

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD



## Introduction

The VM5000 and VM700T are parallel automatic test sets for different applications. The VM700T is a precision measurement set for standard definition video formats in a transmission environment. The VM5000 is a precision multi-format component analog measurement set developed for the high-end consumer product development engineering bench and production line Quality Control. Both instruments automate the otherwise time consuming task of instrument setup and provide repeatable, documented measurements.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note



► Figure 1. VM700T.

## VM700T:

The VM700T has become the industry-standard for standard definition automatic video measurement. It is designed to measure composite NTSC (525/59.94) and PAL (625/50) interlaced single-wire composite video transmission format signals and the three-wire studio RGB and YpbPr component variants of those line rates. Line/Field rate and composite/component options must be selected for the VM700T to operate in any of the formats:

## VM700T Standard Definition Composite Formats:

Option 1	NTSC 525/59.94	interlaced	composite
Option 11	PAL 625/50	interlaced	composite

## VM700T Standard Definition Analog Component Formats:

Options 1, 30	480i60 YpbPr	interlaced component	YPbPr
Options 1, 30	480i60 RGB	interlaced component	RGB
Options 11, 30	576i50 YpbPr	interlaced component	YPbPr
Options 11, 30	576i50 RGB	interlaced component	RGB

► **Table 1.** Composite and Analog Component formats measured by the VM700T Video Measurement Set.

Additionally, the VM700T may be configured with options for standard definition serial digital component video, audio, teletext, and a number of related measurement applications. The VM700T is a dedicated instrument that may be configured to run automatic measurement routines. It will generate a full report to a printer port to document the performance of a device-under-test being fed an industry standard test signal.



► **Figure 2.** VM5000.

### VM5000:

The VM5000 carries on the tradition of the VM700T, extending video measurements to the high definition component analog formats used in broadcast and home entertainment video products. The VM5000 option SD and HD measures:

#### VM5000 Standard Definition Interlaced Analog Component Formats:

480i60 YPbPr	interlaced	Color Difference
480i60 RGB	interlaced	RGB
576i50 YPbPr	interlaced	Color Difference
576i50 RGB	interlaced	RGB

#### VM5000 Progressive & High Definition Analog Component Formats:

480p60 YPbPr	progressive	color difference
480p60 RGB	progressive	RGB
576p50 YPbPr	progressive	color difference
576p50 RGB	progressive	RGB
720p50 YPbPr	progressive	color difference
720p50 RGB	progressive	RGB
720p60 YPbPr	progressive	color difference
720p60 RGB	progressive	RGB

1080i50 YPbPr	interlaced	color difference
1080i50 RGB	interlaced	RGB
1080i60 YPbPr	interlaced	color difference
1080i60 RGB	interlaced	RGB
1080p24 YPbPr	progressive	color difference
1080p24 RGB	progressive	RGB

► **Table 2.** Analog component formats measured by the VM5000 Video Measurement Set.

The VM5000 is based on Tektronix' extended Digital Phosphor (DPX™) oscilloscope technology. This platform provides the wide bandwidth measurement accuracy necessary to measure today's high definition video rates, and the flexibility to support the many parameters and variations found in consumer video products. This platform, which runs on the Windows 2000™ operating system, also provides the GPIB and TCP/IP interconnectivity necessary for integration into modern manufacturing lines.

Development of the VM5000 on this high volume platform provides a number of key advantages. From the ground, up, this is a measurement instrument. The Windows™ operating system provides connectivity for printing, networking, and data exchange, and application development environments such as JAVA are universally supported. The Windows™ operator interface is familiar to design and manufacturing engineers, easing their workflow. A large touch screen color display allows full functionality with or without a mouse and keyboard, while keeping the size and weight of the instrument quite reasonable. This Windows™ platform provides a familiar interface in normal operations and the operating system's flexibility is a clear advantage when integrating the measurement system into a manufacturing or engineering development environment.

## Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

### Operational comparison:

#### VM700T

Upon first power-up, the VM700T initializes to a factory default state, for example to a waveform display of NTSC line 17, depending on the installed option. The desired measurement is then quickly set up through a series of menus using the control knob, buttons, and touch screen. A correct test signal for the desired measurement must be used for the measurement. While proprietary, the VM700T's operating system is quite robust and familiar to experienced operators.

#### VM5000

A new user, familiar with Windows™, will find VM5000 very intuitive. Upon power-up, the VM5000 loads the Windows™ operating system, and then automatically loads the Tektronix oscilloscope application. The VM5000 measurement application is then selected by the operator and comes up configured for most recent measurement parameters.

The VM5000 application sets up and efficiently operates the oscilloscope much as would an expert operator given unlimited time. The operator selects the desired format and set of measurements, and the application takes over from there, using intelligent algorithms to determine if a suitable test signal is present and reporting measurement success in numeric and PASS/FAIL terms. Results are tested to limits developed by the user for the device under test and reported in magnitude relative to a desired reference. Default Reference and Limit files are provided with the instrument, and the user may easily set up device specific Reference and Limit files appropriate for use across all test systems in a production line for consistent Quality Control.

Selection of any of eighteen available formats (nine SD or HD Line/Field rates, each in RGB or YPbPr color space) automatically sets all measurement parameters for default values in that format. Special setups can be easily saved and recalled just as easily, providing a measurement setup specific to the requirements of a production line. This feature is also valuable to the development or production line engineer allowing a quick recall of specific setup for comparison or evaluation purposes.

Averaging and auto scale modes are available to improve the precision and range of the measurement as the signal degrades through the device under test. On the engineering bench, this provides a view of performance vs. design target with signal processes that push the state of the art in terms of perceptual degradations. In a manufacturing environment, measurement automation and speed might be favored in the testing of high volume consumer devices. A full set of measurements for any format, with averaging and auto scale turned off, is completed in approximately 12 seconds. Measurement PASS-FAIL results related to user-selectable limits, announced by an easily visible green or red flag, and individual parameters may be quickly evaluated to determine measured values.

Operational aids include a color picture display to read the device-under-test's on screen menus; a vectorscope display for quick confirmation of correct color space and cable hookup; and a noise-spectrum display to identify any coherent interfering signals. A convenient report utility is provided to document the signal under evaluation in universal cross-platform formats.

### VM700T and VM5000 comparison

For either instrument, the number of operator steps from power up to operation is kept to a practical minimum. While the wider selection of formats in the VM5000 permits additional flexibility vs. a single format setup in the VM700T, the added capability of operating the VM5000 under automatic GPIB or TCP/IP control (possibly along with automatic reconfiguration of the device under test) allows testing of DUT parameters and formats that might otherwise be unreasonably complex for manual measurement.

As measurements are being made, the signal waveform is displayed in the application window. When measuring a single parameter, results are presented alongside an updated waveform of the signal line being measured, providing a quick, sure confirmation of the signal element under test. The engineer will appreciate that the oscilloscope application may be accessed at any time, fully set up for the signal currently measured in the VM5000 application. The VM5000 application may then be restored at the conclusion of oscilloscope operation by simply clicking on an icon.

