PHILIPS
BU RF Solutions

FQ1200MK3/FM1200MK3 FAMILY

Application Note

Disclaimer

Release Notes

Date	Revision	Remarks	Editor
01/10/2003	1.0.0	First release	Sim KP

Release Notes (Evaluation Software)

Date	Revision	Remarks	Editor
01/08/2003	4.8.0.0		Paxton Tan

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This document serves as a guideline to maximize the performance of this module for various applications.

1. Introduction

The FM1200Mk3 and FQ1200Mk3 are the new family of RF video modules family. The MK3 family is the small size front-ends which is designed to meet wider range of RF applications in the areas like PC/TV Multi-Media; LCD TV; PVR and etc. It combines the functions of an all bands tuner, and a Quasi-Split Sound (QSS) IF Demodulation unit.
The frontends have a built-in digital (I^2C) PLL tuning system. A DC-DC converter circuit is built-in to synthesize the tuning voltage, thus making the frontends the true 5V device.
The FQ1200Mk3 and FM1200MK3 are complied all the requirements of FCC, CISPR, JIS, DOC (canada) as well as CENELEC (EN55013, EN55020) with respect to input immunity and EMC.

2. Range of Products

Types	TV standard / Countries	Input connector/ Mounting	12 NC
FQ1216ME/I H-3	CCIR B/G, I, D/K, L/L' Western Europe, East Asia, China, OIRT countries, France, UK, HK, NZ, Australia	IEC/Horizontal	3139 147 18291
FQ1216ME/P H-3		Phono/Horizontal	3139 147 18771
FQ1216ME/I V-3		IEC/Vertical	3139 147 19151
FQ1236/F H-3	M/N USA, Canada, Latin America, Taiwan, S Korea, Philippines	F/Horizontal	3139 147 18351
FQ1236/P H-3		Phono/Horizontal	3139 147 18761
FQ1236/F V-3		F/Vertical	3139 147 19521
FQ1286/F H-3	M/N Japan	F/Horizontal	3139 147 18981
FQ1286/P H-3		Phono/Horizontal	3139 147 20171
FM1216ME/I H-3	CCIR B/G, I, D/K, L/L' & FM Western Europe, East Asia, China, OIRT countries, UK, France, HK, NZ, Australia	IEC/Horizontal	3139 147 18201
FM1236/F H-3	M/N and FM radio USA, Canada, Latin America, Taiwan, S Korea, Philippines	F/Horizontal	3139 147 18261
FM1286/F H-3	M/N and FM radio Japan	F/Horizontal	3139 147 19011

Note : option for active loop-through; passive loop-through, LNA are available.

3. General Block Diagram

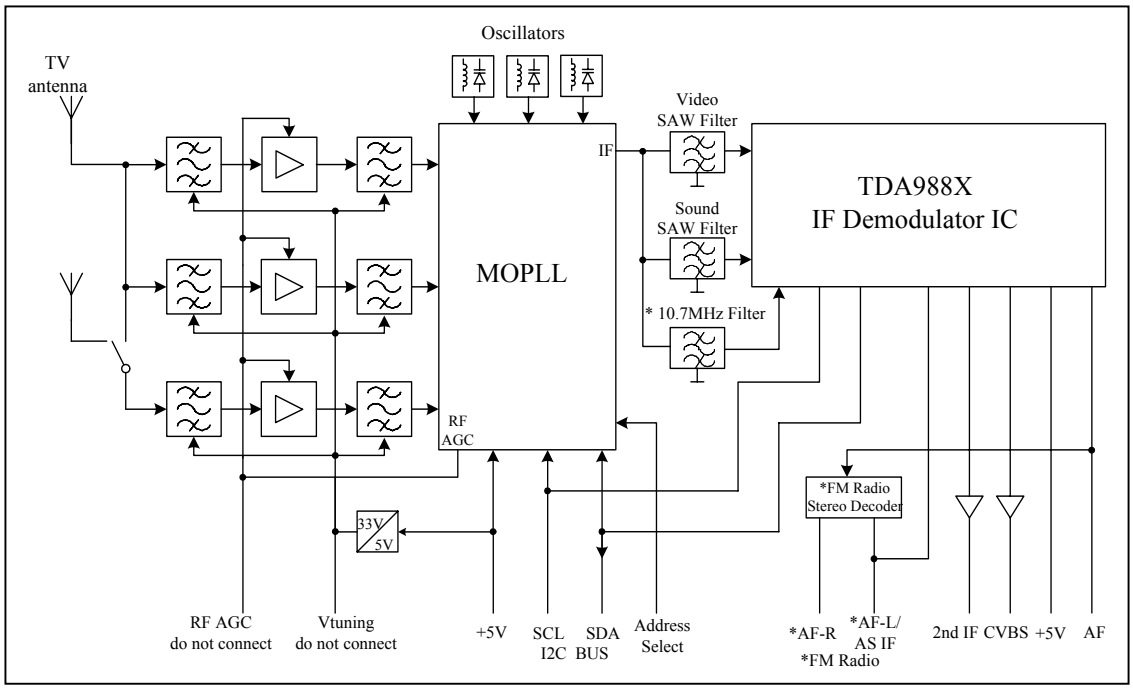


Figure 1, General Block Diagram of FQ/FM1200MK3

4. Pinning Information

Symbol	Pin	Description
N.C	1	Do not Connected (agc Monitor)
N.C	2	Do not Connected (tuning voltage monitor)
+5V	3	Supply Voltage Vb, Tuner section
SCL	4	I^2C – Serial Clock
SDA	5	I^2C – Serial Data
AS	6	I^2C – Address Select
-	7	Do not Connected
-	8	Do not Connected
N.C/AF-R	9	Do not Connected / FM radio Right channel
IF AS /AF-L	10	I^2C – Address Select IF/ FM radio Left channel
2^{nd} Sound IF	11	Second Sound IF output (buffered output)
CVBS	12	Video (buffered output)
+5V IF	13	Supply Voltage, IF section
AF/MPX	14	AF/MPX TV sound output

5. Functional Description

The FQ/FM1200 Mk3 frontend consists of a 3-band tuner that can tune to all channels between 48 and 863 MHz covers all types of TV systems, and an IF system using QSS demodulation concept, designed on a single double-sided Printed Circuit Board. The whole assembly is mounted in a steel folded frame for good EMC performance.

TV Tuner

The tuner section is equipped with 3 tuned RF high-gain MOSFET stages in the input section, ensuring low noise and good inter-modulation performance. The gain control voltages of the MOSFETs are by the wideband AGC voltages generates from the tuner IC when it detects the level of the IF output. The AGC take-over point and the time constant are selectable by the I^2C bus. A band-pass filter, suitably narrow with a 3dB bandwidth of 8-12 MHz, ensures good suppression of unwanted spurious channels. The mixer-oscillator functions are based on an IC which offers good intermodulation and suppression of oscillator harmonics. An IF amplifier provides some gain conversion to drive the SAW filter directly in the IF section. The tuning and bandswitching is done with a digital programmable PLL tuning system contained in the synthesizer IC. The DC-DC converter is built around this IC to provide the required tuning voltages, making the FQ/FM1200 Mk3 frontends the true 5V devices.
The FM radio is integrated with the TV VHF Low band tuner. When switched to FM Radio mode, the tuner RF bandwidth is reduced to about 2.5MHz.
IF section

The IF is designed base on the Philips Semiconductor IF demodulator IC TDA9885/6/7 depend on the versions. It is a true synchronous demodulation, alignment–free multistandard (PAL, SECAM and NTSC) IC for positive and negative modulation via I^2C-bus. The sound IF including AM and FM works on the principle of Quasi Split Sound (QSS) processing. For demodulating the video IF, an extremely linear synchronous PLL demodulator is utilised. Its offers very linear demodulation good intermodualtion, reduce harmonics, and excellent pulse response. The IF selectivity is provided by a Video Surface-Acoustics Wave (SAW) filter, and split Sound SAW filter for the different TV systems. The PLL demodulator is fitted with an Automatic Frequency Tuning (AFT) detector which allows for fine tuning of the picture carrier to the nominal IF.
FM Radio, a separate 10.7MHz IF bandpass filter is connected to the FM input of the TDA9887 IF IC at pin 13. FM radio demodulation is controlled via I^2C. The FM MPX sound is connected to TDA7040 Stereo decoder IC where the L and R audio channels are decoded.
The 2^{nd} IF sound signal at pin 11 is intended for Stereo/NICAM sound decoding. The 2^{nd} IF sound output is buffered and it can be connected directly to the NICAM/Multi system DSP sound IC.

