

UNCLASSIFIED

AD 407 393

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION, ALEXANDRIA, VIRGINIA



UNCLASSIFIED

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

CATALOGED BY DDC
AS AD No. 407393

407 393

63-4-1

GMIIIID

GENERAL DYNAMICS | CONVAIR

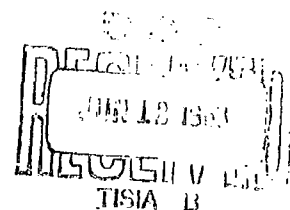
Report No. 8926-104

Material - Finishes and Coatings - Reflective Tapes -
No. 630, 633 and 3270, Minnesota Mining and
Manufacturing Co.

Reflectance Characteristics

B. H. Faulkenberry, F. M. Graber, E. E. Keller

7 May 1959



Published and Distributed
under
Contract AF 33(657)-8926



GENERAL DYNAMICS | CONVAIR

MODEL
DATE

PAGE
REPORT NO.

Report No. 8926-104

Material - Finishes and Coatings - Reflective Tapes -
No. 630, 633 and 3270, Minnesota Mining and
Manufacturing Co.

Reflectance Characteristics

Abstract

The specular reflectance of Minnesota Mining and Manufacturing Co. No. 633 gold colored D.S. Scotchcal, and No. 630 chrome colored D.S. Scotchcal films, and No. 3270 silver W/A D.S. Flat Top (R) Scotchlite reflective film was determined in the 0.35 to 2.5 micron wavelength range with a Beckman DK-2 recording spectrophotometer, and in the 1.0 to 15 micron wavelength range with a Beckman IR-4 recording spectrophotometer. Recordings of all measurements are given.

Reference: Faulkenberry, B. H., Graber, F. M., Keller, E. E.,
"Reflectance Characteristics of Reflective Tapes,"
General Dynamics/Convair Report 59-191, San Diego,
California, 7 May 1959. (Reference attached).



ANALYSIS

PREPARED BY B.H. Faulkenberry

CHECKED BY F.M. Graber

REVISED BY

CONVAIR

SAN DIEGO

PAGE 1

REPORT NO. MP-59-191

MODEL MISC.

DATE 5-7-59

OBJECT:

To determine the reflectance vs. wavelength of No. 633, No. 630 and No. 3270 reflective tapes which were received from the Minnesota Mining and Manufacturing Company.

TEST SPECIMENS:

1. No. 633 Gold Colored D.S. Scotchcal Brand Film
2. No. 630 Chrome Colored D.S. Scotchcal Brand Film
3. No. 3270 Silver W/A D.S. Flat-Top (R) Scotchlite Brand Reflective Sheeting.

TEST PROCEDURE:

A Beckman DK-2 recording spectrophotometer was used to determine the diffuse and total reflectance over the range of 0.35 to 2.5 microns. The ~~total~~ ^{specular} reflectance over this range was calculated by using the following relationship:

$$\text{Total Reflectance} = \text{Diffuse Reflectance} + \text{~~Specular~~ ^{Specular} Reflectance.}$$

A Beckman IR-4 spectrophotometer was used to determine the ~~specular~~ ^{specular} reflectance of the three samples over the range of 1.0 to 15 microns. The specimens were maintained at room temperature for all measurements.

RESULTS:

The reflectance characteristics of the three reflective tapes are shown in Figures I through XII.

Beckman DK-2 CHART

$$1. \text{ Let } u = u^0 + u^1 + u^2 + \dots, \quad \text{where } u^0 = u^0, \quad u^1 = u^1, \quad u^2 = u^2, \quad \dots$$

2002-03

WFO 10-21-64

23

1916, 1917, 1918

100

Clark, R. S.

124-137
B- and E

Final Report

THE UNIVERSITY OF CHICAGO PRESS

CONC	PA (%)	CM
0.0000	0.0000	0.0000
0.0001	0.0001	0.0001
0.0002	0.0002	0.0002
0.0003	0.0003	0.0003
0.0004	0.0004	0.0004
0.0005	0.0005	0.0005
0.0006	0.0006	0.0006
0.0007	0.0007	0.0007
0.0008	0.0008	0.0008
0.0009	0.0009	0.0009
0.0010	0.0010	0.0010
0.0011	0.0011	0.0011
0.0012	0.0012	0.0012
0.0013	0.0013	0.0013
0.0014	0.0014	0.0014
0.0015	0.0015	0.0015
0.0016	0.0016	0.0016
0.0017	0.0017	0.0017
0.0018	0.0018	0.0018
0.0019	0.0019	0.0019
0.0020	0.0020	0.0020
0.0021	0.0021	0.0021
0.0022	0.0022	0.0022
0.0023	0.0023	0.0023
0.0024	0.0024	0.0024
0.0025	0.0025	0.0025
0.0026	0.0026	0.0026
0.0027	0.0027	0.0027
0.0028	0.0028	0.0028
0.0029	0.0029	0.0029
0.0030	0.0030	0.0030
0.0031	0.0031	0.0031
0.0032	0.0032	0.0032
0.0033	0.0033	0.0033
0.0034	0.0034	0.0034
0.0035	0.0035	0.0035
0.0036	0.0036	0.0036
0.0037	0.0037	0.0037
0.0038	0.0038	0.0038
0.0039	0.0039	0.0039
0.0040	0.0040	0.0040
0.0041	0.0041	0.0041
0.0042	0.0042	0.0042
0.0043	0.0043	0.0043
0.0044	0.0044	0.0044
0.0045	0.0045	0.0045
0.0046	0.0046	0.0046
0.0047	0.0047	0.0047
0.0048	0.0048	0.0048
0.0049	0.0049	0.0049
0.0050	0.0050	0.0050
0.0051	0.0051	0.0051
0.0052	0.0052	0.0052
0.0053	0.0053	0.0053
0.0054	0.0054	0.0054
0.0055	0.0055	0.0055
0.0056	0.0056	0.0056
0.0057	0.0057	0.0057
0.0058	0.0058	0.0058
0.0059	0.0059	0.0059
0.0060	0.0060	0.0060
0.0061	0.0061	0.0061
0.0062	0.0062	0.0062
0.0063	0.0063	0.0063
0.0064	0.0064	0.0064
0.0065	0.0065	0.0065
0.0066	0.0066	0.0066
0.0067	0.0067	0.0067
0.0068	0.0068	0.0068
0.0069	0.0069	0.0069
0.0070	0.0070	0.0070
0.0071	0.0071	0.0071
0.0072	0.0072	0.0072
0.0073	0.0073	0.0073
0.0074	0.0074	0.0074
0.0075	0.0075	0.0075
0.0076	0.0076	0.0076
0.0077	0.0077	0.0077
0.0078	0.0078	0.0078
0.0079	0.0079	0.0079
0.0080	0.0080	0.0080
0.0081	0.0081	0.0081
0.0082	0.0082	0.0082
0.0083	0.0083	0.0083
0.0084	0.0084	0.0084
0.0085	0.0085	0.0085
0.0086	0.0086	0.0086
0.0087	0.0087	0.0087
0.0088	0.0088	0.0088
0.0089	0.0089	0.0089
0.0090	0.0090	0.0090
0.0091	0.0091	0.0091
0.0092	0.0092	0.0092
0.0093	0.0093	0.0093
0.0		

REVIEW
REVIEW

Page 1

100-443887-100

Ms. 9.9.

