

# DATA SHEET

## **FM1216**

**Desktop video & FM radio module  
system B/G**

Preliminary specification  
File under BU Tuners, DC03

1997 Mar 13

## Desktop video & FM radio module system B/G

# FM1216

### FEATURES

- System B and G, and FM radio broadcast
- True 5 V device (low power dissipation)
- Full frequency range from channel 2 (48.25 MHz) to channel 69 (855.25 MHz)
- FM radio band coverage from 87.50 MHz to 108.00 MHz
- PLL controlled tuning
- Programmable PLL step size (31.25, 50 or 62.5 kHz)
- True-synchronous vision IF demodulator (PLL)
- Ultra linear FM PLL demodulator for FM radio broadcast
- Demodulated video output, AF sound output, second sound IF output
- I<sup>2</sup>C-bus control of tuning, address selection, AFC status information
- Complies with European regulations on radiation, signal handling and immunity ("*CENELEC 55020, 55013*" and "*Amtsblatt 15/92*")
- Small horizontally mounted metal housing.

### DESCRIPTION

The FM1216 front-end is designed to receive both TV and FM stereo signals in the PC Multimedia environment. The units are available with separate 75 Ω inputs for TV and FM broadcast reception. The input connectors available are either standard phono or IEC type (female for TV, male for FM radio). The tuning, bandswitching and antenna selection are made through the I<sup>2</sup>C-bus.

The front-end covers the TV bands from 48.25 MHz to 855.25 MHz. The FM band covers the standard 87.50 MHz to 108.00 MHz. An RDS decoder can be connected to the AF-MPX output. The FM1216 meets the input immunity and radiation requirements of CENELEC.

The FM1216 consists of a TV tuner, an FM radio tuner and an IF section, all designed on a single PCB. The front-end is assembled in a metal housing made of a rectangular tin-plated steel frame, with front and rear covers, which have soldered contacts to the frame. The two phono or IEC antenna connectors (female for TV, male for FM radio) are mounted on one side of the frame for the TV/FM signal inputs. All other connections are made via pins at the bottom.

The TV IF section uses an intercarrier SAW filter, followed by a true-synchronous vision IF demodulator (PLL) IC. The analog AFC voltage is fed to the 5-level A/D converter in the PLL tuning IC, so that the AFC status can be read via the I<sup>2</sup>C-bus.



In the FM radio mode, the level detector and AFT functions are provided for the auto-search routines. The level detector and AFT status can be read from the A/D bits in the status-byte. The mute function is also provided to suppress the audio output signal, if required.

The tuner AGC for both TV and FM radio operation, is generated with a novel AGC detector which measures the IF signal level directly at the tuner IF output pins. As opposed to the conventional AGC detector, this new circuit allows a higher take-over level and offers superior immunity against tuner overload.

The demodulation of the TV sound and FM radio IF (10.70 MHz) is done with a PLL demodulation circuit contained in the IF IC. In the FM radio mode, the multiplexed AF signal is then channelled to a stereo decoder IC which extracts the left/right analog signals. The multiplexed audio signal is also available at pin 25 to support RDS or BTSC implementations. The 2<sup>nd</sup> IF TV sound output is provided to connect external (analog 2 carrier or digital) stereo processing.

### ORDERING INFORMATION

TYPE	DESCRIPTION	CATALOGUE NUMBERS
FM1216/HM/PH	standard phono	3139 147 13371
FM1216/HM/I	IEC connector	3139 147 13381

### MARKING

The following items of information are printed on a sticker that is on the top cover of the tuner:

- Type number
- Code number
- Origin letter of factory
- Change code
- Year and week code.

# Desktop video & FM radio module system B/G

FM1216

**INTERMEDIATE FREQUENCIES**

SYSTEM	FREQUENCY (MHz)
Picture carrier	38.90
Colour	34.47
Sound 1	33.40
Sound 2	33.16
NICAM	33.05
FM	10.70

**CHANNEL COVERAGE**

BAND	FREQUENCY (MHz)
FM radio band	87.50 to 108.00
Low band	48.25 to 170.00
Mid band	170.00 to 450.00
High band	450.00 to 855.25

**PINNING**

SYMBOL	PIN	DESCRIPTION
V <sub>T</sub>	11	tuning voltage (monitor)
V <sub>S(tuner)</sub>	12	supply voltage tuner section +5 V
SCL	13	I <sup>2</sup> C-bus serial clock
SDA	14	I <sup>2</sup> C-bus serial data
AS	15	I <sup>2</sup> C-bus address select
AF O/P right	20	FM radio right channel
AF O/P left	21	FM radio left channel
2 <sup>nd</sup> IF O/P	22	second IF TV sound output
CVBS	23	Composite Video Baseband Signal (CVBS) output
V <sub>S(IF)</sub>	24	supply voltage IF section +5 V
AF O/P	25	AF sound output
–	TH1, TH2, TH3 and TH4	mounting tags (ground)