6. Application information

6.1 Grounding / Layout Orientation

The FQ1200 MK3 and FM1200 MK3 modules are housed in a metal enclosure that has two function: firstly, preventing the Local Oscillator signals from radiating into the environment and secondly, preventing unwanted RF signals from entering the module and disturbing the wanted signals to be received.
The second function is most critical, since the PC environment is an extremely "polluted" one with a plethora of clock and control signals. The fundamental and harmonic frequencies of many digital signals extend below and beyond the frequency range in use for TV broadcasts. Due to their very high levels, they can easily leak into the frontend and create interference with the wanted TV signals.
To prevent this from happening, it is recommended not to place the digital radiators, especially the VGA and video decoder ICs in close proximity to the frontend. And the crystals that associated to Video decoder and sound decoder should not place near to the frontend. Care must also be exercised regarding the length of PWB tracks going to the pins of the frontend. At certain frequencies, long PWB tracks act like micro-strip lines, presenting a low impedance to the frontend terminals, so that the internal decoupling capacitors on the terminals are no longer effective.
It is essential that a separate analogue ground system be established for the frontend. A ground plane under the frontend is recommended. All tracks carrying digital signals should not be run underneath the frontend. Connections between the analogue and digital ground should be made only via RF chokes. In addition, the analogue ground plane should be in contact with the chassis ground via the slot bracket screw contacts.
The most optimum layout configuration is obtained when the antenna connector of the frontend protrudes from the back of the PC chassis when the TV card is installed. This ensures that the RF signal connection is made directly to the frontend. The use of a extra antenna adapter or cable will degrade the quality of the RF signal. Also it is very critical that the frontend is not located next to any digital device in an adjacent card that radiates a lot of spurious signals into the environment. See Fig 1

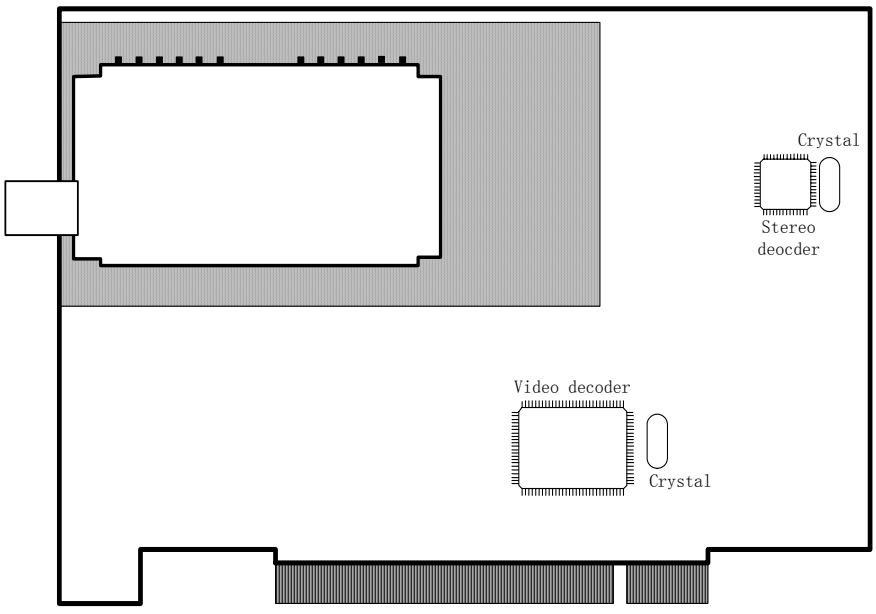


Figure 2,. Suggested card Layout

6.2 Antenna socket / Cable requirement

To prevent excessive loss of signal and picking up of spurious signals under sub-optimal conditions, the antenna cable must be of good quality. A recommended type is the RG-59BU with a characteristic impedance of 75 ohm (preferable double shielded). This has a specified maximum loss of 4.6 dB at 1GHz.

The antenna connector must be properly crimped or soldered to the cable. F and IEC connector are recommended as their characteristics are closer to 75 ohm than the RCA (frequently called standard phono) type. This will ensure an optimum matching to the antenna wall outlet and the frontend.

6.3 Supply requirements

The FQ/FM1200 Mk3 is the true 5V device. For optimum protection against unwanted pick-up, it is recommended that a series choke of 10 nH and a large Elcap (100 uF) be placed at pins3 and 13. See figure 2. The maximum allowable ripple is 5 mVpp in the frequency range 20 Hz to 100 kHz and 10 mVpp from 100 kHz to 500 kHz. . Ideally the frontend should be powered by a separate voltage regulator which is capable of sourcing at least 310mA (150mA for tuner part and 160 mA for the IF part). The frontend works best with a nominal voltage of +5V. It should be verified that the supply voltage at the pins 3 and 13 is at least 4.75V.

It is imperative that good grounding techniques be employed in order to prevent conducted radiation from the digital decoder IC through the analogue/digital grounding.

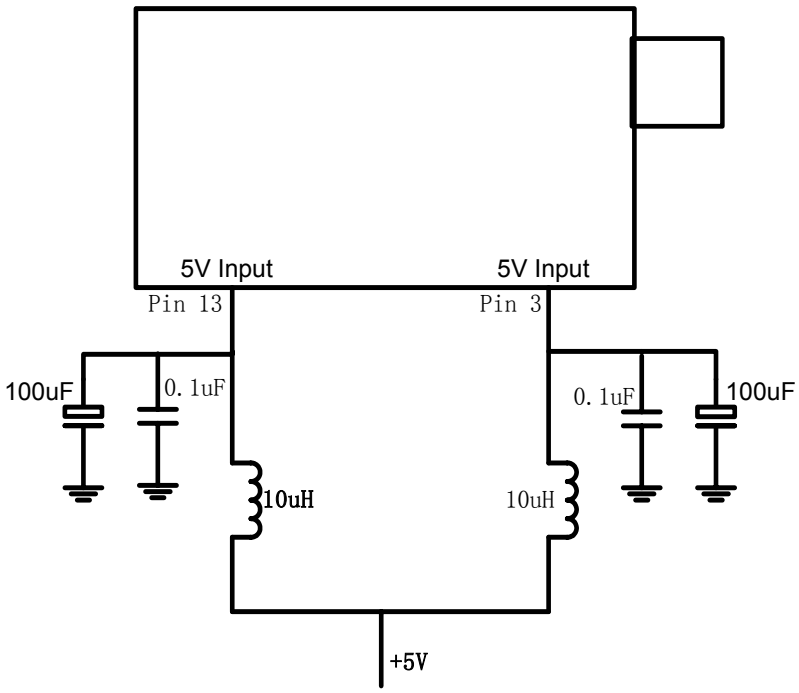


Figure 3, Suggested Supply de-coupling circuit

6.4 I²C Bus Programming

For information regarding general aspects of I²C bus control see *'The I²C-bus and how to use it'*, published by Philips Semiconductors under 12NC : 9398 393 40011

The next section provides programming information specific to the FQ/FMI1200 Mk3 modules.