**Feature comparison:**

Physical Characteristic	VM700T	VM5000
Size/Weight	222-483-556mm HWD/20 kg.	361-447-288mm HWD/11.23 kg.
Display	8" Raster CRT	10.4" Color LCD, 640x480 pixels
Operating System	Tektronix Embedded	Windows 2000™, 2 GHz processor, 80 GB HD, CD-RW
Communications	(2) Serial Ports, GPIB ports optional	Serial, USB, TCP-IP LAN, and GPIB ports standard
Operator Interface	Touch screen, buttons, knob	Touch screen, mouse, keyboard, plus full oscilloscope front panel
Other Applications available	Options for standard definition serial digital video	Fully functional 1-GHz DPX™ Oscilloscope

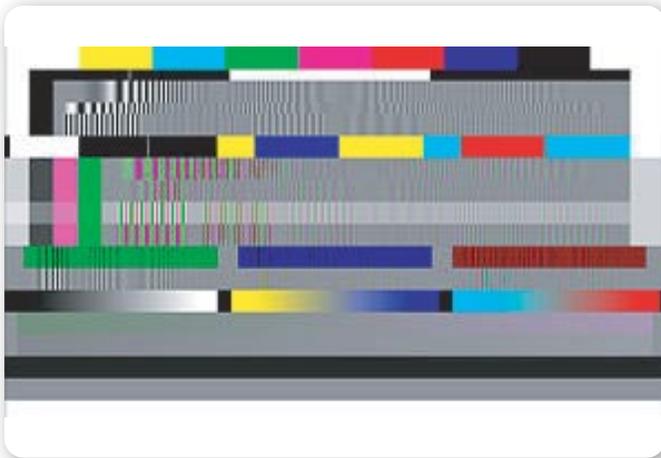
**Performance comparison:**

	VM700T	VM5000
Video Formats	Standard Definition NTSC or PAL Composite and 525/625 Component Analog format options. Option for Serial Digital Component	18 Standard and High Definition Component Analog YPbPr and RGB formats
Component Analog Video Measurements	Channel Delay Color Bars Frequency Response Multiburst Noise, Noise Spectrum Non-Linearity Short Time Distortion, K2T Sync	Channel Delay Color Bars Frequency Response Multiburst Noise, Noise Spectrum Non-Linearity Short Time Distortion, K2T Sync, Line Time
Transmitter Measurements	Intercarrier Phase Modulation Bounce	
Composite Analog Video Measurements	Burst Frequency Chroma/Luma Gain & Delay Chrominance AM/PM Chrominance Freq Response Chrominance Non-Linearity DG/DP Group Delay, Sin x/x	Analog Component only.
Measurement accuracy	32x Averaging mode available	User settable averaging mode available
Measurement speed	Full set with DUT, 525i60 YPbPr Matrix, programmed or manual.	Full set with DUT, 480i60 YPbPr Matrix, approx. 12 Seconds.
Test signal requirements	Full Field or Tektronix Matrix Test Signals	Full Field or Tektronix Matrix Test Signals
Report/alerts	On-screen and printed reports via serial, network, or GPIB interface. Contact Closure alarm port	On-screen and printed reports via network, GPIB, or Windows™ interface. Color changes for out-of-limits. Stop-on-Fail options.

► **Table 3.** A full set of comparative measurements, taken with the VM700T and with the VM5000, in standard definition, analog component formats common to both platforms, is provided in the appendix of this application note.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note



► Figure 3. Tektronix Matrix Test Signal.

## Tektronix Matrix Test Signal

The VM5000 measures both full field and matrix test signals. For fully automatic, production line operations, Tektronix supplies a special matrix of test signals in each of eighteen SD and HD analog component formats that facilitates a suite of standard measurements without having to change the signal source. These matrix test signals, described in the table below, are supplied as .dnl files suitable for download into a Tektronix TG700 TV Signal Generator Platform for output as analog or SDI test signals.

TG700 Tektronix Matrix Signal Line Numbers									
This table is provided AS IS without warranty of any kind, and is intended to be used as a template only. WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPLICITLY DISCLAIMED.									
Copyright 2004 Tektronix. Permission to use and create derivatives in conjunction with VM5000 family products hereby granted. All other rights reserved.									
					720p60 RGB	1080i60 RGB			
					720p60 YPbPr	1080i60 YPbPr			
	480i60 RGB	480p60 RGB	576i50 RGB	576p50 RGB	720p50 RGB	1080i50 RGB	1080p24 RGB	Measurement:	
Test Signal	480i60 YPbPr	480p60 YPbPr	576i50 YPbPr	576p50 YPbPr	720p50 YPbPr	1080i50 YPbPr	1080p24 YPbPr	YPbPr Formats	RGB Formats
Interlaced Field	odd	na	1	na	na	1	na		
Color Bars	21-36	43-74	24-39	45-76	26-89	21-52	42-105	Color Bars	Color Bars
2T Pulse & Bar	37-44	75-90	40-55	77-108	90-121	53-68	106-137		Short Time Dist.
Sweep (RGB F flat)	45-52	91-106	56-71	109-140	122-153	69-100	138-201		Freq Response
Sweep (RGB T flat)	53-60	107-122	72-87	141-172	154-185	101-116	202-233		Channel Delay
Multiburst (RGB Full)	61-68	123-138	88-103	173-204	186-217	117-148	234-297		Multiburst
Mixed 2T Pulse & Bar, RGB	69-84	139-170	104-119	205-236	218-249	149-180	298-361	Short Time Dist.	
Sweep (YPbPr Half BW)	85-100	171-202	120-135	237-268	250-281	181-212	362-425	Channel Delay	
Sweep (YPbPr Full BW)	101-116	203-234	136-151	269-300	282-313	213-244	426-489	Freq Response	
Multiburst (YPbPr Mixed BW)	116-132	235-266	152-167	301-332	314-377	245-276	490-553	Multiburst	
Multiburst (YPbPr Half BW)	133-148	267-298	168-183	333-364	378-441	277-308	554-617		
Sweep Parade (RGB)	149-164	299-330	184-199	365-396	442-473	309-340	618-681		
Sweep Parade (YPbPr)	165-180	331-362	200-215	397-428	474-505	341-372	682-745		
Valid Ramps	181-196	363-394	216-231	429-460	506-569	373-404	746-809	Non-Linearity	Non-Linearity
Shallow Ramp (RGB)	197-212	395-426	232-247	461-492	570-601	405-436	810-873		
Shallow Ramp (YPbPr)	213-220	427-442	248-263	493-524	602-633	437-468	874-937		
7.5% Luminance Pedestal	221-236	443-474	264-279	525-556	634-659	469-500	938-1001	Noise, Sync	Noise, Sync
50% Luminance Pedestal	237-244	475-490	280-295	557-588	660-697	501-532	1002-1065		
100% Luminance Pedestal	245-262	491-525	296-310	589-620	698-745	533-560	1066-1121		
NOTES:	1	2	1	2		1			
1. Test signals repeat on alternate fields of interlaced formats.									
2. Test signals for 480p and 576p are band limited by the AVG7 module to 8 MHz.									

► Figure 4. TG700 Tektronix Matrix Signal Line Numbers.

Channel	Color Error	Pass/Fail
Color Error	0.00	PASS
Hue	0.00	PASS
Sat	0.00	PASS
Luma	0.00	PASS
Chroma	0.00	PASS
Blue	0.00	PASS
Green	0.00	PASS
Red	0.00	PASS

a. RTF format

Measurement	Minimum	Maximum	Success	Reference	Relative (uV)	Relative (%)
White	695.36	665	725	PASS	700	0.58
Yellow	457.89	457	485.50	PASS	465.5	-0.07
Cyan	509.41	525.64	576.26	PASS	553.7	-0.27
Green	489.24	476.57	525.52	PASS	508.4	-0.56
Magenta	488.08	488.41	488.37	PASS	488.4	0.00
Red	488.08	487.96	488.00	PASS	488.0	0.00
Blue	38.52	47.3	53.3	PASS	48.5	-0.29
Black	0.00	0	0	PASS	0	0.00

b. CSV format

▶ Figure 5. RTF format and CSV format.