# Desktop video & FM radio module system B/G

FM1216

## BLOCK DIAGRAM

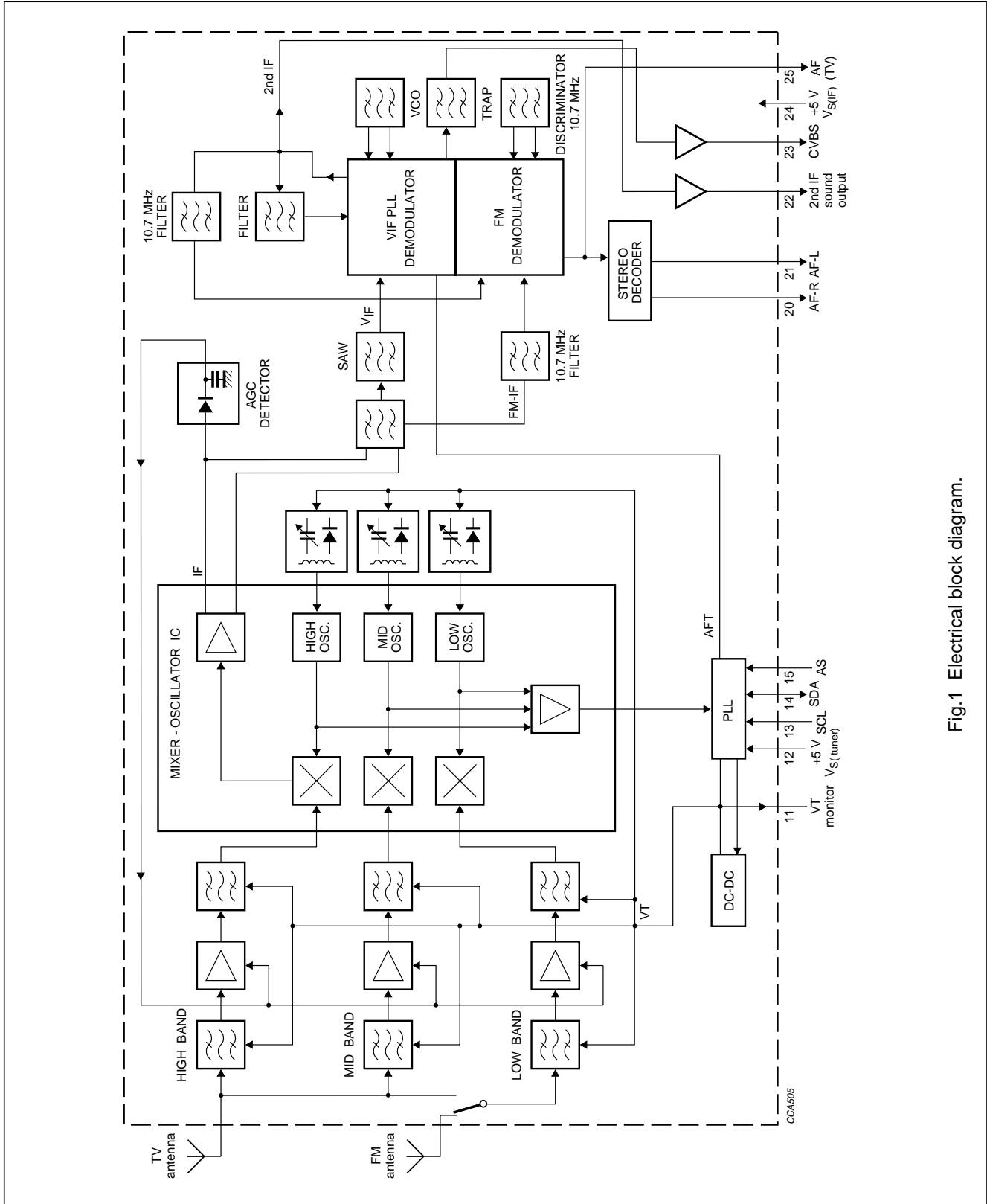


Fig.1 Electrical block diagram.

# Desktop video & FM radio module system B/G

FM1216

## LIMITING VALUES

### Limiting values under operational conditions

The tuner can be guaranteed to function properly under the following conditions.

SYMBOL	PARAMETER	PIN	MIN.	TYP.	MAX.	UNIT
$V_S$	supply voltage	12	4.75	5.00	5.25	V
$V_{S(\text{ripple})}$	peak-to-peak ripple voltage susceptibility (at 5 V $\pm 5\%$ ); note 1		–	–	5	mV
	20 Hz to 100 kHz		–	–	10	mV
	>100 kHz to 500 kHz					
$I_{S(\text{tuner})}$	supply current		–	–	120	mA
$V_{SCL}$	SCL bus input voltage	13	–0.3	–	+5.25	V
$V_{SDA}$	SDA bus input voltage	14	–0.3	–	+5.25	V
$I_{SDA}$	SDA bus current (open collector)		–1	–	+5	mA
$V_{AS}$	address select voltage; note 2	15	–	–	+5.25	V
$V_{AFright(FM)}$	FM right channel DC voltage	20	–	1.0	–	V
$Z_{AFright(FM)}$	FM right channel load impedance parallel connected:		–	50	–	k $\Omega$
	resistive value	–	9	–	pF	
	capacitive value					
$V_{AFleft(FM)}$	FM left channel DC voltage	21	–	1.0	–	V
$Z_{AFleft(FM)}$	FM left channel load impedance:		–	50	–	k $\Omega$
	resistive value	–	9	–	pF	
	capacitive value					
$Z_{IF}$	2 <sup>nd</sup> IF sound output load impedance	22	0.5	–	–	k $\Omega$
$Z_{CVBS}$	Composite Video Baseband Signal load impedance	23	–	75	–	$\Omega$
$t_L$	CVBS load time constant		–	–	100	ns
$V_{S(IF)}$	IF supply voltage	24	4.75	5.0	5.25	V
$I_{S(IF)}$	IF supply current		–	–	150	mA
$Z_{AF}$	AF sound output load impedance parallel connected:	25	5.0	–	–	k $\Omega$
	resistive value		–	–	4	nF
	capacitive value					

### Notes

1. Sinusoidal ripple voltage superimposed on the 5 V supply voltage in the frequency range of 20 Hz to 500 kHz. Criteria for TV interference >57 dB.
2. For detailed information about the address decoding, refer to Chapter "Application information".

# Desktop video & FM radio module system B/G

FM1216

## Environmental conditions

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Non-operational conditions</b>						
T <sub>amb</sub>	ambient temperature		-25	-	+85	°C
RH	relative humidity		-	-	100	%
g <sub>B</sub>	bump acceleration	25 g	-	-	245	m/s <sup>2</sup>
g <sub>S</sub>	shock acceleration	50 g	-	-	490	m/s <sup>2</sup>
	vibration amplitude	10 to 55 Hz	-	0.35	-	mm
<b>Operational conditions</b>						
T <sub>amb</sub>	ambient temperature		-10	-	+60	°C
RH	relative humidity		-	-	95	%

## OVERALL PERFORMANCE

### Conditional data

Unless otherwise specified, all electrical values for Chapter "Overall performance" apply at the following conditions.

SYMBOL	PARAMETER	VALUE	UNIT
T <sub>amb</sub>	ambient temperature	25 ±5	°C
RH	relative humidity	60 ±15	%
V <sub>S</sub>	supply voltage (tuner and IF section)	5 ±0.125	V
Z <sub>CVBS</sub>	video output load impedance (DC)	75	Ω
Z <sub>IF</sub>	2 <sup>nd</sup> IF sound output load impedance (DC)	0.5	kΩ
Z <sub>AF</sub>	AF sound output load impedance	100	kΩ
t <sub>pr</sub>	pre-heating time (+5 V at pin 24)	10	minute
Z <sub>S(AE)</sub>	aerial source impedance (asymmetrical)	75	Ω

## Desktop video & FM radio module system B/G

FM1216

### TUNER CHARACTERISTICS

For detailed information about the PLL programming, refer to Chapter "Application information".

