

S P E C I F I C A T I O N

LG Innotek Co., Ltd.				
A P P D.	C H K D.	D S G D.	MODEL NO	T A D M - H 2 0 2 F
2003.08.21 G.S Park		2003.08.21 H.R Lee	DOCUMENT NO	B C 4 0 4 4 0

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1. Common

1- 1. Application

This specification applies to TMI type (RF Front-End system) for TV, VCR

1- 2. Structure

Refer to the attached assembly drawing.

1- 3. Circuit

Refer to the attached circuit diagram.

2. General specifications.

2- 1. Applicable broadcasting system

M NTSC / US CH

2- 2. Receiving system

Upper Heterodyne

2- 3. Intermediate frequency

Picture intermediate frequency : 45.75 MHz

Sound intermediate frequency : 41.25 MHz

2- 4. Receiving channel

VHF LOW : 2 ~ B Ch

VHF HIGH : C ~ W+11 Ch

UHF : W+12 ~ 69 Ch

2- 5. Output channel of modulator

US 3 / 4 Ch

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	Terminal NO. 2
3 Ch	OPEN
4 Ch	GND

2- 6. Input / Output condition

ANT nominal impedance

ANT IN : 75Ω unbalance

ANT OUT : 75Ω unbalance

Video in impedance : 0.7kΩ ~ 1.3kΩ (typ. 1kΩ)

Audio in impedance : 10kΩ min.

Control impedance : 30kΩ min. (typ. 100kΩ)

Video out load : 10kΩ

Audio out load : 100kΩ

2- 7. Operating temperature range

Temperature: -10℃ ~ +60℃

(Normally Air Temperature)

Humidity : less than 65%RH

2- 8. Storage temperature range

Temperature : -10℃ ~ +70℃

(Normally Air Temperature)

Humidity : less than 70%RH

2-9. Guarantee voltage for operation

Terminal		Supply voltage			
		min.	typ.	max.	unit
+B		4.8	5.0	5.2	Vdc
TU		29.0	32.0	34.0	
CONTROL	VCR Mode	4.8	5.0	5.2	
	TV Mode	-	-	0.5	

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2-10. Maximum ratings

Terminal	Supply voltage	Unit
+B	6.0	Vdc
TU	35.0	
CONTROL(MD:ON)	6.0	

(Note) Within “+B” supply voltage at SCL,SDA,terminal.

2-11. Current consumption

Terminal	Current consumption			
	min.	typ.	max.	unit
+B	–	170	200	mA
TU	–	1.5	5.0	
CONTROL(MD:ON)	–	47.0	173	μA

2-12. PLL characteristics of tuner section

2-12-1. I2C data format

	MSB							LSB	
Address byte	1	1	0	0	0	MA1	MA0	0	A
Divider byte 1	0	N14	N13	N12	N11	N10	N9	N8	A
Divider byte 2	N7	N6	N5	N4	N3	N2	N1	N0	A
Control byte	1	CP	0	0	0	R1	R0	0	A
BAND SW byte	0	0	0	0	BS3	BS2	BS1	BS0	A

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Where:

- A : Acknowledge bit
- Address Selection

“ADSW” Terminal Voltage	MA1	MA0
0~0.1 × +B	0	0
OPEN	0	1
0.4 × +B ~ 0.6 × +B	1	0
0.9 × +B ~+B	1	1

- CP : Charge pump current (CP = 0 = 50 μ A, CP = 1 = 200 μ A)
- N14~N0 : Programmable divider byte

$$N = N_{14} \times 2^{14} + N_{13} \times 2^{13} + \dots + N_1 \times 2^1 + N_0$$
- Band switching byte

	BS3	BS2	BS1	BS0
UHF	1	0	0	0
VHF HIGH	0	0	1	0
VHF LOW	0	0	0	1

2-12-2. Oscillator frequency calculation

$$F_{osc} = F_{ref} \times 8 \times N$$

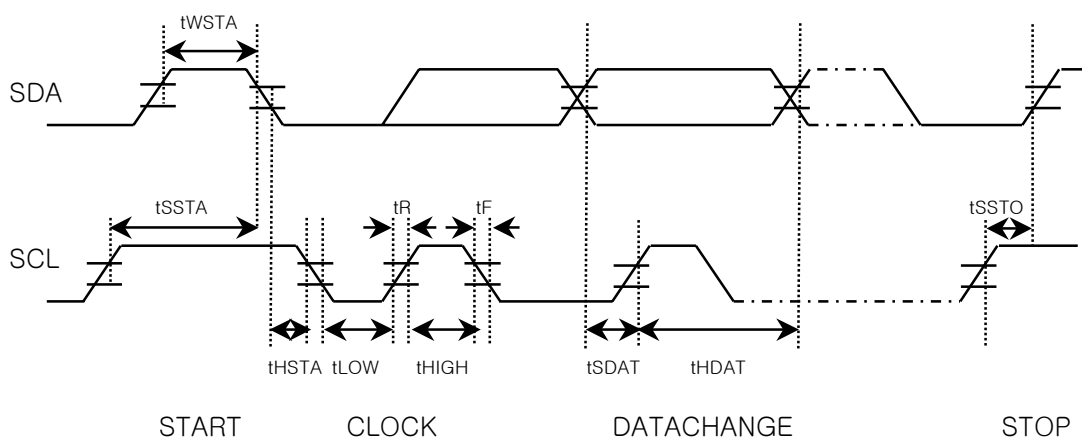
- Fosc : Locked oscillator frequency
- Fref : $4\text{MHz}/512 = 7.8125\text{kHz}$
- N : Oscillator frequency data

2-12-3. Input Signal Level (SCL, SDA)

INPUT Signal level	MIN	MAX	Unit
High level	3.0	5.5	V
Low level	–	1.5	

[illegible]

2-12-4 I²C BUS Time



		MIN	TYP	MAX	단 위
fSCL	SCL clock frequency	0		400	kHz
tWSTA	Start waiting time	1300			nsec
tHSTA	Start hold time	600			"
tLOW	Low clock pulse width	1300			"
tHIGH	High clock pulse width	600			"
tSSTA	Start set-up time	600			"
tHDAT	Data hold time	1300			"
tSDAT	Data set-up time	600			"
tR	Rise time			300	"
tF	Fall time			300	"
tSSTO	Stop set-up time	600			"

2-13. Test condition

Terminal	Supply voltage	Unit	Remarks
+B	5 ± 0.1	Vdc	Ripple:10mVp-p max.
TU	32 ± 2	Vdc	
CONTROL	5 ± 0.1	Vdc	
Ambient temperature	25 ± 5	℃	
Relative humidity	65 ± 10	%RH	

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2-14-1. RF-modulator section

2-14-2. IF section

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3. Electrical characteristics

The unit stated in dBμV is defined the value at 75Ω terminal in this specification. (0 dBm = 109 dBμV)