1. SPEED _____ MIN.

SCALE 0-100

1

CONCLUSIONS

1

$$r \frac{X}{N_2} \frac{X}{P_M} \frac{X}{P_{B3} X}$$

Folkenterru

CONFIDENTIAL

DATE 4-20-59

1

Doc. 2007
11-11-2007

Case No. 2449

Figure 2
Diffusive Reflection

H/2-100
 100-100
 100-100
 100-100

CONC. _____ CM
ORIGIN _____
SOLVENT _____

SOLVENT ☐
REF. MgO

NEW OFFICE &

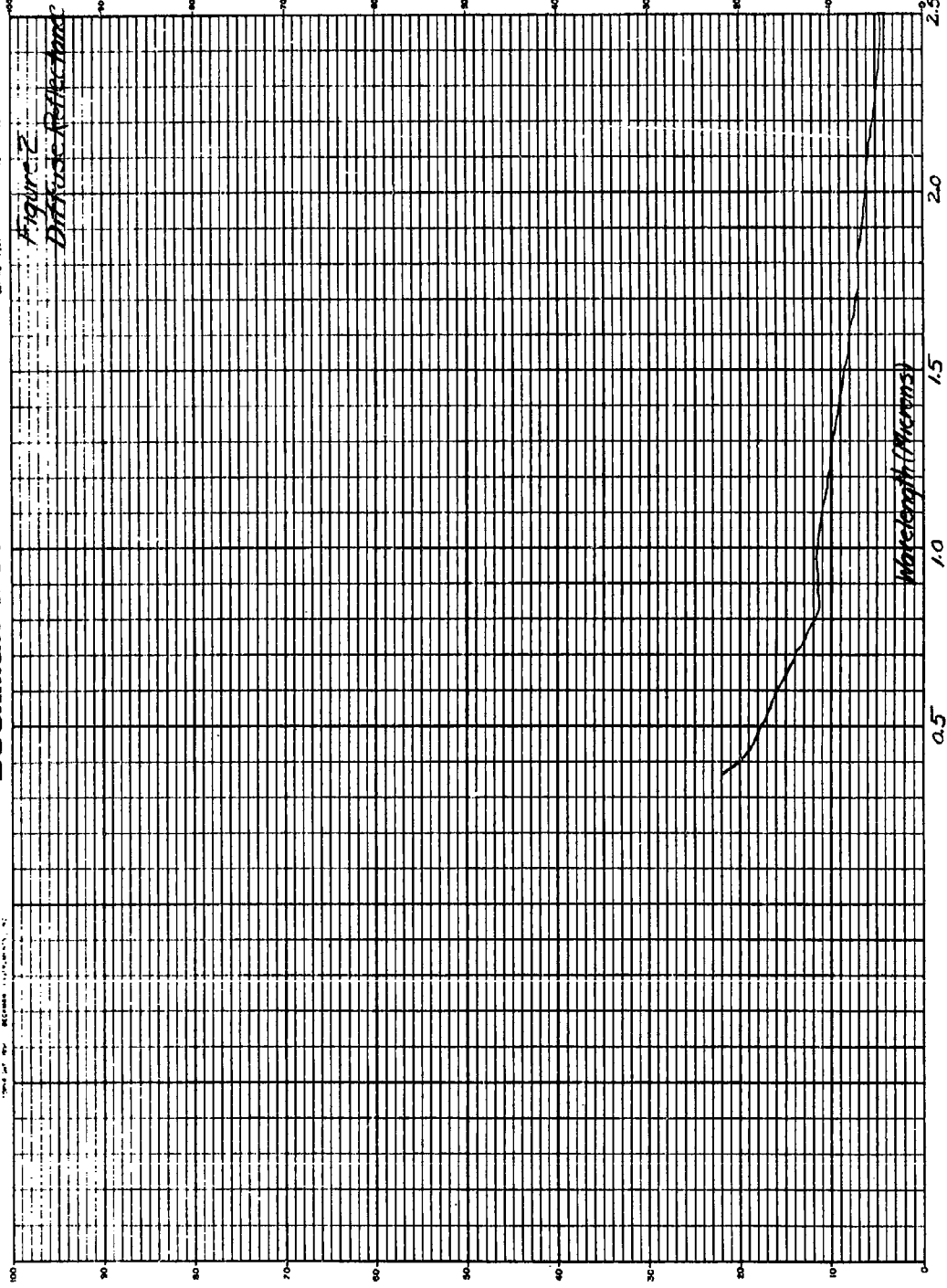
SCALE 0-100

12

PERMCO

2X4X4X4X4X
Falkenberg
ANALYST

DATE 4-20-59



Beckman DK-2 CHART

CONTRACT NO. BECKMAN INSTRUMENTS, INC.