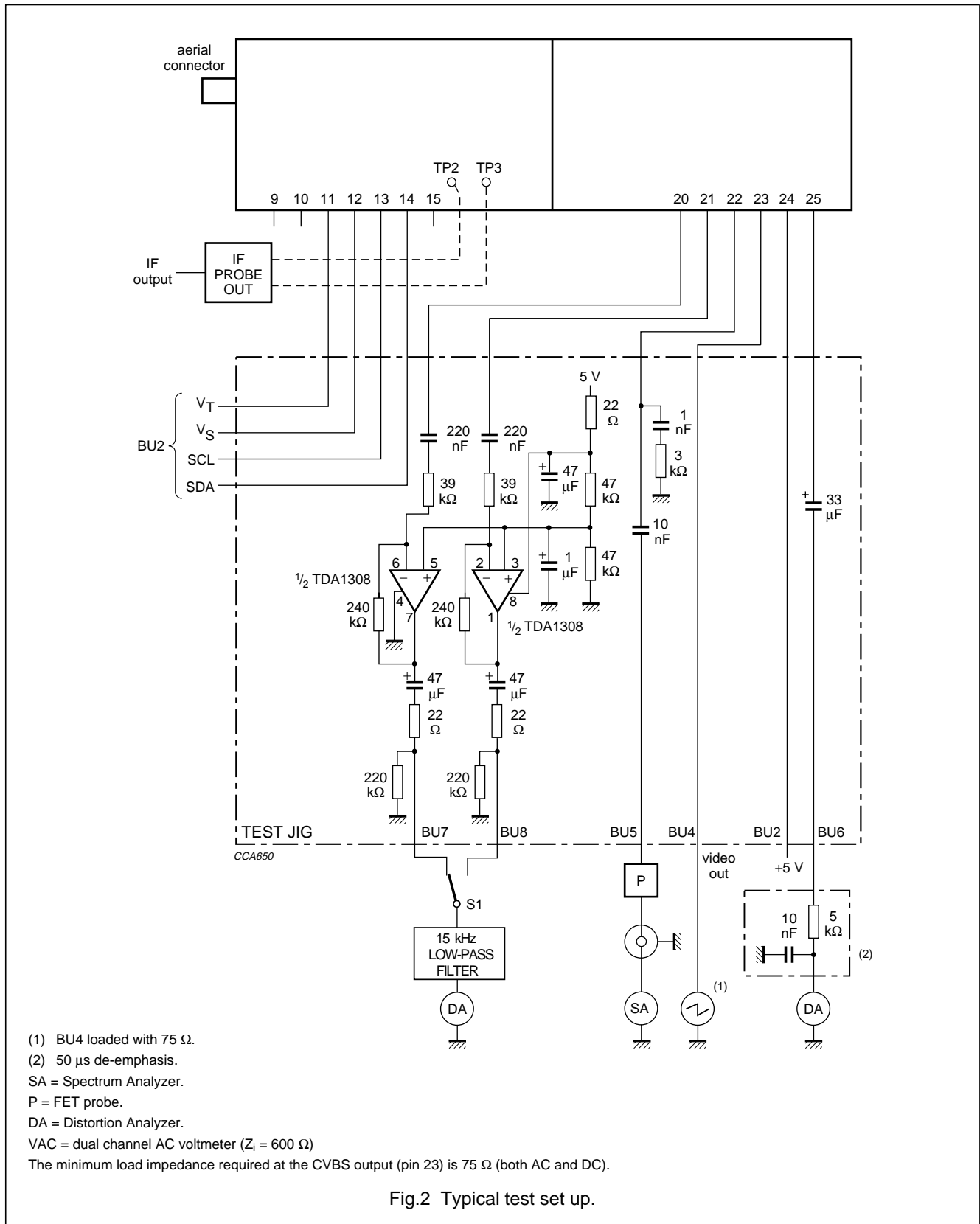
The desktop video tuner is guaranteed to function properly within the specified operational conditions, but a certain deterioration of performance parameters may occur at the limits of the operational conditions.

#### Required data for test equipment to be used

EQUIPMENT	PARAMETER	VALUE	UNIT
DC voltmeter	input impedance	>1	M $\Omega$
Oscilloscope	input impedance: resistance capacitance	>1 <15	M $\Omega$ pF
Spectrum analyzer	input impedance	50	$\Omega$
FET probe	input impedance: resistance capacitance	1 3.5	M $\Omega$ pF
	output impedance	50	$\Omega$
	voltage gain	0	dB
AC millivoltmeter	input impedance	>100	k $\Omega$

# Desktop video & FM radio module system B/G

FM1216





# Desktop video & FM radio module system B/G

FM1216

## Definitions of test signals (see Fig.2)

TEST SIGNAL	FREQ. (MHz)	AMPLITUDE	MODULATION	
			VIDEO	AUDIO
A0: unmodulated vision carrier	480.25	60 dB $\mu$ V		
A1: RF B, G standard signal with video modulation	480.25	60 dB $\mu$ V (top sync)	100% (rest carrier 10%) 2T pulse and bar	
B1: unmodulated sound carrier B, G system	485.75	-13 dB w.r.t. A0 to A1		
B2: FM modulated sound carrier B, G system	485.75	-13 dB w.r.t. A0 to A1		1 kHz; modulation frequency deviation $\pm 25$ kHz; 50 $\mu$ s pre-emphasis
B3: unmodulated sound carrier B, G system	478.75	-13 dB w.r.t. A0 to A1		
C1: FM modulated sound carrier	98.00	60 dB $\mu$ V		1 kHz; modulation frequency deviation $\pm 22.5$ kHz
C2: FM modulated sound carrier	97.70 or 98.30	60 dB $\mu$ V		1 kHz; modulation frequency deviation $\pm 22.5$ kHz
C3: FM modulated sound carrier	98.00	60 dB $\mu$ V		1 kHz; modulation frequency deviation $\pm 75$ kHz; 10% pilot carrier (L = R); 50 $\mu$ s pre-emphasis

## Aerial input characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>SWR</sub>	reflection coefficient	referred to 75 $\Omega$ impedance (worst case on or between picture and sound carrier at maximum gain): all channels in TV mode FM (centre of channel)	-	5 4	
V <sub>PSM</sub>	surge protection voltage		5	-	kV
V <sub>ant</sub>	antenna connection disturbance voltage	<1.75 GHz	-	46	dB $\mu$ V

