

Color & Appearance Testing Program

Summary Report #187 - 1st Qtr 2019

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

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| <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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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.

For further information concerning this report contact:

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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 #187
Analysis 408 1st Qtr 2019

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^* | |
| 3ZBDYT | X | A191 | 53.52 | 23.59 | 19.39 | 0.02 | -0.09 | -0.02 | 0.09 | XN |
| | | A192 | 53.53 | 23.50 | 19.37 | | | | | |
| 4GCMCX | | A191 | 53.98 | 24.97 | 20.12 | 0.94 | -0.58 | -0.58 | 1.24 | GE |
| | A192 | 54.92 | 24.39 | 19.55 | | | | | | |
| 4HPE6E | | A191 | 53.92 | 24.88 | 20.50 | 0.88 | -0.41 | -0.45 | 1.06 | FA |
| | A192 | 54.80 | 24.47 | 20.06 | | | | | | |
| 4RARWJ | | A191 | 53.96 | 24.35 | 19.72 | 0.84 | -0.42 | -0.41 | 1.02 | MU |
| | A192 | 54.79 | 23.93 | 19.31 | | | | | | |
| 7UTGFM | | A191 | 53.66 | 24.70 | 20.06 | 0.82 | -0.40 | -0.43 | 1.00 | HY |
| | A192 | 54.47 | 24.31 | 19.64 | | | | | | |
| A2KXJN | | A191 | 54.62 | 24.58 | 20.32 | 0.87 | -0.41 | -0.47 | 1.07 | HW |
| | A192 | 55.49 | 24.17 | 19.85 | | | | | | |
| AZ9YNF | | A191 | 54.10 | 24.90 | 20.08 | 0.95 | -0.54 | -0.49 | 1.19 | GE |
| | A192 | 55.05 | 24.36 | 19.59 | | | | | | |
| BMHMUG | | A191 | 54.14 | 24.51 | 19.80 | 0.63 | -0.53 | -0.56 | 0.99 | XZ |
| | A192 | 54.77 | 23.99 | 19.24 | | | | | | |
| BUDQE6 | | A191 | 54.12 | 24.52 | 20.19 | 0.90 | -0.43 | -0.46 | 1.09 | HW |
| | A192 | 55.02 | 24.09 | 19.73 | | | | | | |
| CCC7GG | | A191 | 53.86 | 24.38 | 19.75 | 0.94 | -0.41 | -0.40 | 1.09 | HK |
| | A192 | 54.80 | 23.98 | 19.35 | | | | | | |
| CMCU9E | | A191 | 53.99 | 25.00 | 20.10 | 0.97 | -0.53 | -0.51 | 1.21 | GE |
| | A192 | 54.95 | 24.48 | 19.59 | | | | | | |
| FFF9Q2 | | A191 | 54.55 | 24.82 | 20.62 | 0.95 | -0.65 | -0.61 | 1.30 | HW |
| | A192 | 55.50 | 24.18 | 20.01 | | | | | | |
| FH89QX | | A191 | 53.92 | 23.63 | 19.12 | 0.47 | -0.04 | -0.55 | 0.72 | XZ |
| | A192 | 54.39 | 23.60 | 18.57 | | | | | | |
| GUYDDN | X | A191 | 54.57 | 23.93 | 18.95 | -0.05 | 0.13 | 0.07 | 0.15 | MU |
| | | A192 | 54.52 | 24.05 | 19.02 | | | | | |
| HMABR4 | | A191 | 54.38 | 24.42 | 20.18 | 0.82 | -0.40 | -0.45 | 1.01 | HW |
| | A192 | 55.19 | 24.03 | 19.73 | | | | | | |
| JK2HBB | | A191 | 54.04 | 24.51 | 20.05 | 0.94 | -0.53 | -0.54 | 1.20 | XU |
| | A192 | 54.98 | 23.99 | 19.51 | | | | | | |



CTS Interlaboratory Testing Program for Color & Appearance Report #187
Analysis 408 1st Qtr 2019

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^* | |
| KFLB7N | | A191 | 54.40 | 24.42 | 20.05 | 0.88 | -0.49 | -0.53 | 1.13 | GH |
| | | A192 | 55.28 | 23.93 | 19.53 | | | | | |
| KU7U3X | | A191 | 54.31 | 24.52 | 19.61 | 0.94 | -0.30 | -0.42 | 1.07 | TO |
| | | A192 | 55.25 | 24.22 | 19.19 | | | | | |
| KZQW2N | | A191 | 53.70 | 24.27 | 20.22 | 0.94 | -0.47 | -0.49 | 1.16 | HW |
| | | A192 | 54.64 | 23.80 | 19.73 | | | | | |
| L3A7TZ | | A191 | 53.90 | 24.58 | 20.02 | 0.95 | -0.55 | -0.55 | 1.22 | XU |
| | | A192 | 54.84 | 24.03 | 19.47 | | | | | |
| L9ZHUN | | A191 | 54.25 | 24.62 | 20.69 | 0.94 | -0.44 | -0.49 | 1.15 | MG |
| | | A192 | 55.19 | 24.18 | 20.20 | | | | | |
| LERMMT | | A191 | 54.20 | 24.55 | 19.99 | 0.90 | -0.53 | -0.52 | 1.16 | XO |
| | | A192 | 55.10 | 24.02 | 19.48 | | | | | |
| M8YAWN | | A191 | 54.80 | 24.77 | 20.59 | 0.88 | -0.45 | -0.49 | 1.10 | HW |
| | | A192 | 55.68 | 24.33 | 20.10 | | | | | |
| MV99MA | | A191 | 54.48 | 24.08 | 19.50 | 0.86 | -0.37 | -0.41 | 1.02 | XD |
| | | A192 | 55.34 | 23.72 | 19.09 | | | | | |
| P9AQ9T | X | A191 | 61.17 | 27.26 | 26.08 | 1.00 | -0.65 | -0.74 | 1.40 | HW |
| | | A192 | 62.17 | 26.61 | 25.35 | | | | | |
| QGHMNJ | | A191 | 54.25 | 24.48 | 19.98 | 0.74 | -0.44 | -0.48 | 0.98 | XO |
| | | A192 | 54.99 | 24.05 | 19.50 | | | | | |
| QX6YJY | | A191 | 54.20 | 24.58 | 20.42 | 0.94 | -0.58 | -0.57 | 1.24 | HW |
| | | A192 | 55.14 | 24.00 | 19.85 | | | | | |
| R9ZND6 | | A191 | 54.40 | 24.50 | 20.40 | 0.95 | -0.40 | -0.50 | 1.15 | HW |
| | | A192 | 55.35 | 24.10 | 19.90 | | | | | |
| RH87AH | | A191 | 54.52 | 24.23 | 19.35 | 0.96 | -0.49 | -0.48 | 1.18 | XZ |
| | | A192 | 55.48 | 23.75 | 18.88 | | | | | |
| U2AZMR | | A191 | 53.95 | 24.63 | 19.87 | 1.01 | -0.78 | -0.75 | 1.48 | XZ |
| | | A192 | 54.96 | 23.86 | 19.12 | | | | | |
| UUTK4V | | A191 | 54.04 | 24.44 | 19.70 | 0.85 | -0.42 | -0.42 | 1.03 | XB |
| | | A192 | 54.89 | 24.02 | 19.28 | | | | | |
| V7JFWF | | A191 | 54.43 | 24.47 | 20.20 | 0.87 | -0.46 | -0.48 | 1.09 | HW |
| | | A192 | 55.30 | 24.02 | 19.72 | | | | | |



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^* | |
| WMKMR | | A191 | 53.96 | 24.71 | 19.82 | 0.87 | -0.47 | -0.35 | 1.05 | GB |
| | | A192 | 54.83 | 24.25 | 19.48 | | | | | |
| Z6VNVL | | A191 | 54.15 | 24.41 | 20.03 | 0.86 | -0.43 | -0.44 | 1.06 | XM |
| | | A192 | 55.01 | 23.98 | 19.60 | | | | | |
| ZMFC9M | | A191 | 54.09 | 24.47 | 20.00 | 0.85 | -0.42 | -0.48 | 1.06 | XU |
| | | A192 | 54.94 | 24.05 | 19.52 | | | | | |

| Summary Statistics | | | | | | | | |
|---------------------------|-------|-------|-------|--------------|--------------|--------------|--------------|--|
| Samples | L* | a* | b* | ΔL^* | Δa^* | Δb^* | ΔE^* | |
| Grand Means | | | | | | | | |
| A191 | 54.17 | 24.50 | 20.04 | 0.88 | -0.46 | -0.49 | 1.11 | |
| A192 | 55.07 | 24.05 | 19.55 | | | | | |
| Stnd Dev Btwn Labs | | | | | | | | |
| A191 | 0.27 | 0.31 | 0.36 | 0.10 | 0.12 | 0.08 | 0.13 | |
| A192 | 0.28 | 0.23 | 0.35 | | | | | |

Statistics based on 32 of 35 reporting participants

Comments Assigned on Data Flags for Test #408

3ZBDYT(X) - Low "L*" values for Sample A192. Inconsistent in testing between the "b*" values for both samples. Small Delta L, Delta E, large Delta a and Delta b.

GUYDDN(X) - Large replication difference for both "L*" values and A192 "a*" values. Large replication difference for both "b*" values, low "b*" values for A191. Small Delta L, Delta E, large Delta a and Delta b.

P9AQ9T(X) - Extreme Data. All values very high.

Key to Instrument Codes Reported by Participants

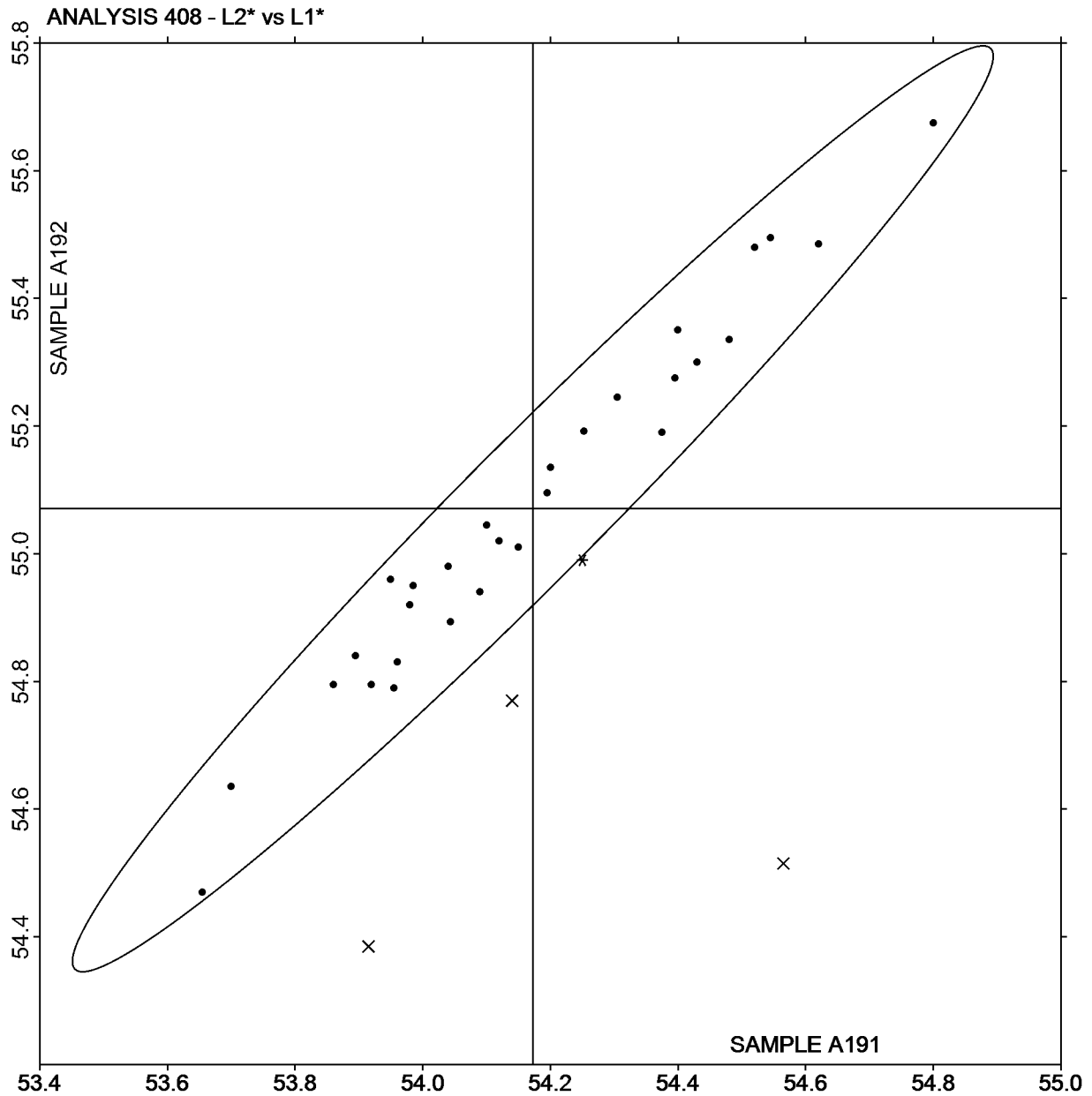
| | | | |
|----|--|----|---|
| FA | BYK Mac | GB | BYK-Gardner spectro-guide sphere gloss |
| GE | BYK-Gardner spectro-guide (45/0) | GH | BYK-Gardner Color-View |
| HK | Hunter MiniScan XE (45/0) | HW | Hunter LabScan XE |
| HY | Hunter Color Flex 45/0 | MG | Macbeth 1500/PLUS or 2025+ Color Eye |
| MU | Minolta | TO | Topcon SR-3 Spectroradiometer |
| XB | X-Rite i1Basic Pro 2 | XD | X-Rite 500 Series SpectroDensitometer |
| XM | X-Rite MA58 Multi-Angle Spectrophotometer | XN | X-Rite MA68 Multi-Angle Spectrophotometer |
| XO | X-Rite MA68 II Multi-Angle Spectrophotometer | XU | X-Rite 964 Portable Spectrophotometer |
| XZ | X-Rite | | |



