

REVISION HISTORY

REV.	PAGE	DESCRIPTION	DATE	PREPARED	APPROVED
IR	All	Initial Release for Certification	06/23/16	J. DELAMORA	K. TRAN

NVIS COMPATIBLE LIGHTING SYSTEM COMPONENT TEST DATA SHEET (CTDS)

A. PROJECT INFORMATION

FAA Project No: N/A ADI Project No: N/A ADI W/O No: 15-5561

B. NVIS COMPATIBLE LIGHTING SYSTEM COMPONENT INFORMATION

OEM: Churchill Nav. OEM Part No: Prototype Model No: N/A
 Serial No: N/A LTG MOD No: N/A TSO No: N/A
 Description: ION Digital Video Recorder Type: Radio/GPS/Other Readout

C. NVIS COMPATIBLE LIGHTING SYSTEM COMPONENT DESIGN DATA (As applicable)

DWG No: N/A Rev: N/A Title: N/A

D. NVIS COMPATIBLE LIGHTING SYSTEM COMPONENT TEST PROCEDURE (CTP)

Doc. No: NVIS-CTP-01 Rev: IR Title: NVIS Compatible Lighting System Component Test Procedure (CTP)

1. INTRODUCTION

(Refer to NVIS-CTP-01 §1 for details.)

1.5 QUALITY ASSURANCE (QA) INSPECTION

I hereby certify that an appropriate QA inspection of the lighting component under test meeting the requirements of Aero Dynamix, Inc. QA Manual No. ADI-QAM-01 §8.0 and/or Repair Station QC Manual No. ADI-RSQCM-01 §1.0 was successfully performed.

QA Inspection Completed By:

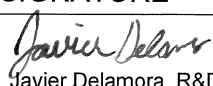
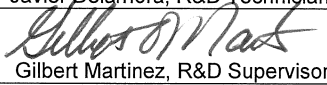
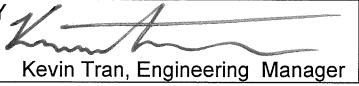
Gilbert Martinez, QC Chief Inspector		06/23/16	
Name, Title	Signature	Date	Stamp

1.6 APPLICABLE STANDARDS

NVIS compatible lighting system component testing was performed against the following standards:

Performance Requirement:	CTP §:	Applicable Standard(s):
Legibility – Daylight per Sunlight or SP-1200	2.3.1	RTCA/DO-275 §3.2.6
Illuminated Color Discernibility – Daylight	2.3.2	RTCA/DO-275 §3.2.8.4
Illuminated Color Uniformity – Daylight	2.3.3	RTCA/DO-275 §3.2.8.4
Legibility – Nighttime per SP-2300	3.3.1	RTCA/DO-275 §3.2.7
Illuminated Color Discernibility – Nighttime	3.3.2	RTCA/DO-275 §3.2.8.4
Illuminated Color Uniformity – Nighttime	3.3.3	RTCA/DO-275 §3.2.8.4
Lighting Uniformity – Nighttime per SP-2400	3.3.4	RTCA/DO-275 §3.2.10
IR Light Leakage per SP-100	4.3.1	RTCA/DO-275 §3.2.9

APPROVALS

SIGNATURE	DATE	 AERO DYNAMIX, INC. 3227 W. EULESS BLVD., EULESS, TEXAS 76040 USA PH: (817) 571-0729 FAX: (817) 283-5432 WWW.AERODYNAMIX.COM		
PREPARED BY  Javier Delamora, R&D Technician	06/23/16			
REVIEWED BY  Gilbert Martinez, R&D Supervisor	06/23/16	NVIS COMPATIBLE LIGHTING SYSTEM COMPONENT TEST DATA SHEET (CTDS)		
APPROVED BY  Kevin Tran, Engineering Manager	06/23/16	CAGE CODE 01FX2	DOCUMENT NO. CTDS-1122	REV. IR

NVG Acuity per SP-2200	4.3.2	RTCA/DO-275 §4.2.1
Failure Modes per SP-2200	4.3.3	RTCA/DO-275 §3.1.8
Luminance per SP-2100	5.3.1	RTCA/DO-275 §3.2.7.1 and Appendix E.7
Illuminance per SP-2100	5.3.2	RTCA/DO-275 §3.2.7.1 and Appendix E.7
NVIS Radiance per SP-3100	5.3.3	RTCA/DO-275 §3.2.8
Chromaticity per SP-3100	5.3.4	RTCA/DO-275 §3.2.8

