

method of judging 'ringing'

Introduction

"Ringing" has been a recurring 'hot' discussion topic for PDP/LCD TV applications. It was widely found that there is a common misunderstanding in the industry as to how this occurs and how this should be checked. As such, it is important that TV designers are aware of the TV standards and the proper way of to check this issue.

This document serves to demonstrate the following

- The 'improper' method of measurement as used by many in the industry using the cross-hatch signal
- The proper method of measurement as per stipulated by TV standards using the proper 2T pulse response

The PHILIPS FQ1286 MK5 is used throughout this document to illustrate the points above.

1. Analogue TV standard

In this report, we will discuss 2 main parameters that contributes to this phenomenon, namely:

- a) Group delay correction
- b) Video bandwidth

We will also touch upon the best Video pattern that clearly illustrates "ringing" or "shadow" phenomenon.

A Group Delay Pre-correction

For standard TV transmission, the group delay is a prerequisite. The full group delay pre-correction characteristic is as shown in the following table. For colour TV systems, group delay with a pre-correction of -170ns between luminance and chrominance signals was adopted for TV standards M/N as well as B/G.

Standard, Precorrec	M, full FCC, EIA 1977		M, full CBC 1976	
	Nominal (ns)	Tolerance (ns)	Nominal (ns)	Tolerance (ns)
0	0	±25	0	±25
0.1		Ref.		Ref.
>0.1		±25	0	±25
1				
2				
3	0		0	±25
3.58	+170	±25	+170	±15
3.9			+264	±200
4.0	+293	±50		
4.18	+346	±100		

Table 1: Standard TV Group delay pre-correction

Therefore, the receiver (in this case the FQD1286 Mk5) has to be designed to match the group delay according to the specific TV standard. In the FQ1286 Mk5 (as well as for all our frontends today), the group delay is properly matched by the following methods:

1. Post-correction built into the SAW filter
2. IF Video IC response (in this case the NTSC demodulator TDA9885)

With the above settings properly matched to the TV Standards, it is then not surprising that should anyone try to check the performance of the receiver without generating the proper video signal with pre-correction, the results will be inaccurate.

This results in 'ringing', made worse with the fact that the receiver now corrects the input signal for group delay when the input signal does not include pre-correction (as required by the transmission standard shown in the table above)

The FLUKE/SHIBASOKU pattern generator does not have pre-correction in the signal generated resulting is inaccurate observation of the video signal

B Video bandwidth Characteristics

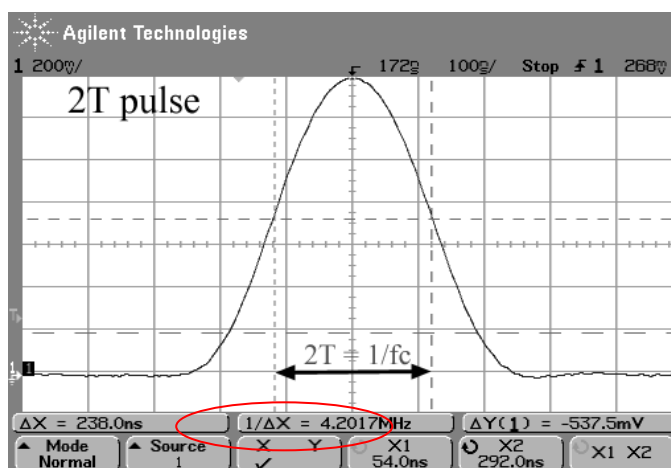
In the Standard NTSC TV system, the upper limit of the entire Video bandwidth is 4.2MHz. The FM sound carrier is at 4.5MHz.