L2* vs L1*

SAMPLE A191 = 54.17

SAMPLE A192 = 55.07

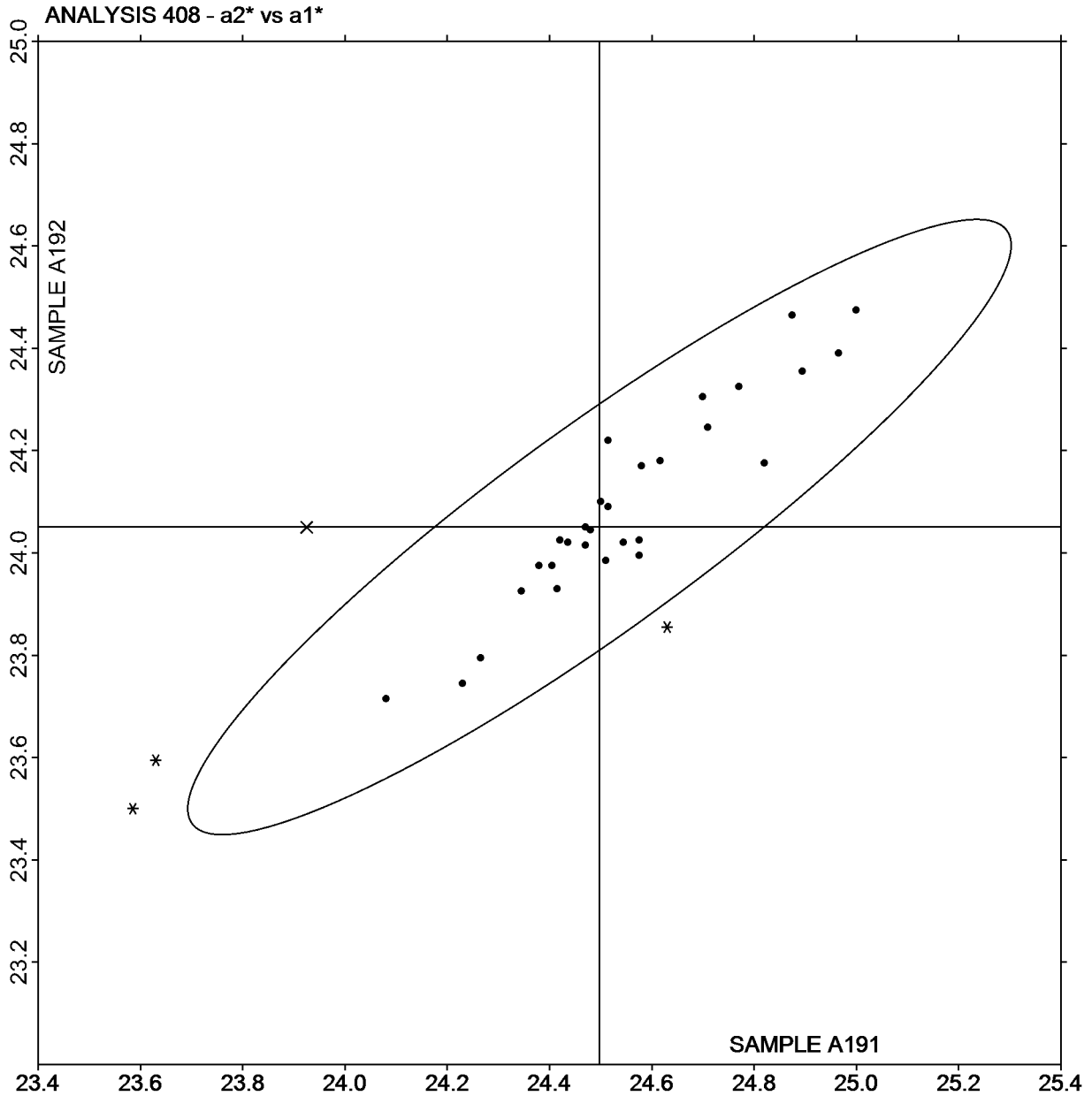




a2* vs a1*

SAMPLE A191 = 24.50

SAMPLE A192 = 24.05

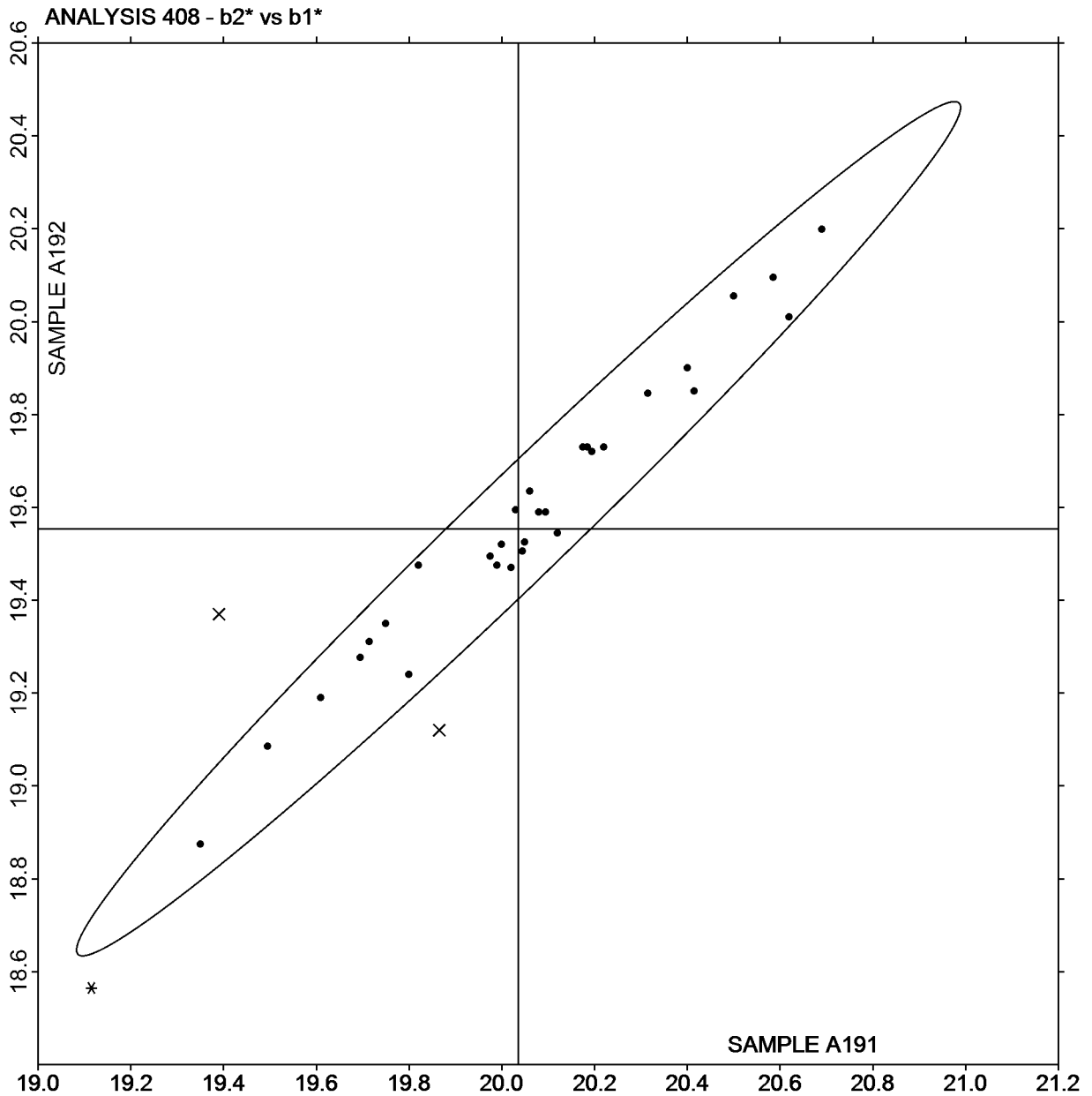




b2* vs b1*

SAMPLE A191 = 20.04

SAMPLE A192 = 19.55





CTS Interlaboratory Testing Program for Color & Appearance Report #187
Analysis 409 1st Qtr 2019

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^* | |
| 27JJVY | | A191 | 54.29 | 24.42 | 19.89 | 0.84 | -0.50 | -0.53 | 1.11 | XH |
| | | A192 | 55.12 | 23.92 | 19.36 | | | | | |
| 298VWQ | | A191 | 54.19 | 24.28 | 19.30 | 0.88 | -0.43 | -0.47 | 1.08 | MU |
| | | A192 | 55.07 | 23.85 | 18.83 | | | | | |
| 2G24CB | | A191 | 54.38 | 24.16 | 19.15 | 0.89 | -0.53 | -0.55 | 1.17 | AO |
| | | A192 | 55.27 | 23.63 | 18.60 | | | | | |
| 2RJK83 | | A191 | 54.26 | 24.47 | 19.41 | 1.01 | -0.71 | -0.66 | 1.39 | XB |
| | | A192 | 55.27 | 23.77 | 18.75 | | | | | |
| 2VMFQ6 | | A191 | 54.07 | 24.51 | 19.27 | 0.94 | -0.61 | -0.61 | 1.27 | MV |
| | | A192 | 55.01 | 23.90 | 18.67 | | | | | |
| 2VXFMZ | | A191 | 54.23 | 24.41 | 19.21 | 0.92 | -0.57 | -0.56 | 1.21 | AH |
| | | A192 | 55.14 | 23.84 | 18.65 | | | | | |
| 37VKB7 | | A191 | 54.27 | 24.62 | 19.66 | 0.89 | -0.46 | -0.51 | 1.12 | CA |
| | | A192 | 55.16 | 24.16 | 19.15 | | | | | |
| 3AYHJD | X | A191 | 60.32 | 21.85 | 22.71 | -1.30 | 0.44 | -0.27 | 1.39 | XM |
| | | A192 | 59.03 | 22.29 | 22.44 | | | | | |
| 3GHJ6H | | A191 | 54.38 | 24.59 | 19.66 | 0.89 | -0.53 | -0.54 | 1.17 | AS |
| | | A192 | 55.27 | 24.06 | 19.12 | | | | | |
| 3GK8MW | | A191 | 54.20 | 24.28 | 19.39 | 0.85 | -0.42 | -0.47 | 1.06 | MV |
| | | A192 | 55.05 | 23.86 | 18.92 | | | | | |
| 3KHXMf | | A191 | 54.25 | 24.27 | 19.44 | 0.87 | -0.46 | -0.50 | 1.10 | XO |
| | | A192 | 55.12 | 23.81 | 18.94 | | | | | |
| 3ZBDYT | X | A191 | 54.77 | 23.63 | 19.61 | 1.12 | -0.55 | -0.41 | 1.31 | XO |
| | | A192 | 55.89 | 23.08 | 19.20 | | | | | |
| 4M3WLW | | A191 | 53.98 | 24.40 | 19.51 | 0.91 | -0.42 | -0.48 | 1.12 | CA |
| | | A192 | 54.89 | 23.98 | 19.03 | | | | | |
| 62UDLE | | A191 | 54.17 | 24.34 | 19.23 | 0.93 | -0.54 | -0.54 | 1.20 | AJ |
| | | A192 | 55.09 | 23.80 | 18.69 | | | | | |
| 7PXPAB | | A191 | 54.27 | 24.45 | 19.23 | 0.94 | -0.53 | -0.54 | 1.20 | AM |
| | | A192 | 55.21 | 23.93 | 18.69 | | | | | |
| 7TW4VF | | A191 | 54.20 | 24.53 | 19.48 | 0.85 | -0.47 | -0.51 | 1.10 | MV |
| | | A192 | 55.05 | 24.06 | 18.97 | | | | | |



