



## Color & Appearance Testing Program

### Summary Report #204 - 2nd Qtr 2023

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[About the Color Program, About CTS](#)

[Key to Tables and Graphs \(Color Tests\)](#)

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<b><u>Analysis</u></b>	<b><u>Analysis Name</u></b>
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<a href="#">408</a>	<a href="#">Color &amp; Color Difference-45-0, D65/10° Observer</a>
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<a href="#">409</a>	<a href="#">Color &amp; Color Difference Sphere, D65/10°Observer</a>
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<a href="#">411</a>	<a href="#">Spectrophotometric - Sphere</a>
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<a href="#">440</a>	<a href="#">Gloss 60 Degree</a>
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## **About The Color & Appearance Program**

The Collaborative Reference Program for Color & Appearance is operated and maintained by Collaborative Testing Services, Inc. (CTS), with technical guidance and advice provided by representatives from various instrument manufacturers. The program allows laboratories to compare periodically the performance of their testing with that of other laboratories.

Paint chip samples, which have been custom-made specifically for Collaborative Testing Services by Munsell Color, X-Rite Inc., Grand Rapids, MI, are distributed four times per year to participating laboratories. Gloss participants test two pairs of paint chip samples at different gloss levels, approximately 5-10 units apart. Color & Color Difference participants measure a set of two opaque color paint chips, selected from throughout the full color spectrum, consisting of a nonmetameric match with small color differences. These data are analyzed in two separate tables based on the conditions of measurement used. Laboratories that also participate in the Spectrophotometric analyses measure one of the opaque color chips for % reflectance at 16 wavelengths.

Please refer to each test's 'Key' for definitions of terms used in the tables and graphs and guidelines to interpreting the results. Also shown are notes concerning specific laboratory results, as well as significant findings related to instrument types or other testing variations.

### **ABOUT CTS**

Founded in 1971, Collaborative Testing Services, Inc. (CTS) is a privately - owned company that specializes in interlaboratory tests for a variety of sectors: including color, rubber, plastics, fasteners and metals, containerboard, paper, agriculture, hemp, and wine, as well as proficiency tests for forensic laboratories. All of the tests are designed to assist organizations in achieving and maintaining quality assurance objectives. Labs from the U.S., as well as more than 100 countries, currently participate in the CTS programs.

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## Key for Color Program Web Summary Report

<b>WebCode</b>	Assigned laboratory identification number (temporary) used to ensure lab confidentiality while permitting a lab to locate its data in the Color Report published on the CTS web site. The Web Code for each analysis can be found in the Performance Analysis Report emailed to each participant.
<b>Lab Mean</b>	The average of the 2 test results obtained by the participant for CIE L*,a*,b* color space values.
<b>Grand Mean</b>	The average of the LAB MEANS for all included participants. Laboratories flagged with an X or an M (see DATA FLAG column) are excluded from the GRAND MEAN.
<b>Between-Lab Standard Deviation</b>	An indication of the precision of measurement between the laboratories. The greater the spread of the LAB MEANS about the GRAND MEAN, the larger the BETWEEN-LAB STANDARD DEVIATION (and vice versa).
<b>Comparative Performance Value</b>	An indication of how well a laboratory's results agree with the other participants. The CPV is a ratio indicating the number of standard deviations from the GRAND MEAN. The closer a laboratory's COMPARATIVE PERFORMANCE VALUE is to zero, the more consistent its results are with the other participants' data (and vice versa). The critical value for each CPV will vary depending on the number of labs participating in a test.
<b>Graphs</b>	For each laboratory, the LAB MEAN for the first sample is plotted against the LAB MEAN for the second sample with each point representing a laboratory. The horizontal and vertical axes are the GRAND MEANS for each sample. For each test there are three plots: L* <sub>2</sub> vs L* <sub>1</sub> , a* <sub>2</sub> vs a* <sub>1</sub> and b* <sub>2</sub> vs b* <sub>1</sub> . The a* and b* plots are created using absolute values.
<b>Inst Code</b>	A code indicating the manufacturer of the instrument used to perform the test (see separate INSTRUMENT CODE LIST for each test section).
<b>Data Flag</b>	DATA FLAGS are assigned based on the simultaneous analysis of both samples tested. Refer to the following chart for an explanation of each symbol:

<u>DATA FLAG</u>	<u>STATISTICALLY INCLUDED/EXCLUDED</u>	<u>ACTION REQUIRED</u>
*	INCLUDED	<b>CAUTION</b> - review testing procedure and monitor future results. Results fall outside 95% ellipse but within a 99% ellipse that is calculated but not drawn.
X	EXCLUDED	<b>STOP</b> - immediate review of data and/or testing procedure is required. Results fall outside the 99% ellipse and one or more CPV are greater than critical value. See specific notes following each table for more information on why the data is excluded. It is also possible to have an "X" for individual color coordinate (L*, a* or b*) without overall "X" flag. It means that results fall outside the 99% ellipse for particular coordinate but have no CPV flags. Those results will not require any action.
M	EXCLUDED	<b>PROCEED</b> - lab was unable to report data for at least one sample. However, a lab receiving two of more M flags for a test may need to stop and review its testing procedures.

## Key for Spectrophotometric Web Summary Report

<b>WebCode</b>	Assigned laboratory identification number (temporary) used to ensure lab confidentiality while permitting a lab to locate its data in the Color Report published on the CTS web site. The Web Code for each analysis can be found in the Performance Analysis Report emailed to each participant.
<b>Grand Mean</b>	The average of the LAB MEANS for all included participants. Laboratories flagged with an X or an M (see DATA FLAG column) are excluded from the GRAND MEAN.
<b>Between-Lab Standard Deviation</b>	An indication of the precision of measurement between the laboratories. The greater the spread of the LAB MEANS about the GRAND MEAN, the larger the BETWEEN-LAB STANDARD DEVIATION (and vice versa).
<b>Inst Code</b>	A code indicating the manufacturer of the instrument used to perform the test (see separate INSTRUMENT CODE LIST for each test section).
<b>Data Flag</b>	DATA FLAGS are assigned based on the simultaneous analysis of both samples tested. Refer to the following chart for an explanation of each symbol:

<u>DATA FLAG</u>	<u>STATISTICALLY INCLUDED/EXCLUDED</u>	<u>ACTION REQUIRED</u>
X	EXCLUDED	<b>STOP</b> - immediate review of data and/or testing procedure is required. See specific notes following each table for more information on why the data is excluded.

In addition to the DATA FLAG column, it is also possible to have a flag on individual wavelength values as follows:

*	The laboratory's mean for that wavelength deviates from the GRAND MEAN by more than two BETWEEN-LAB STANDARD DEVIATIONS.
X	The laboratory's mean for that wavelength deviates from the GRAND MEAN by more than the critical limit determined by a 99.5% confidence interval.

## Key for Gloss Web Summary Report

**WebCode** Assigned laboratory identification number (temporary) used to ensure lab confidentiality while permitting a lab to locate its data in the Color Report published on the CTS web site. The Web Code for each analysis can be found in the Performance Analysis Report emailed to each participant.

**Lab Mean** The average of the test results obtained by the participant.

**Grand Mean** The average of the LAB MEANS for all included participants. Laboratories flagged with an X or an M (see DATA FLAG column) are excluded from the GRAND MEAN.

**Difference from Grand Mean** The difference of the LAB MEAN from the GRAND MEAN.

**Between-Lab Standard Deviation** An indication of the precision of measurement between the laboratories. The greater the spread of the LAB MEANS about the GRAND MEAN, the larger the BETWEEN-LAB STANDARD DEVIATION (and vice versa).

**Comparative Performance Value** An indication of how well a laboratory's results agree with the other participants. The CPV is a ratio indicating the number of standard deviations from the GRAND MEAN. The closer a laboratory's COMPARATIVE PERFORMANCE VALUE is to zero, the more consistent its results are with the other participants' data (and vice versa). The critical value for each CPV will vary depending on the number of labs participating in a test.

**Inst Code** A code indicating the manufacturer of the instrument used to perform the test (see separate INSTRUMENT CODE LIST for each test section).

**Graphs** For each laboratory, the LAB MEAN for the first sample (x-axis) is plotted against the LAB MEAN for the second sample (y-axis) with each point representing a laboratory. The horizontal and vertical cross-hairs are the GRAND MEANS for each sample. When 20 or more laboratories are in the statistics, an ellipse is also drawn so that 95% of the time a randomly selected laboratory will be included inside the ellipse. Plotted data flags are explained above.

**Data Flag** DATA FLAGS are assigned based on the simultaneous analysis of both samples tested. Refer to the following chart for an explanation of each symbol:

<u>DATA FLAG</u>	<u>STATISTICALLY INCLUDED/EXCLUDED</u>	<u>ACTION REQUIRED</u>
*	INCLUDED	<b>CAUTION</b> - review testing procedure and monitor future results. Results fall outside 95% ellipse but within a 99% ellipse that is calculated but not drawn.
X	EXCLUDED	<b>STOP</b> - immediate review of data and/or testing procedure is required. Results fall outside the 99% ellipse. See specific notes following each table for more information on why the data is excluded.
M	EXCLUDED	<b>PROCEED</b> - lab was unable to report data for at least one sample. However, a lab receiving two of more M flags for a test may need to stop and review its testing procedures.



**CTS Interlaboratory Testing Program for Color & Appearance**    **Report #204**  
**Analysis 408**    **2nd Qtr 2023**

Color and Color Difference - Paint Chips - 45-0 Geometry Instruments  
 CIE L\*a\*b\* Color Space - Illuminant D65 - CIE 1964 (10 Degree) Observer

WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
2BKL68		B231	34.28	6.95	-5.84	0.69	0.23	-0.85	1.11	HW
		B232	34.97	7.18	-6.69					
2N9KYH	X	B231	33.06	6.74	-6.35	0.93	0.30	-0.89	1.32	PR
		B232	33.98	7.04	-7.24					
43WJUA		B231	33.99	6.89	-6.00	0.71	0.23	-0.85	1.13	HX
		B232	34.70	7.11	-6.85					
47MKD6		B231	34.21	6.75	-5.80	0.63	0.22	-0.88	1.10	XU
		B232	34.84	6.97	-6.68					
63XV9H		B231	34.32	6.60	-5.94	0.87	0.23	-0.85	1.24	XE
		B232	35.19	6.83	-6.79					
6GB8KJ		B231	34.69	6.83	-5.92	0.66	0.21	-0.84	1.09	XC
		B232	35.35	7.04	-6.75					
77DK8K		B231	34.30	6.93	-5.77	0.74	0.24	-0.89	1.18	HW
		B232	35.04	7.17	-6.66					
7NTWE		B231	34.20	6.81	-5.74	0.79	0.18	-0.81	1.14	HW
		B232	34.99	6.98	-6.55					
87JDDE		B231	33.93	6.88	-5.98	0.80	0.17	-0.80	1.15	HW
		B232	34.74	7.05	-6.78					
8G6WFQ	X	B231	34.74	6.92	-7.13	0.76	0.29	-0.80	1.13	XD
		B232	35.50	7.21	-7.92					
9HEUT8		B231	34.23	6.86	-5.72	0.80	0.26	-0.85	1.19	HW
		B232	35.03	7.12	-6.57					
9RYAD2		B231	34.90	6.59	-5.99	0.68	0.17	-0.85	1.10	XS
		B232	35.58	6.76	-6.83					
AQ2E86	X	B231	33.21	7.81	-6.41	0.72	-0.79	-0.85	1.37	BG
		B232	33.92	7.02	-7.27					
B9DMG4		B231	34.30	7.00	-5.80	0.80	0.20	-0.90	1.22	HW
		B232	35.10	7.20	-6.70					
BVHZUA		B231	34.54	6.79	-5.75	0.73	0.26	-0.89	1.18	MG
		B232	35.27	7.05	-6.64					
BXHEX2		B231	34.20	6.85	-5.80	0.70	0.15	-0.90	1.15	HW
		B232	34.90	7.00	-6.70					



