



Color & Appearance Testing Program

Summary Report #205 - 3rd Qtr 2023

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

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

[Key to Tables and Graphs \(Spectro Test\)](#)

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<u>Analysis</u>	<u>Analysis Name</u>
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408	Color & Color Difference-45-0, D65/10° Observer
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409	Color & Color Difference Sphere, D65/10°Observer
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411	Spectrophotometric - Sphere
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440	Gloss 60 Degree
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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 industries 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

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 2 test results obtained by the participant for CIE L*,a*,b* color space values.
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.
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.
Graphs	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* ₂ vs L* ₁ , a* ₂ vs a* ₁ and b* ₂ vs b* ₁ . The a* and b* plots are created using absolute values.
Inst Code	A code indicating the manufacturer of the instrument used to perform the test (see separate INSTRUMENT CODE LIST for each test section).
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	CAUTION - 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	STOP - 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	PROCEED - 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

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.
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.
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).
Inst Code	A code indicating the manufacturer of the instrument used to perform the test (see separate INSTRUMENT CODE LIST for each test section).
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>
X	EXCLUDED	STOP - 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	CAUTION - 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	STOP - 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	PROCEED - 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 #205

Analysis 408

3rd 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*	ΔL^*	Δa^*	Δb^*	ΔE^*	
2GHAK3		C231	40.27	-9.52	-9.77	0.13	-0.46	-0.82	0.95	GH
		C232	40.40	-9.98	-10.59					
2PAUG3	X	C231	40.65	-8.90	-10.84	0.06	-0.48	-0.79	0.93	XD
		C232	40.71	-9.38	-11.63					
4RMED2		C231	40.34	-9.28	-10.17	-0.01	-0.51	-0.89	1.03	HL
		C232	40.34	-9.79	-11.06					
74T7WR		C231	39.94	-9.15	-10.35	0.07	-0.49	-0.88	1.01	HW
		C232	40.01	-9.64	-11.22					
7YHV7J		C231	39.85	-9.14	-10.30	0.18	-0.46	-0.79	0.93	HW
		C232	40.03	-9.60	-11.09					
83XXAU		C231	40.17	-9.60	-10.16	0.08	-0.49	-0.81	0.95	XW
		C232	40.25	-10.09	-10.97					
8977TJ	X	C231	39.43	-10.05	-10.19	-0.01	-0.56	-0.87	1.04	BG
		C232	39.43	-10.62	-11.06					
A6UDPV		C231	39.71	-9.29	-9.87	0.12	-0.49	-0.81	0.96	GG
		C232	39.82	-9.78	-10.69					
AXUQYG	X	C231	39.56	-10.01	-10.24	0.11	-0.56	-0.83	1.00	BG
		C232	39.67	-10.57	-11.07					
C99KCL		C231	40.07	-9.27	-10.01	0.07	-0.46	-0.85	0.97	XU
		C232	40.14	-9.74	-10.86					
C9PJJC		C231	39.79	-9.26	-10.21	0.15	-0.53	-0.79	0.96	HK
		C232	39.94	-9.78	-11.00					
D9Z68J	X	C231	38.16	-9.24	-9.99	0.00	-0.39	-0.92	0.99	HK
		C232	38.16	-9.62	-10.91					
DFLTDM		C231	39.50	-9.23	-9.89	0.15	-0.49	-0.79	0.94	GG
		C232	39.65	-9.72	-10.68					
EF3EEC		C231	40.30	-9.20	-10.30	0.10	-0.50	-0.90	1.03	HW
		C232	40.40	-9.70	-11.20					
FHLTFQ		C231	40.05	-9.47	-9.82	-0.05	-0.49	-0.94	1.06	XU
		C232	40.00	-9.97	-10.76					
FRRNKG		C231	39.85	-9.11	-10.38	0.05	-0.46	-0.89	1.00	HW
		C232	39.90	-9.57	-11.27					



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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*	ΔL^*	Δa^*	Δb^*	ΔE^*	
GRK6QB		C231	40.00	-9.49	-9.96	0.05	-0.49	-0.86	1.00	XE
		C232	40.04	-9.98	-10.83					
GRMNXM		C231	39.90	-9.40	-10.05	0.09	-0.50	-0.83	0.98	MT
		C232	39.99	-9.90	-10.88					
HXN9EN		C231	40.09	-9.36	-9.86	0.07	-0.50	-0.86	0.99	XU
		C232	40.16	-9.86	-10.72					
JACVXN		C231	40.02	-9.19	-9.68	0.03	-0.53	-0.88	1.03	GE
		C232	40.05	-9.72	-10.56					
JBCLCJ		C231	39.98	-8.99	-10.36	0.00	-0.45	-0.91	1.01	MG
		C232	39.99	-9.43	-11.27					
JRUU68		C231	40.07	-9.38	-9.81	0.11	-0.50	-0.78	0.93	MD
		C232	40.17	-9.88	-10.59					
LUWCG9		C231	39.76	-9.26	-10.03	-0.05	-0.50	-0.93	1.06	HM
		C232	39.71	-9.75	-10.96					
MPVMC7		C231	41.07	-9.37	-9.88	0.16	-0.40	-0.88	0.99	XE
		C232	41.22	-9.77	-10.76					
MRZF6J		C231	40.95	-9.13	-10.33	0.05	-0.46	-0.88	1.00	XJ
		C232	40.99	-9.58	-11.22					
MUREHH		C231	40.19	-9.29	-9.83	-0.01	-0.55	-0.84	1.01	GE
		C232	40.18	-9.85	-10.67					
PW7MMZ		C231	40.20	-9.20	-10.35	0.10	-0.50	-0.85	0.99	HW
		C232	40.30	-9.70	-11.20					
QE9H2C		C231	40.54	-9.53	-10.08	-0.02	-0.47	-0.94	1.05	XE
		C232	40.52	-10.00	-11.02					
QWN2NH		C231	40.06	-9.38	-9.86	0.08	-0.52	-0.87	1.01	XS
		C232	40.15	-9.89	-10.72					
R6ZF9Y		C231	40.17	-9.16	-10.31	0.10	-0.48	-0.82	0.96	HW
		C232	40.27	-9.64	-11.13					
RYNR83		C231	40.47	-9.00	-10.12	0.05	-0.48	-0.87	1.00	XH
		C232	40.52	-9.49	-10.99					
TCEKHB		C231	39.31	-9.40	-10.26	0.17	-0.51	-0.75	0.92	PR
		C232	39.48	-9.91	-11.01					



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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*	ΔL^*	Δa^*	Δb^*	ΔE^*	
VL6DFC		C231	39.58	-9.28	-9.97	-0.07	-0.49	-0.91	1.04	GG
		C232	39.51	-9.77	-10.88					
VM74V8		C231	40.18	-9.42	-10.03	0.18	-0.51	-0.78	0.94	XU
		C232	40.36	-9.93	-10.81					
VMNWM4		C231	40.53	-9.02	-10.23	0.04	-0.48	-0.81	0.94	XH
		C232	40.57	-9.50	-11.04					
W6ZWF6		C231	40.50	-9.11	-10.25	0.04	-0.50	-0.86	1.00	XU
		C232	40.54	-9.61	-11.11					
W88EEZ		C231	40.17	-9.27	-9.80	-0.01	-0.54	-0.91	1.06	GE
		C232	40.17	-9.81	-10.71					
XEZ7ZZ		C231	40.06	-9.36	-10.14	0.09	-0.46	-0.86	0.98	XP
		C232	40.14	-9.83	-10.99					
YY8XF8		C231	40.20	-9.28	-9.98	0.09	-0.48	-0.86	0.99	HW
		C232	40.28	-9.76	-10.84					
Z94B66		C231	39.53	-9.24	-9.86	0.08	-0.51	-0.89	1.02	GA
		C232	39.61	-9.75	-10.75					
ZEBRM7		C231	39.90	-8.98	-10.33	0.01	-0.46	-0.87	0.98	HW
		C232	39.91	-9.44	-11.19					
ZULHGY		C231	40.23	-9.22	-10.19	0.03	-0.48	-0.83	0.97	XM
		C232	40.27	-9.70	-11.02					

Summary Statistics								
Samples	L*	a*	b*	ΔL^*	Δa^*	Δb^*	ΔE^*	
Grand Means								
C231	40.07	-9.25	-10.08	0.06	-0.49	-0.86	0.99	
C232	40.14	-9.75	-10.93					
Std Dev Btwn Labs								
C231	0.38	0.16	0.20	0.07	0.03	0.05	0.04	
C232	0.38	0.17	0.20					

Statistics based on 38 of 42 reporting participants



Comments Assigned on Data Flags for Test #408

2PAUG3(X) - Low b* values for both samples.

8977TJ(X) - Low a* values for both samples. Large replication difference for a* Sample C232. Small Delta a.

AXUQYG(X) - Low a* values for both samples.

D9Z68J(X) - Very low L* values for both samples. Inconsistent in testing between both a* samples. Large Delta a.