CTS Interlaboratory Testing Program for Color & Appearance **Report #187**
Analysis 409 **1st Qtr 2019**

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^* | |
| 86RE22 | | A191 | 54.23 | 24.29 | 19.18 | 0.97 | -0.56 | -0.57 | 1.25 | AQ |
| | | A192 | 55.20 | 23.73 | 18.61 | | | | | |
| 8EEFGB | | A191 | 54.25 | 24.33 | 19.35 | 0.88 | -0.48 | -0.50 | 1.12 | MM |
| | | A192 | 55.13 | 23.85 | 18.85 | | | | | |
| 8MBBGV | | A191 | 54.10 | 24.17 | 19.38 | 0.94 | -0.48 | -0.48 | 1.16 | AJ |
| | | A192 | 55.04 | 23.69 | 18.90 | | | | | |
| 99NHCK | | A191 | 54.19 | 24.37 | 19.23 | 0.97 | -0.65 | -0.61 | 1.31 | AJ |
| | | A192 | 55.15 | 23.72 | 18.63 | | | | | |
| 9AFGKR | X | A191 | 54.95 | 24.30 | 19.35 | 0.89 | -0.60 | -0.56 | 1.21 | XI |
| | | A192 | 55.84 | 23.71 | 18.79 | | | | | |
| 9BTAX7 | | A191 | 54.11 | 24.26 | 19.46 | 0.96 | -0.62 | -0.60 | 1.29 | XZ |
| | | A192 | 55.07 | 23.65 | 18.86 | | | | | |
| 9FPRJD | | A191 | 54.11 | 24.16 | 19.03 | 0.84 | -0.38 | -0.45 | 1.02 | AM |
| | | A192 | 54.94 | 23.78 | 18.59 | | | | | |
| 9KYVMU | | A191 | 54.17 | 24.33 | 19.33 | 0.94 | -0.60 | -0.56 | 1.24 | XH |
| | | A192 | 55.10 | 23.73 | 18.78 | | | | | |
| 9RHBXJ | | A191 | 54.24 | 24.29 | 19.49 | 0.89 | -0.44 | -0.47 | 1.09 | XH |
| | | A192 | 55.13 | 23.85 | 19.02 | | | | | |
| A49C8X | | A191 | 54.21 | 24.35 | 19.32 | 0.94 | -0.49 | -0.59 | 1.21 | AJ |
| | | A192 | 55.15 | 23.86 | 18.73 | | | | | |
| AQVEW3 | | A191 | 54.20 | 24.20 | 19.56 | 0.89 | -0.45 | -0.49 | 1.11 | XB |
| | | A192 | 55.09 | 23.75 | 19.07 | | | | | |
| AXFA2D | X | A191 | -18.10 | 8.12 | 2.23 | 0.95 | -0.61 | -0.60 | 1.28 | XO |
| | | A192 | -17.15 | 7.51 | 1.64 | | | | | |
| AZ92CY | | A191 | 54.47 | 24.05 | 18.91 | 0.94 | -0.55 | -0.55 | 1.21 | XI |
| | | A192 | 55.41 | 23.50 | 18.36 | | | | | |
| BVNVRU | | A191 | 54.26 | 24.29 | 19.36 | 0.86 | -0.42 | -0.46 | 1.06 | MK |
| | | A192 | 55.12 | 23.87 | 18.90 | | | | | |
| CE2G8A | | A191 | 54.17 | 24.16 | 19.18 | 0.94 | -0.46 | -0.50 | 1.16 | AJ |
| | | A192 | 55.11 | 23.70 | 18.69 | | | | | |
| CEHNFD | | A191 | 54.21 | 24.12 | 19.22 | 0.90 | -0.42 | -0.46 | 1.09 | AM |
| | | A192 | 55.11 | 23.70 | 18.77 | | | | | |



CTS Interlaboratory Testing Program for Color & Appearance **Report #187**
Analysis 409 **1st Qtr 2019**

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^* | |
| CFAPEA | | A191 | 54.37 | 24.10 | 19.29 | 0.89 | -0.48 | -0.51 | 1.13 | XI |
| | | A192 | 55.26 | 23.62 | 18.78 | | | | | |
| CJBWVZ | | A191 | 54.36 | 24.25 | 19.25 | 0.90 | -0.45 | -0.50 | 1.12 | AO |
| | | A192 | 55.26 | 23.81 | 18.75 | | | | | |
| CMCU9E | | A191 | 54.02 | 24.14 | 19.41 | 0.97 | -0.55 | -0.56 | 1.25 | GD |
| | | A192 | 54.99 | 23.59 | 18.85 | | | | | |
| DVKN37 | | A191 | 54.55 | 24.38 | 19.36 | 0.93 | -0.45 | -0.48 | 1.14 | CA |
| | | A192 | 55.48 | 23.93 | 18.88 | | | | | |
| DWED8Z | | A191 | 54.32 | 24.26 | 19.65 | 0.92 | -0.52 | -0.55 | 1.19 | XI |
| | | A192 | 55.23 | 23.75 | 19.10 | | | | | |
| DWHYYA | | A191 | 53.89 | 24.35 | 19.44 | 0.95 | -0.60 | -0.58 | 1.26 | XH |
| | | A192 | 54.83 | 23.75 | 18.87 | | | | | |
| F49DFC | | A191 | 54.20 | 24.02 | 19.23 | 0.91 | -0.47 | -0.49 | 1.13 | MM |
| | | A192 | 55.11 | 23.55 | 18.74 | | | | | |
| FGQADZ | X | A191 | 53.79 | 24.45 | 19.53 | 0.96 | -0.65 | -0.58 | 1.29 | XH |
| | | A192 | 54.74 | 23.81 | 18.95 | | | | | |
| FHQB8 | | A191 | 54.31 | 24.34 | 19.17 | 0.90 | -0.43 | -0.43 | 1.08 | MV |
| | | A192 | 55.21 | 23.91 | 18.74 | | | | | |
| FRCCXG | | A191 | 54.31 | 24.46 | 19.57 | 0.95 | -0.60 | -0.60 | 1.27 | XB |
| | | A192 | 55.26 | 23.86 | 18.97 | | | | | |
| G3RLZ2 | | A191 | 54.08 | 24.46 | 19.49 | 0.88 | -0.54 | -0.52 | 1.15 | MI |
| | | A192 | 54.96 | 23.92 | 18.97 | | | | | |
| GKQNUY | | A191 | 54.31 | 24.19 | 19.65 | 0.91 | -0.50 | -0.52 | 1.16 | XM |
| | | A192 | 55.22 | 23.69 | 19.14 | | | | | |
| GRRZQV | | A191 | 54.16 | 24.15 | 19.14 | 0.82 | -0.43 | -0.38 | 0.99 | HP |
| | | A192 | 54.97 | 23.72 | 18.76 | | | | | |
| H2F7B7 | | A191 | 54.13 | 24.24 | 19.15 | 0.87 | -0.46 | -0.25 | 1.01 | AS |
| | | A192 | 55.00 | 23.78 | 18.91 | | | | | |
| H9VRCX | | A191 | 54.45 | 24.10 | 19.51 | 0.93 | -0.47 | -0.63 | 1.22 | HF |
| | | A192 | 55.38 | 23.63 | 18.88 | | | | | |
| HANPJ4 | | A191 | 54.29 | 24.29 | 19.16 | 0.91 | -0.48 | -0.52 | 1.15 | MM |
| | | A192 | 55.19 | 23.81 | 18.65 | | | | | |



CTS Interlaboratory Testing Program for Color & Appearance Report #187
Analysis 409 1st Qtr 2019

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^* | |
| HD9MZ8 | | A191 | 53.99 | 24.48 | 19.53 | 0.88 | -0.53 | -0.51 | 1.14 | XH |
| | | A192 | 54.87 | 23.95 | 19.02 | | | | | |
| HLWRKR | | A191 | 54.21 | 24.34 | 19.17 | 0.88 | -0.49 | -0.51 | 1.12 | AS |
| | | A192 | 55.09 | 23.85 | 18.67 | | | | | |
| HN39ZB | | A191 | 54.16 | 24.25 | 19.27 | 0.81 | -0.41 | -0.47 | 1.02 | AQ |
| | | A192 | 54.97 | 23.84 | 18.81 | | | | | |
| J6RK7Q | X | A191 | 54.33 | 23.78 | 18.89 | 0.90 | -0.44 | -0.41 | 1.08 | MM |
| | | A192 | 55.23 | 23.34 | 18.48 | | | | | |
| JCP94G | | A191 | 54.25 | 24.39 | 19.31 | 0.88 | -0.48 | -0.49 | 1.11 | AS |
| | | A192 | 55.13 | 23.92 | 18.82 | | | | | |
| JK2HBB | | A191 | 54.34 | 24.07 | 19.41 | 0.94 | -0.52 | -0.55 | 1.20 | XI |
| | | A192 | 55.28 | 23.55 | 18.86 | | | | | |
| KFLB7N | | A191 | 54.22 | 24.46 | 19.44 | 0.95 | -0.56 | -0.55 | 1.23 | MT |
| | | A192 | 55.17 | 23.90 | 18.90 | | | | | |
| KNXCLX | | A191 | 54.36 | 24.31 | 19.28 | 0.89 | -0.48 | -0.53 | 1.14 | MM |
| | | A192 | 55.25 | 23.83 | 18.75 | | | | | |
| KU7U3X | X | A191 | 54.18 | 24.53 | 19.94 | 0.87 | -0.44 | -0.45 | 1.07 | CA |
| | | A192 | 55.04 | 24.10 | 19.50 | | | | | |
| LATG3V | | A191 | 54.00 | 23.93 | 18.99 | 0.88 | -0.43 | -0.48 | 1.09 | MM |
| | | A192 | 54.88 | 23.50 | 18.52 | | | | | |
| LERMMT | | A191 | 54.22 | 24.36 | 19.40 | 0.89 | -0.51 | -0.56 | 1.17 | MI |
| | | A192 | 55.11 | 23.85 | 18.84 | | | | | |
| LGCWCK | | A191 | 54.16 | 24.03 | 19.21 | 0.83 | -0.39 | -0.44 | 1.01 | XB |
| | | A192 | 54.99 | 23.65 | 18.77 | | | | | |
| LYF8KW | | A191 | 54.16 | 24.25 | 19.10 | 0.87 | -0.47 | -0.48 | 1.09 | AS |
| | | A192 | 55.03 | 23.79 | 18.63 | | | | | |
| M7RPDV | | A191 | 54.28 | 24.20 | 19.43 | 0.89 | -0.43 | -0.47 | 1.09 | XI |
| | | A192 | 55.17 | 23.77 | 18.96 | | | | | |
| M8JQCR | | A191 | 54.15 | 24.27 | 19.12 | 0.97 | -0.57 | -0.56 | 1.25 | AQ |
| | | A192 | 55.12 | 23.71 | 18.57 | | | | | |
| ME4288 | | A191 | 54.22 | 24.27 | 19.18 | 0.88 | -0.45 | -0.48 | 1.09 | AS |
| | | A192 | 55.10 | 23.82 | 18.70 | | | | | |



CTS Interlaboratory Testing Program for Color & Appearance **Report #187**
Analysis 409 **1st Qtr 2019**