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Color and Color Difference - Paint Chips - 45-0 Geometry Instruments  
 CIE L\*a\*b\* Color Space - Illuminant D65 - CIE 1964 (10 Degree) Observer

WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
BZC4M2		B231	34.19	6.64	-5.75	0.76	0.26	-0.87	1.18	GE
		B232	34.95	6.91	-6.62					
C7Q73P		B231	33.79	6.71	-5.88	0.68	0.15	-0.73	1.01	GA
		B232	34.47	6.86	-6.61					
DJDUT8		B231	33.92	6.75	-5.67	0.87	0.22	-0.87	1.25	GH
		B232	34.78	6.97	-6.54					
E487RY		B231	33.83	6.52	-5.86	0.75	0.27	-0.89	1.19	GG
		B232	34.57	6.78	-6.75					
FPL97V		B231	34.13	6.83	-5.73	0.67	0.18	-0.85	1.10	GE
		B232	34.80	7.02	-6.58					
FYDGZY		B231	33.80	6.85	-6.15	1.13	0.17	-0.73	1.36	XM
		B232	34.93	7.01	-6.88					
GT6KKQ		B231	35.03	6.76	-6.27	0.68	0.13	-0.76	1.02	XJ
		B232	35.70	6.89	-7.03					
GXYJYL		B231	33.79	6.55	-5.77	0.71	0.24	-0.84	1.13	GG
		B232	34.50	6.79	-6.61					
H63KB2		B231	34.10	6.77	-6.04	0.73	0.25	-0.87	1.15	XU
		B232	34.82	7.02	-6.90					
HCYHMJ		B231	34.40	6.70	-6.00	0.70	0.20	-0.90	1.16	HL
		B232	35.10	6.90	-6.90					
JPD9YQ		B231	33.93	6.69	-5.83	0.78	0.20	-0.85	1.17	XU
		B232	34.71	6.89	-6.68					
JTEA3U		B231	34.06	6.82	-5.98	0.83	0.18	-0.83	1.19	HK
		B232	34.89	7.01	-6.82					
K26CJV		B231	34.30	7.00	-5.80	0.70	0.25	-0.90	1.17	HW
		B232	35.00	7.25	-6.70					
L87UCT		B231	33.86	6.55	-6.23	0.68	0.25	-0.82	1.10	XF
		B232	34.54	6.80	-7.06					
LTGHAX	X	B231	41.15	5.59	-4.53	0.29	0.28	-0.65	0.77	XP
		B232	41.44	5.87	-5.18					
MUYC4Q		B231	34.91	6.57	-6.20	0.74	0.24	-0.88	1.17	MW
		B232	35.65	6.81	-7.08					



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**Analysis 408** 2nd Qtr 2023

Color and Color Difference - Paint Chips - 45-0 Geometry Instruments  
 CIE L\*a\*b\* Color Space - Illuminant D65 - CIE 1964 (10 Degree) Observer

WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
Q3ZM3R	X	B231	32.43	6.87	-5.96	0.63	0.12	-0.86	1.07	HK
		B232	33.06	6.99	-6.81					
Q8A4AU		B231	33.77	7.11	-5.97	0.70	0.22	-0.80	1.09	HX
		B232	34.47	7.34	-6.77					
R7T7GV	X	B231	36.18	1.34	-4.21	0.80	0.15	-0.83	1.16	CH
		B232	36.97	1.48	-5.04					
RAKZXX		B231	34.21	7.09	-5.83	0.78	0.21	-0.83	1.15	HW
		B232	34.99	7.30	-6.66					
TJW6NR		B231	33.91	6.56	-5.82	0.70	0.20	-0.82	1.10	GE
		B232	34.62	6.76	-6.65					
TNF73C		B231	34.62	6.61	-6.09	0.65	0.17	-0.84	1.07	XW
		B232	35.27	6.79	-6.93					
TRBXX3		B231	35.00	6.53	-6.07	0.69	0.23	-0.82	1.09	XH
		B232	35.69	6.76	-6.89					
UFYQ2F		B231	34.29	6.59	-6.05	0.73	0.15	-0.77	1.07	XU
		B232	35.02	6.73	-6.82					
URT3CV		B231	34.32	6.27	-5.59	0.65	0.21	-0.85	1.09	GE
		B232	34.97	6.49	-6.44					
UZLHWT		B231	34.06	6.64	-6.06	0.66	0.19	-0.76	1.03	MD
		B232	34.72	6.83	-6.83					
VEX9ER		B231	33.90	6.61	-5.82	0.74	0.22	-0.88	1.17	GG
		B232	34.65	6.83	-6.70					
VJVXRH		B231	33.97	6.80	-5.95	0.59	0.17	-0.85	1.04	MT
		B232	34.56	6.96	-6.80					
WVJHAT		B231	33.11	6.79	-6.24	0.70	0.19	-0.88	1.14	BG
		B232	33.81	6.98	-7.12					
X8M7XF		B231	34.26	7.08	-5.83	0.73	0.19	-0.86	1.14	HW
		B232	34.99	7.27	-6.68					
YKDAPD		B231	35.00	6.61	-6.14	0.77	0.27	-0.88	1.20	XH
		B232	35.77	6.88	-7.02					





<b>Summary Statistics</b>							
<u>Samples</u>	<u>L*</u>	<u>a*</u>	<u>b*</u>	<u>ΔL*</u>	<u>Δa*</u>	<u>Δb*</u>	<u>ΔE*</u>
<b>Grand Means</b>							
B231	34.21	6.75	-5.94	0.73	0.21	-0.84	1.14
B232	34.93	6.96	-6.78				
<b>Std Dev Btwn Labs</b>							
B231	0.42	0.18	0.19	0.09	0.04	0.04	0.07
B232	0.43	0.18	0.18				

Statistics based on 41 of 47 reporting participants

**Comments Assigned on Data Flags for Test #408**

- 2N9KYH(X) - Low L\* value for Sample B231 . Large replication difference for L\* values on Sample B232.
- 8G6WFQ(X) - Low b\* values for both samples.
- AQ2E86(X) - High a\* value for Sample B231 . Large replication difference for L\* values on Sample B231 . Small Delta b, large Delta E.
- LTGHAX(X) - Extreme Data. Small Delta L & E, large Delta b.
- Q3ZM3R(X) - Low L\* values for both samples.
- R7T7GV(X) - High L\* values for both samples. Extreme data for both a\* & b\* values.

**Key to Instrument Codes Reported by Participants**

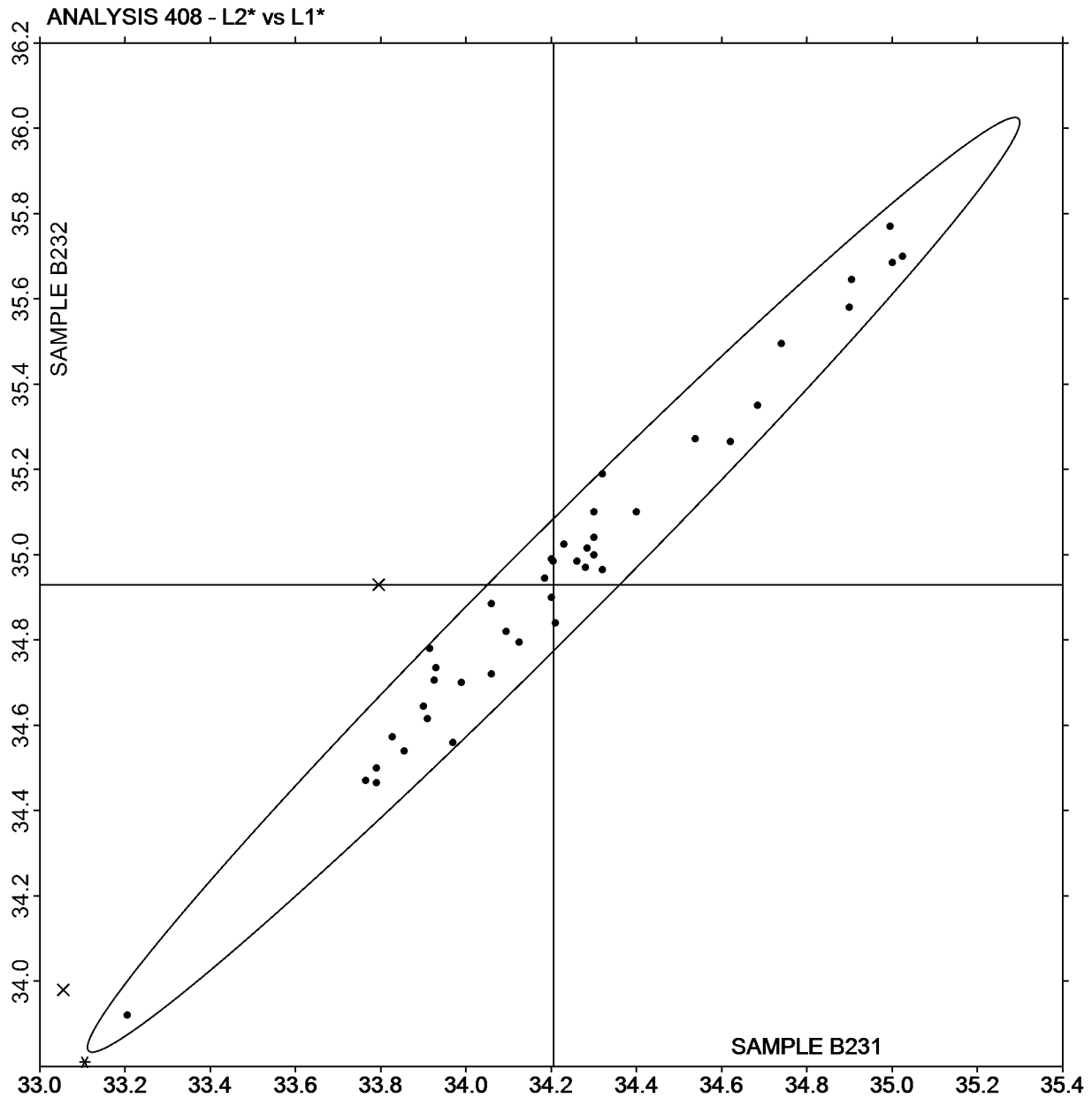
<b>BG</b> BYK Mac i	<b>CH</b> CHN Spec CS-10 Colorimeter
<b>GA</b> BYK-Gardner	<b>GE</b> BYK-Gardner spectro-guide (45/0)
<b>GG</b> BYK-Gardner spectro2-guide (45/0) gloss	<b>GH</b> BYK-Gardner Color-View
<b>HK</b> Hunter MiniScan XE (45/0)	<b>HL</b> Hunter Agera
<b>HW</b> Hunter LabScan XE	<b>HX</b> Hunter Color FlexEZ 45/0
<b>MD</b> Minolta FD 7	<b>MG</b> Macbeth 1500/PLUS or 2025+ Color Eye
<b>MT</b> Minolta CM-25cG Spectrophotometer	<b>MW</b> Minolta CM 3700a Spectrophotometer
<b>PR</b> PhotoResearch PR730	<b>XC</b> X-Rite i1Basic Pro
<b>XD</b> X-Rite 500 Series SpectroDensitometer	<b>XE</b> X-Rite eXact Portable Spectrophotometer
<b>XF</b> X-Rite i1 iSis	<b>XH</b> X-Rite Color i5
<b>XJ</b> X-Rite CI7XX0	<b>XM</b> X-Rite MA58 Multi-Angle Spectrophotometer
<b>XP</b> X-Rite MA9 Multi-Angle Spectrophotometer	<b>XS</b> X-Rite 962 Portable Spectrophotometer
<b>XU</b> X-Rite 964 Portable Spectrophotometer	<b>XW</b> X-Rite



