



Color & Appearance Testing Program

Summary Report #178 - 4th Qtr 2016

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



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

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

[Key to Tables and Graphs \(GlossTests\)](#)

<u>Analysis</u>	<u>Analysis Name</u>
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408	Color & Color Difference (Paint Chips) - 45-0
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409	Color & Color Difference (Paint Chips) Sphere
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411	Spectrophotometric (Paint Chips) - Sphere
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440	Gloss 60 Degree (Paint Chips)
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442	Gloss 85 Degree (Paint Chips)
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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, CTS is a privately-owned company that specializes in interlaboratory tests for a wide variety of industries, including rubber, plastics, fasteners and metals, containerboard, paper, color, and wine as well as proficiency tests for forensic laboratories. All of the tests are designed to assist organizations in achieving and maintaining quality control objectives. Labs from the U.S., as well as more than 80 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 mailed 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 mailed 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>
*	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. 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 an X on individual wavelength values as follows:

- X - The laboratory's mean for that wavelength is greater than a 95% deviation from the GRAND MEAN.

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 mailed 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 #178

Analysis 408

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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^*	
3CYNXP		D161	59.75	-20.00	8.02	1.03	0.26	-0.11	1.06	HY
		D162	60.77	-19.74	7.91					
6HFX4P		D161	60.49	-19.88	7.77	0.91	0.22	0.01	0.94	AB
		D162	61.40	-19.66	7.78					
7CNBPV		D161	59.77	-20.26	7.42	1.21	0.30	-0.16	1.26	MG
		D162	60.98	-19.96	7.26					
8AFFLH		D161	60.35	-20.01	8.51	1.09	0.27	-0.13	1.12	GB
		D162	61.44	-19.75	8.39					
8M2P8N		D161	60.25	-20.21	7.48	0.91	0.24	-0.07	0.94	HW
		D162	61.16	-19.97	7.41					
9HMAFB		D161	60.25	-20.08	8.12	1.15	0.32	-0.17	1.20	XU
		D162	61.40	-19.76	7.95					
AP3JX6		D161	60.31	-19.98	7.84	1.08	0.27	-0.06	1.11	XO
		D162	61.39	-19.71	7.78					
BRLR4J		D161	60.22	-20.15	7.57	1.00	0.27	-0.12	1.04	HW
		D162	61.22	-19.88	7.45					
C4C3QG		D161	60.12	-20.03	8.35	1.02	0.24	-0.05	1.05	XR
		D162	61.14	-19.79	8.30					
DDFEKP		D161	60.41	-20.20	8.20	1.11	0.29	-0.13	1.15	GH
		D162	61.52	-19.92	8.08					
DFK6R6		D161	59.98	-19.88	7.94	1.28	0.33	-0.18	1.33	XN
		D162	61.25	-19.55	7.76					
EPLWNC		D161	60.39	-20.14	8.26	0.94	0.25	-0.07	0.97	GH
		D162	61.33	-19.89	8.19					
FTZR7U		D161	60.35	-20.33	8.50	1.07	0.29	-0.06	1.11	GE
		D162	61.42	-20.04	8.44					
FYLZAL		D161	59.94	-20.10	8.01	1.10	0.26	-0.14	1.14	MU
		D162	61.04	-19.84	7.87					
FZYGKD		D161	60.43	-20.09	7.66	0.94	0.22	-0.02	0.97	HW
		D162	61.37	-19.87	7.64					
GDZK96		D161	60.29	-20.26	7.96	1.01	0.26	-0.10	1.05	XZ
		D162	61.30	-20.00	7.86					



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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^*	
GJ8X84		D161	60.18	-20.10	7.64	1.12	0.29	-0.15	1.17	HW
		D162	61.30	-19.81	7.49					
GZVBLV		D161	60.11	-19.74	7.63	1.09	0.31	-0.16	1.14	XK
		D162	61.19	-19.43	7.47					
HBU97A		D161	60.51	-19.81	7.77	0.99	0.23	-0.09	1.01	XZ
		D162	61.50	-19.59	7.68					
HERT99		D161	59.90	-19.75	7.71	1.02	0.25	-0.07	1.05	HK
		D162	60.92	-19.51	7.64					
J8AUZE		D161	60.26	-19.98	8.59	1.05	0.25	-0.19	1.10	HG
		D162	61.31	-19.73	8.40					
KPHHJQ		D161	59.78	-20.07	8.08	1.04	0.25	-0.11	1.07	HY
		D162	60.82	-19.82	7.97					
LFTWC7		D161	60.46	-20.24	7.51	1.10	0.21	-0.06	1.12	HW
		D162	61.56	-20.03	7.45					
N62FBV		D161	60.37	-20.06	7.79	1.07	0.29	-0.12	1.11	XO
		D162	61.44	-19.77	7.68					
PH9GT7		D161	60.20	-20.08	8.10	1.05	0.25	-0.13	1.08	XM
		D162	61.25	-19.83	7.97					
Q4AWR9		D161	60.41	-20.05	7.79	1.15	0.30	-0.15	1.20	MU
		D162	61.56	-19.75	7.64					
QKQ6KW		D161	60.11	-20.16	7.48	1.08	0.28	-0.08	1.11	HW
		D162	61.18	-19.89	7.41					
QT49E3		D161	60.18	-20.13	7.45	1.01	0.31	-0.07	1.05	HW
		D162	61.19	-19.82	7.38					
QYQ48U		D161	60.31	-20.21	7.53	1.11	0.27	-0.18	1.15	HW
		D162	61.42	-19.94	7.36					
VW8HQF		D161	60.17	-20.11	7.51	0.93	0.23	-0.09	0.96	HW
		D162	61.09	-19.88	7.43					
XEZ3JK		D161	60.42	-20.24	8.00	1.15	0.31	-0.16	1.20	XZ
		D162	61.57	-19.94	7.84					
XGPJHK		D161	60.11	-20.09	8.56	1.10	0.32	-0.63	1.30	XU
		D162	61.20	-19.77	7.93					



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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^*	
XP2JCV		D161	60.15	-19.98	7.89	1.02	0.20	-0.06	1.04	XO
		D162	61.17	-19.78	7.84					
XTZ27G		D161	60.21	-20.30	8.40	1.05	0.21	0.03	1.07	TO
		D162	61.26	-20.09	8.42					
Y8Y69M		D161	60.29	-20.05	7.88	1.05	0.26	-0.10	1.08	XO
		D162	61.34	-19.79	7.78					
YKZ26T		D161	60.50	-20.39	7.43	1.00	0.22	-0.05	1.02	HW
		D162	61.49	-20.17	7.38					
YTHAVB		D161	60.35	-20.10	8.42	1.07	0.31	-0.07	1.11	GE
		D162	61.41	-19.80	8.36					
Z4VURD		D161	60.70	-20.03	7.99	1.16	0.38	-0.05	1.22	XD
		D162	61.86	-19.65	7.95					

Summary Statistics							
Samples	L*	a*	b*	ΔL^*	Δa^*	Δb^*	ΔE^*
Grand Means							
D161	60.23	-20.08	7.89				
D162	61.29	-19.82	7.80	1.06	0.27	-0.11	1.10
Std Dev Btwn Labs							
D161	0.22	0.15	0.34				
D162	0.22	0.16	0.34	0.08	0.04	0.10	0.09

Statistics based on 38 of 38 reporting participants

Key to Instrument Codes Reported by Participants

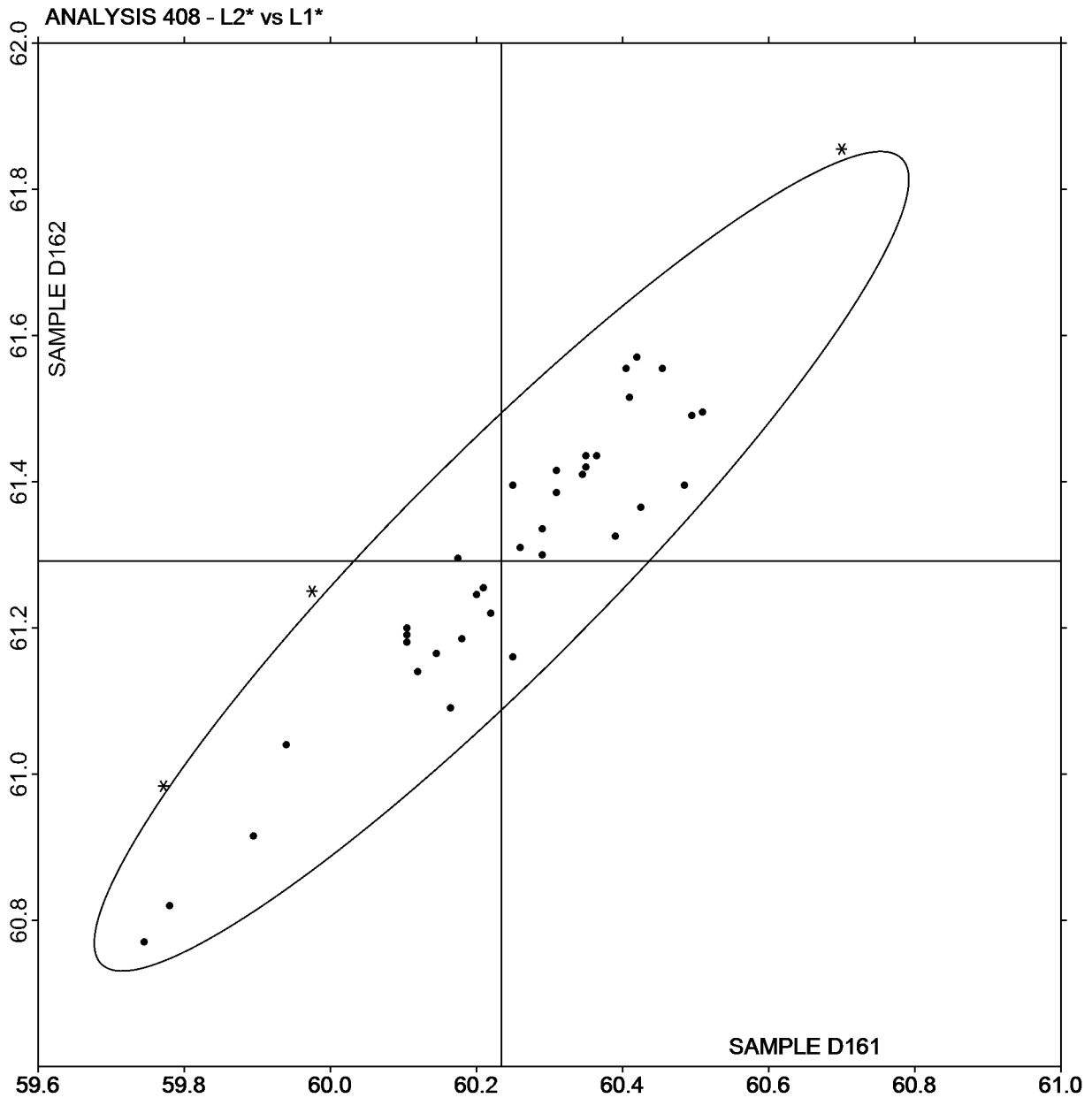
AB Data Color	GB BYK-Gardner spectro-guide sphere gloss
GE BYK-Gardner spectro-guide (45/0)	GH BYK-Gardner Color-View
HG Hunter ColorQUEST	HK Hunter MiniScan XE (45/0)
HW Hunter LabScan XE	HY Hunter Color Flex 45/0
MG Macbeth 1500/PLUS or 2025+ Color Eye	MU Minolta
TO Topcon SR-3 Spectroradiometer	XD X-Rite 500 Series SpectroDensitometer
XK X-Rite MA100 Multi-Angle SpectroPhotometer	XM X-Rite MA58 Multi-Angle SpectroPhotometer
XN X-Rite MA68 Multi-Angle SpectroPhotometer	XO X-Rite MA68 II Multi-Angle SpectroPhotometer
XR X-Rite 968 Portable SpectroPhotometer	XU X-Rite 964 Portable SpectroPhotometer
XZ X-Rite	