3- 1. RF-modulator section

Item					Specification				Note	
					min.	typ.	max.	unit		
3-1- 1. Video modulation					74	80	86	%	Input signal : 1.0Vp-p white Measure at the output of the standard demodulator.	
3-1- 2. Video limit modulation					87	93	99	%	Input signal : 1.5Vp-p stair-steps or ramp. Measure at the output of the standard demodulator.	
3-1- 3. V/S ratio					10:3.8	10:4.0	10:4.1	-	Input signal :1.0Vp-p white V : S = 10 : 4 Measure at the output of the standard demodulator.	
3-1- 4. Video amplitude frequency characteristics					-3.0	-0.5	+3.0	dB	Measure range : 0.1MHz ~ 4.2MHz Based on 1MHz	
3-1- 5. Differential Gain (DG)					-	2	7	%	Input signal : 1.0Vp-p stair-steps Chrominance : 20 IRE Luminance : 0 ~ 90 %	
3-1- 6. Differential Phase (DP)					-	2	7	deg	Input signal : 1.0Vp-p stair-steps Chrominance : 20 IRE Luminance : 0 ~ 90 %	
3-1- 7. Video S/N					45	47	-	dB	Compensation of spectral luminance efficacy. RF output should be amped 12dB. (LGEC control method Measurement conditions. Measure at the out of the Standard demodulator. (5126A - NIHON TSUSHINKI)	
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Item					Specification				Note
					min.	typ.	max.	unit	
									Video Measurement : VM700A (TEKTRONIX) HPF : 100kHz, LPF : 4.2MHz SC TRAP : ON, WEIGHT : OFF Input signals : Video : 100% white signal Audio : none Video band : 0.1MHz ~ 4.2MHz
3-1- 8. Chroma beat (920kHz P.C.S. beat)					55	65	-	dB	Input signal : 0.4Vp-p 3.58MHz sine wave Use spectrum analyzer to measure the level of Fp + 0.92MHz The value is relative to the level of Fp without video modulation.
3-1- 9. Audio modulation (deviation)					32 (64)	40 (80)	48 (96)	kHz dev (%)	Input signal : -6.5dBs, (1.04Vp-p) 1kHz sine wave (100 % modulation = ± 25kHz dev.)
3-1-10. Audio maximum modulation					150 (300)	220 (440)	-	kHz dev (%)	Input signal : 1kHz sine wave The input should be adjusted to the level just before the saturation of the modulation.
3-1-11. Audio amplitude frequency characteristics					-3	+0.2 -0.6	+3	dB	Input signal : -6.5dBs, (1.04Vp-p) Measure range : 50Hz ~ 10kHz Based on 1kHz
3-1-12. Audio distortion					-	0.5	2.0	%	Input signals : Audio : -6.5dBs (1.04Vp-p), 1kHz sine wave Video : 1Vp-p color bar De-emphasis is on.(75 μ sec)
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Item					Specification				Note	
					min.	typ.	max.	unit		
3-1-13. Audio S/N					48	54	-	dB	Input signals : Audio : -6.5dBs (1.04Vp-p), 1kHz sine wave Video : All black (sync. only) Use standard demodulator of inter-carrier system. De-emphasis is on. (75μ sec)	
3-1-14. Audio buzz					45	55	-	dB	Video input signal : 1Vp-p color bar Other conditions : same as item 3-1-13.	
3-1-15. Video carrier output level					63	66.0	69	dBμV	Video input signal : 1Vp-p 100% white signal.	
3-1-16. P/S ratio (sound carrier level)					-12.5	-14.5	-17	dB	Audio input signal : none Other conditions : same as item 3-1-15.	
3-1-17. Video carrier frequency					-150	-	+150	kHz	Video input signal : none	
3-1-18. Sound carrier frequency					4493	4500	4507	kHz	Audio input signal : none The measurements are taken after 1 min. from the power on.	
3-1-19. Out-band spurious					-	-	39.5	dBμV	Video input signal : 1Vp-p color bar Measure range : 0 ~ 1GHz Except the range from Fp-4.6MHz to Fp+7.4MHz.	
3-1-20. In-band spurious					60	-	-	dB	Input signals : Video : none Audio : none Measure range : Fp~Fp+4.5MHz.	
3-1-21. Terminal leakage					-	-	54	dBμV	Measure range : 0 ~ 1GHz except GND.	
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- 3-1-22-1. Video carrier frequency rise up time.
The time to approach the set value $\pm 50\text{kHz}$: within 3 seconds
- 3-1-22-2. Audio carrier frequency rise up time.
The time to approach the set value $\pm 5\text{kHz}$: within 10 seconds
- 3-1-22-3. Video carrier frequency shift by supply voltage drift.
Within $\pm 10\text{kHz}$ by $\pm 0.3\text{V}$ shift of the supply voltage.
- 3-1-22-4. Audio carrier frequency shift by supply voltage drift.
Within $\pm 2\text{kHz}$ by $\pm 0.3\text{V}$ shift of the supply voltage.

3-1-23-1. Thermal stability of video modulation.
Within $\pm 8\%$ based on the temperature of 25°C.

Test measurement order and time :
 $25^{\circ}\text{C} \rightarrow -10^{\circ}\text{C} (2\text{H}) \rightarrow 10^{\circ}\text{C} (1\text{H}) \rightarrow 25^{\circ}\text{C} (1\text{H}) \rightarrow 45^{\circ}\text{C} (1\text{H}) \rightarrow 60^{\circ}\text{C} (2\text{H})$

3-1-23-6. Thermal stability of P/S ratio
Within ± 3.0 dB based on the temperature of 25°C , but the P/S ratio itself should not be less than 13 dB.

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3- 2. ANT SW section

Unless otherwise specified, measurement range shall be 54MHz ~ 810MHz,
and unused RF terminals shall be terminated by rated impedance
Terminator.

Item	Specification				Note				
	min.	typ.	max.	unit					
3-2-1. Insertion loss	-	5	6	dB	ANT IN to ANT OUT mode : TV (at MD OFF)				
3-2-2. VSWR I	-	5.5	7		ANT IN Terminal mode : TV (at MD OFF) 54MHz ~ 810MHz				
3-2-3. VSWR II	-	2	4		ANT OUT terminal mode : TV (at MD OFF) 54MHz ~ 810MHz				
	-	2	3		mode : VCR (at MD ON) 61MHz ~ 72MHz				
3-2-4. Isolation	60	65	-	dB	Isolation from ANT OUT to ANT IN mode : VCR (at MD ON) 61MHz ~ 72MHz				
3-2-5. ANT IN leakage - MD - TU OSC	-	-	9.5	dB μ V	mode : VCR (at MD ON) RF-modulator section : none input signal				
	-	-	52	dB μ V	Tuner OSC leakage.				
3-2-6. 2nd Harmonics inter modulation	55	64	-	dB	f1/(f1+f2) ratio mode : TV (at MD OFF)				
					<table border="1"> <tr> <td>item</td><td>freq(MHz)</td><td>level(dB)μV</td></tr> <tr> <td>f1</td><td>91.25</td><td>100</td></tr> <tr> <td>f2</td><td>103.25</td><td>100</td></tr> </table>	item	freq(MHz)	level(dB) μ V	f1
item	freq(MHz)	level(dB) μ V							
f1	91.25	100							
f2	103.25	100							
Both f1 and f2 are not modulated.									

[illegible]

Item					Specification				Note										
					min.	typ.	max.	unit											
3-2-7. Cross modulation					55	62	-	dB	Then take the smallest ratio from the sideband to f2 as cross modulation value. <table><tr><td>item</td><td>freq(MHz)</td><td>level(dB)μV</td></tr><tr><td>f1</td><td>91.25</td><td>105</td></tr><tr><td>f2</td><td>193.25</td><td>80</td></tr></table> f1 is 40% AM modulated by 15.75KHz sine wave. f2 is not modulated.		item	freq(MHz)	level(dB) μV	f1	91.25	105	f2	193.25	80
											item	freq(MHz)	level(dB) μV						
											f1	91.25	105						
											f2	193.25	80						
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3- 3. Tuner section

When the test characteristics, test point is IF output terminal.