L2\* vs L1\*

SAMPLE B231 = 34.21

SAMPLE B232 = 34.93



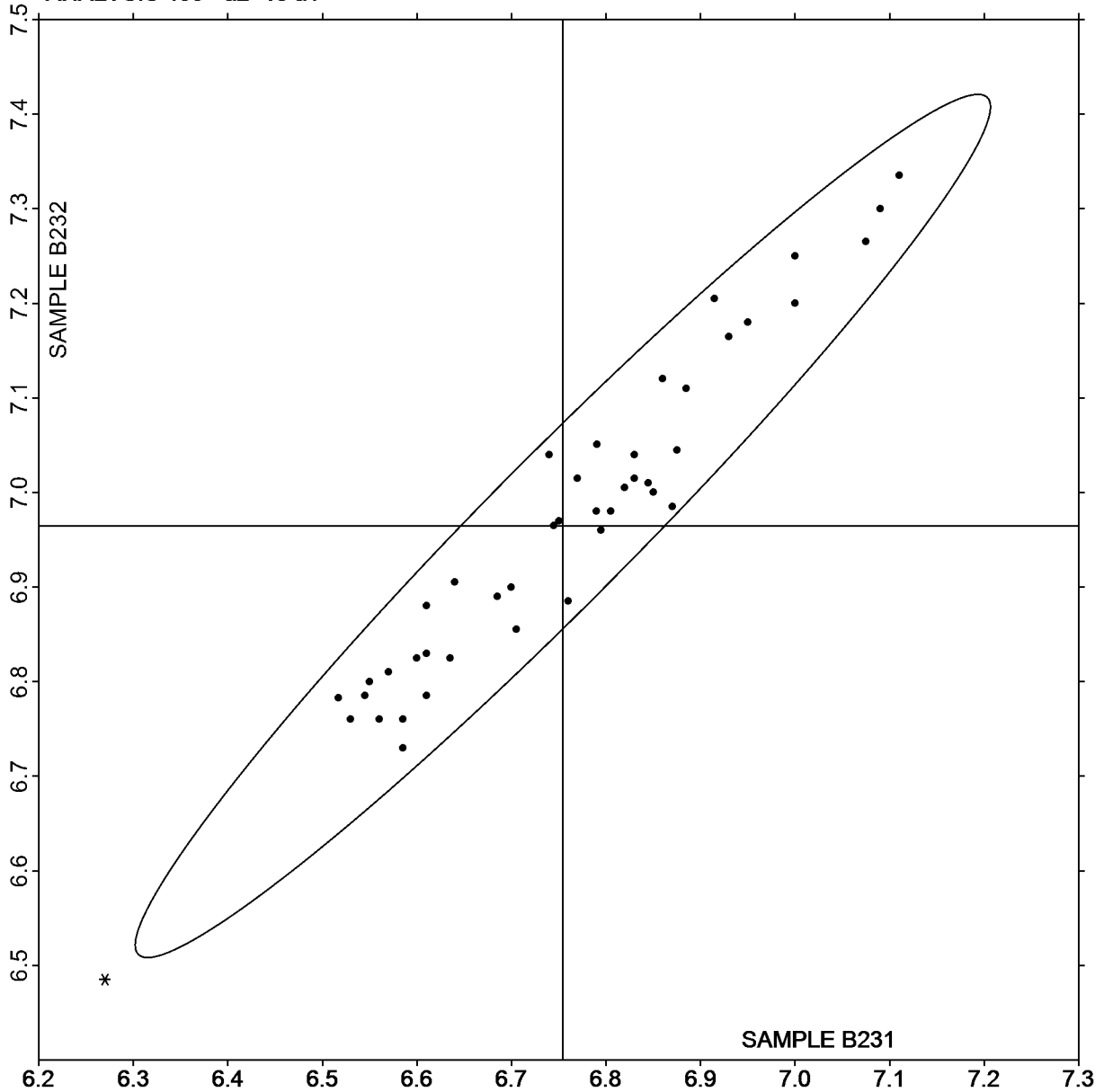


a2\* vs a1\*

SAMPLE B231 = 6.75

SAMPLE B232 = 6.96

ANALYSIS 408 - a2\* vs a1\*



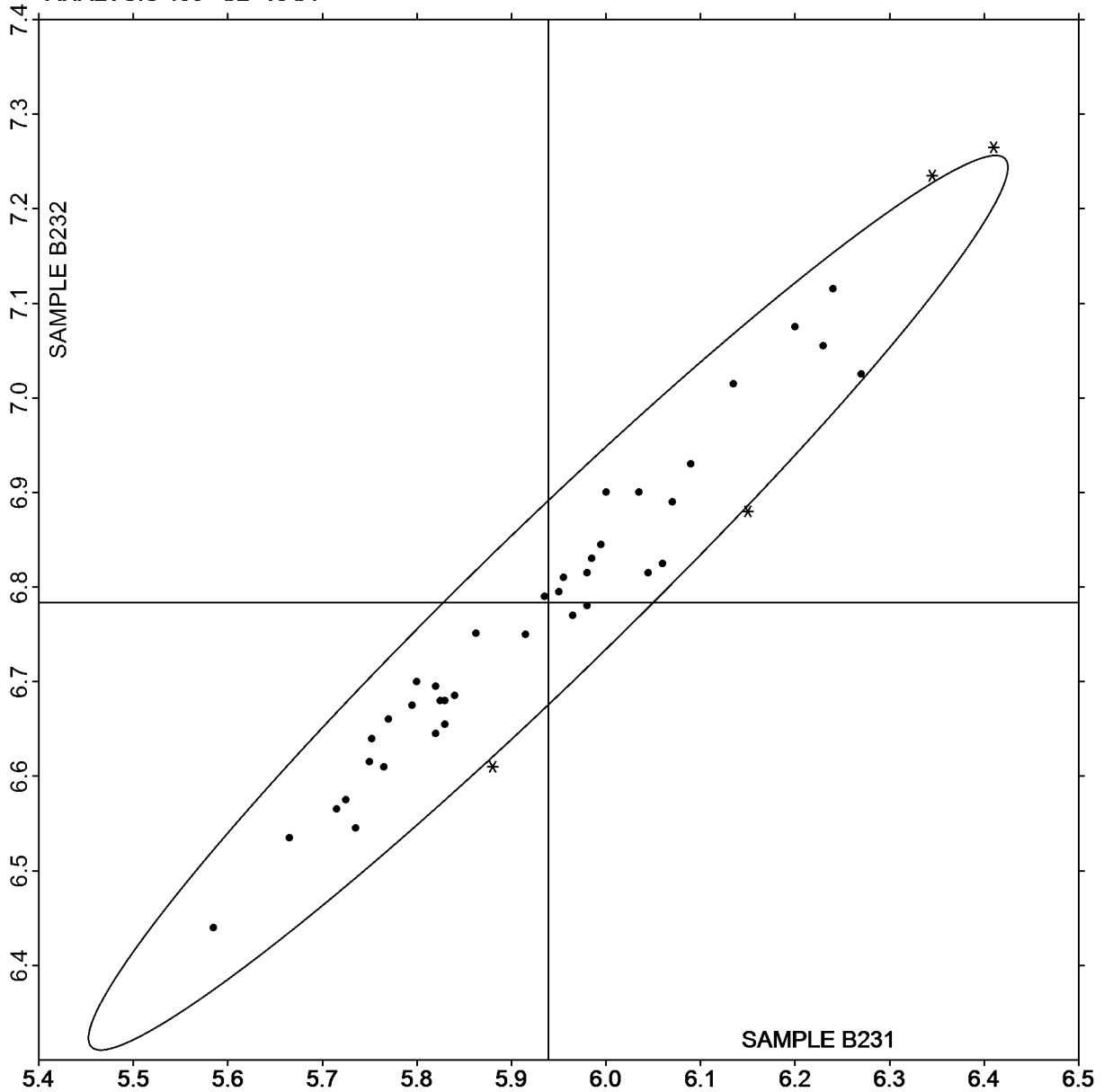


**b2\* vs b1\***

SAMPLE B231 = -5.94

SAMPLE B232 = -6.78

ANALYSIS 408 - b2\* vs b1\*



Plot created using absolute values.



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Color and Color Difference - Paint Chips - Sphere Geometry Instruments  
 CIE L\*a\*b\* Color Space - Illuminant D65 - CIE 1964 (10 Degree) Observer

WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
2N9KYH	X	B231	34.90	6.58	-6.30	0.51	0.20	-0.83	0.99	CA
		B232	35.42	6.78	-7.12					
2UTMX8		B231	34.93	6.64	-6.21	0.73	0.19	-0.81	1.10	XD
	B232	35.65	6.82	-7.02						
2XMNVF		B231	34.84	6.62	-6.21	0.76	0.23	-0.81	1.13	MQ
	B232	35.60	6.85	-7.02						
3KPRRA		B231	34.89	6.66	-6.17	0.72	0.18	-0.82	1.11	MK
	B232	35.61	6.84	-6.99						
42TQDH		B231	35.16	6.53	-5.99	0.70	0.21	-0.86	1.13	AO
	B232	35.87	6.74	-6.85						
47MKD6		B231	34.91	6.61	-6.26	0.72	0.22	-0.84	1.13	XD
	B232	35.63	6.83	-7.10						
47NFXV		B231	34.86	6.63	-6.19	0.73	0.18	-0.81	1.11	XI
	B232	35.59	6.81	-7.00						
4X6ANH		B231	34.87	6.63	-6.11	0.72	0.21	-0.84	1.13	XI
	B232	35.58	6.84	-6.95						
4ZRUPF	X	B231	34.63	6.59	-6.13	0.73	0.20	-0.83	1.12	XE
		B232	35.36	6.79	-6.95					
64MZNH		B231	35.06	6.67	-6.13	0.63	0.16	-0.77	1.00	AU
	B232	35.69	6.83	-6.90						
66KDC9		B231	35.05	6.62	-5.97	0.73	0.20	-0.86	1.15	AS
	B232	35.79	6.82	-6.83						
67CCHG		B231	35.01	6.56	-5.96	0.75	0.26	-0.84	1.16	AS
	B232	35.75	6.81	-6.80						
72KNF9		B231	34.98	6.66	-5.88	0.73	0.24	-0.86	1.15	AE
	B232	35.71	6.91	-6.74						
7FYP2D		B231	34.87	6.60	-6.18	0.80	0.31	-0.88	1.23	XD
	B232	35.67	6.91	-7.06						
8JWPRM		B231	34.83	6.52	-5.95	0.76	0.24	-0.84	1.16	XO
	B232	35.59	6.75	-6.79						
8UATXT		B231	34.89	6.49	-5.86	0.68	0.22	-0.85	1.11	XO
	B232	35.56	6.71	-6.72						



**CTS Interlaboratory Testing Program for Color & Appearance** **Report #204**  
**Analysis 409** **2nd Qtr 2023**

Color and Color Difference - Paint Chips - Sphere Geometry Instruments  
 CIE L\*a\*b\* Color Space - Illuminant D65 - CIE 1964 (10 Degree) Observer

WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
8V827C		B231	34.93	6.62	-5.98	0.73	0.18	-0.85	1.14	AS
		B232	35.66	6.80	-6.83					
8WH3TB		B231	34.86	6.57	-6.16	0.77	0.24	-0.84	1.16	MM
		B232	35.63	6.82	-7.00					
9LF4VM		B231	35.03	6.65	-6.02	0.74	0.20	-0.81	1.12	XO
		B232	35.77	6.85	-6.83					
9RYAD2	X	B231	34.08	6.78	-5.86	0.66	0.16	-0.82	1.06	AJ
		B232	34.73	6.94	-6.68					
9V34B8	X	B231	34.74	6.70	-6.55	0.89	0.29	-0.86	1.27	CA
		B232	35.63	6.99	-7.41					
9Y49YD		B231	35.08	6.58	-6.09	0.72	0.26	-0.88	1.17	AO
		B232	35.80	6.84	-6.96					
AAXZQB		B231	34.98	6.57	-6.05	0.73	0.28	-0.90	1.19	MW
		B232	35.71	6.85	-6.94					
AD3C44		B231	34.99	6.60	-6.25	0.78	0.21	-0.83	1.15	XI
		B232	35.76	6.82	-7.08					
AQ386C		B231	34.91	6.63	-6.02	0.77	0.21	-0.80	1.13	AT
		B232	35.68	6.84	-6.82					
BVT489		B231	35.19	6.65	-6.26	0.71	0.21	-0.87	1.14	CA
		B232	35.90	6.86	-7.13					
C7Q73P		B231	35.01	6.68	-5.99	0.75	0.20	-0.84	1.15	AJ
		B232	35.77	6.88	-6.84					
CAVKQ		B231	34.76	6.64	-6.08	0.80	0.25	-0.88	1.21	XD
		B232	35.56	6.89	-6.95					
CQ4MPG		B231	34.77	6.60	-6.11	0.73	0.25	-0.89	1.17	XB
		B232	35.49	6.84	-7.00					
D7L98K		B231	34.91	6.61	-6.15	0.71	0.25	-0.89	1.16	XD
		B232	35.62	6.86	-7.03					
DEF2L		B231	34.76	6.58	-6.21	0.80	0.29	-0.87	1.22	MM
		B232	35.56	6.87	-7.08					
DJDUT8		B231	35.10	6.65	-6.03	0.73	0.22	-0.86	1.14	MV
		B232	35.83	6.88	-6.89					



**CTS Interlaboratory Testing Program for Color & Appearance**    **Report #204**  
**Analysis 409**    **2nd Qtr 2023**

Color and Color Difference - Paint Chips - Sphere Geometry Instruments  
 CIE L\*a\*b\* Color Space - Illuminant D65 - CIE 1964 (10 Degree) Observer

WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
E4ZLQH	X	B231	33.70	7.11	-5.91	0.63	0.14	-0.83	1.04	HF
		B232	34.32	7.25	-6.73					
EET6RG		B231	34.87	6.65	-6.21	0.67	0.19	-0.80	1.05	XD
	B232	35.53	6.84	-7.00						
EPAYY4		B231	34.93	6.66	-5.99	0.79	0.25	-0.86	1.19	AS
	B232	35.72	6.91	-6.85						
EPKKVD		B231	34.94	6.59	-6.04	0.69	0.21	-0.85	1.12	XI
	B232	35.63	6.80	-6.89						
FB4FHN		B231	34.85	6.74	-6.07	0.76	0.23	-0.87	1.18	AS
	B232	35.62	6.98	-6.93						
FN6LCN		B231	34.93	6.63	-6.40	0.75	0.23	-0.82	1.13	XB
	B232	35.68	6.86	-7.21						
FRJC7X	X	B231	35.23	6.66	-6.14	0.38	0.25	-0.78	0.90	XC
		B232	35.60	6.91	-6.92					
FYFGRL		B231	35.09	6.68	-6.16	0.69	0.22	-0.85	1.12	AP
	B232	35.78	6.90	-7.01						
GL3HE6		B231	34.83	6.47	-6.27	0.75	0.21	-0.92	1.20	HP
	B232	35.58	6.69	-7.18						
GNDFU9		B231	35.05	6.60	-6.28	0.70	0.21	-0.85	1.12	AQ
	B232	35.76	6.80	-7.13						
GTW8K3		B231	34.93	6.59	-6.02	0.73	0.23	-0.87	1.16	AS
	B232	35.66	6.82	-6.89						
GV9F9Z		B231	34.99	6.72	-6.30	0.71	0.15	-0.82	1.09	MT
	B232	35.70	6.87	-7.12						
H63KB2		B231	35.11	6.62	-6.31	0.70	0.24	-0.87	1.14	XI
	B232	35.81	6.86	-7.18						
HJNZFM		B231	34.86	6.63	-6.05	0.68	0.25	-0.88	1.14	XH
	B232	35.54	6.88	-6.93						
HKBWJ7		B231	34.84	6.47	-6.05	0.64	0.26	-0.88	1.12	XG
	B232	35.48	6.72	-6.93						
JPD9YQ		B231	34.92	6.63	-6.25	0.74	0.19	-0.81	1.12	XB
	B232	35.66	6.82	-7.06						



**CTS Interlaboratory Testing Program for Color & Appearance** Report #204  
**Analysis 409** 2nd Qtr 2023

Color and Color Difference - Paint Chips - Sphere Geometry Instruments  
 CIE L\*a\*b\* Color Space - Illuminant D65 - CIE 1964 (10 Degree) Observer

WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
JQRMA7		B231	34.82	6.66	-6.26	0.76	0.21	-0.85	1.16	MV
		B232	35.58	6.88	-7.11					
JYLZ7Z		B231	34.86	6.56	-6.21	0.77	0.25	-0.88	1.20	MY
		B232	35.63	6.82	-7.09					
K7HU2D		B231	34.85	6.53	-6.16	0.81	0.27	-0.87	1.22	XD
		B232	35.66	6.80	-7.03					
KEQNUK		B231	35.03	6.63	-6.03	0.76	0.25	-0.90	1.21	AN
		B232	35.79	6.88	-6.93					
KLQ4JR		B231	35.03	6.60	-6.22	0.72	0.18	-0.82	1.11	AS
		B232	35.75	6.78	-7.04					
LA6VWD		B231	34.85	6.63	-6.18	0.74	0.22	-0.82	1.12	XI
		B232	35.59	6.85	-7.00					
LHVF2P		B231	35.05	6.70	-6.07	0.76	0.25	-0.87	1.18	AT
		B232	35.81	6.96	-6.94					
LTGHAX	X	B231	35.44	6.68	-6.13	0.67	0.18	-0.81	1.07	XF
		B232	36.11	6.86	-6.94					
MDB2GN		B231	34.89	6.59	-5.97	0.73	0.19	-0.83	1.12	XM
		B232	35.62	6.78	-6.80					
ML72TV		B231	35.05	6.55	-6.21	0.73	0.22	-0.87	1.16	MM
		B232	35.78	6.78	-7.07					
MUYC4Q		B231	35.02	6.64	-6.12	0.76	0.22	-0.85	1.16	MY
		B232	35.78	6.86	-6.97					
MX7G9Z		B231	34.93	6.66	-6.15	0.64	0.26	-0.82	1.07	XI
		B232	35.56	6.92	-6.97					
N2CURH		B231	34.97	6.61	-6.04	0.77	0.27	-0.89	1.21	AJ
		B232	35.74	6.88	-6.93					
N63VBD	X	B231	35.29	6.57	-6.41	0.57	0.20	-0.76	0.97	HP
		B232	35.85	6.77	-7.18					
N82C7T		B231	34.94	6.68	-6.22	0.72	0.21	-0.82	1.10	XD
		B232	35.66	6.89	-7.04					
P4ZG7Q		B231	34.93	6.65	-6.14	0.78	0.22	-0.83	1.16	MU
		B232	35.70	6.86	-6.97					





**CTS Interlaboratory Testing Program for Color & Appearance** Report #204  
**Analysis 409** 2nd Qtr 2023

Color and Color Difference - Paint Chips - Sphere Geometry Instruments  
 CIE L\*a\*b\* Color Space - Illuminant D65 - CIE 1964 (10 Degree) Observer

WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
PCULZR		B231	34.97	6.57	-6.13	0.76	0.28	-0.90	1.21	XD
		B232	35.73	6.84	-7.03					
PLPC6L		B231	34.95	6.65	-6.09	0.75	0.16	-0.82	1.12	AT
		B232	35.70	6.82	-6.91					
Q2N9BC		B231	35.10	6.63	-6.05	0.71	0.20	-0.82	1.10	AP
		B232	35.81	6.83	-6.87					
QLL92A		B231	34.91	6.58	-6.00	0.73	0.26	-0.88	1.17	AS
		B232	35.64	6.85	-6.87					
QM9ZHK		B231	35.09	6.63	-6.02	0.68	0.25	-0.85	1.12	AJ
		B232	35.77	6.88	-6.87					
T4ZXMK		B231	35.06	6.67	-6.14	0.69	0.21	-0.84	1.10	MW
		B232	35.75	6.88	-6.97					
THB67P		B231	34.98	6.48	-6.13	0.71	0.22	-0.80	1.09	GG
		B232	35.68	6.71	-6.93					
U8JCQK		B231	34.95	6.75	-6.36	0.63	0.17	-0.72	0.98	XB
		B232	35.58	6.92	-7.08					
UB6TJQ		B231	35.01	6.71	-6.07	0.67	0.21	-0.81	1.07	AU
		B232	35.68	6.93	-6.88					
UFYQ2F		B231	34.95	6.78	-6.27	0.66	0.16	-0.78	1.03	XE
		B232	35.61	6.94	-7.05					
URT3CV	X	B231	34.84	6.23	-6.24	0.72	0.15	-0.84	1.12	GD
		B232	35.56	6.38	-7.08					
V2AB6G		B231	34.93	6.60	-6.18	0.66	0.27	-0.85	1.11	XH
		B232	35.60	6.87	-7.03					
VE226C		B231	35.06	6.59	-6.10	0.72	0.23	-0.88	1.16	AJ
		B232	35.78	6.82	-6.98					
VEX9ER	X	B231	34.51	6.63	-6.06	0.76	0.21	-0.85	1.16	GE
		B232	35.27	6.85	-6.91					
VJVXRH		B231	34.95	6.64	-6.30	0.66	0.20	-0.80	1.06	XB
		B232	35.61	6.84	-7.10					
WC7WTQ		B231	34.96	6.67	-6.24	0.69	0.18	-0.78	1.06	XG
		B232	35.65	6.85	-7.02					



**CTS Interlaboratory Testing Program for Color & Appearance** **Report #204**  
**Analysis 409** **2nd Qtr 2023**

Color and Color Difference - Paint Chips - Sphere Geometry Instruments  
 CIE L\*a\*b\* Color Space - Illuminant D65 - CIE 1964 (10 Degree) Observer

WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
WL2D3V		B231	35.02	6.65	-5.98	0.72	0.23	-0.83	1.13	XF
		B232	35.74	6.88	-6.82					
WPH33X		B231	35.12	6.68	-6.15	0.66	0.18	-0.85	1.09	MI
		B232	35.79	6.86	-7.00					
WQTKL4		B231	34.97	6.71	-6.05	0.72	0.19	-0.84	1.12	AU
		B232	35.69	6.89	-6.89					
WTY8WM		B231	34.87	6.49	-6.11	0.88	0.25	-0.85	1.25	XI
		B232	35.75	6.74	-6.97					
XKB8G9		B231	34.93	6.57	-6.17	0.73	0.25	-0.88	1.17	AQ
		B232	35.65	6.81	-7.06					
XZNKRE		B231	35.03	6.68	-6.20	0.68	0.19	-0.78	1.05	MW
		B232	35.71	6.87	-6.97					
YJ62VK		B231	34.79	6.72	-6.19	0.76	0.24	-0.85	1.17	XE
		B232	35.55	6.96	-7.04					
YKDAPD		B231	34.98	6.66	-6.16	0.69	0.20	-0.84	1.10	XH
		B232	35.67	6.86	-6.99					
YQKHNU		B231	34.84	6.59	-6.19	0.77	0.23	-0.86	1.18	XD
		B232	35.61	6.82	-7.05					
Z2YZL4		B231	34.83	6.62	-5.89	0.74	0.25	-0.92	1.21	XH
		B232	35.57	6.87	-6.81					
ZHHVU8		B231	34.97	6.55	-6.32	0.73	0.21	-0.81	1.11	HP
		B232	35.70	6.76	-7.13					

Summary Statistics								
Samples	L*	a*	b*	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta E^*$	
<b>Grand Means</b>								
B231	34.95	6.62	-6.12	0.73	0.22	-0.84	1.14	
B232	35.67	6.84	-6.97					
<b>Std Dev Btwn Labs</b>								
B231	0.10	0.06	0.12	0.04	0.03	0.04	0.05	
B232	0.09	0.06	0.11					

Statistics based on 81 of 91 reporting participants



**Comments Assigned on Data Flags for Test #409**

- 2N9KYH(X) - Low L\* values for Sample B232. Large replication difference for L\* Sample B232. Small Delta L & E.
- 4ZRUPF(X) - Low L\* values for both samples.
- 9RYAD2(X) - Very low L\* values for both samples.
- 9V34B8(X) - Large replication difference for Sample B231 for L\*. Low b\* values for both samples. Large Delta L.
- E4ZLQH(X) - Extreme data for both L\* & a\* values.
- FRJC7X(X) - High L\* values for Sample B231. Small Delta L & E.
- LTGHAX(X) - High L\* values for both samples.
- N63VBD(X) - High L\* values for Sample B231. Small Delta L & E.
- URT3CV(X) - Very low a\* values for both samples.
- VEX9ER(X) - Low L\* values for both samples.

