

Application Note:

How to Specify Detector Log Video Amplifiers (DLVA); Parameters and Terms

Introduction

When specifying a Detector Log Video Amplifier (DLVA), it is important to capture the key parameters to assure optimal system performance. It is also important that the specifications are achievable. The objective of this Application Note is to assist a system designer in the terms and specifications of the DLVA.

Key Parameters and Terms essential in specifying a DLVA:

1. Frequency Range or RF Bandwidth
2. Tangential Signal Sensitivity (TSS)
3. Operational (Usable) Sensitivity
4. Dynamic Range
5. DC Coupled DLVA
6. AC Coupled DLVA
7. Logging Range
8. Log Linearity
9. Log Slope
10. Frequency Flatness
11. Output Stability or Temperature Variation
12. DC Output Offset
13. DC Output Offset Variation
14. Absolute Accuracy
15. Propagation Delay
16. Rise Time
17. Settling Time
18. Total Response Time
19. Dwell Time
20. Fall Time
21. Recovery Time
22. Partial Recovery Time
23. Trailing Edge Re-Entrance
24. Pulse on Pulse or Pulse on CW
25. CW Immunity
26. CW Immunity Dynamic Range
27. CW Rejection Time

Frequency Range or RF Bandwidth:

Frequency Range is defined as the range over which the DLVA will be optimized to achieve the specified flatness.

Tangential Signal Sensitivity TSS:

Tangential signal is defined as the pulse whose bottom level coincides with the top level of the noise on either side of the pulse. The corresponding signal-to-noise ratio (SNR) depends on many system factors, normally the SNR of 8 dB is generally accepted at the specified bandwidth. See Figure I.

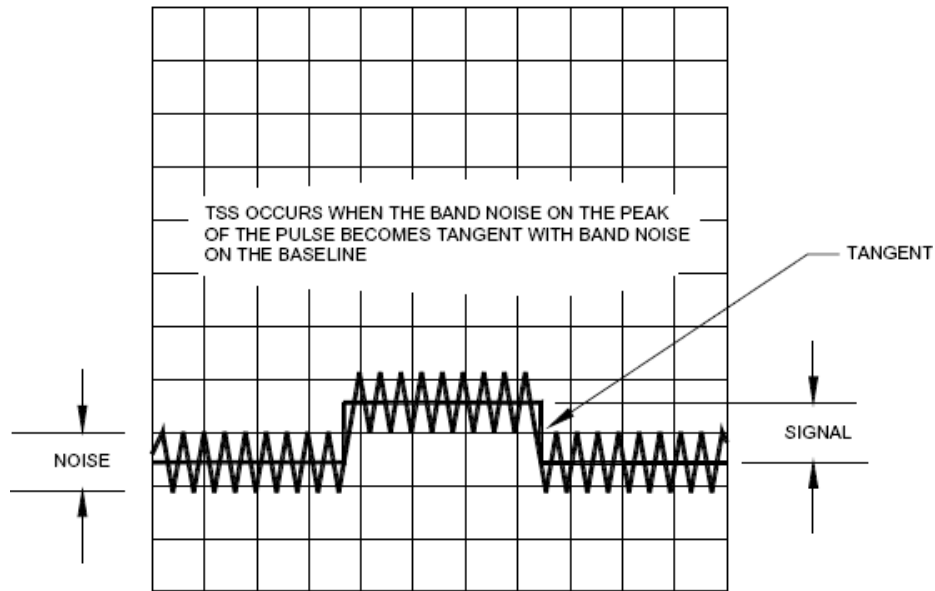


Figure I. Tangential Signal Sensitivity

Operational (Usable) Sensitivity:

This is equivalent to a 14 dB output Signal-to-Noise Ratio (SNR). More specifically, this is 5 dB stronger than the equivalent Tangential Signal Sensitivity.

Dynamic Range:

Defined as the range of the input signal in dB from TSS to the end of the Logging Range. Not to be confused with Usable logging Range.

DC Coupled DLVA:

Defined as when the detector and all other stages are directly coupled. Used when processing long signal pulses or CW signals is desired.