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^* | |
| N9ACJM | | A191 | 54.21 | 24.14 | 18.98 | 0.93 | -0.52 | -0.52 | 1.18 | HP |
| | | A192 | 55.13 | 23.62 | 18.46 | | | | | |
| NCAFCV | | A191 | 54.21 | 24.39 | 19.40 | 0.91 | -0.55 | -0.55 | 1.19 | MV |
| | | A192 | 55.12 | 23.85 | 18.86 | | | | | |
| NL2TEF | | A191 | 54.15 | 24.24 | 19.21 | 0.98 | -0.63 | -0.63 | 1.32 | AJ |
| | | A192 | 55.13 | 23.61 | 18.58 | | | | | |
| NMDQL7 | | A191 | 54.18 | 24.29 | 19.26 | 0.95 | -0.44 | -0.49 | 1.15 | AJ |
| | | A192 | 55.12 | 23.85 | 18.77 | | | | | |
| PJ8MBV | | A191 | 54.12 | 24.05 | 19.59 | 0.95 | -0.50 | -0.53 | 1.20 | XM |
| | | A192 | 55.07 | 23.55 | 19.06 | | | | | |
| PYZCBX | | A191 | 54.29 | 24.39 | 19.36 | 0.89 | -0.50 | -0.58 | 1.17 | AJ |
| | | A192 | 55.18 | 23.90 | 18.78 | | | | | |
| Q66MRQ | | A191 | 54.12 | 24.34 | 19.31 | 0.89 | -0.59 | -0.57 | 1.21 | AS |
| | | A192 | 55.00 | 23.75 | 18.74 | | | | | |
| QZBGHU | | A191 | 54.05 | 24.13 | 19.26 | 0.88 | -0.50 | -0.52 | 1.14 | XI |
| | | A192 | 54.93 | 23.63 | 18.74 | | | | | |
| RFKRK8 | | A191 | 53.95 | 24.12 | 18.89 | 0.90 | -0.48 | -0.50 | 1.14 | HP |
| | | A192 | 54.85 | 23.64 | 18.39 | | | | | |
| RHATQV | | A191 | 54.25 | 24.46 | 19.45 | 0.91 | -0.53 | -0.55 | 1.19 | AJ |
| | | A192 | 55.16 | 23.93 | 18.91 | | | | | |
| RKQKDH | | A191 | 54.11 | 24.17 | 19.45 | 0.91 | -0.48 | -0.52 | 1.14 | XI |
| | | A192 | 55.01 | 23.69 | 18.93 | | | | | |
| T7DCCE | | A191 | 54.29 | 24.32 | 19.16 | 0.84 | -0.45 | -0.45 | 1.05 | AO |
| | | A192 | 55.13 | 23.88 | 18.71 | | | | | |
| TAQAJ2 | | A191 | 54.43 | 24.06 | 19.13 | 0.83 | -0.39 | -0.42 | 1.01 | XI |
| | | A192 | 55.26 | 23.67 | 18.72 | | | | | |
| TL74XF | | A191 | 53.99 | 24.26 | 19.28 | 0.94 | -0.51 | -0.55 | 1.20 | AS |
| | | A192 | 54.93 | 23.76 | 18.74 | | | | | |
| U2CNBX | | A191 | 54.41 | 24.53 | 19.50 | 0.89 | -0.44 | -0.43 | 1.07 | MV |
| | | A192 | 55.29 | 24.09 | 19.07 | | | | | |
| U4J689 | | A191 | 54.11 | 24.43 | 19.35 | 0.94 | -0.61 | -0.58 | 1.26 | AD |
| | | A192 | 55.05 | 23.82 | 18.78 | | | | | |



CTS Interlaboratory Testing Program for Color & Appearance Report #187
Analysis 409 1st Qtr 2019

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^* | |
| UD67MH | | A191 | 54.15 | 24.48 | 19.33 | 0.96 | -0.60 | -0.62 | 1.28 | AJ |
| | | A192 | 55.10 | 23.88 | 18.72 | | | | | |
| UXARJH | | A191 | 54.14 | 24.12 | 19.16 | 0.90 | -0.44 | -0.40 | 1.08 | MS |
| | | A192 | 55.04 | 23.68 | 18.76 | | | | | |
| VEF7LX | | A191 | 54.04 | 24.29 | 19.02 | 0.96 | -0.48 | -0.51 | 1.18 | AJ |
| | | A192 | 54.99 | 23.81 | 18.51 | | | | | |
| VLW23R | | A191 | 54.13 | 24.16 | 19.66 | 0.91 | -0.50 | -0.50 | 1.15 | XO |
| | | A192 | 55.03 | 23.66 | 19.16 | | | | | |
| VUQWFP | | A191 | 54.25 | 24.23 | 19.46 | 0.92 | -0.44 | -0.50 | 1.13 | XB |
| | | A192 | 55.17 | 23.79 | 18.96 | | | | | |
| W9KXCM | | A191 | 54.18 | 24.24 | 19.35 | 0.96 | -0.58 | -0.59 | 1.27 | XI |
| | | A192 | 55.14 | 23.67 | 18.76 | | | | | |
| WNWCV7 | | A191 | 54.28 | 24.01 | 19.34 | 0.88 | -0.59 | -0.56 | 1.20 | XI |
| | | A192 | 55.16 | 23.42 | 18.79 | | | | | |
| WUNJEE | | A191 | 54.36 | 24.19 | 19.26 | 0.90 | -0.51 | -0.50 | 1.14 | XI |
| | | A192 | 55.26 | 23.68 | 18.77 | | | | | |
| WVGHLL | | A191 | 54.38 | 24.19 | 19.37 | 0.86 | -0.42 | -0.48 | 1.07 | XI |
| | | A192 | 55.24 | 23.77 | 18.89 | | | | | |
| WYDEXX | | A191 | 54.18 | 24.17 | 19.24 | 0.90 | -0.42 | -0.45 | 1.09 | XH |
| | | A192 | 55.07 | 23.75 | 18.79 | | | | | |
| X48D8M | | A191 | 54.28 | 24.37 | 19.56 | 0.88 | -0.51 | -0.91 | 1.36 | AO |
| | | A192 | 55.16 | 23.86 | 18.66 | | | | | |
| XLLYKH | | A191 | 54.15 | 24.26 | 19.39 | 0.91 | -0.44 | -0.46 | 1.10 | MT |
| | | A192 | 55.05 | 23.82 | 18.94 | | | | | |
| YCJWZL | | A191 | 54.11 | 24.37 | 19.36 | 0.86 | -0.50 | -0.51 | 1.11 | XI |
| | | A192 | 54.97 | 23.88 | 18.86 | | | | | |
| YE3B4L | | A191 | 54.49 | 24.61 | 19.60 | 0.88 | -0.46 | -0.49 | 1.11 | HU |
| | | A192 | 55.37 | 24.15 | 19.11 | | | | | |
| YVCV7J | | A191 | 54.21 | 24.06 | 19.14 | 0.90 | -0.57 | -0.57 | 1.21 | MM |
| | | A192 | 55.11 | 23.49 | 18.57 | | | | | |
| ZK7AGW | | A191 | 53.82 | 24.22 | 19.12 | 0.92 | -0.56 | -0.56 | 1.21 | MM |
| | | A192 | 54.74 | 23.66 | 18.56 | | | | | |



| WebCode | Flag | Samples | CIE L* a* b* Color Values | | | Color Difference Values | | | | InstrCode |
|---------|------|---------|---------------------------|-------|-------|-------------------------|--------------|--------------|--------------|-----------|
| | | | L* | a* | b* | ΔL^* | Δa^* | Δb^* | ΔE^* | |
| ZMFC9M | | A191 | 54.26 | 24.25 | 19.37 | 0.88 | -0.41 | -0.46 | 1.07 | XI |
| | | A192 | 55.13 | 23.84 | 18.92 | | | | | |
| ZUVZ24 | | A191 | 54.18 | 24.44 | 19.38 | 0.97 | -0.65 | -0.65 | 1.33 | XI |
| | | A192 | 55.15 | 23.79 | 18.73 | | | | | |

| Summary Statistics | | | | | | | | |
|--------------------------|-------|-------|-------|--------------|--------------|--------------|--------------|--|
| Samples | L* | a* | b* | ΔL^* | Δa^* | Δb^* | ΔE^* | |
| Grand Means | | | | | | | | |
| A191 | 54.21 | 24.28 | 19.33 | 0.90 | -0.50 | -0.52 | 1.16 | |
| A192 | 55.11 | 23.78 | 18.81 | | | | | |
| Std Dev Btwn Labs | | | | | | | | |
| A191 | 0.13 | 0.15 | 0.19 | 0.04 | 0.07 | 0.07 | 0.08 | |
| A192 | 0.13 | 0.14 | 0.19 | | | | | |

Statistics based on 91 of 98 reporting participants

Comments Assigned on Data Flags for Test #409

- 3AYHJD(X) - Extreme data. Data for "L*" and "b*" are very high. Data for "a*" are very low.
- 3ZBDYT(X) - Very high "L*" values and large replication difference for A191 "L*" values. Low "a*" values for both samples. High Delta L.
- 9AFGKR(X) - High "L*" values for both samples.
- AXFA2D(X) - Extreme data. All Data very low.
- FGQADZ(X) - Low "L*" values for both samples.
- J6RK7Q(X) - Low "a*" values for both samples.
- KU7U3X(X) - High "b*" values for both samples.



Key to Instrument Codes Reported by Participants

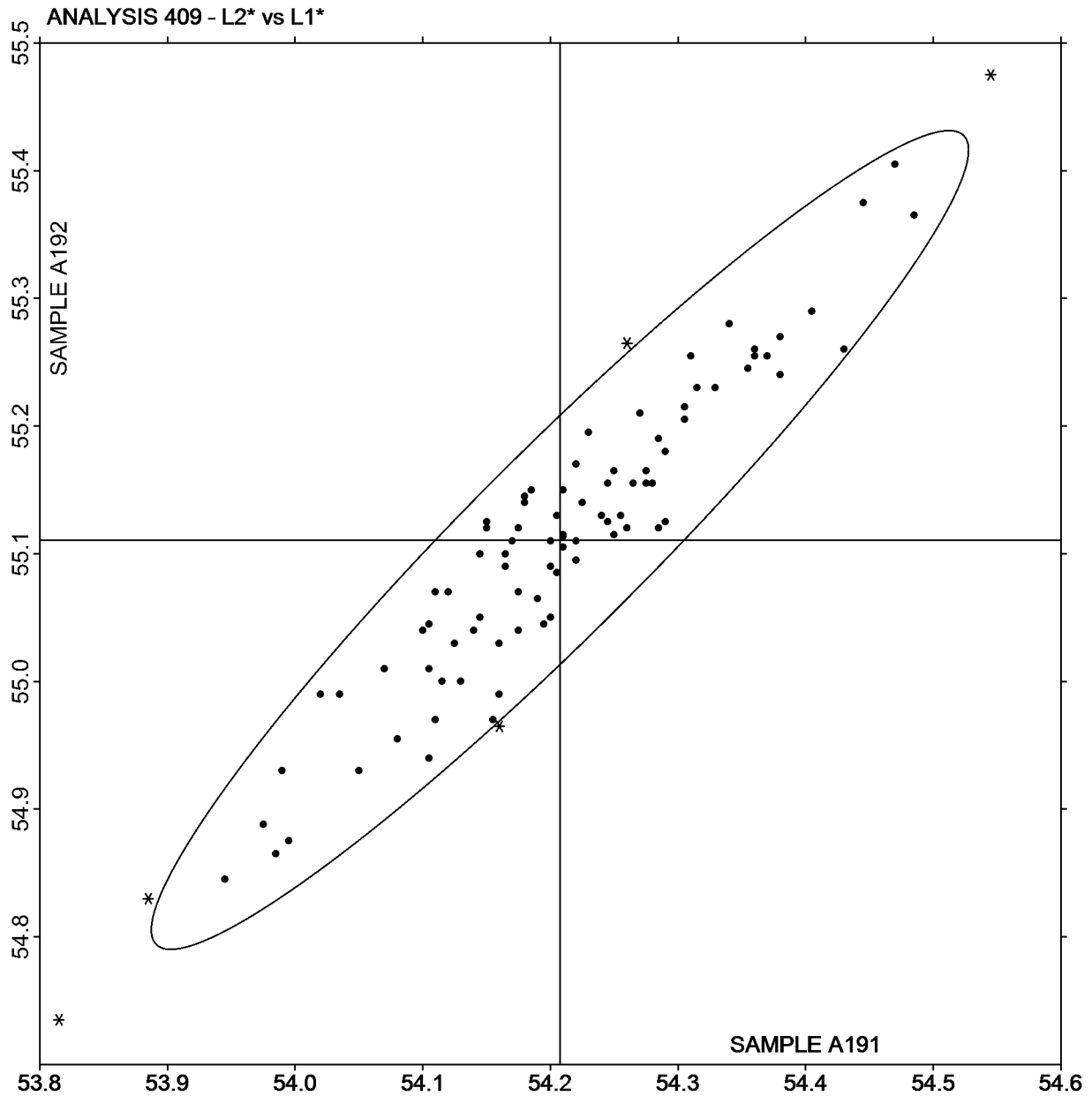
| | | | |
|-----------|---|-----------|---|
| AD | Datacolor 100 | AH | ACS-DataColor 550 |
| AJ | ACS-Datacolor 600 | AM | ACS-Datacolor 600 Plus |
| AO | ACS-Datacolor 650X | AQ | ACS-Datacolor 600X |
| AS | ACS-Datacolor 800 Series | CA | Cary 5000 |
| GD | BYK-Gardner spectro-guide sphere | HF | Hunter ColorFlex Diffuse |
| HP | Hunter UltraScan PRO | HU | Hunter UltraScan |
| MI | Macbeth Color i 5 | MK | Macbeth Color-Eye 7000 |
| MM | Macbeth Color-Eye 7000a | MS | Minolta CM-600d |
| MT | Minolta CM-2600d | MU | Minolta |
| MV | Minolta CM-3000d Series Spectrophotometer | XB | X-Rite Ci7000 Series 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 |
| XZ | X-Rite | | |