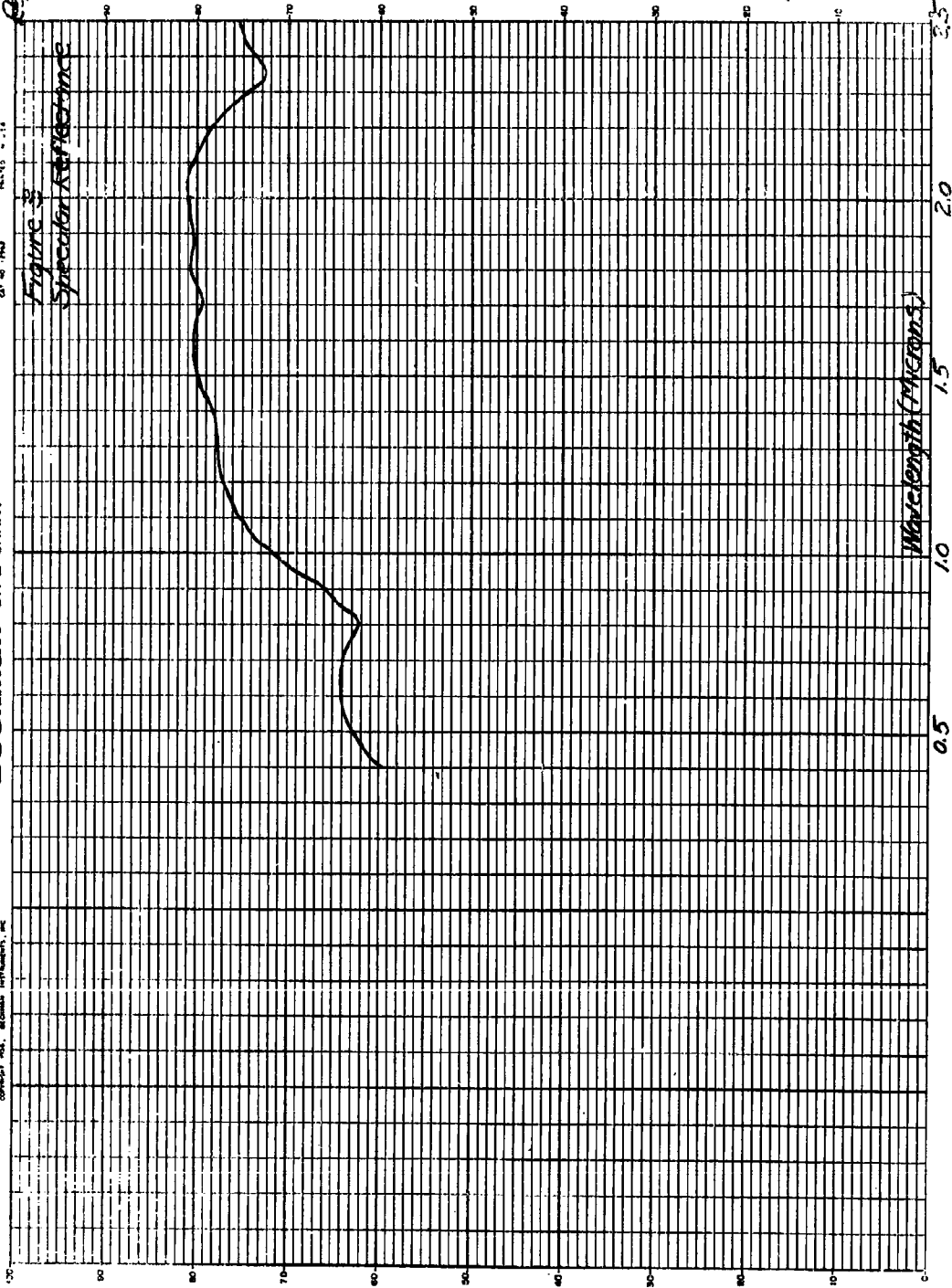
DATE OF RUN

PLATES x .16

Page 4
Report M-59-191

Figure 3
Spectroscopic Absorbance

Sample #130 Chem:
Colored P.S.
Scotchcal
Broad Film



CONC. PATH. CM
ORIGIN
SOLVENT

SOLVENT ☐
REF ☐
MgO₂

1. SPEED

SCALE 0-100

SENS. 12

PERIOD

EXPOSURE

Analyst
Friedkeniery

DATE

ALL INFORMATION CONTAINED
HEREIN IS UNCLASSIFIED

Page 5
Report # M1259-191

Figure 4
Total Resistance

633 Giraffe
Colored P.S.
Scotchcal
Brand Tape

CM
 CONC. NAME
 ORIGIN
 500 VENT

SOLVENT ☐
REF. MgO₂

SECRET

SCALE 0-100

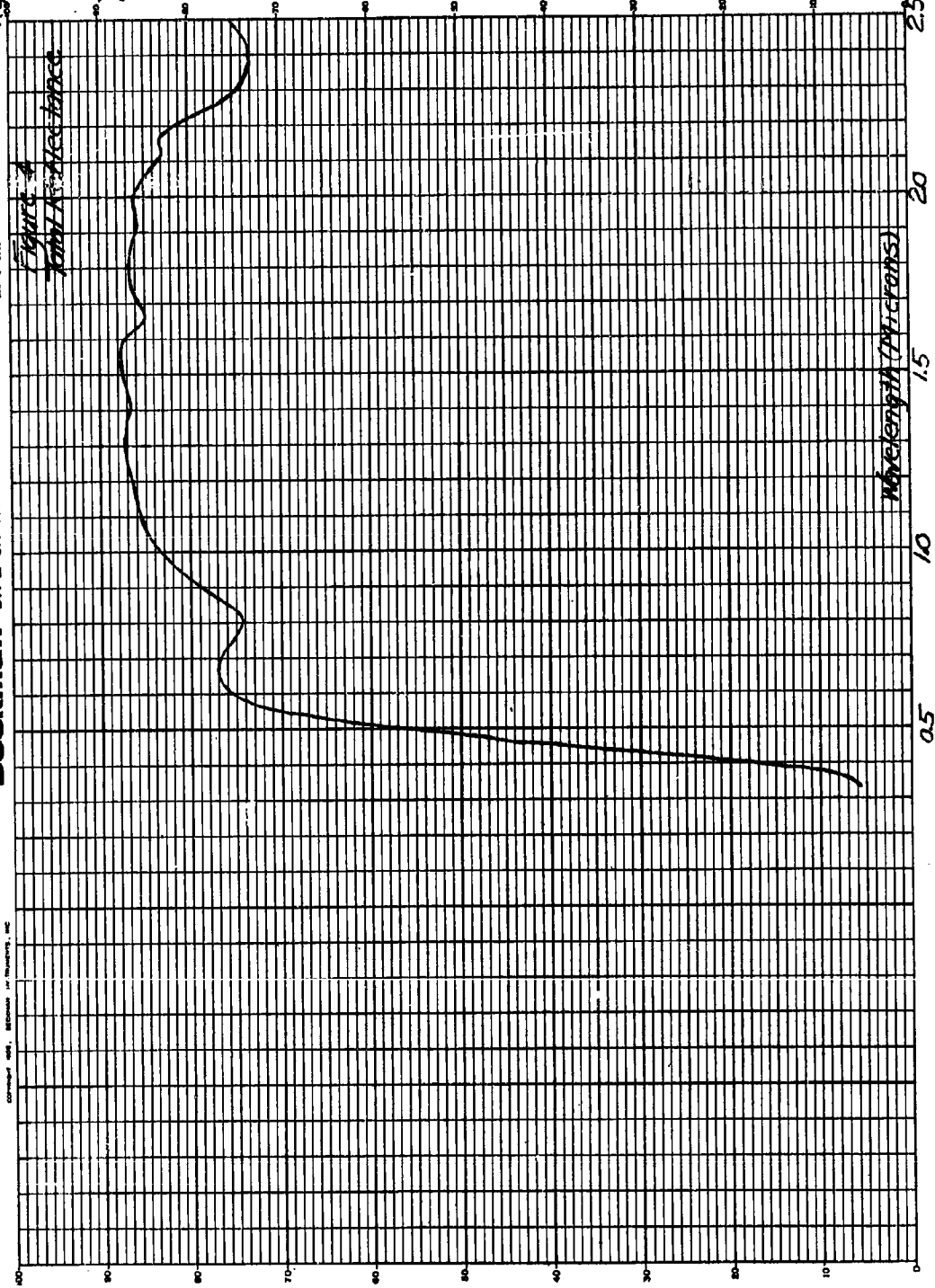
12

PLANO

Хүснэгт 1.1.1

Foulkenberry

DATE 4-20-89



Beckman DK-2 CHART

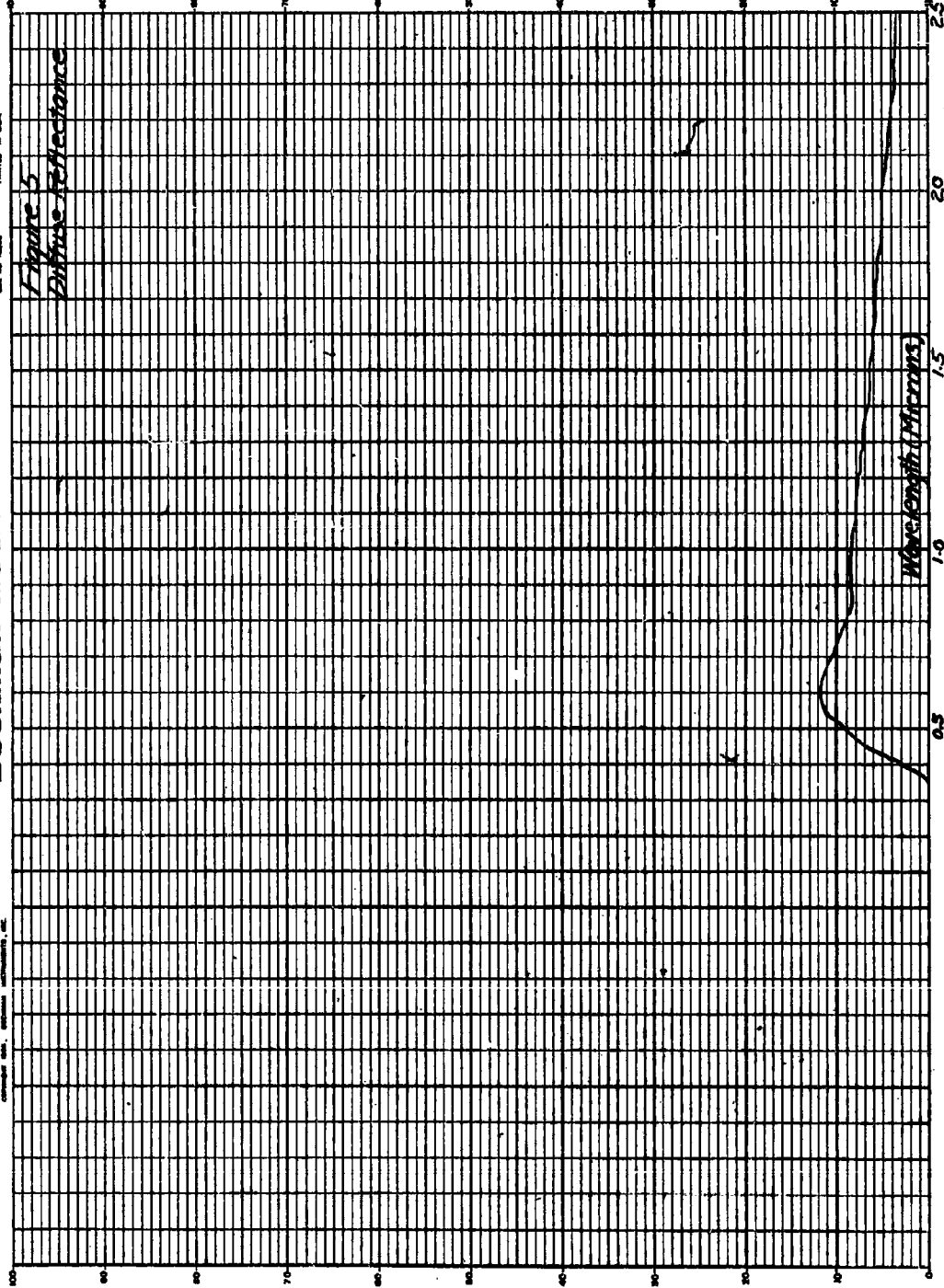
Page 6
Report 19-191

#633 Gold
