

Hacking the Si4734

Programming Handbook for Shortwave

VERSION 1 ©2010



This information is PRELIMINARY and may contain errors.

This handbook distills 250 pages of [Si4734](#) commands and properties down to 3 pages. It covers the fundamentals (setup; frequency and bandwidth changes; seeking) and various [pitfalls](#).

Si4734 Setup					
Command	0x01	POWER_UP	byte2 =	0x11	byte3 = 0x05
Command	0x80	GPIO_CTL	byte2 =	0x0E	
Command	0x81	GPIO_SET	byte2 =	0x00	
Command	0x12	SET_PROPERTY			
	byte2 =	0x00			
	byte3 =	Property HI	byte4 =	Property LO	
	byte5 =	Value HI	byte6 =	Value LO	
Property	0x3302	AM_SOFT_MUTE_MAX_ATTENUATION			
	byte5 =	0x00	byte6 =	0x00	
Command	0x11	POWER_DOWN			

Command **0x01** powers the chip in [AM](#) mode with analog audio output, crystal oscillator via GPO3, non-patch boot, no [CTS](#) (Clear To Send) or [GPO2](#) (General Purpose Output) interrupt. CTS typically takes $\sim 300 \mu\text{S}$ while commands **0x01** and **0x12** take **110** and **10 mS** respectively.

Command **0x80** takes the three output pins (GPO1, GPO2, GPO3) out of their [hi-Z](#) state. Command **0x81** sets the pins to [ground](#). These two commands are necessary to reduce current and enhance stability. Unfortunately, chips prior to version **2.0** cannot execute these commands.

Command **0x12** allows us to set properties by sending six bytes containing the property and its new value. Setting property **0x3302** to zero disables soft muting; this facilitates [DXing](#). Therefore, the six byte sequence: **0x12, 0x00, 0x33, 0x02, 0x00, 0x00** will disable soft muting.

Command **0x11** causes the chip to enter a low-power mode that only responds to **0x01**. In this mode the chip consumes **10 μA** . Typical AM current is **17.3 mA**: using **52 mW** at 3 Volts. Switching between AM and FM modes requires **POWER_DOWN** (all register contents are lost). Version **1.0** requires a reset if sent a command other than **POWER_UP** while in **POWER_DOWN**.

An MCU needs only three lines ([SCLK](#), [SDIO](#), [RST](#) or clock, data, reset) for control of the Si4734. There is one big **caveat**: all data on the SDIO line (meaning MCU control of the Si4734, or any other device on the bus) must be suspended during tuning and seeking. Failure to do so may result in crystal oscillator jitter and lead to mistuning, false seek stops, and a lowered SNR. Radios should not attempt to poll signal strength information (SNR/RSSI) during tuning/seeking.

Due to the above warning, advanced control programs must setup GPO2/[INT](#) ([PIN 18](#)) as an interrupt line. This is accomplished by setting byte2 of **POWER_UP** to **0xD1** [bit 6 for INT and bit7 for CTS]. During interrupts [INT](#) is driven low for **1 μS** . The [STCINT](#) or Seek / Tune Complete Interrupt should be used instead of polling. **GPO_IEN** configures interrupt resources, including: [STCINT](#), [CTS](#), [ERR](#) (Error), [ASQINT](#) (Audio), and [RSQINT](#) (Received Signal Quality). To examine and update the interrupt status byte, **GET_INT_STATUS** is called. **AM_RSQ_INT_SOURCE** is used to create interrupts based on signal quality: SNR or RSSI (triggered by low or high values).

Si4734 Frequency and Bandwidth		
Command	0x40	AM_TUNE_FREQ
	byte2 =	0x00
	byte3 =	Frequency HI
	byte4 =	Frequency LO
	byte5 =	Capacitor HI
	byte6 =	Capacitor LO
Property	0x3102	AM_CHANNEL_FILTER
	byte5 =	0x00
	byte6 =	0x00 - 0x04

Command **0x40** permits tuning both the I/Q mixer LOs and the onboard capacitor. Valid capacitor values are 0 (automatic tuning) and 1 to 6143. Capacitor values can be calculated via the formula: $0.095 * \text{word_value} + 7$ in pF. This calculates to a tuning range of ~7 to 590 pF.

Property **0x3102** allows setting filter bandwidth. Values include: 0x00 6-kHz, 0x01 4-kHz, 0x02 3-kHz, 0x03 2-kHz, and 0x04 1-kHz. Note: the 1-kHz filter requires version 2.A.2 or newer.