L2* vs L1*

SAMPLE A191 = 54.21

SAMPLE A192 = 55.11

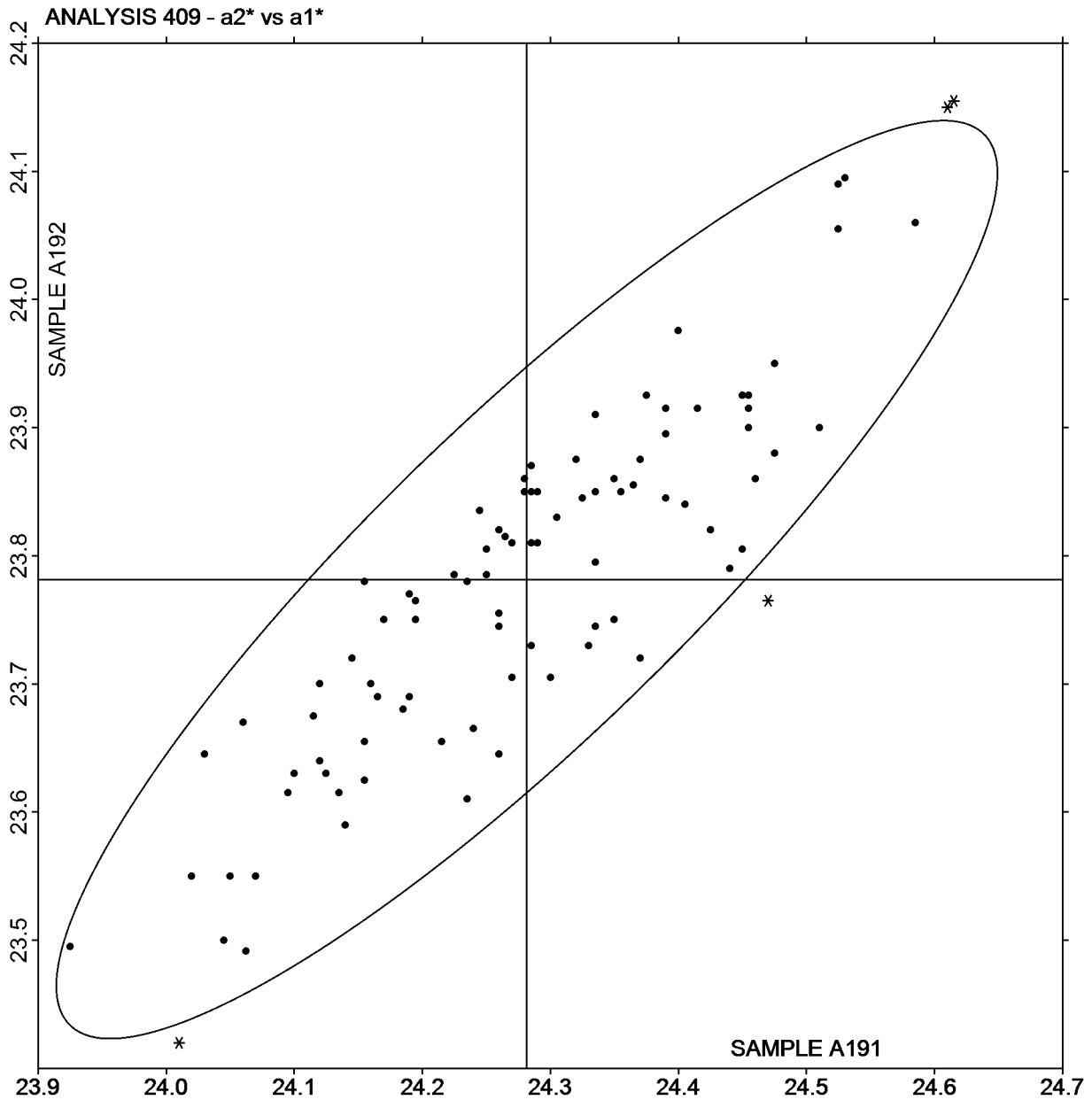




a2* vs a1*

SAMPLE A191 = 24.28

SAMPLE A192 = 23.78

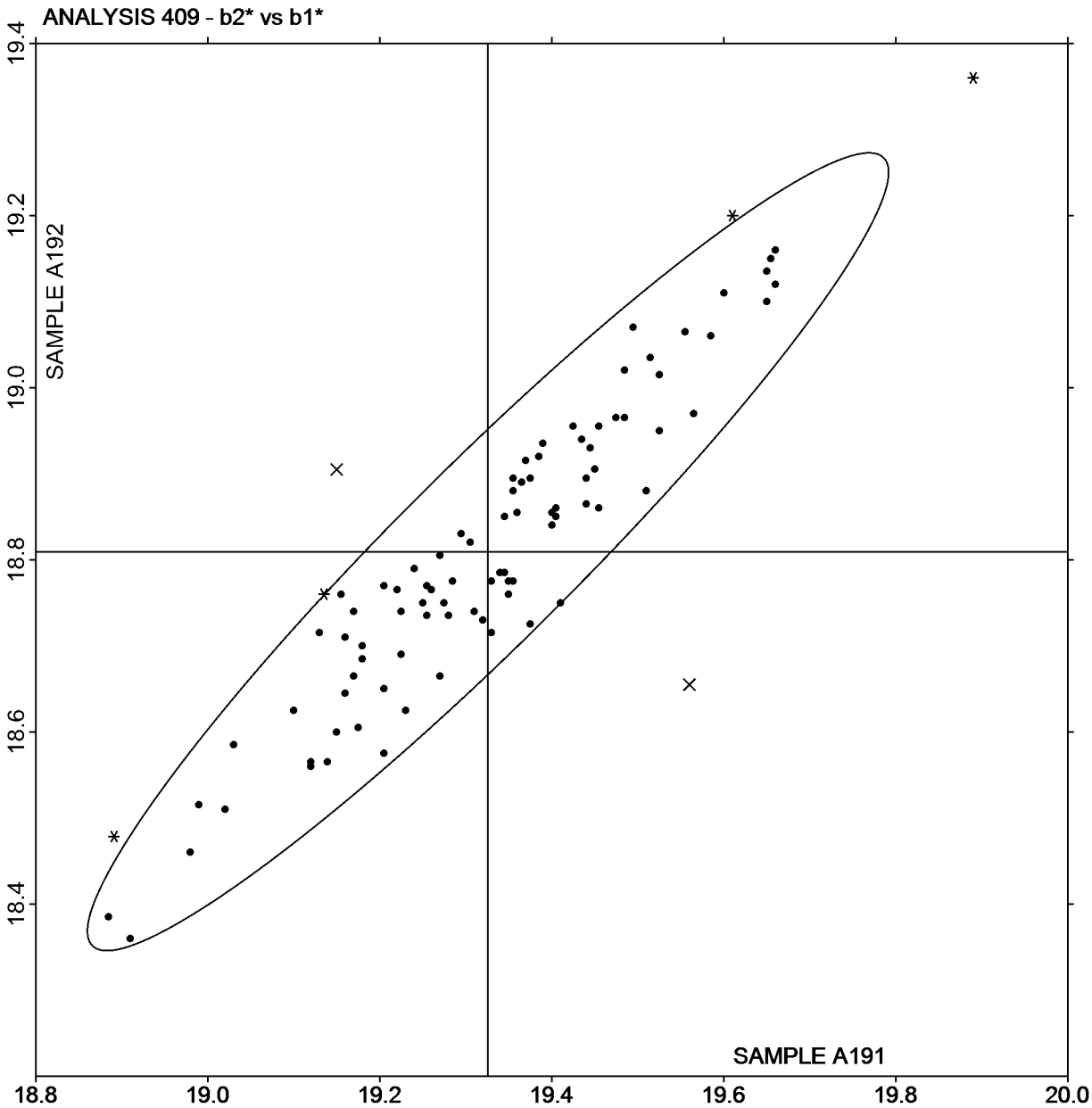




b2* vs b1*

SAMPLE A191 = 19.33

SAMPLE A192 = 18.81





CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

Report #187
1st Qtr 2019

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 A191 | | | | | | | | | | | | | | | | | | |
| 27JJVY | | 11.06 | 12.07 | 12.92 | 13.27 | 13.23 | 13.68 | 14.42 | 15.49 | 18.63 | 27.94* | 38.20 | 42.20 | 43.72 | 45.59 | 48.68 | 52.85 | XH |
| 298VWQ | | 11.21 | 12.24 | 13.06 | 13.46 | 13.42 | 13.79 | 14.63 | 15.61 | 18.36 | 27.25 | 37.96 | 42.27 | 43.71 | 45.35 | 48.38 | 52.26 | MV |
| 2G24CB | | 11.40 | 12.40 | 13.30 | 13.60 | 13.60 | 14.00 | 14.80 | 15.80 | 18.50 | 27.45 | 37.95 | 42.50 | 44.20* | 46.30* | 49.30* | 51.80 | AO |
| 2RJK83 | | 11.29 | 12.24 | 13.09 | 13.40 | 13.41 | 13.82 | 14.64 | 15.68 | 18.44 | 27.41 | 38.06 | 42.45 | 43.90 | 45.84 | 49.03 | 53.23 | XB |
| 2VMFQ6 | | 11.22 | 12.16 | 13.04 | 13.36 | 13.28 | 13.71 | 14.49 | 15.48 | 18.13 | 27.15 | 37.86 | 42.30 | 43.80 | 45.69 | 48.81 | 52.94 | MV |
| 2VXFMZ | | 11.26 | 12.32 | 13.11 | 13.49 | 13.48 | 13.85 | 14.64 | 15.66 | 18.44 | 27.36 | 37.81 | 42.44 | 43.91 | 45.90 | 49.20 | 52.73 | AH |
| 37VKB7 | | 11.36 | 12.22 | 13.14 | 13.47 | 13.42 | 13.85 | 14.67 | 15.69 | 18.41 | 27.48 | 38.25 | 42.51 | 43.95 | 45.72 | 48.58 | 52.60 | CA |
| 3AYHJD | X | 13.24X | 14.40X | 15.85X | 16.64X | 16.85X | 17.83X | 19.66X | 21.72X | 25.76X | 35.75X | 45.96X | 49.66X | 50.86X | 52.50X | 55.24X | 59.04X | XF |
| 3GHJ6H | | 11.54 | 12.20 | 13.05 | 13.42 | 13.44 | 13.83 | 14.67 | 15.67 | 18.46 | 27.81 | 38.42 | 42.64 | 44.11 | 46.07 | 49.27* | 52.93 | AS |
| 3KHXMf | | 11.26 | 12.22 | 13.04 | 13.40 | 13.47 | 13.85 | 14.65 | 15.70 | 18.44 | 27.17 | 37.50 | 42.13 | 43.77 | 45.63 | 48.56 | 50.46X | XO |
| 3ZBDYT | X | 11.77 | 12.91X | 13.93X | 14.36X | 14.31X | 14.99X | 15.87X | 17.02X | 20.05X | 27.87 | 38.74X | 43.45X | 45.14X | 47.12X | 50.21X | 54.19X | XO |
| 4M3WLW | | 11.10 | 11.96* | 12.86 | 13.20 | 13.18* | 13.59* | 14.39 | 15.41* | 18.11 | 27.17 | 37.87 | 42.02 | 43.40 | 45.15* | 47.96* | 51.95 | CA |
| 62UDLE | | 12.22X | 12.30 | 13.07 | 13.41 | 13.45 | 13.88 | 14.67 | 15.69 | 18.37 | 27.14 | 37.65 | 42.40 | 43.95 | 45.95 | 49.08 | 52.86 | AJ |
| 7PXPAB | | 11.31 | 12.42 | 13.20 | 13.47 | 13.44 | 13.81 | 14.63 | 15.64 | 18.68 | 27.48 | 37.93 | 42.45 | 44.07 | 46.01 | 49.07 | 51.73 | AM |
| 7TW4VF | | 11.23 | 12.16 | 13.02 | 13.36 | 13.30 | 13.70 | 14.51 | 15.46 | 18.30 | 27.53 | 38.21 | 42.32 | 43.65 | 45.51 | 48.40 | 52.55 | MV |
| 86RE22 | | 11.52 | 12.37 | 13.14 | 13.47 | 13.49 | 13.87 | 14.67 | 15.70 | 18.50 | 27.24 | 37.71 | 42.39 | 43.93 | 45.89 | 48.94 | 52.78 | AQ |
| 8EEFGB | | 11.27 | 12.23 | 13.10 | 13.43 | 13.41 | 13.81 | 14.61 | 15.66 | 18.55 | 27.45 | 37.96 | 42.25 | 43.79 | 45.66 | 48.54 | 52.60 | MM |
| 99NHCK | | 11.27 | 12.29 | 13.10 | 13.42 | 13.47 | 13.85 | 14.61 | 15.65 | 18.34 | 27.31 | 37.75 | 42.37 | 43.90 | 45.91 | 48.98 | 52.05 | AJ |
| 9AFGKR | X | 11.64 | 12.69X | 13.61X | 13.88X | 13.86X | 14.34X | 15.12X | 16.20X | 19.21X | 28.29X | 38.79X | 43.31X | 44.88X | 46.83X | 49.81X | 53.96* | XI |
| 9BTAX7 | | 11.19 | 12.13 | 12.98 | 13.29 | 13.27 | 13.71 | 14.53 | 15.59 | 18.48 | 27.35 | 37.60 | 41.95 | 43.61 | 45.65 | 48.76 | 53.07 | XZ |
| 9FPRJD | | 11.29 | 12.32 | 13.13 | 13.46 | 13.46 | 13.83 | 14.62 | 15.62 | 18.50 | 27.08 | 37.64 | 42.08 | 43.59 | 45.45 | 48.54 | 51.64 | AM |
| 9KYVMU | | 11.16 | 12.27 | 13.02 | 13.39 | 13.35 | 13.76 | 14.55 | 15.60 | 18.55 | 27.32 | 37.69 | 42.14 | 43.84 | 45.71 | 48.82 | 53.06 | XH |
| 9RHBXJ | | 11.19 | 12.18 | 13.04 | 13.38 | 13.35 | 13.78 | 14.55 | 15.61 | 18.63 | 27.67 | 37.98 | 42.07 | 43.50 | 45.36 | 48.35 | 52.35 | XH |
| AQVEW3 | | 11.22 | 12.12 | 13.00 | 13.32 | 13.32 | 13.75 | 14.55 | 15.63 | 18.50 | 27.40 | 37.81 | 42.18 | 43.72 | 45.49 | 48.34 | 52.27 | XB |