L2* vs L1*

SAMPLE D161 = 60.23

SAMPLE D162 = 61.29

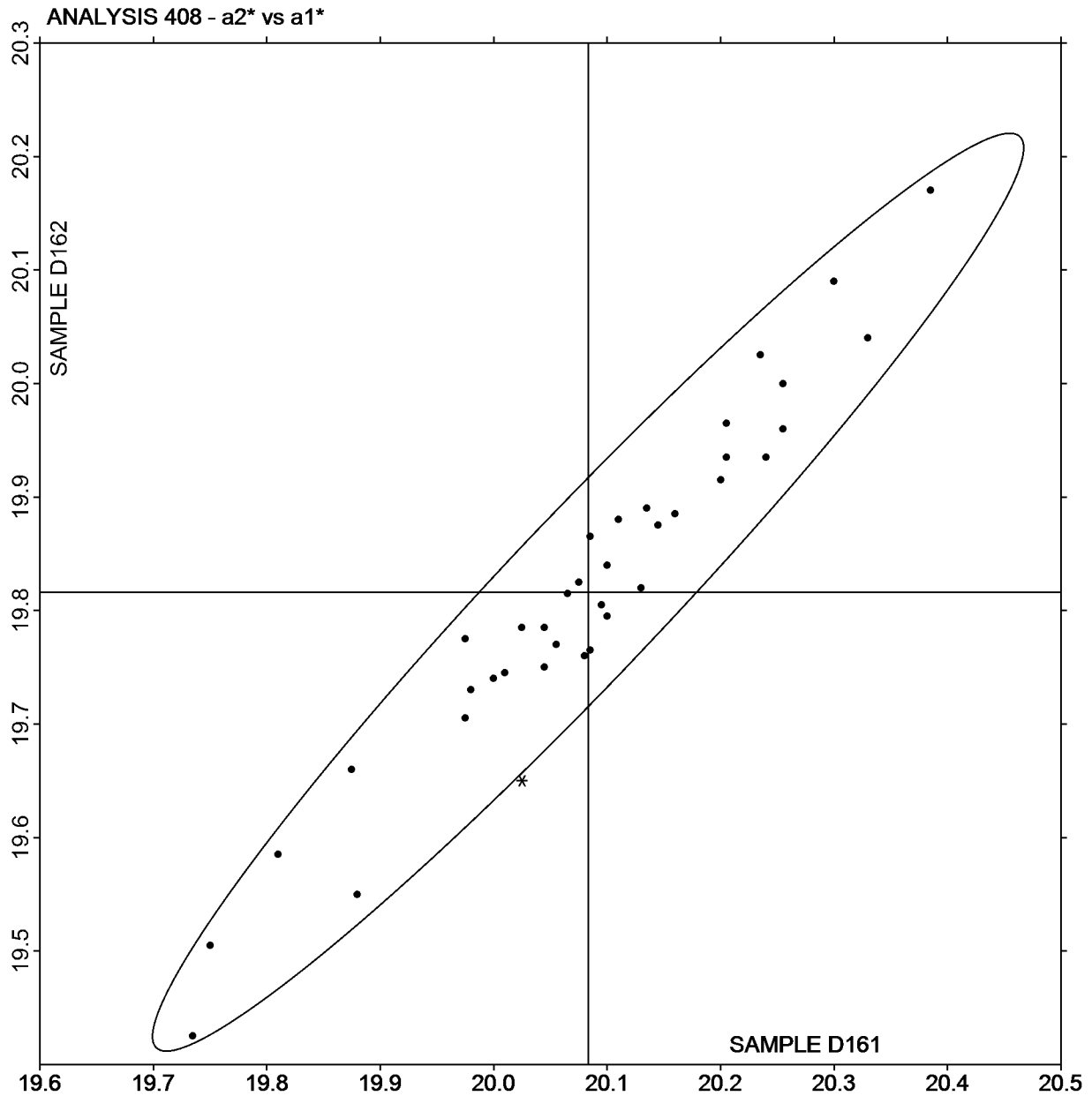




a2* vs a1*

SAMPLE D161 = -20.08

SAMPLE D162 = -19.82



Plot created using absolute values.

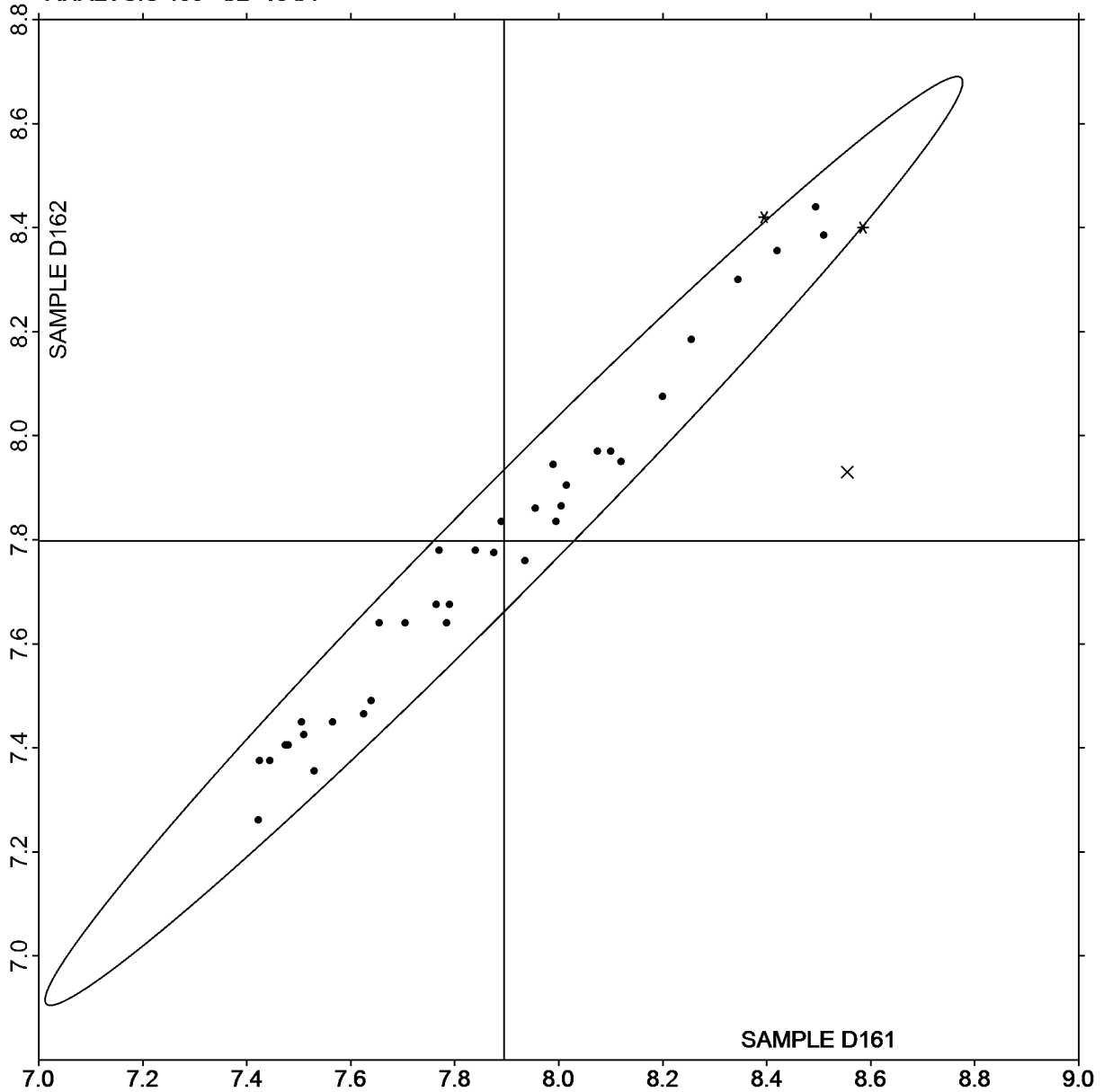


b2* vs b1*

SAMPLE D161 = 7.89

SAMPLE D162 = 7.80

ANALYSIS 408 - b2* vs b1*





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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^*	
2RB3JT		D161	60.78	-19.85	7.67	0.96	0.19	-0.02	0.97	MT
		D162	61.73	-19.66	7.65					
3CGRFN		D161	60.14	-19.82	7.69	1.07	0.26	-0.14	1.11	XH
		D162	61.21	-19.56	7.55					
3E77X7	X	D161	94.78	2.41	-15.19	-0.06	-0.03	0.15	0.16	AO
		D162	94.73	2.39	-15.04					
3GRMFQ		D161	60.60	-19.82	7.77	0.95	0.26	-0.06	0.99	AQ
		D162	61.55	-19.56	7.71					
3NWK4X		D161	60.61	-19.90	7.87	1.08	0.31	-0.14	1.13	AJ
		D162	61.69	-19.59	7.73					
3VAF3C		D161	60.40	-20.10	7.81	1.02	0.25	-0.11	1.06	PE
		D162	61.42	-19.85	7.70					
3WJPRN		D161	60.35	-19.90	7.54	1.02	0.26	-0.03	1.05	HP
		D162	61.37	-19.64	7.51					
3WPUDT		D161	60.77	-20.05	7.72	1.00	0.25	-0.07	1.03	AM
		D162	61.77	-19.80	7.65					
4KPL8V		D161	60.49	-19.89	7.74	0.99	0.24	-0.09	1.02	MV
		D162	61.47	-19.65	7.66					
6DJEY7		D161	60.32	-19.58	7.65	1.02	0.28	-0.07	1.06	AJ
		D162	61.34	-19.30	7.58					
6HCF2K		D161	60.59	-19.92	7.87	1.08	0.27	-0.14	1.12	AS
		D162	61.66	-19.65	7.73					
6R3YGE		D161	60.20	-19.84	7.55	1.16	0.33	-0.25	1.23	AJ
		D162	61.36	-19.51	7.30					
6U9LUH		D161	60.25	-19.87	7.56	1.12	0.28	-0.14	1.16	XI
		D162	61.36	-19.59	7.42					
6WXV4J		D161	60.44	-19.80	7.88	1.04	0.29	-0.17	1.09	AJ
		D162	61.48	-19.51	7.71					
76L43F	X	D161	62.13	-19.47	8.28	5.60	1.25	-0.91	5.80	XM
		D162	67.72	-18.22	7.37					
7A6WLV		D161	60.43	-19.87	7.46	1.03	0.26	-0.11	1.07	XI
		D162	61.46	-19.61	7.36					



