PRODUCT NAME

TR3003

TITLE

1. The relationship between programmable counter settings and FM transmission frequency

2. Flow diagram to adjust FM transmission frequency

3. After turns off FM Transmitter power, method to lower MCU power consumption

APPLICATION NOTE

1. The relationship between programmable counter settings and FM transmission frequency:

(1). TR3003 operation range is VDD = 2.2V~3.6V. 38KHz reference clock input may be used.

(2). FM transmission frequency may be set from 76.0MHz to 108.0MHz. The emission interval between transmission frequencies is 0.1MHz. There are a total of 321 FM transmission frequencies can be set.

(3). For FM transmission frequencies between 76.0MHz to 108.0MHz, the required range settings for programmable counter are: 6000~8526. If the intervals of frequencies are ± 0.1MHz, the variations of programmable counter are ± 8.

(4). If the method of changes in FM transmission frequency is from xxx.9MHz downward decreasing to xxx.0MHz, or from xxx.0MHz upward increasing to xxx.9MHz, for each transmission frequency value change of 0.1MHz, the corresponding variations of programmable counter are ± 8.
For example: 76.0MHz~76.9MHz, 87.0MHz~87.9MHz, 95.0MHz~95.9MHz.

If the method of changes in FM transmission frequency is from xxx.9MHz upward increasing to xxx.0MHz or from xxx.0MHz downward decreasing to xxx.9MHz, for each transmission frequency value change of 0.1MHz, the corresponding variations of programmable counter are ± 7.
For example: 76.9MHz upward increases to 77.0MHz or 96.0MHz downward decreases to 95.9MHz.

They are as shown in the following two tables:

FM Transmission Frequency	Programmable Counter Corresponding Value (Dec)	Programmable Counter Corresponding Value (Hex)
87.0 MHz	6868	1AD4
87.1 MHz	6876	1ADC
87.2 MHz	6884	1AE4
87.3 MHz	6892	1AEC
87.4 MHz	6900	1AF4
87.5 MHz	6908	1AFC
87.6 MHz	6916	1B04
87.7 MHz	6924	1B0C
87.8 MHz	6932	1B14
87.9 MHz	**6940**	**1B1C**
88.0 MHz	**6947**	**1B23**

FM Transmission Frequency	Programmable Counter Corresponding Value (Dec)	Programmable Counter Corresponding Value (Hex)
107.0 MHz	8447	20FF
107.1 MHz	8455	2107
107.2 MHz	8463	210F
107.3 MHz	8471	2117
107.4 MHz	8479	211F
107.5 MHz	8487	2127
107.6 MHz	8495	212F
107.7 MHz	8503	2137
107.8 MHz	8511	213F
107.9 MHz	**8519**	**2147**
108.0 MHz	**8526**	**214F**

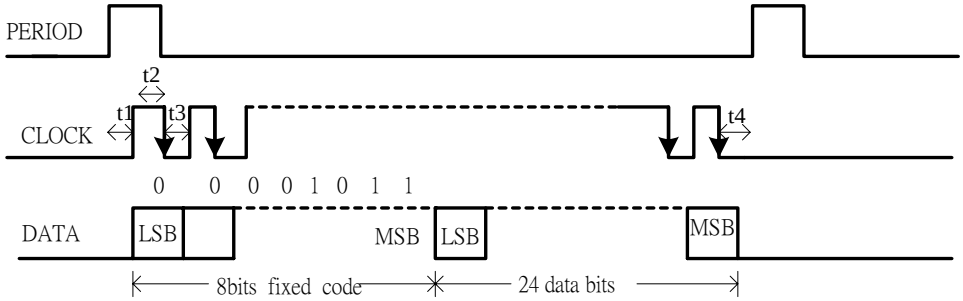
(5). The following two sets of FM transmission frequency are exceptions: for "76.9MHz and 77.0MHz" and "95.9MHz and 96.0MHz", the interval for each 0.1MHz frequency change, the corresponding variations of programmable counter is ±6. They are as shown in the following two tables:

