Signals Type Approval

Certificate No: ★00/0401R1

Manufacturer: - - - - - - - - - -	**UGL Infrastructure Pty Ltd**
Supplier: - - - - - - - - - - - - - -	**UGL Infrastructure Pty Ltd**
Product Description: - - - - - -	**Subsidiary White LED Signal**
Approved For: - - - - - - - - - - -	**Railway Signalling Applications on RailCorp Infrastructure**
Restrictions or Limitations: - - - - - - - - - - - -	**For outdoor applications only**
Date of Issue: - - - - - - - - - -	***17 July 2012***

Warwick Allison
Chief Engineer Signals & Control Systems

This approval is applicable to the item being used on RailCorp infrastructure in accordance with RailCorp installation standards and procedures. It makes no conclusions about the suitability for use under any other circumstances, and any reliance on the approval by any other organisation is done so entirely at that organisation's own risk. Should changes be made to the equipment which alters its model number, performance characteristics or dimensions a new application for type approval must be made.

NSW Transport RailCorp

Chief Engineers Division

RailCorp

SIGNALLING TYPE APPROVAL SUMMARY	SIGNALS TYPE APPROVAL REGISTER No	*00/0401

ITEM	UGL Subsidiary white LED signal
SUPPLIER	UGL Infrastructure Pty Ltd (ALSTOM)
MANUFACTURER	UGL Infrastructure Pty Ltd (ALSTOM)

ITEM DESCRIPTION	Subsidiary signal 127mm diameter white LED Signal (Presently used white LEDs are obsolete and a complete signal with similar LEDs submitted for approval.)			
VERSION DATA				
RELEVANT SPECIFICATIONS	Signal Standard Specification SPG 1571 – Light signals			
DEVELOPMENT STATUS	Commercial product	Manufactured to RailCorp Signalling specifications		
APPLICATION STATUS				

EVALUATION SUMMARY

- A "UGL" Subsidiary white LED signal was submitted for type approval as the currently used white LEDs are obsolete and the submitted signal consists of similar LEDs identical in chromaticity and brightness has been reduced by adjusting the LED current.
- Checked LED manufacturer's information and specifications.
- Inspection tested the new signal.
- Checked chromaticity and compared with the test results of currently used white LED signals.
- Tested light intensity and compared values with the currently used LED signal.
- Tested viewing signals under bright sunny daylight conditions with new LEDs at distances in excess of 200m and in comparison to the old white LED signal.
- As white LED warning lights are not current proved, testing for lamp proving was not performed.

REPORT PREPARED BY	REVIEWED BY	APPROVED BY
Name: Siri Kamalasuriya	Name: David Nolan	Name: Warwick Alison
Position: Senior Engineer – Equipment & Interfaces	Position: Principal Engineer Equipment & Interfaces	Position: Chief Engineer Signals & Control Systems
Signature:	Signature:	Signature:
Date: 17/07/2012	Date: 17/7/12.	Date: 17-7-12

ITEM	RESULTS		STATUS
FORM & FIT			OK
APPLICATION DETAILS	White LED signals are used for warning lights in NSW. Due to recent driver complaints regarding excess intensity of LED signals, there is a tendency to fit diffusers in front of the signal aspects to reduce the brightness of LED signals for driver comfort. The signals covered under this type approval, LED brightness is reduced by reducing the current through LEDs. .		OK
FUNCTION			
DESIGN INSPECTION	Product is functionally acceptable. Design is based on the currently used LED signals.		OK
BENCH TESTS	The following tests were performed at the Alstom test facility: • Intensity measurements (see detailed report) • Chromaticity measurements (see detailed report) Chromaticity is acceptable for the application. although the chromaticity is just outside the boundary for white light as defined in SPG 1571(see the attached test report prepared by UGL) Currently used signal LEDs also fall outside the boundary towards the blue region. However the product is acceptable because of previous experience with currently used white LED signals. New white LED signal tested for daytime viewing in comparison to the current white LED signal on a bright sunny day (9/7/2012). Both signals viewed as equal brightness. On -axis visibility >200m., also viewed from a distance of 350m Off -axis visibility> 200m		OK OK
INTERFACES			
HUMAN FACTORS	Product is acceptable in terms of light output intensity and viewing distance.		
TRAINING	No abnormal training required.		
LEGISLATIVE REQUIREMENTS	Light unit complies with RailCorp Equipment Specification Document SPG 1571.		
LIFE CYCLE			
MANUALS	N/A		
SERVICE HISTORY	No service history for this particular signal , but previous versions on which this light is based on have proven to be reliable and have service history over 12 years..		OK
SERVICE TRIAL	N/A		OK
SUPPORT ANALYSIS	Spares	Available with suppliers	OK
	Supply	Will also be available in Stores	OK
	Maintenance	Will also be available in Stores	OK
QUALITY ANALYSIS	Design	Satisfactory; UGL carry ISO 9001 accreditation	OK