Key to Instrument Codes Reported by Participants

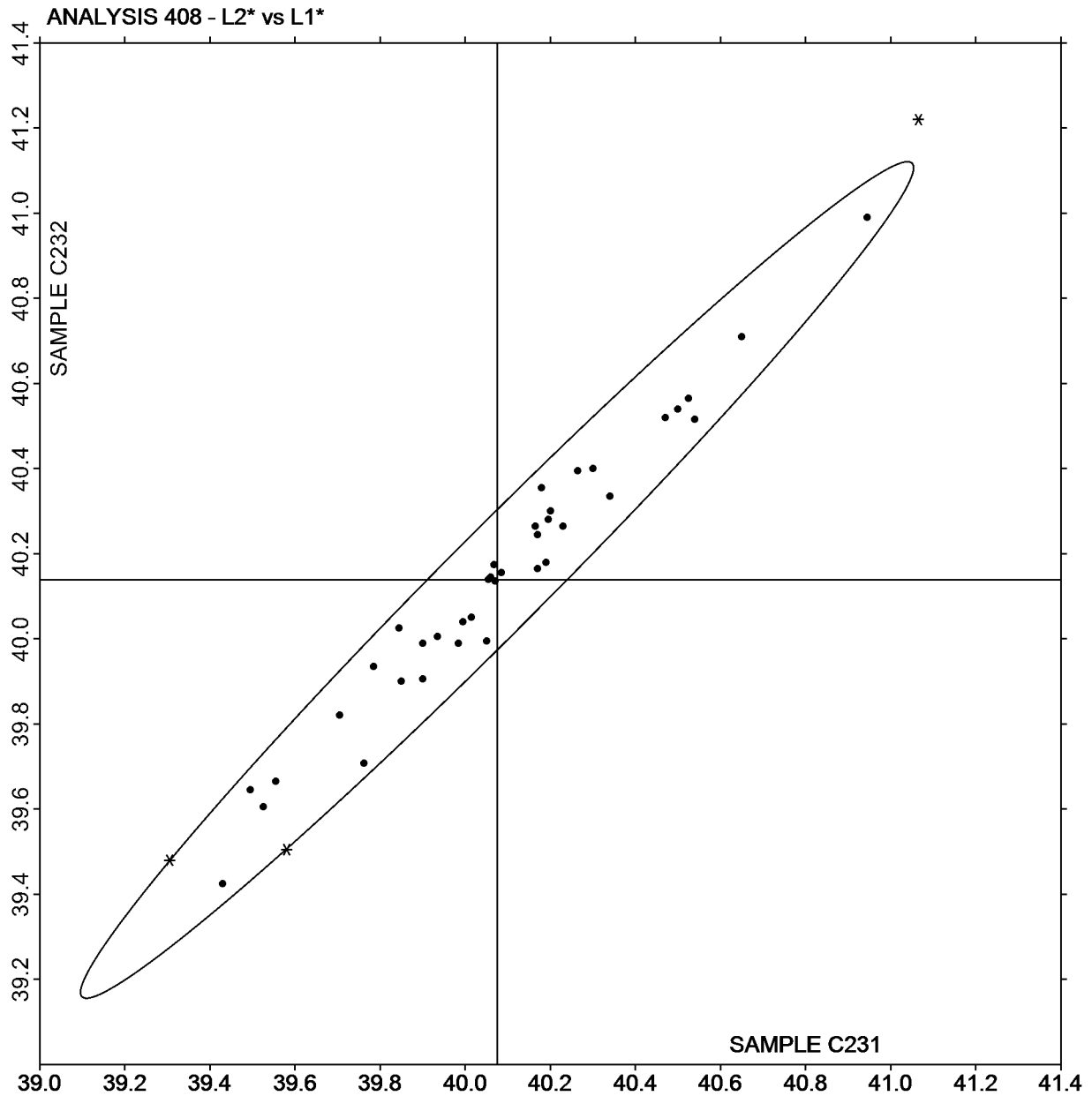
BG	BYK Mac i	GA	BYK-Gardner
GE	BYK-Gardner spectro-guide (45/0)	GG	BYK-Gardner spectro2-guide (45/0) gloss
GH	BYK-Gardner Color-View	HK	Hunter MiniScan XE (45/0)
HL	Hunter Agera	HM	Hunter MiniScan EZ 4500L
HW	Hunter LabScan XE	MD	Minolta FD 7
MG	Macbeth 1500/PLUS or 2025+ Color Eye	MT	Minolta CM-25cG Spectrophotometer
PR	PhotoResearch PR730	XD	X-Rite 500 Series SpectroDensitometer
XE	X-Rite eXact Portable Spectrophotometer	XH	X-Rite Color i5
XJ	X-Rite CI7XX0	XM	X-Rite MA58 Multi-Angle Spectrophotometer
XP	X-Rite MA9 Multi-Angle Spectrophotometer	XS	X-Rite 962 Portable Spectrophotometer
XU	X-Rite 964 Portable Spectrophotometer	XW	X-Rite



L2* vs L1*

SAMPLE C231 = 40.07

SAMPLE C232 = 40.14

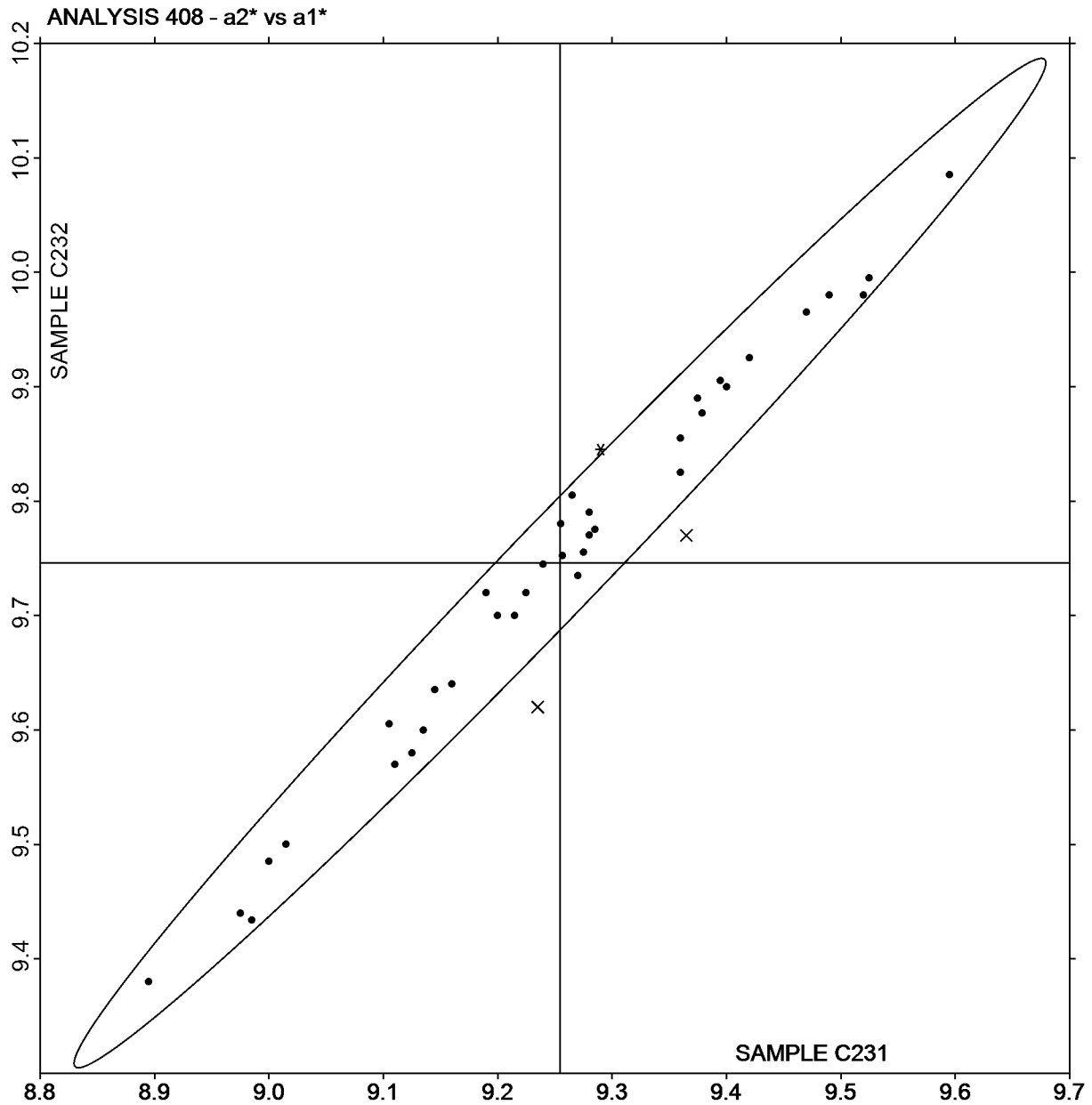




a2* vs a1*

SAMPLE C231 = -9.25

SAMPLE C232 = -9.75



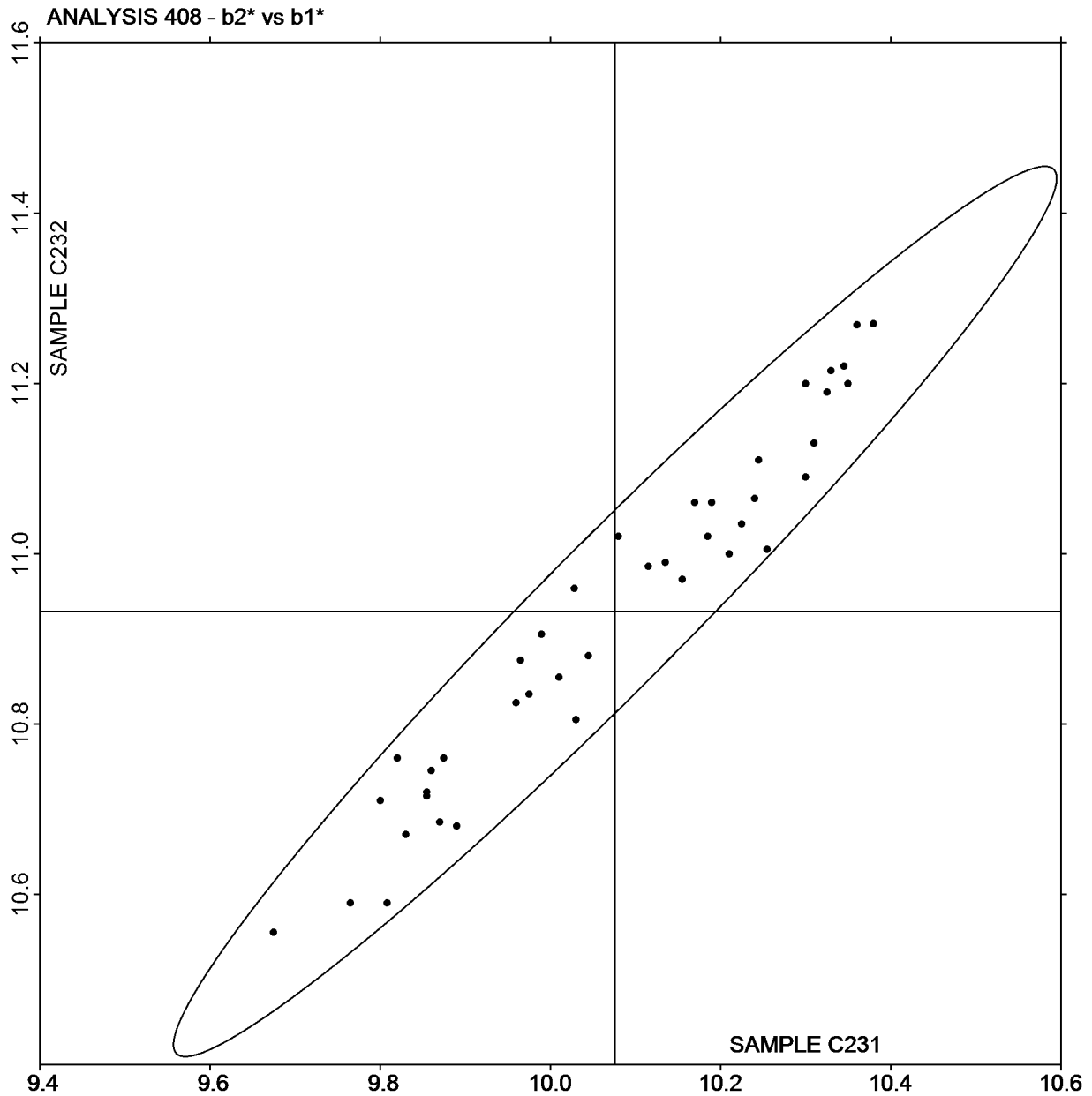
Plot created using absolute values.