1.7 BASIC DESIGN CHARACTERISTICS

The NVIS compatible lighting system component under test has the following basic design characteristics:

Characteristic	Value	Characteristic	Value
Material:	Metallic case w/ glass screen	Voltage (VDC):	28
Color/Finish:	Black	Current (A):	N/A (Customer-Provided AC Power Cable)
Dimensions (in):	7.0 x 5.0 x 1.875	Process No:	N/A
Weight (lbs.):	2.5		

2. DAYLIGHT READABILITY INSPECTION

(Refer to NVIS-CTP-01 §2 for details.)

2.2 DAYLIGHT READABILITY INSPECTION SET-UP

Voltage supplied to component for daylight readability inspection: **28 VDC**

2.3.1 LEGIBILITY – DAYLIGHT PER SUNLIGHT OR SP-1200

Lighting Component:	Type:	Method:		Pass	Result:	
		Sunlight	SP-1200		Fail	N/A
Display Screen	E&EO Display	X		X		
Pushbuttons	Primary	X		X		
LED Indicator	Warning Signal	X		X		

2.3.2 ILLUMINATED COLOR DISCERNIBILITY – DAYLIGHT

Lighting Component:	Type:	NVIS Color:	Pass	Result:	
				Fail	N/A
Display Screen	E&EO Display	Multi-Color	X		
Pushbuttons	Primary	NVIS Green A	X		
LED Indicator	Warning Signal	NVIS Red	X		

2.3.3 ILLUMINATED COLOR UNIFORMITY – DAYLIGHT

Lighting Component:	Type:	NVIS Color:	Pass	Result:	
				Fail	N/A
Display Screen	E&EO Display	Multi-Color	X		
Pushbuttons	Primary	NVIS Green A	X		
LED Indicator	Warning Signal	NVIS Red	X		

3. NIGHT UNAIDED READABILITY INSPECTION

(Refer to NVIS-CTP-01 §3 for details.)

3.2 NIGHT UNAIDED READABILITY INSPECTION SET-UP

Voltage supplied to component for night unaided readability inspection: **28 VDC**

3.3.1 LEGIBILITY – NIGHTTIME PER SP-2300

Lighting Component:	Type:	Pass	Result:	
			Fail	N/A
Display Screen	E&EO Display	X		
Pushbuttons	Primary	X		
LED Indicator	Warning Signal	X		

CAGE CODE

01FX2

DOCUMENT NO.

CTDS-1122

REV.

IR

U.S. EXPORT LAWS MAY CONTROL
INFORMATION CONTAINED IN THIS
DOCUMENT AND UNAUTHORIZED
EXPORT OR RE-EXPORT IS PROHIBITED.

THE INFORMATION CONTAINED ON THIS DOCUMENT IS
PROPRIETARY TO AERO DYNAMIX, INC. AND SHALL NOT BE USED
OR REPRODUCED WITHOUT PRIOR WRITTEN CONSENT.

PAGE

2 OF 5

3.3.2 ILLUMINATED COLOR DISCERNIBILITY – NIGHTTIME

Lighting Component:	Type:	NVIS Color:	Result:		
			Pass	Fail	N/A
Display Screen	E&EO Display	Multi-Color	X		
Pushbuttons	Primary	NVIS Green A	X		
LED Indicator	Warning Signal	NVIS Red	X		

3.3.3 ILLUMINATED COLOR UNIFORMITY – NIGHTTIME

Lighting Component:	Type:	NVIS Color:	Result:		
			Pass	Fail	N/A
Display Screen	E&EO Display	Multi-Color	X		
Pushbuttons	Primary	NVIS Green A	X		
LED Indicator	Warning Signal	NVIS Red	X		

3.3.4 LIGHTING UNIFORMITY – NIGHTTIME PER SP-2400

Lighting Component:	Type:	Result:		
		Pass	Fail	N/A
Display Screen	E&EO Display	X		
Pushbuttons	Primary	X		
LED Indicator	Warning Signal	X		

4. NIGHT NVG COMPATIBILITY INSPECTION

(Refer to NVIS-CTP-01 §4 for details.)