Standard	B/G CCIR	D/K DIBT	M FCC	N South America
Frequency	VHF/UHF	VHF/UHF	VHF/UHF	VHF/UHF
Number of lines per frame	625	625	525	625
Field frequency	Hz 50	50	60	50
Line frequency	Hz 15 625	15 625	15 750	15 625
Duration of line sync pulse	μs 4.7	4.7	5 (4.7) ²⁾	5
Duration of line blanking pulse	μs 12	12	10.8 (11) ²⁾	10.9
Front porch	μs 1.5	1.5	1.9 (1.75) ³⁾	1.9
Field blanking interval	Lines 25	25	19 to 21	19 to 25
Video bandwidth	MHz 5	6	4.2	4.2
RF channel width	MHz 7(B)/8(G)	8	6	6
Vision-sound carrier spacing ²⁾	MHz +5.5/5.74/5.85	+6.5	+4.5	+4.5
Width of vestigial sideband	MHz 0.75	0.75	0.75	0.75
Spacing of vision carrier from nearest edge of channel	MHz +1.25	+1.25	+1.25	+1.25
RF sync level	% 100	100	100	100
RF blanking level	% 75 ⁴⁾	75	75	75
RF white level (residual carrier)	% 10	12.5	10	10
Type of vision modulation	C3F neg.	C3F neg.	C3F neg.	C3F neg.
Type of sound modulation	F3E F3EH ⁵⁾	F3E	F3E	F3E
Frequency deviation	kHz ±50	±50	±25	±25
Preemphasis	μs 50	50	75	75
Vision/sound power ratio	10:1 to 20:1 ⁵⁾ 20:1:0.2 ⁶⁾	10:1 to 5:1	10:1 to 5:1 ⁶⁾	10:1 to 5:1

Table 2: Standard TV bandwidth

We now compare below, the subtle differences between the 2T pulse and Cross-hatch pattern.

a. 2T pulse (from the Rohde & Schwarz SFF):

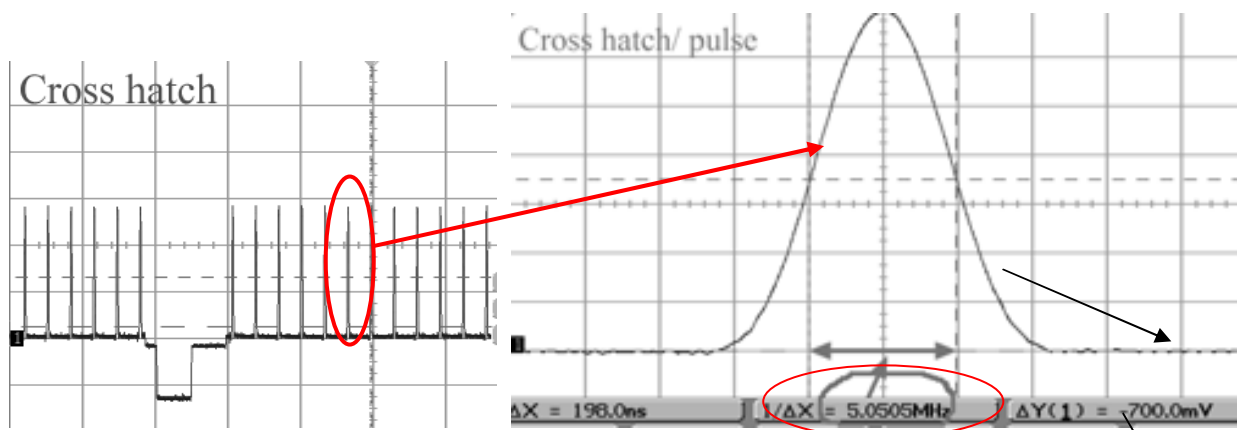


2T pulse is best recommended to check the overall IF on Gain errors, pulse shape distortions and also reflection of the TV receiver. This is the best pulse/pattern to check for the "ringing" symptom. The k-Factor, is used to determine 'ringing' performance (this is illustrated in the Appendix section).

The name of the pulse is derived from its duration at half amplitude; in fact, by T we understand an interval of time equal to $1/2fc$, where fc is the upper limit of the frequency band of the video signal. For television standard G, $fc = 5\text{MHz}$. And standard NTSC $fc = 4.2\text{MHz}$.

Therefore, by definition, the 2T pulse represents the upper limit of the video frequency band.

b. Cross-hatch (from the FLUKE pattern generator)



The cross-hatch signal, comprises of 19 vertical lines or vertical pulses as seen in the oscilloscope plots above. On the video screen, a cross-hatch pattern is seen (series of equally spaced vertical and horizontal lines crossing each other). The basic use of this pattern is used to check for convergence errors and geometrical distortion of the TV picture tube.

The problem with the FLUKE generator is that regardless of what system it is set to, the pulse bandwidth measured above is always at 5MHz. This has exceeded the NTSC standard of 4.2MHz. Any NTSC receiver that is designed to receive the proper standard NTSC transmission will exhibit problems, resulting in very bad 'ringing'.

Due to the improper bandwidth of the pulse within the cross-hatch pattern the 'ringing' symptom becomes more apparent and lucid.

The cross-hatch pattern is used for CRT receivers for different parameter checks (mainly for legacy CRT designs), NOT FOR 'RINGING'.