b2* vs b1*

SAMPLE C231 = -10.08

SAMPLE C232 = -10.93



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*	ΔL^*	Δa^*	Δb^*	ΔE^*	
262PTT		C231	40.78	-9.28	-10.05	-0.01	-0.51	-0.87	1.01	MW
		C232	40.78	-9.78	-10.92					
2GHAK3		C231	40.80	-9.22	-10.20	0.17	-0.46	-0.78	0.92	MV
		C232	40.97	-9.68	-10.98					
2VZ6QZ		C231	40.68	-9.14	-10.27	-0.01	-0.49	-0.88	1.00	XG
		C232	40.67	-9.63	-11.14					
37DNM3		C231	40.55	-9.19	-10.35	0.19	-0.47	-0.75	0.91	XD
		C232	40.74	-9.66	-11.10					
3Q22KY		C231	40.55	-9.21	-10.18	0.14	-0.48	-0.80	0.94	XD
		C232	40.69	-9.69	-10.98					
43M4WN		C231	40.68	-9.30	-10.07	0.20	-0.45	-0.75	0.90	AS
		C232	40.88	-9.76	-10.82					
483CKN		C231	40.54	-9.15	-10.33	0.14	-0.47	-0.78	0.92	XD
		C232	40.67	-9.62	-11.11					
67MD2Y	X	C231	41.16	-9.35	-10.22	0.04	-0.49	-0.84	0.97	CA
		C232	41.20	-9.83	-11.06					
6K8VWM	X	C231	40.57	-9.20	-9.68	0.19	-0.47	-1.26	1.36	MM
		C232	40.75	-9.67	-10.94					
6NLPZ		C231	40.74	-9.26	-10.04	0.13	-0.49	-0.78	0.93	AT
		C232	40.86	-9.75	-10.82					
6TJ673		C231	40.61	-9.15	-10.31	-0.04	-0.46	-0.82	0.94	XF
		C232	40.57	-9.60	-11.13					
6WHF22		C231	40.57	-9.07	-10.21	0.05	-0.46	-0.82	0.94	XI
		C232	40.62	-9.53	-11.03					
6YKECU		C231	40.78	-9.24	-10.12	0.10	-0.49	-0.84	0.98	AT
		C232	40.87	-9.73	-10.96					
77K3KL		C231	40.65	-9.27	-10.08	0.18	-0.46	-0.78	0.92	AS
		C232	40.83	-9.74	-10.86					
7GG9EK		C231	40.74	-9.22	-10.10	0.12	-0.50	-0.82	0.97	AU
		C232	40.85	-9.72	-10.92					
7YYA82		C231	40.72	-9.11	-10.14	-0.03	-0.47	-0.90	1.02	AN
		C232	40.69	-9.58	-11.04					



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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*	ΔL^*	Δa^*	Δb^*	ΔE^*	
7ZZZLW		C231	40.46	-9.16	-10.30	-0.05	-0.43	-0.91	1.01	XI
		C232	40.41	-9.59	-11.22					
97BAGU		C231	40.84	-9.28	-10.19	0.05	-0.49	-0.86	0.99	XD
		C232	40.89	-9.77	-11.04					
98377N		C231	40.54	-9.24	-10.21	-0.01	-0.48	-0.89	1.01	XE
		C232	40.52	-9.72	-11.10					
9T7R7U		C231	40.68	-9.25	-10.05	0.09	-0.48	-0.85	0.98	MW
		C232	40.77	-9.73	-10.90					
A6UDPV		C231	40.39	-9.34	-9.92	0.16	-0.46	-0.82	0.95	GE
		C232	40.56	-9.80	-10.73					
AAAKDU		C231	40.60	-9.24	-10.24	0.06	-0.48	-0.86	0.99	MM
		C232	40.66	-9.72	-11.10					
ABJPQJ		C231	41.04	-9.27	-10.37	0.14	-0.48	-0.80	0.95	MT
		C232	41.17	-9.75	-11.18					
ABM9WU		C231	40.83	-9.24	-9.95	0.03	-0.55	-0.82	0.99	AE
		C232	40.86	-9.78	-10.77					
AGDH8T		C231	40.63	-9.23	-10.37	-0.02	-0.49	-0.90	1.03	XB
		C232	40.61	-9.72	-11.27					
ARPUDV		C231	40.77	-9.21	-10.10	0.01	-0.49	-0.89	1.02	AJ
		C232	40.78	-9.70	-10.99					
AXWCVW	X	C231	40.21	-9.22	-10.26	0.06	-0.47	-0.86	0.98	XO
		C232	40.27	-9.69	-11.12					
B8FE8N		C231	40.76	-9.21	-10.15	0.10	-0.49	-0.79	0.93	MY
		C232	40.86	-9.70	-10.94					
BVMVQX		C231	40.81	-9.31	-10.05	0.03	-0.49	-0.89	1.02	AP
		C232	40.84	-9.80	-10.94					
C99KCL		C231	40.58	-9.17	-10.35	0.08	-0.45	-0.87	0.98	XE
		C232	40.66	-9.62	-11.22					
CFP3KM		C231	40.67	-9.16	-10.26	-0.02	-0.46	-0.88	0.99	XI
		C232	40.66	-9.62	-11.14					
CM8LNM		C231	40.79	-9.25	-10.00	0.07	-0.50	-0.88	1.02	AS
		C232	40.86	-9.75	-10.88					



CTS Interlaboratory Testing Program for Color & Appearance

Report #205

Analysis 409

3rd 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*	ΔL^*	Δa^*	Δb^*	ΔE^*	
CQM4XQ		C231	40.73	-9.16	-10.20	-0.01	-0.48	-0.89	1.01	XD
		C232	40.72	-9.64	-11.09					
DF6YAR		C231	40.50	-9.19	-10.32	0.16	-0.47	-0.76	0.91	XO
		C232	40.66	-9.66	-11.08					
DFHB7B		C231	40.50	-9.17	-10.38	0.21	-0.49	-0.76	0.93	XD
		C232	40.71	-9.66	-11.15					
DKHM3B		C231	40.51	-9.16	-10.26	0.20	-0.46	-0.78	0.92	XI
		C232	40.70	-9.62	-11.03					
E6H8EM		C231	40.66	-9.22	-10.11	0.08	-0.49	-0.84	0.98	MU
		C232	40.74	-9.71	-10.95					
EJ3MHL	X	C231	40.82	-9.39	-10.54	0.05	-0.55	-0.92	1.07	HP
		C232	40.86	-9.94	-11.46					
EWM6DB		C231	40.83	-9.09	-10.38	0.09	-0.54	-0.82	0.99	XB
		C232	40.92	-9.63	-11.20					
FH3WXP		C231	40.86	-9.16	-10.12	0.06	-0.47	-0.83	0.96	HP
		C232	40.92	-9.63	-10.95					
FHLLFQ		C231	40.66	-9.23	-10.32	-0.01	-0.50	-0.92	1.05	XB
		C232	40.65	-9.73	-11.24					
FHZERD		C231	40.43	-9.17	-10.32	-0.02	-0.46	-0.87	0.98	XR
		C232	40.41	-9.63	-11.19					
FRQX7M		C231	40.35	-9.13	-10.07	0.04	-0.48	-0.86	0.99	XM
		C232	40.39	-9.61	-10.93					
FZ2YRM		C231	40.48	-9.18	-10.29	0.03	-0.49	-0.86	0.99	XC
		C232	40.51	-9.67	-11.15					
GE39UM		C231	40.91	-9.26	-10.09	0.07	-0.47	-0.83	0.96	AO
		C232	40.98	-9.74	-10.92					
GKLFA8	X	C231	40.66	-9.55	-10.49	0.09	-0.50	-0.80	0.95	CA
		C232	40.75	-10.05	-11.29					
GRMNXM		C231	40.68	-9.31	-10.25	0.10	-0.50	-0.82	0.96	XB
		C232	40.78	-9.80	-11.07					
JHPJXH		C231	40.79	-9.13	-10.24	0.15	-0.48	-0.76	0.92	MM
		C232	40.94	-9.61	-11.01					



CTS Interlaboratory Testing Program for Color & Appearance

Report #205

Analysis 409

3rd 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*	ΔL^*	Δa^*	Δb^*	ΔE^*	
JN2K4L	X	C231	40.79	-8.93	-10.35	0.09	-0.49	-0.83	0.97	MI
		C232	40.88	-9.42	-11.18					
K22JQJ		C231	40.79	-9.30	-10.10	0.06	-0.50	-0.85	0.98	AT
		C232	40.85	-9.80	-10.94					
K22TCN		C231	40.59	-9.20	-10.27	0.15	-0.46	-0.78	0.92	XH
		C232	40.74	-9.65	-11.05					
K7WDNK		C231	40.54	-9.01	-10.16	-0.02	-0.47	-0.94	1.05	XI
		C232	40.52	-9.47	-11.10					
LK8MJK		C231	40.70	-9.08	-10.22	0.05	-0.51	-0.83	0.98	XD
		C232	40.75	-9.59	-11.06					
LMD6HF		C231	40.89	-9.26	-10.03	-0.01	-0.53	-0.85	1.00	AJ
		C232	40.88	-9.79	-10.88					
LWMBU7		C231	40.60	-9.29	-10.18	0.15	-0.47	-0.75	0.91	MY
		C232	40.76	-9.76	-10.93					
M4Y7WJ		C231	40.78	-9.27	-10.12	0.06	-0.47	-0.86	0.98	GG
		C232	40.84	-9.74	-10.98					
M9EEKH		C231	40.59	-9.20	-10.13	0.02	-0.48	-0.89	1.01	XI
		C232	40.61	-9.68	-11.02					
MF9NL2		C231	40.82	-9.36	-10.01	0.02	-0.53	-0.88	1.02	AS
		C232	40.84	-9.89	-10.89					
MUWGLA	X	C231	40.32	-8.94	-10.06	0.09	-0.43	-0.84	0.95	XH
		C232	40.41	-9.37	-10.90					
ND4DBJ		C231	40.64	-9.17	-10.12	0.05	-0.48	-0.83	0.96	XG
		C232	40.69	-9.66	-10.95					
NLFEN8		C231	40.61	-9.21	-10.09	0.20	-0.50	-0.74	0.92	AS
		C232	40.81	-9.72	-10.83					
P2K74G		C231	40.50	-9.09	-10.02	0.00	-0.45	-0.87	0.98	XO
		C232	40.50	-9.54	-10.89					
P47ACE		C231	40.63	-9.26	-10.23	0.13	-0.50	-0.79	0.95	AQ
		C232	40.76	-9.76	-11.03					
P7X729		C231	40.58	-9.16	-10.25	0.02	-0.39	-0.88	0.96	XD
		C232	40.60	-9.55	-11.13					