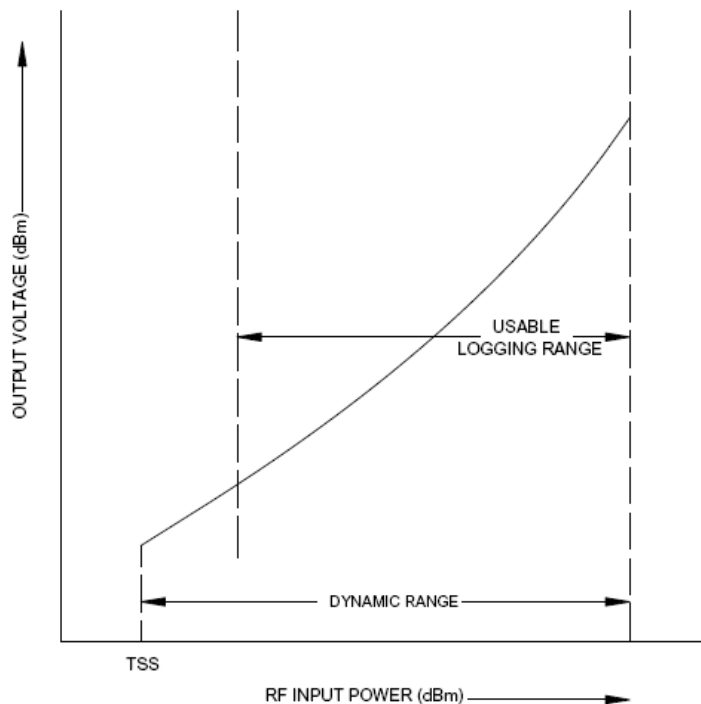
AC Couple DLVA:

Logging stages and detectors stages are AC couple. Not usable for CW or long pulse signals. All AMC DLVA's are DC coupled.

Logging Range:

Defined as the range in dB from the usable sensitivity to the end of the logging range of the DLVA. This is usually the range over which the signal information is processed and exhibits a straight line relationship with defined linearity between RF input power expressed in dBm and the linear video output voltage expressed in millivolts (mV). See Figure II.

Figure II. Logging Range



Log Linearity:

Defined as the maximum deviation in dB of all measured points from the calculated best-fit straight line at a given temperature and at a given frequency. See Figure III.

Log Slope:

Defined as the transfer characteristics of the slope of the best-fit straight line which passes through the actual output voltage data over the dynamic range. The Log Slope is expressed in $mV/dB \pm \% mV/dB$.

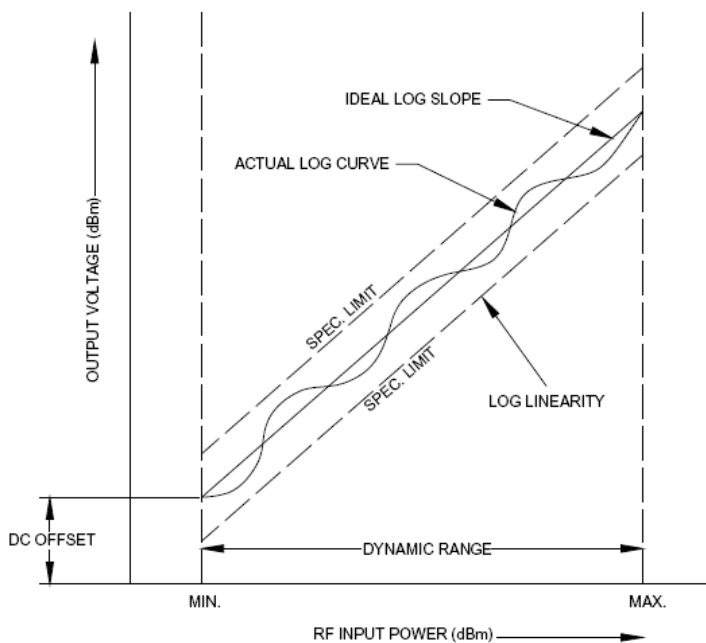


Figure III. Log Linearity

Frequency Flatness:

Defined as the variation in output voltage at a constant temperature and constant RF input power as the frequency is varied. It is expressed in dB. See Figure IV.

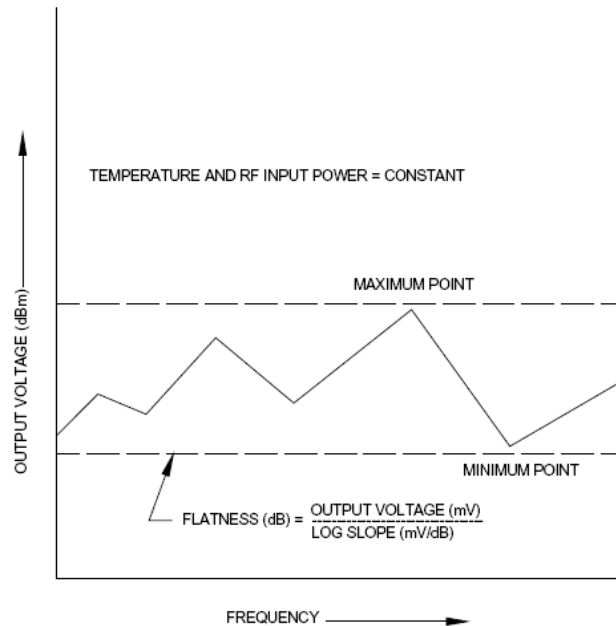


Figure IV. Frequency Flatness

Output Stability or Temperature Variation:

Defined as the variation in output voltage at a constant RF input power and a given frequency as the temperature is varied. It is expressed in dB.