The Tektronix Matrix test signal is also supplied on DVD for testing DVD playback devices, and in ATSC program stream formats for testing consumer players and set top boxes. The ATSC program streams are .trp files adjusted for efficient playback in 480i60, 480p60, 720p60, 1080i60, and 1080p formats. A table of line numbers is provided for each .trp file indicating the typical line number range that will be delivered by a representative device under test that converts to other formats. Display of the test signal in single measurement mode provides easy confirmation that the signal line number in the matrix appropriate for the test is available from the DUT.

**Test Documentation:**

The VM5000 provides a report of the measurements made in each video format. Report files are standard Windows™ files in RTF, PDF, or CSV in a traditional VM5000 HD or enhanced VM5000TV format. These report files may be used intact, edited into other documents, or transferred over a network.

RTF and PDF reports provide performance documentation in an easy to read PASS-FAIL format, and are of value in QC applications. In some cases, such reports may be shipped with the device under test as a certificate of calibration.

The enhanced VM5000TV format is a comma-separated-values (CSV) file that may be opened and further processed in EXCEL™ or Quattro Pro™. This format contains detailed information, including the state of the instrument, the line number used for each measurement, measured and target reference values, pass-fail limiting values, and relative values in measurement units and percent error. The CSV file provides a detailed history of each measurement set, and is extremely useful to the design or troubleshooting engineer.

The appendix provides several annotated examples of RTF format reports. Note that all tests indicate PASS or FAIL, and any warnings that were generated. In these examples, each report has been edited to manually to add in parens ( ) the VM700T measurements taken on a similar standard definition analog component signal.

**Summary and recommended application:**

The VM700T is the recommended automatic measurement set for standard definition analog composite and component digital signal performance documentation. It can be programmed to print a DUT output report via a local serial or GPIB connected printer.

The VM5000 is the recommended automatic measurement set for analog component video testing in any of the 18 component formats commonly associated with consumer electronics development and manufacturing. Any one format may be tested with a single command, and a printed report generated automatically. Under GPIB or TCP-IP network control, a script may be written to control both the test signal generator, and the VM5000, and perhaps the device under test, to run a full set of measurements automatically for all component analog formats.

## Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

### ► Application Note

#### Things to watch for when making precision video measurements:

*Cable lengths should be equal from the point of test to the point of measurement – any difference will affect the channel-to-channel delay measurement result.*

*Set up measurement system for optimum noise performance – By default, the VM5000 measurement set will expect sync on Channel 4 to allow auto ranging for best accuracy on measured channels 1, 2, and 3. A special test fixture is provided to optimize the noise measurement when sync is available only on channel 1.*

*Connect with the DUT using good 75-ohm cables and terminations – any mismatch will affect the frequency response measurement as the system becomes a 'tuned' circuit. Avoid tee connections and cable stubs.*

*Keep hookup cables short -- cables roll off in frequency response as they get longer.*

*Use good terminations-- most commercial terminators are OK as long as they are resistive and within about .25% of the correct value. In this range, any error will be indicated as a direct percentage of voltage. A greater deviation may cause noticeable reflections be seen to have an effect on frequency response vs. cable length.*

*Develop a reliable connection fixture -- BNC connectors are not made to be continually connected and disconnected. T's appear to be especially venerable and difficult to connect and disconnect in a production environment.*

*Use the appropriate Tektronix sync adapter to synchronize the VM5000 on channel 4. The VGA/RGB sync adapter, pn 012-1664-00, provides a bi-level TTL level sync from the H and V signals on the VGA connector. The Sync Pickoff adapter, pn 012-1680-00, for three wire signals with sync on Y or G, provides sync to channel 4 with a minimum disruption to frequency response, delay, and level, and allows autoscaling on channel 1 for noise measurement when the signal is a high signal-to-noise ratio.*

*Allow for cumulative specification buildup -- The signal source is not perfect. The measurement hardware is not perfect. Cables and connectors are not perfect. MPEG converters are not perfect. All exhibit some analog degradation that will affect measurement accuracy. Generally, the device under test will contribute a majority of any measurement deviation.*

*Minimize setup variables – Use instrument setup files (File/Save Setup) to capture special setups within a format, and the test set's GPIB capability to develop scripting to automatically run tests across multiple formats.*

*Expect MPEG to change the signal -- Test signals may be generated differently to minimize impact of pixel block boundaries. Conversion of signal formats by the DUT may result in different timings, rise times, blanking widths, and test signal frequencies. The DUT may not be band limited to avoid aliasing, or filters may have unexpected characteristics. MPEG instabilities are more likely to occur on the first few or last few lines of a test signal.*

## Developing your own Reference and Limits Files

Example Reference and Limits files are located in C:\VM5000TV\RefLimFiles\ directory and should be modified to suit the user's application. For example, in a production line test application, Limits files would be set to PASS good DUT's, but FAIL any DUT's outside QC limits.

Reference files have a filename like "DefaultReference 1080i60-YPbPr.csv", and are used to specify a nominal, target measurement value. When 'Relative Result Display' is enabled under the 'Reference & Limits' Configuration tab, the reference value will appear in any 'Results' tab measurement as 'Reference' values, and 'Relative' values will be any deviation of actual measured values from the Reference File values.

Limits files have a filename like "DefaultLimits 1080i60-YPbPr.csv", and are used to specify the trigger points for determination of PASS/FAIL status. When "Limit Testing" is enabled under the 'Reference & Limits' Configuration tab, any measured value outside the Limits File values will indicate in a red color on the individual Results Measurement screen, and the measurement will report as a FAIL on the Results Summary screen.

These are comma delimited (.csv) files in plain text and can be edited in Notepad. The application looks in the first column for an exact parameter name, and for comma-separated numeric values that follow on the same row. First the format is checked to determine that the correct file has been selected. Then the file setup is checked to determine if the file is a Reference (one number following) or Limit (two numbers following) file. To replace Limits or Reference files, simply copy over the old file. The new file will be automatically selected with the next change in measurement format, or may be manually loaded manually using Limits Selection or Reference Selection under the Reference & Limits tab under the Configuration menu.

## Instrument Setup Files

Instrument setup files are user generated files in the C:\VM5000 directory with the extension .vmset. This file is generated by naming and saving the current state of the instrument under File > Save Setup, and is edited by recalling the setup and re-saving it with any desired change. This file is not a plain text file and should not be modified except by the application.

The .vmset instrument setup file is useful when DUT parameters or desired operation differs from the default value for each format. For example, a setup would be saved for easy recall when the device under test changed measurement line numbers of the signal being used for a particular measurement. In addition to saving the format to be measured, and the operating parameters of the instrument, the .vmset files save information on which line numbers are associated with each measurement, measurement frequencies and locations, and which reference and limits files are to be used.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

## Appendix

Comparative measurement report examples for standard definition analog component formats:

The following reports are provided to illustrate comparable performance parameters recorded by VM5000TV and VM700T automatic measurement sets in the standard definition formats addressed by both units. Signals are from the same test generator or device under test, and measurement setups were as similar as practical. Measurement results variations are within specifications of the equipment used and under test.

These reports demonstrate the ease and convenience of having reports generated in a common, PC recognizable format. In these examples, the .rtf files produced by the VM5000 are directly editable in Microsoft™ WORD or other standard word processing programs.

### 480i60 (525/59.94) YPbPr Format: VM5000 Video Measurements Results Report

July 27, 2004 09:13 AM

Format: 480I/60 Color Space: YPbPr

Reference File: C:\VM5000TV\RefLimFiles\DefaultRef480i60-YPbPr.csv

Limit File: C:\VM5000TV\RefLimFiles\DefaultLim480i60-YPbPr.csv

Autoscale: On Trigger: Ch4 Stop On Limit Error: Off

SUMMARY:	Status	Warnings
Channel Delay	PASS	
Color Bars	PASS	
Frequency Response	PASS	
Multiburst	PASS	
Noise	PASS	
Non Linearity	PASS	
Short Time Distortion	PASS	
Sync	PASS	

► **VM700T notes:** The VM700T displays individual measurements with user adjustable limit lines and will generate an out-of-limits report.