**Key to Instrument Codes Reported by Participants**

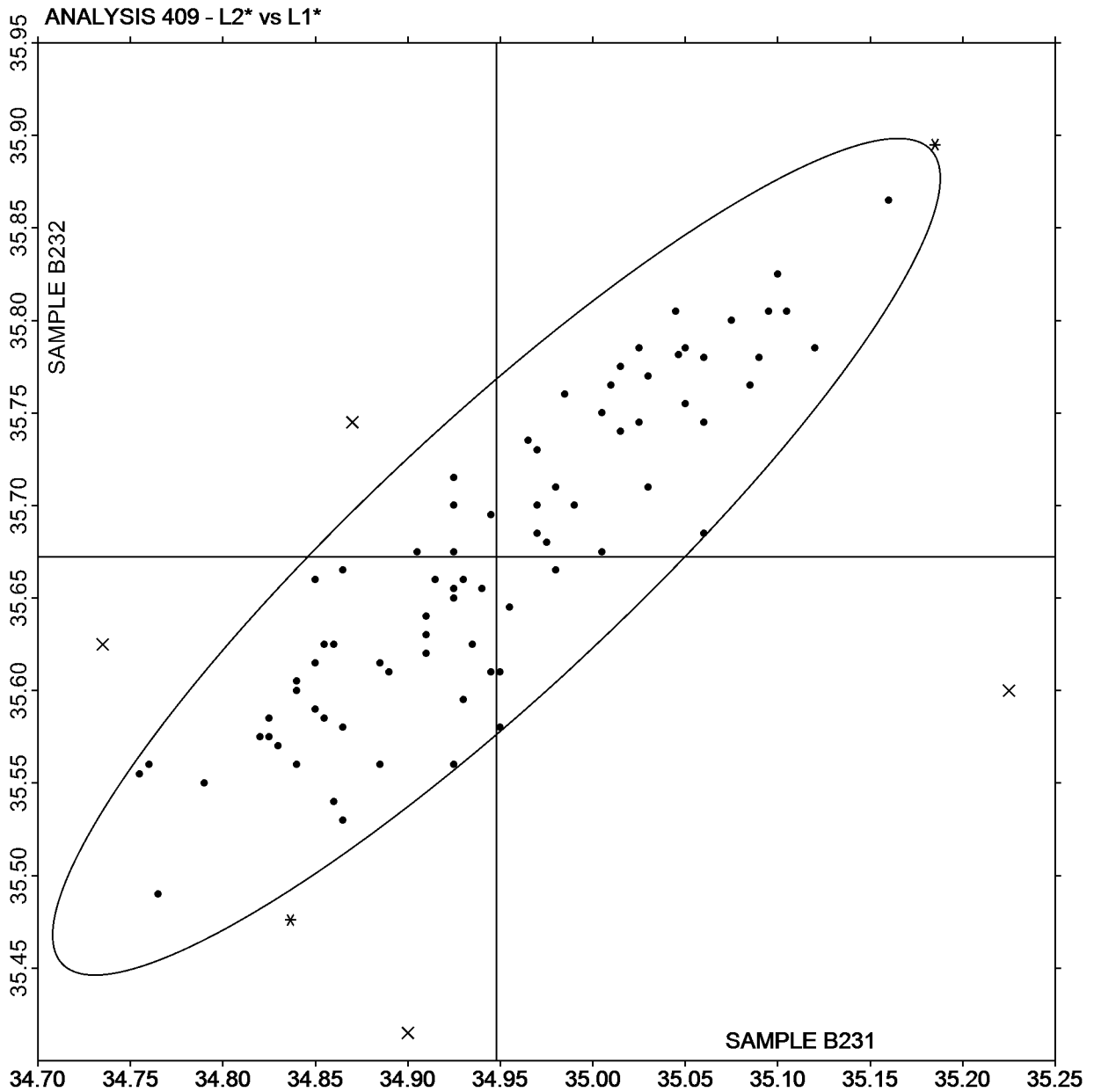
<b>AE</b> Datacolor 110	<b>AJ</b> Datacolor 600
<b>AN</b> Datacolor 650	<b>AO</b> Datacolor 650x
<b>AP</b> Datacolor 750	<b>AQ</b> Datacolor 600x
<b>AS</b> Datacolor 800	<b>AT</b> Datacolor 850
<b>AU</b> Datacolor 1000	<b>CA</b> Cary 5000
<b>GD</b> BYK-Gardner Spectro-Guide Sphere	<b>GE</b> BYK-Gardner Spectro2-Guide Sphere Gloss
<b>GG</b> BYK-Gardner TCS II	<b>HF</b> Hunter ColorFlex Diffuse
<b>HP</b> Hunter UltraScan PRO	<b>MI</b> Macbeth Color i5
<b>MK</b> Macbeth Color-Eye 7000	<b>MM</b> Macbeth Color-Eye 7000a
<b>MQ</b> Minolta CM-700d	<b>MT</b> Minolta CM-2600d
<b>MU</b> Minolta	<b>MV</b> Minolta CM-3000d Spectrophotometer
<b>MW</b> Minolta CM 3700a Spectrophotometer	<b>MY</b> Minolta Benchtop Spectrophotometer CM-3600a
<b>XB</b> X-Rite Ci7000 Series Benchtop Spectrophotometer	<b>XC</b> X-Rite Ci4200 Benchtop Spectrophotometer
<b>XD</b> X-Rite Ci7800 Benchtop Spectrophotometer	<b>XE</b> X-Rite Ci7600 Benchtop Spectrophotometer
<b>XF</b> X-Rite Ci6x Portable Spectrophotometer	<b>XG</b> X-Rite Ci7860 Benchtop Spectrophotometer
<b>XH</b> X-Rite Color i5 Benchtop Spectrophotometer	<b>XI</b> X-Rite Color i7 Benchtop Spectrophotometer
<b>XM</b> X-Rite SP62 Portable Sphere Spectrophotometer	<b>XO</b> X-Rite SP64 Portable Sphere Spectrophotometer