Item					Specification				Note				
					min.	typ.	max.	unit					
3-3-1. IF Rejection									75Ω terminated				
		UHF			60	80	-	dB				ANT INPUT level 65dB μ V	
VHF	HIGH			60	80	-							
	LOW			45	60	-							
		UHF			40	60	-	dB				ANT INPUT level 95dB μ V	
VHF	HIGH			40	65	-							
	LOW			40	60	-							
3-3-2. Image Rejection									75Ω terminated				
		UHF			45	60	-	dB				ANT INPUT level 65dB μ V	
VHF	CATV			45	70	-							
	13 ~ 7			60	75	-							
	6 ~ 2			60	75	-							
		UHF			40	55	-	dB				ANT INPUT level 95dB μ V	
VHF	CATV			40	60	-							
	13 ~ 7			40	60	-							
	6 ~ 2			40	60	-							
3-3-3. 920kHz Color Beat Rejection									ANT INPUT level p:60dB μ V (75Ω terminated) c:44dB μ V (75Ω terminated) s:54dB μ V (75Ω terminated)				
		UHF			50	80	-	dB					
		VHF			50	80	-						
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Item					Specification				Note			
					min.	typ.	max.	unit				
3-3-4. CH 6 beat					45	60	-	dB	ANT INPUT level desire : 60dB μ V (75 Ω terminated) undesire : 54dB μ V (75 Ω terminated)			
3-3-5. CH A-5 beat					45	60	-	dB	ANT INPUT level desire : 60dB μ V (75 Ω terminated)			
3-3-6. CB rejection.					0.535 MHz ~ 30 MHz -7dBm min				desire : 55.25MHz ~ 83.25MHz (Ch.2 ~ Ch.6) -66dBm			
3-3-7. 1% Cross modulation					(dB μV) desire input signal 75Ω terminated A B Un-desire signal (dBμV)							
					CH				A(dB μ V)		B(dB μ V)	
					UHF				64		84	
					VHF		W+11 ~ J		64		84	
							13 ~ 2		64		84	
					Cross modulation value should be within hantched area. ※ Tuner should be measured for 1% cross modulation with ± 2 channel undesired signal.							
3-3-8. +B shift					CH		min.	typ.	max.	unit.	note	
					UHF		-	-	250	kHz	+ B $\pm$ 10% PLL "ON"	
					VHF HIGH		-	-	250			
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3-3-9. Over range	CH	Vtu		min.	typ.	max.	unit.
	UHF	28.0 V		2.0	-	-	MHz
		0.5 V		2.0	-	-	
	VHF	28.0 V		2.0	-	-	
		0.5 V		2.0	-	-	
3-3-10. Noise Figure	CH	min.	typ.	max.	unit.	note	
	UHF	-	9.0	14.0	dB		
	VHF HIGH	-	8.0	14.0			
	VHF LOW	-	8.0	13.0			
3-3-11. Power gain deviation	UHF	-	6	12	dB		
	VHF HIGH	-	6	12			
	VHF LOW	-	6	12			
3-3-12. Temperature shift	W+12 ~ 69	-	-	3000	kHz	25℃ ± 25℃	
	W+11 ~ J	-	-	3000			
	13 ~ 2	-	-	2000			

3-4. IF section

When the test electrical characteristics when there are no instruction. fp input level is 70 dB μ V and p/s ratio is -7 dB.

Item					Specification				Note	
					min.	typ.	max.	unit		
3-4-1. Video S/N					VHF	45	47	-	dB	A figure in parentheses is spec by LGIT measurement system
					UHF	45	47	-		50% white signal. 87.5% modulation. Sub-carrier trap : on HPF : 100 kHz, LPF : 4.2 MHz
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Item					Specification				Note	
					min.	typ.	max.	unit		
3-4-2. Noise limiting sensitivity						45	48	dB μ V	A figure in parentheses is spec by LGIT measurement system	
AIR										
CATV										
UHF										
3-4-3. Video output level					0.8	1.0	1.2	Vp-p	Standard color bar:87.5% mod.	
3-4-4. SYNC ratio					25	28.6	30	%	Standard color bar:87.5% mod.	
Burst ratio					17	25	37			
3-4-5. Video amplitude frequency characteristics								dB	Full sweep : 87.5% mod. based on 0.5 Mhz	
1.0 Mhz										
2.0 Mhz										
3.0 Mhz										
3.58Mhz					-6	-2	+2			
3-4-6. Sin ² 2T pulse response					70	90	-	%	Sin ² 2T pulse & bar:87.5% mod.	
3-4-7. Differential Gain					-	5	10	%	5 stair-steps : 87.5% mod. Set modulation at the peak of 5'th chroma signal	
3-4-8. Differential Phase					-	5	10	deg	5 stair-steps : 87.5% mod. Set modulation at the peak of 5'th chroma signal	
3-4-9. Y/C delay time					-100	0	+100	nsec	0.25 Mhz standard Envelope delay meter.	
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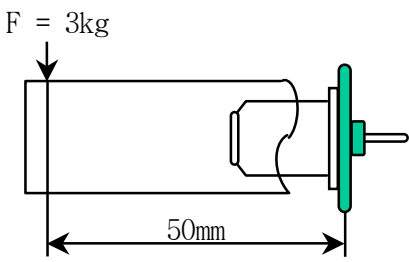
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					min.	typ.	max.	unit	
3-4-10. Audio output level					-7.2	-4.2	-1.2	dBm	1kHz / ± 25 kHz dev. standard color bar:87.5% mod.
3-4-11. Audio distortion					-	1	2	%	1kHz / ± 25 kHz dev. standard color bar:87.5% mod.
3-4-12. Audio frequency characteristics									20Hz ~ 12kHz Based on 1kHz / ± 7.5 kHz dev. standard color bar:87.5% mod. PRE-EMP (75usec) : "ON"
50 Hz					-3	0	+3	dB	
10 kHz					-3	0	+3		
3-4-13. Audio S/N					45	50	-	dB	1kHz / ± 25 kHz dev. standard color bar:87.5% mod. Use IHF filter.
3-4-14. SYNC buzz					-	50	100	mVp-p	standard color bar:87.5% mod. 400Hz/ ± 25 kHz dev. P/S=-17dB
3-4-15. AFT alignment accuracy					1.5	2.5	3.5	Vdc	Alignment center : 2.5V IF input level : 90dB μ V P/S=-7dB standard color bar:87.5% mod. (25°C $\pm$ 10°C & 0 ~ 45% Hum)
3-4-16. SIF Output Level					70	75		dB μ V	Video mod. : Color Bar 87.5% mod. RF INPUT Level = 70 dB μ V P/S = -6dB Measure peak of 4.5MHz carrier Level using Spectrum Analyzer and 1:10 Probe.
					A P P D.		C H K D.		MODEL NO: TADM-H202F
									TITLE:
									SPECIFICATION
									DOCUMENT NO:
SYMB	NO	APPD	CHKD	DSGD					BC 40440 (19/23)