CTS Interlaboratory Testing Program for Color & Appearance

Report #205

Analysis 409

3rd 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*	ΔL^*	Δa^*	Δb^*	ΔE^*	
QATADD		C231	40.70	-9.13	-10.25	0.10	-0.49	-0.80	0.94	XI
		C232	40.81	-9.62	-11.05					
QE9RMG		C231	40.89	-9.30	-10.11	-0.05	-0.46	-0.91	1.02	AP
		C232	40.84	-9.77	-11.02					
QJX6N6		C231	40.56	-9.19	-9.98	0.00	-0.50	-0.88	1.01	MP
		C232	40.56	-9.69	-10.86					
QWN2NH		C231	40.57	-9.26	-10.07	0.11	-0.46	-0.84	0.97	AJ
		C232	40.68	-9.73	-10.91					
QWNR3D		C231	40.68	-9.26	-10.18	0.08	-0.51	-0.83	0.98	AS
		C232	40.75	-9.77	-11.01					
R84BR2		C231	40.86	-9.27	-10.05	0.01	-0.50	-0.88	1.01	AS
		C232	40.87	-9.77	-10.92					
TCEKHB		C231	40.54	-9.32	-10.30	0.22	-0.45	-0.74	0.89	CA
		C232	40.76	-9.77	-11.04					
TTXE7E		C231	40.75	-9.19	-10.24	0.13	-0.49	-0.85	0.99	HP
		C232	40.88	-9.69	-11.09					
U6PM48		C231	40.75	-9.37	-10.25	0.14	-0.47	-0.81	0.95	MV
		C232	40.89	-9.84	-11.06					
U7J2ZC		C231	40.58	-9.11	-10.25	0.06	-0.46	-0.83	0.95	XE
		C232	40.64	-9.56	-11.08					
UEGT97		C231	40.86	-9.30	-9.95	0.02	-0.46	-0.89	1.00	AJ
		C232	40.88	-9.75	-10.84					
VAG646		C231	40.84	-9.13	-10.15	0.09	-0.52	-0.83	0.98	AJ
		C232	40.93	-9.65	-10.98					
VEAD46		C231	40.69	-9.27	-10.09	0.02	-0.49	-0.86	0.99	AS
		C232	40.70	-9.76	-10.95					
VH9PZ6		C231	40.78	-9.23	-10.07	0.05	-0.49	-0.86	0.99	AU
		C232	40.83	-9.72	-10.93					
VM3LNV		C231	40.60	-9.28	-10.11	0.18	-0.48	-0.76	0.92	AU
		C232	40.79	-9.75	-10.87					
VM74V8		C231	40.73	-9.19	-10.16	0.19	-0.49	-0.73	0.90	XI
		C232	40.92	-9.67	-10.89					



CTS Interlaboratory Testing Program for Color & Appearance

Report #205

Analysis 409

3rd 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*	ΔL^*	Δa^*	Δb^*	ΔE^*	
VMNWM4		C231	40.51	-9.04	-10.21	0.06	-0.49	-0.81	0.95	XH
		C232	40.57	-9.53	-11.03					
VYTFY4		C231	40.62	-9.24	-10.25	0.01	-0.46	-0.84	0.96	XD
		C232	40.64	-9.70	-11.09					
W6ZWF6		C231	40.59	-9.18	-10.27	0.06	-0.48	-0.83	0.96	XD
		C232	40.65	-9.66	-11.10					
W88NZ6	X	C231	40.04	-9.08	-9.93	-0.26	-0.39	-0.77	0.90	MR
		C232	39.78	-9.47	-10.70					
WMH69T		C231	40.64	-9.30	-10.11	0.18	-0.47	-0.75	0.90	MW
		C232	40.82	-9.77	-10.86					
XEZ7ZZ		C231	40.51	-9.16	-10.22	0.12	-0.46	-0.81	0.94	XF
		C232	40.63	-9.62	-11.03					
XPJNT7		C231	40.93	-9.34	-10.01	0.10	-0.51	-0.79	0.95	AO
		C232	41.03	-9.85	-10.80					
XW4TGZ		C231	40.67	-9.16	-10.27	0.01	-0.45	-0.86	0.97	XI
		C232	40.68	-9.61	-11.13					
YANHZ4		C231	40.69	-9.22	-10.07	-0.03	-0.46	-0.89	1.01	AU
		C232	40.66	-9.69	-10.96					
YHCH8Z		C231	40.56	-9.12	-10.25	0.06	-0.47	-0.83	0.96	XB
		C232	40.63	-9.59	-11.08					
Z2994U		C231	40.79	-9.14	-10.10	-0.02	-0.50	-0.88	1.01	AU
		C232	40.77	-9.64	-10.99					
Z6NUV2	X	C231	40.48	-8.95	-10.16	0.04	-0.49	-0.86	0.99	XH
		C232	40.52	-9.44	-11.02					
Z94B66		C231	40.76	-9.30	-10.01	0.04	-0.46	-0.87	0.98	AJ
		C232	40.80	-9.77	-10.87					
Z9NRK9		C231	40.67	-9.28	-10.10	-0.01	-0.49	-0.91	1.03	AS
		C232	40.66	-9.77	-11.00					
ZA42JZ		C231	40.82	-9.22	-10.09	0.03	-0.48	-0.88	1.00	AP
		C232	40.85	-9.70	-10.96					
ZRNTJZ		C231	40.66	-9.20	-10.21	0.11	-0.47	-0.81	0.94	MK
		C232	40.76	-9.67	-11.02					



Summary Statistics							
<u>Samples</u>	<u>L*</u>	<u>a*</u>	<u>b*</u>	<u>ΔL*</u>	<u>Δa*</u>	<u>Δb*</u>	<u>ΔE*</u>
Grand Means							
C231	40.67	-9.21	-10.17	0.07	-0.48	-0.84	0.97
C232	40.74	-9.69	-11.00				
Std Dev Btwn Labs							
C231	0.14	0.07	0.12	0.07	0.02	0.05	0.04
C232	0.15	0.08	0.12				

Statistics based on 87 of 96 reporting participants

Comments Assigned on Data Flags for Test #409

- 67MD2Y(X) - High L* values for both samples.
- 6K8VWM(X) - Very high b* values for Sample C231. Large replication difference for b* Sample C231. Small Delta b and large Delta E.
- AXWCVW(X) - Low L* values for both samples.
- EJ3MHL(X) - Low a* values for Sample C232. Large replication difference for a* Sample C232. Low b* values for both samples. Small Delta a.
- GKLFA8(X) - Very low a* values for both samples. Large replication difference for a* Sample C231.
- JN2K4L(X) - High a* values for both samples. Large replication difference for a* values for both samples.
- MUWGLA(X) - High a* values for both samples. Large replication difference for a* Sample C231.
- W88NZ6(X) - Extreme data for both L* values. High a* values for Sample C232. Small Delta L and large Delta a.
- Z6NUV2(X) - High a* values for both samples.