Colored P.S.
Scotchcal
Brand Film

DATE NO. 191912

COMPARISON DATA, BECKMAN INSTRUMENTS, INC.

PRINTED IN U.S.A.
Figure 5
Diffuse Reflectance



DIFFUSE REFLECTANCE
WAVELENGTH (microns)

SCALE 0-100

WAVELENGTH (microns)

ANALYST

DATE 4-20-59

Beckman DK-2 CHART

CONRAD P. HALL, BECKMAN INSTRUMENTS, INC.

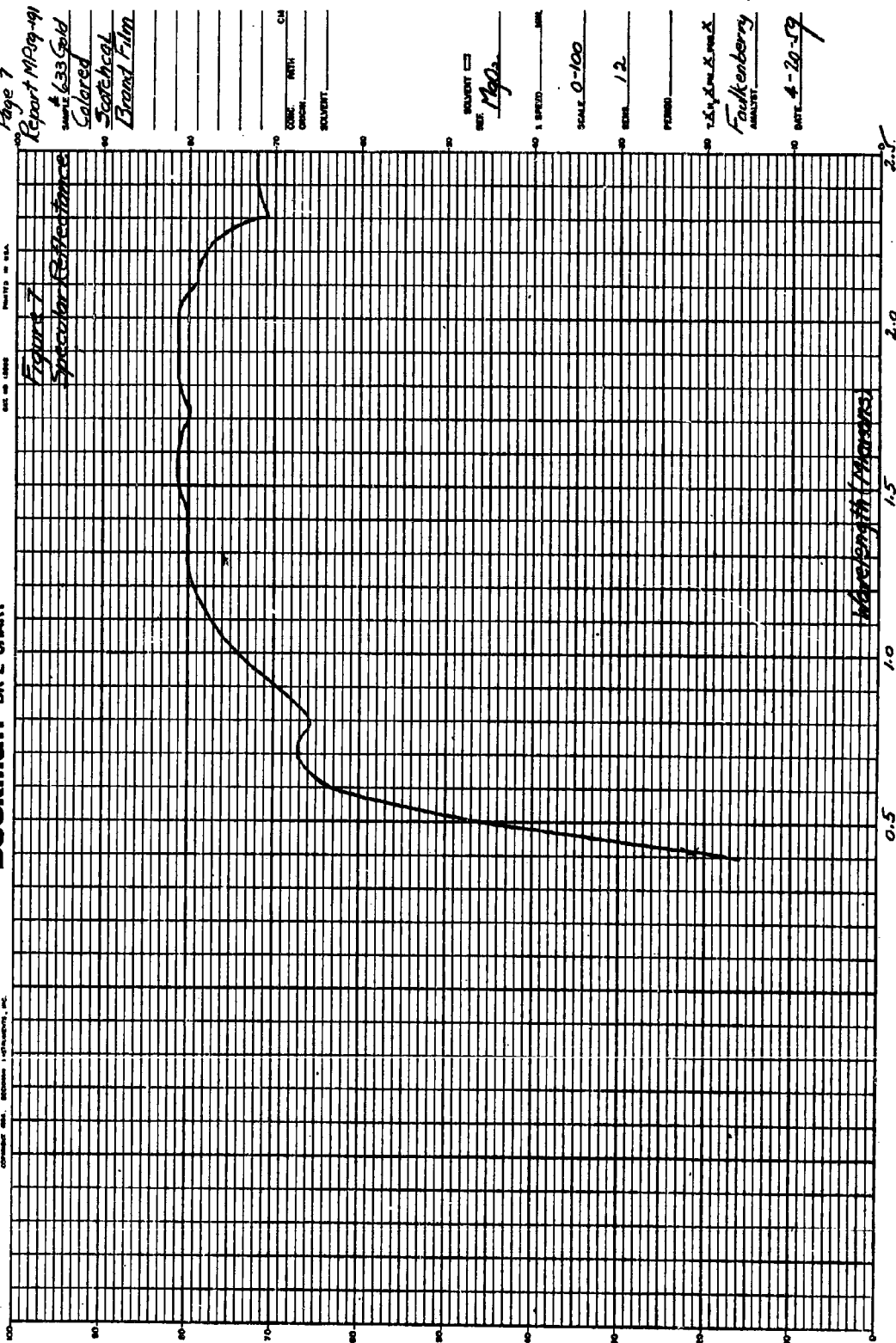
DATE OF ORDER

PAID TO IN U.S.A.

Page 7

Report M29-91
#633 Gold
Colored
Scotchcal
Brand Film

Figure 7
Specular Reflectance



REFLECTANCE

100%

WAVELENGTH (microns)

SCALE 0-100

WAVELENGTH (microns)

WAVELENGTH (microns)

WAVELENGTH (microns)

WAVELENGTH (microns)

WAVELENGTH (microns)

WAVELENGTH (microns)

WAVELENGTH (microns)

WAVELENGTH (microns)

WAVELENGTH (microns)