FM transmission frequency	Programmable counter Corresponding value (Dec)	Programmable counter Corresponding value (Hex)
76.0 MHz	6000	1770
76.1 MHz	6008	1778
76.2 MHz	6016	1780
76.3 MHz	6024	1788
76.4 MHz	6032	1790
76.5 MHz	6040	1798
76.6 MHz	6048	17A0
76.7 MHz	6056	17A8
76.8 MHz	6064	17B0
76.9 MHz	**6072**	**17B8**
77.0 MHz	**6078**	**17BE**

FM Transmission Frequency	Programmable Counter Corresponding Value (Dec)	Programmable Counter Corresponding Value (Hex)
95.0 MHz	7500	1D4C
95.1 MHz	7508	1D54
95.2 MHz	7516	1D5C
95.3 MHz	7524	1D64
95.4 MHz	7532	1D6C
95.5 MHz	7540	1D74
95.6 MHz	7548	1D7C
95.7 MHz	7556	1D84
95.8 MHz	7564	1D8C
95.9 MHz	**7572**	**1D94**
96.0 MHz	**7578**	**1D9A**

(6). Serial data transfer format:

Use the serial I/O of TR3003 to transmit the values of the programmable counter.



(A). PERIOD signal: Between the two PERIOD signals (upward edge to upward edge), there shall be 32 CK clocks included.

(B). CLOCK signal: DATA signal will be latched inside TR3003 at the downward edge of the CLOCK.

(C). DATA signal: The values of the programmable counter shall be sent first from LSB.

(D). t1, t2, t3, t4 time : > 4us。

(E). After the 32 bits data were sent, PERIOD & CLOCK & DATA signal shall be maintained at low status.

(F). The format of 24 data bits is as follows:

LSB MSB

P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	0	1	1	0	1	0	0	0

(7). How to calculate the settings of the programmable counter:

[P15…...P0] = N (Programmable counter settings:1600(dec) < N < 65280 (dec))

For example:

If N = 6868;

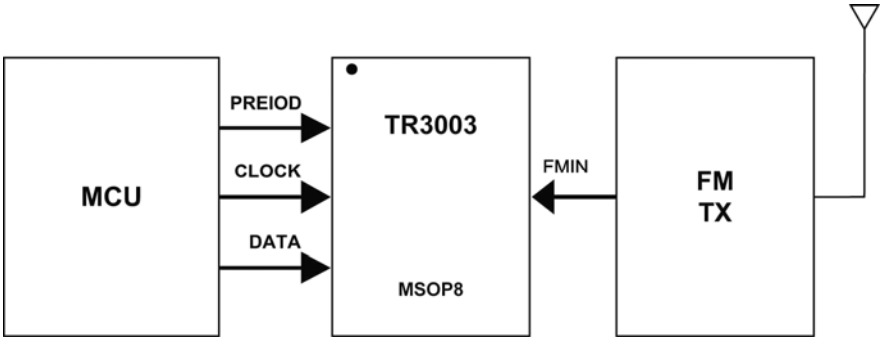
Frequency Clock = 38kHz;

Reference Frequency = 38kHz/3 (fixed) = 12.6667kHz

Synthesis Frequency f = 12.6667kHz * N = 12.6667kHz * 6868

= 86.995MHz ≅ 87MHz

(8). Hardware: (as shown in the following block diagram)
Use MCU to control TR3003.



(9). The following program example uses the 4 bit MCU of tenx technology inc. to control TR3003 and transmit 87.0MHz [1AD4(hex)] FM frequency signal. (Use IOA port to transmit PERIOD & CLOCK & DATA signals. And define IOA3=PERIOD & IOA2=CLOCK & IOA1=DATA)