# Desktop video & FM radio module system B/G

FM1216

## General characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$f_b$	frequency range:					
	FM band		87.50	–	108.00	MHz
	low band		48.25	–	168.25	MHz
	mid band		175.25	–	447.25	MHz
	high band		455.25	–	855.25	MHz
$\Delta f_b$	margin:					
	for FM band		3	–	–	MHz
	for low band		1.5	–	–	MHz
	for mid/high band		3	–	–	MHz
$\alpha_i$	image rejection (nominal gain to 10 dB gain reduction):					
	low band		68	–	–	dB
	mid band	<300 MHz	66	–	–	dB
	mid band	>300 MHz	60	–	–	dB
	high band (channel 14 to 69)		50	–	–	dB
$\alpha_{IF}$	IF rejection (picture)		60	–	–	dB
$Z_{IF}$	$\frac{1}{2}$ IF susceptibility:					
	low, mid band		75	–	–	dB $\mu$ V
	high band		60	–	–	dB $\mu$ V
$m_x$	cross modulation:					
	in-channel		65	–	–	dB $\mu$ V
	in-band					
	low band ( $n \pm 2$ )		78	–	–	dB $\mu$ V
	mid band ( $n \pm 3$ )		78	–	–	dB $\mu$ V
	high band ( $n \pm 5$ )		84	–	–	dB $\mu$ V
	out of band		–	100	–	dB $\mu$ V
	breakthrough susceptibility:					
	channel 2 to 69		60	–	–	dB $\mu$ V
$V_{osc}$	oscillator voltage at all pins		–	–	70	dB $\mu$ V
$t_{li}$	oscillators lock-in time	charge pump set logic HIGH	–	–	150	ms
$\alpha_{vs}$	the video signal-to-sound interference ratio with the tuner exposed to sound signals in the audio frequency range 100 Hz to 10 kHz and sound pressure levels up to 105 dB (20 $\mu$ Pa)		40	–	–	dB
	audio S/N ratio		40	–	–	dB
$V_{ESD}$	electrostatic discharge (ESD) on all pins	note 1	2	–	–	kV

# Desktop video & FM radio module system B/G

FM1216

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>FM radio characteristics</b>						
$\alpha_{26}$	limiting sensitivity for (S+N)/N	test signal C1	–	7	30	dB $\mu$ V
$\alpha_{50}$		test signal C3	–	30	40	dB $\mu$ V
	S/N ratio: mono at f = 22.5 kHz mono at f = 75 kHz stereo	test signal C1	55	58	–	dB
			65	68	–	dB
		test signal C3	55	63	–	dB
$\alpha_{i(FM)}$	FM image rejection	test signal C1	53	65	–	dB
	effective selectivity $S_{300}$	test signal C1 + C2	50	–	–	dB
	frequency response: lower –3 dB point upper –3 dB point	test signal C3; –3 dB points	–	20	40	Hz
			14	18	–	kHz
	AM suppression	test signal C1	38	–	–	dB
	FM AF output level at terminal 20/21 (RMS value): mono stereo	test signal C1	40	57	74	mV
		test signal C3	120	175	230	mV
	stereo separation	test signal C3; 1 kHz	28	35	–	dB
THD	total harmonic distortion: stereo at 1 kHz during overmodulation at f = $\pm 100$ kHz	test signal C3	–	0.8	1.5	%
			–	1.5	3	%

**Note**

1. All the pins of the desktop video tuner are protected against electrostatic discharge (ESD) up to 2 kV. The product is classified in category B ("MIL-STD-883C").

# Desktop video & FM radio module system B/G

FM1216

## Video and audio characteristics (see Fig.2)

PARAMETER	TEST SIGNAL	TEST POINT	MIN.	TYP.	MAX.	UNIT
CVBS characteristics:						
video amplitude signal at pin 23	A1 (peak-to-peak value)	BU4	0.75	0.95	1.15	V
DC level sync pulse at pin 23	A1	BU4	–	0.7	–	V
Video amplitude drop with respect to modulation 1 MHz at $T_{amb} = 45\text{ }^{\circ}\text{C}$ :						
at 2 MHz	A1	BU4	–1.5	–	+1.5	dB
at 3 MHz	A1	BU4	–2.5	–	+1.5	dB
at 4 MHz	A1	BU4	–4.0	–	+2.0	dB
at 4.43 MHz	A1	BU4	–4.0	–	+2.0	dB
Sound carrier rejection	A1 (1 MHz) + B1	BU4	40	–	–	dB
Residual 40.40 MHz signal in video channel: level of 1.5 MHz	A1 + B3	BU4	–	–	68	dB $\mu$ V
Residual 77.8 MHz signal in video channel	A1	BU4	–	–	80	dB $\mu$ V
Second IF sound output level at level of 5.5 MHz	A1 (black) + B1	BU5	84	–	–	dB $\mu$ V
Test on 2T pulse at $T_{amb} = 45\text{ }^{\circ}\text{C}$ :						
2T pulse/bar response	A1	BU4	–2.8	–	+2.8	%
2T pulse response	A1	BU4	–	–	+3.5	%
CVBS S/N (unweighted)	A1 + B1	BU4	41	–	–	dB
Gain limited sensitivity at 1 dB reduction of video output	A1	BU4	–	–	30	dB $\mu$ V
Maximum usable single input signal	A1	BU4	90	–	–	dB $\mu$ V
Audio characteristics:						
AF output level measured via LP 200 kHz filter, RMS detector, 50 $\mu$ s de-emphasis	A1 + B2	BU6	250	350	450	mV
THD (Total Harmonic Distortion) measured via LP 200 kHz filter, RMS detector, 50 $\mu$ s de-emphasis	A1 + B2	BU6	–	–	0.5	%
S/N measured via CCIR filter, peak CCIR detector, 50 $\mu$ s de-emphasis	A1 (full field colour bar) + B1	BU6	38	–	–	dB
AM suppression ratio	A1 (black) + B2	BU6	40	–	–	dB
Aerial input level for S/N = 41 dB	A1 (black) + B2	BU6	–	–	45	dB $\mu$ V

## Digital AFC status

ADC word at I<sup>2</sup>C-bus during read operation

DIGITAL READ-OUT	FREQUENCY (kHz)
00	–125
01	–62.5
02	0
03	+62.5
04	+125

# Desktop video & FM radio module system B/G

FM1216

## APPLICATION INFORMATION

A detailed description of the I<sup>2</sup>C-bus specification, with applications, is given in brochure "The I<sup>2</sup>C-bus and how to use it". This brochure may be ordered using the code number 9398 393 40011.