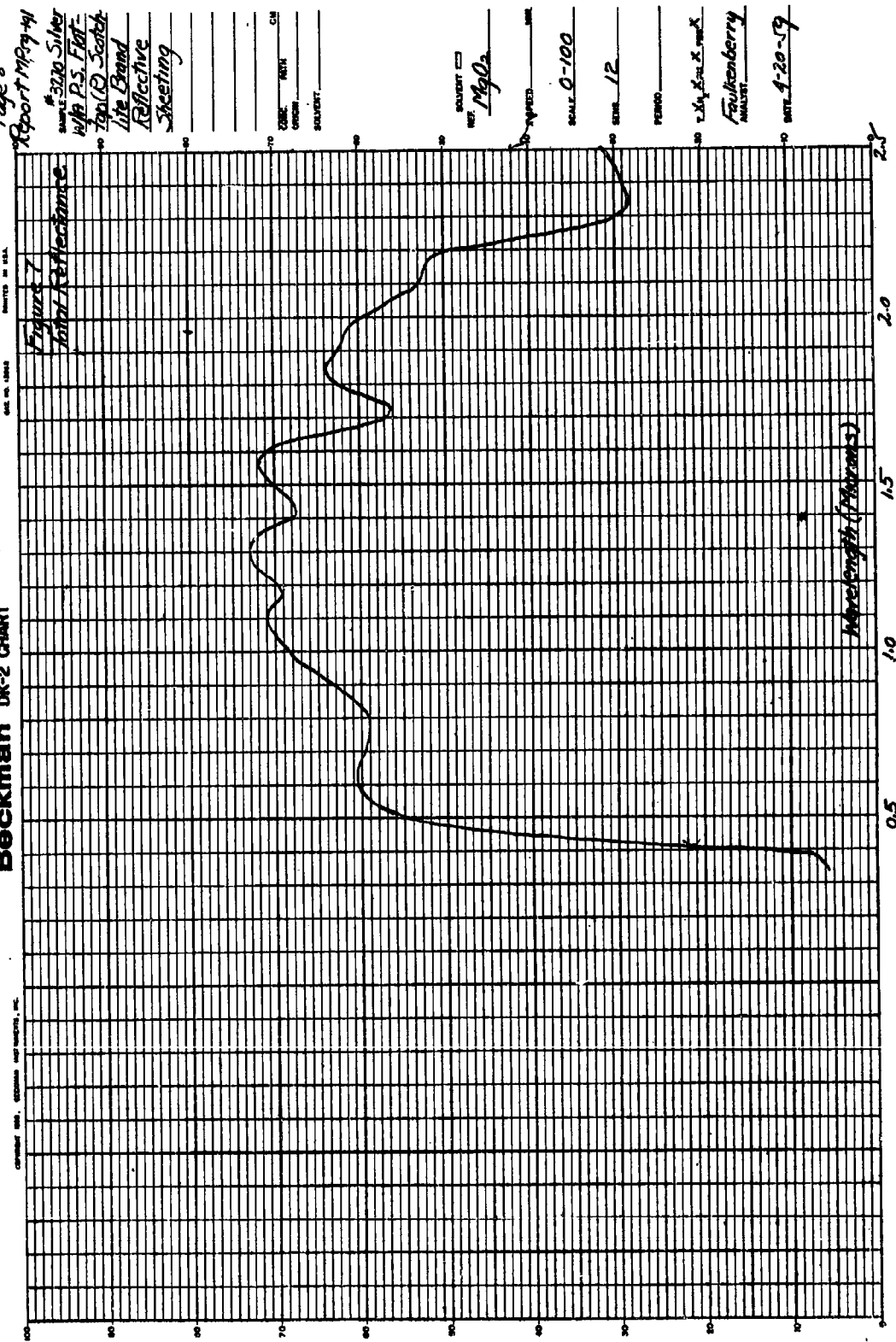
WAVELENGTH (microns)

Beckman DK-2 CHART

Page 8
Report MP39-41

SAMPLE #3220 Silver
with P.S. Flat-
Top (D) Scotch
Life Guard
Reflective
Sheeting

Figure 7
Total Reflectance



ZONE PATH CM
CROWN
SOLVENT

SOLVENT ☐
REF MgO₂

SCALE 0-100

SERIAL 12

PERIOD

ANALYST McLellan, R. W.

ANALYST Falkenberg

DATE 4-20-59

Wavelength (microns)

Page 9
Report MP9-191.

COMPANY: IBM, BUSINESS MACHINES CORP.

DATE NO. 12042

FORM 1041-2 (9-19-74)

Figure 8
Diffuse Reflectance

#3270 Silver
W/PA P.S. Flat
top (R) Scotch
lite Brand
Reflective
Sheeting

CONF. WITH _____
ORIGIN _____
INVENT _____

SOLVENT ☐ MeOH

TESTED **MADE**

SCALE 0-100

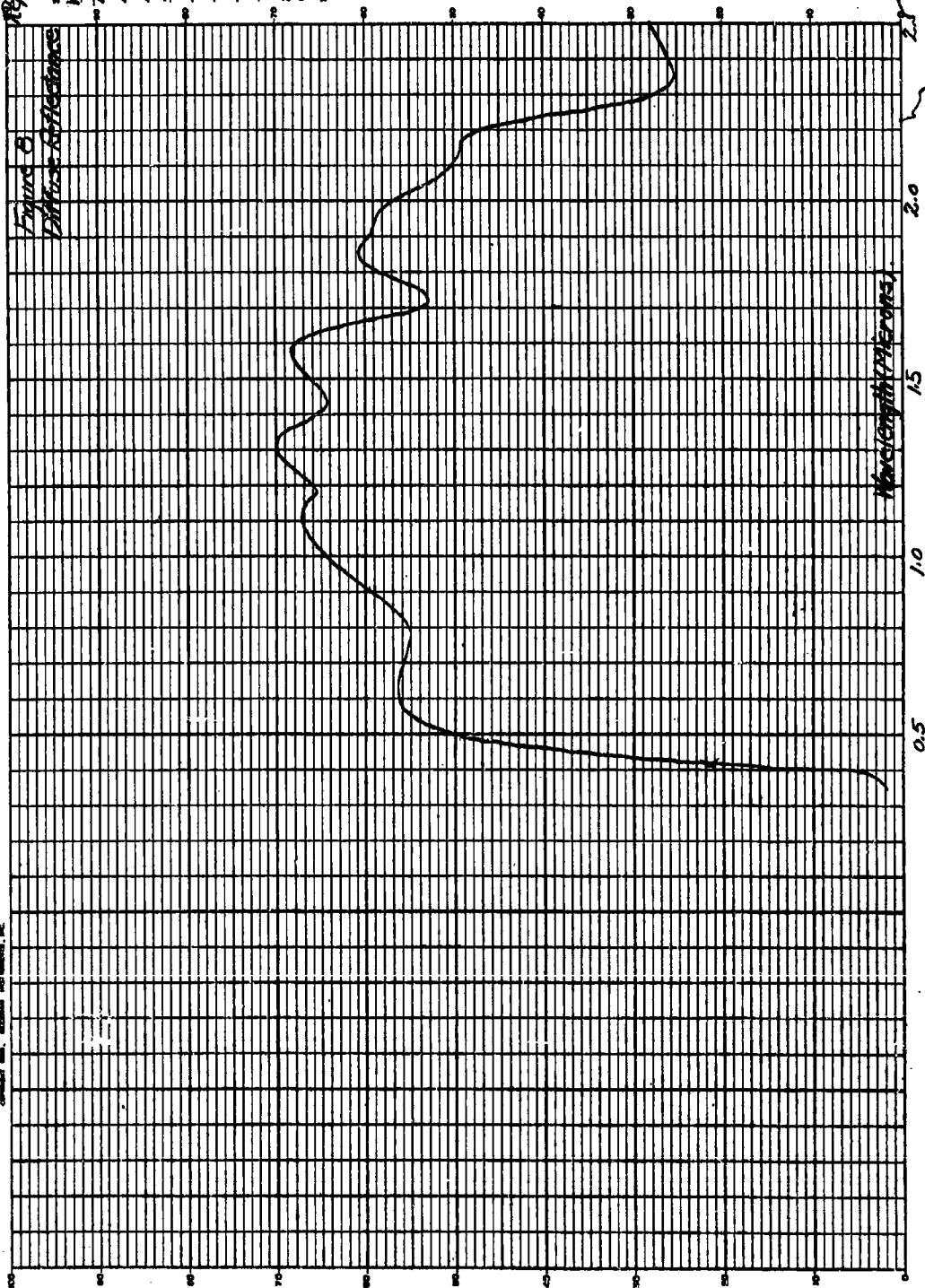
sum. 12.

Principles

TX₁ TX₂ TX₃ TX₄

Foulkenberry

DATE 4-20-59



DATE NO 10042 POWERED IN U.S.A.