4. ENVIRONMENTAL TESTS

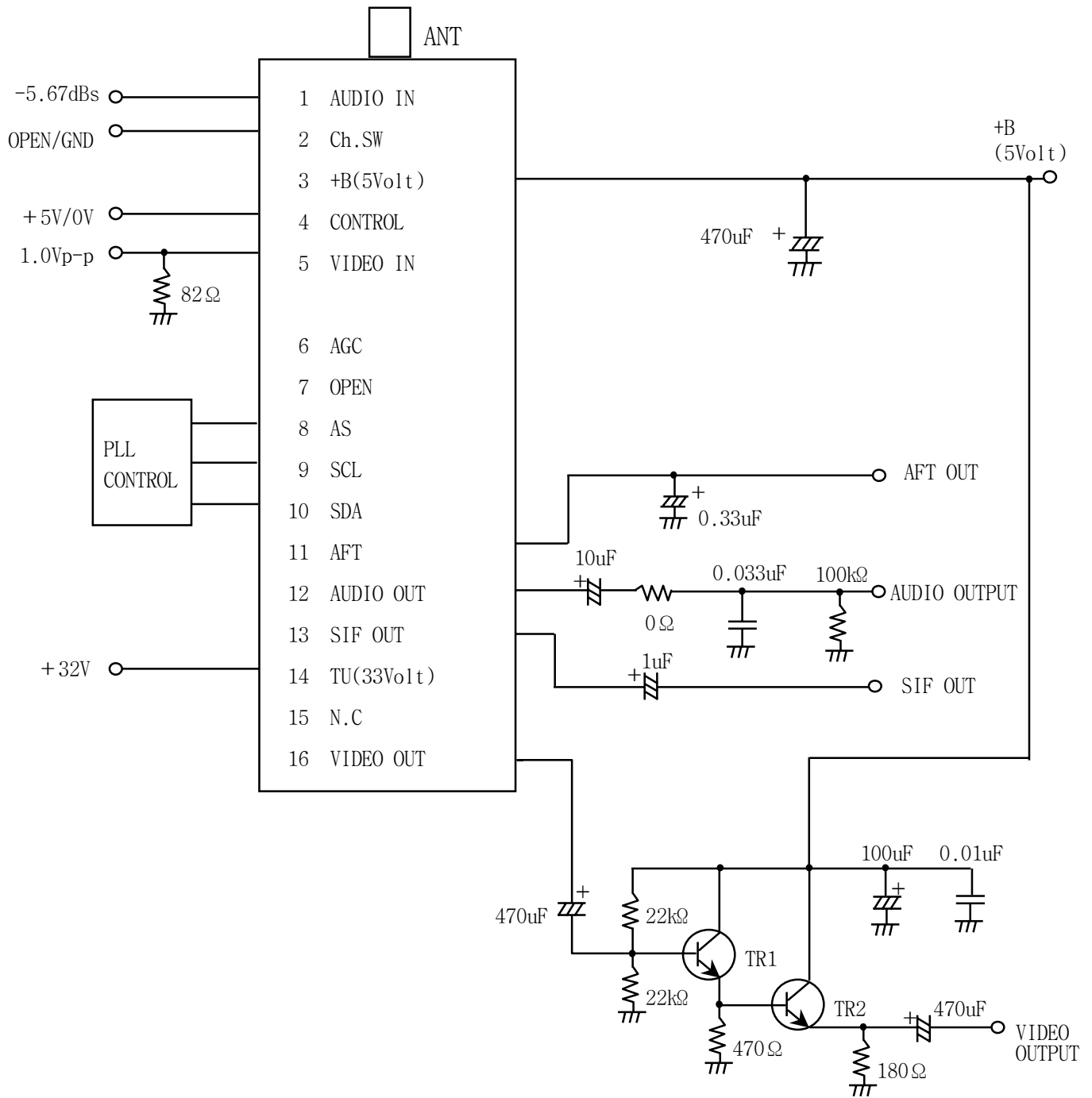
Item	Specification			Note
	TUNER	MODULATOR	IF	
4-1. Heat load test	OSC frequency (PLL : ON) UHF : $\pm 100\text{kHz}$ VHF : $\pm 100\text{kHz}$	Video modulation $\pm 8\%$ max Video carrier frequency $\pm 150\text{kHz}$ max Video carrier output level $\pm 4\text{dB}$ max Audio modulation $\pm 18\%$ max Audio carrier frequency $\pm 20\text{kHz}$ max P/S ratio $\pm 3\text{dB}$ max	Video S/N $\pm 6\text{dB}$ Video output $\pm 0.2\text{Vp-p}$ max Noise limiting sensitivity $\pm 6\text{dB}$ Audio output $\pm 30\%$ max	test condition 4-1-1
4-2. Humidity load test	same as in item 4-1			test condition 4-2-1
4-3. Cold test	same as in item 4-1			test condition 4-3-1
4-4. Operating life test	same as in item 4-1			test condition 4-4-1
4-5. High voltage test	same as in item 4-1			test condition 4-5-1
4-6. Vibration test	same as in item 4-1			test condition 4-6-1
4-7. Impact test	same as in item 4-1			test condition 4-7-1

					A P P D.	C H K D.	D S G D.	MODEL NO: TADM-H202F
								TITLE: SPECIFICATION
								DOCUMENT NO:
SYMB	NO	APPD	CHKD	DSGD				BC 40440 (20/23)

Environmental test condition								
Item					Test condition			
4-1-1 Heat load teat					1. Initial value measure at standard test condition. 2. Leave samples in $70^{\circ}\text{C}\pm2^{\circ}\text{C}$ for 96 ± 5 hours, and in standard test condition for 30 minutes, then take measurements within 1 hour. 3. Supply voltage : standard $\pm10\%$ 4. Supply voltage cycle : 1.5h on, 0.5h off			
4-2-1 Humidity load test					1. Leave samples in $40\pm5^{\circ}\text{C}$ for 24 ± 2 hours, and in standard test condition for 30 minutes, then take measurements. 2. Leave samples in $40\pm5^{\circ}\text{C}$ 80 ~ 90% rh, for 96 ± 5 hours, and in standard test condition for 30 minutes, then take measurements within 1 hour. 3. Supply voltage : standard $+10\%$ 4. Supply voltage cycle : 1.5h on, 0.5h off			
4-3-1 Cold test					1. Initial value measure at standard test condition. 2. Leave samples in $-20^{\circ}\text{C}\pm2^{\circ}\text{C}$ for 96 ± 5 hours, and in standard test condition for 2 hours, then take measurements within 1 hour.			
4-4-1 Operating life test					1. Take measurements in standard test condition. 2. Leave samples for 1000 hours, then take measurements. 3. Supply voltage : standard			
4-5-1 High voltage test					Ant. IN : $\pm15\text{kV}$, 10 times (150pF charged) series R=150 Ω			
4-6-1 Vibration test					Vibration test fixture in used to vibrate the tuner with a total amplitude of 1mm and frequency ranging from 10 to 55hz, once per minute consecutively, for 40 minutes in each of three directions, x,y and z.			
4-7-1 Impact test					1. Impact acceleration : 50m/sec ² 2. Impact time : 11msec 3. Impact time & direction : 3 times per each 6 sides			
5. Mechanical characteristics								
5-1 Outline view assembly appearance					No defects of wiring, soldering and assembling. No dirt, rust, corrosion or foreign material.			
					A P P D.	C H K D.	D S G D.	MODEL NO: TADM-H202F
								TITLE: SPECIFICATION
								DOCUMENT NO:
SYMB	NO	APPD	CHKD	DSGD				BC 40440 (21/23)

Item					Test condition					
5-2 Appearance structure Dimension Mounting Weight 6. Others 6-1. Ant jack Load Test					As assembly drawing. As assembly drawing. Approximately 60±5g.					
					Crack, defection and shaking should not be existed with 15kg.cm banding moment after caulking. 					
					A P P D.	C H K D.	D S G D.	MODEL NO: TADM-H202F		
								TITLE:		
										SPECIFICATION
										DOCUMENT NO:
SYMB	NO	APPD	CHKD	DSGD				BC 40440 (22/23)		

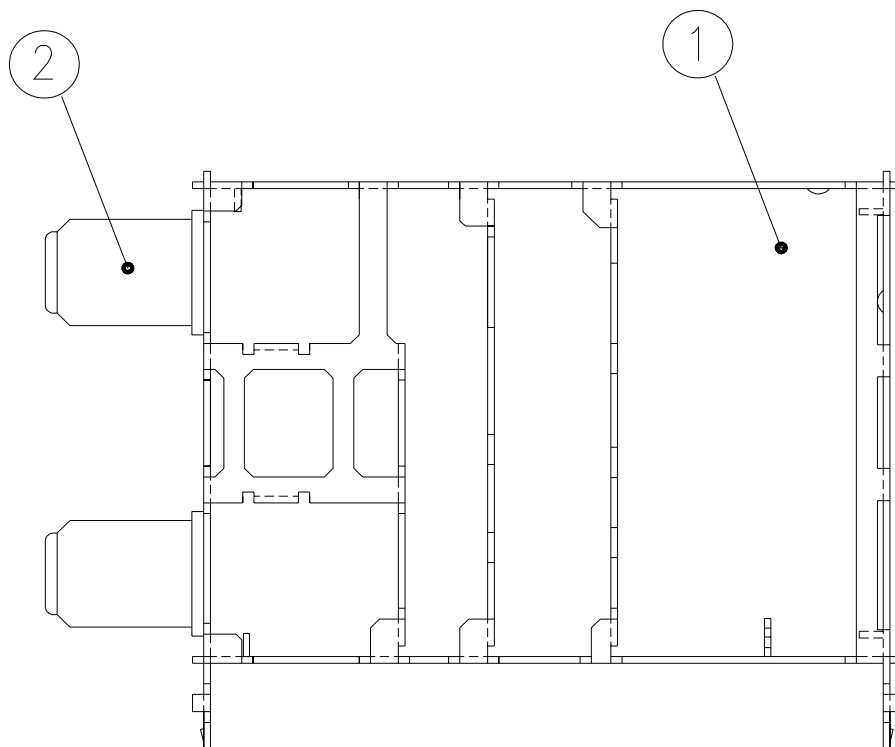
7. TEST CIRCUIT



NOTE

TR1, TR2 : 2SC1213 or
EQUIVALENT

					A P P D.	C H K D.	D S G D.	MODEL NO: TADM-H202F
								TITLE:
								SPECIFICATION
								DOCUMENT NO:
SYMB	NO	APPD	CHKD	DSGD				BC 40440 (23/23)