### Channel Delay

Line = 93 Average = 1

	VM5000	VM700T
Y to Pb(nS)	2.792	-1
Y to Pr(nS)	-1.382	-1
Pb to Pr(nS)	1.791	

▶ **VM700T notes:** The VM700T measures Channel Delay using the green/magenta transition of the color bar signal. (The VM5000 compares times of a high frequency sweep signal. The VM700T finds Delay: B-Y at -1ns, and R-Y at -1ns (listed in the VM5000 report table above).

### Color Bars

Line = 29 Average = 1

Color	Y Level(mV)		Pb Level(mV)		Pr Level(mV)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
White	700.22	98.1ire=696.5mv	-0.09	0ire=0mv	-0.1	0ire=0mv
Yellow	623.0	86.9ire=620.5mv	-349.36	-48.9ire=-355.6mv	56.12	7.9ire=56.4mv
Cyan	492.73	68.8ire=509.1mv	115.84	16.5ire=117.81mv	-348.65	-49ire=-349.9mv
Green	412.87	57.5ire=425.5mv	-231.85	-32.5ire=-232.05mv	-292.91	-41.1ire=-293.5mv
Magenta	291.94	40.5ire=289mv	228.78	32.3ire=230.85mv	291.24	41.1ire=293.5mv
Red	211.24	29.4ire=209.9	-118.36	-16.6ire=-118.52mv	347.65	49ire=349.9mv
Blue	81.69	11.2ire=80mv	347.14	48.9ire=349.15mv	-56.6	-7.9ire=56.4mv
Black	1.13	0ire=0mv	0.12	0ire=0ire	0.14	0ire=0mv

▶ **VM700T notes:** The VM700T reports values as a graphic annotated in IRE for this format. VM700T values are manually converted to mv and added to the chart above.

### Frequency Response

Line = 109 Average = 1

Filter Bandwidth: 25.0 MHz

Channel	Y		Pb		Pr	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Freq Location(MHz)	2.0	2.005	2.0	2.024	2.0	1.996
Time Location(uS)	29.98	30.2us	29.98	30.5us	29.98	30.3us
Flag Amp(mV)	318.3	320mv	317.1	318mv	316.78	320mv
Amp(dB re flag)	-0.04dB	-0.8mv	0.0dB	-5.6mv	-0.01dB	-1.6mv
RMS Dist(% of amp)	0.0		0.0		0.0	

▶ **VM700T notes:** *Frequency Location(MHz)* can be measured manually, using the Multiburst measurement special positioning, and moving the packet indicating cursor, reducing the separation of the measurement cursors to provide a better resolution. Using this manual technique, the VM700T *Time Location(us)* can be estimated from the graphic display at about 30us for each of the three channels.

*Flag Amp(mV)* can be measured manually, using the composite waveform display mode, with the amplitude readout of the signal at the timing cursors.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

## Multiburst

Line = 125 Average = 1

Channel Burst	Y				Pb				Pr			
	Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Flag (mV)	---		317.94	44.8ire	---		318.8	44.7ire	---		319.2	44.7ire
Burst 1	1.0	.99	-0.02	-0.05	0.5	.49	-0.06	-.10	0.5	.49	-0.1	-.09
Burst 2	2.0	1.99	0.0	-0.09	1.01	.99	-0.08	-.07	1.01	1.0	-0.12	-.03
Burst 3	3.0	2.99	0.01	-0.04	1.53	1.49	-0.17	-.07	1.53	1.49	-0.19	-.04
Burst 4	4.01	3.99	0.0	-0.06	2.0	1.99	-0.05	-.06	2.0	1.99	-0.08	-.07
Burst 5	5.0	4.98	-0.02	-0.13	2.51	2.49	-0.05	-.05	2.51	2.49	-0.06	-.03
Burst 6	6.0	5.99	-0.03	-0.88	3.02	2.99	-0.07	-.03	3.02	2.99	-0.1	-.07

► **VM700T notes:** The VM700T produces a graphic display, with packet frequencies and amplitudes noted.

## Noise

Line = 229 Average = 1

Cursor (Hz): 675000

Filter: Unweighted, Bandwidth Selection = 6 MHz

Channel	Y		Pb		Pr	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
mV	0.05		0.06		0.06	
dB	83.13	-82.3	81.2	-82.2	81.64	-82.1
Cursor mV	0.0		0.0		0.0	
Cursor dB	-124.22		-132.81		-128.99	

► **VM700T notes:** The VM700T reports noise in dB rms, and provides a graph of noise in a user-selected channel. The VM5000 reports noise as an unsigned ratio to 700mv. The VM700T adds a negative sign to indicate the noise is below the signal. Cursor values above refer to noise at the cursor position in the VM5000 Noise Spectrum Display. A Similar display, with no cursor values is presented as a VM700T measurement screen.

## Non Linearity

Line = 189 Average = 1

Channel	Y (%)		Pb (%)		Pr (%)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Maximum	0.77	0.40	0.47	0.6	0.71	0.5
Step 1	0.77	0.10	0.0	0.3	0.24	0.2
Step 2	0.77	0.40	0.47	0.2	0.59	0.2
Step 3	0.0	0.20	0.06	0.6	0.71	0.5
Step 4	0.64	0.00	0.18	0.0	0.41	0.0
Step 5	0.71	0.30	0.3	0.2	0.0	0.2

► **VM700T notes:** The VM700T requires a step signal, with results reported in % of expected amplitude. Values are manually converted and reported as %err above. The VM5000 measurement uses a full amplitude ramp.

**Short Time Distortion**  
Line = 77 Average = 1

	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
<b>K2T</b>			0.62	0.2		
<b>Channel</b>	<b>Y</b>		<b>Pb</b>		<b>Pr</b>	
Rise(nS)	251.54	251.2	504.15	500.1	496.14	501
Fall(nS)	249.48	251.2	499.98	500.0	499.4	501
Overshoot(%)	0.61		0.57		0.57	
Undershoot(%)	0.68		0.39		0.5	
Settling Rise(nS)	0.0		0.0		0.0	
Settling Fall(nS)	0.0		0.0		0.0	

▶ **VM700T notes:** The VM700T K Factor measurement measures only K Factor. The VM700T measurement also reports pulse to bar ratio and half amplitude duration of the 2T pulse. These measurements may be taken manually using the VM5000 oscilloscope application. Rise and Fall time measurements are available in the set of composite measurements, taken separately for each channel. Overshoot, undershoot, and settling times are a part of the VM700T K Factor measurement.

**Sync**  
Line = 229 Average = 1

	VM5000	VM700T
Front Porch (nS)	1302.4	1320
Negative Sync Fall (nS)	142.26	137
Negative Sync Width (nS)	4700.8	4700
Sync Rise (nS)	152.71	151
Positive Sync Width (nS)	---	
Positive Sync Fall (nS)	---	
Back Porch (nS)	4302.4	4310
Line Time (nS)	63.57	
Start Active Video (nS)	9.0	9.01
End Active Video (nS)	62.27	
Front Porch Level (mV)	0.87	
Negative Sync Level (mV)	-298.71	42.0ire=299.88mv
Positive Sync Level (mV)	---	

▶ **VM700T notes:** The VM700T provides an annotated graphic of the horizontal blanking interval. Line times and front porch level are not provided. Additional sync timing are provided in a separate VM700T report and are included in the table above.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

480i60 (525/59.94) GBR Format:  
VM5000 Video Measurements Results Report

July 27, 2004 02:02 PM

Format: 480I/60 Color Space: RGB

Reference File: C:\VM5000TV\RefLimFiles\DefaultRef480i60-RGB.csv

Limit File: C:\VM5000TV\RefLimFiles\DefaultLim480i60-RGB.csv

Autoscale: On Trigger: Ch4 Stop On Limit Error: Off

SUMMARY:	Status	Warnings
Channel Delay	PASS	
Color Bars	PASS	
Frequency Response	PASS	
Multiburst	PASS	
Noise	PASS	
Non Linearity	PASS	
Short Time Distortion	PASS	
Sync	PASS	

► **VM700T notes:** The VM700T displays individual measurements with user adjustable limit lines and will generate an out-of-limits report.