L2\* vs L1\*

SAMPLE B231 = 34.95

SAMPLE B232 = 35.67

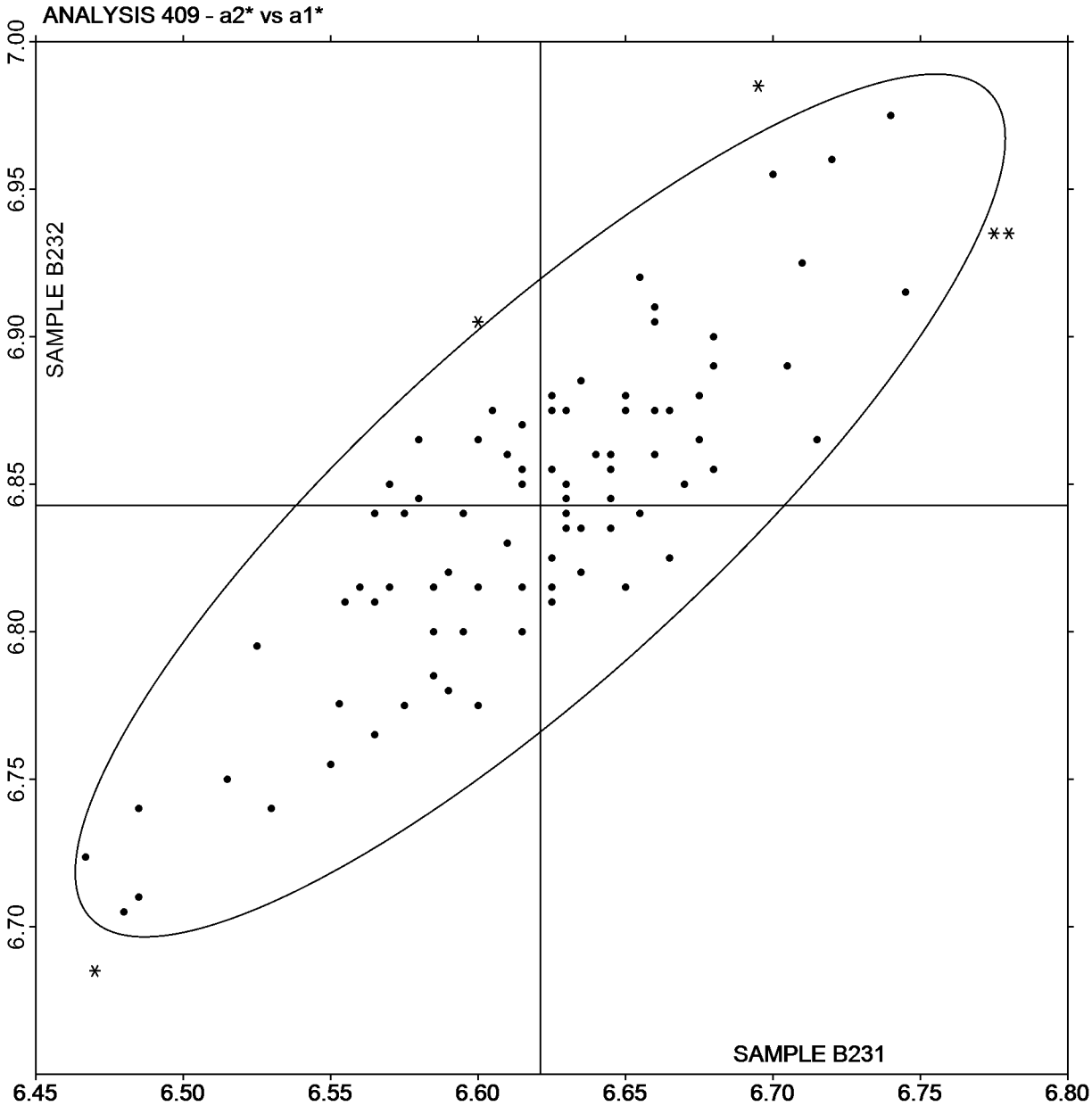




a2\* vs a1\*

SAMPLE B231 = 6.62

SAMPLE B232 = 6.84

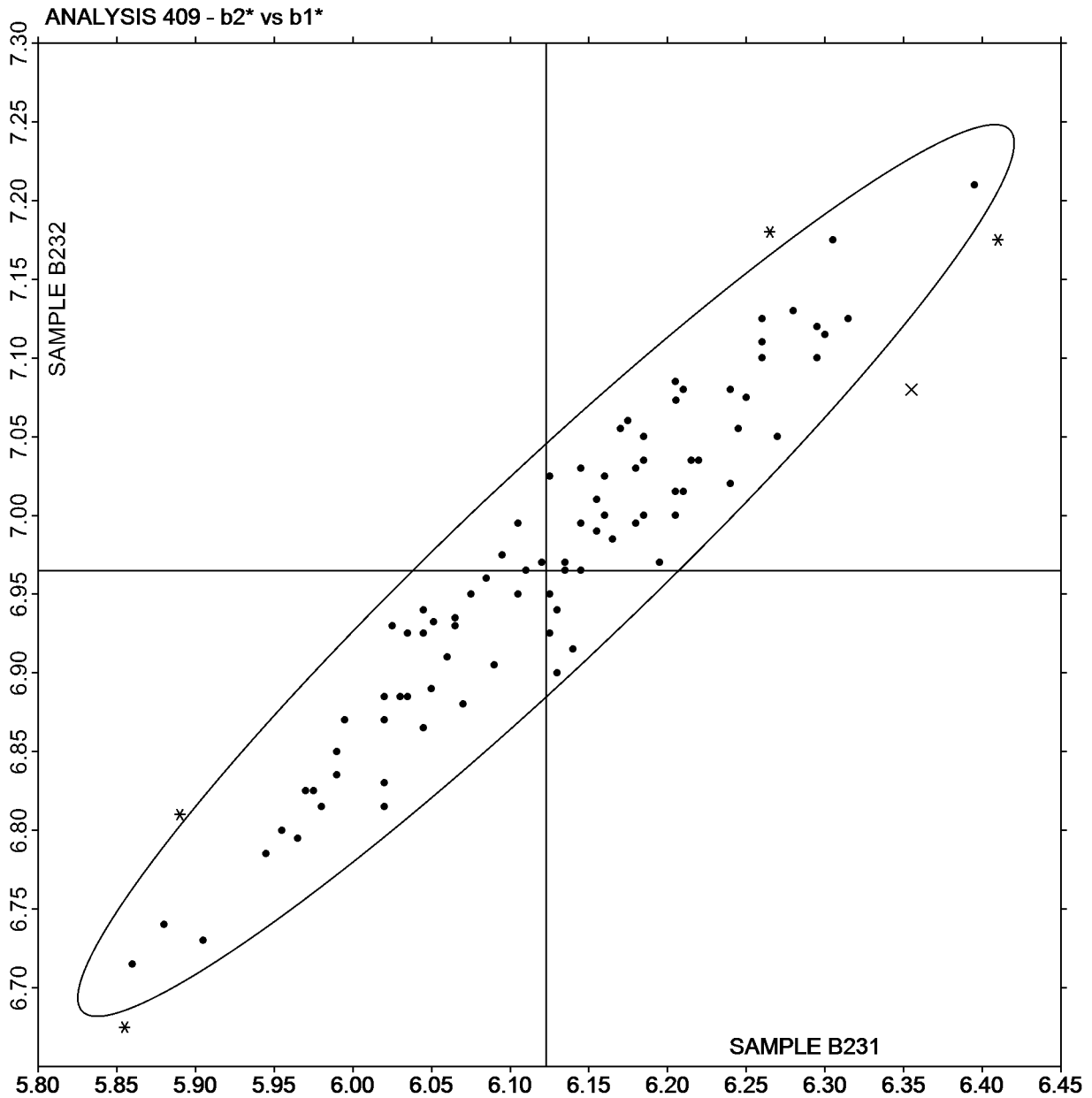




**b2\* vs b1\***

SAMPLE B231 = -6.12

SAMPLE B232 = -6.97



Plot created using absolute values.



## CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

**Report #204  
2nd Qtr 2023**

Spectrophotometric - Sphere Geometry Instruments  
Reflectance at 16 Selected Wavelengths

WebCode	Data Flag	Spectrophotometric Reflectance values (as %) at selected wavelengths																Instr Code
		400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	
Sample B231																		
2N9KYH		10.75	11.01	10.72	10.32	9.70	8.65	7.73	7.37	7.55	8.45	9.91	9.43	9.84	11.72	12.81	13.11	CA
2UTMX8		10.75	11.06	10.76	10.31	9.67	8.68	7.75	7.39	7.56	8.50	9.84	9.48	9.99	11.78	12.83	13.06	XD
2XMNVF		10.66	11.00	10.71	10.28	9.63	8.64	7.70	7.35	7.52	8.41	9.81	9.47	9.90	11.75	12.84	13.12	MQ
3KPRRA		10.63	11.00	10.73	10.30	9.67	8.64	7.72	7.37	7.55	8.48	9.85	9.48	9.94	11.78	12.86	13.15	MK
42TQDH		10.88	11.12	10.82	10.34	9.81	8.79	7.85	7.53*	7.63	8.57	9.96	9.73*	10.07	11.94	13.02	13.21	AN
47MKD6		10.73	11.06	10.77	10.33	9.71	8.67	7.73	7.37	7.55	8.47	9.86	9.46	9.91	11.73	12.79	12.95	XD
47NFXV		10.69	10.99	10.72	10.28	9.64	8.64	7.71	7.35	7.54	8.47	9.83	9.42	9.91	11.72	12.71	12.94	XI
4ZRUPF		10.95	10.84*	10.56*	10.12*	9.50*	8.51*	7.60X	7.25X	7.44	8.36*	9.69*	9.31*	9.81*	11.56*	12.56*	12.79	XE
64MZNH		10.77	11.05	10.79	10.36	9.73	8.70	7.75	7.43	7.64	8.50	9.92	9.63	10.03	11.91	12.92	13.00	AU
66KDC9		10.76	11.01	10.70	10.34	9.66	8.71	7.76	7.47	7.67	8.54	9.91	9.67	10.03	11.88	12.94	12.97	AS
67CCHG		10.77	10.99	10.73	10.27	9.68	8.67	7.75	7.44	7.66	8.53	9.87	9.63	10.00	11.82	12.94	13.00	AS
72KNF9		10.69	10.91	10.63	10.26	9.67	8.64	7.73	7.43	7.61	8.49	9.84	9.64	10.05	11.94	12.85	12.37X	AE
7FYP2D		10.73	11.01	10.71	10.27	9.64	8.63	7.71	7.36	7.55	8.49	9.79	9.41	9.96	11.76	12.73	12.96	XD
8JWPRM		10.54	10.80*	10.61	10.21	9.57	8.55	7.67	7.37	7.55	8.50	9.75	9.39	9.94	11.69	12.72	12.94	XO
8UATXT	X	10.09X	10.43X	10.22X	9.82X	9.23X	8.27X	7.42X	7.13X	7.33	8.20X	9.47X	9.06X	9.61X	10.87X	12.32X	12.51X	XO
8V827C		10.70	10.97	10.69	10.25	9.60	8.65	7.72	7.41	7.62	8.47	9.83	9.60	10.00	11.82	12.88	13.01	AS
8WH3TB		10.58	10.96	10.71	10.28	9.65	8.64	7.72	7.35	7.52	8.42	9.80	9.47	9.95	11.77	12.83	13.10	MM
9LF4VM		10.67	11.07	10.76	10.33	9.67	8.68	7.75	7.42	7.62	8.59	9.89	9.51	10.11	11.90	12.90	13.22	XO
9V34B8		11.09	11.37X	11.01X	10.64X	9.96X	8.88X	7.91X	7.50	7.72	8.62	10.12X	9.63	10.03	11.97	13.07	13.41*	CA
9Y49YD		10.89	11.02	10.81	10.35	9.72	8.73	7.78	7.47	7.65	8.52	9.91	9.67	10.07	11.97	12.97	13.13	AN
AAXZQB		10.60	11.00	10.70	10.30	9.70	8.70	7.75	7.40	7.60	8.50	9.90	9.55	9.90	11.75	12.90	13.20	MW
AD3C44		10.74	11.08	10.83	10.36	9.69	8.71	7.76	7.41	7.57	8.52	9.85	9.51	10.03	11.83	12.81	13.00	XI



## CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

**Report #204  
2nd Qtr 2023**

Spectrophotometric - Sphere Geometry Instruments  
Reflectance at 16 Selected Wavelengths

WebCode	Data Flag	Spectrophotometric Reflectance values (as %) at selected wavelengths																Instr Code
		400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	
Sample B231																		
AQ386C		10.79	10.98	10.69	10.21	9.62	8.64	7.72	7.40	7.50	8.47	9.82	9.58	9.98	11.81	12.84	13.11	AT
BVT489		10.95	11.22	10.93*	10.49*	9.86*	8.80	7.84	7.49	7.67	8.59	10.08*	9.60	10.01	11.96	13.07	13.36	CA
CAVVKQ		10.55	10.90	10.62	10.17	9.55	8.56	7.65	7.31	7.51	8.44	9.74	9.40	9.91	11.64	12.63	12.87	XD
CQ4MPG		10.67	10.93	10.64	10.18	9.56	8.58	7.67	7.33	7.50	8.42	9.75	9.40	9.89	11.64	12.65	12.91	XB
D7L98K		10.69	11.01	10.73	10.30	9.65	8.65	7.73	7.38	6.57X	8.50	9.83	9.45	9.97	11.75	12.76	13.00	XD
DJDUT8		10.74	11.04	10.80	10.39	9.76	8.73	7.77	7.44	7.65	8.61	10.00	9.58	10.04	11.89	12.99	13.28	MV
EET6RG		11.13*	11.02	10.73	10.29	9.65	8.63	7.70	7.35	7.54	8.46	9.82	9.44	9.96	11.80	12.82	13.05	XD
EPAYY4		10.71	10.97	10.69	10.24	9.66	8.62	7.75	7.40	7.56	8.47	9.83	9.61	9.99	11.86	12.98	12.91	AS
EPKKVD		10.74	11.05	10.68	10.26	9.61	8.68	7.76	7.38	7.56	8.56	9.81	9.49	10.05	11.75	12.71	12.95	XI
FB4FHN		10.66	10.93	10.67	10.22	9.64	8.61	7.66	7.34	7.54	8.43	9.83	9.58	9.97	11.81	13.15*	13.02	AS
FN6LCN		10.86	11.17	10.83	10.35	9.68	8.67	7.76	7.40	7.57	8.51	9.84	9.42	9.91	11.76	12.76	12.95	XB
FRJC7X		10.86	11.16	10.90	10.43	9.77	8.78	7.79	7.47	7.67	8.64*	9.95	9.58	10.14*	11.90	12.99	13.34	XC
FYFGRL		10.82	11.13	10.82	10.38	9.79	8.73	7.79	7.46	7.67	8.55	9.94	9.70	10.05	11.88	13.01	13.13	AP
GL3HE6		10.82	11.02	10.71	10.31	9.66	8.66	7.74	7.35	7.45	8.31X	9.79	9.46	9.79*	11.72	12.67	13.07	HP
GNDFU9		11.81X	11.15	10.87	10.38	9.75	8.72	7.79	7.46	7.65	8.52	9.81	9.64	9.98	11.87	12.88	13.14	AQ
GTW8K3		10.78	10.98	10.67	10.25	9.66	8.65	7.76	7.42	7.58	8.45	9.83	9.57	9.93	11.83	12.89	13.08	AS
GV9F9Z		10.74	11.10	10.82	10.41	9.74	8.72	7.75	7.40	7.57	8.48	9.92	9.57	9.98	11.88	12.98	13.29	MT
H63KB2		10.80	11.18	10.89	10.46	9.79	8.79	7.84	7.48	7.62	8.57	9.90	9.58	10.09	11.94	12.91	13.20	XI
HJNZFM		10.64	10.94	10.69	10.22	9.56	8.60	7.69	7.38	7.56	8.51	9.79	9.47	9.91	11.69	12.69	12.96	XH
HKBWJ7		10.64	10.94	10.65	10.23	9.60	8.60	7.71	7.37	7.54	8.45	9.74	9.41	9.93	11.67	12.66	12.91	XD
JPD9YQ		10.77	11.06	10.78	10.32	9.67	8.65	7.72	7.38	7.56	8.53	9.85	9.44	9.90	11.67	12.67	12.87	XB
JQRMA7		10.62	11.01	10.71	10.27	9.66	8.64	7.66	7.33	7.50	8.41	9.87	9.43	9.79*	11.76	12.81	13.10	MV





## CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

**Report #204  
2nd Qtr 2023**

Spectrophotometric - Sphere Geometry Instruments  
Reflectance at 16 Selected Wavelengths