6.4.1 I²C Bus Structure

The FQ/FM1200 MK3 contains two I²C transceivers, one in the tuner section and one in the IF section. It is imperative to ensure that both I²C devices are programmed correctly according to their address.

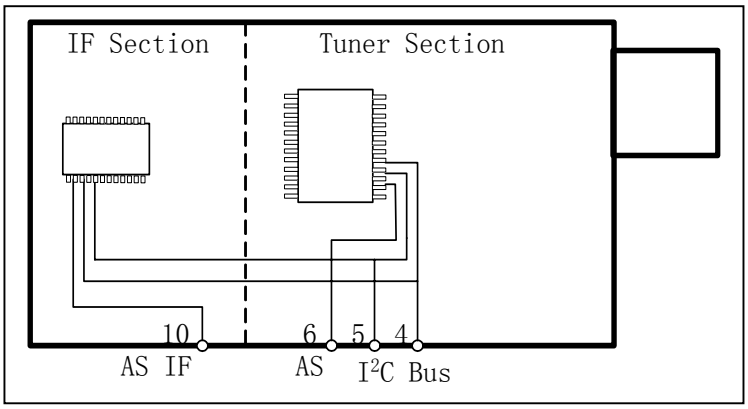


Figure 4, I²C Bus Structure

6.4.2 Tuner Section Programming

6.4.2.1 Logic Diagram (WRITE Mode , R/W = 0)

	MSB							LSB	ACK
Address Byte ADB	1	1	0	0	0	MA1	MA0	R/W=0	A
Divider Byte 1 DB1	0	N14	N13	N12	N11	N10	N9	N8	A
Divider Byte 2 DB2	N7	N6	N5	N4	N3	N2	N1	N0	A
Control Byte CB	1	CP	T2	T1	T0	RSA	RSB	OS	A
Bandswitch Byte BB	P7	P6	P5	P4	P3	P2	P1	P0	A
Auxiliary Byte AB *	ATC	AL2	AL1	AL0	0	0	0	0	A

*Note : By default, it is set to AL2=0, AL1=1,ALO=0. This sets the tuner AGC TOP to 112dBµV upon power –on reset.

6.4.2.2 Address Byte (MA1, MA0)

Voltage at Pin 6 of the tuner (AS pin)	Address	MA1	MA0
0 - 0.5 V	C0	0	0
1.0 – 1.5 V	C2	0	1
2.0 – 3.0 V	C4	1	0
4.5 – 5.0 V	C6	1	1

If the AS pin (pin 6 of the tuner) is left floating, or not connect to any voltage, the internal biasing will automatically set the address to C2.

6.4.2.3 Programmable Divider Setting (Byte 1 and Byte 2)

Divider ratio: N = f_{OSC} / f_{SS}

Where f_{OSC} = $f_{RF.\,PC}$ + f_{VIF} MHz and f_{SS} = step size set by RSA and RSB

Thus, N = 8192*N13 + 4096*N12 + 2048*N11 + 1024*N10 + 512*N9 + 256*N8 + 128*N7 + 64*N6 + 32*N5 + 16*N4 + 8*N3 + 4*N2 + 2*N1 + N0

For :	FQ/FM1216ME MK3,	f_{VIF} = 38.9MHz	B/G, D/K, I, L mode
	FQ/FM1216ME MK3,	f_{VIF} = 33.9MHz	L' mode
	FQ/FM1236MK3,	f_{VIF} = 45.75MHz	NTSC USA
	FQ/FM1286MK3,	f_{VIF} = 58.75MHz	NTSC Japan
and :	FM radio,	f_{VIF} = 10.7MHz	

6.4.2.4 Control Byte CB

6.4.2.4.1 Charge Pump Setting:

CP can be set to either 0 (low current) or 1 (high current).
CP = 1 results in fastest tuning
CP = 0 in moderate speed tuning with slightly better residual osc FM.

For TV mode, it is recommended to set CP=1. The only exception allowed is when fine tuning under viewing conditions, then a low current CP=0 should be selected, but returning to CP=1 immediately after completion of fine tuning.

For FM radio mode, it is recommended to set CP=0 at all times.

6.4.2.4.2 Test Mode Setting:

Mode	T2	T1	T0
Normal operation (default)	0	0	1
Byte AB will follow byte BB (otherwise BB Byte will follow)	0	1	1

It is default to set test bits at normal operation mode. The only exception when AB byte is used, this is necessary when at TV mode, the AGC time constant (bit ATC) and AGC TOP (bits AL2, AL1, AL0) should change to recommended values. (refer to AB bytes)

6.4.2.4.3 Ratio Select Bits

Frequency step size (f_{SS})		RSA	RSB
50kHz	For FM tuning	0	0
31.25kHz	For slow TV tuning	0	1
166.7kHz		1	0
62.5kHz	For normal TV tuning	1	1

6.4.2.4.4 PLL Disabling

	OS
For normal operation	0
Disable PLL tuning	1

6.4.2.5 Bandswitch Byte CB

	P7	P6	P5	P4	P3	P2	P1	P0
TV Low Band	X	X	X	0	0	0	0	1
TV Mid Band	X	X	X	0	0	0	1	0
TV High Band	X	X	X	0	0	1	0	0
FM band Stereo	X	0	X	1	1	0	0	1
FM Band Mono	X	1	X	1	1	0	0	1

6.4.2.6 Auxiliary Byte AB

6.4.2.6.1 AGC Time Constant (ATC Byte)

	ATC
AGC time constant = 2sec (recommended setting for all TV Systems and FM radio)	0
AGC time constant = 50msec (Not recommended setting)	1

6.4.2.6.2 AGC TOP Setting

IF Output Level		AL2	AL1	AL0
115 dBµV		0	0	0
112 dBµV	Default mode at POR	0	1	0
109 dBµV		0	1	1
106 dBµV	Recommended for PAL B/G, D/K, I & NTSC & FM	1	0	0
103 dBµV	Recommended for only L/L'	1	0	1

6.4.2.7 Logic Diagram (READ MODE R/W = 1)

	MSB							LSB	ACK
Address Byte ADB	1	1	0	0	0	A1	MA0	R/W=1	A
Status Byte SB	POR	FL	1	1	AGC	A2	A1	A0	A

The following data can be read from the device through the status byte:

6.4.2.7.1 POR (power on reset):

The POR bit = 1, at power-one

6.4.2.7.2 FL (PLL Lock Flag)

FL = 1, when the phase lock loop is in lock
The loop must be phase-locked during at least 8 consecutive periods of the internal 7.8125 kHz reference-frequency (ie. 1msec respectively) before the FL flag internally will be raised to 1.

6.4.2.7.3 AGC : Internal AGC flag

	AGC
Internal AGC is Non-active	0
Internal AGC is active	1

6.4.2.7.4 A2, A1, A0

Used for indicating if the FM radio signal received is in Stereo or Mono mode.
These bits do not apply to TV mode.