Page 10
Report MP 59-14

Figure 9
Specular Reflectance

SAMPLE 5720 Silver
WLA P.S. Scotch
lite Brand
Reflective
Sheeting

CASE
CONC.
PATH
DICOM
SCH VENT

SOLVENT ☐
REF. MgO₂

SECRET

001-0

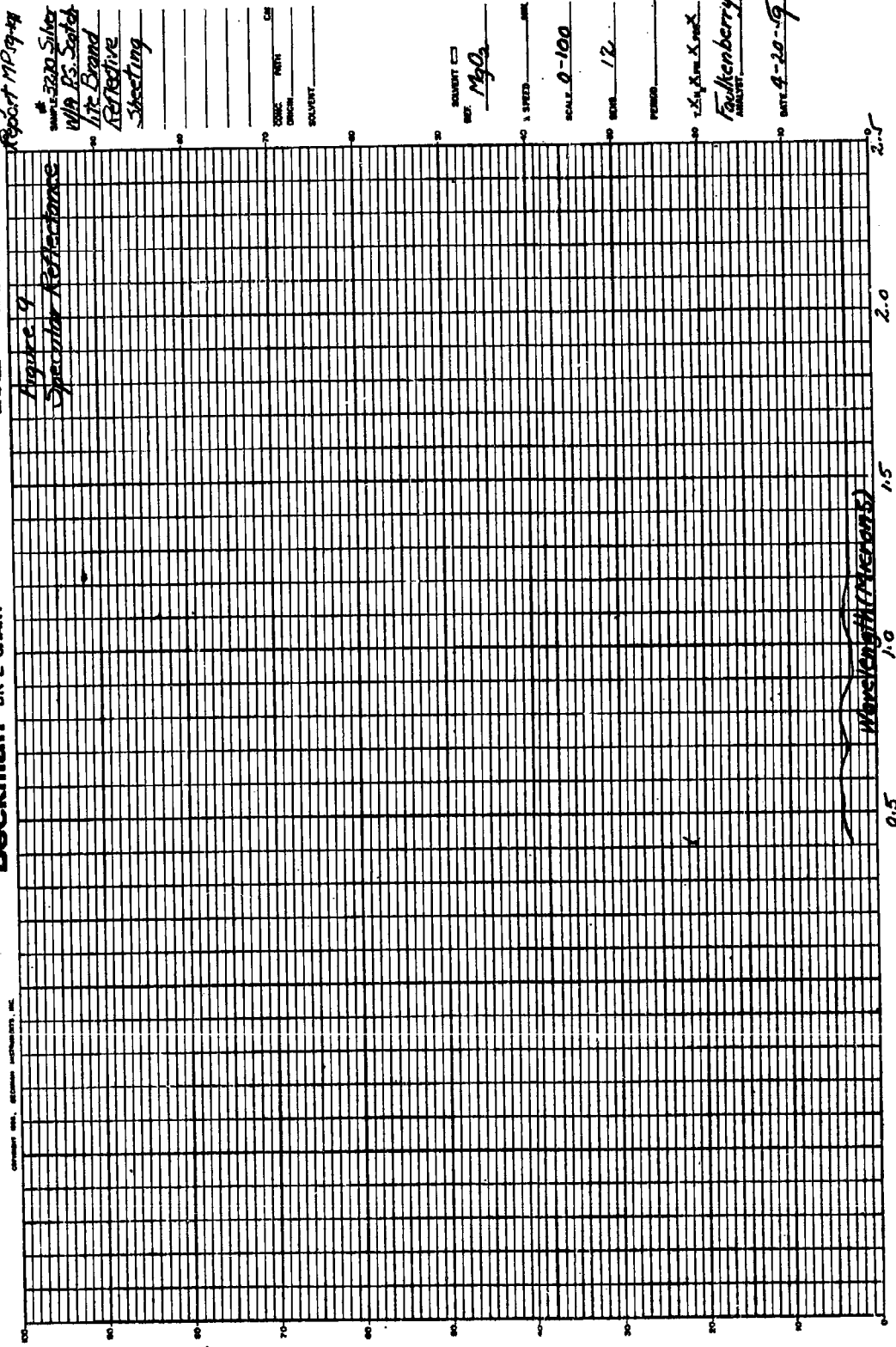
12.

020457

[illegible]