DC Output Offset:

Defined as the DC output voltage with RF port terminated (no RF signal applied) into a 50 ohm load.

DC Output Offset Variation:

Defined as the output offset voltage variation with RF input port terminated into a 50 ohm load and the temperature is varied over its specified range.

Absolute Accuracy:

Defined as the total power uncertainty along a defined straight line as the RF frequency, RF power and temperature are varied. This includes the effect of the Log Linearity, Frequency, Temperature Variation and DC Offset Variation. It is expressed in dB. See Figure V.

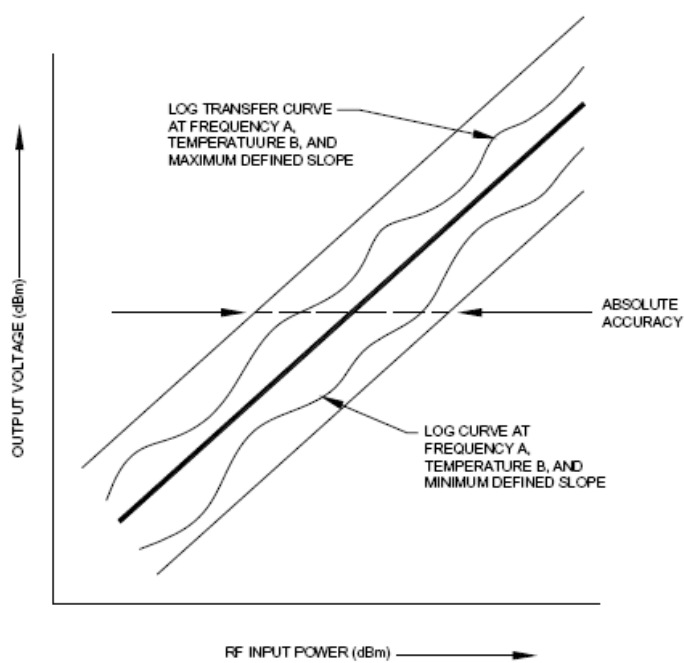


Figure V. Absolute Accuracy

Propagation Delay:

Defined as the time between the application of an RF input pulse, from 50% RF of the leading edge of the RF input envelope to 50% of the leading edge of the video output. See Figure VI.

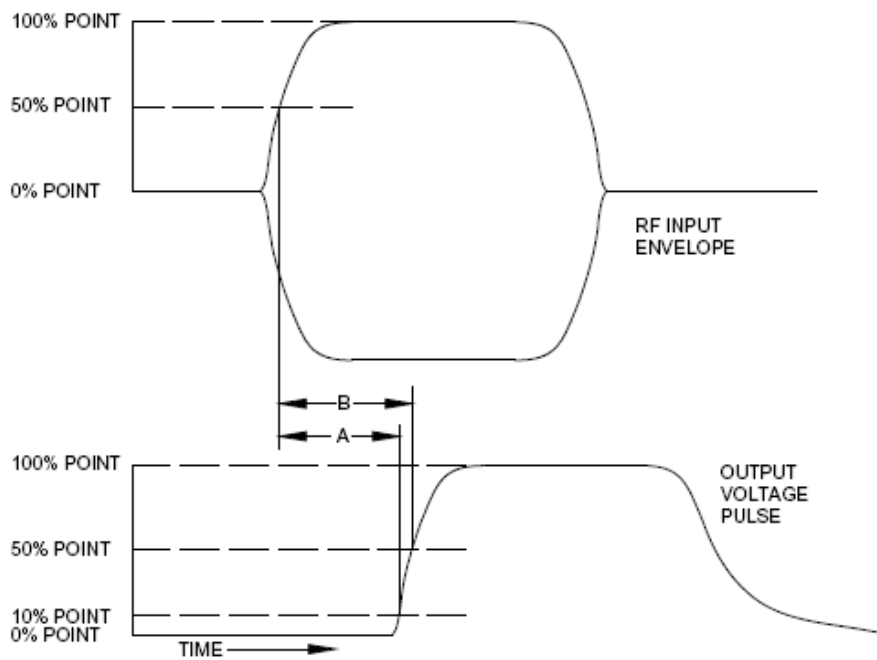


Figure VI. Propagation Delay

Rise Time:

Defined as the response time between the 10% to 90% of the leading edge of the video output. See Figure VII.

Settling Time:

Defined as the time from the 10% of the leading edge of the video output pulse to a point where the pulse has settled to ± 0.5 dB of its final steady state value. See Figure VII.