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Color and Color Difference - Paint Chips - Sphere Geometry Instruments
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WebCode	Flag	Samples	CIE L* a* b* Color Values			Color Difference Values				InstrCode
			L*	a*	b*	ΔL^*	Δa^*	Δb^*	ΔE^*	
7NWW83		D161	60.64	-20.08	7.75	1.06	0.28	-0.14	1.10	AJ
		D162	61.70	-19.80	7.61					
7VHPPU		D161	60.43	-20.04	7.87	1.12	0.35	-0.23	1.19	AL
		D162	61.55	-19.69	7.65					
7X8ZFM		D161	60.41	-19.93	7.66	1.00	0.21	-0.01	1.02	HP
		D162	61.40	-19.72	7.65					
7ZR8FA		D161	60.57	-19.94	7.70	0.98	0.30	-0.05	1.02	MV
		D162	61.55	-19.65	7.66					
84MBRE		D161	60.43	-19.83	7.80	1.02	0.27	-0.09	1.06	AJ
		D162	61.45	-19.56	7.71					
86KNDL		D161	60.33	-19.82	7.63	1.08	0.29	-0.13	1.13	XI
		D162	61.41	-19.53	7.51					
8B4T42		D161	60.54	-20.07	7.97	1.13	0.30	-0.18	1.18	AJ
		D162	61.67	-19.78	7.79					
8QJPPP		D161	60.38	-19.97	7.52	1.03	0.23	-0.05	1.05	XI
		D162	61.40	-19.74	7.47					
8QNADR		D161	60.68	-19.93	7.72	1.06	0.29	-0.12	1.11	AO
		D162	61.74	-19.64	7.60					
923NVK		D161	60.33	-19.74	7.69	0.97	0.22	-0.06	0.99	XI
		D162	61.29	-19.52	7.64					
9HMAFB		D161	60.28	-19.91	7.69	1.15	0.33	-0.17	1.21	XI
		D162	61.43	-19.59	7.52					
A3MY24		D161	59.90	-19.60	7.48	1.19	0.34	-0.08	1.24	MG
		D162	61.09	-19.26	7.40					
A8L9DQ		D161	60.15	-19.82	7.97	1.07	0.30	-0.14	1.11	XH
		D162	61.21	-19.52	7.83					
AD8BDG		D161	60.31	-19.59	7.68	0.96	0.22	-0.09	0.98	XH
		D162	61.26	-19.37	7.60					
AR7CR3		D161	60.35	-19.75	7.51	1.03	0.24	-0.06	1.05	XI
		D162	61.37	-19.51	7.46					
B67BFZ		D161	60.37	-19.95	7.74	1.15	0.21	-0.09	1.17	MV
		D162	61.51	-19.74	7.65					



CTS Interlaboratory Testing Program for Color & Appearance

Report #178

Analysis 409

4th Qtr 2016

**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^*	
BPLJY9		D161	60.22	-20.12	7.58	1.04	0.27	-0.13	1.08	XI
		D162	61.26	-19.85	7.45					
BRNEHC		D161	60.39	-19.99	7.65	1.14	0.27	-0.15	1.18	XI
		D162	61.53	-19.72	7.50					
BTLFHE		D161	60.66	-19.87	7.74	1.05	0.27	-0.11	1.08	AJ
		D162	61.71	-19.61	7.64					
BVLXKA		D161	60.48	-20.00	7.69	1.03	0.24	-0.07	1.05	MK
		D162	61.51	-19.76	7.62					
C4YBZK		D161	60.36	-19.92	7.59	1.02	0.27	-0.09	1.06	XO
		D162	61.38	-19.65	7.50					
DCGG43		D161	60.15	-19.73	7.72	1.06	0.28	-0.15	1.10	XH
		D162	61.21	-19.45	7.58					
DDFEKP		D161	60.57	-20.07	7.87	1.04	0.27	-0.12	1.08	MV
		D162	61.61	-19.80	7.75					
DFK6R6		D161	60.02	-19.75	7.52	1.13	0.26	0.01	1.16	XO
		D162	61.15	-19.49	7.53					
DH6YKY	X	D161	60.35	-19.64	7.22	1.01	0.13	-0.13	1.02	GD
		D162	61.36	-19.51	7.09					
ED9M7E		D161	60.52	-19.85	7.91	1.00	0.24	-0.06	1.03	AM
		D162	61.52	-19.61	7.85					
EDCAL7		D161	60.71	-19.92	7.70	0.98	0.25	-0.08	1.01	AO
		D162	61.68	-19.67	7.62					
EE3HKA		D161	60.52	-19.81	7.75	0.99	0.22	-0.13	1.02	SH
		D162	61.51	-19.59	7.62					
EXE8X8		D161	60.50	-19.78	7.64	1.09	0.25	-0.10	1.12	MM
		D162	61.58	-19.53	7.54					
FE6ML4		D161	60.53	-19.79	7.68	0.98	0.22	-0.07	1.01	AM
		D162	61.51	-19.57	7.62					
GDMV9D		D161	60.34	-19.50	7.73	1.13	0.30	-0.16	1.18	MM
		D162	61.47	-19.21	7.57					
GPH4QF		D161	60.41	-19.78	7.77	1.05	0.29	-0.17	1.10	MM
		D162	61.46	-19.49	7.60					



CTS Interlaboratory Testing Program for Color & Appearance

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4th Qtr 2016

**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^*	
GRLZC6		D161	60.62	-19.97	7.63	1.10	0.29	-0.11	1.14	AJ
		D162	61.72	-19.68	7.52					
GZVBLV		D161	60.61	-19.86	7.65	1.07	0.25	-0.15	1.11	AO
		D162	61.68	-19.61	7.51					
H2MNLT		D161	60.45	-19.95	7.64	1.04	0.26	-0.14	1.08	AQ
		D162	61.49	-19.69	7.50					
HA398D	X	D161	60.31	-21.76	6.86	0.75	0.25	-0.07	0.79	XM
		D162	61.05	-21.51	6.80					
HLUVGE		D161	60.34	-20.01	7.50	1.10	0.30	-0.13	1.14	XI
		D162	61.44	-19.71	7.37					
HRFR2V		D161	60.47	-19.97	7.76	1.16	0.29	-0.16	1.20	XZ
		D162	61.63	-19.68	7.60					
HZVNNH		D161	60.58	-20.02	7.78	1.05	0.30	-0.18	1.10	AS
		D162	61.62	-19.72	7.60					
J8AUZE		D161	60.23	-19.60	7.57	1.10	0.27	-0.12	1.14	XI
		D162	61.33	-19.33	7.46					
JB8BC9	X	D161	60.52	-19.68	7.59	1.01	0.28	6.53	6.61	HF
		D162	61.53	-19.41	14.12					
JC27Q6		D161	60.30	-19.91	7.69	0.99	0.30	-0.13	1.04	XH
		D162	61.29	-19.61	7.56					
JNQ3R3		D161	60.44	-20.01	7.67	1.18	0.36	-0.20	1.25	AQ
		D162	61.62	-19.65	7.47					
KLPEWD		D161	60.60	-19.88	7.76	1.10	0.28	-0.11	1.14	AO
		D162	61.70	-19.60	7.65					
L2U4P6		D161	60.77	-20.15	7.86	1.04	0.28	-0.11	1.08	AJ
		D162	61.80	-19.87	7.75					
LCEGJU		D161	60.18	-19.87	7.51	1.00	0.25	-0.02	1.02	XM
		D162	61.18	-19.63	7.49					
LRAUZB		D161	60.70	-20.05	7.84	1.02	0.24	-0.09	1.05	AJ
		D162	61.72	-19.81	7.75					
LXEHWX		D161	60.45	-20.03	7.84	1.12	0.31	-0.21	1.18	MU
		D162	61.57	-19.72	7.64					



CTS Interlaboratory Testing Program for Color & Appearance

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4th Qtr 2016

**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^*	
MAJ9VB		D161	60.67	-19.87	7.62	1.04	0.31	-0.11	1.09	AO
		D162	61.71	-19.56	7.52					
MUB4NX		D161	60.51	-19.84	7.68	1.04	0.26	-0.09	1.07	MM
		D162	61.54	-19.58	7.59					
N3ZCLU		D161	60.22	-20.01	7.75	1.07	0.26	-0.12	1.11	XH
		D162	61.29	-19.76	7.63					
P7E3TA		D161	60.59	-19.72	7.65	1.04	0.24	-0.05	1.07	AJ
		D162	61.63	-19.49	7.60					
P8ME86	X	D161	60.94	-22.65	7.37	0.99	0.29	-0.08	1.03	MU
		D162	61.92	-22.36	7.29					
PP9X4C		D161	60.17	-19.89	7.60	1.13	0.26	-0.15	1.16	XI
		D162	61.29	-19.64	7.46					
PVGJUU		D161	60.30	-19.96	7.64	0.97	0.25	-0.06	1.00	XH
		D162	61.27	-19.71	7.58					
PW3AVY		D161	60.01	-19.90	7.71	1.20	0.30	-0.19	1.25	XH
		D162	61.21	-19.60	7.52					
QDANRM		D161	60.75	-20.09	7.71	1.03	0.31	-0.09	1.08	AO
		D162	61.78	-19.79	7.63					
QQGEUV	X	D161	59.49	-20.22	7.67	1.03	0.31	-0.13	1.08	XO
		D162	60.52	-19.91	7.54					
QVUD8A		D161	60.84	-19.89	7.81	1.10	0.25	-0.14	1.13	AJ
		D162	61.94	-19.64	7.67					
R2UYQW		D161	60.52	-19.80	7.66	1.15	0.30	-0.11	1.19	MM
		D162	61.67	-19.50	7.56					
RBKG8Q		D161	60.63	-19.82	7.44	1.07	0.26	-0.12	1.10	AM
		D162	61.69	-19.57	7.32					
T2TN9Y	X	D161	60.93	-19.82	8.64	1.04	0.07	-0.22	1.06	XZ
		D162	61.97	-19.75	8.43					
TFMBEQ		D161	60.65	-19.90	7.77	1.08	0.26	-0.14	1.12	AR
		D162	61.73	-19.64	7.63					
TGM4G6	X	D161	60.38	-21.77	7.07	1.09	0.33	-0.13	1.14	MK
		D162	61.46	-21.45	6.94					