Faulkenberry

DATE 4-20-19



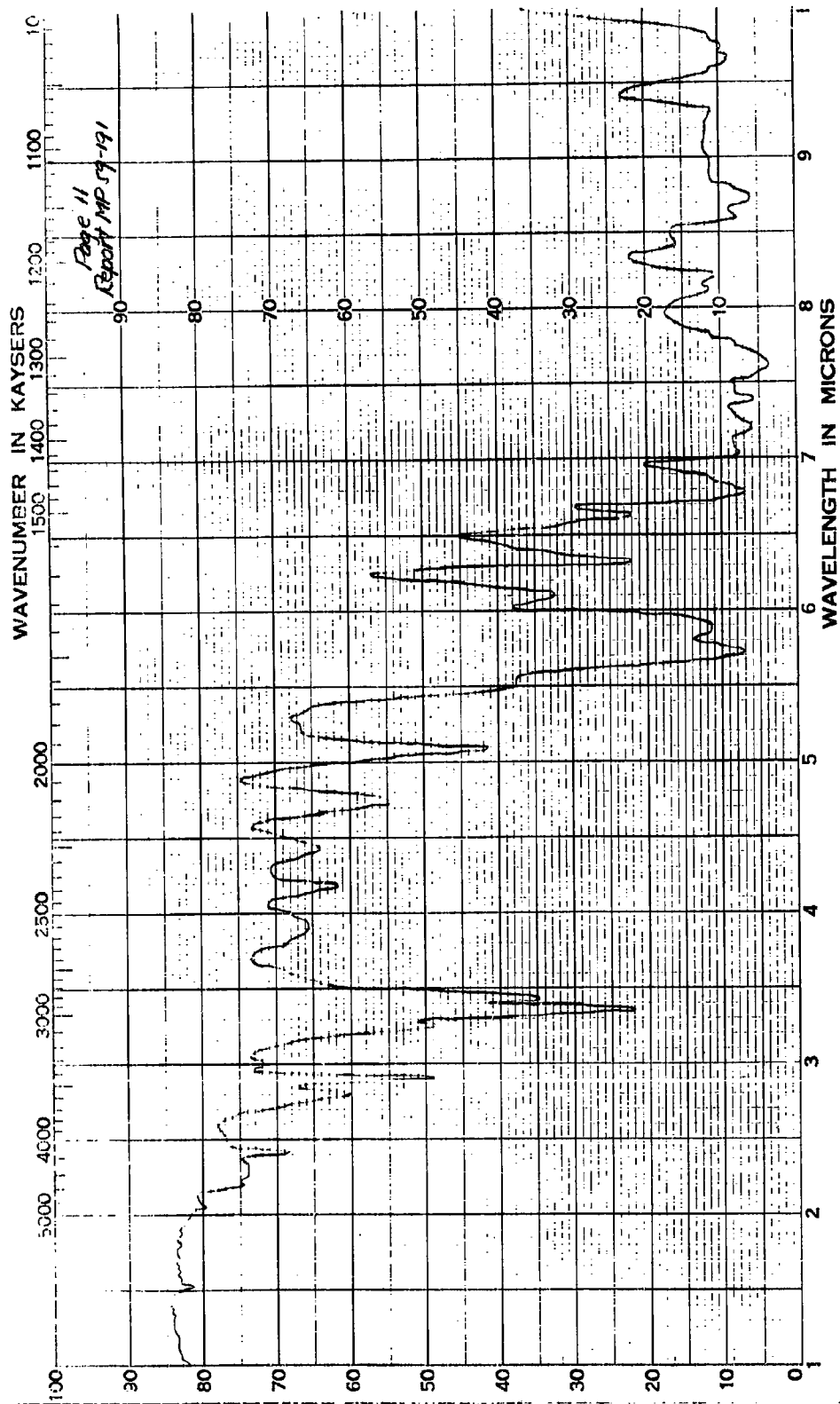


Figure 10
Specular reflection

SAMPLE #130 Chromo colored P.S

Scotchcol Brand Film

Page 11-1
Report MF 59-191

PATH_____mm

SOLVENT _____

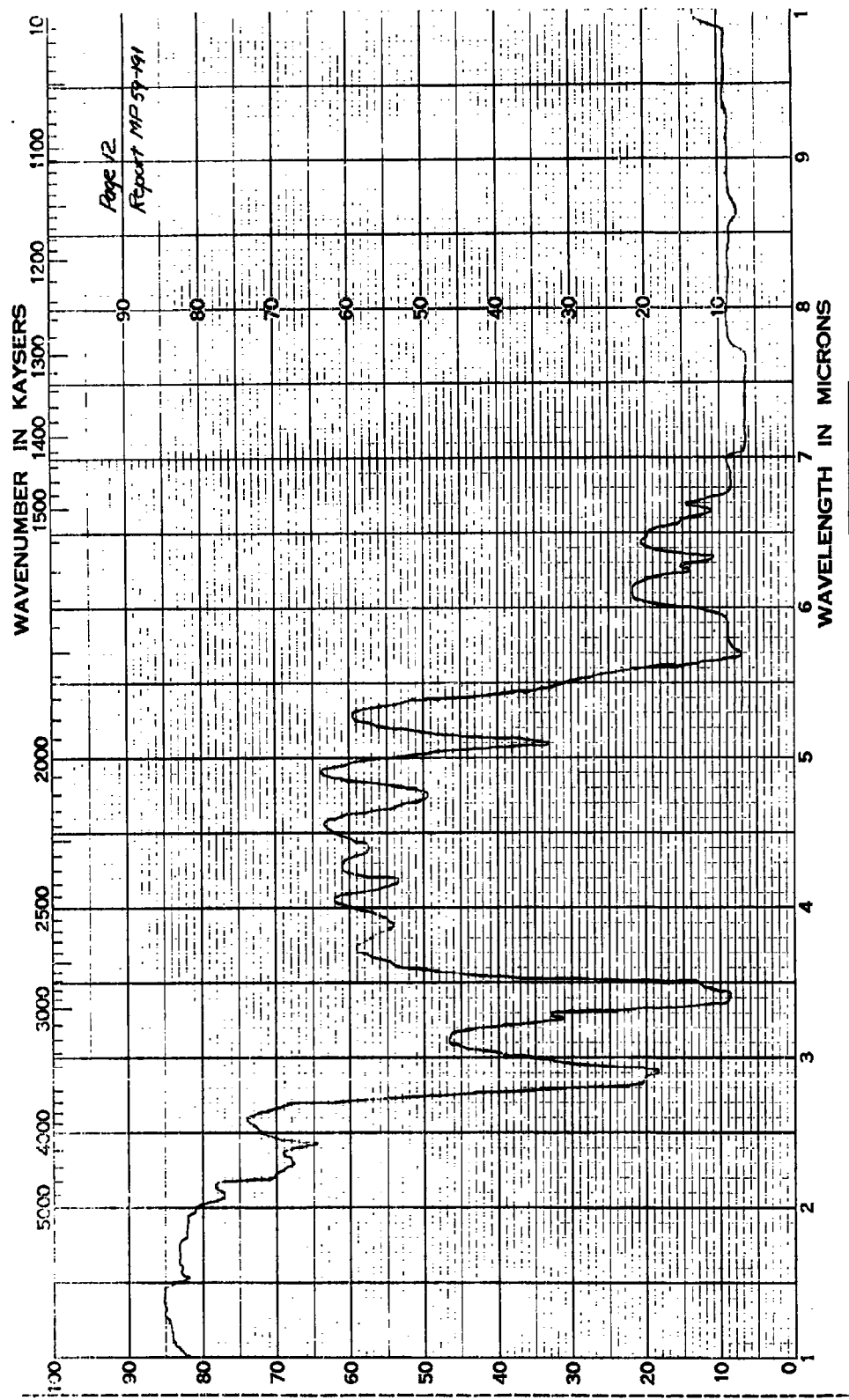
ORIGIN_____

REFERENCE

SOLVENT _____ AIR X

SPEED 54 mm/sec 1 1 1
GAIN 1.3 %
PERIOD 2 SLIT SCHED Sol. 10 μm 75 mm.
ORIGIN SCALE 58 15
NaCl PRISM X DATE 4-20-59
ANALYST bankberry