	Manufacture	Satisfactory	OK
	Materials	Satisfactory	OK
SAFETY EVALUATION	Increased driver comfort as LED signal brightness has been brought to comfortable levels.		OK
SOFTWARE / HARDWARE VALIDATION REVIEW	N/A		
RISK ANALYSIS	Safety	Increased safety because of driver comfort as the brightness has been reduced to comfortable levels.	OK
	Function	Signal is visualised as white easily, although the chromaticity is just outside the boundary for white light. There is no risk of identifying the visual colour as white. The previous version of this LED signal has the same chromaticity coordinates and has proven that there was no issue at all.	OK
	Reliability	Increased reliability as LED life will increase due to reduces LED current.	OK
MATTERS OUTSTANDING			
RESTRICTIONS ON APPLICATION			
EVALUATION HISTORY & SIGNIFICANT ISSUES			

Attachments:

1. Day light signal viewing tests

2. UGL factory test report for UGL White LED Signal
   - Intensity measurements
   - Chromaticity measurements

Daylight signal viewing tests:

(110V applied on both the new signal and the old signal viewed at distances up to 350m; A bright sunny day without clouds. Viewing done around 1200Hrs.)

Viewing Distance	Photo	Comments
100m		Both signals visible at similar intensity
100m		Both signals visible at similar intensity
200m		Signal is visible
250m		Signal still visible
300m		Still visible, but very tiny
350m		Signal is too small to view at this distance

Factory Test Report

to

Transport RailCorp

of

UGL White LED Signal

DOCUMENT NUMBER	01_15_35_02
REVISION	1.0
DATE	04/05/2012
CONTROL STATUS	Unmaintained if printed

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0.1. CONTENTS

0.2. INDEX FOR FIGURES

0.3. INDEX FOR TABLES

0.4. APPROVAL

Function	Position	Name	Signature	Date
Prepared By	Product Development Engineer	Aman K. Dhareula		04/05/12
Checked By	Product Development Manager	Darren Slattery		04/05/12.
Approved By	Engineering Manager	Wojciech Stepniewski		4/5/2012

Table 1: Table of Approvers

0.5. AMENDMENT RECORD

Changes made to this document since its last revision, which affect its scope or sense, are given in the table below.

Author	Version	Date	Amendment Description
A.K. Dhareula	1.0	04/05/2012	Original Issue

Table 2: Revision Table

0.6. DISTRIBUTION RECORD

The Products Manager/Engineer maintains the master document and PDF formatted document on the Transport Documents database.

When an update is issued, it is the responsibility of the holder to replace superseded material with the current issue. Superseded material should be DESTROYED or marked "SUPERSEDED" as appropriate by the user.

0.7. MASTER DOCUMENTS/ELECTRONIC COPY

The MASTER of this document is stamped on the cover page in RED with the word "MASTER" and is filed in the relevant product file.

An ELECTRONIC copy of the current version of this document is attached to the Transport Documents database located on the Company's drive at:

Server: AUNSW06FPP01

Path: U:\Transport Engineering\PRODUCTS\SIGNALS (LED)\Type Approval\White LEDs

"MASTER's" that have been superseded are attached to the relevant database record and are located in the "Documents with History" view of the above database.

1. INTRODUCTION

UGL was pleased to demonstrate the specifications of white 127mm LED signal to RailCorp. The demonstration was conducted at the UGL Milperra facility on the 27th April 2012 and witnessed by RailCorp representatives.