### WRITE mode

BYTE	BITS								
	7 MSB	6	5	4	3	2	1	0 LSB	A <sup>(1)</sup>
Address byte	1	1	0	0	0	MA1	MA0	0	A
Program divider byte 1	0	n14	n13	n12	n11	n10	n9	n8	A
Program divider byte 2	n7	n6	n5	n4	n3	n2	n1	n0	A
Control information byte 1	1	CP	T2	T1	T0	RSA	RSB	OS	A
Control information byte 2	P7	P6	P5	P4	P3	P2	P1	P0	A

### Note

1. A = Acknowledge.

### ADDRESS SELECTION

V<sub>S</sub> = +5 V (PLL supply voltage).

MA1	MA0	ADDRESS	VOLTAGE AT PIN 15 (see note 1)
0	0	C0	0.0V <sub>S</sub> to 0.1V <sub>S</sub>
0	1	C2	0.2V <sub>S</sub> to 0.3V <sub>S</sub>
1	0	C4	0.4V <sub>S</sub> to 0.6V <sub>S</sub>
1	1	C6	0.9V <sub>S</sub> to 1.0V <sub>S</sub>

### Note

1. If the AS pin is left floating, the internal bias will automatically set the address to C2.

### PROGRAMMABLE DIVIDER SETTINGS (BYTES 1 AND 2)

Divider ratio:

$N = 16 \times \{f_{RF(pc)} + f_{IF(pc)}\}$ , where (pc) is picture carrier and  $f_{RF}$  and  $f_{IF}$  are expressed in MHz

$f_{osc} = N/16$  (MHz).

$N = (8192 \times n13) + (4096 \times n12) + (2048 \times n11) + (1024 \times n10) + (512 \times n9) + (256 \times n8) + (128 \times n7) + (64 \times n6) + (32 \times n5) + (16 \times n4) + (8 \times n3) + (4 \times n2) + (2 \times n1) + n0$

## Desktop video & FM radio module system B/G

FM1216

### CONTROL BYTE

Charge pump settings:

CP = 1, for fast tuning

CP = 0, for moderate speed tuning with slightly better residual oscillator FM.

It is recommended to set CP = 1 at all times in the TV mode. In the FM radio mode, set CP = 1 only during the search tuning. Once the wanted channel is obtained, set CP = 0 to get the best signal-to-noise ratio.

Test mode settings:

T2 = T1 = 0; T0 = 1, for normal operation.

PLL disabling:

OS = 0, for normal operation

OS = 1, for switching the charge pump to the high impedance state. I<sub>DC</sub> output voltage is LOW.

### Ratio select bits

RSA	RSB	STEP SIZE
X	0	50 kHz (for FM band)
0	1	31.25 kHz (for slow picture search)
1	1	62.5 kHz (for normal picture search)

### PORTS BYTE

FUNCTION	BIT							
	P7	P6	P5	P4	P3	P2	P1	P0
<b>TV/FM bandswitching</b>								
FM band	1	0	1	0		1		
Low band	1	0	1	0		0		
Mid band	1	0	0	1		0		
High band	0	0	1	1		0		
<b>TV mode</b>								
Power down mode; see note 1					0	0	0	1
System B, G negative mode					0	0	0	0
<b>FM radio mode</b>								
AFC; see note 2					0	1	0	1
R <sub>IF</sub> ; see note 3					0	1	0	0
Mono					0	1	1	0
Mute					1	1	0	0

### Notes

1. If the TV function is not required, the tuner can be switched to power-down mode. In this mode the tuner reduces the current consumption by up to 100 mA.
2. By this setting the FM radio AFC status can be read from the A/D bits in the status byte.
3. By this setting the RF input level can be read from the A/D bits in the status byte.

## Desktop video & FM radio module system B/G

FM1216

### TELEGRAM EXAMPLES (WRITE MODE)

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb - Ack - Pb - Ack - Stop.

Start - Adb - Ack - Cb - Ack - Pb - Ack - Db1 - Ack - Db2 - Ack - Stop.

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb - Ack - Stop.

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Stop.

Where:

Start = start condition

Adb = address byte

Ack = acknowledge

Db1 = divider byte 1

Db2 = divider byte 2

Cb = control byte

Pb = ports byte

Stop = stop condition.

### READ mode

The in-lock can be read by setting the R/W bit to 1.

BYTE	BITS								
	7 MSB	6	5	4	3	2	1	0 LSB	A <sup>(5)</sup>
Address byte	1	1	0	0	0	MA1	MA0	1	A
Status byte	POR <sup>(1)</sup>	FL <sup>(2)</sup>	I2 <sup>(3)</sup>	I1 <sup>(3)</sup>	I0 <sup>(3)</sup>	A2 <sup>(4)</sup>	A1 <sup>(4)</sup>	A0 <sup>(4)</sup>	A

### Notes

1. POR = Power On Reset. POR is internally set to 1 in case  $V_S$  drops below 3 V. The POR bit is reset when an end of data is detected by the PLL IC.
2. FL = In-lock flag; FL = 1: loop is phase-locked. The loop must be phase-locked during at least 8 periods of the internal reference frequency (either 7.8125 kHz, 3.90625 kHz or 6.25 kHz) before the FL flag is internally set to 1.
3. I2, I1 and I0 = digital information for I/O ports P2, P1 and P0 respectively.
4. A2, A1 and A0 = built-in 5-level A/D converter on the internal I/O port P6 (see Table "Digital AFC status").
5. A = Acknowledge.

### TELEGRAM EXAMPLES (READ MODE)

Start - Adb - Ack - STB - Ack - STB - - Stop (no Ack from processor = End-of-data).

Start - Adb - Ack - STB - - Stop (no Ack from processor = End-of-data).

Where:

STB = Status byte.