4.2.2 EQUIPMENT SET-UPVoltage supplied to component for night NVG compatibility inspection: **28 VDC****Night Vision Goggle and Monocular Information:**

Inspector:	OEM:	Model:	P/N:	S/N:	Due Date of Next Re-Cert:
Gilbert	Gen III	MV-14	MV-14	006378 (QC-220)	07-30-16
Gilbert	L-3	M949KC-001	245080-004	660897 (QC-262)	07-30-16

4.3.1 IR LIGHT LEAKAGE CHECK PER SP-100

Lighting Component:	Type:	Result:		
		Pass	Fail	N/A
Display Screen	E&EO Display	X		
Pushbuttons	Primary	X		
LED Indicator	Warning Signal	X		

4.3.2 NVG ACUITY CHECK PER SP-2200

Lighting Component:	Type:	Result:		
		Pass	Fail	N/A
Display Screen	E&EO Display	X		
Pushbuttons	Primary	X		
LED Indicator	Warning Signal	X		

4.3.3 FAILURE MODE CHECK PER SP-2200

Lighting Component:	Type:	Result:		
		Pass	Fail	N/A
Display Screen	E&EO Display	X		
Pushbuttons	Primary			X
LED Indicator	Warning Signal			X

CAGE CODE

01FX2

DOCUMENT NO.

CTDS-1122

REV.

IR

U.S. EXPORT LAWS MAY CONTROL
INFORMATION CONTAINED IN THIS
DOCUMENT AND UNAUTHORIZED
EXPORT OR RE-EXPORT IS PROHIBITED.

THE INFORMATION CONTAINED ON THIS DOCUMENT IS
PROPRIETARY TO AERO DYNAMIX, INC. AND SHALL NOT BE USED
OR REPRODUCED WITHOUT PRIOR WRITTEN CONSENT.

PAGE

3 OF 5

5. SPECTRORADIOMETER & PHOTOMETER INSPECTION

(Refer to NVIS-CTP-01 §5 and attached Appendix 1 for details.)

5.2.2 EQUIPMENT SET-UP

Voltage supplied to component for spectroradiometer & photometer inspection: **28 VDC**

Spectroradiometer & Photometer Information:

<u>Inspector:</u>	<u>OEM:</u>	<u>Model:</u>	<u>P/N:</u>	<u>S/N:</u>	<u>Due Date of Next Re-Cert:</u>
Gilbert	Inst. Sys.	CAS140CT-153	CAS140CT-153	472714213 (QC-360)	09-02-16
Gilbert	L-3	M949KC-001	245080-004	660897 (QC-262)	07-30-16

5.3.1 LUMINANCE PER SP-2100

Lighting Component:	Type:	<u>Luminance (fL):</u>		Measurement:	Pass	<u>Result:</u>	
		Day	Night			Fail	N/A
Display Screen	E&EO Display						X
Pushbuttons	Primary						X
LED Indicator	Warning Signal						X

5.3.2 ILLUMINANCE PER SP-2100

Lighting Component:	Type:	<u>Illuminance (fc):</u>		Measurement:	Pass	<u>Result:</u>	
		Min	Max			Fail	N/A
Display Screen	E&EO Display						X
Pushbuttons	Primary						X
LED Indicator	Warning Signal						X

5.3.3 NVIS RADIANCE PER SP-3100

Lighting Component:	Type:	<u>NVIS Radiance (NR_B):</u>		Measurement:	Pass	<u>Result:</u>	
		Min	Max			Fail	N/A
Display Screen	E&EO Display (Max)	N/A	$1.100 \times 10^{-8} \text{ NR}_B$	$2.024 \times 10^{-9} \text{ NR}_B$	X		
Display Screen	E&EO Display (White)	N/A	$2.200 \times 10^{-9} \text{ NR}_B$	$4.226 \times 10^{-9} \text{ NR}_B$		X*	
Pushbuttons	Primary	N/A	$1.700 \times 10^{-10} \text{ NR}_B$	$2.387 \times 10^{-11} \text{ NR}_B$	X		
LED Indicator	Warning Signal	$4.700 \times 10^{-8} \text{ NR}_B$	$1.400 \times 10^{-7} \text{ NR}_B$	$2.073 \times 10^{-8} \text{ NR}_B$		X*	

5.3.4 CHROMATICITY PER SP-3100

Lighting Component:	Type:	NVIS Color:	Measurement:	Pass	<u>Result:</u>	
					Fail	N/A
Display Screen	E&EO Display	Multi-Color	N/A			X
Pushbuttons	Primary	NVIS Green A	$u'=0.081, v'=0.575$	X		
LED Indicator	Warning Signal	NVIS Red	$u'=0.328, v'=0.551$		X*	

*See §7.2 for mitigating factors.