As part of the type approval process, UGL forwards this document as additional correspondence to its type approval revision application.

2. PURPOSE

The purpose of this document is to illustrate and record the test results that were performed at UGL Milperra and compare the chromaticity, intensity and current consumption of the new white LEDs with the obsolete LEDs. It is also intended to provide additional evidence for the type approval revision application for LED module with new LEDs.

Please note that this document is to be read in conjunction with the test specifications contained in document 01_15_35_01 Demonstration Proposal of UGL White LED Signal, Rev1.0.

3. SCOPE

The scope of this document shall cover the tests mentioned in the document 01_15_35_01 Demonstration Proposal of UGL White LED Signal, Rev1.0 and test results, which were performed at UGL Milperra to demonstrate to RailCorp, the functional specification of the UGL LED signals.

4. REFERENCE / RELATED DOCUMENTS

Item	Number	Issue	Document title/Description
[1]	20_01_41_03	1.4	LED Signal Intensity and Colour Test Procedure
[2]	01_02_35_03	1.0	Comparison Report for 127mm White LED Signals
[3]	01_02_06_01	2.5	User Manual for LED Signals
[4]	01_15_35_01	1.0	Demonstration Proposal of UGL White LED Signal
[5]	SPG1571	1.5	RailCorp Specification for Light Signal

5. ABBREVIATIONS

For the purposes of this specification, the following definitions, acronyms & abbreviations apply:-

Term	Meaning
LED	Light Emitting Diode
mA	milli-Amperes
nm	nano meter
PSU	Power Supply Unit
Rev	Revision
V	volts

6. TESTS PERFORMED AT THE UGL SITE

The following tests were performed at the UGL site to demonstrate the technical specification of UGL white 127mm signals to RailCorp.

6.1. CURRENT MEASUREMENT

The nominal supply voltage for the LED signal with new LED and obsolete LEDs was set at 96V, 110V, 120V, 125V and corresponding current consumption of the signals was recorded with an ammeter. A voltmeter was used to measure the voltage across the signals.
The current consumption of the UGL white 127mm LED signal with new and obsolete LEDs at different voltages is given in the table below:

Signal type	Voltage (V)	Current consumption of new LEDs (mA)	Current consumption of old LEDs (mA)
127mm White	96	68.8	72.2
	110	80.4	91.7
	120	89.2	101.8
	125	92.2	109.8

Table 3: Current consumption record table

The current consumption of the new LEDs is a bit less than the old LEDs indicating new LEDs being more efficient.

6.2. INTENSITY AND CHROMATICITY MEASUREMENT

The intensity and chromaticity of the LED signal offered by UGL was measured using a PR-650 spectrometer in the dark room. The intensity measured was in Lux and then converted into candela using the formula below

Intensity (Candela) =
Here Distance = *= 19.98 = 20 (approx.)*

The peak wavelength of the aspects was also recorded.
The intensity and chromaticity of the modules with new and old LEDs are listed in the table below

LED type	Voltage (V)	Intensity in Lux	Intensity in Candela	Chromaticity		Peak Wavelength
				X	Y	
New	96	1.547e+001	309.4	0.2755	0.2677	460 nm
	110	1.668e+001	333.6	0.2745	0.2666	
	120	1.726e+001	345.2	0.2733	0.2650	
	125	1.770e+001	354	0.2725	0.2643	
Old	96	1.312e+001	262.4	0.2724	0.2704	464 nm
	110	1.466e+001	293.2	0.2766	0.2686	
	120	1.559e+001	311.8	0.2756	0.2673	
	125	1.630e+001	326	0.2735	0.2662	

Table 4: Intensity and chromaticity record table

Please note that the plot for the x and y chromaticity boundary condition for new and old LEDs is attached in **Appendix A.**

7. CONCLUSION

UGL forwards the attached results as further evidence that the tests performed on the white LED signal were successful and test results as expected. The specification of the new white LEDs used in 127mm modules is similar to the obsolete ones.