WebCode	Data Flag	Spectrophotometric Reflectance values (as %) at selected wavelengths																Instr Code
		400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	
Sample B231																		
JYLZ7Z		10.61	10.99	10.71	10.29	9.66	8.67	7.72	7.34	7.51	8.41	9.85	9.47	9.82	11.70	12.80	13.12	MY
K7HU2D		10.67	10.98	10.70	10.25	9.64	8.65	7.73	7.37	7.54	8.44	9.84	9.42	9.81*	11.62	12.66	12.84	XD
KEQNUK		10.76	11.07	10.76	10.27	9.71	8.68	7.76	7.44	7.63	8.53	9.92	9.64	9.98	11.86	12.88	13.07	AN
KLQ4JR		10.75	11.07	10.83	10.39	9.75	8.76	7.79	7.45	7.62	8.48	9.86	9.67	9.99	11.89	12.98	13.15	AS
LA6VWD		10.69	10.99	10.71	10.27	9.63	8.63	7.71	7.35	7.53	8.46	9.83	9.42	9.91	11.72	12.71	12.94	XI
LHVF2P		10.78	11.06	10.78	10.33	9.71	8.69	7.74	7.46	7.65	8.53	9.89	9.65	10.04	12.03*	12.96	13.07	AT
LTGHAX	X	11.04	11.41X	11.07X	10.62X	9.95X	8.93X	7.98X	7.62X	7.82	8.79X	10.13X	9.78*	10.34X	12.14X	13.21X	13.52X	XR
MDB2GN		10.90	11.10	10.85	10.40	9.70	8.70	7.80	7.50	7.65	8.70X	10.00	9.40	9.90	11.90	12.80	13.20	HW
ML72TV		10.73	11.13	10.82	10.40	9.74	8.75	7.81	7.45	7.64	8.51	9.86	9.60	10.03	11.75	12.89	13.19	MM
MUYC4Q		10.84	11.06	10.77	10.36	9.72	8.71	7.77	7.40	7.61	8.52	9.96	9.59	9.91	11.79	12.98	13.23	NA
N2CURH		10.72	11.01	10.73	10.27	9.68	8.68	7.74	7.43	7.61	8.48	9.83	9.61	9.97	11.78	12.83	12.98	AJ
N63VBD		10.85	11.30X	11.03X	10.60X	9.91X	8.93X	7.93X	7.54*	7.69	8.58	10.06*	9.71	9.95	11.95	13.07	13.34	HP
N82C7T		10.76	11.08	10.78	10.34	9.68	8.67	7.73	7.38	7.56	8.49	9.86	9.50	10.02	11.85	12.90	13.13	XD
P4ZG7Q		10.63	11.02	10.72	10.32	9.69	8.68	7.72	7.36	7.57	8.47	9.90	9.53	9.92	11.77	12.94	13.21	MV
PCULZR		10.78	11.04	10.76	10.31	9.67	8.68	7.77	7.42	7.60	8.53	9.87	9.47	9.97	11.79	12.76	13.00	XD
PLPC6L		10.79	11.01	10.74	10.28	9.66	8.67	7.76	7.42	7.60	8.49	9.85	9.60	9.99	11.85	12.74	13.02	AT
Q2N9BC		10.77	11.11	10.81	10.35	9.75	8.75	7.81	7.49	7.68	8.53	9.95	9.68	10.01	12.00	12.94	13.09	AP
QLL92A		10.68	10.94	10.65	10.25	9.65	8.63	7.72	7.40	7.58	8.45	9.83	9.59	9.92	11.80	12.91	13.04	AS
QM9ZHK		10.79	11.09	10.77	10.36	9.69	8.75	7.79	7.47	7.67	8.55	9.90	9.69	10.06	11.87	13.01	13.02	AJ
THB67P		10.78	11.00	10.75	10.32	9.72	8.72	7.77	7.39	7.60	8.50	9.85	9.46	9.93	11.80	12.87	13.14	GG
U8JCQK		10.79	11.13	10.84	10.37	9.71	8.69	7.74	7.37	7.57	8.50	9.87	9.50	10.03	11.83	12.84	13.13	XB
UB6TJQ		10.77	11.05	10.73	10.33	9.68	8.67	7.76	7.43	7.62	8.53	9.91	9.64	10.02	11.92	13.00	13.03	AU



## CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

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2nd Qtr 2023**

Spectrophotometric - Sphere Geometry Instruments  
Reflectance at 16 Selected Wavelengths

WebCode	Data Flag	Spectrophotometric Reflectance values (as %) at selected wavelengths																Instr Code
		400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	
Sample B231																		
UFYQ2F		10.82	11.10	10.82	10.34	9.70	8.66	7.72	7.39	7.58	8.53	9.89	9.51	10.03	11.89	12.86	13.05	XE
URT3CV		11.02	10.94	10.73	10.24	9.85*	8.61	7.80	7.43	7.51	8.49	9.51X	9.41	9.84	11.81	12.82	12.70*	GD
V2AB6G		10.74	11.06	10.76	10.31	9.66	8.65	7.74	7.38	7.57	8.50	9.84	9.45	9.98	11.80	12.80	13.03	XH
VE226C		10.84	11.13	10.82	10.31	9.77	8.74	7.79	7.47	7.60	8.53	9.92	9.65	10.01	11.89	12.90	13.19	AJ
VEX9ER	X	10.39*	10.73X	10.51X	10.01X	9.46X	8.46X	7.52X	7.18X	7.37	8.31X	9.62X	9.30*	9.74X	11.56*	12.71	13.05	GE
VJVXRH		10.74	11.09	10.82	10.36	9.73	8.70	7.76	7.38	7.56	8.47	9.90	9.47	9.90	11.75	12.82	13.03	XB
WC7WTQ		10.78	11.08	10.79	10.35	9.70	8.68	7.75	7.39	7.58	8.53	9.85	9.48	10.02	11.85	12.88	13.05	XG
WL2D3V		10.79	11.04	10.74	10.29	9.65	8.65	7.75	7.41	7.61	8.60	9.90	9.52	10.09	11.89	12.91	13.22	XF
WPH33X		10.74	11.15	10.85	10.40	9.75	8.74	7.84	7.45	7.67	8.57	9.96	9.64	10.15*	11.90	12.95	13.23	MI
WQTKL4		10.85	11.01	10.74	10.31	9.63	8.66	7.73	7.43	7.61	8.48	9.87	9.65	10.02	11.85	13.11	13.20	AU
WTY8WM		10.59	10.98	10.69	10.25	9.62	8.69	7.73	7.37	7.56	8.47	9.79	9.42	9.92	11.67	12.62	12.90	XI
XKB8G9		10.55	11.03	10.72	10.33	9.68	8.67	7.73	7.40	7.62	8.46	9.77	9.56	9.92	11.75	12.78	13.08	AQ
XZNKRE		10.67	11.11	10.80	10.38	9.76	8.74	7.78	7.41	7.59	8.51	9.96	9.61	9.97	11.86	13.06	13.34	MW
YJ62VK		10.71	10.97	10.69	10.23	9.58	8.57	7.66	7.33	7.51	8.46	9.79	9.39	9.95	11.76	12.77	13.04	XE
YKDAPD		10.80	11.08	10.79	10.32	9.66	8.68	7.76	7.42	7.59	8.56	9.84	9.51	10.07	11.82	12.81	13.03	XH
YQKHNU		10.69	10.99	10.70	10.26	9.63	8.63	7.71	7.35	7.55	8.45	9.78	9.43	9.93	11.70	12.65	12.90	XD
ZHHVU8		10.91	11.15	10.83	10.38	9.75	8.75	7.80	7.39	7.56	8.42	9.86	9.58	9.87	11.72	12.92	13.19	HP



## CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

**Report #204  
2nd Qtr 2023**

Spectrophotometric - Sphere Geometry Instruments  
Reflectance at 16 Selected Wavelengths

### Summary Statistics

	<b>400</b>	<b>420</b>	<b>440</b>	<b>460</b>	<b>480</b>	<b>500</b>	<b>520</b>	<b>540</b>	<b>560</b>	<b>580</b>	<b>600</b>	<b>620</b>	<b>640</b>	<b>660</b>	<b>680</b>	<b>700</b>
<b>Grand Means</b>	10.77	11.04	10.75	10.32	9.69	8.68	7.75	7.40	7.57	8.50	9.86	9.53	9.97	11.81	12.86	13.06
<b>SD Btwn Labs</b>	0.16	0.09	0.08	0.08	0.08	0.07	0.05	0.05	0.13	0.06	0.08	0.10	0.08	0.09	0.13	0.16

8UATXT (X) - Low % reflectance data for almost all wavelengths. Large replication difference for almost all wavelengths.

LTGHAX (X) - High % reflectance data for almost all wavelengths.

VEX9ER (X) - Low % reflectance data for most wavelengths.

### Key to Instrument Codes Reported by Participants

<b>AE</b> Datacolor 110	<b>AJ</b> Datacolor 600	<b>AN</b> Datacolor 650
<b>AP</b> Datacolor 750	<b>AQ</b> Datacolor 600x	<b>AS</b> Datacolor 800
<b>AT</b> Datacolor 850	<b>AU</b> Datacolor 1000	<b>CA</b> Cary 5000
<b>GD</b> BYK-Gardner Spectro-Guide Sphere	<b>GE</b> BYK-Gardner Spectro2-Guide Sphere Gloss	<b>GG</b> BYK-Gardner TCS II
<b>HP</b> Hunter UltraScan PRO	<b>HW</b> Hunter UltraScan XE	<b>MI</b> Macbeth Color i5
<b>MK</b> Macbeth Color-Eye 7000	<b>MM</b> Macbeth Color-Eye 7000a	<b>MQ</b> Minolta CM-700d
<b>MT</b> Minolta CM-2600d	<b>MV</b> Minolta CM-3000d Spectrophotometer	<b>MW</b> Minolta CM 3700a Spectrophotometer
<b>MY</b> Minolta Benchtop Spectrophotometer CM-3600a	<b>NA</b> Minolta Benchtop Spectrophotometer CM-3700A	<b>XB</b> X-Rite Ci7000 Series Benchtop Spectrophotometer
<b>XC</b> X-Rite Ci4200 Benchtop Spectrophotometer	<b>XD</b> X-Rite Ci7800 Benchtop Spectrophotometer	<b>XE</b> X-Rite Ci7600 Benchtop Spectrophotometer
<b>XF</b> X-Rite Ci6x Portable Spectrophotometer	<b>XG</b> X-Rite Ci7860 Benchtop Spectrophotometer	<b>XH</b> X-Rite Color i5 Benchtop Spectrophotometer
<b>XI</b> X-Rite Color i7 Benchtop Spectrophotometer	<b>XO</b> X-Rite SP64 Sphere Spectrophotometer	<b>XR</b> X-Rite