| AXFA2D | | 11.21 | 12.21 | 13.09 | 13.41 | 13.37 | 13.84 | 14.64 | 15.72 | 18.77 | 27.69 | 38.15 | 42.45 | 44.08 | 46.26* | 49.44* | 53.34 | XO |



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

Report #187
1st Qtr 2019

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 A191 | | | | | | | | | | | | | | | | | | |
| AZ92CY | | 11.71 | 12.68X | 13.41* | 13.73X | 13.71* | 14.15X | 14.91* | 15.92* | 18.78 | 27.64 | 38.00 | 42.30 | 43.91 | 45.78 | 48.77 | 52.87 | XI |
| BVNVRU | | 11.28 | 12.25 | 13.11 | 13.44 | 13.42 | 13.84 | 14.64 | 15.70 | 18.58 | 27.44 | 37.97 | 42.25 | 43.80 | 45.64 | 48.47 | 52.50 | MK |
| CE2G8A | | 11.33 | 12.27 | 13.08 | 13.45 | 13.48 | 13.88 | 14.68 | 15.70 | 18.36 | 27.18 | 37.59 | 42.19 | 43.85 | 45.67 | 48.26 | 50.95* | AJ |
| CEHNFD | | 11.33 | 12.33 | 13.11 | 13.47 | 13.46 | 13.82 | 14.63 | 15.67 | 18.48 | 27.27 | 37.70 | 42.23 | 43.67 | 45.48 | 48.58 | 51.81 | AM |
| CFAPEA | | 11.45 | 12.39 | 13.22 | 13.52 | 13.49 | 13.92 | 14.73 | 15.82 | 18.77 | 27.18 | 37.92 | 42.16 | 43.59 | 45.62 | 48.50 | 52.40 | XI |
| CJBVVZ | | 11.50 | 12.40 | 13.20 | 13.50 | 13.55 | 14.00 | 14.75 | 15.70 | 18.45 | 27.50 | 38.10 | 42.50 | 44.00 | 45.90 | 48.80 | 51.20 | AO |
| CMCU9E | | 11.48 | 12.10 | 12.83* | 13.25 | 13.30 | 13.79 | 14.34* | 15.61 | 17.96* | 27.42 | 37.31 | 42.02 | 43.50 | 45.42 | 48.22 | 52.38 | GD |
| DVKN37 | | 11.54 | 12.39 | 13.31 | 13.64* | 13.59 | 14.01 | 14.82 | 15.85 | 18.59 | 27.81 | 38.63* | 42.82* | 44.21* | 45.96 | 48.83 | 52.85 | CA |
| DWHYYA | | 11.06 | 11.99 | 12.81* | 13.17* | 13.14* | 13.60* | 14.36* | 15.39* | 18.28 | 26.97 | 37.35 | 41.81 | 43.53 | 45.37 | 48.53 | 52.66 | XH |
| F49DFC | | 11.33 | 12.27 | 13.12 | 13.45 | 13.44 | 13.85 | 14.65 | 15.71 | 18.55 | 27.19 | 37.67 | 42.10 | 43.74 | 45.58 | 48.46 | 52.48 | MM |
| FGQADZ | | 10.79* | 11.88* | 12.70X | 13.07X | 13.09X | 13.44X | 14.26X | 15.30X | 18.19 | 26.85 | 37.28 | 41.79* | 43.40 | 45.31 | 48.39 | 52.68 | XH |
| FHQBG8 | | 11.31 | 12.36 | 13.21 | 13.61 | 13.53 | 13.89 | 14.73 | 15.62 | 18.34 | 27.39 | 38.14 | 42.45 | 43.81 | 45.72 | 48.57 | 52.71 | MV |
| FRCCXG | | 11.35 | 12.23 | 13.06 | 13.38 | 13.36 | 13.78 | 14.60 | 15.69 | 18.59 | 27.66 | 38.09 | 42.37 | 43.95 | 45.91 | 48.97 | 53.16 | XB |
| G3RLZ2 | | 11.08 | 12.05 | 12.93 | 13.28 | 13.28 | 13.68 | 14.42 | 15.45 | 18.45 | 27.35 | 37.73 | 42.04 | 43.71 | 45.59 | 48.67 | 52.89 | MI |
| GKQNUY | | 11.31 | 12.22 | 13.06 | 13.32 | 13.30 | 13.76 | 14.55 | 15.60 | 18.71 | 27.74 | 37.93 | 42.05 | 43.61 | 45.50 | 48.32 | 52.43 | XF |
| GRRZQV | | 11.55 | 12.40 | 13.16 | 13.40 | 13.35 | 13.85 | 14.62 | 15.65 | 18.52 | 26.86 | 37.71 | 42.24 | 43.66 | 45.24 | 48.27 | 52.10 | HP |
| H2F7B7 | | 11.30 | 12.27 | 13.07 | 13.44 | 13.45 | 13.83 | 14.63 | 15.66 | 18.36 | 27.13 | 37.62 | 42.19 | 43.79 | 45.70 | 48.72 | 51.37 | AS |
| H9VRCX | | 11.47 | 12.33 | 13.18 | 13.43 | 13.52 | 13.88 | 14.75 | 15.84 | 18.87 | 27.73 | 38.12 | 42.46 | 43.68 | 45.46 | 48.77 | 52.46 | HF |
| HANPJ4 | | 11.38 | 12.34 | 13.21 | 13.53 | 13.51 | 13.91 | 14.71 | 15.78 | 18.57 | 27.26 | 37.94 | 42.41 | 44.02 | 45.93 | 48.80 | 52.90 | MM |
| HD9MZ8 | X | 9.34X | 11.77X | 12.40X | 13.16* | 13.17* | 13.26X | 13.97X | 14.77X | 16.41X | 22.05X | 33.00X | 40.35X | 42.82X | 44.41X | 46.74X | 50.39X | XH |
| HLWRKR | | 11.43 | 12.29 | 13.20 | 13.43 | 13.49 | 13.91 | 14.67 | 15.68 | 18.29 | 27.34 | 37.89 | 42.28 | 43.84 | 45.74 | 48.66 | 51.17 | AS |
| HN39ZB | | 11.20 | 12.25 | 13.07 | 13.42 | 13.42 | 13.80 | 14.62 | 15.59 | 18.48 | 27.34 | 37.72 | 42.17 | 43.61 | 45.43 | 48.35 | 52.00 | AQ |
| J6RK7Q | | 11.48 | 12.50 | 13.33* | 13.67* | 13.63 | 14.03 | 14.83 | 15.90* | 18.79 | 27.23 | 37.55 | 42.19 | 43.81 | 45.69 | 48.46 | 52.44 | MM |
| JCP94G | | 11.36 | 12.23 | 13.09 | 13.42 | 13.44 | 13.86 | 14.64 | 15.64 | 18.30 | 27.40 | 37.92 | 42.36 | 43.91 | 45.85 | 48.58 | 51.06* | AS |
| JK2HBB | | 11.23 | 12.24 | 13.14 | 13.48 | 13.48 | 13.94 | 14.71 | 15.78 | 18.75 | 27.63 | 37.88 | 42.23 | 43.65 | 45.42 | 48.39 | 52.36 | XI |