CTS Interlaboratory Testing Program for Color & Appearance

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Analysis 409

4th Qtr 2016

**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^*	
TU9HJ6		D161	60.34	-19.75	7.47	1.01	0.22	-0.08	1.04	XI
		D162	61.35	-19.54	7.40					
TVKD2Q		D161	60.52	-19.83	7.59	1.07	0.29	-0.12	1.11	XH
		D162	61.59	-19.54	7.47					
TYNX7Q		D161	60.43	-19.61	7.71	1.08	0.28	-0.12	1.13	MM
		D162	61.51	-19.32	7.60					
TZW6B4		D161	60.08	-19.71	7.70	1.00	0.24	-0.01	1.03	AO
		D162	61.08	-19.48	7.70					
U7D3CW		D161	60.57	-19.95	7.70	0.97	0.27	-0.04	1.00	XX
		D162	61.53	-19.68	7.67					
ULW3N		D161	60.79	-19.91	7.54	1.01	0.24	-0.05	1.03	AO
		D162	61.79	-19.67	7.49					
UQPPZP		D161	60.73	-20.28	7.82	1.16	0.33	-0.18	1.21	CA
		D162	61.88	-19.95	7.65					
UWANTJ		D161	60.50	-19.85	7.67	1.10	0.27	-0.14	1.14	MM
		D162	61.60	-19.58	7.53					
V9Y8KU		D161	60.70	-19.67	7.58	1.11	0.27	-0.12	1.15	XI
		D162	61.81	-19.40	7.46					
VB9CXH		D161	60.30	-19.90	7.49	1.03	0.27	-0.02	1.06	XI
		D162	61.32	-19.63	7.47					
VDG82U		D161	60.73	-19.77	7.48	0.94	0.21	-0.02	0.96	AM
		D162	61.67	-19.56	7.46					
VM4FAN		D161	60.61	-20.13	7.79	1.04	0.26	-0.12	1.07	MV
		D162	61.64	-19.87	7.67					
W2Y8MD		D161	60.31	-19.87	7.66	1.04	0.27	-0.13	1.08	XO
		D162	61.35	-19.61	7.53					
W6G86D		D161	60.66	-19.70	7.66	0.78	0.31	-0.09	0.84	MM
		D162	61.43	-19.39	7.57					
W8K3NG		D161	60.75	-19.95	7.70	1.09	0.32	-0.07	1.14	AS
		D162	61.84	-19.64	7.64					
WPLZTX		D161	60.28	-19.89	7.57	0.98	0.25	-0.08	1.01	XI
		D162	61.26	-19.65	7.49					



CTS Interlaboratory Testing Program for Color & Appearance

**Report #178
4th Qtr 2016**

Analysis 409

**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^*	
XGPJHK		D161	60.35	-19.71	7.64	1.13	0.36	-0.16	1.19	XI
		D162	61.48	-19.35	7.48					
XP2JCV		D161	60.35	-19.84	7.63	0.94	0.26	-0.06	0.97	MI
		D162	61.28	-19.58	7.58					
XTZ27G		D161	60.24	-20.15	7.84	1.03	0.26	-0.04	1.06	CA
		D162	61.27	-19.89	7.80					
Y7GCAX	X	D161	58.72	-19.88	7.70	0.96	0.17	0.06	0.97	AJ
		D162	59.67	-19.71	7.76					
YTHAVB		D161	60.13	-19.81	7.48	1.16	0.30	-0.11	1.20	GD
		D162	61.29	-19.51	7.37					
ZNFLX2		D161	60.62	-20.03	7.78	0.93	0.27	-0.13	0.98	HP
		D162	61.55	-19.76	7.65					
ZNXXDK		D161	60.13	-19.76	7.50	1.09	0.22	-0.12	1.11	GD
		D162	61.22	-19.54	7.39					
ZWE9QL		D161	60.39	-20.30	7.85	1.11	0.27	-0.11	1.15	GD
		D162	61.50	-20.03	7.74					

Summary Statistics							
Samples	L*	a*	b*	ΔL^*	Δa^*	Δb^*	ΔE^*
Grand Means							
D161	60.45	-19.89	7.68	1.05	0.27	-0.11	1.09
D162	61.50	-19.62	7.58				
Std Dev Btwn Labs							
D161	0.21	0.15	0.12	0.07	0.03	0.05	0.07
D162	0.20	0.15	0.11				

Statistics based on 94 of 104 reporting participants



Comments Assigned on Data Flags for Test #409

- 3E77X7(X) - High "L*" and "a*" values and Low "b*" values.
- 76L43F(X) - High "L*" and "b*" values. Also inconsistent in testing within "b*" values.
- DH6YKY(X) - Inconsistent in testing within "a*", low values for Sample D161. Also low "b*" values.
- HA398D(X) - Inconsistent in testing within "L*" values. Low "a*" and "b*" values.
- JB8BC9(X) - Inconsistent in testing for "b*" values, high "b*" data for Sample D162.
- P8ME86(X) - Low "a*" values.
- QQGEUV(X) - Low "L*" values.
- T2TN9Y(X) - Inconsistent in testing within "a*" values and high "b*" values.
- TGM4G6(X) - Low "a*" and "b*" values.
- Y7GCAX(X) - Low "L*" and "a*" values.

Key to Instrument Codes Reported by Participants

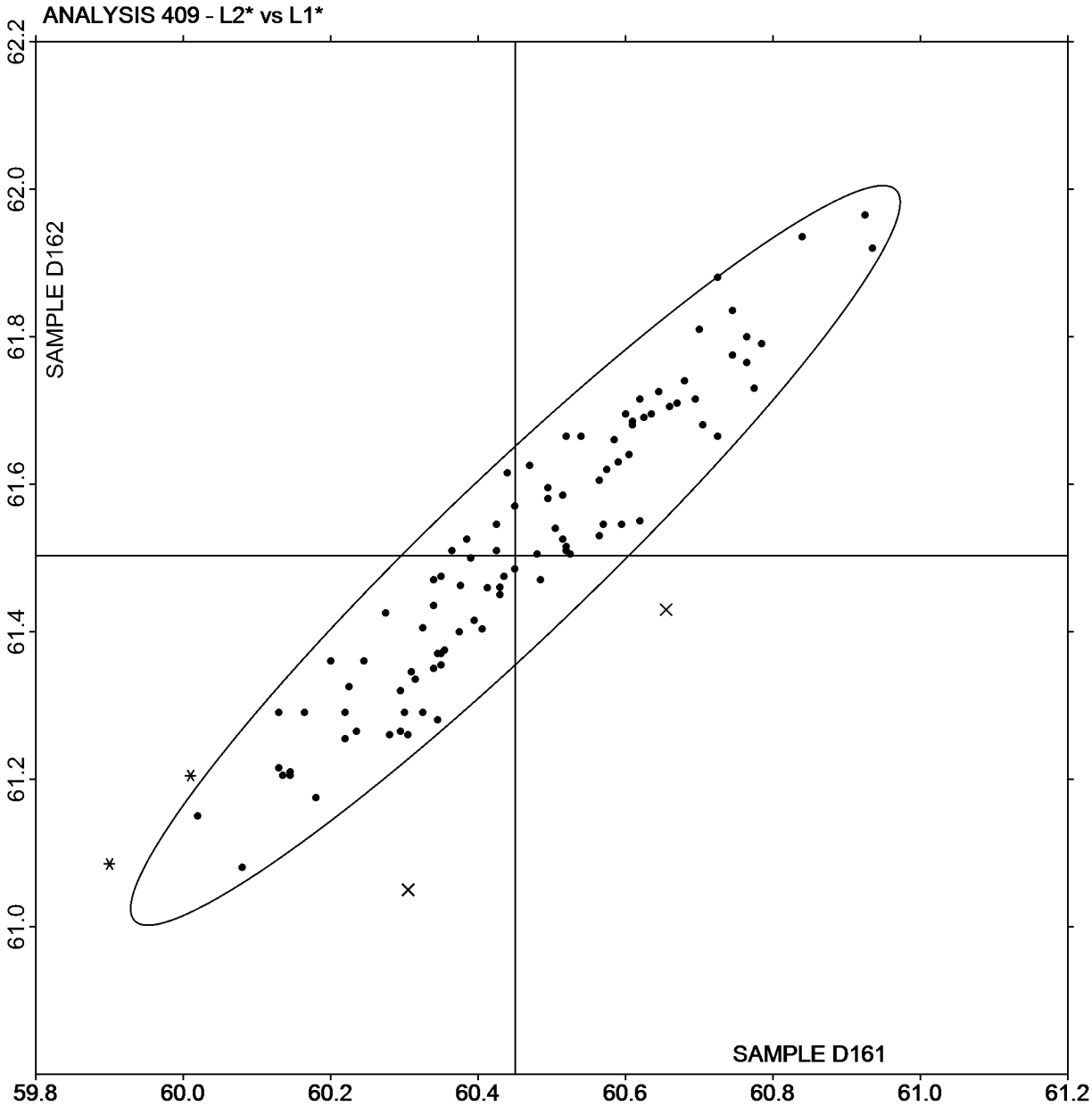
AJ	ACS-Datcolor 600	AL	ACS-Datcolor Intl. Dataflash 100
AM	ACS-Datcolor 600 Plus	AO	ACS-Datcolor 650X
AQ	ACS-Datcolor 600X	AR	Datcolor 400
AS	ACS-Datcolor 800 Series	CA	Cary 5000
GD	BYK-Gardner spectro-guide sphere	HF	Hunter ColorFlex Diffuse
HP	Hunter UltraScan PRO	MG	Macbeth 2180 Color Eye
MI	Macbeth Color i 5	MK	Macbeth Color-Eye 7000
MM	Macbeth Color-Eye 7000a	MT	Minolta CM-2600d
MU	Minolta	MV	Minolta CM-3000d Series Spectrophotometer
PE	Perkin Elmer Spectrophotometer	SH	SIMADZU UV 3101PC
XH	X-Rite Color i5	XI	X-Rite Color i7
XM	X-Rite SP62 Portable Sphere Spectrophotometer	XO	X-Rite SP64 Portable Sphere Spectrophotometer
XX	Instrument make/model not specified by lab	XZ	X-Rite