# Interlaboratory Testing Program for Color & Appearance

Report #204

## Analysis 440

2nd Qtr 2023

### 60 Degree Gloss - Paint Chips

#### ASTM Method D 523

WebCode	Data Flag	Sample F231			Sample F232			Instr Code
		Lab Mean	Diff from Grand Mean	CPV	Lab Mean	Diff from Grand Mean	CPV	
239ACF		40.18	1.28	1.53	51.00	1.53	1.73	GL
2FNRE6		39.40	0.50	0.60	49.85	0.38	0.43	GK
2N9KYH		38.40	-0.50	-0.60	49.35	-0.12	-0.13	GL
2XMNVF		39.20	0.30	0.36	49.83	0.36	0.40	MX
3GQD76	*	39.68	0.78	0.93	48.75	-0.72	-0.81	XX
3GVBVE		40.78	1.88	2.24	51.23	1.76	1.98	ST
47MKD6		39.20	0.30	0.36	50.30	0.83	0.94	GL
4E7GFP	*	36.70	-2.20	-2.63	47.53	-1.94	-2.19	GL
4X6ANH		38.24	-0.66	-0.79	49.18	-0.29	-0.33	GL
63XV9H		39.15	0.25	0.30	50.48	1.01	1.14	RQ
64MZNH		37.95	-0.95	-1.13	48.48	-0.99	-1.12	GL
67CCHG		38.98	0.08	0.09	49.60	0.13	0.15	GL
72KNF9		38.33	-0.57	-0.69	50.08	0.61	0.69	GL
73BQCA		39.18	0.28	0.33	50.28	0.81	0.91	GK
8JWPRM		39.88	0.98	1.17	50.23	0.76	0.86	MW
8T67P8		39.30	0.40	0.48	49.90	0.43	0.49	GK
8UATXT		38.88	-0.02	-0.03	48.68	-0.79	-0.89	GN
8V827C		38.68	-0.22	-0.27	50.00	0.53	0.60	GL
8WH3TB		38.83	-0.07	-0.08	48.60	-0.86	-0.97	GL
9HEUT8		38.83	-0.07	-0.09	49.40	-0.07	-0.07	GL
9RYAD2		39.18	0.28	0.33	49.65	0.18	0.21	GL
AAXZQB		39.18	0.28	0.33	49.45	-0.02	-0.02	GK
B446N3		40.20	1.30	1.56	51.00	1.53	1.73	GN
BZC4M2		37.48	-1.42	-1.70	48.75	-0.72	-0.81	GD
C7Q73P		38.00	-0.90	-1.07	49.58	0.11	0.12	GK
CEJJZ4		39.10	0.20	0.24	49.50	0.03	0.04	GN
DRKGKU		37.70	-1.20	-1.43	49.23	-0.24	-0.27	GL
DY6V6E		39.05	0.15	0.18	49.53	0.06	0.07	GL
E4ZLQH		38.90	0.00	0.00	49.60	0.13	0.15	GL
EET6RG		39.98	1.08	1.29	50.08	0.61	0.69	RA
EPAYY4		38.83	-0.07	-0.09	49.50	0.03	0.04	GK
EPKKVD		38.59	-0.31	-0.37	49.26	-0.21	-0.23	GL
FB4FHN		37.78	-1.12	-1.34	49.13	-0.34	-0.38	GK



# Interlaboratory Testing Program for Color & Appearance

Report #204  
2nd Qtr 2023

## Analysis 440

60 Degree Gloss - Paint Chips

ASTM Method D 523

WebCode	Data Flag	Sample F231			Sample F232			Instr Code
		Lab Mean	Diff from Grand Mean	CPV	Lab Mean	Diff from Grand Mean	CPV	
FN22LZ		38.85	-0.05	-0.06	49.13	-0.34	-0.38	GL
FPL97V		38.35	-0.55	-0.66	49.65	0.18	0.21	GK
FYDGZY		39.10	0.20	0.24	49.45	-0.02	-0.02	GL
GXYJYL		37.53	-1.37	-1.64	47.40	-2.07	-2.33	GD
H63KB2		39.83	0.93	1.11	50.08	0.61	0.69	GN
J8VBEQ	X	35.48	-3.42	-4.09	46.95	-2.52	-2.84	XX
JPD9YQ		37.43	-1.47	-1.76	47.28	-2.19	-2.47	GL
KLQ4JR		38.70	-0.20	-0.24	48.33	-1.14	-1.29	GK
KR3PW6		38.90	0.00	0.00	49.98	0.51	0.57	GN
LTGHAX		40.30	1.40	1.68	50.90	1.43	1.62	GL
MDB2GN		38.50	-0.40	-0.48	49.60	0.13	0.15	GK
ML72TV		38.60	-0.30	-0.36	49.70	0.23	0.26	GL
MUYC4Q		39.01	0.11	0.13	50.30	0.83	0.94	GL
MX7G9Z		37.48	-1.42	-1.70	48.23	-1.24	-1.40	GL
N82C7T		37.83	-1.07	-1.28	48.45	-1.02	-1.15	GK
NDWZ4E		39.38	0.48	0.57	50.15	0.68	0.77	GN
P4ZG7Q		39.25	0.35	0.42	49.50	0.03	0.04	GL
PCULZR		39.48	0.58	0.69	50.03	0.56	0.63	GL
PWVNR2		39.73	0.83	0.99	49.75	0.28	0.32	RA
QM9ZHK	X	39.23	0.33	0.39	39.60	-9.87	-11.13	GL
QUM2PG		38.50	-0.40	-0.48	48.60	-0.87	-0.98	RQ
QY4YYQ	*	40.78	1.88	2.24	51.68	2.21	2.49	GK
R7T7GV	X	35.43	-3.47	-4.15	45.78	-3.69	-4.16	EN
T4ZXMK		38.08	-0.82	-0.98	49.15	-0.32	-0.36	GN
TJW6NR		37.65	-1.25	-1.49	47.70	-1.77	-1.99	GN
TNF73C		39.90	1.00	1.20	50.15	0.68	0.77	GN
UFYQ2F		39.28	0.38	0.45	50.15	0.68	0.77	GL
URT3CV		39.18	0.28	0.33	49.70	0.23	0.26	GN
V2AB6G		40.38	1.48	1.77	50.33	0.86	0.97	GL
VE226C		38.80	-0.10	-0.12	49.45	-0.02	-0.02	GL
VJVXRH		39.23	0.33	0.39	50.15	0.68	0.77	ZA
W6MH2E	X	36.03	-2.87	-3.44	47.10	-2.37	-2.67	GL



# Interlaboratory Testing Program for Color & Appearance

Report #204  
2nd Qtr 2023

## Analysis 440

60 Degree Gloss - Paint Chips

ASTM Method D 523

WebCode	Data Flag	Sample F231			Sample F232			Instr Code
		Lab Mean	Diff from Grand Mean	CPV	Lab Mean	Diff from Grand Mean	CPV	
WC7WTQ		39.15	0.25	0.30	49.70	0.23	0.26	GL
WPH33X		38.83	-0.07	-0.09	48.65	-0.82	-0.92	GL
WQ6PBM		38.55	-0.35	-0.42	49.48	0.01	0.01	GL
WTY8WM		38.98	0.08	0.09	49.60	0.13	0.15	MM
WVJHAT	*	38.38	-0.52	-0.63	47.40	-2.07	-2.33	GL
X2J4TF		38.60	-0.30	-0.36	48.60	-0.87	-0.98	GD
XZNKRE		37.20	-1.70	-2.03	48.33	-1.14	-1.29	GT
Y6ZNK2		39.08	0.18	0.21	48.93	-0.54	-0.61	GL
YB3V2P	X	36.18	-2.72	-3.26	36.13	-13.34	-15.05	MA
YKDAPD		40.15	1.25	1.50	49.70	0.23	0.26	GL
Z2YZL4		39.32	0.42	0.50	49.80	0.34	0.38	GL
ZJDEXU		38.88	-0.02	-0.03	49.53	0.06	0.07	GL

### Summary Statistics

#### Grand Means

38.90 Gloss Units

49.47 Gloss Units

#### Std Dev Btwn Labs

0.84 Gloss Units

0.89 Gloss Units

Statistics based on 72 of 77 reporting participants

### Comments on Assigned Data Flags for Test #440

J8VBEQ(X) - Data for both samples are low. Possible systematic error.

QM9ZHK(X) - Extreme data for Sample F232.

R7T7GV(X) - Data for both samples are low. Possible systematic error.

W6MH2E(X) - Low data for Sample F231.

YB3V2P(X) - Extreme data.

### Key to Instrument Codes Reported by Participants

EN	Elcometer 480	GD	BYK Gardner Spectro2Guide 45/0
GK	BYK-Gardner micro-gloss (60)	GL	BYK-Gardner micro-TRI-gloss
GN	BYK-Gardner new micro-TRI-gloss	GT	Gardco Novo-Gloss (20/60/85)
MA	M&A ETB-0833 Glossmeter	MM	Macbeth Lab-Gloss
MW	Minolta Multi-Gloss 268	MX	Minolta Multi-Gloss 268 Plus
RA	Rhpoint Novo-Gloss Glossmeter	RQ	Rhpoint IQ Goniophotometer 20/60/85°
ST	Sheen Tri-Glossmaster	XX	Instrument make/model not specified by lab
ZA	Zehntner ZGM Series		



Interlaboratory Testing Program for Color & Appearance

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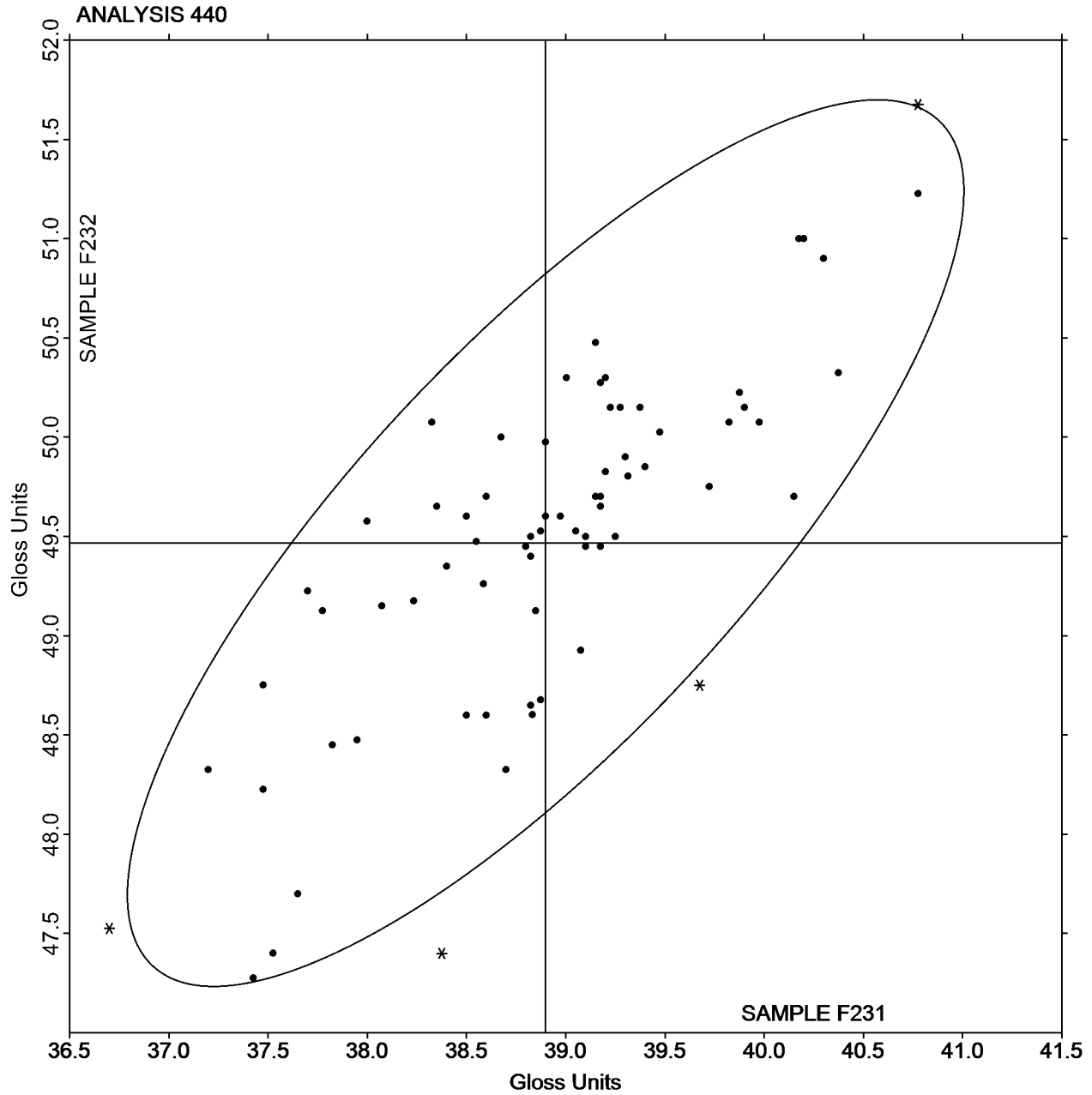
Analysis 440

60 Degree Gloss - Paint Chips

ASTM Method D 523

SAMPLE F231 = 38.90 Gloss Units

SAMPLE F232 = 49.47 Gloss Units



-End of Report-