	A2	A1	A0
FM Radio Stereo mode	1	0	0
FM Radio Mono mode	0	X	X

6.4.3 IF Section Programming

6.4.3.1 Logic Diagram (WRITE Mode, R/W = 0)

I^2C bus format to write (slave receives data)

S	SLAVE ADDRESS	R/W= 0	A	SAD	DATA	AN	P

BIT	FUNCTION
S	START condition, generated by the master
Standard SLAVE ADDRESS	See table 1
R/W = 0	Write command, generated by the master
A	Acknowledge, generated by the slave
SUBADDRESS (SAD)	See table 2 and 3
DATA	8 bits data words, transmitted by the master, See table 4,5,6
AN	Acknowledge not, generated by the master
P	STOP condition

6.4.3.2 Standard SLAVE ADDRESS

Table 1, Slave address

Value (hex)	A6	A5	A4	A3	A2	A1	A0	R/W
86	1	0	0	0	0	1	1	0
84	1	0	0	0	0	1	0	0

Default address = 86 (hex), pin 10 open
Alternate address = 84 (hex), 2nd tuner for PIP application. Pin 10 connect a 2k2 resistor to ground.

6.4.3.3 SUBADDRESS (SAD)

There are 3 byte of data can be transmitted, such as B data; C data and D data. SAD is used to point to desired data to be transmitted. If more than 1 byte of data is transmitted, then auto-increment is performed; starting from the transmitted sub-address and auto-increment of sub-address in accordance with the order of table below is performed.

Table 2, Definition of the subaddress (second byte after slave address)

Function	MSB							LSB
	D7(1)	D6	D5	D4	D3	D2	D1	D0
Switching (B DATA)	0	0	0	0	0	0	0	0
Adjust (C DATA)	0	0	0	0	0	0	0	1
Data (E DATA)	0	0	0	0	0	0	1	0

(1): D7 = 1 is not allowed.

Table 3, Examples for more than 1 byte of data is transmitted (auto-increment is performed)

S	Slave address	R/W	SAD	DATA	DATA	DATA	P
			00	B	C	E	
			01	C	E		
			02	E			

6.4.3.4 Description of the various Data bytes

6.4.3.4.1 B Data

Table 4, Definition of B data

Bit	Values	Description	Remarks
B7	= 1 = 0	L' Sound Switch L' Sound B/G, I,D/K, L ,M/N Sound	
B6	= 1 = 0	FM sensitivity setting High sensitivity Normal sensitivity	Only for FM auto-tuning
B5	= 1 = 0	Force audio mute On Off	
B4, B3	= 00 = 10 = X1	TV standard Modulation and radio mode Positive modulation Negative modulation FM radio	L/L' B/G,D/K,I, M/N
B2	= 1	QSS Mode	
B1	= 1 = 0	Mute of FM AF outputs Active Inactive	Recommended
B0	= 0	Sound trap active	

6.4.3.4.2 C Data

Table 5, Definition of C data

Bit	Values	Description	Remarks
C7	= 1 = 0	Audio gain - 6dB 0dB	FM Stereo only For all TV mode
C6	= 1 = 0	De-emphasis time constant 50µs 75µs	PAL B/G, D/K,I NTSC M/N
C5	= 1 = 0	De-emphasis On Off	PAL B/G, D/K, I L/L', NTSC M/N, FM**
C4 to C0	=10000	Tuner AGC Take over point setting Not applicable	Default setting

**: Incase the for BTSC; SAP and FM radio applications, the de-emphasis must be switched OFF.

6.4.3.4.3 E Data

Table 6, Definition of E data

Bit	Values	Description	Remarks
E7	= 0	VIF AGC Output Off	For all setting
E6	= 1	L standard PLL gating HIGH Gating in case of 36% positive modulation	For all setting
E5	= 1 = 0	IF gain Minimum Normal	FM mode TV mode
E4, E3, E2	= 000 = 001 = 010 = 100	Video IF Frequency f_{VIF} = 58.75MHz f_{VIF} = 45.75MHz f_{VIF} = 38.9MHz f_{VIF} = 33.9MHz	NTSC Japan NTSC B/G, D/K, I, L L’
E1, E0	= 00 = 01 = 10 = 11	Sound carrier frequency f_{FM} = 4.5MHz f_{FM} = 5.5MHz f_{FM} = 6.0MHz f_{FM} = 6.5MHz	NTSC M/N PAL B/G PAL I PAL D/K, L ,L’

6.4.3.4.4 For convenience, the programming has been consolidated as a single table

6.4.3.4.4.1 TV mode FQ1216ME MK3

Description	Bits	B/G	I	D/K	L	L'	Force Audio Mute
		TV Systems					
Sound Intercarrier	E 0	1	0	1	1	1	X
	E 1	0	1	1	1	1	X
Video IF	E 2	0	0	0	0	0	X
	E 3	1	1	1	1	0	X
	E 4	0	0	0	0	1	X
IF Gain	E 5	0	0	0	0	0	X
L/L' PLL Gating	E 6	1	1	1	1	1	X
VIF AGC Output	E 7	0	0	0	0	0	0
TOP Adjustment	C 0	0	0	0	0	0	X
	C 1	0	0	0	0	0	X
	C 2	1	1	1	1	1	X
	C 3	0	0	0	0	0	X
	C 4	1	1	1	1	1	X
De-Emphasis	C 5	1	1	1	0	0	X
De-Emphasis Time	C 6	1	1	1	1	1	X
Audio Gain	C 7	0	0	0	0	0	X
Video Trap Bypass Auto Mute FM	B 0	0	0	0	0	0	X
	B 1	1	1	1	1	1	X
Carrier Mode	B 2	1	1	1	1	1	X
FM Mode	B 3	0	0	0	0	0	X
TV Modulation	B 4	1	1	1	0	0	X
Forced Mute Audio	B 5	0	0	0	0	0	1
Not Used (OP1)	B 6	0	0	0	0	0	X
L/L' Sound (OP2)	B 7	0	0	0	0	1	X

6.4.3.4.4.2 TV Mode FQ1236 MK3 / FQ1286 MK3

Description	Bits	TV Systems: M	TV Systems: M / Japan	TV Systems: Force Audio Mute
Sound Intercarrier	E 0	0	0	X
	E 1	0	0	X
Video IF	E 2	1	1	X
	E 3	0	0	X
	E 4	0	0	X
IF Gain	E 5	0	0	X
L/L' PLL Gating	E 6	1	1	X
VIF AGC Output	E 7	0	0	0
TOP Adjustment	C 0	0	0	X
	C 1	0	0	X
	C 2	0	0	X
	C 3	0	0	X
	C 4	1	1	X
De-Emphasis	C 5	1	1	X
De-Emphasis Time	C 6	0	0	X
Audio Gain	C 7	0	0	X
Video Trap Bypass	B 0	0	0	X
Auto Mute FM	B 1	1	1	X
Carrier Mode ***	B 2	1	0	X
FM Mode	B 3	0	0	X
TV Modulation	B 4	1	1	X
Forced Mute Audio	B 5	0	0	1
OP1 (Not used)	B 6	0	0	X
OP2 (Not used)	B 7	X	X	X

6.4.3.4.4.3 FM Radio mode

Description	Bits					
Sound Intercarrier	E 0	X	X	X	X	X
	E 1	X	X	X	X	X
Video IF	E 2	X	X	X	X	X
	E 3	X	X	X	X	X
	E 4	X	X	X	X	X
IF Gain	E 5	1	1	1	1	X
L/L' PLL Gating	E 6	X	X	X	X	X
VIF AGC Output	E 7	0	0	0	0	0
TOP Adjustment	C 0	0	0	0	0	X
	C 1	0	0	0	0	X
	C 2	0	0	0	0	X
	C 3	0	0	0	0	X
	C 4	1	1	1	1	X
De-Emphasis	C 5	0	1	1	1	X
De-Emphasis Time	C 6	X	0	0	0	X
Audio Gain	C 7	1	0	0	0	X
Video Trap Bypass	B 0	X	X	X	X	X
Auto Mute FM	B 1	1	1	1	1	X
Carrier Mode	B 2	X	X	X	X	X
FM Mode	B 3	1	1	1	1	X
TV Modulation	B 4	X	X	X	X	X
Forced Mute Audio	B 5	0	0	0	0	1
FM Sensitivity (OP1)	B 6	X	X	1	0	X
L/L' Sound (OP2)	B 7	X	X	X	X	X
		Stereo	Mono	High Sensitivity	Normal Sensitivity	Force Audio Mute
		FM				