L2* vs L1*

SAMPLE D161 = 60.45

SAMPLE D162 = 61.50

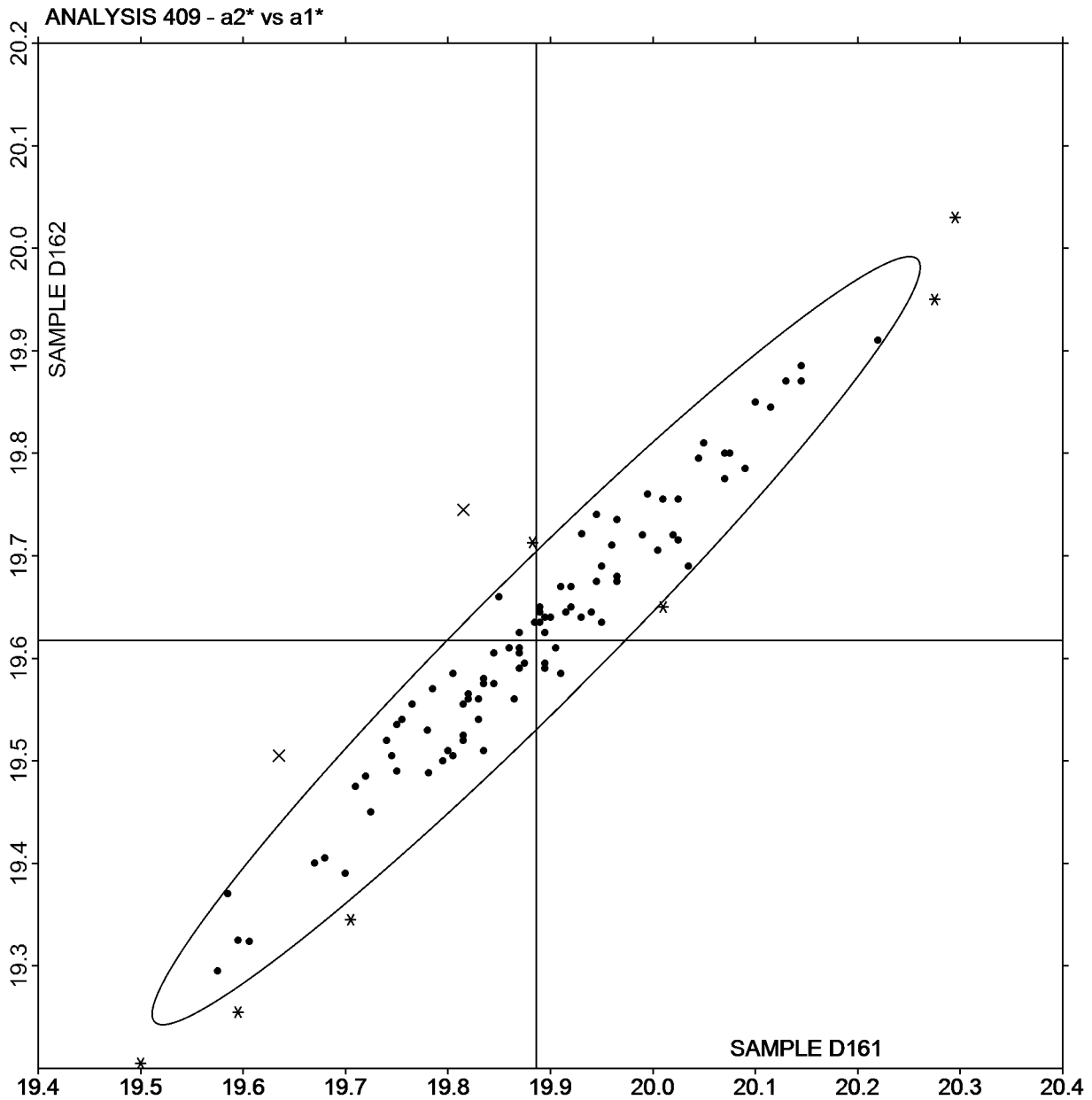




a2* vs a1*

SAMPLE D161 = -19.89

SAMPLE D162 = -19.62



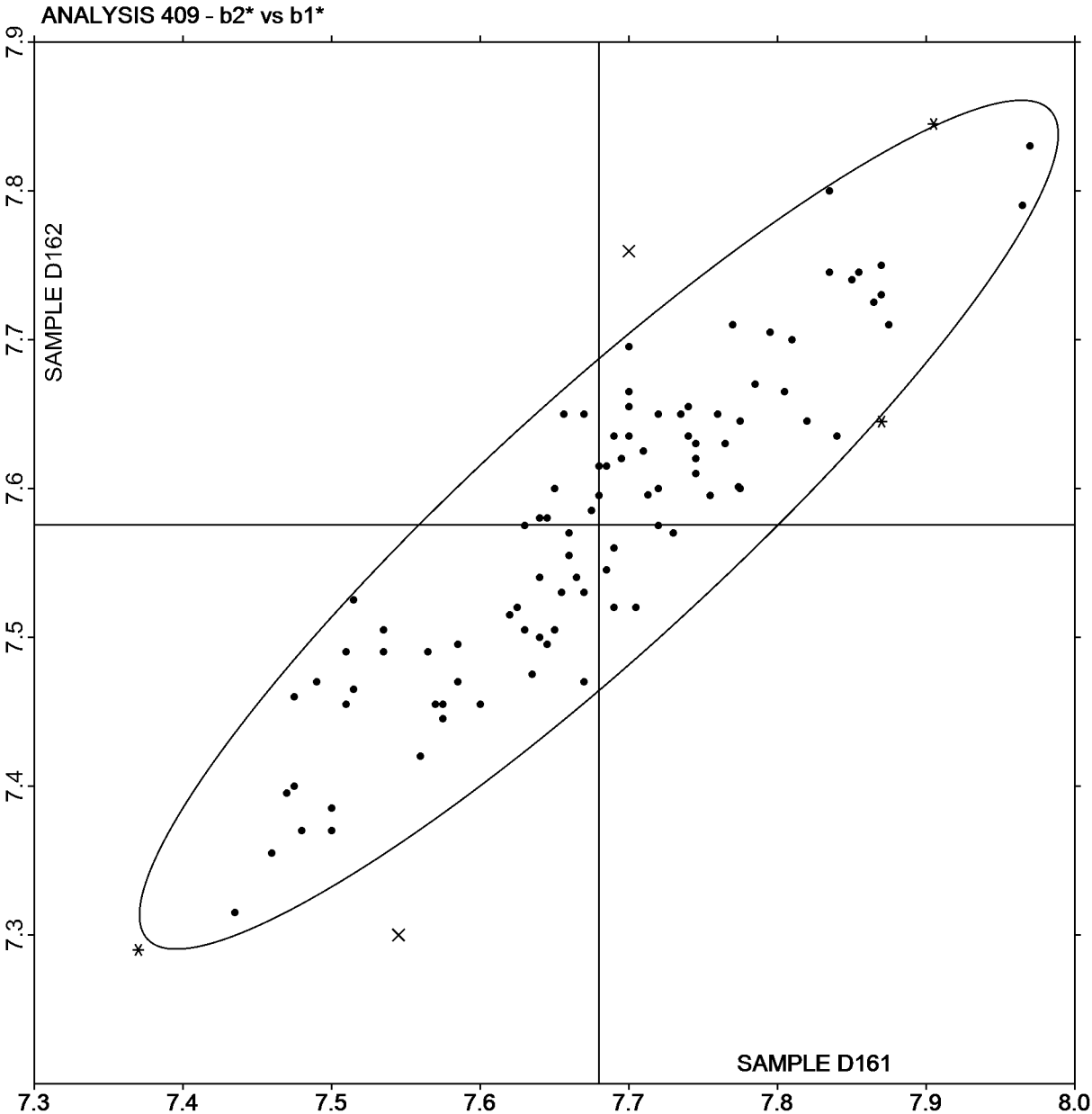
Plot created using absolute values.