					LG Innotek CO., Ltd.				
					APPD. '02.10.26 Kim Byoung Yong	CHKD. 	DSGD. '02.10.26 Lee Kap Soul	NOTE	TADM-TYPE
				TITLE				INSULATION MATERIAL LIST	
				DOCUMENT NO.				BN40044(1/10)	
SYMB	NO	APPD	CHKD	DSGD					

INSULATING MATERIALS TABLE

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[illegible]

(NOTE) THE MATERIALS MARKED *IN CATEGORY NUMBER ARE CURRENT USE
AND OTHERS CAN BE USED IN THE FUTURE.

NO	DESCRIPTION	BASE MATERIALS								PRINTED WIRING BOARD			NOTE
		GENERIC I.D	MANUFACTURER	CAT. NO. OR GRADE	FLAME CLASS	HMI PL3	HAI PL3	GTI PL3	UL FILE NO	UL MARK	MANUFACTURER	FLAME CLASS	
1	PRINTED WIRING BOARD	PHENOLIC RESIN OF COPPER GLAD LAMINATES	HITACHI CHEMICAL CO., LTD	M3L-487F	94V-0	800+	200+	-	EB014B	▲ 8YH-294V-0	SANYOHI CO., LTD (E52568)	94V-0	
										▲ 6MK-77X	6MK CORP CO., LTD (E41888)	94V-0	
										P10A ▲ OR	GOLDSTAR TELECOMMUNICATION CO., LTD (E71042)		
										88EP-2110A ▲	TELECOMMUNICATION CO., LTD (E71042)		
										Ⓚ K8-15 ▲	KOREA CIRCUIT CO., LTD (E55891)		
										H.8.140HI ▲	PT.HITACHI CHEMICAL INDONESIA (E41480)	94V-0	
			WATSHITA ELECTRIC WORK LTD	R-B700	94V-0	120+	200+	500	EB1888		GRAND CIRCUIT INDUSTRY SDN BHD (E182082)	94V-0	
										H.8.140MM ▲	PT.HITACHI CHEMICAL INDONESIA (E41480)	94V-0	

NO	DESCRIPTION	BASE MATERIALS								PRINTED WIRING BOARD			NOTE
		GENERIC I.D	MANUFACTURER	CAT. NO. OR GRADE	FLAME CLASS	HMI PL3	HAI PL3	GTI PL3	UL FILE NO	UL MARK	MANUFACTURER	FLAME CLASS	
			OAK INDUSTRIES KOREA LTD	AD8-1107(A)	94V-0	258	200+	-	E882B8	▲ 8H-4458	SAM HAN ELECTRIC CO. (E94018)		
										▲ 88EP-2112	GOLDSTAR TELECOMMUNICATION CO., LTD (E71042)		
										Ⓚ K8-15	KOREA CIRCUIT CO., LTD (E55891)		
										▲ ⓀⓂ B-V0	SEONG MIN ELECTRONICS CO., LTD (E172889)	94V-0	
										H.8.14008 ▲	PT.HITACHI CHEMICAL INDONESIA (E41480)	94V-0	
				OAK-FR2-1	94V-0	800+	200+	-	E882B8	▲ 88EP-2108	GOLDSTAR TELECOMMUNICATION CO., LTD (E71042)		
										▲ 8H-4458	SAM HAN ELECTRIC CO. (E94018)		

NO	DESCRIPTION	BASE MATERIALS								PRINTED WIRING BOARD			NOTE
		GENERIC I.D	MANUFACTURER	CAT. NO. OR GRADE	FLAME CLASS	HMI PL3	HAI PL3	GTI PL3	UL FILE NO	UL MARK	MANUFACTURER	FLAME CLASS	
		PAPER EPOXY	HITACHI	M3L-E-47	94V-0	800+	200+	800+	EB014B	▲ 8 A1	SANYOH CO., LTD	94V-1	
		RESIN LAMINATES	CHEMICAL								(E62558)		
			CO., LTD										
										▲ 8MK-8Y	8MK CORP CO., LTD	94V-1	
											(E41888)		
										▲ 8SEP-2118	GOLDSTAR		
											TELECOMMUNICATION		
											CO., LTD		
											(E71042)		
										▲ 8HI	SAM HAN		
											ELECTRIC CO., LTD		
											(E94018)		
										Ⓚ K8-B	KOREA CIRCUIT		
											CO., LTD		
											(E65881)		
										H.6.1 7B ▲	PT. HITACHI	94V-0	
											CHEMICAL INDONESIA		
											(E41480)		

NO	DESCRIPTION	BASE MATERIALS								PRINTED WIRING BOARD			NOTE
		GENERIC I.D	MANUFACTURER	CAT. NO. OR GRADE	FLAME CLASS	HMI PL3	HAI PL3	GTI PL3	UL FILE NO	UL MARK	MANUFACTURER	FLAME CLASS	
	PRINTED WIRING	GLASSFIBER	MATSUSHITA	R-17B1	94V-0	120+	200+	500	EB1888	▲ 8 KX	8MK CORP	94V-0	
	BOARD	REINFORCED EPOXY	ELECTRIC								(E41888)		
		RESIN COPPER	WORK LTD										
		GLAD LAMINATES								▲ 8E 28	NIPPON ELECT	94V-0	
											CO., LTD		
											(E41188)		
										8 TO ▲	SANYOH	94V-0	
											CO., LTD		
											(E62558)		
										E4A ▲ OR	GOLD STAR	94V-0	
										8SEP-2804A ▲	TELECOMMUNI-		
											CATION CO., LTD		
											(E71042)		
										Ⓚ 5 ▲	LIANG DAR	94V-0	
											TECHNOLOGY		
											CO., LTD		
											(E188182)		
										H.6.1 118	PT. HITACHI	94V-0	
											CHEMICAL INDONESIA		
											(E41480)		

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1. GENERAL SPECIFICATION

1) APPLICATION

This specification is applied to the VCR receiving the US 181 channel system VHF and UHF bands. (RF modulator output channel is 3 or 4 CH.)

2) RECEIVING CHANNELS

- * M NTSC / USA
- * UHF : CH. W+12 - CH. 69
- * VHF HIGH BAND : CH. C - CH. W+11
- * VHF LOW BAND : CH. 2 - CH. B

3) INTERMEDIATE FREQUENCY

- * PIF : 45.75MHz
- * SIF : 41.25MHz

4) RECEIVING SYSTEM

- * UPPER HETERODYNE SYSTEM

5) OUTPUT CHANNEL OF MODULATION

- * 3 CH. : OPEN (61.25MHz)
- * 4 CH. : GND (67.25MHz) By controlled PIN NO.2 (CH)

6) OPERATING CONDITIONS FOR GUARANTEE

- * TEMPERATURE : -10 ~ 60℃ , HUMIDITY 85% OR LESS

7) STORAGE CONDITION

- * TEMPERATURE : - 20 ~ 70℃ , HUMIDITY 90% OR LESS

8) TESTING AMBIENT CONDITION

- * DEFINED AS TEMPERATURE OF $25 \pm 5^{\circ}\text{C}$ AND HUMIDITY OF $65 \pm 10\% \text{ RH}$

9) REGULATION

- * TCMN0682PA20C4 IS APPLIED FOR FCC REGULATION.