APPENDIX A: CHROMATICITY PLOT

Chromaticity plot for the old and new LEDs at 110 V can be seen in the figure below:

LED module	x	y
cond1	0.2850	0.0000
x≥0.285	0.2850	0.9000
cond2	0.4400	0.0000
x≤0.440	0.4400	0.9000
cond3	0.0000	0.0500
y=0.050 + 0.750x	0.8000	0.6500
cond4	0.0000	0.1500
y=0.150 + 0.640x	0.8000	0.6620
New LED	0.2745	0.2666
Old LED	0.2766	0.2686

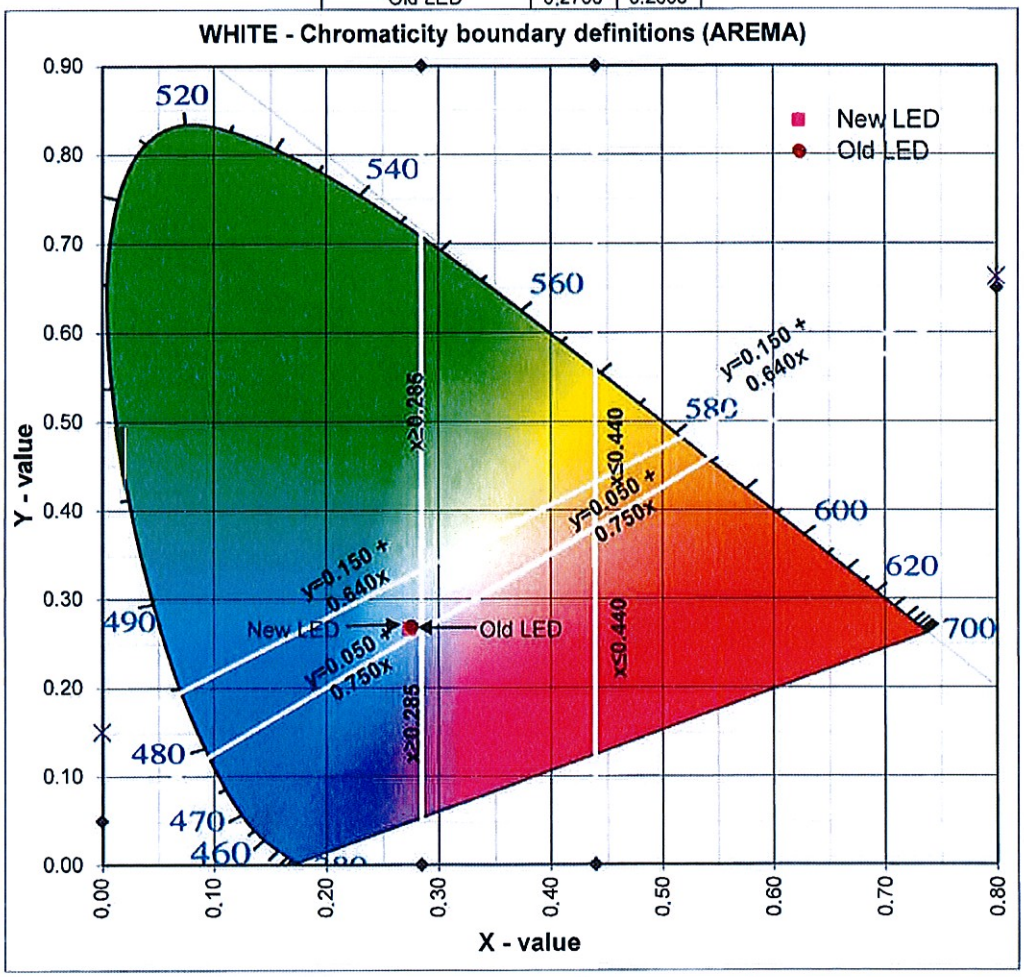

Figure 1: Chromaticity Plot for New LED and Old LEDs at 110 V

From the chromaticity plot above we see that the chromaticity of the New and the Old white LEDs is nearly the same at 110 V.