b2* vs b1*

SAMPLE D161 = 7.68

SAMPLE D162 = 7.58





CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

Report #178
4th Qtr 2016

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 D161																		
2RB3JT		15.77	18.93	22.99	25.81	26.71	29.81	35.54	38.17	31.22	23.77	20.16	18.36	18.15	19.30	19.07	17.20	MT
3CGRFN		15.33	18.51	22.28	25.07	26.04	29.19	34.52	37.24	30.33	23.19	19.62	17.98	17.73	18.87	18.36	16.55	XH
3E77X7	X	31.83X	97.36X	115.11X	102.94X	97.41X	92.48X	88.49X	86.40X	86.10X	84.99X	84.72X	84.89X	86.19X	86.69X	86.11X	86.86X	XI
3GRMFQ		16.63	18.86	22.72	25.51	26.49	29.50	35.16	37.90	31.01	23.69	20.11	18.26	18.09	19.12	18.88	17.04	AQ
3NWK4X		15.62	18.68	22.70	25.43	26.43	29.49	35.10	37.96	31.08	23.64	20.09	18.26	18.03	19.05	18.80	17.01	AJ
3VAF3C		15.63	18.47	22.53	25.28	26.19	29.31	35.00	38.00	30.62	23.25	19.76	18.02	17.75	18.94	18.72	16.85	PE
3WJPRN		16.03	18.75	22.68	25.32	26.32	29.43	35.06	37.60	30.60	23.40	19.80	18.06	17.57	18.83	18.51	16.84	HP
3WPUdT		16.01	18.89	22.94	25.67	26.67	29.79	35.43	38.32	31.11	23.73	20.10	18.33	18.14	19.23	18.95	17.11	AM
4KPL8V		16.09	18.69	22.63	25.48	26.27	29.30	35.03	38.11	30.90	23.39	19.85	18.11	17.85	19.09	18.90	17.00	MV
6DJEY7		15.43	18.69	22.54	25.24	26.38	29.41	34.80	37.24	30.70	23.56	19.88	18.10	17.93	18.76	18.55	16.91	AJ
6HCF2K		15.68	18.61	22.70	25.39	26.44	29.48	35.10	37.90	31.01	23.60	20.06	18.23	18.03	19.12	18.86	16.70	AS
6R3YGE		15.34	18.59	22.40	25.20	26.22	29.22	34.83	37.29	30.30	23.25	19.72	17.97	17.76	18.82	18.59	16.85	AJ
6U9LUH		15.58	18.67	22.51	25.21	26.24	29.33	34.82	37.32	30.48	23.28	19.67	18.00	17.83	18.90	18.47	16.67	XI
76L43F	X	16.48	19.68X	23.84X	26.82X	27.93X	31.20X	37.18X	39.79X	32.72X	25.45X	21.77X	19.96X	19.72X	20.80X	20.61X	19.12X	XM
7A6WLV		15.68	18.86	22.86	25.46	26.46	29.59	35.14	37.73	30.66	23.36	19.87	18.07	17.87	19.11	18.63	16.83	XI
7NWX83		15.73	18.77	22.76	25.51	26.57	29.69	35.32	38.01	30.95	23.58	20.00	18.22	18.06	19.04	18.81	16.56	AO
7VHPPU		15.40	18.56	22.49	25.27	26.28	29.42	35.00	37.69	30.78	23.47	19.83	18.06	17.78	18.87	18.71	16.78	AL
7X8ZFM		16.07	18.71	22.66	25.38	26.34	29.43	34.98	37.83	30.75	23.53	19.89	18.02	17.65	18.94	18.55	16.85	HP
7ZR8FA		15.65	18.78	22.75	25.60	26.43	29.49	35.23	38.16	30.91	23.48	19.94	18.19	17.93	19.12	19.01	17.19	MV
84MBRE		15.41	18.61	22.50	25.35	26.31	29.29	34.89	37.83	30.90	23.48	19.90	18.09	17.83	18.86	18.72	16.92	AJ
86KNDL		15.41	18.64	22.50	25.32	26.29	29.36	34.82	37.45	30.60	23.38	19.77	18.10	17.92	19.00	18.63	16.84	XI
8QJPPP		15.64	18.82	22.65	25.39	26.40	29.46	34.96	37.60	30.67	23.40	19.78	17.99	17.74	18.90	18.55	16.69	XI
8QNADR		15.71	18.80	22.83	25.62	26.64	29.53	35.20	38.11	31.14	23.68	20.09	18.26	18.04	19.14	18.82	16.95	AO
9HMAFB		15.52	18.62	22.40	25.21	26.19	29.29	34.78	37.41	30.56	23.38	19.73	17.95	17.70	18.75	18.52	16.83	XI
A3MY24		15.50	18.38	22.33	24.92	25.77	28.94	34.49	36.96	29.89	22.97	19.48	17.82	17.66	18.78	18.38	16.78	MG



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

Report #178
4th Qtr 2016

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 D161																		
A8L9DQ		14.99	18.35	22.04	24.96	25.91	29.03	34.48	37.18	30.55	23.38	19.65	17.87	17.68	18.76	18.51	16.80	XH
AD8BDG		15.58	18.73	22.46	25.26	26.21	29.19	34.59	37.36	30.75	23.52	19.87	18.09	17.86	18.89	18.71	16.96	XH
AR7CR3		15.70	18.74	22.69	25.34	26.33	29.35	34.82	37.52	30.63	23.37	19.80	18.11	17.87	19.01	18.66	16.84	XI
BPLJY9		15.46	18.54	22.52	25.20	26.21	29.36	34.87	37.44	30.40	23.13	19.55	17.89	17.71	18.82	18.45	16.60	XI
BRNEHC		15.76	18.67	22.61	25.29	26.31	29.42	34.98	37.70	30.59	23.35	19.77	18.06	17.82	18.95	18.62	16.71	XI
BTFLHE		15.71	18.82	22.76	25.54	26.58	29.54	35.20	38.02	31.14	23.69	20.11	18.27	18.10	19.12	18.73	16.82	AJ
BVLXKA		15.61	18.70	22.68	25.39	26.41	29.58	35.10	37.78	30.74	23.51	19.83	18.11	17.89	19.02	18.78	16.89	MK
C4YBZK		15.58	18.68	22.63	25.36	26.36	29.45	35.25	37.71	30.44	23.31	19.76	18.06	17.94	18.94	18.72	16.90	XO
DCGG43		15.48	18.46	22.31	25.07	26.05	29.04	34.54	37.15	30.52	23.24	19.67	17.93	17.77	18.82	18.53	16.70	XH
DDFEKP		15.46	18.63	22.63	25.49	26.36	29.50	35.36	38.04	31.00	23.45	19.92	18.15	17.95	19.10	18.98	16.97	MV
DFK6R6		15.39	18.31	22.25	24.83	25.87	28.79X	34.55	36.92	29.74X	22.69	19.30	17.70	17.60	18.66	18.37	16.59	XO
ED9M7E		16.00	18.71	22.56	25.37	26.36	29.37	35.00	37.90	31.09	23.62	20.02	18.11	17.86	18.98	18.73	17.08	AM
EDCAL7		15.83	18.90	22.78	25.67	26.66	29.64	35.29	38.07	31.11	23.77	20.10	18.29	18.08	19.13	18.98	17.03	AO
EE3HKA		15.73	18.66	22.74	25.40	26.35	29.39	35.02	38.06	30.90	23.49	19.98	18.20	17.86	19.06	18.87	17.05	SH
EXE8X8		15.77	18.79	22.71	25.46	26.44	29.57	35.03	37.80	30.85	23.56	19.90	18.17	17.95	19.07	18.81	16.93	MM
FE6ML4		15.51	18.90	22.67	25.42	26.54	29.62	35.10	37.57	30.90	23.66	20.05	18.23	17.99	19.01	18.74	17.14	AM
GDMV9D		15.55	18.68	22.52	25.25	26.28	29.35	34.70	37.33	30.81	23.62	19.91	18.17	17.91	18.88	18.76	17.01	MM
GPH4QF		15.53	18.61	22.55	25.31	26.28	29.41	34.95	37.70	30.80	23.52	19.85	18.11	17.89	18.99	18.79	16.87	MM
GRLZC6		15.72	18.86	22.90	25.55	26.59	29.61	35.24	38.05	30.97	23.58	20.03	18.21	18.01	19.07	18.74	16.80	AJ
GZVBLV		15.80	18.96	22.93	25.66	26.68	29.63	35.28	38.07	31.09	23.67	20.09	18.26	18.04	19.09	18.84	17.00	AO
H2MNLT		15.51	18.64	22.67	25.52	26.41	29.43	35.08	37.71	30.73	23.44	19.88	18.10	17.93	18.92	18.66	16.82	AQ
HA398D		15.67	19.13	23.08	25.55	26.61	29.85	35.36	37.65	30.41	23.45	20.08	18.39	18.24	19.32	19.18	17.38	XM
HLUVGE		15.66	18.73	22.67	25.34	26.36	29.51	34.93	37.55	30.57	23.34	19.71	17.97	17.75	18.85	18.35	16.56	XI
HRFR2V		15.71	18.67	22.59	25.34	26.36	29.41	35.00	37.88	30.74	26.36X	19.88	18.14	17.88	19.03	18.66	16.79	XZ
HZVNNH		15.90	18.68	22.70	25.43	26.47	29.54	35.19	37.97	30.93	23.51	20.00	18.16	18.00	19.12	18.79	16.96	AS



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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 D161																		
J8AUZE		15.52	18.69	22.48	25.19	26.21	29.21	34.59	37.28	30.42	23.35	19.83	18.10	17.89	18.96	18.60	16.79	XI
JB8BC9		16.24	18.91	22.87	25.50	26.47	29.54	35.16	37.67	30.92	23.63	19.96	18.21	17.82	19.15	18.91	17.64X	HF
JC27Q6		15.39	18.68	22.48	25.18	26.22	29.31	34.86	37.44	30.64	23.33	19.70	18.02	17.84	18.92	18.49	16.69	XH
JNQ3R3		15.66	18.58	22.70	25.37	26.40	29.42	35.09	37.75	30.69	23.42	19.87	18.07	17.87	18.91	18.79	16.84	AQ
KLPEWD		15.65	18.80	22.70	25.50	26.50	29.60	35.20	38.00	31.00	23.60	20.00	18.20	18.10	19.25	18.90	16.70	AO
L2U4P6		15.78	18.78	22.81	25.58	26.68	29.77	35.46	38.30	31.19	23.71	20.10	18.29	18.07	19.12	18.87	17.03	AJ
LCEGJU		16.09	18.78	22.93	25.49	26.51	29.68	35.30	37.52	30.39	23.35	19.84	18.16	17.84	19.30	19.12	17.44	HW
LRAUZZ		16.64	18.71	22.77	25.51	26.60	29.59	35.33	38.18	31.15	23.65	20.06	18.27	18.06	19.11	18.85	17.14	AJ
LXEHWX		15.40	18.63	22.49	25.42	26.25	29.29	35.22	37.91	30.86	23.32	19.82	18.08	17.86	19.02	18.91	16.96	MV
MAJ9VB		15.70	18.85	23.00	25.60	26.60	29.70	35.40	38.10	31.10	23.60	20.10	18.30	18.10	19.30	18.90	16.80	AO
MUB4NX		15.59	18.77	22.71	25.41	26.44	29.56	35.06	37.69	30.84	23.62	19.93	18.19	17.95	19.03	18.78	16.95	MM
N3ZCLU		15.36	18.51	22.33	25.12	26.13	29.27	34.83	37.38	30.44	23.24	19.58	17.97	17.78	18.85	18.57	16.70	XH
P7E3TA		15.75	18.83	22.82	25.51	26.53	29.56	35.19	37.94	30.96	23.62	20.09	18.26	18.09	19.17	18.80	16.77	AJ
P8ME86		15.50	18.70	22.90	25.70	26.50	29.70	35.50	38.45	31.00	23.60	20.10	18.40	18.20	19.40	19.20	17.40	MU
PP9X4C		15.44	18.53	22.42	25.12	26.11	29.24	34.71	37.20	30.34	23.24	19.62	17.88	17.66	18.81	18.56	16.83	XI
PVGJUJ		15.49	18.59	22.48	25.26	26.29	29.37	34.89	37.48	30.47	23.28	19.69	18.04	17.87	18.90	18.54	16.66	XH
PW3AVY		15.13	18.34	22.19	24.93	25.91	29.09	34.65	37.10	30.13	23.08	19.44	17.80	17.67	18.72	18.44	16.57	XH
QDANRM		15.76	18.87	22.88	25.64	26.71	29.83	35.47	38.12	31.11	23.72	20.09	18.28	18.10	19.19	18.88	16.77	AO
QQGEUV		15.16	17.78X	21.62X	24.23X	25.44X	28.70X	34.22X	36.44X	29.39X	22.41X	18.94X	17.31X	17.22X	18.19X	17.80X	15.93X	XO
R2UYQW		15.76	18.81	22.70	25.48	26.43	29.52	35.00	37.64	30.90	23.61	19.94	18.22	17.97	19.10	18.83	16.96	MM
RBKG8Q		15.77	19.13	23.00	25.64	26.67	29.70	35.38	37.84	30.86	23.63	20.08	18.26	18.05	19.05	18.81	17.10	AM
T2TN9Y		14.20X	18.59	22.45	25.61	26.68	29.83	35.49	38.39	31.23	23.83	20.22	18.41	18.13	19.29	19.13	17.25	XZ
TGM4G6		15.63	18.70	22.68	25.35	26.31	29.46	34.96	37.65	30.72	23.47	19.82	18.10	17.88	18.98	18.74	16.89	MK
TU9HJ6		15.62	18.80	22.70	25.46	26.45	29.55	35.05	37.58	30.54	23.39	19.80	18.13	17.93	19.03	18.47	16.82	XI
TYNX7Q		15.58	18.70	22.61	25.33	26.37	29.44	34.85	37.55	30.84	23.63	19.92	18.18	17.95	18.99	18.79	17.02	MM