6.4.3.5 LOGIC DIAGRAM (READ MODE , R/W =1)

I^2C bus format to Read (Slave transmits data)

S	SLAVE ADDRESS	R/W= 1	A	DATA	AN	P

BIT	**FUNCTION**
S	START condition, generated by the master
Standard SLAVE ADDRESS	See table 7
R/W = 1	Read command, generated by the master
A	Acknowledge bit, generated by the slave
DATA	8 bit data words, transmitted by the slave, see table 8
AN	Acknowledge-not bit, generated by the master
P	STOP condition

The master generates an acknowledge when it has received the data word READ. The master next generates an acknowledge, then slave begins transmitting the data word READ, and so on until the master generates no acknowledge and transmits a STOP condition.

6.4.3.6 Standard SLAVE ADDRESS

Table 7, Slave address

Value (hex)	A6	A5	A4	A3	A2	A1	A0	R/W
87	1	0	0	0	0	1	1	1
85	1	0	0	0	0	1	0	1

Default address = 86 (hex), pin 10 open
Alternate address = 84 (hex), 2nd tuner for PIP application. Pin 10 connect a 2k2 resistor to ground.

6.4.3.7 Description of the various Data bytes

Definition of the transmitted byte Data D, after read condition (status register)

Function	D7	D6	D5	D4	D3	D2	D1	D0
Read	AFCWin	VIFL	FMIFL	AFC4	AFC3	AFC2	AFC1	POR

6.4.3.7.1 Power-on reset POR

POWER-ON RESET	D0
After power-on reset or after supply breakdown	1
After a successful reading of the register	0

6.4.3.7.2 Automatic frequency control

f_{VIF}	D4	D3	D2	D1
f_o - 187.5kHz ≥	0	1	1	1
f_o - 162.5kHz	0	1	1	0
f_o - 137.5KHz	0	1	0	1
f_o - 112.5kHz	0	1	0	0
f_o - 87.5kHz	0	0	1	1
f_o - 62.5kHz	0	0	1	0
f_o - 37.5kHz	0	0	0	1
f_o - 12.5kHz	0	0	0	0
f_o + 12.5kHz	1	1	1	1
f_o + 37.5kHz	1	1	1	0
f_o + 62.5kHz	1	1	0	1
f_o + 87.5kHz	1	1	0	0
f_o + 112.5kHz	1	0	1	1
f_o + 137.5kHz	1	0	1	0
f_o + 162.5kHz	1	0	0	1
≥ f_o + 187.5kHz	1	0	0	0

Note: f_o is the nominal frequency of $f_{VIF.}$ For PAL is 38.9MHz and NTSC is 45.75MHz

6.4.3.7.3 FM IF Level detection

FM IF Level detection	D5
FM Detection	1
No FM detection	0

6.4.3.7.4 VIF LEVEL window

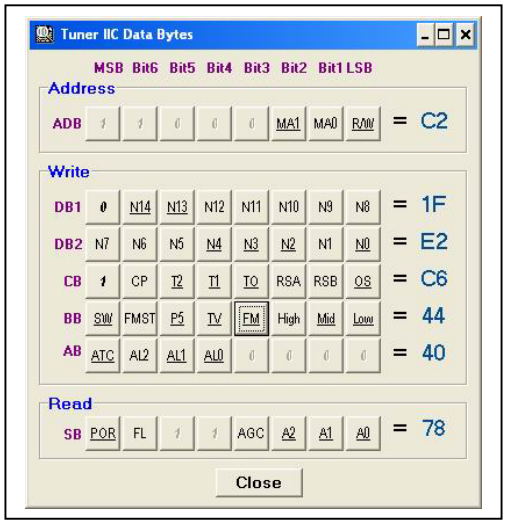
VIF LEVEL	D6
VIF HIGH LEVEL (Above 25dBuV RF input)	1
VIF LOW LEVEL (Below 20dBuV RF input)	0

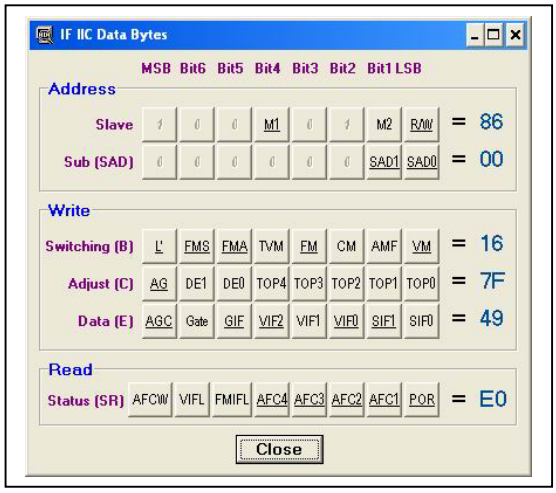
6.4.3.7.5 AFC window

AFC WINDOW	D7
VCO inside AFC window (Within +/- 1.6MHz)	1
VCO outside AFC window (Outside +/- 1.6MHz)	0

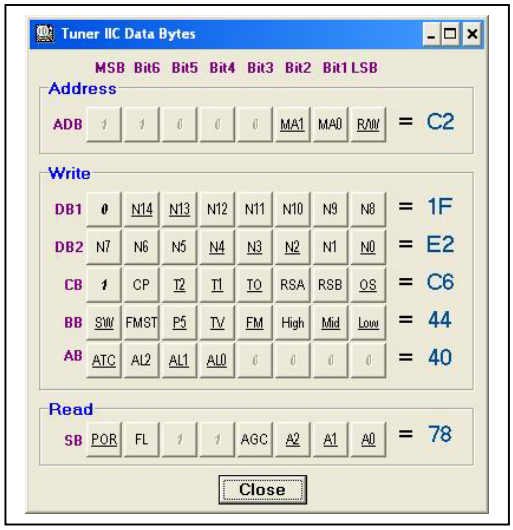
6.4.4 I^2C Bus Programming examples

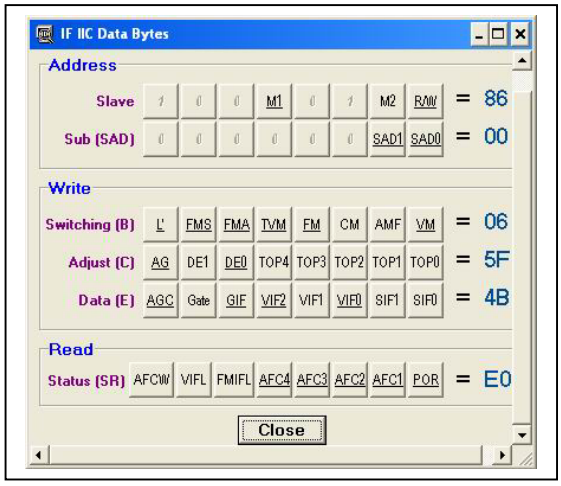
6.4.4.1 Examples 1, tune to PAL B/G (at 471.25MHz)