The chromaticity plot for new and old LEDs at 120 V is given in the figure below:

LED module	x	y
cond1	0.2850	0.0000
x≥0.285	0.2850	0.9000
cond2	0.4400	0.0000
x≤0.440	0.4400	0.9000
cond3	0.0000	0.0500
y=0.050 + 0.750x	0.8000	0.6500
cond4	0.0000	0.1500
y=0.150 + 0.640x	0.8000	0.6620
New LED	0.2733	0.2650
Old LED	0.2756	0.2673

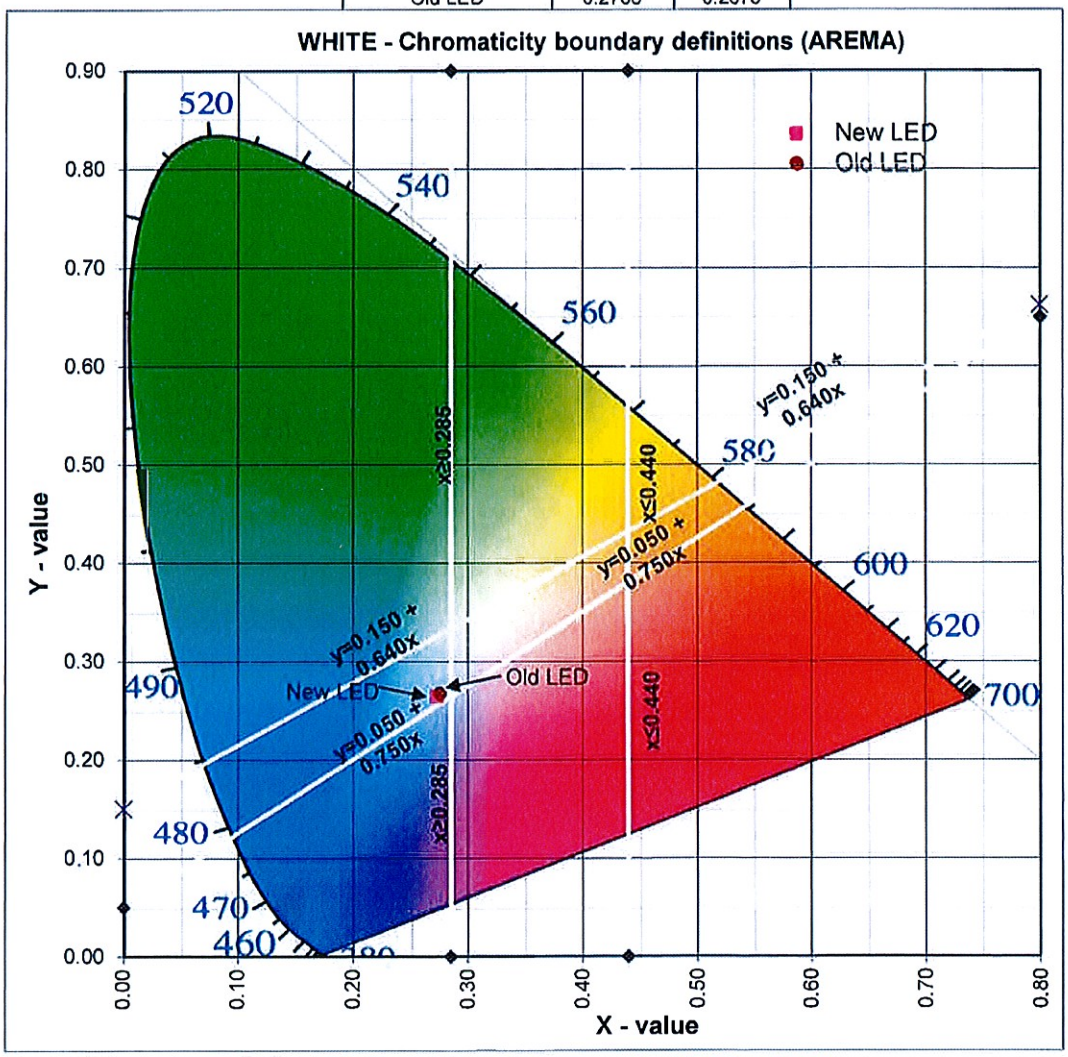

Figure 2: Chromaticity plot for new and old LEDs at 120 V

From the chromaticity plot above we see that the chromaticity of the New and the Old white LEDs is nearly the same even at 120 V.