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

Report #187
1st Qtr 2019

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 A191 | | | | | | | | | | | | | | | | | | |
| KFLB7N | | 11.27 | 12.13 | 13.14 | 13.41 | 13.34 | 13.76 | 14.57 | 15.56 | 18.42 | 27.42 | 38.01 | 42.39 | 44.00 | 45.84 | 48.87 | 53.19 | MT |
| KNXCLX | | 11.45 | 12.37 | 13.20 | 13.54 | 13.50 | 13.92 | 14.71 | 15.75 | 18.65 | 27.52 | 38.12 | 42.42 | 43.96 | 45.83 | 48.69 | 52.82 | MM |
| KU7U3X | | 10.59X | 11.76X | 12.77* | 13.18* | 13.21 | 13.68 | 14.50 | 15.56 | 18.25 | 27.19 | 38.32 | 42.63 | 44.16 | 45.82 | 48.95 | 52.82 | CA |
| LATG3V | | 11.28 | 12.22 | 13.06 | 13.42 | 13.40 | 13.80 | 14.57 | 15.63 | 18.35 | 26.77* | 37.22* | 41.84 | 43.55 | 45.45 | 48.32 | 52.35 | MM |
| LERMMT | | 11.21 | 12.20 | 13.04 | 13.36 | 13.35 | 13.78 | 14.54 | 15.57 | 18.54 | 27.43 | 37.87 | 42.23 | 43.63 | 45.45 | 48.47 | 52.42 | MI |
| LGCWCK | | 11.24 | 12.24 | 13.08 | 13.43 | 13.42 | 13.84 | 14.67 | 15.72 | 18.54 | 27.22 | 37.50 | 41.98 | 43.58 | 45.44 | 48.22 | 52.15 | XB |
| LYF8KW | | 11.33 | 12.27 | 13.15 | 13.45 | 13.50 | 13.88 | 14.65 | 15.71 | 18.31 | 27.15 | 37.62 | 42.25 | 43.88 | 45.86 | 49.10 | 51.59 | AS |
| M7RPDV | | 11.27 | 12.27 | 13.08 | 13.43 | 13.40 | 13.85 | 14.62 | 15.68 | 18.67 | 27.66 | 37.92 | 42.10 | 43.57 | 45.39 | 48.34 | 52.26 | XI |
| M8JQCR | | 12.35X | 12.36 | 13.08 | 13.44 | 13.44 | 13.83 | 14.62 | 15.65 | 18.49 | 27.10 | 37.52 | 42.31 | 43.94 | 45.90 | 49.09 | 52.87 | AQ |
| ME4288 | | 11.36 | 12.29 | 13.10 | 13.47 | 13.50 | 13.91 | 14.66 | 15.70 | 18.38 | 27.29 | 37.72 | 42.32 | 43.88 | 45.74 | 48.80 | 51.06* | AS |
| NCAFCV | | 11.39 | 12.13 | 13.02 | 13.46 | 13.40 | 13.78 | 14.61 | 15.57 | 18.35 | 27.29 | 38.04 | 42.42 | 43.92 | 45.66 | 48.77 | 52.77 | MV |
| NL2TEF | | 11.34 | 12.27 | 13.09 | 13.42 | 13.44 | 13.85 | 14.63 | 15.64 | 18.22 | 27.16 | 37.62 | 42.31 | 43.89 | 45.99 | 49.24 | 51.97 | AJ |
| NMDQL7 | | 11.33 | 12.25 | 13.04 | 13.44 | 13.46 | 13.86 | 14.61 | 15.66 | 18.35 | 27.26 | 37.78 | 42.25 | 43.79 | 45.73 | 48.50 | 51.32 | AJ |
| PJ8MBV | | 11.60 | 12.40 | 13.20 | 13.50 | 13.50 | 13.95 | 14.80 | 15.90* | 19.30X | 28.40X | 38.55* | 42.60 | 43.80 | 45.20 | 48.40 | 52.20 | HW |
| PYZCBX | | 11.44 | 12.30 | 13.12 | 13.45 | 13.50 | 13.86 | 14.66 | 15.73 | 18.50 | 27.46 | 38.01 | 42.51 | 43.93 | 45.85 | 48.87 | 52.38 | AJ |
| Q66MRQ | | 11.28 | 12.24 | 12.98 | 13.36 | 13.39 | 13.82 | 14.59 | 15.61 | 18.33 | 27.17 | 37.61 | 42.22 | 43.94 | 45.64 | 48.73 | 51.31 | AS |
| QZBGHU | | 11.18 | 12.23 | 13.02 | 13.33 | 13.30 | 13.69 | 14.51 | 15.48 | 18.42 | 27.23 | 37.52 | 41.85 | 43.45 | 45.24 | 48.22 | 52.44 | XI |
| RFKRK8 | | 11.53 | 12.25 | 13.07 | 13.41 | 13.34 | 13.79 | 14.59 | 15.57 | 17.95* | 26.56X | 37.39 | 41.89 | 43.45 | 45.23 | 48.23 | 52.23 | HP |
| RKQKDH | | 11.04 | 12.10 | 12.96 | 13.29 | 13.29 | 13.72 | 14.51 | 15.56 | 18.51 | 27.37 | 37.59 | 41.91 | 43.48 | 45.40 | 48.45 | 52.42 | XI |
| T7DCCE | | 11.41 | 12.39 | 13.16 | 13.57 | 13.54 | 13.89 | 14.70 | 15.72 | 18.56 | 27.37 | 37.89 | 42.40 | 43.90 | 45.79 | 48.76 | 52.51 | AO |
| TAQAJ2 | | 11.39 | 12.49 | 13.29 | 13.63 | 13.63* | 14.03 | 14.83 | 15.88* | 18.75 | 27.67 | 37.97 | 42.28 | 43.81 | 45.56 | 48.51 | 52.23 | XI |
| TL74XF | | 11.47 | 12.14 | 12.95 | 13.27 | 13.32 | 13.74 | 14.48 | 15.53 | 18.26 | 27.04 | 37.45 | 41.91 | 43.55 | 45.54 | 48.77 | 52.33 | AS |
| U2CNBX | | 11.28 | 12.29 | 13.16 | 13.53 | 13.40 | 13.85 | 14.66 | 15.63 | 18.45 | 27.85 | 38.54* | 42.63 | 43.92 | 45.73 | 48.67 | 52.84 | MV |
| U4J689 | | 11.07 | 12.13 | 13.01 | 13.37 | 13.35 | 13.73 | 14.53 | 15.59 | 18.40 | 27.09 | 37.65 | 42.29 | 43.99 | 45.93 | 48.94 | 53.10 | AE |
| UD67MH | | 11.38 | 12.28 | 13.04 | 13.35 | 13.37 | 13.76 | 14.54 | 15.58 | 18.36 | 27.31 | 37.82 | 42.36 | 43.91 | 45.97 | 48.94 | 52.00 | AJ |



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

Report #187
1st Qtr 2019

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 A191 | | | | | | | | | | | | | | | | | | |
| UXARJH | | 11.30 | 12.20 | 13.10 | 13.40 | 13.40 | 13.80 | 14.60 | 15.60 | 18.40 | 27.20 | 37.70 | 42.10 | 43.60 | 45.40 | 48.30 | 52.35 | MS |
| VEF7LX | | 11.27 | 12.27 | 13.10 | 13.42 | 13.42 | 13.81 | 14.59 | 15.61 | 18.15 | 26.99 | 37.44 | 42.08 | 43.71 | 45.67 | 48.59 | 51.33 | AJ |
| VLW23R | | 10.97 | 12.01 | 12.89 | 13.25 | 13.21 | 13.66 | 14.48 | 15.52 | 18.64 | 27.49 | 37.74 | 41.86 | 43.57 | 45.34 | 48.56 | 52.63 | XO |
| W9KXCM | | 11.16 | 12.26 | 13.02 | 13.38 | 13.37 | 13.80 | 14.57 | 15.60 | 18.53 | 27.51 | 37.73 | 42.04 | 43.57 | 45.46 | 48.55 | 52.60 | XI |
| WNWCV7 | | 11.33 | 12.32 | 13.13 | 13.42 | 13.41 | 13.87 | 14.64 | 15.66 | 18.61 | 27.63 | 37.76 | 42.03 | 43.59 | 45.55 | 48.67 | 52.89 | XI |
| WUNJEE | | 11.37 | 12.37 | 13.22 | 13.53 | 13.51 | 13.94 | 14.72 | 15.78 | 18.71 | 27.64 | 37.93 | 42.28 | 43.80 | 45.78 | 48.76 | 52.84 | XI |
| X48D8M | | 11.45 | 12.36 | 13.19 | 13.51 | 13.51 | 13.96 | 14.70 | 15.72 | 18.34 | 27.48 | 38.06 | 42.38 | 43.89 | 45.90 | 48.71 | 51.46 | AO |
| XLLYKH | | 11.07 | 12.10 | 13.00 | 13.41 | 13.38 | 13.75 | 14.59 | 15.60 | 18.36 | 27.18 | 37.78 | 42.26 | 43.79 | 45.54 | 48.45 | 52.51 | MT |
| YCJWZL | | 11.28 | 12.22 | 13.04 | 13.27 | 13.28 | 13.68 | 14.47 | 15.49 | 18.43 | 27.45 | 37.70 | 41.98 | 43.50 | 45.44 | 48.46 | 52.54 | XI |
| YE3B4L | | 11.24 | 12.33 | 13.14 | 13.52 | 13.47 | 13.92 | 14.71 | 15.68 | 18.42 | 27.62 | 38.94X | 43.00X | 43.90 | 45.40 | 48.70 | 52.67 | HU |
| YVCV7J | | 11.38 | 12.34 | 13.17 | 13.49 | 13.47 | 13.88 | 14.66 | 15.72 | 18.57 | 27.11 | 37.58 | 42.21 | 43.93 | 45.84 | 48.91 | 53.07 | MM |
| ZMFC9M | | 11.34 | 12.29 | 13.08 | 13.41 | 13.40 | 13.83 | 14.58 | 15.67 | 18.62 | 27.65 | 37.84 | 42.17 | 43.67 | 45.42 | 48.29 | 52.15 | XI |

Summary Statistics

| | 400 | 420 | 440 | 460 | 480 | 500 | 520 | 540 | 560 | 580 | 600 | 620 | 640 | 660 | 680 | 700 |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Grand Means | 11.32 | 12.25 | 13.08 | 13.42 | 13.41 | 13.82 | 14.61 | 15.65 | 18.47 | 27.36 | 37.84 | 42.25 | 43.78 | 45.65 | 48.65 | 52.34 |
| SD Btwn Labs | 0.23 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.20 | 0.28 | 0.31 | 0.23 | 0.19 | 0.24 | 0.29 | 0.60 |

Comments Assigned on Data Flags for Test #411

- 3AYHJD (X) - High % reflectance data at all wavelengths.
- 3ZBDYT (X) - High % reflectance data for most wavelengths.
- 9AFGKR (X) - High % reflectance data for most wavelengths.
- HD9MZ8 (X) - Low % reflectance data for most wavelengths.



CTS Interlaboratory Testing Program for Color & Appearance Analysis 411

Report #187
1st Qtr 2019

Spectrophotometric - Sphere Geometry Instruments
Reflectance at 16 Selected Wavelengths

Key to Instrument Codes Reported by Participants

| | | |
|---|---|---|
| AE ACS-Datcolor 110 | AH ACS-Datcolor 550 | AJ ACS-Datcolor 600 |
| AM ACS-Datcolor 600 Plus | AO ACS-Datcolor 650 | AQ ACS-Datcolor 600X |
| AS ACS-Datcolor 800 Series | CA Cary 5000 | GD BYK-Gardner spectro-guide sphere |
| HF Hunter ColorFlex Diffuse | HP Hunter UltraScan PRO | HU Hunter UltraScan |
| HW Hunter UltraScan XE | MI Macbeth Color i5 | MK Macbeth Color-Eye 7000 Spectrophotometer |
| MM Macbeth Color-Eye 7000a | MS Minolta CM-600d | MT Minolta CM-2600d |
| MV Minolta CM-3000d Series Spectrophotometer | XB X-Rite Ci7000 Series Benchtop Spectrophotometer | XF X-Rite Ci6x Series Portable Spectrophotometer |
| XH X-Rite Color i5 | XI X-Rite Color i7 | XO X-Rite SP64 |
| XZ X-Rite | | |