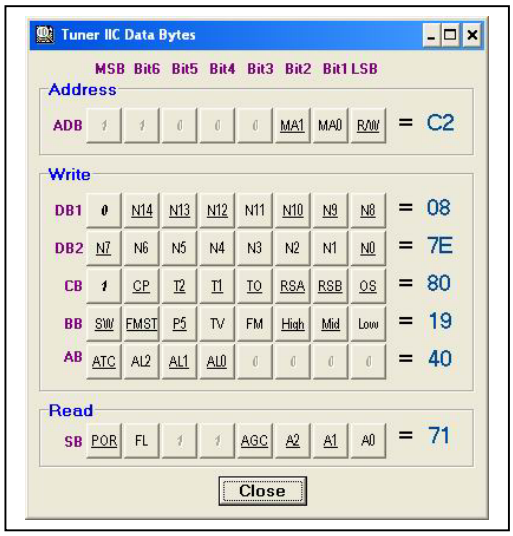


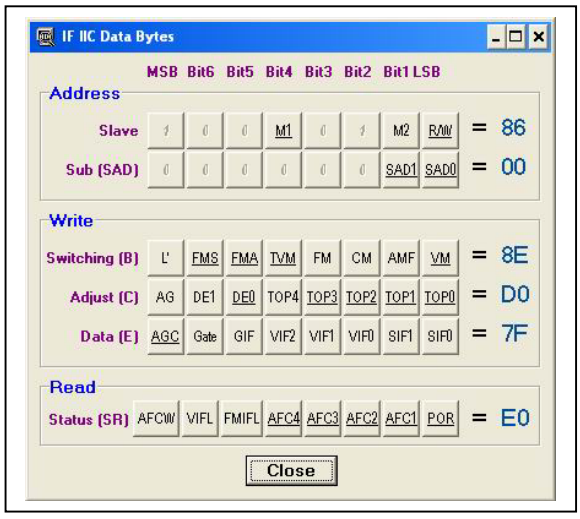
6.4.4.2 Examples 2, tune to SECAM L mode (at 471.25MHz)





6.4.4.3 Examples 3, tune to FM Radio mode (at 98.0MHz)





6.5 Specific pin Connections

6.5.1 Loading of I²C Bus (pins 4/5)

The SDA and SCL lines are already contain series impedances of 200 Ohms and parallel capacitances of 22 pF inside the module. Therefore, Care must be taken to ensure that the total load on the I²C Bus does not exceed that mentioned in the I²C brochure " The I²C-bus and how to use it"

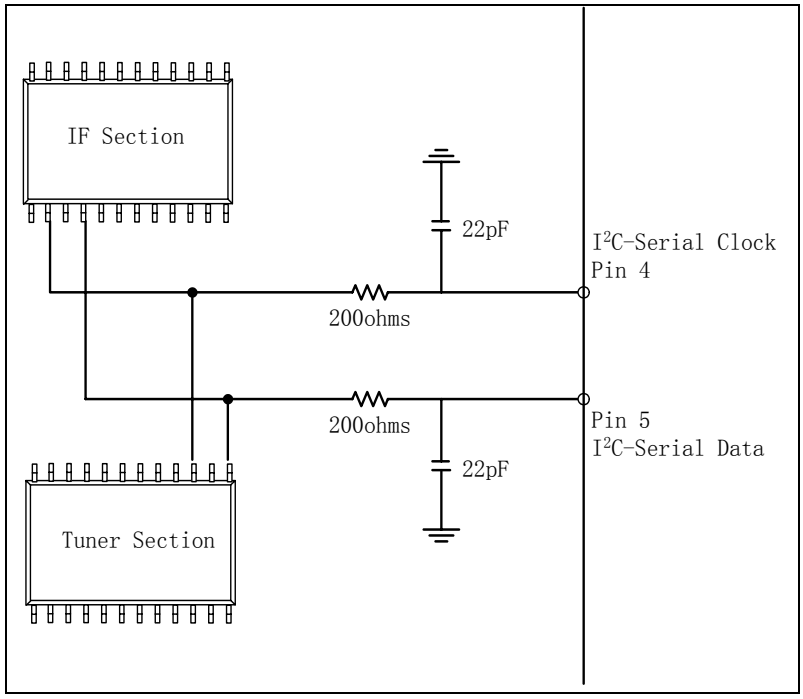


Figure 5, I²C loading

6.5.2 AF-R / AF-L (Pin9 /pin 10)

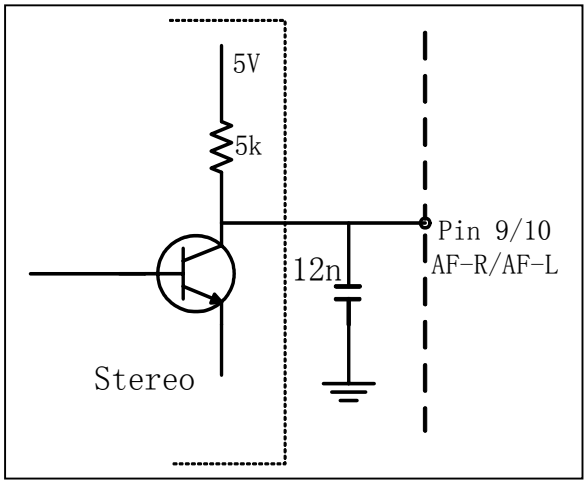


Figure 6, AF-R/AF-L Pins

6.5.3 2nd IF Sound Output (pin11)

The 2nd IF Sound is intended for the Stereo Sound applications.

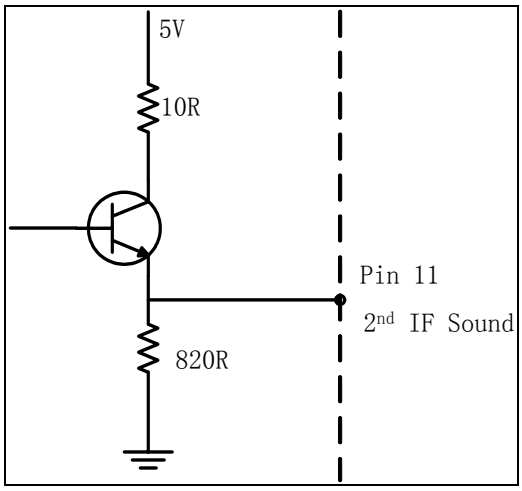


Figure 7, 2nd IF Sound Output

6.5.4 CVBS Load (Pin 12)

A video buffer is built into the frontend to enable the module to drive a 75ohms load directly.

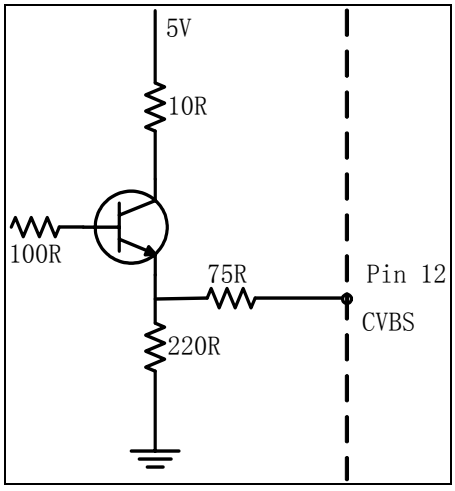


Figure 8, CVBS Output

6.6. TV Stereo Sound System

TV System	Sound carrier	2nd Sound Carrier	Sound Modulation	Remarks
B/G	5.5 MHz	5.742 MHz	FM-Stereo (A2)	Germany; Malaysia
	5.5 MHz	5.85 MHz	FM-Mono/ NICAM	Scandinavia, Singapore
I	6.0 MHz	6.552 MHz	FM-Mono/ NICAM	UK, Hong Kong
D/K	6.5 MHz	6.258 MHz	FM-Stereo (A2, D/K1)	Slovak. Rep
	6.5 MHz	5.85 MHz	FM-Mono/ NICAM	China, Hungary
L	6.5 MHz	5.85 MHz	AM-Mono/NICAM	France
M	4.5 MHz	4.724 MHz	FM-Stereo (A2)	Korea
	4.5 MHz	-	FM-FM(EIA-J)	Japan
	4.5 MHz	-	BTSC-Stereo + SAP	USA, Taiwan

The above table show the different audio systems used in the various TV Systems. The FQ/FM1200 MK3 can provide the necessary applications to recover the Stereo audio output.
The AF output at pin 14 provides the TV mono audio signal as well as the AM-MPX signal for the BTSC and EIA-J.
There are ICs that support the BTSC and EIA-J Stereo sound. Philips Semiconductors, the TDA9850/9852/9855 series and the SBX1637A/SBX1673 modules from SONY, can be connected directly from pin 14 of FQ/FM1200MK3.