10) TERMINAL NAMES AND FUNCTIONS

ITEM	PIN NO.	TERMINAL	FUNCTION	REMARK
R F SECTION		RF INPUT	RF SIGNAL INPUT TERMINAL	
		RF OUTPUT	RF SIGNAL OUTPUT TERMINAL	
	1	A I	AUDIO INPUT	
	2	C H	CHANNEL CONTROL(OPEN:3CH,GND:4CH)	
	3	B +	POWER SUPPLY TERMINAL	5V DC
	4	CONTROL	VIDEO /TV CONTROL TERMINAL	
	5	V I	VIDEO SIGNAL INPUT	
TUNER / PIF SECTION	6	N.C	—	
	7	N.C	—	
	8	SAS	ADDRESS TERMINAL	
	9	SCL	PLL CLOCK SUPPLY TERMINAL	
	10	SDA	PLL DATA SUPPLY TERMINAL	
	11	AFT	AFT OUTPUT TERMINAL	
	12	A0	AUDIO OUTPUT TERMINAL	
	13	SIF	SIF OUTPUT TERMINAL	
	14	BT	TUNING VOLTAGE POWER SUPPLY TERMINAL	33V DC
	15	N.C	—	
	16	V0	VIDEO OUTPUT TERMINAL	

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11) SEMICONDUCTOR USED

ITEM	FUNCTION		Q'TY	NAME OF SEMICONDUCTOR	REMARK
R F SECTION	I C		1	LA77000V	
	S/W TRANSISTOR		2	BF799W	
	S/W DIODE		1	KDS114E	
TUNER SECTION	MOPLL IC		1	TDA6503ATS	
	VVC DIODE		11	BB153,BB149	
	RF AMP	VHF	1	TBB1002	
		UHF	1	BF909WR	
PIF SECTION	I C		1	LA75676V	
	VIDEO OUTPUT BUFFER		1	STC4081G	
	FILTER	SAW-FILTER	1	M1865D	
		C - TRAP	1	TPS4.5MB, XT4.5MB	
		C - FILTER	1	SFSH4.5MDB, LT4.5MH	

12) CURRENT CONSUMPTION & SUPPLY VOLTAGE

TERMINAL		STANDARD SUPPLY VOLTAGE(V)	CURRENT CONSUMPTION(mA)			GURANTEE VOL.RATINS
			MIN.	TYP.	MAX.	
MOD.	MB	5 ± 0.1V DC	-	50	55	4.8 ~ 5.2 V
	CON.	5 ± 0.1V DC	-	0.047	0.173	4.8 ~ 5.2 V
TUNER AND PIF	BT	33 ± 0.1V DC	-	2.5	5	30 ~ 34 V
	BP	5V ± 0.1V DC	115	140	165	4.8 ~ 5.2 V

13) PLL DATA FORMAT

13-1) Description of Tuner PLL Block

The PLL on this IC supports the IIC bus control format.

The control pins are as shown in the table below.

ref) ADSW(Address selection), SCL(SCL input), SDA(SDA I/O)

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13-2) INPUT SIGNAL LEVEL(SCL,SDA)

HIGH -LEVEL INPUT VOLTAGE : 3.0V MIN.

LOW -LEVEL INPUT VOLTAGE : 1.5V MAX.

13-3) X-TAL FREQUENCY : 4MHz

STEP SIZE IS CHANGED BY REFERENCE DIVIDER.

13-4) Address Setting

The response address can be changed according to the ADSW pin voltage, so that multiple PLL can exist within one system.

ADSW pin voltage	MA1	MA0
0 to 0.1Vcc	0	0
Open or 0.2Vcc to 0.3Vcc	0	1
0.4Vcc to 0.6Vcc	1	0
0.9Vcc to Vcc	1	1

HEXA MODE = C2

13-5) Programming

The VCO lock frequency is obtained according to the following formula.

$$f_{osc} = f_{ref} * 8 * (32M + S)$$

The variable frequency division range of M and S are as follows, and are set as binary.

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13-6) The TDA6503ATS control format is as follows

13-6-1) Write-mode

Byte Write Data	Byte	Bits									Remarks
		MSB							LSB		
Address byte	ADB	1	1	0	0	0	MA1	MA0	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	0	0	0	*	0	1	0	A	
band SW byte	BB	X	X	X	X	PUHF	X	PVHFH	PVHFL	A	

13-6-2) Read-mode : Slave Transmitter

Mode	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	
Address byte	1	1	0	0	0	MA1	MA0	1	A
Status byte	POR	FL	R	1	1	A2	A1	A0	A

13-6-3) Description of symbols used in table

SYMBOL	DESCRIPTION			
A	Acknowledge bit			
MA1,MA0	programmable address bits (MA1=0 ,MA0=1) ref: 13-4)			
N14 to N0	programmable divider bits			
CP	charge pump current bit(output current) logic 0 : charge pump current is 60μA logic 1 : charge pump current is 280μA(default)			
OS	tuning amplifier control bits logic 0 : tuning voltage is 'on' (during normal operating) logic 1 : tuning voltage is 'off';high impedance output of pin VT(default)			
PVHFL,PVHFH,PUHF and FMST	PMOS ports control bis: logic 0 : corresponding buffer is 'off'(default) logic 1 : corresponding buffer is 'on'			
X	don't care : may be a logic 0 or a logic 1.			
RSA and RSB	Reference Divider ratio select bits			
	RSA	RSB	Divider	FREQUENCY STEP(KHz)
	X	0	80	50
	0	1	128(1024)	31.25
	1	1	64	62.5
POR	power-on reset flag: logic 0 : at power off logic 1 : at power on			
FL	in-lock flag : logic 0 : loop is not locked logic 1 : loop is locked			
R	ready flag: logic 0 : mode after power-on reset and the PLL is locked logic 1 : in other conditions			
A2,A1 and A0	digital outputs of the 5-level ADC			

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2.ELECTRICAL CHARACTERISTICS

2-1.RF SECTION PERFORMANCE

2-1-1.VIDEO CHARACTERISTICS

ITEM	SPECIFICATION			UNIT	REMARK
	MIN.	TYP.	MAX.		
Video Modulation	72	80	88	%	Input signal:1Vp-p white stair step or ramp
Video Limiter Modulation	87	93	99	%	Input signal:1.5Vp-p stair step or ramp
V/S Ratio	10:3.8	10:4	10:4.1		Input signal:1Vp-p white V:S = 10:4
Video Amplitude Frequency Characteristics	-3.0	-0.5	+3.0	dB	Measure range:0.1MHz~4.2MHz Based on 1MHz Audio input signal:None
Differential Gain(DG)	-7	+2	+7	%	Input signal:1.0Vp-p stair step Video Mod. : 80% Luminance :10~90%
Differential Phase(DP)	-7	+1.5	+7	deg	Input signal:1.0Vp-p stair step Video Mod. : 80% Luminance :10~90%
Video S/N	45	47	-	dB	Measurement Conditions -Standard De-modulator. -S/N Meter H.P.F:100KHz, L.P.F:4.2MHz SC trap:ON, Weight:OFF *Input signal Video:100% White signal Audio:None Video band:0.1~4.2MHz
Chroma Beat	58	65		dB	Input signal Video:0.4Vp-p,3.58MHz, Sine wave Audio:None

2-1-2. SOUND CHARACTERISTICS

ITEM	SPECIFICATION			UNIT	REMARK
	MIN.	TYP.	MAX.		
Audio Modulation	64	80	96	%	Input signal:1.1Vp-p Sine wave 1KHz (100% Mod.=± 25KHzp-p dev.)
Audio Maximum Modulation	150				Input signal : 1KHz, Sine wave
Audio Amplitude Frequency Characteristics	-3	+0.2 -0.6	+3	dB	Input signal:1.1Vp-p Sine wave Measure range:50Hz~10KHz Based on 1KHz
Audio Distortion		0.3	2.0	%	Input signal: 1.1Vp-p,1KHz De-emphasis :0N(75usec)
Audio S/N	48	-	-	dB	Video input signal :Black burst Reference audio input signal :1.1Vp-p,1KHz,Sine wave