BECKMAN
SPECTROPHOTOMETER
MODEL IR 4



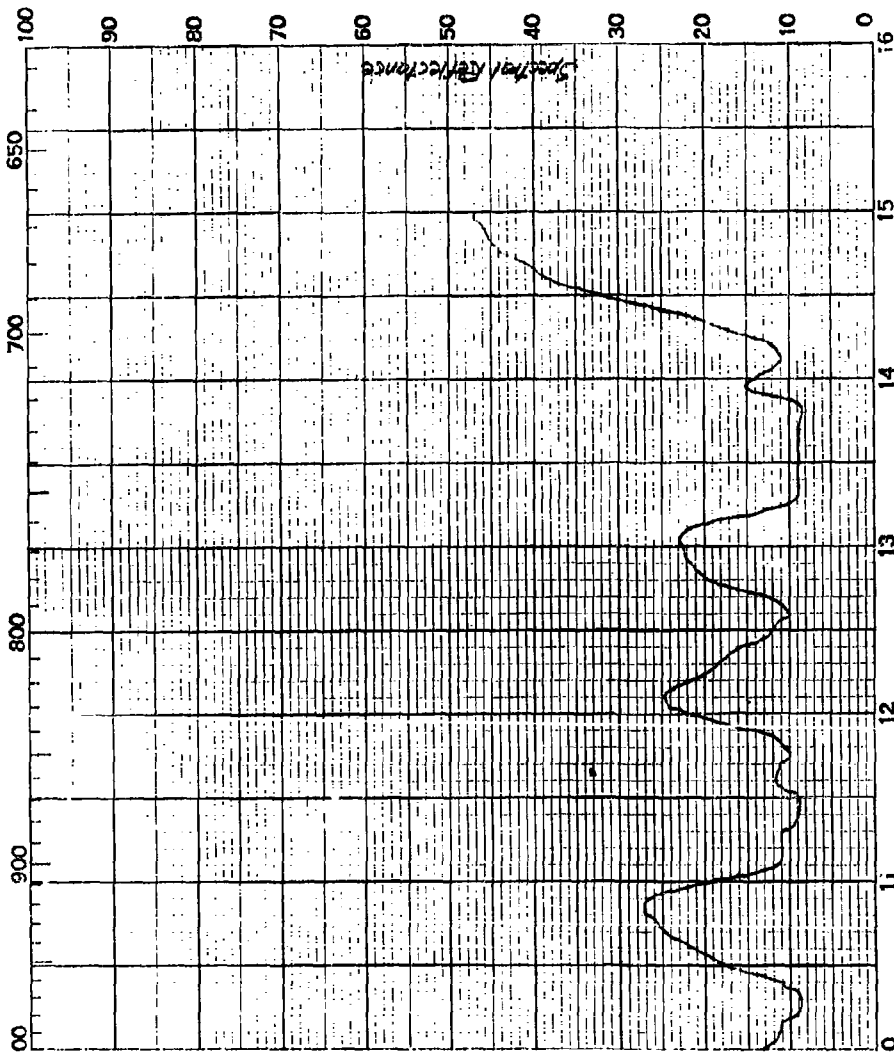


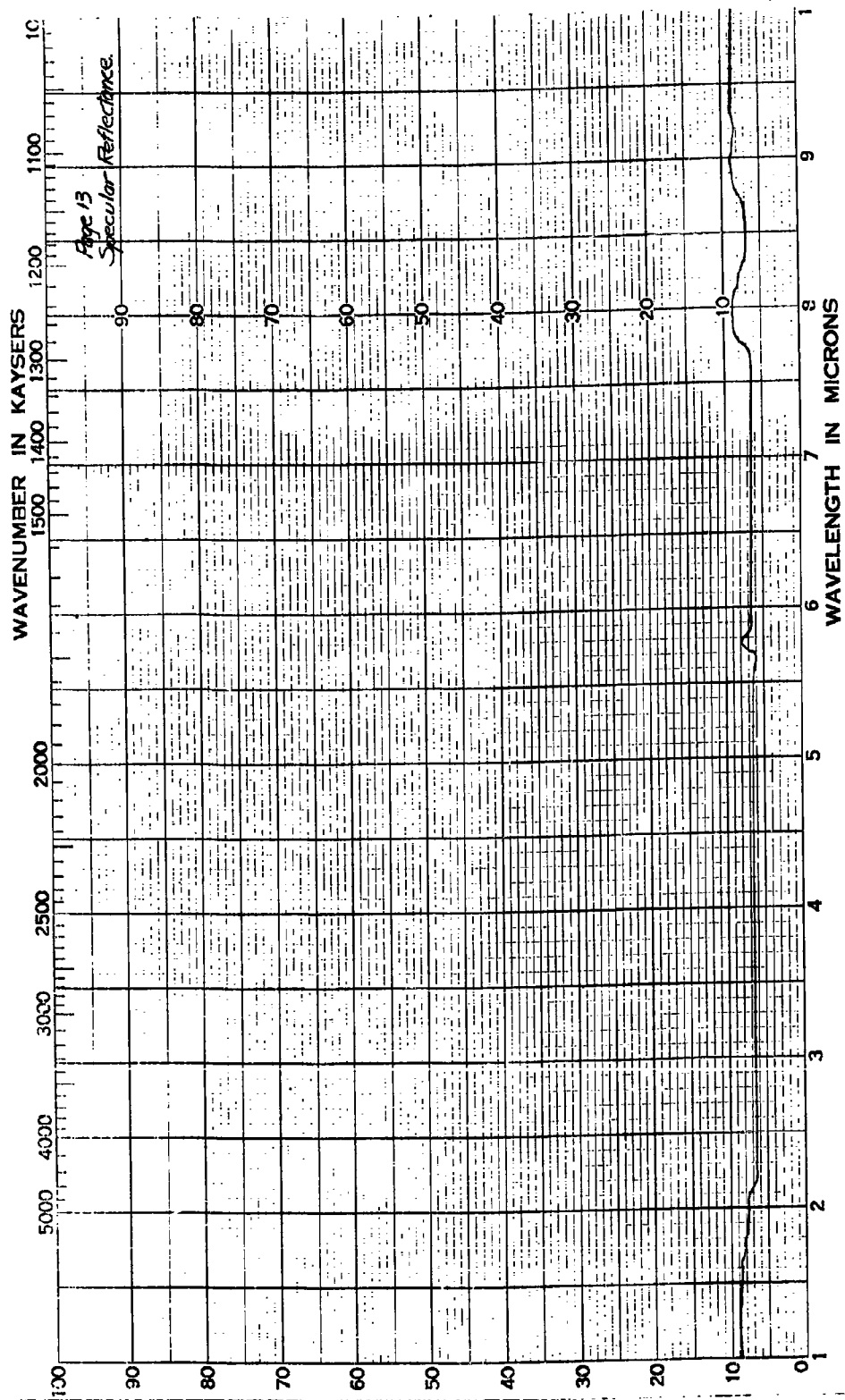
Figure 11
Spectral Reflectance
SAMPLE # 33 Gold Colored Scotch 21
Brand Film Page 12-1
Report # 1459-49

PATH 11mm
SOLVENT
ORIGIN

REFERENCE
SOLVENT AIR X

SPEED 54 /min SCALE 1 100
GAIN 1.3
PERIOD 2 SUT SCHED Set 1000 11 15mm
COORDINATE SCALE SR 10
INCI PRESS DATE 1-20-59
ANALYST Faulkner

BECKMAN
SPECTROPHOTOMETER
MODEL 124



WATER THERMOMETER PREPARED BY CHART NO. 14037-RECOMMENDED BY DECKMAN INSTRUMENTS CO. FOR ANALYSIS OF

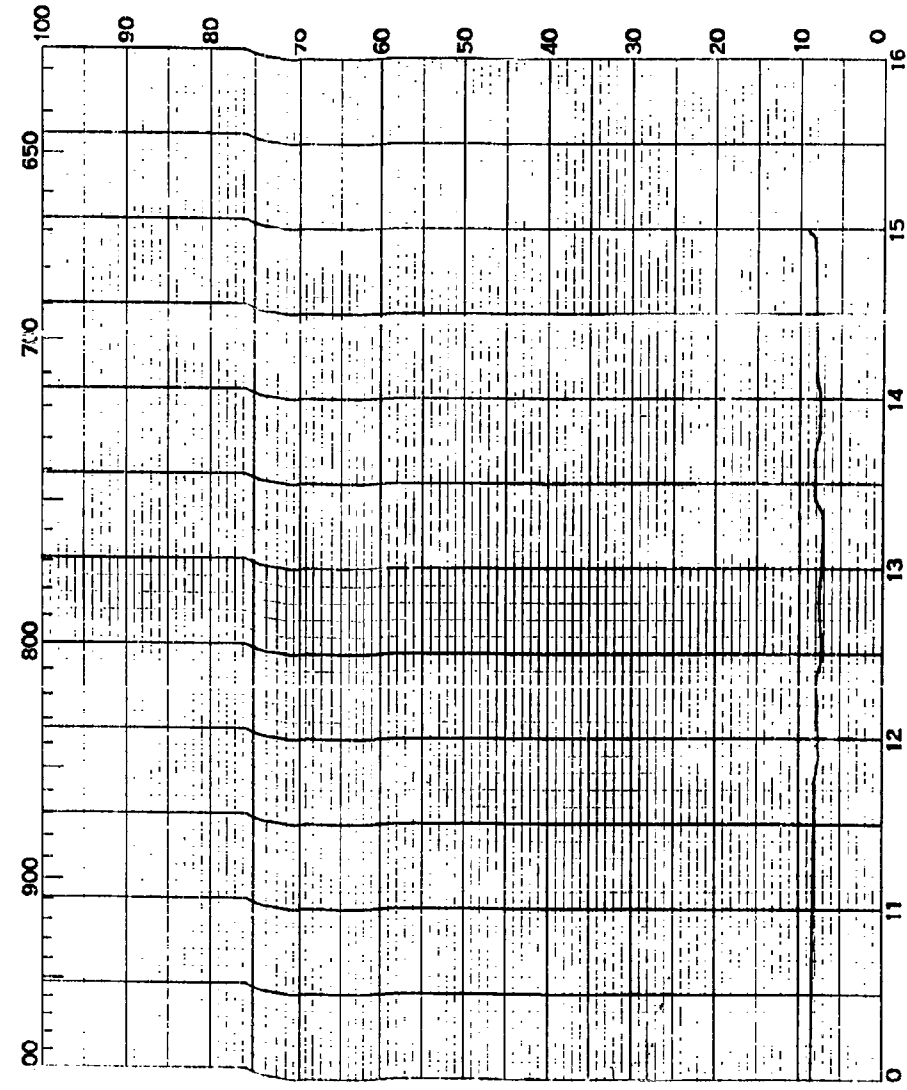


Figure 13
Specular Reflectance
SAMPLE #3230 Silver PS Flat Top
Scotchlite Brand Reflective Sheet
Page 13-1
Report MP-9-191

PATH 11mm
SOLVENT
ORIGIN
REFERENCE
SOLVENT AIR X

SPEED 0.5 mm 1 1"
GAIN 1.5 %
PERIOD 2 SLIT CH 2 mm
ORDINATE SCALE SB DB X
NAD PRISM DATE 4-20-59
ANALYST Faulkenberry

BECKMAN
SPECTROPHOTOMETER
MODEL 1R4

UNCLASSIFIED

UNCLASSIFIED