CAGE CODE

01FX2

DOCUMENT NO.

CTDS-1122

REV.

IR

U.S. EXPORT LAWS MAY CONTROL
INFORMATION CONTAINED IN THIS
DOCUMENT AND UNAUTHORIZED
EXPORT OR RE-EXPORT IS PROHIBITED.

THE INFORMATION CONTAINED ON THIS DOCUMENT IS
PROPRIETARY TO AERO DYNAMIX, INC. AND SHALL NOT BE USED
OR REPRODUCED WITHOUT PRIOR WRITTEN CONSENT.

PAGE

4 OF 5

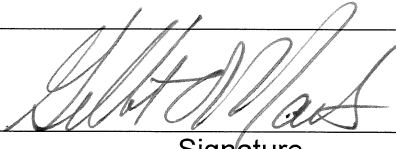
6. CERTIFICATION
(Refer to NVIS-CTP-01 §6 for details.)

I hereby certify that the Component Test Procedure (CTP) documented herein was conducted to the best of my ability, that the results presented herein are accurate to the best of my knowledge, and that the component under test met the qualitative and quantitative NVIS lighting performance standards listed in Sections 1.6, 1.7, 2, 3, 4, 5, and Appendix 1 to the extent specified below:

Component Test Results:

	PASS – Component under test meets or exceeds all qualitative and quantitative NVIS lighting requirements specified in this document.
X	MARGINAL PASS – Component under test meets or exceeds all qualitative NVIS lighting performance requirements of Sections 1.6, 1.7, 2, 3, and 4, but does not meet all quantitative requirements of Section 5 and Appendix 1. In accordance with RTCA/DO-275 §3.2.8, MIL-L-85762A §3.4, and MIL-STD-3009 §C.5.2, this component's deviation from quantitative requirements is acceptable based on the qualitative results. Refer to Section 7 for a description of any failures.
	FAIL – Component under test does not meet all qualitative and quantitative NVIS lighting performance requirements specified in this document. Refer to Section 7 for a description of any failures.

Component Testing Completed By:

Gilbert Martinez, QC Chief Inspector Name, Title	 Signature	06/23/16 Date
--	---	-------------------------

7. INSPECTION NOTES
(Refer to NVIS-CTP-01 §7 for details.)

7.1 PIN-OUTS & MANUALS

- A customer-provided power supply (AC outlet) was used to power the unit.

7.2 LIMITATIONS & FAILURES

- The component is intended to be used in conjunction with an aircraft NVIS compatible lighting system.
- The display screen slightly exceeded the maximum NVIS radiance limit for E&EO Displays (White) and the LED Indicator slightly exceeded the minimum NVIS radiance limit for Warning Signals, so a qualitative NVG acuity test was performed in a dark room using NVGs, an illuminator producing 0.17 lux at a distance of 12 inches, and a 1951 USAF High Contrast Tri-Bar Resolution Chart located 20 feet away to simulate an aircraft-level evaluation in accordance with RTCA/DO-275. No resolution element losses were observed for this modified E&EO display; therefore, the unit passed the qualitative evaluation. A qualitative assessment is allowed by RTCA/DO-275 §3.2.8 for units that do not explicitly meet the quantitative requirements of each specification on a component level but are able to pass on the aircraft level during a qualitative evaluation using NVGs.
- The LED indicator slightly deviated from the designated chromaticity range, but it remains readily identifiable and distinguishable qualitatively during day and night conditions. Therefore, this deviation is acceptable in accordance with RTCA/DO-275 §3.2.8.4.

7.3 COLORS & CHROMATICITY

- Display is multi-color; pushbuttons are NVIS Green A; LED indicator is NVIS Red.