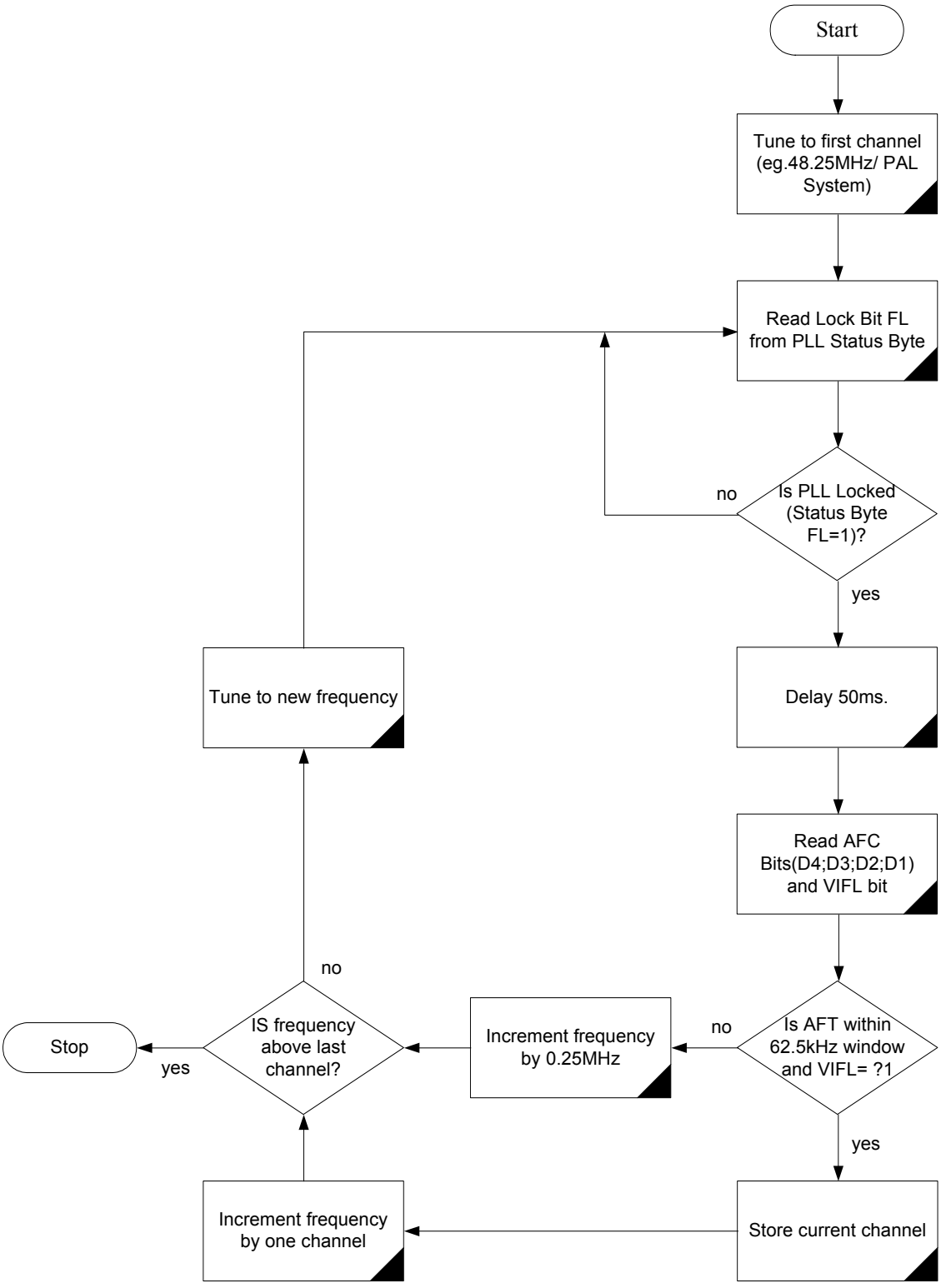
For other Audio systems, like NICAM and 2 Carrier FM Stereo, the 2nd Sound IF at pin 11 which is internally buffered, it can be AC-coupled directly to the input of the specific ICs for Stereo sound decoding.
Philips Semiconductors IC TDA9874/9875 and SAA7284 are able to take in the 2nd Sound IF for Stereo sound decoding.
The SAA7134 Video/PCI decoder has the function of Stereo sound decoding for NICAM/ FM-FM (A2),
The SAA7133 Video/PCI decoder has the function of BTSC and EIA-J Stereo Sound decoding using 2nd Sound IF input.