## Channel Delay

Line = 57 Average = 1

	VM5000	VM700T
G to B(nS)	2.463	-1
G to R(nS)	-1.611	0
B to R(nS)	1.941	

► **VM700T notes:** The VM700T measures Channel Delay using the green/magenta transition of the color bar signal. The VM5000 compares times of a high frequency sweep signal. The VM700T finds Delay: B-Y at -1ns, and R-Y at 0ns in the VM5000 report table above.

## Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

▶ Application Note

### Color Bars

Line = 29 Average = 1

Color	G Level(mV)		B Level(mV)		R Level(mV)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
White	697.14		695.51	97.6ire=696.9mv	695.3	98ire=699.72mv
Yellow	698.97	98ire=699.72mv	2.05	0	695.87	98ire=699.72mv
Cyan	699.12	98ire=699.72mv	695.22	97.6ire=696.9mv	1.57	0
Green	699.51	98ire=699.72mv	2.31	0	0.6	0
Magenta	2.78	0	695.43	97.6ire=696.9mv	695.43	98ire=699.72mv
Red	1.25	0	2.4	0	696.44	98ire=699.72mv
Blue	1.14	0	695.64	97.6ire=696.9mv	1.96	0
Black	0.91	0	2.2	0	0.86	0

▶ **VM700T notes:** The VM700T reports values as a graphic annotated in IRE for the 525/60 format. VM700T values are manually converted to mv and added to the chart above.

### Frequency Response

Line = 49 Average = 1

Filter Bandwidth: 54.0 MHz

Channel	G		B		R	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Freq Location(MHz)	3.0	3.009	3.0	3.0	3.0	3.004
Time Location(uS)	33.51	33.5	33.47	33.5	33.43	33.5
Flag Amp(mV)	692.32	702.8	690.34	699.3	693.6	702.8
Amp(dB re flag)	0.05dB	-3.1mv	0.05dB	-4.7mv	0.03dB	-5.9mv
RMS Dist(% of amp)	0.0		0.0		0.0	

▶ **VM700T notes:** **Frequency Location(MHz)** can be measured manually, using the Multiburst measurement special positioning, and moving the packet indicating cursor, reducing the separation of the measurement cursors to provide a better resolution. Using this manual technique, the VM700T **Time Location(us)** can be estimated from the graphic display at about 30us for each of the three channels.

**Flag Amp(mV)** can be measured manually, using the composite waveform display mode, with the amplitude readout of the signal at the timing cursors.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

## Multiburst

Line = 65 Average = 1

Channel Burst	G				B				R			
	Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Flag (mV)	---		696.26	700.43	---		694.23	679.7	---		695.8	700.43
Burst 1	1.01	1.00	-0.06	-.04	1.0	.99	-0.08	-.08	1.01	0.99	-0.1	-.05
Burst 2	2.01	1.99	-0.04	-.05	2.01	1.99	-0.04	-.08	2.01	1.99	-0.08	-.09
Burst 3	3.01	2.99	-0.06	-.05	3.01	2.99	-0.05	-.05	3.01	2.99	-0.09	-.05
Burst 4	4.0	3.99	-0.04	-.08	4.0	3.99	-0.06	-.07	4.0	3.99	-0.09	-.09
Burst 5	5.01	4.98	-0.05	-.16	5.01	4.98	-0.04	-.17	5.01	4.98	-0.1	-.16
Burst 6	6.0	5.99	-0.06	-.88	6.0	5.99	-0.06	-.87	6.0	6.00	-0.07	-.85

► **VM700T notes:** The VM700T produces a graphic display, with packet frequencies and amplitudes noted.

## Noise

Line = 229 Average = 1

Cursor (Hz): 675000

Filter: Unweighted, Bandwidth Selection = 6 MHz

Channel	G		B		R	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
mV	0.29		0.25		0.27	
dB	84.59	-82.1	83.36	-82.1	83.05	-82.0
Cursor mV	0.00		0.00		0.00	
Cursor dB	-162.1		-152.73		-162.44	

► **VM700T notes:** The VM700T reports noise in dB rms, and provides a graph of noise in a user-selected channel. The VM5000 reports noise as an unsigned ratio to 700mv. The VM700T adds a negative sign to indicate the noise is below the signal. Cursor values above refer to noise at the cursor position in the VM5000 Noise Spectrum Display. A Similar display, with no cursor values is presented as a VM700T measurement screen.

## Non Linearity

Line = 189 Average = 1

Channel	G (%)		B (%)		R (%)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Maximum	0.9	0.4	1.0	0.4	1.53	0.4
Step 1	0.18	0.0	0.18	0.0	0.0	0.0
Step 2	0.9	0.3	0.89	0.4	1.53	0.1
Step 3	0.0	0.4	1.0	0.4	0.35	0.4
Step 4	0.36	0.2	0.53	0.1	0.89	0.1
Step 5	0.78	0.2	0.0	0.4	0.41	0.0

► **VM700T notes:** The VM700T requires a step signal, with results reported in % of expected amplitude. Values are manually converted and reported as %err above. The VM5000 measurement uses a full amplitude ramp.

**Short Time Distortion**  
Line = 41 Average = 1

	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
<b>K2T</b>			0.51	0.2 all channels		
<b>Channel</b>	<b>G</b>		<b>B</b>		<b>R</b>	
Rise(nS)	251.66	251.5	252.5	251.7	247.49	251.9
Fall(nS)	251.4	251.3	248.34	251.4	250.9	251.6
Overshoot(%)	0.61		0.05		0.29	
Undershoot(%)	0.6		0.48		0.53	
Settling Rise(nS)	0.0		0.0		0.0	
Settling Fall(nS)	0.0		0.0		0.0	

**Sync**  
Line = 229 Average = 1

	VM5000	VM700T
Front Porch (nS)	1299.2	1320
Negative Sync Fall (nS)	137.17	138
Negative Sync Width (nS)	4699.2	4700
Sync Rise (nS)	157.22	151
Positive Sync Width (nS)	---	
Positive Sync Fall (nS)	---	
Back Porch (nS)	4304.0	4310
Line Time (nS)	63.57	
Start Active Video (nS)	9.0	9.01
End Active Video (nS)	62.27	
Front Porch Level (mV)	0.8	
Negative Sync Level (mV)	-297.14	
Positive Sync Level (mV)	---	

▶ **VM700T notes:** The VM700T provides an annotated graphic of the horizontal blanking interval. Line times and front porch level are not provided. Additional sync timing are provided in a separate VM700T report and are included in the table above.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

576i50 (625/50) YPbPr format:

VM5000 Video Measurements Results Report

July 28, 2004 01:23 PM

Format: 576I/50 Color Space: YPbPr

Reference File: C:\VM5000TV\RefLimFiles\DefaultRef576i50-YPbPr.csv

Limit File: C:\VM5000TV\RefLimFiles\DefaultLim576i50-YPbPr.csv

Autoscale: On Trigger: Ch4 Stop On Limit Error: Off

SUMMARY:	Status	Warnings
Channel Delay	PASS	
Color Bars	PASS	
Frequency Response	PASS	
Multiburst	PASS	
Noise	PASS	
Non Linearity	PASS	
Short Time Distortion	PASS	
Sync	PASS	

► **VM700T notes:** The VM700T displays individual measurements with user adjustable limit lines and will generate an out-of-limits report.