Signals Type Approval document review for : *Cobalt µCoder – Lamp Inputs Electrical Characteristics TRV1340002998 Rel. 2B* on 26 March 2012.

Responses to previous comments noted.

Section	Comment
1.	**Introduction** This section does not describe or identify the uCoder and ALIS products. Section 2.2.2 defines LEU type in tables only. What is the ALIS product? This section is not consistent with *Micro-Coder User Manual TRV1340003990* Revision 4A section 7.2 lamp input and constraint UM_MCOB_0005 in section 10.2.1. Is the lamp current for a 2 pulse rectified device acceptable? Typically a single phase 50Hz device will have current with THD of >100%.
2.	**Definition** *Ipeak* is equated to ABS(Iinrush) on page 8. Ipeak should have a better definition. Is Ipeak meant to be the repetitive peak of a waveform or the absolute maximum current detected? I.e. typically the highest inrush current peak. See comments of section 2.1.3, 2.1.4 as well.
2.1.1	**Introduction** In the "Caution" should "The over-range situation shall **no** occur ..." be "The over-range situation shall **not** occur ..."
2.1.3	**Example: No over-range** Should "Ipeak =" be "Ipeak_max="? A timing requirement for the Ipeak_max current has not been nominated. A previous response was that a 500us over-range is similar to 100ms. A statement like "Ipeak_max currents of durations less than 100us are not significant" should be included. Alternatively do spikes of this duration need to be suppressed?
2.1.4	**Example: Over-range** Should "I at 100ms =" be "Ipeak_max after 100ms ="?
2.1.5	**Recommendation** This should include a statement that selection of curve and thresholds determines over range or no over range situation; i.e. no site specific data is required.
2.1.6	**I1 Calculation** A typo "lampe" should be "lamp" in the Max current callout box. Last line on page 10 should use Square root instead of the French term Racine. Are the allowed values of I1 correct as shown on the curve as it is a "Details" curve? The maximum permitted value of I1 needs to be less than I max =12.7A on the curve or the 14A as per the top I1 scale value on the curve shown in Section 5.1 on page 57 or 6A as per the maximum current rating of a Micro-Coder type 2 lamp input as detailed on page 7. Also does the I1 threshold need to have a margin below the nominal current for the item?

TRANSPORT

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ALSTOM

1 June 2012

Greg Hockings
Rail Corporation New South Wales
36-46 George Street
Burwood NSW 2134

Your Ref:
Our Ref: CDRL 0736

Subject: Response to Questions raised on 26/03/12 on TRV11340002998 rel 2B

7	P200	µCODER - Lamp Inputs Electrical Characteristics

Dear Greg ,

In response to your request for clarifications on the above document ,we reply as follows:

§1:

- µCoder and ALIS can be now identified. ALIS definition has been added (ALIS is a module as a Micro-Coder without balise interface.)
- User manual will be corrected to be consistent with the present document
- 2 pulse rectified device acceptable if it does not induce a THD over 430Hz is greater than 5%.

§2: corrected, definition updated

§2.1.1: corrected

§2.1.3:

- yes, Ipeak has been replaced by Ipeak_max
- Sentence added in the Introduction :
  The over-range situation shall not occur more than once per minute.
  The over-range situation is induced by any spike value greater than the Ipeak_max value of the range ID.

§2.1.4:
Replaced by maximum peak current after 100ms

§2.1.6:

- Typo corrected
- Square root corrected
- Corrected (curve range adapted to Imax)

§2.1.7:

- Typo corrected
- Typo corrected
- An I0 threshold of 0Arms is permitted, but in this case, the module will never declare an OFF state in secure way.
  Sentence has been added.

RAIL SERVICES AUSTRALIA

Type Approval

issued to

Alstom Australia Ltd

for

LED Subsidiary Signal Modules

127 mm, 120v AC Daylight Medium-Range
Red, Yellow, Green, White and Lunar White

issued by

Rail Services Australia
Safety & Standards
Signal Engineering

R J Logan

R.J. Logan
Principal Signalling Engineer

Date : 10th April 2000

Type Approval Register No : *00/0401