Key to Instrument Codes Reported by Participants

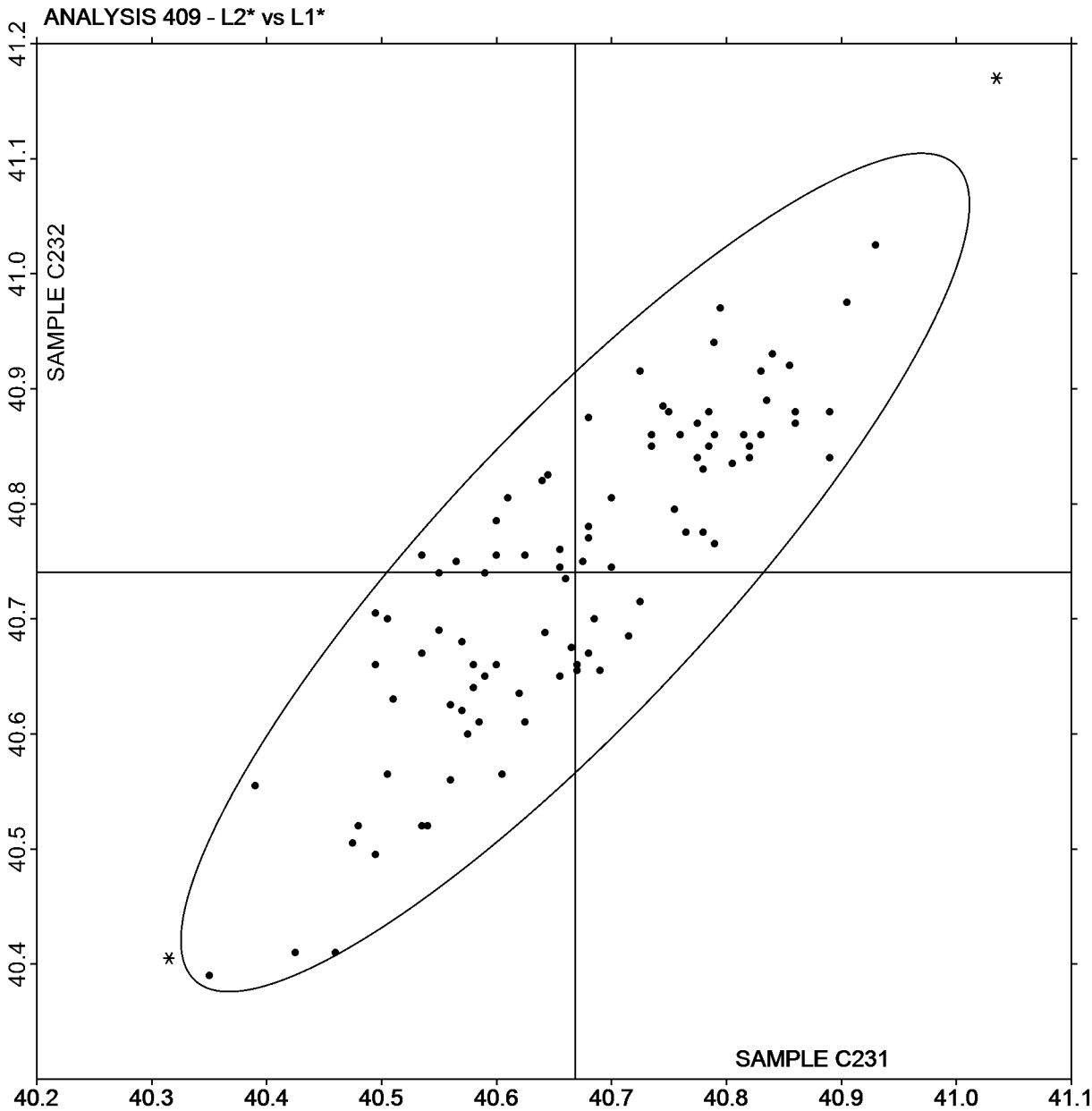
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AN	Datacolor 650	AO	Datacolor 650x
AP	Datacolor 750	AQ	Datacolor 600x
AS	Datacolor 800	AT	Datacolor 850
AU	Datacolor 1000	CA	Cary 5000
GE	BYK-Gardner Spectro2-Guide Sphere Gloss	GG	BYK-Gardner TCS II
HP	Hunter UltraScan PRO	MI	Macbeth Color i5
MK	Macbeth Color-Eye 7000	MM	Macbeth Color-Eye 7000a
MP	Minolta CM-36dG	MR	Minolta CM-5
MT	Minolta CM-2600d	MU	Minolta
MV	Minolta CM-3000d Spectrophotometer	MW	Minolta CM 3700a Spectrophotometer
MY	Minolta Benchtop Spectrophotometer CM-3600a	XB	X-Rite Ci7000 Series Benchtop Spectrophotometer
XC	X-Rite Ci4200 Benchtop Spectrophotometer	XD	X-Rite Ci7800 Benchtop Spectrophotometer
XE	X-Rite Ci7600 Benchtop Spectrophotometer	XF	X-Rite Ci6x Portable Spectrophotometer
XG	X-Rite Ci7860 Benchtop Spectrophotometer	XH	X-Rite Color i5 Benchtop Spectrophotometer
XI	X-Rite Color i7 Benchtop Spectrophotometer	XM	X-Rite SP62 Portable Sphere Spectrophotometer
XO	X-Rite SP64 Portable Sphere Spectrophotometer	XR	X-Rite



L2* vs L1*

SAMPLE C231 = 40.67

SAMPLE C232 = 40.74

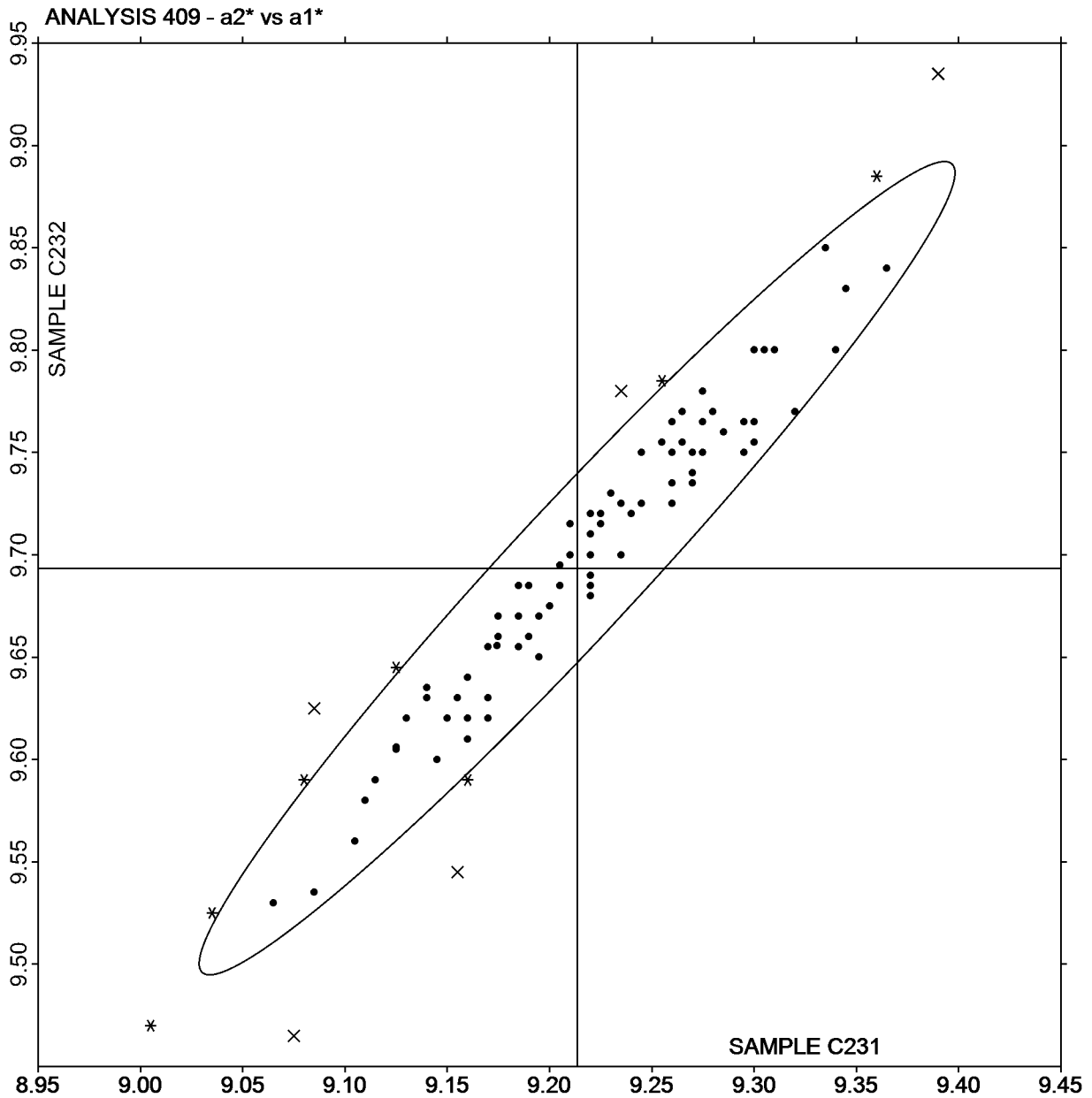




a2* vs a1*

SAMPLE C231 = -9.21

SAMPLE C232 = -9.69



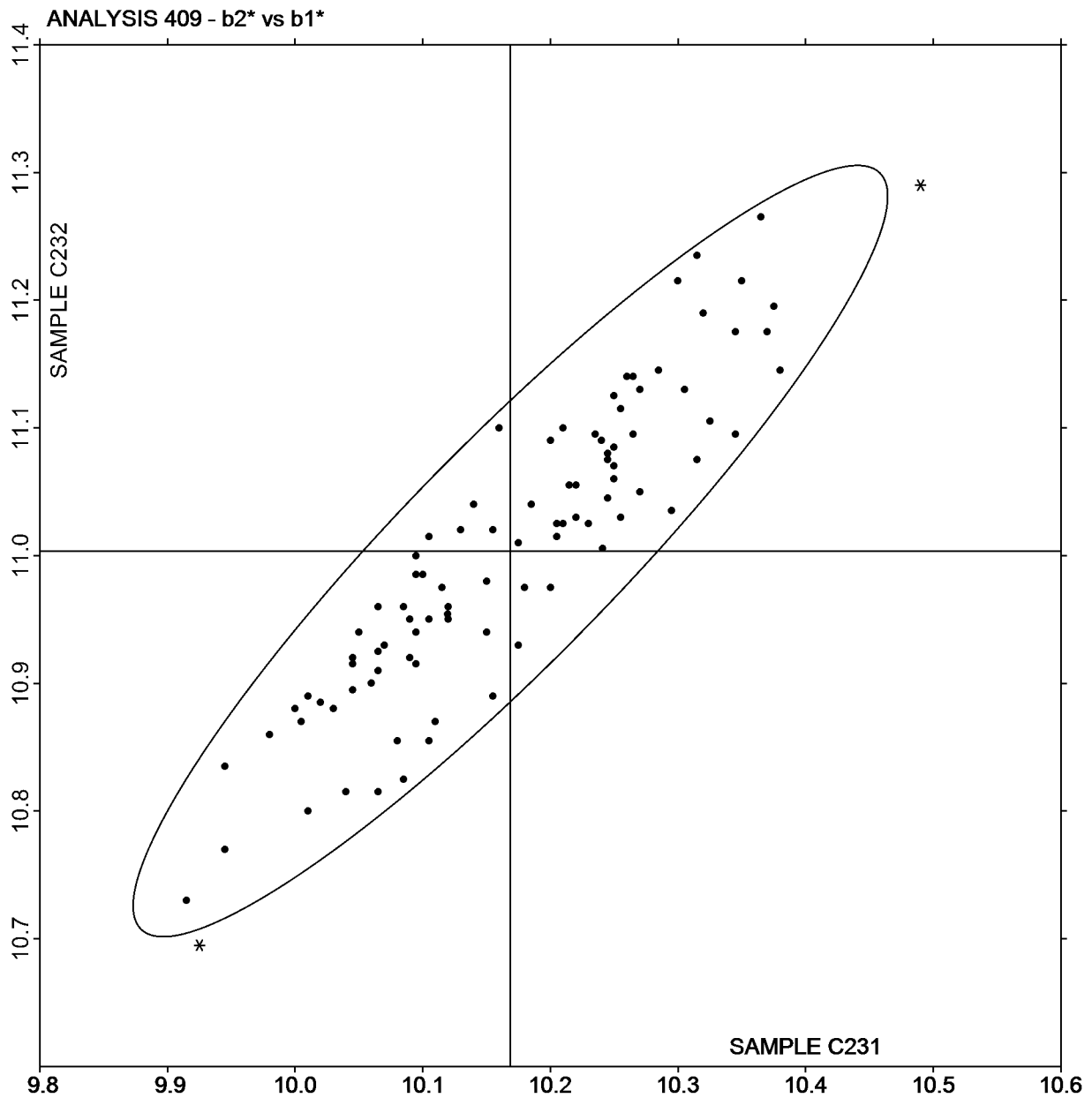
Plot created using absolute values.



b2* vs b1*

SAMPLE C231 = -10.17

SAMPLE C232 = -11.00



Plot created using absolute values.