2-1-3. OUTPUT CHARACTERISTICS

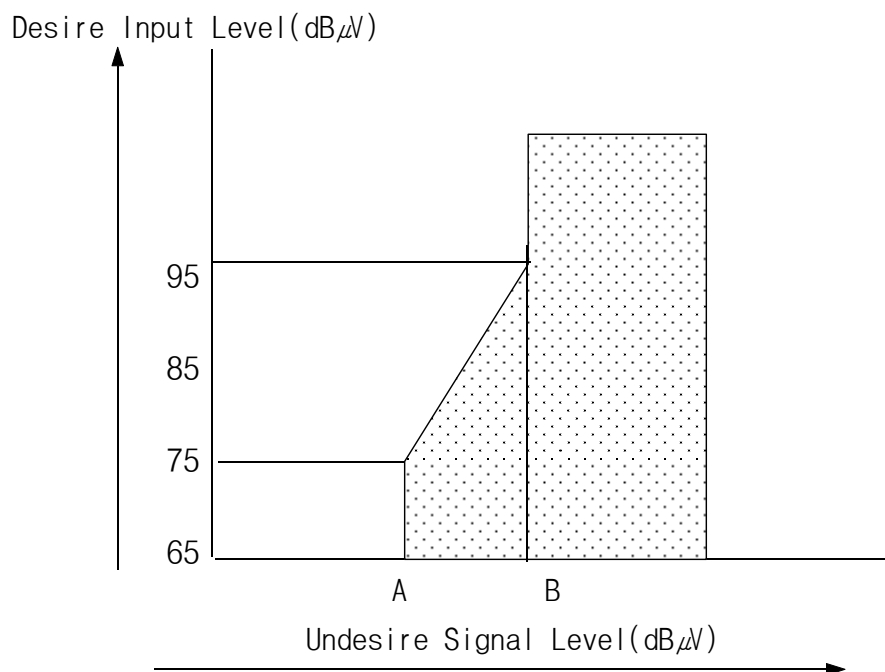
ITEM	SPECIFICATION			UNIT	REMARK
	MIN.	TYP.	MAX.		
Video Carrier	-80	Fp	+80	KHz	Video input signal:None
Sound Carrier	-7	Fs	+7	KHz	Audio input signal:None
Outband spurious	30	-		dB	FCC Standard Precedure Measure range:0~1GHz
Inband spurious	60	-	-	dB	Input signal Video:None Audio:None Measure range:Fp ~ +4.5MHz
Video Carrier Output Level	63	66	69	dB μ V	
P/S Ratio	13	16	19	dB	Audio input signal:None

2-1-4. ANTENNA CHARACTERISTICS

ITEM	SPECIFICATION			UNIT	REMARK
	MIN.	TYP.	MAX.		
Insertion Loss	-	-	7.0	dB	ANT IN to ANT OUT Mode:TV (at MOD. OFF)
VSWR			3		ANT OUT Terminal Mode:TV (at MOD. OFF) 54~810MHz Mode:VCR(at MOD. ON) 61~ 72MHz
Isolation	60	-	-	dB	Isolation from ANT OUT to ANT IN:Mode-VCR(at MOD. ON) 61~72MHz
ANT. IN Leakage		5	9.5	dB μ V	Mode:VCR (at MOD. ON) 0~1GHz ANTENA-OUT 75 Ω Loaded Applied for FCC

2-2. TUNER SECTION

ITEM	SPECIFICATION			UNIT	REMARK
	MIN.	TYP.	MAX.		
IF Rejection					
UHF	60	90	—	dB	GR = 0dB (75Ω terminate) GR:Gain Reduction
VHF High	60	90	—		
VHF Low	55	80	—		
UHF	40	65	—		
VHF High	50	75	—		
VHF Low	45	70	—		
Image Rejection					
UHF	50	60	—	dB	GR = 0dB (75Ω terminate) GR:Gain Reduction
VHF W+11~J	50	70	—		
13~2	60	75	—		
UHF	40	55	—		
VHF W+11~J	45	60	—		
13~2	50	65	—		
CH 6 Beat	50			dB	ANT INPUT Des:60dB(μV), (75Ω terminate) Und:54dB(μV), (75Ω terminate)
CH A-5 Beat	50			dB	ANT INPUT Des:54dB(μV), (75Ω terminate)
CB Rejection	0.535MHz ~ 30MHz -7dBm Min.				Desire:55.25MHz~83.25MHz (CH2 ~ CH6) -66dBm s/i=40dB
Available Input signal level	90	100		dB μV	Distortion is nothing on normal condition.

1% Cross
Modulation

CH	A (dB μ V)	B (dB μ V)
UHF	≥ 64	≥ 84
VHF	≥ 64	≥ 84

Cross modulation value should be within hatched area.

A = GR = 0dB

B = GR = 30dB

※ Tuner should be measured for 1% cross modulation with ± 2 channel undesired signal.

Over Range

CH	OSC Fre.	MIN.	TYP.	MAX.	UNIT	
UHF	High-end	+1			MHz	
	Low -end	-2				
V High	High-end	+1				
	Low -end	-2				
V Low	High-end	+2				
	Low -end	-2				

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Noise Figure	CH	MIN.	TYP.	MAX.	UNIT
	VHF			12.5	dB
	CATV			12.5	
	UHF			14	
Lock-up time (Tuning searching time)		Band low ch.<->high ch.		UNIT	REMARK
	VHF	100(typ.)		ms	CP = 0 (Charge pump current=± 50μA)
	CATV	100(typ.)			
	UHF	100(typ.)			
ANT Local Radiation	Applied for FCC			When Tuner will be mounted in standard set box,field strength local oscillator should be measured. (Measurement distance:3m)	
	MIN.	TYP.	MAX.	UNIT	
Accuracy of Oscillator	-80		+80	KHz	

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2-3. IF SECTION

When test the electrical characteristics, Fp input level is 70dB μ V,
P/S=-7dB, unless otherwise specified.

ITEM	SPECIFICATION			UNIT	REMARK
	MIN.	TYP.	MAX.		
Video S/N					100% white signal. 87.5% modulation. Subcarrier trap:0N HPF:100KHz, LPF:4.2MHz ANT input level VHF:70dB μ V, UHF:70dB μ V (75 Ω terminate)
VHF	44	46		dB	
UHF	44	45			
Video Noise Limit Sensitivity					100% white signal. 87.5% modulation. Subcarrier trap:0N HPF:100KHz, LPF:4.2MHz Video S/N=30dB
VHF			48	dB μ V	
UHF			48		
Video Output Level	0.8	1.0	1.2	Vp-p	Standard color bar:87.5% mod.
Sync Ratio	23.6	28	33.6	%	Standard color bar:87.5% mod. V+S=100%
Color Burst Level	220	270	320	mV	Input Level : 70dB μ V Standard color bar:87.5% mod.

