Measurement of Camber

An ECIA Knowledge Document

Volume 1, Number 2

October 2009

Reaffirmed: June 2023

NOTICE

ECIA Knowledge Documents are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such documents shall not in any respect preclude any member or nonmember of ECIA from manufacturing or selling products not conforming to the documents, nor shall the existence of such documents preclude their voluntary use by those other than ECIA members, whether the document is to be used either domestically or internationally.

ECIA does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the Document.

This Document does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this Document to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

This ECIA Knowledge Document was formulated under the cognizance of the Automated Component Handling Standards Committee.

Published by

©2023 Electronic Components Industry Association
EIA Standards & Technology Department
13873 Park Center Road, Suite 315
Herndon, VA 20171

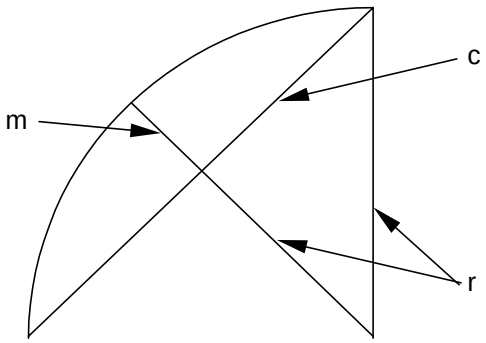
Measurement of Camber

The measurement of camber is easily misunderstood. Mathematically, camber is the measurement of the midpoint (m) of an arc across a specific chord length (c). On a given sample, the radius (r) is constant, so if the chord length changes, the midpoint (or camber) will also change. See the formulas and depiction below

$r = (m^2+c^2/4)/2m$

$m = r-\sqrt{r^2-c^2/4}$

$c = 2\sqrt{2mr-m^2}$



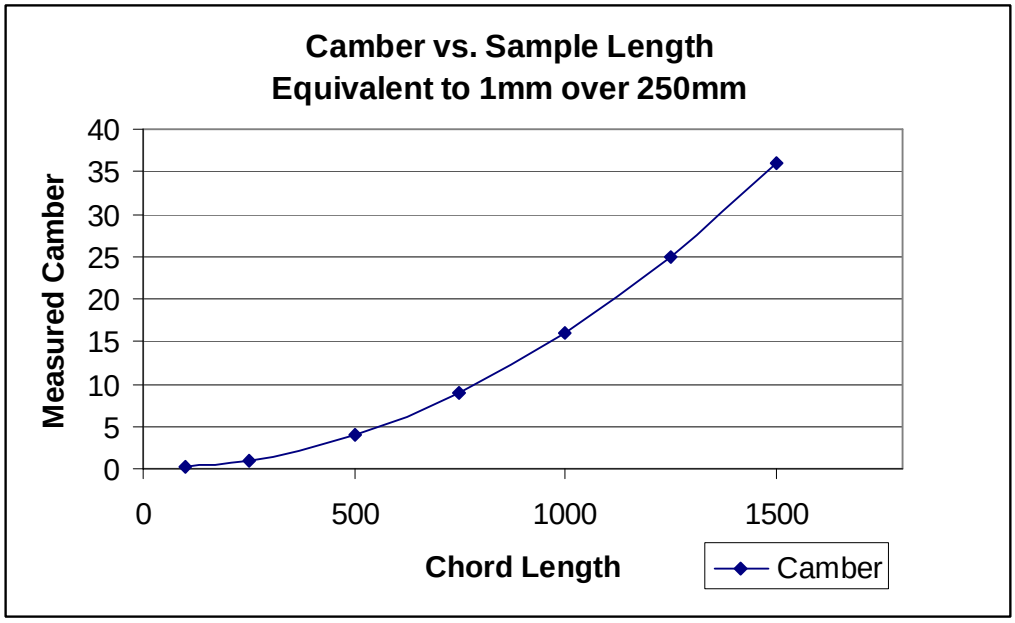
There is not a linear relationship when comparing camber measurements of different length samples. For example, if camber is measured as 1mm in 250mm, the same piece of tape that is 750mm long would not measure a camber of 3mm, but rather 9mm (the square of the multiplier).

Equivalent Midpoints (or camber) for various chord lengths are shown below. These equivalents are all based on the EIA 481 camber maximum of 1mm per 250mm

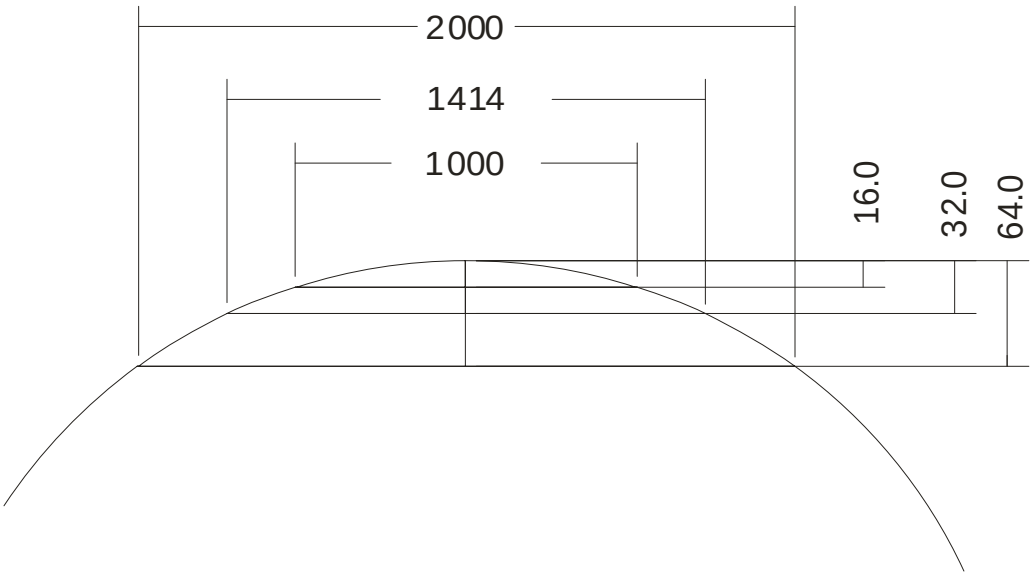
		Midpoint	Chord	
Input	Measured	1	250	
	Equivalent			
		Equivalent Midpoint	Based on Chord Length	
Outputs		0.16	100	
Radius		**1.00**	**250**	**EIA 481 Requirement**
7813		16.0	1000	1 meter sample
		23.8	1219	Equivalent Measurement on 4' Advantek Gauge
		6.0	610	2' Sample

All dimensions in mm

By plotting the amount of camber for various chord lengths, we can see the exponential (non-linear) growth exhibited, as a sample gets longer.



The following is a pictorial representation of the camber measurement of an arc with different chord lengths. The radius of the arc is constant, but as the chord length grows, the measured camber grows at a faster rate. Doubling the chord length increases the camber measurement by 4 times (2 squared)


2000
1414
1000
16.0
32.0
64.0