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

**Report #205
3rd 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 C231																		
262PTT		13.42	15.26	15.85	15.99	15.63	15.27	14.58	13.12	10.87	9.02	8.10	7.59	7.43	7.52	7.44	7.09	MW
2GHAK3		13.70	15.28	15.97	16.06	15.73	15.34	14.62	13.10	10.80	9.01	8.12	7.62	7.50	7.58	7.47	7.13	MV
2VZ6QZ		13.74	15.25	15.93	15.97	15.60	15.23	14.49	13.00	10.76	9.00	8.08	7.58	7.38	7.44	7.31	6.97	XG
37DNM3		13.61	15.19	15.87	15.90	15.55	15.16	14.42	12.92	10.68	8.91	7.98	7.49	7.34	7.39	7.26	6.90	XD
3Q22KY		13.51	15.11	15.79	15.83	15.48	15.11	14.40	12.93	10.71	8.94	7.99	7.50	7.32	7.36	7.21	6.87	XD
43M4WN		13.52	15.14	15.80	15.88	15.57	15.19	14.52	13.03	10.80	8.92	8.06	7.52	7.36	7.43	7.28	7.06	AS
483CKN		14.61X	15.18	15.84	15.88	15.54	15.14	14.41	12.92	10.67	8.89	7.98	7.48	7.32	7.41	7.26	6.85	XD
67MD2Y		13.98	15.46	16.28X	16.33X	15.97X	15.60X	14.89X	13.37X	11.04*	9.19*	8.25*	7.73*	7.55*	7.65*	7.53*	7.17	CA
6K8VWM		13.48	15.13	15.81	15.86	15.51	15.14	14.42	12.94	10.72	8.92	7.99	7.50	7.34	7.44	7.32	6.99	MM
6NLP AZ		13.72	15.23	15.82	15.91	15.59	15.25	14.54	13.08	10.80	9.01	8.12	7.57	7.41	7.40	7.28	7.08	AT
6TJ673		13.74	15.20	15.90	15.91	15.58	15.24	14.47	12.95	10.67	8.92	8.03	7.54	7.39	7.48	7.38	7.03	XF
6WHF22		13.60	15.15	15.81	15.87	15.48	15.14	14.41	12.89	10.67	8.99	8.05	7.54	7.39	7.44	7.28	6.93	XI
6YKECU		13.74	15.28	15.90	15.98	15.66	15.28	14.54	13.13	10.86	9.01	8.12	7.60	7.43	7.50	7.47	7.12	AT
77K3KL		13.53	15.17	15.77	15.87	15.55	15.18	14.47	13.01	10.77	8.96	8.04	7.55	7.38	7.46	7.32	7.05	AS
7GG9EK		13.74	15.24	15.85	15.94	15.60	15.25	14.54	13.07	10.87	9.01	8.12	7.61	7.43	7.48	7.30	7.03	AU
7YYA82		13.70	15.27	15.91	15.92	15.63	15.21	14.49	13.05	10.81	9.01	8.15	7.59	7.43	7.46	7.35	7.09	AN
7ZZZLW		13.51	15.17	15.78	15.82	15.43	15.07	14.35	12.87	10.62	8.88	7.94	7.44	7.32	7.38	7.22	6.83	XI
97BAGU		13.77	15.28	16.00	16.05	15.72	15.34	14.64	13.11	10.86	9.06	8.15	7.62	7.41	7.46	7.34	6.96	XD
98377N		13.56	15.14	15.79	15.85	15.49	14.62X	14.41	12.94	10.70	8.90	7.98	7.47	7.29	7.30*	7.13*	6.74	XE
9T7R7U		13.40	15.20	15.80	15.90	15.55	15.20	14.50	13.05	10.80	9.00	8.05	7.55	7.40	7.50	7.40	7.05	MW
A6UDPV		13.30	14.66X	15.55*	15.67*	15.37	15.01	14.28*	12.84	10.65	8.84	7.91*	7.43	7.27	7.33	7.20	6.89	GE
ABJPQJ		13.89	15.57*	16.23X	16.34X	15.91*	15.52*	14.80*	13.28*	10.98	9.13	8.19	7.67	7.50	7.59	7.47	7.12	MT



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

**Report #205
3rd 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 C231																		
ABM9WU		13.73	15.15	15.78	16.00	15.71	15.31	14.55	13.15	10.88	9.07	8.21	7.67	7.50	7.55	7.32	5.75X	AE
AGDH8T		13.74	15.26	15.94	15.98	15.62	15.23	14.49	12.99	10.72	8.93	8.02	7.51	7.34	7.44	7.30	6.96	XB
ARPUDV		13.69	15.26	15.88	15.98	15.66	15.29	14.58	13.09	10.85	9.03	8.14	7.61	7.45	7.47	7.32	7.09	AJ
AXWCVW		13.17*	14.92*	15.55*	15.64*	15.31*	14.90*	14.18X	12.71X	10.49X	8.68X	7.84X	7.34X	7.20X	7.24X	7.14*	6.78	XO
B8FE8N		13.89	15.23	15.92	16.03	15.64	15.28	14.57	13.09	10.83	9.00	8.09	7.61	7.44	7.52	7.44	7.08	NA
BVMVQX		13.64	15.30	15.87	15.97	15.68	15.31	14.59	13.11	10.90	9.04	8.15	7.60	7.43	7.51	7.39	7.08	AP
C99KCL		13.77	15.24	15.91	15.91	15.54	15.16	14.43	12.94	10.71	8.96	8.01	7.47	7.30	7.37	7.20	6.85	XE
CFP3KM		13.68	15.26	15.91	15.96	15.60	15.21	14.48	13.01	10.76	8.98	8.05	7.56	7.39	7.48	7.32	6.98	XI
CM8LNM		13.66	15.21	15.77	15.98	15.62	15.24	14.54	13.12	10.86	9.05	8.17	7.63	7.43	7.46	7.44	7.07	AS
CQM4XQ		13.72	15.26	15.94	15.97	15.62	15.24	14.52	13.04	10.80	9.02	8.10	7.60	7.41	7.48	7.33	6.98	XD
DFHB7B		13.67	15.18	15.85	15.87	15.52	15.12	14.38	12.89	10.63	8.87	7.95	7.48	7.31	7.39	7.23	6.89	XD
E6H8EM		13.44	15.18	15.80	15.93	15.57	15.17	14.52	13.02	10.76	8.96	8.07	7.54	7.40	7.49	7.40	7.05	MV
EJ3MHL		14.45X	15.57*	16.09	16.20*	15.95X	15.43	14.62	13.07	10.71	8.92	8.10	7.66	7.19X	7.34	7.04X	6.73	HP
EWM6DB		13.89	15.45	16.11	16.12	15.73	15.34	14.59	13.11	10.85	9.07	8.15	7.63	7.44	7.53	7.39	7.01	XB
FHLTFQ		13.74	15.27	15.93	15.97	15.62	15.22	14.50	13.00	10.75	8.97	8.04	7.50	7.33	7.42	7.27	6.91	XB
FHZERD		13.67	15.11	15.76	15.77	15.44	15.09	14.34	12.83	10.57*	8.82*	7.92	7.44	7.29	7.37	7.27	6.92	XC
FRQX7M		13.95	15.30	16.00	16.00	15.70	15.30	14.50	13.00	10.70	9.00	8.05	7.60	7.50	7.70X	7.30	7.05	HW
FZ2YRM		13.52	15.11	15.80	15.79	15.45	15.10	14.38	12.87	10.61	8.86	7.96	7.47	7.32	7.40	7.31	6.97	XC
GE39UM		13.86	15.29	15.98	16.06	15.74	15.37	14.61	13.20	10.93	9.09	8.20	7.66	7.49	7.51	7.46	7.21	AN
GKLFA8		13.86	15.36	16.15*	16.20*	15.83	15.45	14.75*	13.24	10.93	9.06	8.12	7.59	7.42	7.52	7.41	7.06	CA
GRMNXM		13.63	15.22	15.92	15.96	15.63	15.25	14.53	13.03	10.76	8.96	8.05	7.52	7.32	7.37	7.24	6.87	XB
JHPJXH		13.68	15.33	16.02	16.03	15.72	15.30	14.57	13.07	10.86	9.05	8.10	7.62	7.44	7.51	7.40	7.09	MM