The only proper way to check for this is to use a proper 2T pulse from a broadcast quality equipment such as the R&S SFF (pattern generator) along with a R&S SFM (modulator/up-converter)

Conclusion

The report details the 'proper' method of judging the 'ringing' symptom. While generators (including the SHIBASOKU) that fall within the same range as FLUKE 54200 offer economical ways of checking TV performance, it should not in any way be used to simulate the real field condition and detailed measurements. These equipments are only fit for general checks.

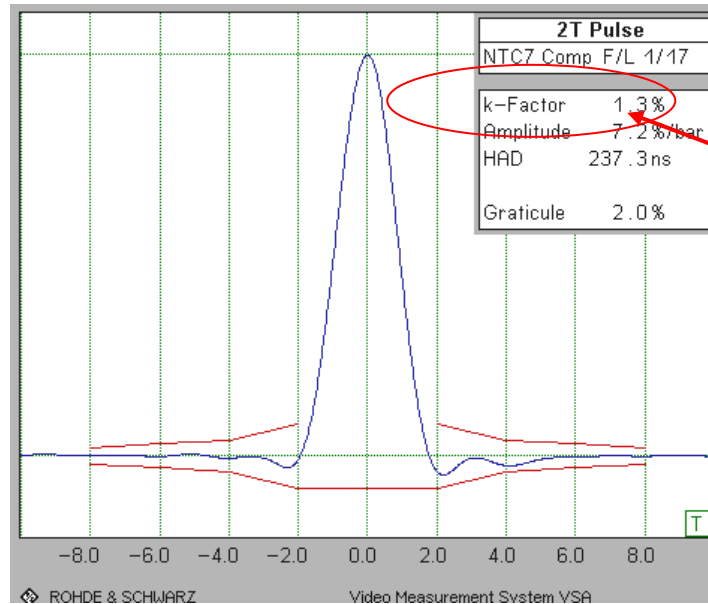
For detailed measurements and optimization exercises, broadcast quality equipment such as the R&S SFF and SFM should be used as they best reflect the real-field condition by conforming strictly to the TV standards.

TV designers should take note that if they optimize their designs using equipment such as the FLUKE 54200 or SHBASOKU, they run the risk of the TV set not performing optimally under real-field conditions. This is because, to begin with, such equipment does not conform to the actual prevailing TV standards in the field.