Total Response Time:

Defined as the time from the 50% of the leading edge of the video output pulse to a point where the pulse has settled to ± 0.5 dB of its final steady state value. Also referred to as propagation delay + settling time.

Dwell Time:

Defined as the minimum time for the output pulse to be flat within ± 0.5 dB for the test condition of the required minimum pulse width. Also referred to as Flat Top. See Figure VII.

Fall Time:

Defined as the time required for the trailing edge of the video pulse to fall from the 90% point to 10% point for a given RF power level. Usually the RF power level is the highest power level of the logging range. See Figure VII.

Recovery Time:

Defined as the time it takes from the 90% point of the falling edge of the video pulse to a point of ± 1 dB of the base line. When the video pulse reaches the 1 dB of the base line, the DLVA has recovered and able to accept a new RF pulse. See Figure VII. See note 1.

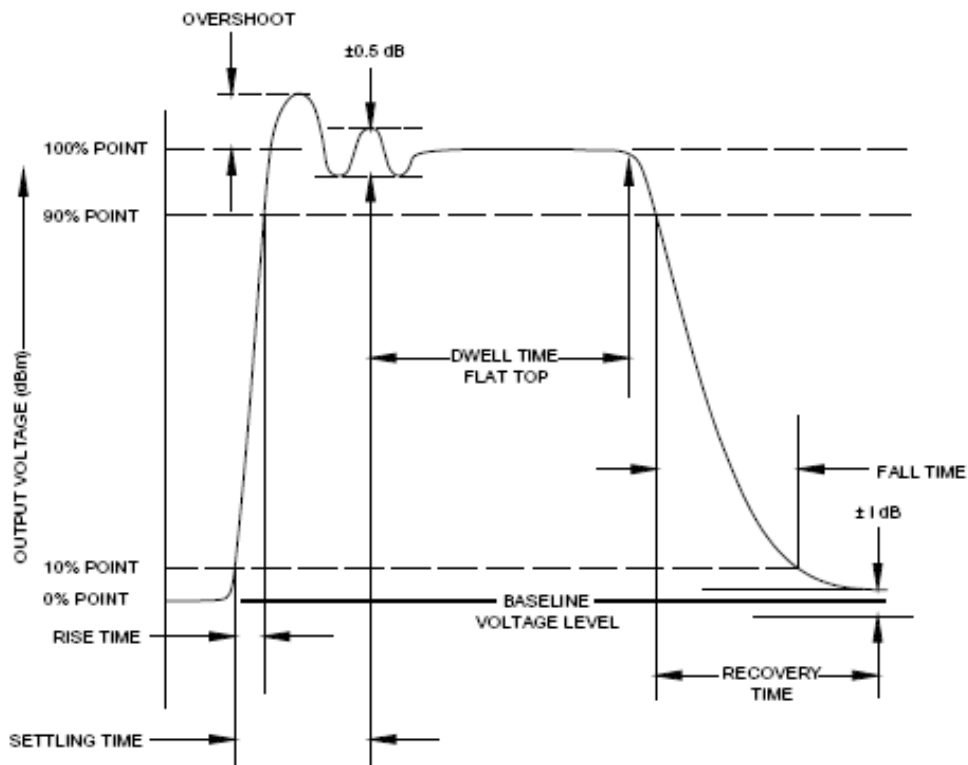


Figure VII. Pulse Response

Partial Recovery Time:

Defined as the time required for the output trailing edge to fall 1 dB below peak pulse to within 1 dB of baseline voltage level. This partial recovery is measured for a 16 dB drop in the output trailing edge voltage. Critical when two pulse amplitude need to be measured. See note 1.

Trailing Edge Re-Entrance:

Defined as the excursion or ringing of the pulse trailing edge which is specified to be below the threshold sensitivity level.

Pulse-on-Pulse or Pulse-on-CW:

This describes the application of the DLVA where the pulse amplitude of a signal riding on a CW or RF noise level can be accurately measured. The pulse level can either be weaker or stronger than the specified CW or noise level.

CW Immunity:

Defined as the ability of a DLVA to reject continuous wave (CW) signals, or signals of specified time duration.

CW Immunity Dynamic Range:

Defined as the CW range above threshold sensitivity level so that a pulse level at threshold sensitivity level can be measured within a specified error value, while rejecting the CW level.

CW Rejection Time:

Defined as the time required by the DLVA to cancel the maximum specified CW level so that the pulse level at the threshold sensitivity value can be measured within specified error value.

Note 1:

All output dB levels are referred to the RF input level required to achieve the indicated video output voltage variation.

American Microwave Corporation welcomes the opportunity to support our customers in the specification process. Please contact us by phone or e-mail with your questions or to set up a visit or technical conference call.

sales@americanmic.com

Tel: 301-662-4700

AMERICAN MICROWAVE CORPORATION