7.4 OTHER NOTES

- N/A

--- End of Data ---

CAGE CODE	DOCUMENT NO.	REV.
01FX2	CTDS-1122	IR
THE INFORMATION CONTAINED ON THIS DOCUMENT IS PROPRIETARY TO AERO DYNAMIX, INC. AND SHALL NOT BE USED OR REPRODUCED WITHOUT PRIOR WRITTEN CONSENT.		PAGE 5 OF 5

U.S. EXPORT LAWS MAY CONTROL
INFORMATION CONTAINED IN THIS
DOCUMENT AND UNAUTHORIZED
EXPORT OR RE-EXPORT IS PROHIBITED.

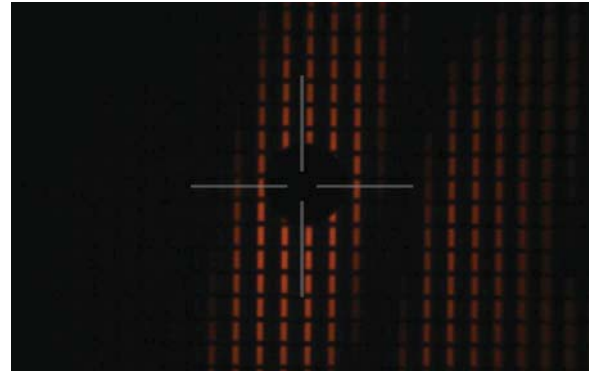


Measurement Conditions

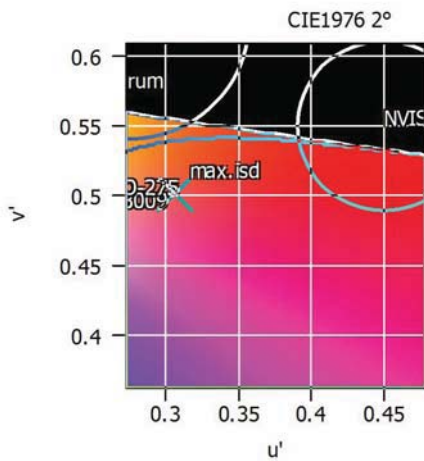
Analysis range: 377.9 - 1041 nm
 Integration time: 1232 ms
 Averages: 1
 Density filter: N/A
 Signal Level: 77 % 23821 Counts

Specification: RTCA/DO-275

Type: TYPE I
 Class: CLASS B
 Device: E&EO-display (max)



Results



Integrals

Luminance: 4.64 fL

Color Coordinates

x: 0.4732 u: 0.3067 u': 0.3067
 y: 0.3432 v: 0.3336 v': 0.5004

NVIS-A	4.092E-007 W/(cm ² sr)	NVIS-B	1.878E-008 W/(cm ² sr)	NVIS-C	1.874E-009 W/(cm ² sr)
ref [fl]	0.5 fL	ref [fl]	0.5 fL	ref [fl]	0.5 fL
scaled	4.409E-008 W/(cm ² sr)	scaled	2.024E-009 W/(cm ² sr)	scaled	2.019E-010 W/(cm ² sr)

Pass/Fail

Result	Value	Min	Max	Pass/Fail
Signal Level	77 %	15 %	99 %	PASS
NVISRadiance	2.024E-009 W/(cm ² sr)	0.000E+000 W/(cm ² sr)	1.100E-008 W/(cm ² sr)	PASS

Comment: Apt: 0.5mm Lens: NVIS HR
 Red Fault LED + Dark Display Filter
 Churchill Ion DVR S/N: Prototype
 Meas: (I)ON top left