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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 D161																		
TZW6B4		15.04	18.37	22.29	24.99	26.03	29.09	34.57	37.09	30.37	23.19	19.62	17.89	17.77	18.79	18.20	16.01X	AO
U7D3CW		15.72	18.74	22.71	25.52	26.50	29.47	35.17	37.91	31.01	23.54	20.01	18.16	17.95	18.99	18.71	16.92	XX
ULVV3N		15.69	19.08	23.10	25.73	26.76	29.74	35.41	38.23	31.20	23.75	20.16	18.33	18.17	19.16	18.86	16.89	AO
UQPPZP		15.87	18.80	22.85	25.70	26.59	29.65	35.43	38.49	31.13	23.62	20.06	18.24	17.96	19.18	18.96	17.02	CA
UWANTJ		15.68	18.74	22.69	25.42	26.12	29.51	35.01	37.76	30.82	23.57	19.89	18.17	17.94	19.05	18.82	16.95	MM
V9Y8KU		15.72	19.06	22.97	25.66	26.70	29.74	35.26	37.96	31.04	23.80	20.21	18.40	18.18	19.37	19.04	17.18	XI
VB9CXH		15.74	18.84	22.65	25.23	26.39	29.60	35.04	37.40	30.45	23.28	19.74	17.97	17.90	18.96	18.53	16.63	XI
VDG82U		16.44	19.07	23.08	25.72	26.76	29.76	35.28	38.16	31.02	23.76	20.12	18.38	18.18	19.19	19.01	17.18	AM
VM4FAN		15.58	18.73	22.79	25.57	26.37	29.57	35.40	38.30	30.93	23.44	19.89	18.17	17.91	19.15	18.95	17.06	MV
W2Y8MD		15.53	18.57	22.49	25.29	26.30	29.36	35.09	37.63	30.40	23.31	19.75	18.03	17.91	18.96	18.71	16.82	XO
W6G86D		15.83	19.00	22.84	25.56	26.61	29.71	35.14	37.81	31.09	23.82	20.12	18.38	18.10	19.16	18.96	17.18	MM
W8K3NG		15.75	18.89	22.94	25.69	26.66	29.73	35.34	38.17	31.16	23.74	20.16	18.30	18.13	19.27	18.91	16.84	AM
WPLZTX		15.49	18.66	22.53	25.27	26.26	29.36	34.85	37.42	30.46	23.30	19.71	18.03	17.83	18.89	18.45	16.65	XI
XGPJHK		15.58	18.68	22.56	25.32	26.26	29.36	34.83	37.41	30.65	23.48	19.92	18.11	17.87	18.92	18.70	17.01	XI
XP2JCV		15.44	18.69	22.54	25.30	26.30	29.39	34.83	37.53	30.56	23.42	19.81	18.08	17.81	18.89	18.69	16.84	MI
XTZ27G		15.35	18.24	22.33	25.10	26.05	29.13	34.82	37.86	30.51	23.09	19.61	17.86	17.58	18.78	18.56	16.68	CA
Y7GCAX	X	13.49X	16.73X	20.62X	23.18X	24.22X	27.11X	32.48X	35.07X	28.39X	21.40X	18.02X	16.33X	16.11X	17.04X	16.74X	14.85X	AJ
YTHAVB		15.82	18.28	22.32	25.45	26.50	29.50	34.76	36.80	30.44	23.54	19.21X	17.57	17.77	18.75	18.67	16.89	GD
ZNFLX2		15.88	18.76	22.80	25.50	26.50	29.70	35.31	38.08	30.97	23.68	20.02	18.13	17.88	18.88	18.71	16.89	HP
ZNXXDK		15.83	18.34	22.41	25.47	26.30	28.86	34.80	36.67	30.81	23.47	19.05X	17.60	17.60	18.65	18.65	17.17	GD
ZWE9QL		19.56X	18.10X	22.47	25.27	26.30	29.54	35.16	37.71	30.64	23.81	19.76	17.00X	17.84	18.73	18.72	17.30	GD



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

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Reflectance at 16 Selected Wavelengths

Summary Statistics

Grand Means	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700
Grand Means	15.68	18.69	22.63	25.38	26.37	29.45	35.04	37.71	30.74	23.50	19.86	18.10	17.90	18.99	18.72	16.89
Stnd Dev Btwn Labs	0.51	0.21	0.24	0.23	0.23	0.23	0.28	0.40	0.33	0.38	0.24	0.22	0.17	0.19	0.22	0.25

Comments Assigned on Data Flags for Test #411

3E77X7 (X) - Extreme data for all wavelengths.

76L43F (X) - High % reflectance data at all wavelengths.

Y7GCAX (X) - Low % reflectance data at all wavelengths.

Key to Instrument Codes Reported by Participants

AJ ACS-Datascolor 600	AL ACS-Datascolor Intl. Dataflash 100	AM ACS-Datascolor 600 Plus
AO ACS-Datascolor 650	AQ ACS-Datascolor 600X	AS ACS-Datascolor 800 Series
CA Cary 5000	GD BYK-Gardner spectro-guide sphere	HF Hunter ColorFlex Diffuse
HP Hunter UltraScan PRO	HW Hunter UltraScan XE	MG Macbeth 2180 Color Eye
MI Macbeth Color i5	MK Macbeth Color-Eye 7000 Spectrophotometer	MM Macbeth Color-Eye 7000a
MT Minolta CM-2600d	MU Minolta	MV Minolta CM-3000d Series Spectrophotometer
PE Perkin Elmer Spectrophotometer	SH SIMADZU UV 3101PC	XH X-Rite Color i5
XI X-Rite Color i7	XM X-Rite SP62	XO X-Rite SP64
XX Instrument make/model not specified by lab	XZ X-Rite	



Interlaboratory Testing Program for Color & Appearance

Report #178

Analysis 440

4th Qtr 2016

60 Degree Gloss - Paint Chips

ASTM Method D 523

WebCode	Data Flag	Sample H161			Sample H162			Instr Code
		Lab Mean	Difference from Grand Mean	Comparative Performance Value	Lab Mean	Difference from Grand Mean	Comparative Performance Value	
2KXTDL		35.68	0.99	2.27	45.53	1.12	2.09	MW
3CGRFN		34.98	0.29	0.66	44.90	0.50	0.93	GL
3NWK4X		34.70	0.01	0.03	44.63	0.22	0.41	GN
4KPL8V		34.60	-0.09	-0.20	43.78	-0.63	-1.18	RA
6NKR4C		34.75	0.06	0.14	44.20	-0.20	-0.38	GL
6R3YGE	*	33.65	-1.04	-2.39	42.98	-1.43	-2.67	GK
6U9LUH		34.60	-0.09	-0.20	44.10	-0.30	-0.57	GL
6WXV4J		34.73	0.04	0.09	44.53	0.12	0.23	GL
6YZUFC		34.90	0.21	0.49	44.43	0.02	0.04	GL
76L43F	X	1.45	-33.24	-76.57	1.40	-43.00	-80.30	GK
7VHPPU		34.70	0.01	0.03	44.65	0.25	0.46	GL
86KNDL		35.16	0.47	1.09	44.82	0.41	0.77	GL
8AFFLH	X	32.98	-1.71	-3.95	41.83	-2.58	-4.82	GB
8B4T42		34.85	0.16	0.37	44.78	0.37	0.69	MW
8EQBLL		34.68	-0.01	-0.03	44.40	0.00	-0.01	GL
8WBZZM		34.63	-0.06	-0.15	44.48	0.07	0.13	GL
923NVK		34.48	-0.21	-0.49	44.08	-0.33	-0.61	GL
9HMAFB		34.83	0.14	0.32	44.60	0.20	0.37	GL
A3MY24		34.80	0.11	0.26	44.33	-0.08	-0.15	GL
AD8BDG		35.08	0.39	0.89	44.90	0.50	0.93	GL
AP3JX6		34.38	-0.31	-0.72	44.43	0.02	0.04	GL
AWH2UK		33.80	-0.89	-2.05	43.83	-0.58	-1.08	MW
BTFLHE		34.83	0.14	0.32	44.45	0.05	0.09	GK
C4YBZK		35.25	0.56	1.29	45.05	0.65	1.21	XX
DCGG43		34.35	-0.34	-0.78	43.88	-0.53	-0.99	GL
DFK6R6		35.10	0.41	0.95	44.35	-0.05	-0.10	GL
DH6YKY		34.48	-0.21	-0.49	43.53	-0.88	-1.64	GB
EPLWNC		34.53	-0.16	-0.38	44.55	0.15	0.27	GA
EXE8X8		33.63	-1.06	-2.45	43.25	-1.15	-2.16	GL
FFG6YH		34.65	-0.04	-0.09	44.40	0.00	-0.01	GX