Desktop video & FM radio module system B/G

FM1216

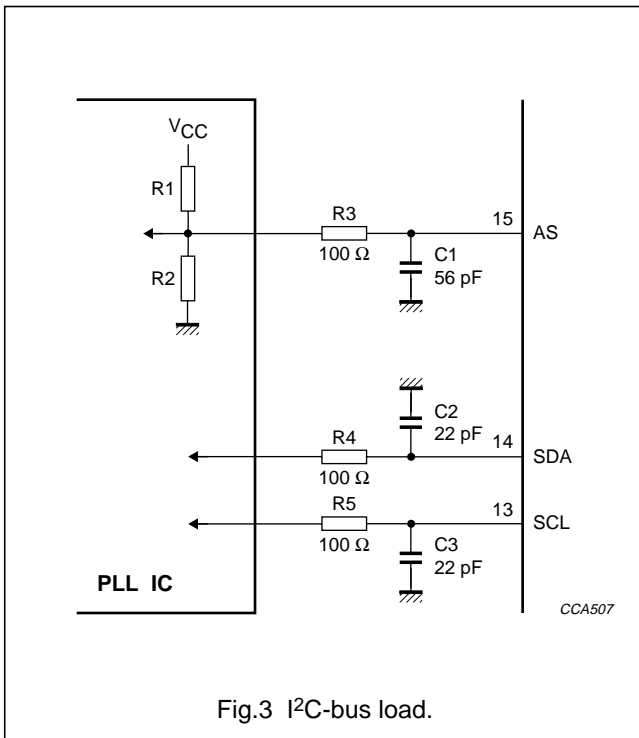


Fig.3 I<sup>2</sup>C-bus load.

**Video buffer**

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

**I<sup>2</sup>C-bus load**

The FM1216 contains a series resistor (R = 100 Ω) in the SCL and SDA lines. Both lines also have a capacitive load of typical 22 pF (see Fig.3).