Date: 6/23/2016 2:58:34 PM

Measurement Report - NVIS

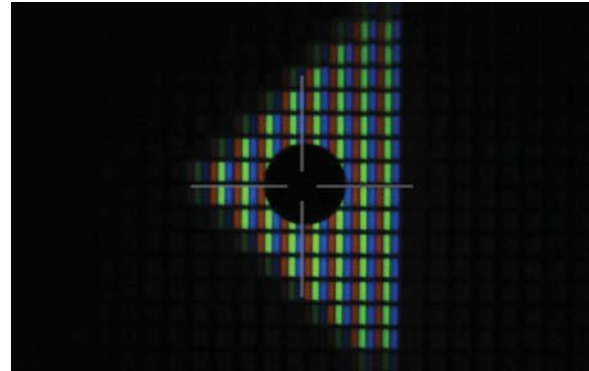


Measurement Conditions

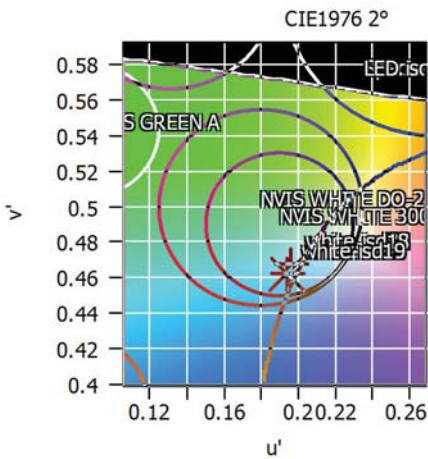
Analysis range: 377.9 - 1041 nm
 Integration time: 462 ms
 Averages: 1
 Density filter: N/A
 Signal Level: 90 % 27696 Counts

Specification: RTCA/DO-275

Type: TYPE I
 Class: CLASS B
 Device: E&EO-display (white)



Results



Integrals

Luminance: 16.3 fL

Color Coordinates

x: 0.3031 u: 0.1941 u': 0.1941
 y: 0.3212 v: 0.3084 v': 0.4627

NVIS-A	5.720E-007 W/(cm ² sr)	NVIS-B	1.377E-007 W/(cm ² sr)	NVIS-C	2.945E-008 W/(cm ² sr)
ref [fL]	0.5 fL	ref [fL]	0.5 fL	ref [fL]	0.5 fL
scaled	1.755E-008 W/(cm ² sr)	scaled	4.226E-009 W/(cm ² sr)	scaled	9.036E-010 W/(cm ² sr)

Pass/Fail

Result	Value	Min	Max	Pass/Fail
Signal Level	90 %	15 %	99 %	PASS
NVISRadiance	4.226E-009 W/(cm ² sr)	0.000E+000 W/(cm ² sr)	2.200E-009 W/(cm ² sr)	FAIL

Comment: Apt: 0.8mm Lens: NVIS HR
 Red Fault LED + Dark Display Filter
 Churchill Ion DVR S/N: Prototype
 Meas:left arrow in panel brightness page

Date: 6/22/2016 10:50:11 AM

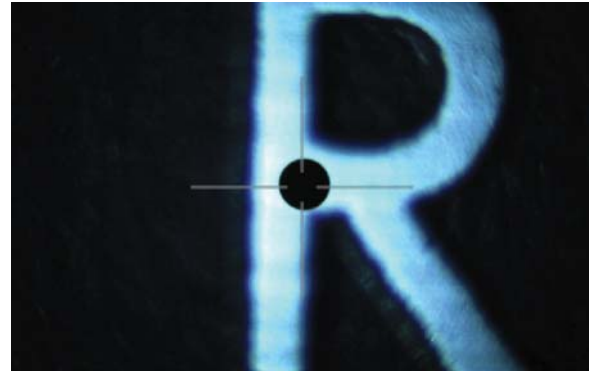


Measurement Conditions

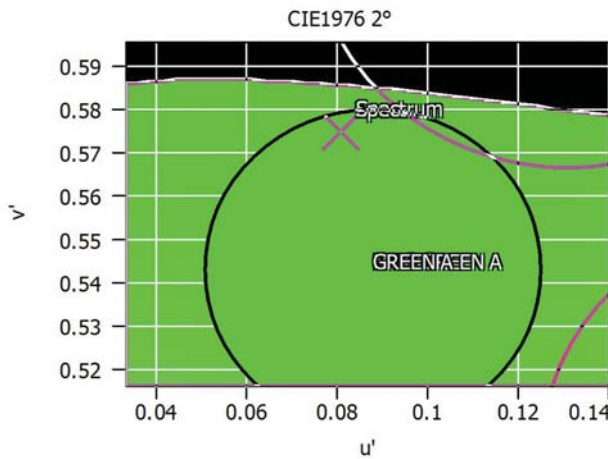
Analysis range: 377.9 - 1041 nm
 Integration time: 7404 ms
 Averages: 1
 Density filter: N/A
 Signal Level: 82 % 25354 Counts