Interlaboratory Testing Program for Color & Appearance

Report #178

Analysis 440

4th Qtr 2016

60 Degree Gloss - Paint Chips

ASTM Method D 523

WebCode	Data Flag	Sample H161			Sample H162			Instr Code
		Lab Mean	Difference from Grand Mean	Comparative Performance Value	Lab Mean	Difference from Grand Mean	Comparative Performance Value	
FTZR7U		35.03	0.34	0.78	45.15	0.75	1.39	GK
FYLZAL		34.55	-0.14	-0.32	44.18	-0.23	-0.43	RA
GDZK96	X	27.20	-7.49	-17.25	34.80	-9.60	-17.93	GK
GPH4QF		34.13	-0.56	-1.30	44.08	-0.33	-0.61	GL
GZVBLV		34.35	-0.34	-0.78	44.28	-0.13	-0.24	GQ
HERT99		34.25	-0.44	-1.01	44.50	0.10	0.18	GL
HNZDFB		34.60	-0.09	-0.20	44.43	0.02	0.04	GL
J8AUZE	*	35.83	1.14	2.62	45.53	1.12	2.09	GL
JBBXR2	*	34.43	-0.26	-0.61	44.98	0.57	1.07	GK
JNQ3R3		34.60	-0.09	-0.20	44.88	0.47	0.88	PC
JVCZKW		34.00	-0.69	-1.59	43.60	-0.80	-1.50	GN
K3R2FY		34.30	-0.39	-0.89	44.00	-0.40	-0.75	GN
LCEGJU		34.18	-0.51	-1.18	44.05	-0.35	-0.66	GK
LPX24M		34.63	-0.06	-0.15	44.45	0.05	0.09	GL
LXEHWX		34.88	0.19	0.43	44.73	0.32	0.60	GL
N62FBV		34.70	0.01	0.03	44.88	0.47	0.88	GL
P7E3TA		34.53	-0.16	-0.38	43.90	-0.50	-0.94	XX
PH9GT7		34.25	-0.44	-1.01	43.58	-0.83	-1.55	GL
PP9X4C		34.85	0.16	0.37	44.45	0.05	0.09	MH
PVGJUJ		35.05	0.36	0.83	44.88	0.47	0.88	GK
PW3AVY		34.68	-0.01	-0.03	44.35	-0.05	-0.10	GL
Q4AWR9		34.88	0.19	0.43	44.73	0.32	0.60	GK
QD9T7W		33.80	-0.89	-2.05	43.13	-1.28	-2.39	GL
QQGEUV		35.23	0.54	1.24	45.05	0.65	1.21	GK
QVW3ER	X	34.15	-0.54	-1.24	44.83	0.42	0.79	GK
RCRY42		34.73	0.04	0.09	44.33	-0.08	-0.15	GK
TEC9TT		35.40	0.71	1.64	45.10	0.70	1.30	GK
TFMBEQ		34.58	-0.11	-0.26	44.15	-0.25	-0.47	GN
TRJAA4		35.33	0.64	1.47	45.33	0.92	1.72	GL
TYNX7Q		35.35	0.66	1.52	45.00	0.60	1.11	GL



Interlaboratory Testing Program for Color & Appearance

Report #178

Analysis 440

4th Qtr 2016

60 Degree Gloss - Paint Chips

ASTM Method D 523

WebCode	Data Flag	Sample H161			Sample H162			Instr Code
		Lab Mean	Difference from Grand Mean	Comparative Performance Value	Lab Mean	Difference from Grand Mean	Comparative Performance Value	
U2K29W		34.80	0.11	0.26	44.40	0.00	-0.01	GX
UNYLA4		34.20	-0.49	-1.12	43.95	-0.45	-0.85	GL
VDG82U		34.90	0.21	0.49	44.10	-0.30	-0.57	GK
VRF9GG		34.48	-0.21	-0.49	44.53	0.12	0.23	GK
W2Y8MD		35.13	0.44	1.01	44.73	0.32	0.60	GN
WZ4EXL		34.98	0.29	0.66	44.75	0.35	0.65	GK
XGPJHK		35.13	0.44	1.01	44.70	0.30	0.55	GL
XP2JCV		34.93	0.24	0.55	44.85	0.45	0.83	GL
XTZ27G		34.35	-0.34	-0.78	43.48	-0.93	-1.74	GL
YTHAVB		34.65	-0.04	-0.09	44.58	0.17	0.32	GN
ZNXXDK		34.33	-0.36	-0.84	43.68	-0.73	-1.36	GB
ZWE9QL		35.15	0.46	1.06	44.38	-0.03	-0.05	GB

Summary Statistics

Grand Means

34.69 Gloss Units

44.40 Gloss Units

Std Dev Btwn Labs

0.43 Gloss Units

0.54 Gloss Units

Statistics based on 68 of 72 reporting participants

Comments on Assigned Data Flags for Test #440

76L43F(X) - Extreme Data.

8AFFLH(X) - All values are low. Possible Systematic Error.

GDZK96(X) - All values are low.

QVW3ER(X) - Inconsistent in testing between samples.

Key to Instrument Codes Reported by Participants

GA BYK Gardner Color - Guide Gloss

GB BYK Gardner Spectro - Guide Sphere Gloss

GK BYK-Gardner micro-gloss (60)

GL BYK-Gardner micro-TRI-gloss

GN BYK-Gardner new micro-TRI-gloss

GQ BYK-Gardner haze-gloss

GX BYK-Gardner (model not specified)

MH X-Rite/Macbeth Color-Eye XTH

MW Minolta Multi-Gloss 268

PC Picogloss 503 Erichson

RA Rhopoint Novo-Gloss Glossmeter

XX Instrument make/model not specified by lab



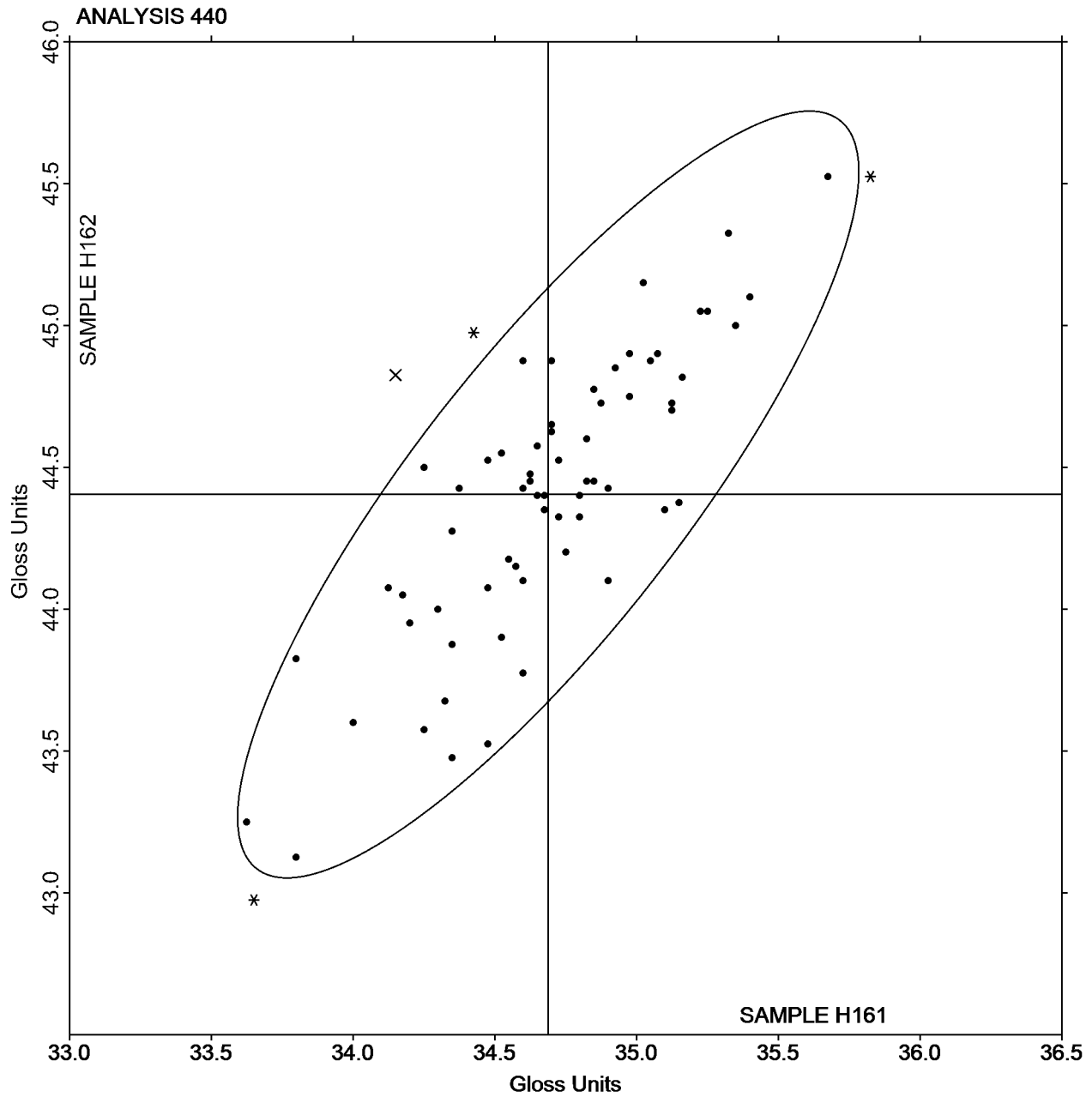
Analysis 440

60 Degree Gloss - Paint Chips

ASTM Method D 523

SAMPLE H161 = 34.69 Gloss Units

SAMPLE H162 = 44.40 Gloss Units





Interlaboratory Testing Program for Color & Appearance

Report #178

Analysis 442

4th Qtr 2016

85 Degree Gloss - Paint Chips

ASTM Method D 523

WebCode	Data Flag	Sample M161			Sample M162			Instr Code
		Lab Mean	Difference from Grand Mean	Comparative Performance Value	Lab Mean	Difference from Grand Mean	Comparative Performance Value	
3CGRFN		7.78	0.30	1.07	11.48	0.32	0.72	GL
3NWK4X		7.15	-0.33	-1.18	10.90	-0.25	-0.56	GN
6U9LUH		7.68	0.20	0.71	11.48	0.32	0.72	GL
EXE8X8		7.53	0.05	0.17	11.18	0.02	0.05	GL
J8AUZE		7.55	0.07	0.26	11.13	-0.03	-0.06	GL
LXEHWX		7.70	0.22	0.80	11.48	0.32	0.72	GL
TYNX7Q		7.55	0.07	0.26	11.20	0.05	0.11	GN
W2Y8MD		7.53	0.05	0.17	11.45	0.30	0.66	GN
XTZ27G		6.85	-0.63	-2.26	10.00	-1.15	-2.57	GL
YTHAVB		7.48	0.00	-0.01	11.25	0.10	0.22	GN

Summary Statistics			
Grand Means			
	7.48	Gloss Units	11.15 Gloss Units
Std Dev Btwn Labs			
	0.28	Gloss Units	0.45 Gloss Units
Statistics based on 10 of 10 reporting participants			

Key to Instrument Codes Reported by Participants

GL BYK-Gardner micro-TRI-gloss

GN BYK-Gardner new micro-TRI-gloss



Interlaboratory Testing Program for Color & Appearance

Report #178

Analysis 442

4th Qtr 2016

85 Degree Gloss - Paint Chips

ASTM Method D 523

SAMPLE M161 = 7.48 Gloss Units

SAMPLE M162 = 11.15 Gloss Units