Si4734 Seeking		
Property	0x3400	AM_SEEK_BAND_BOTTOM
	byte5 =	Frequency HI
	byte6 =	Frequency LO
Property	0x3401	AM_SEEK_BAND_TOP
	byte5 =	Frequency HI
	byte6 =	Frequency LO
Property	0x3402	AM_SEEK_FREQ_SPACING
	byte5 =	0x00
	byte6 =	0x05 (0x01, 0x09, 0x0A)
Property	0x3403	AM_SEEK_TUNE_SNR_THRESHOLD
	byte5 =	0x00
	byte6 =	0x05 - 0x3F
Property	0x3404	AM_SEEK_BAND_RSSI_THRESHOLD
	byte5 =	0x00
	byte6 =	0x05 - 0x3F
Command	0x41	AM_SEEK_START
	byte2 =	0x00 + 0x08 [UPWARD] + 0x04 [WRAP]
Command	0x42	AM_TUNE_STATUS
	byte2 =	0x02

Properties **0x3400** and **0x3401** setup the seek range in kHz (149 to 23000 being valid). While **0x3402** sets the spacing to 5-kHz (other applicable values are 1-kHz, 9-kHz, and 10-kHz).

Properties **0x3403** and **0x3404** set the SNR (Signal to Noise Ratio) and RSSI (Received Signal Strength Indicator) values in dB and dBµV respectively. Range is 1 to 63; 0 being disabled.

S-meter Equivalents		
S1	0.2 µV	-14 dBµV
S2	0.4 µV	-8 dBµV
S3	0.8 µV	-2 dBµV
S4	1.6 µV	4 dBµV
S5	3.2 µV	10 dBµV
S6	6.3 µV	16 dBµV
S7	13.0 µV	22 dBµV
S8	25.0 µV	28 dBµV
S9	50.0 µV	34 dBµV
S9+10	160.0 µV	44 dBµV
S9+20	500.0 µV	54 dBµV

Command **0x41** starts seeking downward and halts at the end of the band. Adding 0x08 causes upward seeking and adding 0x04 causes wrapping around when at the end of the band.

Command **0x42** is used to determine where the radio stopped. Value 0x02 aborts seeking. It takes 80 mS per station to seek. Seeking the 31M band (9250 to 9995 kHz) takes ~59 seconds.

Response Bytes	
GET_PROPERTY	3
AM_RSQ_STATUS	5
AM_TUNE_STATUS	7
GET_REV	8
POWER_UP	15

Note: POWER_UP returns 15 bytes only in [Query Library ID](#) mode.

All of the commands in the blue tables above return zero response bytes: except for the **AM_TUNE_STATUS** command; which is used to abort seeking. This fact can be used on simple control programs along with the general timing guidelines. The chip uses an [I2C](#) bus as default: this can reach speeds of 400 kHz. The [3-wire](#) and [SPI](#) buses can run as fast as 2.50 MHz. Using [SEN \(PIN 6\)](#) [Serial Enable] the I2C bus address can be altered: [0x22](#) [SEN LO]; [0xC6](#) [SEN HI].

The following may help simplify some programs. It is possible to send all seven argument bytes for all commands. However, unused arguments must be sent as [0x00](#). It is also possible to read all fifteen response bytes for all commands. However, all unused response bytes will contain random values. **WARNING:** writing a block of more than eight bytes (one command byte followed by 7 argument bytes) to the chip will result in an input buffer overrun and unpredictable behavior.

Other Si4734 Commands			
Command	0x10	GET_REV	Read Revision Data
Command	0x13	GET_PROPERTY	Read Property Values
Command	0x14	GET_INT_STATUS	Read Interrupt Status
Command	0x15	PATCH_ARGS	Software Patch (15856 bytes maximum)
Command	0x16	PATCH_DATA	Software Patch (~0.5 second via I2C)
Command	0x43	AM_RSQ_STATUS	Received Signal Quality

Interrupt related function calls are highlighted.

Other Si4734 Properties		
0x0001	GPO_IEN	Interrupt Enabling
0x0201	REFCLK_FREQ	31130-32768 Hz SW (0 disables AFC)
0x0202	REFCLK_PRESCALE	1-4095 divisor (support to 40 MHz)
0x3100	AM_DEEMPHASIS	50 μ s
0x3200	AM_RSQ_INT_SOURCE	Interrupt Source:
0x3201	AM_RSQ_SNR_HIGH_THRESHOLD	SNR > 0-127 dB
0x3202	AM_RSQ_SNR_LOW_THRESHOLD	SNR < 0-127 dB
0x3203	AM_RSQ_RSSI_HIGH_THRESHOLD	RSSI > 0-127 dBμV
0x3204	AM_RSQ_RSSI_LOW_THRESHOLD	RSSI < 0-127 dBμV
0x3300	AM_SOFT_MUTE_RATE	1-255 * 4.35 dB/s
0x3301	AM_SOFT_MUTE_SLOPE	1-5 dB/dB
0x3303	AM_SOFT_MUTE_SNR_THRESHOLD	0-63 dB
0x4000	RX_VOLUME	0-63 (default 63)
0x4001	RX_HARD_MUTE	Mute Audio Output

Interrupt related variables are highlighted.

REFERENCE

just_rtfm@<NOSPAM>yahoo.com
http://home.comcast.net/~phils_radio_designs

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