Specification: RTCA/DO-275

Type: TYPE I
 Class: CLASS B
 Device: Primary GREEN A



Results



Integrals

Luminance: 1.605 fL

Color Coordinates

x: 0.2207 u: 0.0807 u': 0.0807
 y: 0.6982 v: 0.3830 v': 0.5745

NVIS-A	1.389E-009 W/(cm ² sr)	NVIS-B	3.830E-010 W/(cm ² sr)	NVIS-C	1.675E-009 W/(cm ² sr)
ref [fL]	0.1 fL	ref [fL]	0.1 fL	ref [fL]	0.1 fL
scaled	8.655E-011 W/(cm ² sr)	scaled	2.387E-011 W/(cm ² sr)	scaled	1.044E-010 W/(cm ² sr)

Pass/Fail

Result	Value	Min	Max	Pass/Fail
Signal Level	82 %	15 %	99 %	PASS
NVISRadiance	2.387E-011 W/(cm ² sr)	0.000E+000 W/(cm ² sr)	1.700E-010 W/(cm ² sr)	PASS
in GREEN A	0.0324	0.0000	0.0370	PASS

Comment: Apt: 0.5mm Lens: NVIS HR
 Red Fault LED + Dark Display Filter
 Churchill Ion DVR S/N: Prototype
 Meas: (R)EC Pushbutton

Date: 6/22/2016 9:58:12 AM

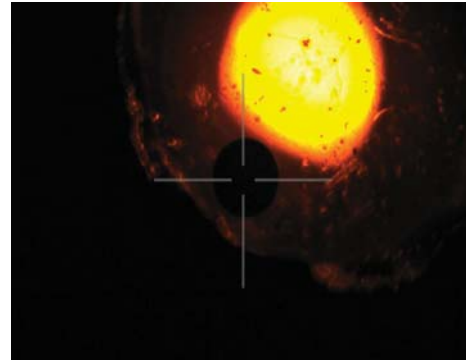


Measurement Conditions

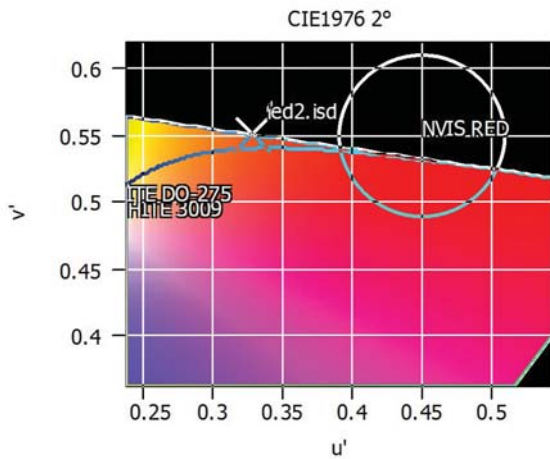
Analysis range: 377.9 - 1041 nm
 Integration time: 955 ms
 Averages: 1
 Density filter: N/A
 Signal Level: 77 % 23851 Counts

Specification: RTCA/DO-275

Type: TYPE I
 Class: CLASS B
 Device: Warning Signal



Results



Integrals

Luminance: 4.272 fL

Color Coordinates

x: 0.5722 u: 0.3280 u': 0.3280
 y: 0.4269 v: 0.3671 v': 0.5506

NVIS-A	4.447E-008 W/(cm ² sr)	NVIS-B	5.905E-009 W/(cm ² sr)	NVIS-C	2.398E-009 W/(cm ² sr)
ref [fL]	15 fL	ref [fL]	15 fL	ref [fL]	15 fL
scaled	1.561E-007 W/(cm ² sr)	scaled	2.073E-008 W/(cm ² sr)	scaled	8.419E-009 W/(cm ² sr)

Pass/Fail

Result	Value	Min	Max	Pass/Fail
Signal Level	77 %	15 %	99 %	PASS
NVISRadiance	2.073E-008 W/(cm ² sr)	4.700E-008 W/(cm ² sr)	1.400E-007 W/(cm ² sr)	FAIL
in NVIS RED	0.1220	0.0000	0.0600	FAIL

Comment: Apt: 0.8mm Lens: NVIS HR
 Red Fault LED + Dark Display Filter
 Churchill Ion DVR S/N: Prototype
 Meas: bottom left of LED

Date: 6/23/2016 11:34:32 AM