## Channel Delay

Line = 128 Average = 1

	VM5000	VM700T
Y to Pb(nS)	1.862	0
Y to Pr(nS)	-1.979	0
Pb to Pr(nS)	2.167	

► **VM700T notes:** The VM700T measures Channel Delay using the green/magenta transition of the color bar signal. The VM5000 compares times of a high frequency sweep signal. The VM700T finds Delay: B-Y at Ons, and R-Y at Ons.

**Color Bars**

Line = 32 Average = 1

Color	Y Level(mv)		Pb Level(mv)		Pr Level(mv)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
White	698.64	700.5	-0.14	-0.1	-0.05	-0.1
Yellow	621.34	620.6	-348.26	-347.7	55.62	56.3
Cyan	491.37	491.0	116.56	117.0	-348.39	-350.7
Green	411.61	411.0	-230.25	-230.4	-292.56	-293.9
Magenta	290.3	289.7	229.84	229.8	290.65	293.3
Red	209.87	209.2	-117.2	-117.4	346.61	349.8
Blue	81.58	79.9	346.57	346.9	-56.54	-56.8
Black	0.85	0.0	0.51	-0.1	0.27	-0.1

▶ **VM700T notes:** *The VM700T reports values as a graphic annotated in mv for the 625/50 format.*

**Frequency Response**

Line = 144 Average = 1

Filter Bandwidth: 25.0 MHz

Channel	Y		Pb		Pr	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Freq Location(MHz)	2.0	2.013	2.0	2.012	2.0	2.009
Time Location(uS)	30.02	30.05	30.03	30.03	30.03	30.03
Flag Amp(mV)	316.6	319.7	316.16	317.0	316.45	319.7
Amp(dB re flag)	0.01dB	-2.9mv	-0.01dB	-1.6mv	0.0dB	-1.8mv
RMS Dist(% of amp)	0.0		0.0		0.0	

▶ **VM700T notes:** *Frequency Location(MHz) can be measured manually, using the Multiburst measurement special positioning, and moving the packet indicating cursor, reducing the separation of the measurement cursors to provide a better resolution. Using this manual technique, the VM700T Time Location(us) can be estimated from the graphic display at about 30us for each of the three channels. Flag Amp(mV) can be measured manually, using the composite waveform display mode, with the amplitude readout of the signal at the timing cursors.*

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

## Multiburst

Line = 160 Average = 1

Channel Burst	Y				Pb				Pr			
	Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Flag (mV)	---		317.1	319.2	---		316.8	316.3	---		318.8	319.6
Burst 1	1.0	.99	0.0	-.04	0.51	0.49	-0.02	-.04	0.51	0.49	-0.06	-.03
Burst 2	2.0	1.99	-0.02	0.0	1.0	0.99	-0.02	-.02	1.0	0.99	-0.08	-.04
Burst 3	3.0	2.99	0.01	-.01	1.5	1.49	-0.03	.02	1.49	1.49	-0.08	-.03
Burst 4	4.0	3.99	0.02	-.02	2.0	1.99	-0.02	-.04	2.0	1.99	-0.1	-.03
Burst 5	5.0	4.98	0.0	-.04	2.49	2.49	-0.03	.01	2.49	2.49	-0.1	-.02
Burst 6	6.0	5.99	-0.04	-.06	3.0	2.99	-0.01	-.02	3.0	3.00	-0.08	-.01

► **VM700T notes:** The VM700T produces a graphic display, with packet frequencies and amplitudes noted.

## Noise

Line = 272 Average = 1

Cursor (Hz): 675000

Filter: Unweighted, Bandwidth Selection = 6 MHz

Channel	Y		Pb		Pr	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
mV	0.04		0.06		0.05	
dB	84.04	-80.9	81.92	-79.2	82.51	-79.6
Cursor mV	0.0		0.0		0.0	
Cursor dB	-127.28		-124.89		-131.78	

► **VM700T notes:** The VM700T reports noise in dB rms, and provides a graph of noise in a user-selected channel. The VM5000 reports noise as an unsigned ratio to 700mv. The VM700T adds a negative sign to indicate the noise is below the signal. Cursor values above refer to noise at the cursor position in the VM5000 Noise Spectrum Display. A Similar display, with no cursor values is presented as a VM700T measurement screen.

## Non Linearity

Line = 224 Average = 1

Channel	Y (%)		Pb (%)		Pr (%)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Maximum	0.94	0.4	0.7	0.3	0.65	0.2
Step 1	0.65	0.1	0.58	0.0	0.12	0.1
Step 2	0.7	0.0	0.35	0.1	0.36	0.0
Step 3	0.0	0.4	0.7	0.3	0.65	0.2
Step 4	0.76	0.2	0.53	0.1	0.06	0.0
Step 5	0.94	0.2	0.0	0.2	0.0	0.1

► **VM700T notes:** The VM700T requires a step signal, with results reported in % of expected amplitude. Values are manually converted and reported as %err above. The VM5000 measurement uses a full amplitude ramp.

**Short Time Distortion**

Line = 112 Average = 1

	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
<b>K2T</b>			0.33	0.3 on Y channel		
<b>Channel</b>	<b>Y</b>		<b>Pb</b>		<b>Pr</b>	
Rise(nS)	200.4	199.7	399.59	400.0	401.04	400.3
Fall(nS)	201.39	200.9	401.02	400.1	397.21	400.3
Overshoot(%)	0.6		0.68		0.06	
Undershoot(%)	0.39		0.01		0.08	
Settling Rise(nS)	0.0		0.0		0.0	
Settling Fall(nS)	0.0		0.0		0.0	

▶ **VM700T notes:** The VM700T K Factor measurement measures only K Factor, as reported above. The VM700T measurement also reports pulse to bar ratio and half amplitude duration of the 2T pulse. These measurements may be taken manually using the VM5000 oscilloscope application. Rise and Fall time measurements are available in the set of composite measurements, taken separately for each channel. Overshoot, undershoot, and settling times are a part of the VM700T K Factor measurement.

**Sync**

Line = 272 Average = 1

	VM5000	VM700T
Front Porch (nS)	1494.4	1490
Negative Sync Fall (nS)	241.18	251
Negative Sync Width (nS)	4697.6	4700
Sync Rise (nS)	250.4	252
Positive Sync Width (nS)	---	
Positive Sync Fall (nS)	---	
Back Porch (nS)	5806.4	
Line Time (nS)	64.0	
Start Active Video (nS)	10.5	10.5
End Active Video (nS)	62.51	
Front Porch Level (mV)	0.17	
Negative Sync Level (mV)	-297.86	300
Positive Sync Level (mV)	---	

▶ **VM700T notes:** The VM700T provides an annotated graphic of the horizontal blanking interval. Line times and front porch level are not provided. Additional sync timing are provided in a separate VM700T report and are included in the table above.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

576i50 (625/50) GBR Format:

VM5000 Video Measurements Results Report

July 28, 2004 01:28 PM

Format: 576I/50 Color Space: RGB

Reference File: C:\VM5000TV\RefLimFiles\DefaultRef576i50-RGB.csv

Limit File: C:\VM5000TV\RefLimFiles\DefaultLim576i50-RGB.csv

Autoscale: On Trigger: Ch4 Stop On Limit Error: Off

SUMMARY:	Status	Warnings
Channel Delay	PASS	
Color Bars	PASS	
Frequency Response	PASS	
Multiburst	PASS	
Noise	PASS	
Non Linearity	PASS	
Short Time Distortion	PASS	
Sync	PASS	

► **VM700T notes:** The VM700T displays individual measurements with user adjustable limit lines and will generate an out-of-limits report.