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

Report #205
3rd 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 C231																		
JN2K4L		13.67	15.34	16.05	16.07	15.71	15.31	14.50	13.03	10.77	9.02	8.16	7.67	7.54*	7.57	7.43	7.13	MI
K22JQJ		13.63	15.25	15.88	15.99	15.67	15.28	14.59	13.13	10.85	9.00	8.11	7.61	7.43	7.48	7.38	7.10	AT
K22TCN		13.64	15.21	15.85	15.92	15.57	15.17	14.46	12.97	10.71	8.90	8.00	7.52	7.37	7.43	7.26	6.90	XH
LK8MJK		13.78	15.28	15.93	15.96	15.60	15.22	14.50	13.02	10.78	9.03	8.11	7.59	7.42	7.49	7.37	7.05	XD
LMD6HF		13.76	15.30	15.94	16.05	15.72	15.34	14.61	13.17	10.95	9.08	8.17	7.68	7.49	7.54	7.45	7.13	AJ
LWMBU7		13.40	15.16	16.30X	15.92	15.51	15.17	14.47	13.02	10.72	8.91	8.00	7.51	7.33	7.44	7.34	7.02	MY
M4Y7WJ		13.75	15.26	15.89	16.02	15.68	15.29	14.56	13.11	10.84	9.04	8.08	7.59	7.43	7.50	7.38	7.05	GG
MF9NL2		13.50	15.26	15.86	15.99	15.67	15.28	14.61	13.14	10.92	9.05	8.17	7.60	7.42	7.45	7.34	7.06	AS
ND4DBJ		13.57	15.16	15.84	15.88	15.57	15.17	14.45	13.00	10.78	9.00	8.05	7.53	7.37	7.41	7.27	6.94	XD
NLFEN8		13.81	15.18	15.73	15.85	15.52	15.12	14.43	13.00	10.76	8.93	8.05	7.53	7.37	7.41	7.29	7.03	AS
P2K74G		13.41	15.02	15.62*	15.75	15.44	15.02	14.36	12.89	10.66	8.92	8.02	7.52	7.39	7.44	7.34	7.00	XO
P47ACE		13.48	15.16	15.84	15.96	15.63	15.24	14.48	12.98	10.77	8.95	8.05	7.53	7.38	7.39	7.26	7.01	AQ
P7X729		13.63	15.18	15.85	15.90	15.53	15.15	14.43	12.95	10.72	8.93	8.01	7.51	7.34	7.39	7.23	6.89	XD
QATADD		13.72	15.35	15.97	16.04	15.63	15.28	14.54	13.05	10.78	8.98	8.09	7.62	7.43	7.50	7.32	6.95	XI
QE9RMG		13.68	15.33	15.99	16.06	15.75	15.38	14.63	13.17	10.92	9.08	8.19	7.64	7.46	7.49	7.38	7.12	AP
QJX6N6		13.43	15.00	15.71	15.78	15.44	15.07	14.40	12.97	10.70	8.92	8.04	7.52	7.37	7.49	7.39	7.09	MP
QWNR3D		13.81	15.23	15.86	15.92	15.63	15.24	14.49	13.03	10.79	8.96	8.07	7.54	7.36	7.42	7.26	7.02	AS
R84BR2		13.71	15.31	15.91	16.04	15.73	15.32	14.64	13.17	10.61	9.07	8.17	7.65	7.48	7.52	7.40	7.12	AS
TCEKHB		13.56	14.97	15.80	15.87	15.49	15.15	14.45	12.95	10.68	8.85	7.95	7.45	7.28	7.39	7.27	6.93	CA
TTXE7E		14.00	15.38	16.01	16.04	15.67	15.32	14.58	13.03	10.83	9.03	8.11	7.57	7.38	7.48	7.36	7.02	HP
U6PM48		13.52	15.37	15.95	15.97	15.72	15.34	14.55	13.14	10.79	8.96	8.01	7.59	7.46	7.57	7.39	7.08	MV
U7J2ZC		13.70	15.19	15.86	15.88	15.53	15.15	14.42	12.94	10.70	8.95	8.04	7.56	7.36	7.44	7.32	6.89	XE



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

Report #205
3rd 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 C231																		
UEGT97		13.67	15.23	15.78	16.01	15.71	15.31	14.59	13.16	10.93	9.08	8.17	7.67	7.47	7.52	7.40	7.08	AJ
VAG646		13.84	15.38	15.98	16.02	15.74	15.32	14.58	13.13	10.85	9.06	8.17	7.66	7.48	7.48	7.38	7.11	AJ
VEAD46		13.70	15.18	15.80	15.93	15.61	15.21	14.49	13.04	10.79	8.98	8.10	7.55	7.40	7.42	7.31	7.04	AS
VH9PZ6		13.94	15.24	15.88	15.99	15.64	15.27	14.57	13.11	10.88	9.03	8.14	7.64	7.45	7.47	7.47	7.07	AU
VM3LNV		13.48	15.11	15.77	15.87	15.54	15.13	14.46	12.96	10.76	8.93	8.04	7.50	7.35	7.40	7.25	7.03	AU
VM74V8		13.50	15.24	15.86	15.97	15.62	15.26	14.52	13.03	10.79	9.01	8.09	7.59	7.45	7.53	7.35	7.06	XI
VMNWM4		13.56	15.06	15.79	15.83	15.42	15.06	14.35	12.88	10.64	8.93	8.01	7.54	7.39	7.42	7.28	6.92	XH
VYTFY4		13.58	15.20	15.87	15.92	15.58	15.20	14.45	12.98	10.75	8.95	8.02	7.52	7.33	7.41	7.26	6.94	XD
W6ZWF6		13.67	15.20	15.85	15.90	15.55	15.15	14.43	12.96	10.72	8.94	8.02	7.52	7.34	7.41	7.25	6.90	XD
W88NZ6	X	12.99X	14.63X	15.27X	15.35X	15.05X	14.69X	13.99X	12.57X	10.44X	8.70X	7.81X	7.33X	7.15X	7.26X	7.16	6.85	MR
XEZ7ZZ		13.47	15.12	15.77	15.83	15.47	15.15	14.40	12.89	10.65	8.89	7.98	7.49	7.34	7.42	7.32	6.97	XF
XPJNT7		13.80	15.36	15.95	16.08	15.81	15.41	14.65	13.26*	10.94	9.10	8.18	7.66	7.48	7.51	7.44	7.18	AN
XW4TGZ		13.67	15.25	15.92	15.96	15.60	15.21	14.48	13.01	10.77	8.98	8.06	7.56	7.39	7.48	7.33	7.00	XI
YANHZ4		13.65	15.19	15.79	15.90	15.57	15.23	14.50	13.02	10.80	8.99	8.12	7.58	7.40	7.44	7.36	7.07	AU
YHCH8Z		13.90	15.19	15.83	15.85	15.51	15.11	14.40	12.93	10.70	8.93	8.03	7.52	7.34	7.41	7.30	6.92	XB
Z2994U		13.62	15.28	15.89	15.98	15.65	15.28	14.58	13.10	10.89	9.04	8.18	7.63	7.45	7.48	7.34	7.11	AU
Z6NUV2		13.57	15.07	15.75	15.77	15.38	15.00	14.30	12.88	10.65	8.95	8.02	7.56	7.38	7.45	7.29	6.96	XH
Z9NRK9		13.53	15.65X	15.83	15.88	15.61	15.22	14.48	13.02	10.80	8.96	8.09	7.53	7.38	7.42	7.36	7.01	AS
ZA42JZ		13.73	15.28	15.93	16.01	15.67	15.31	14.60	13.12	10.90	9.04	8.19	7.64	7.45	7.48	7.46	7.14	AP
ZRNTJZ		13.55	15.18	15.86	15.94	15.59	15.20	14.48	12.99	10.76	8.99	8.04	7.55	7.39	7.48	7.36	7.02	MK



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

**Report #205
3rd Qtr 2023**

Spectrophotometric - Sphere Geometry Instruments
Reflectance at 16 Selected Wavelengths

Summary Statistics

	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700
Grand Means	13.67	15.23	15.88	15.94	15.61	15.22	14.50	13.03	10.77	8.98	8.07	7.56	7.39	7.46	7.33	6.99
SD Btwn Labs	0.21	0.13	0.13	0.12	0.12	0.13	0.11	0.11	0.10	0.08	0.08	0.07	0.07	0.07	0.09	0.17

W88NZ6 (X) - Low % reflectance data for almost all wavelengths.

Key to Instrument Codes Reported by Participants

AE Datacolor 110	AJ Datacolor 600	AN Datacolor 650
AP Datacolor 750	AQ Datacolor 600x	AS Datacolor 800
AT Datacolor 850	AU Datacolor 1000	CA Cary 5000
GE BYK-Gardner Spectro2-Guide Sphere Gloss	GG BYK-Gardner TCS II	HP Hunter UltraScan PRO
HW Hunter UltraScan XE	MI Macbeth Color i5	MK Macbeth Color-Eye 7000
MM Macbeth Color-Eye 7000a	MP Minolta CM-36dG	MR Minolta CM-5
MT Minolta CM-2600d	MV Minolta CM-3000d Spectrophotometer	MW Minolta CM 3700a Spectrophotometer
MY Minolta Benchtop Spectrophotometer CM-3600a	NA Minolta Benchtop Spectrophotometer CM-3700A	XB X-Rite Ci7000 Series Benchtop Spectrophotometer
XC X-Rite Ci4200 Benchtop Spectrophotometer	XD X-Rite Ci7800 Benchtop Spectrophotometer	XE X-Rite Ci7600 Benchtop Spectrophotometer
XF X-Rite Ci6x Portable Spectrophotometer	XG X-Rite Ci7860 Benchtop Spectrophotometer	XH X-Rite Color i5 Benchtop Spectrophotometer
XI X-Rite Color i7 Benchtop Spectrophotometer	XO X-Rite SP64 Sphere Spectrophotometer	



Interlaboratory Testing Program for Color & Appearance

Report #205

Analysis 440

3rd Qtr 2023

60 Degree Gloss - Paint Chips

ASTM Method D 523

WebCode	Data Flag	Sample G231			Sample G232			Instr Code
		Lab Mean	Diff from Grand Mean	CPV	Lab Mean	Diff from Grand Mean	CPV	
262PTT	*	40.68	-2.52	-2.25	51.53	-2.92	-2.80	GT
2Q2Q6W		42.33	-0.87	-0.78	53.98	-0.47	-0.45	EN
2VZ6QZ		42.60	-0.59	-0.53	53.83	-0.62	-0.59	GL
2WRZFU		41.68	-1.52	-1.36	52.90	-1.54	-1.48	RQ
483CKN		45.03	1.83	1.64	54.93	0.48	0.46	RA
48N4FU		43.48	0.28	0.25	54.75	0.31	0.30	GK
6K8VWM		43.29	0.10	0.09	54.10	-0.34	-0.33	GL
6WHF22		43.35	0.16	0.14	54.80	0.36	0.34	GL
6WZCLN		40.50	-2.69	-2.41	52.33	-2.12	-2.03	EN
74T7WR		41.15	-2.04	-1.83	53.03	-1.42	-1.36	GL
77K3KL		43.48	0.28	0.25	54.63	0.18	0.18	GL
7ZZZLW		44.78	1.58	1.42	54.93	0.48	0.46	MM
83XXAU		44.33	1.13	1.01	55.68	1.23	1.18	GN
8977TJ		42.20	-0.99	-0.89	52.95	-1.49	-1.43	GL
9T7R7U		43.18	-0.02	-0.02	54.43	-0.02	-0.02	GK
9UGQ3P		44.65	1.46	1.31	55.83	1.38	1.33	RA
ABM9WU		43.65	0.46	0.41	54.95	0.51	0.49	GL
AXWCVW		44.55	1.36	1.22	55.70	1.26	1.21	MW
B8FE8N		44.05	0.86	0.77	56.18	1.73	1.66	GL
C99KCL		42.63	-0.57	-0.51	53.80	-0.64	-0.62	GL
CQM4XQ		43.65	0.46	0.41	55.15	0.71	0.68	GL
DFLTDM		42.55	-0.64	-0.58	54.30	-0.14	-0.14	GD
DKHM3B		44.84	1.64	1.47	55.54	1.10	1.06	GL
E6H8EM		41.23	-1.97	-1.76	52.73	-1.72	-1.65	GL
FH3WXP		41.65	-1.54	-1.38	52.55	-1.89	-1.81	GL
FHLTFQ		43.05	-0.14	-0.13	54.03	-0.42	-0.40	GL
FHZERD		43.30	0.11	0.10	53.38	-1.07	-1.02	GL
FRQX7M		41.30	-1.89	-1.69	53.43	-1.02	-0.97	GK
GRMNXM		44.60	1.41	1.26	55.33	0.88	0.85	ZA
HYYBZM		42.90	-0.29	-0.26	54.40	-0.04	-0.04	GL
J666VH		43.15	-0.04	-0.04	54.75	0.31	0.30	GN
JACVXN		41.78	-1.42	-1.27	53.30	-1.14	-1.09	GK
JHPJXH		43.03	-0.17	-0.15	55.05	0.61	0.58	GL