6.7 Approbation

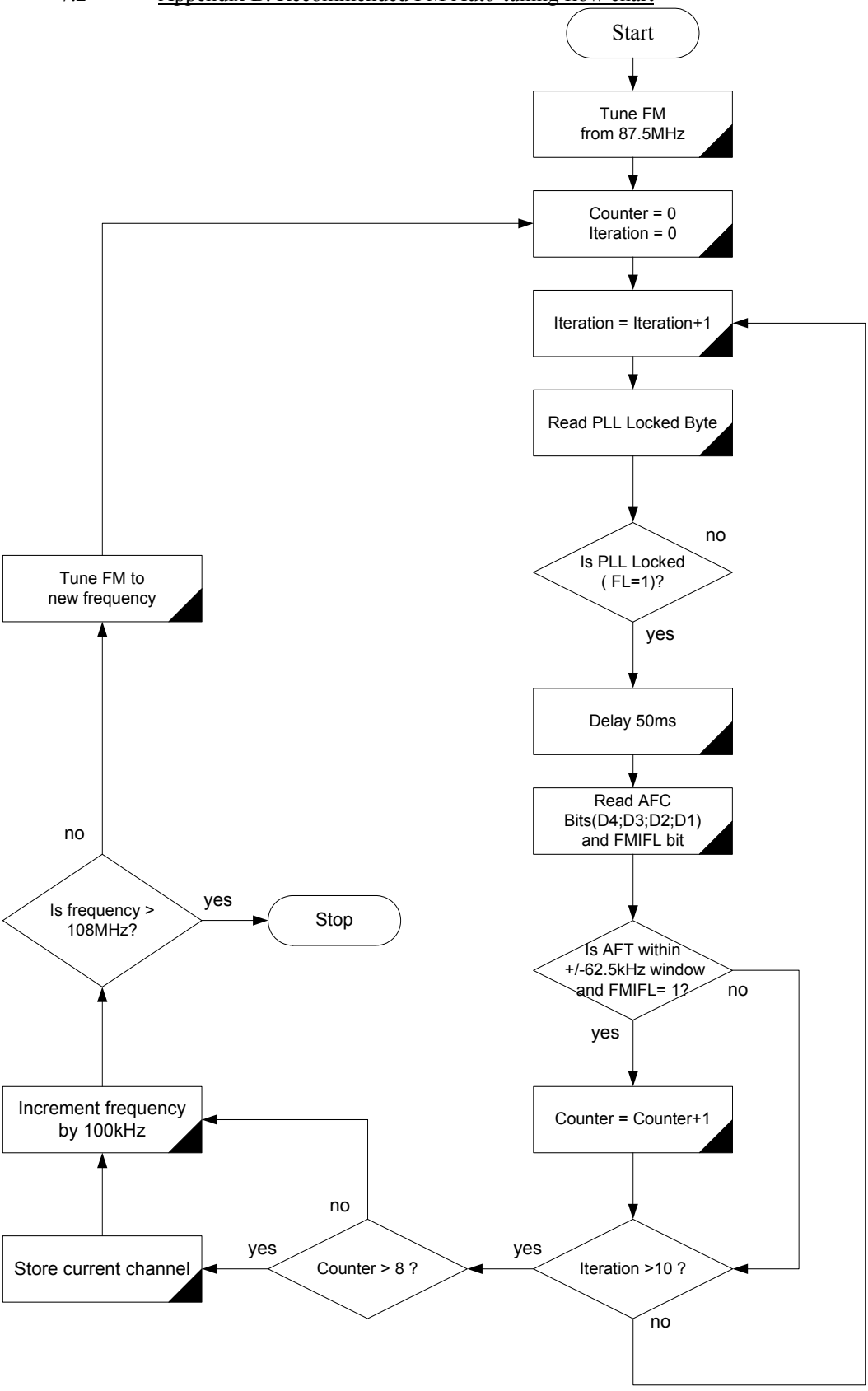
The FQ/FM1200 MK3 family fulfils a wide range of regulations including FCC, CISPR, JIS, DOC, BZT and CENELEC (EN55013 and EN55020). However, the final approbation is always given for the complete receiver unit like, TV set, TV box, PC equipped with a TV/PCA card.
Basic requirement for FCC compliance is the tuner Noise Figure of less than 14dB.

7.0 Appendix

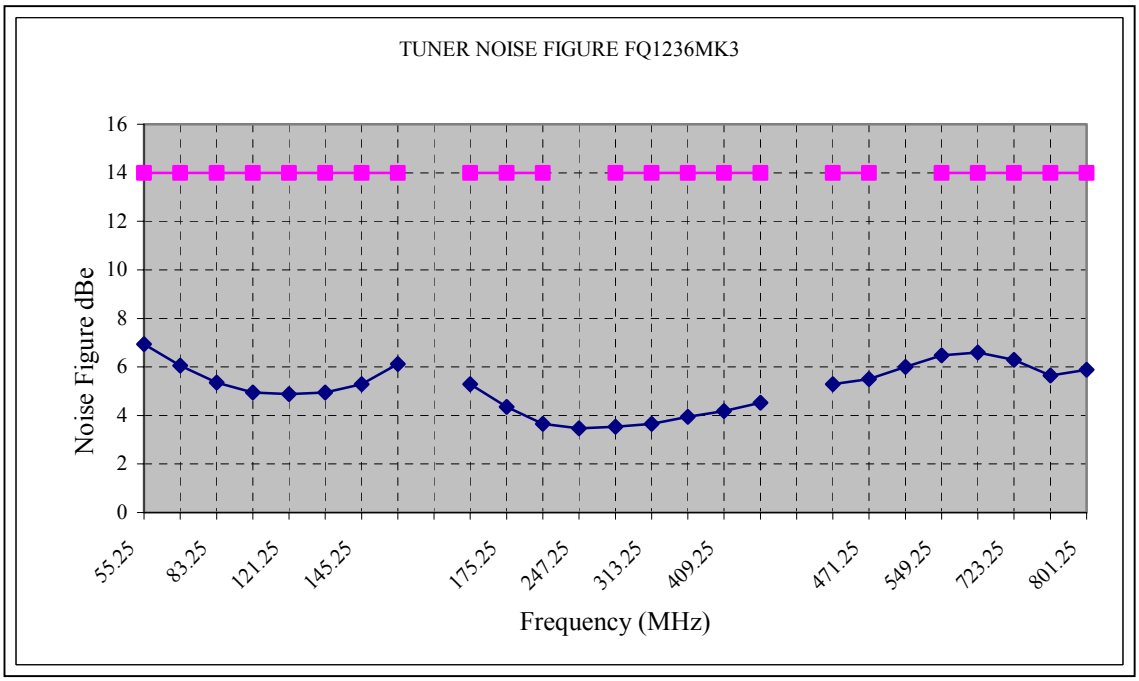
7.1. Appendix A: Recommended TV Auto-tuning flow chart



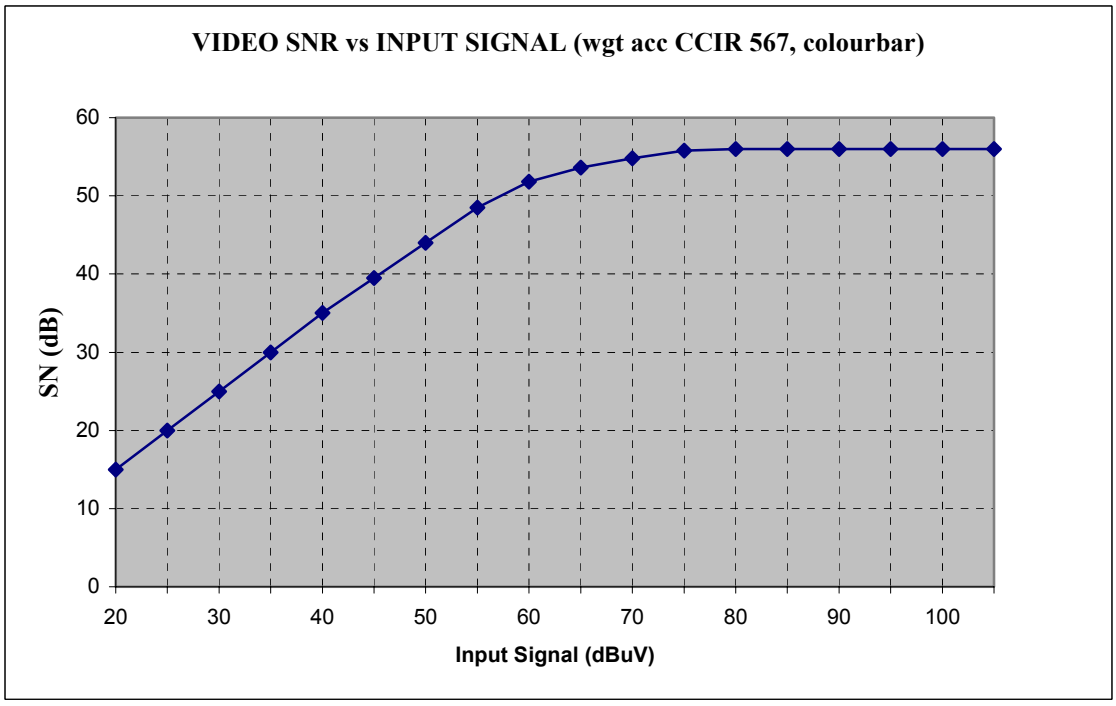
7.2 Appendix B: Recommended FM Auto-tuning flow chart



7.3 Appendix C: FQ1236 MK3 Noise Figure (FCC)



7.4 Appendix D: Video SNR (CCIR 567 Weighted) Vs RF Input Level



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