## Channel Delay

Line = 80 Average = 1

	VM5000	VM700T
G to B(nS)	1.921	1
G to R(nS)	-1.647	0
B to R(nS)	1.591	

► **VM700T notes:** The VM700T measures Channel Delay using the green/magenta transition of the color bar signal. The VM5000 compares times of a high frequency sweep signal. The VM700T finds Delay: B-Y at +1ns, and R-Y at 0ns in the report table above.

### Color Bars

Line = 32 Average = 1

Color	G Level(mV)		B Level(mV)		R Level(mV)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
White	698.96	700.0	696.34	693.8	696.4	699.9
Yellow	701.07	700.0	1.7	-0.3	697.35	699.8
Cyan	701.23	700.0	696.4	693.8	1.75	-0.2
Green	701.44	700.1	1.53	-0.2	0.76	-0.2
Magenta	3.36	-0.2	696.52	693.8	696.85	699.8
Red	1.43	-0.2	1.63	-0.2	697.5	699.8
Blue	1.61	-0.1	696.74	693.9	2.1	-0.2
Black	1.18	-0.1	1.67	-0.1	1.06	-0.1

► **VM700T notes:** The VM700T reports values as a graphic annotated in mv for the 625/50 format.

### Frequency Response

Line = 64 Average = 1

Filter Bandwidth: 25.0 MHz

Channel	G		B		R	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Freq Location(MHz)	3.0	3.008	3.0	2.997	3.0	2.993
Time Location(uS)	33.52	33.5	33.57	33.5	33.59	33.6
Flag Amp(mV)	691.2	700.2	691.36	694.2	690.83	700.2
Amp(dB re flag)	0.07dB	-3.7mv	0.02dB	-0.1mv	0.05Db	-5.0mv
RMS Dist(% of amp)	0.0	0.0	0.0			

► **VM700T notes:** *Frequency Location(MHz)* can be measured manually, using the Multiburst measurement special positioning, and moving the packet indicating cursor, reducing the separation of the measurement cursors to provide a better resolution. Using this manual technique, the VM700T *Time Location(us)* can be estimated from the graphic display at about 30us for each of the three channels. *Flag Amp(mV)* can be measured manually, using the composite waveform display mode, with the amplitude readout of the signal at the timing cursors.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

## Multiburst

Line = 96 Average = 1

Channel Burst	G				B				R			
	Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Flag (mV)	---		694.4	700.8	---		693.44	694.2	---		692.65	699.7
Burst 1	1.0	0.99	0.0	-.06	1.0	0.99	0.0	-.01	1.0	0.99	-0.02	-.01
Burst 2	2.0	1.99	0.03	-.04	2.0	1.99	-0.02	-.04	2.0	1.99	-0.01	-.04
Burst 3	3.0	2.99	0.08	-.04	3.0	2.99	-0.03	-.05	3.0	2.99	-0.02	-.02
Burst 4	4.0	3.99	0.04	-.07	4.0	3.99	-0.03	-.08	4.0	3.99	-0.01	-.04
Burst 5	5.0	4.98	0.05	-.08	5.0	4.98	-0.04	-.09	5.0	4.98	-0.03	-.08
Burst 6	6.0	5.99	0.05	-.06	6.0	5.99	-0.03	-.06	6.0	6.00	-0.05	-.06

► **VM700T notes:** The VM700T produces a graphic display, with packet frequencies and amplitudes noted.

## Noise

Line = 272 Average = 1

Cursor (Hz): 675000

Filter: Unweighted, Bandwidth Selection = 6 MHz

Channel	G		B		R	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
mV	0.05		0.06		0.05	
dB	83.32	-81.0	82.05	-80.1	82.54	-79.4
Cursor mV	0.0		0.0		0.0	
Cursor dB	-127.91		-128.23		-128.09	

► **VM700T notes:** The VM700T reports noise in dB rms, and provides a graph of noise in a user-selected channel. The VM5000 reports noise as an unsigned ratio to 700mv. The VM700T adds a negative sign to indicate the noise is below the signal. Cursor values above refer to noise at the cursor position in the VM5000 Noise Spectrum Display. A Similar display, with no cursor values is presented as a VM700T measurement screen.

## Non Linearity

Line = 224 Average = 1

Channel	G (%)		B (%)		R (%)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Maximum	0.61	0.4	1.04	0.4	0.54	0.5
Step 1	0.31	0.0	0.0	0.0	0.24	0.0
Step 2	0.61	0.1	1.04	0.2	0.48	0.2
Step 3	0.0	0.4	0.67	0.4	0.54	0.5
Step 4	0.31	0.2	0.55	0.3	0.48	0.1
Step 5	0.61	0.0	0.43	0.0	0.0	0.1

► **VM700T notes:** The VM700T requires a step signal, with results reported in % of expected amplitude. Values are manually converted and reported as %err. The VM5000 measurement uses a full amplitude ramp.

Short Time Distortion  
 Line = 48 Average = 1

	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
<b>K2T</b>			0.34	0.2 in all channels		
<b>Channel</b>	<b>G</b>		<b>B</b>		<b>R</b>	
Rise(nS)	201.49	200.8	201.69	200.9	200.58	200.9
Fall(nS)	200.93	200.5	202.25	200.6	200.51	200.7
Overshoot(%)	0.52		0.45		0.08	
Undershoot(%)	0.49		0.18		0.52	
Settling Rise(nS)	0.0		0.0		0.0	
Settling Fall(nS)	0.0		0.0		0.0	

▶ **VM700T notes:** The VM700T K Factor measurement measures only K Factor. The VM700T measurement also reports pulse to bar ratio and half amplitude duration of the 2T pulse. These measurements may be taken manually using the VM5000 oscilloscope application. Rise and Fall time measurements are available in the set of composite measurements, taken separately for each channel. Overshoot, undershoot, and settling times are a part of the VM700T K Factor measurement.

Sync  
 Line = 272 Average = 1

	VM5000	VM700T
Front Porch (nS)	1499.2	1490
Negative Sync Fall (nS)	143.21	140
Negative Sync Width (nS)	4697.6	4700
Sync Rise (nS)	155.1	151
Positive Sync Width (nS)	---	
Positive Sync Fall (nS)	---	
Back Porch (nS)	5804.8	5760
Line Time (nS)	64.01	
Start Active Video (nS)	10.5	10.46
End Active Video (nS)	62.51	
Front Porch Level (mV)	0.66	
Negative Sync Level (mV)	-297.73	300
Positive Sync Level (mV)	---	

▶ **VM700T notes:** The VM700T provides an annotated graphic of the horizontal blanking interval. Line times and front porch level are not provided. Additional sync timing are provided in a separate VM700T report and are included in the table above.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

DVD Playback, 480i60 YPbPr format:  
VM5000 Video Measurements Results Report

July 29, 2004 04:36 PM

Format: 480I/60 Color Space: YPbPr

Reference File: C:\VM5000TV\RefLimFiles\DefaultRef480i60-YPbPr.csv

Limit File: C:\VM5000TV\RefLimFiles\DefaultLim480i60-YPbPr.csv

Autoscale: On Trigger: Ch1 Stop On Limit Error: Off

SUMMARY:	Status	Warnings
Channel Delay	FAIL	
Color Bars	FAIL	
Frequency Response	FAIL	
Multiburst	FAIL	
Noise	PASS	
Non Linearity	PASS	
Short Time Distortion	PASS	
Sync	FAIL	

► **VM700T notes:** FAIL Status in the table above compares signal measurement results to a user generated DefaultLimits file. The VM700T displays individual measurements with user adjustable limit lines and will generate an out-of-limits report.