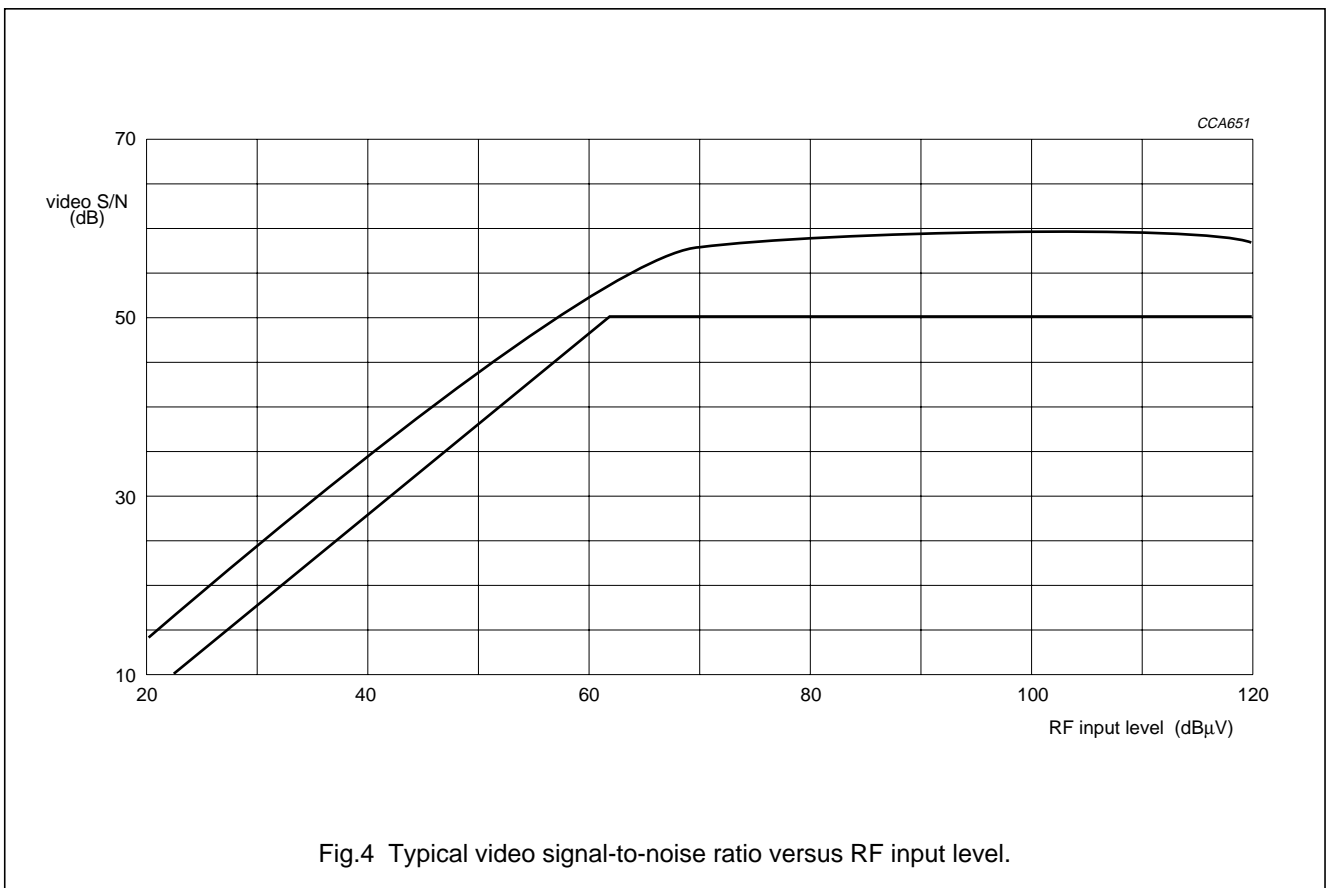


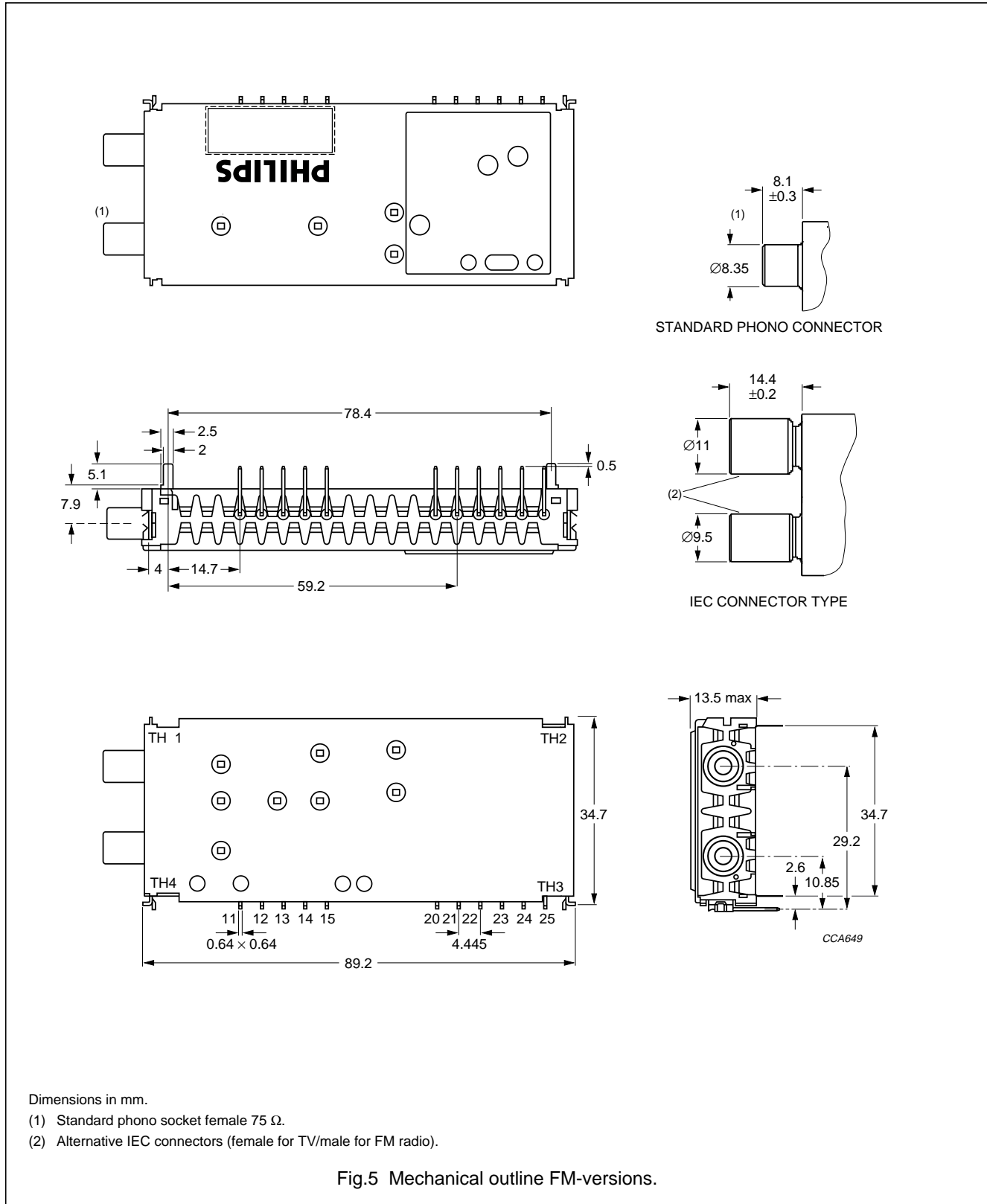
Fig.4 Typical video signal-to-noise ratio versus RF input level.



Desktop video & FM radio module  
system B/G

FM1216

MECHANICAL DATA



Dimensions in mm.

- (1) Standard phono socket female 75  $\Omega$ .
- (2) Alternative IEC connectors (female for TV/male for FM radio).

Fig.5 Mechanical outline FM-versions.

# Desktop video & FM radio module system B/G

FM1216

### Aerial connections

Standard-phono socket female 75 Ω or IEC (female for TV, male for FM radio).

### Solderability

The solderability of pins and mounting tags when tested initially and after 16 hours steam ageing in accordance with "IEC 68-2-20", test Ta, method 1 (solder bath 235 ±5 °C for 2 ±5 s), results in a wetted area of 95%. No de-wetting will occur when soldered at 260 ±5 °C for 5 ±0.5 s.

### Resistance to soldering heat

The product will not be damaged when tested in accordance with "IEC 68-2-20", test Tb, method 1A (solder bath 260 ±5 °C for 5 ±1 s).

### Mass

Approximately 50 g.

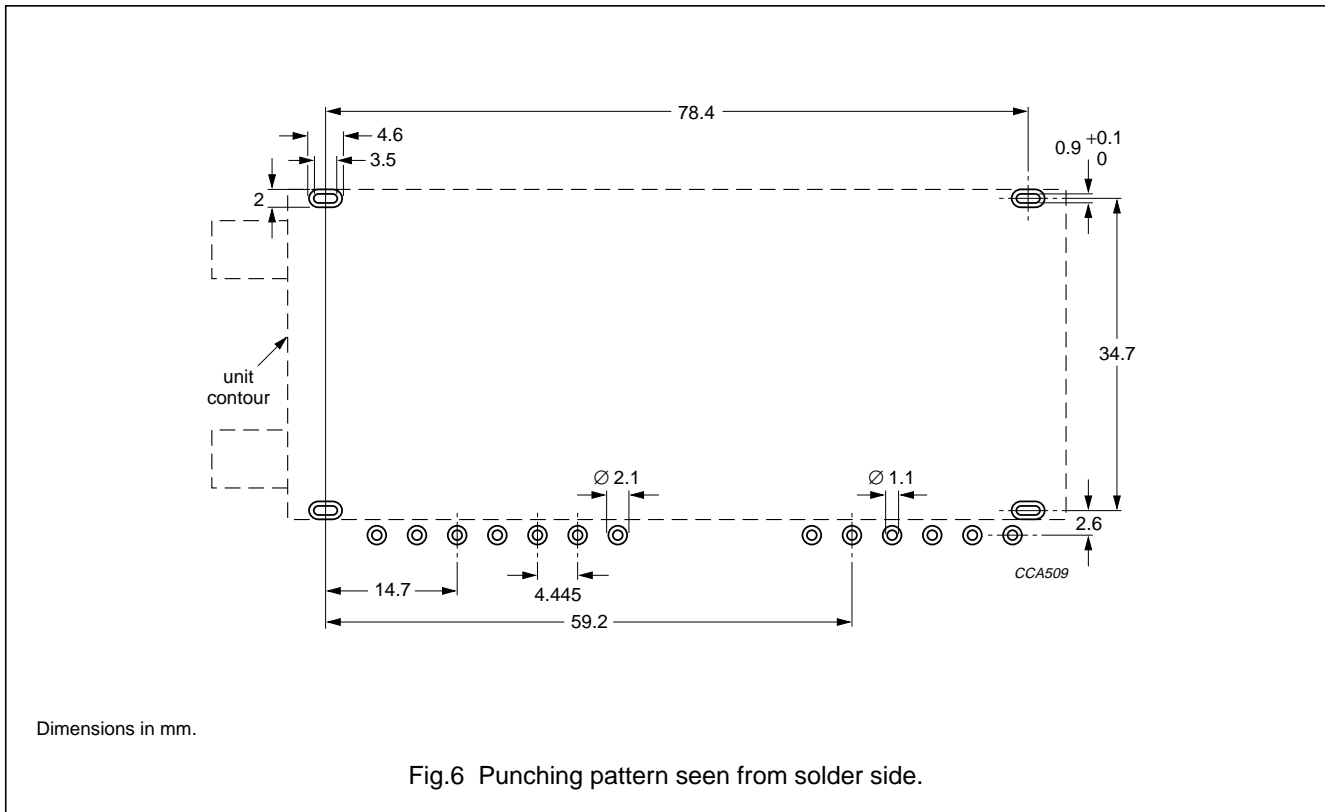
### Robustness of pins

The pins will not be damaged when tested in accordance with "IEC 68-2-21":

- Test Ua1, tensile of 20 N in axial direction
- Test Ua2, thrust of 4 N in axial direction
- Test Ua2, thrust of 2 N in axial direction.