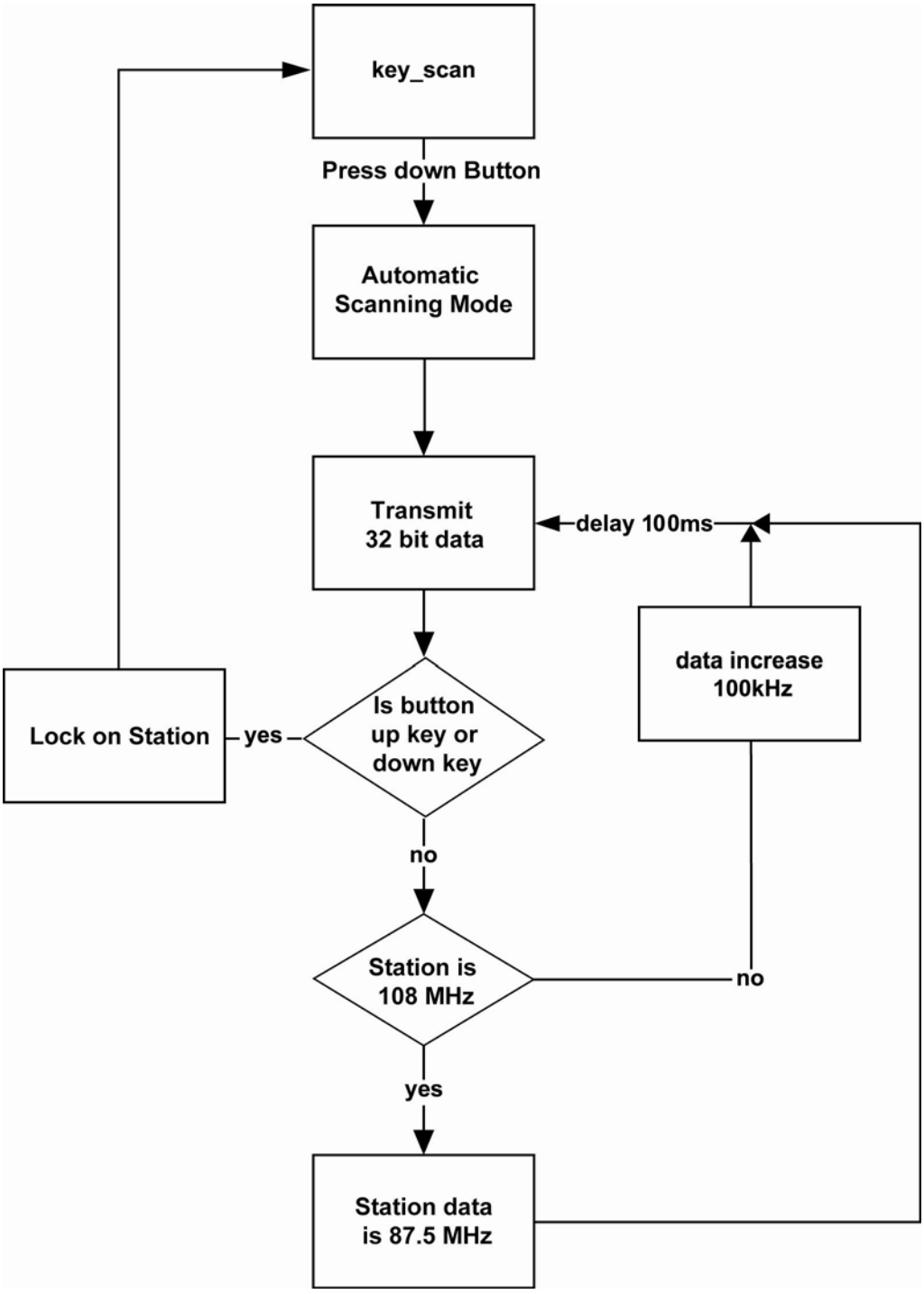
```
.data
                data0   equ  00h            ; define data0~data7 as values for programmable
                                               counter
                data1   equ  01h            ; data7 is MSB; data0 is LSB
                data2   equ  02h            ; data0, data1, data6, data7 register data content
                                               fixed
                data3   equ  03h            ; data0=00h, data1=0dh, data6=06h, data7=01h
                data4   equ  04h
                data5   equ  05h
                data6   equ  06h
                data7   equ  07h
                radio_signal   equ   08h    ; Define send out PERIOD, CLOCK, DATA signal
                                               register
                global_buf0    equ   09h
                global_buf1    equ   0ah
                global_buf2    equ   0bh
                global_buf3    equ   0ch
                .endd


.code
Start:
                lds  data0 , 00H            ; Initialize data0~data7(161AD4D0h)
                lds  data1 , 0dH
                lds  data2 , 04H
                lds  data3 , 0dH
```

```
                    lds  data4 , 0aH
                    lds  data5 , 01H
                    lds  data6 , 06H
                    lds  data7 , 01H
;*************************************************************************************************
radio_protocol:

                    mv1   force_zero
                    mvh   force_zero
                    mvu   force_zero
                    1da#  @h1
                    sta     global_buf2          ; move data0 register content to global_buf2
                                                   register

                    spa     0fh
                    lds  radio_signal,00h        ; Initialize PERIOD=0, CLOCK=0, DATA=0
                    opa  radio_signal            ; Send out from IOA port

                    lds   global_buf0,08h        ;code data total 32 bit
                    lds   global_buf3,04h        ;set global_buf0* global_buf3=32
                    call  send_radio_data
                    call  period_end
.endc



;***********   sdio data transfer  ***************************************************************
send_radio_data:                                 ; Function: Use serial mode method to send out
                                                   data0~data7 register contents from IOA port.
                    fast
                    lda    radio_signal,04h
                    opa   radio_signal
                    1da   global_buf2
                    jb0    sdio_0
                    lds    radio_signal,06h
                    opa   radio_signal
                    lda    radio_signal,04h
                    opa   radio_signal
                    lda    radio_signal,00h
                    opa   radio_signal
                    jmp   sdio_1
sdio_0:
                    lds    radio_signal,07h
                    opa   radio_signal
                    lda    radio_signal,05h
                    opa   radio_signal
                    lda    radio_signal,01h
                    opa   radio_signal
sdio_1:
                    dec*  global_buf3
                    sr0    global_buf2
sdio_2:
                    1da   global_buf2
                    jb0    sdio_3
                    lda    radio_signal,02h
                    opa   radio_signal
                    lda    radio_signal,00h
```