## Channel Delay

Line = 93 Average = 1

	VM5000	VM700T
Y to Pb(nS)	24.068	-32
Y to Pr(nS)	20.039	-31
Pb to Pr(nS)	2.757	

► **VM700T notes:** The VM700T measures Channel Delay using the green/magenta transition of the color bar signal. The VM5000 compares times of a high frequency sweep signal. The VM700T finds Delay: B-Y at -32ns, and R-Y at -31ns in the report table above.

## Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

### Color Bars

Line = 29 Average = 1

Color	Y Level(mV)		Pb Level(mV)		Pr Level(mV)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
White	718.49	100.7ire=719mv	-0.09	0ire=0mv	0.19	0ire=0mv
Yellow	639.4	89.3ire=638mv	-344.48	-46.9ire=-335mv	55.37	7.8ire=56mv
Cyan	503.13	70.3ire=502mv	111.3	15.3ire=109mv	-348.15	-49.1ire=-351mv
Green	421.66	58.8ire=420mv	-226.45	-30.8ire=-220mv	-292.73	-41.1ire=293mv
Magenta	300.13	41.8ire=298mv	223.82	30.7ire=219mv	290.36	41ire=293mv
Red	218.4	30.5ire=218mv	-115.76	-15.8ire=113mv	345.4	48.7ire=348mv
Blue	83.75	11.5ire=82mv	339.27	46.4ire=331mv	-55.26	-7.8ire=56mv
Black	0.18	-.1ire=-0.7mv	0.15	0ire=0mv	0.29	0ire=0mv

► **VM700T notes:** The VM700T reports values as a graphic annotated in IRE for this format. VM700T values are manually converted to mv and added to the chart above.

### Frequency Response

Line = 109 Average = 1

Filter Bandwidth: 25.0 MHz

Channel	Y		Pb		Pr	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Freq Location(MHz)	2.0	2.008	2.0	2.007	2.0	1.973
Time Location(uS)	31.52	31.5	30.4	31.5	30.66	31.5
Flag Amp(mV)	330.97	333.4	308.88	303.9	313.67	318.6
Amp(dB re flag)	0.05dB	6mv	-2.95dB	-208mv	-2.98dB	-103mv
RMS Dist(% of amp)	0.07		0.0		0.0	

► **VM700T notes:** *Frequency Location (MHz)* can be measured manually, using the Multiburst measurement special positioning, and moving the packet indicating cursor, reducing the separation of the measurement cursors to provide a better resolution. Using this manual technique, the VM700T *Time Location (us)* can be estimated from the graphic display at about 30us for each of the three channels. *Flag Amp (mV)* can be measured manually, using the composite waveform display mode, with the amplitude readout of the signal at the timing cursors.

# Component Analog Signal Analysis: VM700T Option 30 and VM5000 Option SD

► Application Note

## Multiburst

Line = 125 Average = 1

Channel Burst	Y				Pb				Pr			
	Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)		Frq (MHz)		Amp (dB)	
Flag (mV)	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
	---		321.54	45.4ire= 324mv	---		292.0	39.6ire= 283mv	---		296.8	42.1ire= 301mv
Burst 1	1.0	0.99	0.22	0.18	0.5	0.49	-0.18	-1.61	0.5	0.48	-0.2	-1.62
Burst 2	2.0	1.99	0.46	0.36	1.0	0.97	-0.76	-2.0	1.0	0.97	-0.82	-1.92
Burst 3	3.0	3.00	0.45	0.37	1.52	1.49	-1.84	-2.93	1.51	1.49	-1.87	-2.99
Burst 4	4.01	3.99	-0.1	-0.27	2.0	1.99	-3.31	-4.47	1.99	2.00	-3.34	-4.44
Burst 5	5.0	4.98	-1.75	-1.89	2.47	2.50	-5.55	-6.66	2.47	2.49	-5.33	-6.46
Burst 6	6.01	5.99	-4.0	-5.08	3.0	2.99	-7.74	-9.13	3.01	3.00	-7.83	-9.37

► **VM700T notes:** The VM700T produces a graphic display, with packet frequencies and amplitudes noted.

## Noise

Line = 229 Average = 1

Cursor (Hz): 675000

Filter: Unweighted, Bandwidth Selection = 6 MHz

Channel	Y		Pb		Pr	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
mV	0.34		0.11		0.1	
dB	66.34	-71.3	76.19	-77.1	77.16	-77.2
Cursor mV	0.02		0.0		0.0	
Cursor dB	-93.12		-125.38		-120.27	

► **VM700T notes:** VM5000 sync incorrectly set for channel 1 in this measurement, as noted at top of this report.

The VM700T reports noise in dB rms, and provides a graph of noise in a user-selected channel. The VM5000 reports noise as an unsigned ratio to 700mv. The VM700T adds a negative sign to indicate the noise is below the signal. Cursor values above refer to noise at the cursor position in the VM5000 Noise Spectrum Display. A Similar display, with no cursor values is presented as a VM700T measurement screen.

## Non Linearity

Line = 189 Average = 1

Channel	Y (%)		Pb (%)		Pr (%)	
	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
Maximum	1.57		1.31		1.84	
Step 1	1.48		0.0		0.3	
Step 2	0.0		0.37		0.0	
Step 3	1.57		0.94		1.84	
Step 4	1.04		0.69		0.59	
Step 5	0.0		1.31		1.6	

► **VM700T notes:** A five-step test signal was not available for the VM700T test. The VM5000 uses either a five-step or full ramp signal.

**Short Time Distortion**  
Line = 77 Average = 1

	VM5000	VM700T	VM5000	VM700T	VM5000	VM700T
<b>K2T</b>			0.85	0.6 in Y channel		
<b>Channel</b>	<b>Y</b>		<b>Pb</b>		<b>Pr</b>	
Rise(nS)	243.13	245.2	521.81	524.1	518.1	522.8
Fall(nS)	245.43	247.4	521.17	523.6	529.68	526.0
Overshoot(%)	0.81		0.43		0.08	
Undershoot(%)	0.8		0.21		0.19	
Settling Rise(nS)	0.0		0.0		0.0	
Settling Fall(nS)	0.0		0.0		0.0	

▶ **VM700T notes:** The VM700T K Factor measurement measures only K Factor, as reported above. The VM700T measurement also reports pulse to bar ratio and half amplitude duration of the 2T pulse. These measurements may be taken manually using the VM5000 oscilloscope application. Rise and Fall time measurements are available in the set of composite measurements, taken separately for each channel. Overshoot, undershoot, and settling times are a part of the VM700T K Factor measurement.

**Sync**  
Line = 229 Average = 1

	VM5000	VM700T
Front Porch (nS)	1779.2	1790
Negative Sync Fall (nS)	104.17	98.0
Negative Sync Width (nS)	4664.0	4670.0
Sync Rise (nS)	100.71	103.0
Positive Sync Width (nS)	---	
Positive Sync Fall (nS)	---	
Back Porch (nS)	5108.8	5110.0
Line Time (nS)	63.56	
Start Active Video (nS)	9.77	9.78
End Active Video (nS)	61.78	
Front Porch Level (mV)	-0.13	
Negative Sync Level (mV)	-290.35	-291.31
Positive Sync Level (mV)	---	

▶ **VM700T notes:** The VM700T provides an annotated graphic of the horizontal blanking interval. Line times and front porch level are not provided.

**Component Analog Signal Analysis:  
VM700T Option 30 and VM5000 Option SD**

▶ Application Note

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