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ITEM	SPECIFICATION			UNIT	REMARK
	MIN.	TYP.	MAX.		
Video Amplitude Frequency Characteristics					Multi-burst Signal:87.5% mod.
1.0 MHz	-3	-1	2	dB	0.5MHz standard
2.0 MHz	-3	-1	2		
3.0 MHz	-4	-1	2.5		
3.58MHz	-4	-2	2		
Sin ² 2T Pulse Response	80	90		%	Sin ² 2T Pulse & bar:87.5% mod.
Differential Gain		4	8	%	5 stair step:87.5% mod. Set modulation at the peak of 5th chroma signal.
Differential Phase		4	8	deg	5 stair step:87.5% mod. Set modulation at the peak of 5th chroma signal.
Y/C Delay time	-200	-50	100	nSec	Input Sin ² 2T Pulse & Bar. Use VM700A(Tektronix)
Chroma S/N					100% Chroma signal(RED) 87.5% modulation. Subcarrier trap:OFF HPF:100Hz, LPF:500KHz Ant input level VHF:70dB μ V, UHF:70dB μ V (75 Ω terminate)
AM	47	52		dB	
PM	46	51			
Audio Output Level	400	500	600	mV rms	1KHz/± 25KHz Dev.(100%) Standard color bar:87.5% mod. De-emphasis:0N (ref: figure A of page 16)
Audio Distortion [CH:11]		0.5	3	%	1KHz/± 25KHz Dev.(100%) Standard color bar:87.5% mod. De-emphasis:0N (ref: figure A of page 16)

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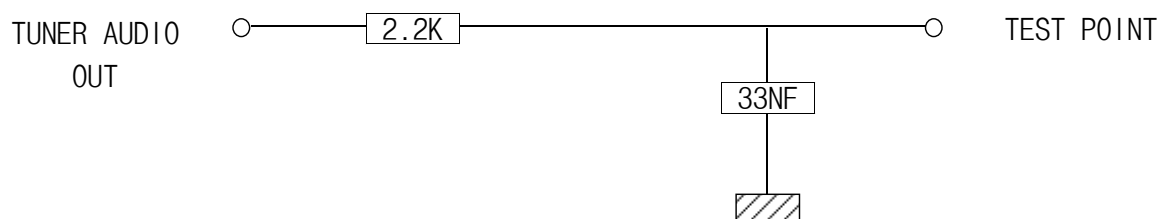
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ITEM	SPECIFICATION			UNIT	REMARK
	MIN.	TYP.	MAX.		
Audio Frequency 50 Hz 10KHz	-3 -3	0 0	3 3	dB	50Hz~10KHz 1KHz/± 15KHz Standard Standard color bar:87.5% De-emphasis:ON (ref: figure A of page 16)
Audio S/N	45	48		dB	1KHz/± 25KHz Dev. Standard color bar:87.5% mod. use 30KHz filter De-emphasis:ON (ref: figure A of page 16)
Audio Buzz		40	100	mV(p-p)	Standard color bar:87.5% mod. Ant input level:70dB(μV) P/S=-10dB De-emphasis:ON (ref: figure A of page 16)
AFT Alignment Accuracy	-50	0	50	KHz	Alignment center:2.5V RF input level:70dB(μV) P/S=-7dB Standard color bar:87.5% mod. Testing channel:11CH
920KHz Beat	40	48		dB	11CH,100dB(μV)(75 Ω term.) P/S=-7dB Video:100% Chroma(RED) $S/i = \frac{3.58MHz\ signal\ level}{920KHz\ beat\ level}$ *Check at Video output terminal

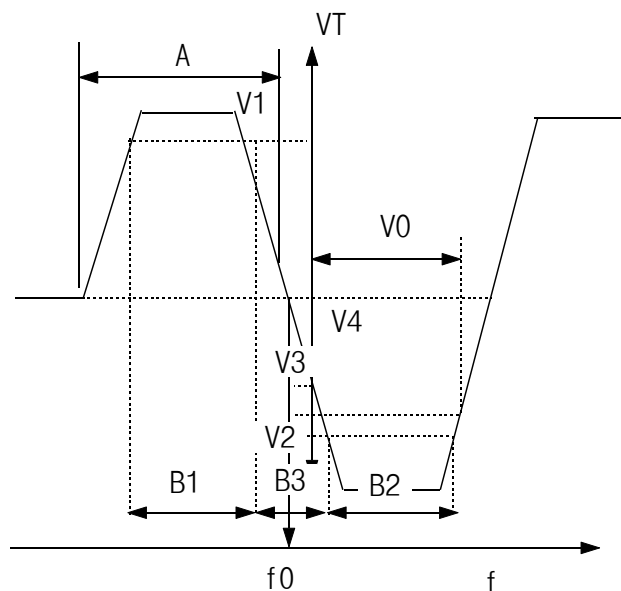
ITEM	SPECIFICATION			UNIT	REMARK
	MIN.	TYP.	MAX.		
Side CH. Rejection	30	37		dB	11CH, 70dB(μV)(75 Ω term.) P/S=-7dB $S/i = \frac{500KHz\ 0.25V\ level}{Side\ CH\ signal\ level}$ *Check at Video output terminal
Side CH. Rejection	25	35		dB	11CH, 70dB(μV)(75 Ω term.) P/S=-7dB SG3: fp-1.5MHz 70dB(μV) $S/i = \frac{500KHz\ 0.25V\ level}{Side\ CH\ signal\ level}$ *Check at Video output terminal
4.5MHz Signal Leakage	40	48		dB	11CH, 100dB(μV)(75 Ω term.) P/S=-7dB Video: 100% Chroma(RED) $S/i = \frac{3.58MHz\ signal\ level}{4.5MHz\ beat\ level}$ *Check at Video output terminal
SIF LEVEL (4.5MHz)	50	60		dB μV	Standard color bar: 87.5% mod. Ant input level: 70dB(μV) P/S=-7dB

「 Figure A 」



[De-emphasis circuits for Test (Audio)

"S"
Characteristics
Curve [CH:11]



	Modulation 87.5% Color bar
V1:High level voltage	more than 4.0V
V2:Low level voltage	less than 1.5V
B1:Width of high level	more than 600KHz
B2:Width of low level	more than 300KHz
B3:Width of "S"curve slope	10KHz/V typ.(at 0.3~0.9Vcc)
V3:Center frequency	2.5V ↓
V4:Center - 1step	2.8V ↑

Testing Channel : 11CH.

3.ENVIRONMENT TEST

ITEM	SPECIFICATION		TEST CONDITION
	TUNER	IF	
Heat Load Test	OSC frequency UHF: $\pm 2.0\text{MHz}$ VHF: $\pm 2.5\text{MHz}$		1.Initial value measure at standard test condition. 2.Leave samples in $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 96 ± 5 hours, and in standard test condition for 30 minutes, then take measurements within 1 hours. 3.Supply voltage : Standard $\pm 10\%$ 4.Supply voltage cycle : 1.5H ON, 0.5H OFF
Humidity Load Test		*VIDEO S/N $\pm 6\text{dB}$ *VIDEO OUTPUT LEVEL $\pm 0.2\text{Vp-p}$ *NOISE LIMIT SENSITIVITY $\pm 6\text{dB}$	1.Leave samples in $40^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 24 ± 2 hours, and in standard test condition for 30 minutes, then take measurements 2.Leave samples in $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for $96 \pm 5\%$ RH hours, for 96 ± 5 hours, and in standard test condition for 30 minutes then take measurement within 1 hours. 3.Supply voltage : Standard $\pm 10\%$ 4.Supply voltage cycle : 1.5 hours ON , 0.5 hours OFF
Cold Test		*AUDIO OUTPUT LEVEL $\pm 30\% \text{ MAX}$	1.Initial value measure at standard test condition. 2.Leave samples in $-20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 96 ± 5 hours, and in standard test condition for 2 hours, then take measurements within 1 hours.
Vibration Test			1.Vibration test fixture is used to vibrate the tuner with a total amplitude of 1mm and frequency ranging from 10 to 55Hz, once per minute consecutively, for 40 minutes in each of three directions X, Y and Z.

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ITEM	SPECIFICATION		TEST CONDITION
	TUNER	IF	
Operating Life Test	OSC frequency	*VIDEO S/N $\pm 6\text{dB}$	1.Take measurements in standard test condition. 2.Leave samples for 1000 hours, then take measurements. 3.Supply voltage : Standard
Impact Test		*VIDEO OUTPUT LEVEL $\pm 0.2\text{Vp-p}$	1.Impact acceleration : 50 m/s^2 2.Impact time : 11msec 3.Impact direction : 6 sides per each direction
High Test (Static Electricity Test)		*NOISE LIMIT SENSITIVITY $\pm 6\text{dB}$ *AUDIO OUTPUT LEVEL $\pm 30\% \text{ MAX}$	5KV~20KV, 3 times(150pF charged) series R = 330ohm Terminal: Between RF-IN,RF-OUT & GND Standard pulse at 5KV~20KV