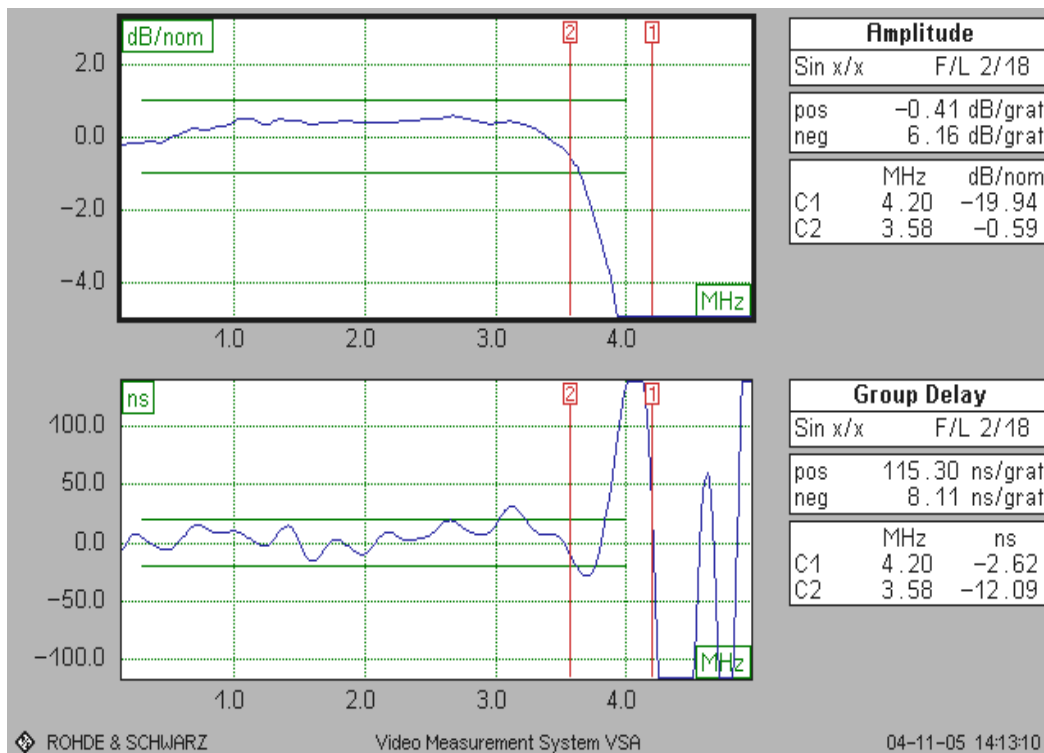
Appendix

1. Measurements on FQD1286 Mk5

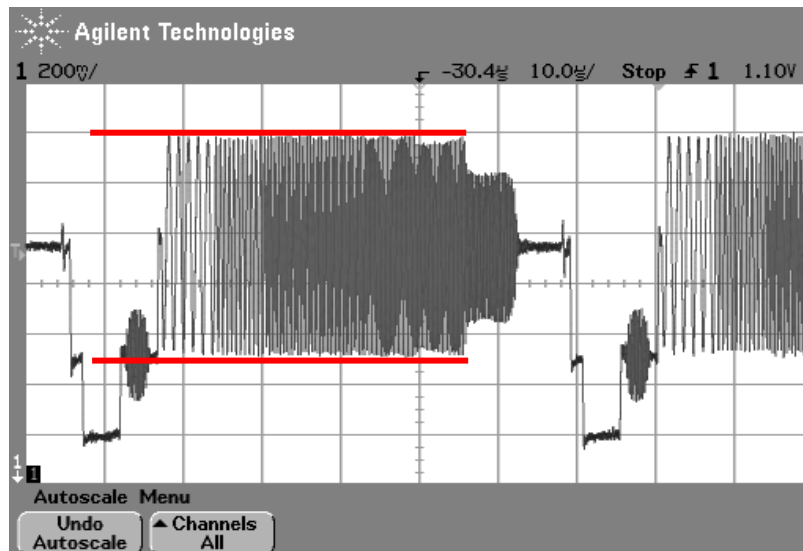
A. Using R&S SFF pattern generator (2T pulse with group delay pre-correction +170ns)



The k Factor is measured at 1.3% (which is less than 3%)

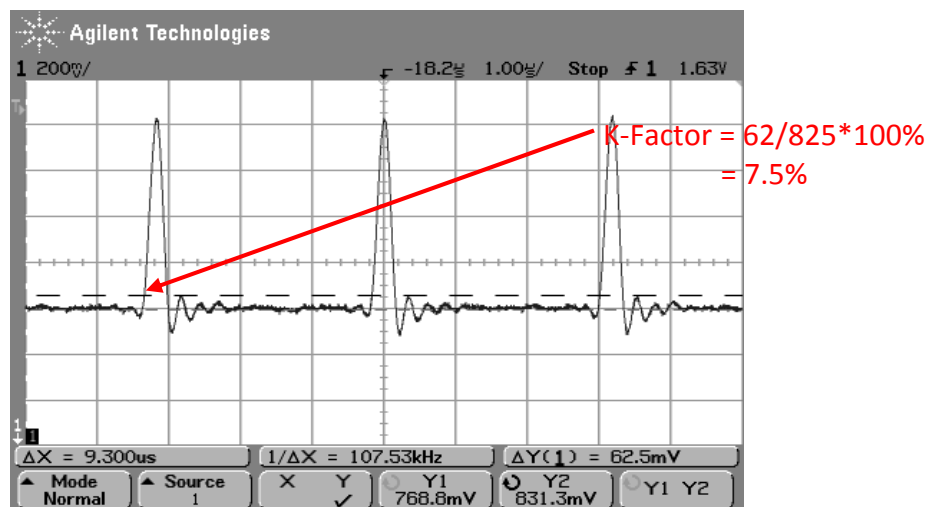


The top plot shows that the video frequency response is flat throughout the frequency range. The bottom plot shows that the group delay response is within +/-50nsec as per expected of a good receiver.



The flat video frequency response (as indicated in the earlier plot) equates to a flat response using the multi-burst pattern, as can be seen from the consistent horizontal flatness of the pattern

B. Using Fluke 54200 pattern generator (Cross-hatch pattern, no group delay pre-correction)



Using this pattern from the FLUKE generator, higher k-factor of 7.5% is observed. This is largely due to the 2 factors discussed in the main text: the absence of pre-correction in the generated signal and the 5MHz bandwidth of the pulse which exceed the NTSC 4.2MHz standard.

2. Rohde & Schwarz Standard TV set up

SFF CCVS Generator
SFM TV TEST Transmitter

