br>0 = not ready | 0 |

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