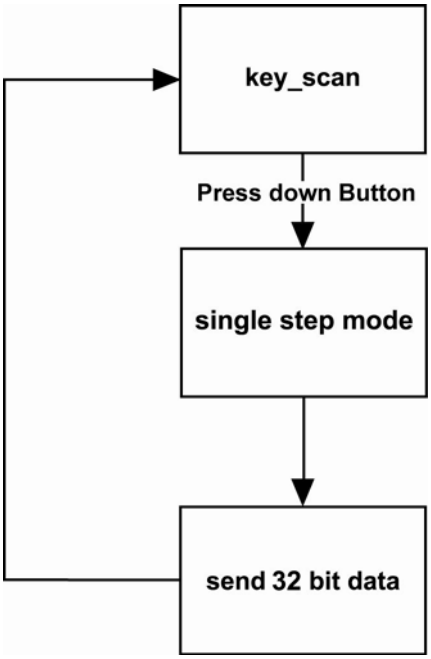
```
                    jmp   sdio_4
sdio_3:
                    lds    radio_signal,03h
                    opa   radio_signal
                    lda    radio_signal,01h
                    nop
sdio_4:
                    dec*  global_buf3
                    jz     sdio_5
                    opa   radio_signal
                    sr0    global_buf2
                    jmp   sdio_2
sdio_5:
                    opa   radio_signal
                    1da   global_buf3,04h
                    dec*  global_buf0
                    jz     sdio_6
                    1da#  @h1
                    sta    global_buf2
                    jmp  sdio_2
Sdio_6:
                    rts


;*************************************************************************************************
period_end:

                    1ds   radio_signal,0ch
                    opa   radio_signal
                    spa   0fh
                    1da  radio_signal,08h
                    opa  radio_signal
                    slow
                    rts
```

2. Flow diagram to adjust FM transmission frequency:

(1). Flow diagram to replace transmission frequency station automatically (Suggested method to change transmission frequency is from 76.0MHz upward to 108.0MHz):



(2). Flow diagram mode to replace 0.1MHz transmission frequency each time:



3. Set the status of the three signals PERIOD, CLOCK and DATA between MCU and TR3003 to "LOW" after turning off FM Transmitter power, this will reduce the unnecessary power consumption on the MCU I/O pins.