### Punching pattern of chassis PCB

Field rejects are often related to broken tag joints. Therefore, the following punching pattern is recommended (see Fig.6).



## Desktop video & FM radio module system B/G

FM1216

### TV CHANNEL FREQUENCIES (MHz)

#### CCIR cable

Vision IF = 38.90 MHz; sound IF = 33.40 MHz.

CHANNEL	FREQ. RANGE	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY
E2	47-54	48.25	53.75
E3	54-61	55.25	60.75
E4	61-68	62.25	67.75
S01	68-75	69.25	74.75
S02	75-82	76.25	81.75
S03	82-89	83.25	88.75
S1	104-111	105.25	110.75
S2	111-118	112.25	117.75
S3	118-125	119.25	124.75
S4	125-132	126.25	131.75
S5	132-139	133.25	138.75
S6	139-146	140.25	145.75
S7	146-153	147.25	152.75
S8	153-160	154.25	159.75
S9	160-167	161.25	166.75
S10	167-174	168.25	173.75
E5	174-181	175.25	180.75
E6	181-188	182.25	187.75
E7	188-195	189.25	194.75
E8	195-202	196.25	201.75
E9	202-209	203.25	208.75
E10	209-216	210.25	215.75
E11	216-223	217.25	222.75
E12	223-230	224.25	229.75
S11	230-237	231.25	236.75
S12	237-244	238.25	243.75
S13	244-251	245.25	250.75
S14	251-258	252.25	257.75

CHANNEL	FREQ. RANGE	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY
S15	258-265	259.25	264.75
S16	265-272	266.25	271.75
S17	272-279	273.25	278.75
S18	279-286	280.25	285.75
S19	286-293	287.25	292.75
S20	293-300	294.25	299.75
S21	302-310	303.25	308.75
S22	310-318	311.25	316.75
S23	318-326	319.25	324.75
S24	326-334	327.25	332.75
S25	334-342	335.25	340.75
S26	342-350	343.25	348.75
S27	350-358	351.25	356.75
S28	358-366	359.25	364.75
S29	366-374	367.25	372.75
S30	374-382	375.25	380.75
S31	382-390	383.25	388.75
S32	390-398	391.25	396.75
S33	398-406	399.25	404.75
S34	406-414	407.25	412.75
S35	414-422	415.25	420.75
S36	422-430	423.25	428.75
S37	430-438	431.25	436.75
S38	438-446	439.25	444.75
S39	446-454	447.25	452.75
S40	454-462	455.25	460.75
S41	462-470	463.25	468.75

## Desktop video & FM radio module system B/G

FM1216

**CCIR B/G**

Vision IF = 38.90 MHz; sound IF = 33.40 MHz.

CHANNEL	FREQ. RANGE	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY
2	47-54	48.25	53.75
3	54-61	55.25	60.75
4	61-68	62.25	67.75
5	174-181	175.25	180.75
6	181-188	182.25	187.75
7	188-195	189.25	194.75
8	195-202	196.25	201.75
9	202-209	203.25	208.75
10	209-216	210.25	215.75
11	216-223	217.25	222.75
12	223-230	224.25	229.75
21	470-478	471.25	476.75
22	478-486	479.25	484.75
23	486-494	487.25	492.75
24	494-502	495.25	500.75
25	502-510	503.25	508.75
26	510-518	511.25	516.75
27	518-526	519.25	524.75
28	526-534	527.25	532.75
29	534-542	535.25	540.75
30	542-550	543.25	548.75
31	550-558	551.25	556.75
32	558-566	559.25	564.75
33	566-574	567.25	572.75
34	574-582	575.25	580.75
35	582-590	583.25	588.75
36	590-598	591.25	596.75
37	598-606	599.25	604.75
38	606-614	607.25	612.75
39	614-622	615.25	620.75

CHANNEL	FREQ. RANGE	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY
40	622-630	623.25	628.75
41	630-638	631.25	636.75
42	638-646	639.25	644.75
43	646-654	647.25	652.75
44	654-662	655.25	660.75
45	662-670	663.25	668.75
46	670-678	671.25	676.75
47	678-686	679.25	684.75
48	686-694	687.25	692.75
49	694-702	695.25	700.75
50	702-710	703.25	708.75
51	710-718	711.25	716.75
52	718-726	719.25	724.75
53	726-734	727.25	732.75
54	734-742	735.25	740.75
55	742-750	743.25	748.75
56	750-758	751.25	756.75
57	758-766	759.25	764.75
58	766-774	767.25	772.75
59	774-782	775.25	780.75
60	782-790	783.25	788.75
61	790-798	791.25	796.75
62	798-806	799.25	804.75
63	806-814	807.25	812.75
64	814-822	815.25	820.75
65	822-830	823.25	828.75
66	830-838	831.25	836.75
67	838-846	839.25	844.75
68	846-854	847.25	852.75
69	854-862	855.25	860.75

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**Desktop video & FM radio module  
system B/G**

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**FM1216****Italy**

Vision IF = 38.90 MHz; sound IF = 33.40 MHz.

<b>CHANNEL</b>	<b>PICTURE CARRIER FREQUENCY</b>	<b>SOUND CARRIER FREQUENCY</b>
A	53.75	59.25
B	62.25	67.75
C	82.25	87.75
D	175.25	180.75
E	183.75	189.25
F	197.25	192.75
G	201.25	206.75
H	210.25	215.75
H1	217.25	222.75
H2	224.25	229.75

## Desktop video & FM radio module system B/G

FM1216

### DEFINITIONS

<b>Data sheet status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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FM1216

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