Interlaboratory Testing Program for Color & Appearance

Report #187

Analysis 440

1st Qtr 2019

60 Degree Gloss - Paint Chips

ASTM Method D 523

| WebCode | Data Flag | Sample E191 | | | Sample E192 | | | Instr Code |
|---------|-----------|-------------|----------------------|--------|-------------|----------------------|--------|------------|
| | | Lab Mean | Diff from Grand Mean | CPV | Lab Mean | Diff from Grand Mean | CPV | |
| 27JJVY | | 29.88 | 0.59 | 0.88 | 40.55 | 0.44 | 0.88 | GL |
| 298VWQ | | 28.75 | -0.54 | -0.79 | 39.33 | -0.78 | -1.55 | GL |
| 2RJK83 | | 30.10 | 0.81 | 1.21 | 40.65 | 0.54 | 1.08 | GL |
| 326DPC | | 29.23 | -0.06 | -0.09 | 40.60 | 0.49 | 0.97 | MW |
| 3AYHJD | X | 0.90 | -28.39 | -42.14 | 0.95 | -39.16 | -77.66 | GK |
| 3GK8MW | | 29.68 | 0.39 | 0.58 | 40.43 | 0.32 | 0.63 | GN |
| 3KHXMf | | 28.93 | -0.36 | -0.53 | 40.13 | 0.02 | 0.03 | GN |
| 3ZBDYT | | 29.05 | -0.24 | -0.35 | 39.95 | -0.16 | -0.31 | GL |
| 4GCMCX | | 29.58 | 0.29 | 0.43 | 39.78 | -0.33 | -0.66 | GK |
| 4GUQQQ | X | 32.20 | 2.91 | 4.33 | 43.25 | 3.14 | 6.23 | GK |
| 4HPE6E | | 29.50 | 0.21 | 0.32 | 40.15 | 0.04 | 0.08 | GL |
| 69VTCL | | 28.88 | -0.41 | -0.61 | 40.40 | 0.29 | 0.58 | GN |
| 86RE22 | | 28.68 | -0.61 | -0.91 | 39.50 | -0.61 | -1.21 | GK |
| 8EEFGB | | 29.08 | -0.21 | -0.31 | 40.50 | 0.39 | 0.78 | RA |
| 8MBBGV | | 29.90 | 0.61 | 0.91 | 40.78 | 0.67 | 1.32 | GL |
| 9FPRJD | * | 27.50 | -1.79 | -2.65 | 39.65 | -0.46 | -0.91 | GQ |
| 9KYVMU | | 29.28 | -0.01 | -0.01 | 40.73 | 0.62 | 1.22 | GL |
| 9RHBXJ | | 29.53 | 0.24 | 0.36 | 39.85 | -0.26 | -0.51 | GK |
| AXFA2D | X | 54.90 | 25.61 | 38.03 | 65.95 | 25.84 | 51.25 | MW |
| AZ9YNF | | 29.75 | 0.46 | 0.69 | 39.88 | -0.23 | -0.46 | GN |
| BMHMUG | | 29.90 | 0.61 | 0.91 | 40.90 | 0.79 | 1.57 | GN |
| CCC7GG | | 29.40 | 0.11 | 0.17 | 40.18 | 0.07 | 0.13 | GL |
| CD9JZ4 | | 30.20 | 0.91 | 1.36 | 40.50 | 0.39 | 0.78 | GL |
| CE2G8A | | 28.18 | -1.11 | -1.65 | 40.30 | 0.19 | 0.38 | GL |
| CMCU9E | | 28.90 | -0.39 | -0.57 | 39.40 | -0.71 | -1.41 | GN |
| DHAEW9 | | 30.38 | 1.09 | 1.62 | 40.88 | 0.77 | 1.52 | XX |
| DUQZNH | | 28.05 | -1.24 | -1.83 | 39.80 | -0.31 | -0.61 | GK |
| DWED8Z | | 28.75 | -0.54 | -0.79 | 39.80 | -0.31 | -0.61 | GL |
| DWHYYA | | 29.53 | 0.24 | 0.36 | 40.30 | 0.19 | 0.38 | GL |
| EX9ERH | | 28.55 | -0.74 | -1.09 | 40.30 | 0.19 | 0.38 | GL |



Interlaboratory Testing Program for Color & Appearance

Report #187

Analysis 440

1st Qtr 2019

60 Degree Gloss - Paint Chips

ASTM Method D 523

| WebCode | Data Flag | Sample E191 | | | Sample E192 | | | Instr Code |
|---------|-----------|-------------|----------------------|-------|-------------|----------------------|--------|------------|
| | | Lab Mean | Diff from Grand Mean | CPV | Lab Mean | Diff from Grand Mean | CPV | |
| G3RLZ2 | | 28.80 | -0.49 | -0.72 | 39.88 | -0.23 | -0.46 | GL |
| GUYDDN | X | 35.23 | 5.94 | 8.82 | 34.48 | -5.63 | -11.17 | GK |
| H2F7B7 | X | 29.53 | 0.24 | 0.36 | 37.78 | -2.33 | -4.63 | GN |
| HANPJ4 | | 30.33 | 1.04 | 1.54 | 40.58 | 0.47 | 0.92 | RA |
| HD9MZ8 | | 28.86 | -0.42 | -0.63 | 39.50 | -0.61 | -1.21 | GL |
| JK2HBB | | 29.30 | 0.01 | 0.02 | 40.18 | 0.07 | 0.13 | GL |
| KU7U3X | * | 30.13 | 0.84 | 1.25 | 41.48 | 1.37 | 2.71 | GL |
| LATG3V | | 29.55 | 0.26 | 0.39 | 40.03 | -0.08 | -0.17 | GL |
| LERMMT | | 28.83 | -0.46 | -0.68 | 40.13 | 0.02 | 0.03 | GL |
| M7RPDV | | 29.96 | 0.68 | 1.01 | 40.36 | 0.25 | 0.50 | GL |
| NEJKR6 | | 29.05 | -0.24 | -0.35 | 40.05 | -0.06 | -0.12 | GL |
| NL2TEF | | 30.13 | 0.84 | 1.25 | 40.70 | 0.59 | 1.17 | GL |
| NMDQL7 | | 30.00 | 0.71 | 1.06 | 40.90 | 0.79 | 1.57 | MW |
| PJ8MBV | | 29.15 | -0.14 | -0.20 | 39.60 | -0.51 | -1.01 | GK |
| Q66MRQ | | 28.98 | -0.31 | -0.46 | 39.93 | -0.18 | -0.36 | GL |
| QU4XEV | | 29.10 | -0.19 | -0.27 | 40.60 | 0.49 | 0.97 | GL |
| QZBGHU | | 27.88 | -1.41 | -2.09 | 39.05 | -1.06 | -2.10 | GK |
| RH87AH | | 30.03 | 0.74 | 1.10 | 39.95 | -0.16 | -0.31 | RA |
| RHATQV | | 29.53 | 0.24 | 0.36 | 40.45 | 0.34 | 0.68 | GK |
| RKQKDH | * | 29.90 | 0.61 | 0.91 | 39.38 | -0.73 | -1.45 | MM |
| U4J689 | | 30.00 | 0.71 | 1.06 | 39.88 | -0.23 | -0.46 | GL |
| UXARJH | | 29.10 | -0.19 | -0.27 | 39.33 | -0.78 | -1.55 | GK |
| VEF7LX | | 29.05 | -0.24 | -0.35 | 39.55 | -0.56 | -1.11 | GK |
| VLW23R | | 29.48 | 0.19 | 0.28 | 40.38 | 0.27 | 0.53 | GN |
| VUQWFP | | 30.03 | 0.74 | 1.10 | 39.95 | -0.16 | -0.31 | GL |
| WMKMR | X | 26.88 | -2.41 | -3.58 | 37.93 | -2.18 | -4.33 | GB |
| WAV23T | | 28.18 | -1.11 | -1.65 | 39.73 | -0.38 | -0.76 | GL |
| WUNJEE | | 29.83 | 0.54 | 0.80 | 40.43 | 0.32 | 0.63 | GL |
| WVGHLL | | 28.78 | -0.51 | -0.76 | 39.63 | -0.48 | -0.96 | GL |
| YVCV7J | | 30.43 | 1.14 | 1.69 | 40.53 | 0.42 | 0.83 | GL |



Interlaboratory Testing Program for Color & Appearance

Report #187

Analysis 440

1st Qtr 2019

60 Degree Gloss - Paint Chips

ASTM Method D 523

| WebCode | Data Flag | Sample E191 | | | Sample E192 | | | Instr Code |
|---------|-----------|-------------|----------------------|-------|-------------|----------------------|-------|------------|
| | | Lab Mean | Diff from Grand Mean | CPV | Lab Mean | Diff from Grand Mean | CPV | |
| Z6VNVL | | 28.63 | -0.66 | -0.98 | 39.78 | -0.33 | -0.66 | GL |
| ZMFC9M | | 28.80 | -0.49 | -0.72 | 40.03 | -0.08 | -0.17 | GL |
| ZUVZ24 | | 28.43 | -0.86 | -1.28 | 39.13 | -0.98 | -1.95 | GL |

Summary Statistics

Grand Means

29.29 Gloss Units

40.11 Gloss Units

Std Dev Btwn Labs

0.67 Gloss Units

0.50 Gloss Units

Statistics based on 57 of 63 reporting participants

Comments on Assigned Data Flags for Test #440

3AYHJD(X) - Extreme data.

4GUQQQ(X) - Data for both samples are extremely high. Possible systematic error.

AXFA2D(X) - Extreme data.

GUYDDN(X) - Extreme data.

H2F7B7(X) - Low data for Sample E192. Inconsistent within the determinations for Sample E192.

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

Key to Instrument Codes Reported by Participants

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

MM Macbeth Lab-Gloss

MW Minolta Multi-Gloss 268

RA Rhopoint Novo-Gloss Glossmeter

XX Instrument make/model not specified by lab

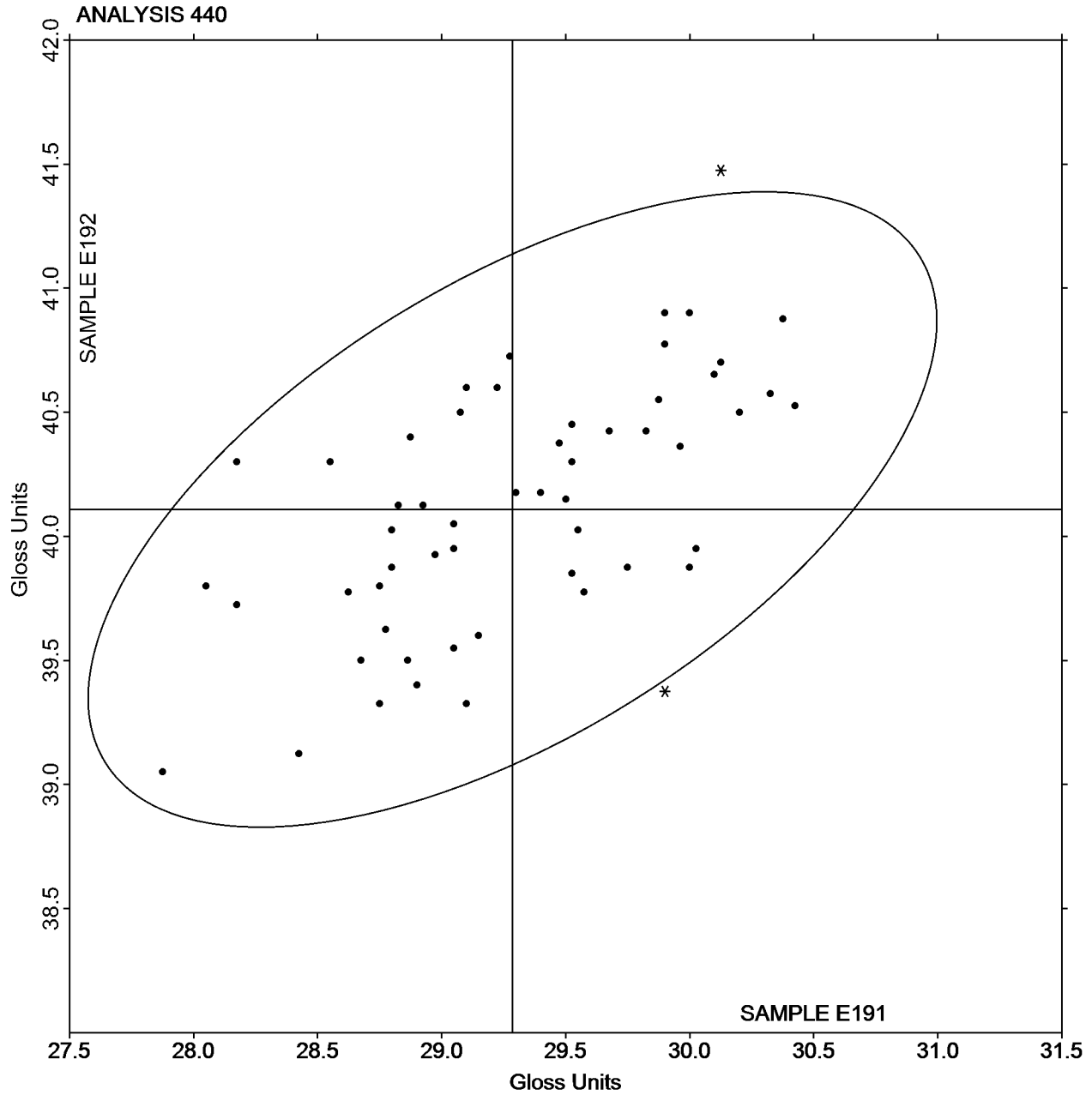


Interlaboratory Testing Program for Color & Appearance
Analysis 440
60 Degree Gloss - Paint Chips
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SAMPLE E191 = 29.29 Gloss Units

SAMPLE E192 = 40.11 Gloss Units



-End of Report-