Interlaboratory Testing Program for Color & Appearance

Report #205

Analysis 440

3rd Qtr 2023

60 Degree Gloss - Paint Chips

ASTM Method D 523

WebCode	Data Flag	Sample G231			Sample G232			Instr Code
		Lab Mean	Diff from Grand Mean	CPV	Lab Mean	Diff from Grand Mean	CPV	
JN2K4L		44.38	1.18	1.06	56.25	1.81	1.73	GL
K22TCN		42.48	-0.72	-0.64	53.73	-0.72	-0.69	GL
K7WDNK		42.90	-0.29	-0.26	55.10	0.66	0.63	GL
KRAAXF		44.13	0.93	0.84	55.60	1.16	1.11	GN
KU29CD		42.00	-1.19	-1.07	53.90	-0.54	-0.52	GL
LMD6HF		43.18	-0.02	-0.02	54.73	0.28	0.27	GL
M9EEKH		43.23	0.03	0.03	54.45	0.01	0.01	GL
MF9NL2		40.80	-2.39	-2.14	52.30	-2.14	-2.05	GK
MUREHH		43.18	-0.02	-0.02	55.15	0.71	0.68	GL
MUWGLA		43.48	0.29	0.26	54.48	0.04	0.04	GL
N3KWJC		43.68	0.48	0.43	54.98	0.53	0.51	GK
P2K74G		42.43	-0.77	-0.69	53.68	-0.77	-0.74	GN
P7X729		43.00	-0.19	-0.17	55.43	0.98	0.94	GK
PVFP92	X	46.03	2.83	2.54	54.35	-0.09	-0.09	MA
QE9H2C		43.28	0.08	0.07	54.10	-0.34	-0.33	RQ
QJX6N6		43.83	0.63	0.57	55.95	1.51	1.45	MX
QWN2NH		43.60	0.41	0.37	54.43	-0.02	-0.02	GL
R84BR2		43.08	-0.12	-0.11	54.15	-0.29	-0.28	GK
RCECW7		43.88	0.68	0.61	54.80	0.36	0.34	GL
RL3C43		44.13	0.93	0.84	55.00	0.56	0.54	GL
RPJ3R3		43.98	0.78	0.70	54.45	0.01	0.01	GL
TCEKHB		44.60	1.41	1.26	56.00	1.56	1.49	GL
U7GJT2		44.48	1.28	1.15	54.63	0.18	0.18	GL
UEGT97		44.90	1.71	1.53	56.35	1.91	1.83	NH
VAG646		43.95	0.76	0.68	54.78	0.33	0.32	GL
VL6DFC		42.08	-1.12	-1.00	52.93	-1.52	-1.45	GD
VM3LNV		45.35	2.16	1.93	55.63	1.18	1.13	GL
VM74V8		44.28	1.08	0.97	55.58	1.13	1.09	GN
VMNWM4		44.05	0.86	0.77	54.83	0.38	0.37	GL
VRXDWR		43.03	-0.17	-0.15	54.88	0.43	0.42	GN
W6ZWF6		43.65	0.46	0.41	53.53	-0.92	-0.88	GL
W88EEZ	X	37.85	-5.34	-4.78	47.68	-6.77	-6.49	GD



Interlaboratory Testing Program for Color & Appearance

Report #205

Analysis 440

3rd Qtr 2023

60 Degree Gloss - Paint Chips

ASTM Method D 523

WebCode	Data Flag	Sample G231			Sample G232			Instr Code
		Lab Mean	Diff from Grand Mean	CPV	Lab Mean	Diff from Grand Mean	CPV	
WMH69T		42.45	-0.74	-0.66	53.83	-0.62	-0.59	GN
XEZ7ZZ		43.45	0.26	0.23	55.50	1.06	1.01	GL
XGDGD7		43.53	0.33	0.30	54.70	0.26	0.25	GL
Z2994U		42.30	-0.89	-0.80	54.25	-0.19	-0.18	GL
Z94B66		44.05	0.86	0.77	54.78	0.33	0.32	GK
Z9NRK9		41.55	-1.64	-1.47	53.58	-0.87	-0.83	GK
ZJ99YZ		42.45	-0.74	-0.66	52.85	-1.59	-1.53	XX
ZM9KVZ		44.38	1.18	1.06	55.45	1.01	0.97	GK
ZULHGY		42.23	-0.97	-0.87	54.03	-0.42	-0.40	GL

Summary Statistics

Grand Means

43.19 Gloss Units

54.44 Gloss Units

Std Dev Btwn Labs

1.12 Gloss Units

1.04 Gloss Units

Statistics based on 72 of 74 reporting participants

Comments on Assigned Data Flags for Test #440

PVFP92(X) - Inconsistent in testing between samples.

W88EEZ(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
NH	3nh NHG268 Multi-angle Precise Gloss Meter	RA	Rhpoint Novo-Gloss Glossmeter
RQ	Rhpoint IQ Goniophotometer 20/60/85°	XX	Instrument make/model not specified by lab
ZA	Zehntner ZGM Series		



Interlaboratory Testing Program for Color & Appearance

Report #205

Analysis 440

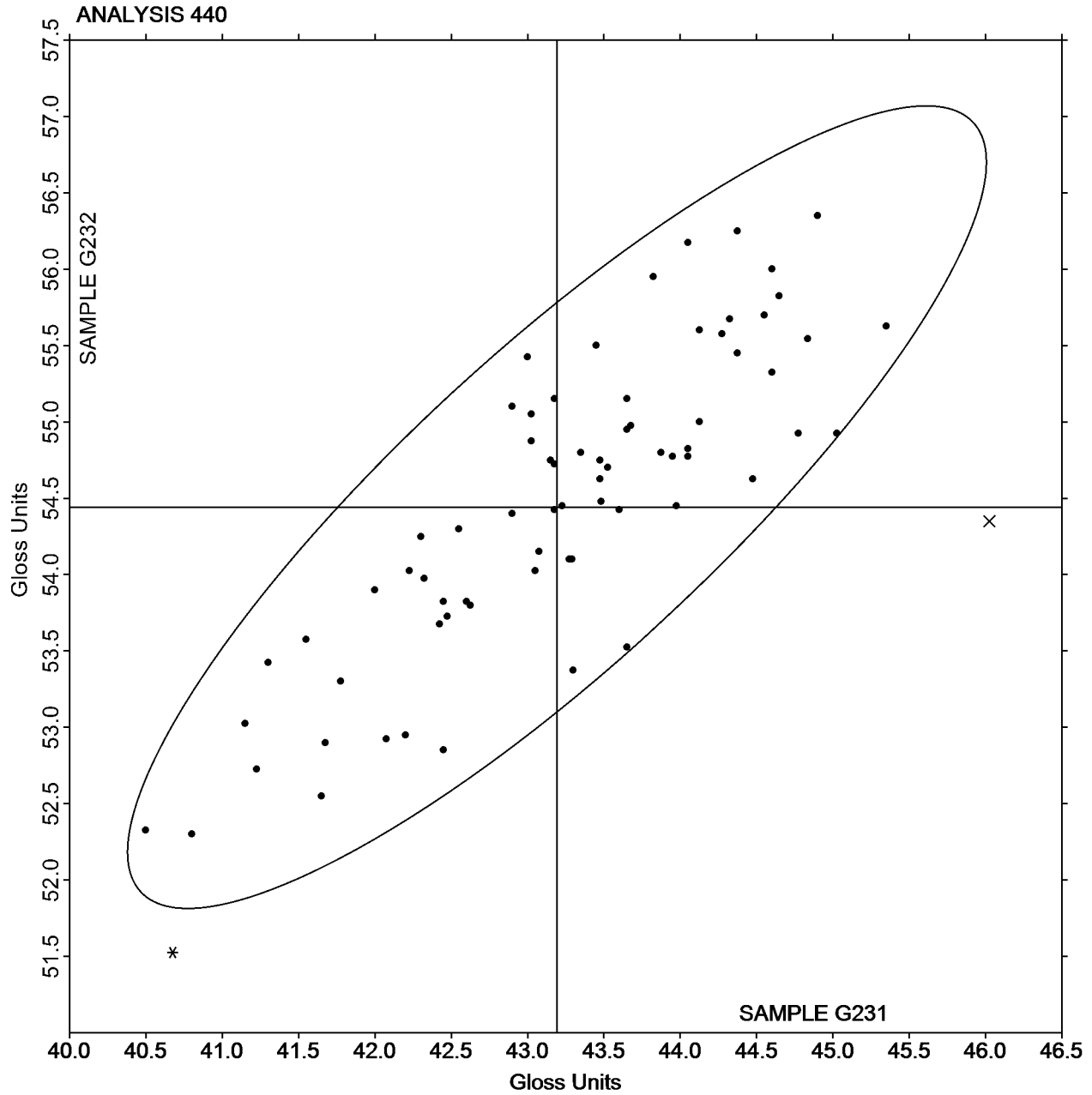
3rd Qtr 2023

60 Degree Gloss - Paint Chips

ASTM Method D 523

SAMPLE G231 = 43.19 Gloss Units

SAMPLE G232 = 54.44 Gloss Units



-End of Report-