



Final Report

Optical Transmittance measurement of Encapsulant as per IEC 62788-1-4:2016

MCIND SPVL Report Number: MCIND/21-22/LB/101.V1

Issue Date: 30.11.2021

Customer

Navitas Alpha Renewables Private Limited
Address: Plot No. B-20/21, Road No. 14, Palsana-Baleshwar Rd, Hoziwala Industrial Estate, Sachin, Surat, Gujarat 394230.

Contact Person

Mr. Anil Deshmukh
+91-8108851973
anil.deshmukh@navitasalpha.com

Laboratory

Solar PV Laboratory
Mitsui Chemicals India Private Limited
Lab Address: Plot no. 5 & 6, Swastik Industrial Estate, Sarkhej-Bavla Highway, Village: Sari, Tal: Sanand, Ahmedabad
INDIA

Contact Person

Mr. Puneet Kumar
+91 9971742221
Puneet.Kumar@mitsuichemicals.com



Technical Licensing partner

Solar PV Laboratory, Mitsui Chemicals India Pvt.Ltd.

Plot no.5 & 6 Swastik Industrial estate, Sarkhej-Bavla highway, Ahmedabad.

Phone: +91 9650077875

web: in.mitsuichem.com

Bank Account: Standard Chartered

A/C no.: 52205916410

IFSC : SCBL0036020

Registered Office: New Delhi

GST No.: 24AAFCM4312D1Z2

Lab Management:

Mr. Puneet Kumar – Lab Manager

Mr. Ganesh Gowri – Technical Manager

Report details

Report number	MCIND/21-22/LB/101.V1	Order date	24-08-2021
Order number	MCIND/20-21/017.V1	Sample Receive Date	20-08-2021
Test start Date:	06-09-2021	Test end date:	25-09-2021

Customer Information

Customer	Navitas Alpha Renewables Private Limited	Street address	Plot No. B-20/21, Road No. 14, Palsana-Baleshwar Rd, Hoziwala Industrial Estate, Sachin, Surat, Gujarat 394230
Responsible person	Anil Deshmukh	City / State	Gujarat
Phone number	+91-8108851973	Pin code	394230
E-Mail	anil.deshmukh@navitasalpha.com	Country	INDIA

Lab information

Lab	Mitsui Chemicals India Pvt Ltd	Street address	Plot no. 5 & 6, Swastik Industrial Estate, Sarkhej-Bavla Highway, Village:Sari, Tal: Sanand, Ahmedabad
Responsible engineer	Shubham Kumar	City / State	Ahmedabad, Gujarat
Phone number	+91-9650079706	Pin code	382220
E-mail	Shubham.kumar@mitsuichemicals.com	Country	INDIA

Signatures

Prepared By	 Mr. Shubham Thakur	Authorized and Issued by	 Mr. Gowri Ganesh
Checked by	 Mr. Mayur Nakarani		

DISCLAIMER: The data reported in this report are valid at the time of and under the stipulated conditions of measurement and the test results are only applicable to those items which have been tested. The sampling was done by the client. The data contents in this report do not constitute a qualification certificate under any set of specifications. MCIND does not accept any liability for any consequences including commercial or otherwise arising out of the utilization of the information contained in this report. MCIND reserves the right to utilize the information contained in this report in the interest of scientific progress without disclosing the identity of the customer. The duplication, publication as well as passing on of this report is only allowed if it is complete and written permission from MCIND is given. MCIND is a licensing partner of PI Berlin, who provided technical consulting services for the establishment and operation of the laboratory. PI Berlin is not responsible for the module sampling, scope of work, test procedure, test completion or test results contained in this report.

Copyright © 2020 – MCIND. All rights reserved – worldwide. Any content of this document shall be subject to the Indian Copyright Act. No part of this document shall be reproduced or transmitted in any form, by any means without prior written permission. MCIND has put forth its best efforts in preparing and arranging this document.

Table of Contents

1	General Information about the Report	4
1.1	Order	4
1.2	Approach.....	4
1.3	List of abbreviations and symbols used	4
2	General Information about the Test and Test Objects	5
2.1	Delivery Condition	5
2.2	Sample Description	5
3	Performed Tests	6
3.1	Test Description	6
3.2	Detailed Test Results.....	8
3.2.1	Optical Transmittance.....	8

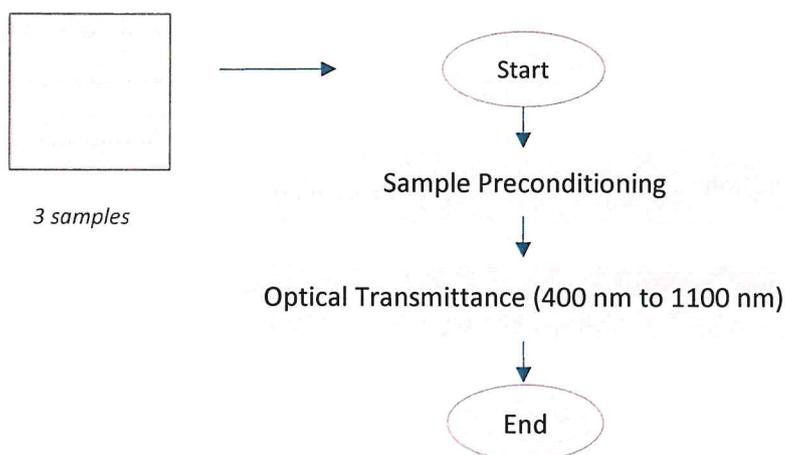
1 General Information about the Report

1.1 Order

The objective of the project is to evaluate optical transmittance characteristics of encapsulant material intended to be used for PV module application.

1.2 Approach

MCIND received 3 nos. of Glass-EVA-Glass sample from Navitas Alpha Renewables Pvt. Ltd. model type EVO FCP UVB for which the following test sequence was agreed:



1.3 List of abbreviations and symbols used

Abbreviation/symbol	Particulars
EVA	Ethylene Vinyl Acetate
N/A	Not applicable
IEC	International Electrotechnical Commission
RH	Relative Humidity
nm	Nano meter
ζ	transmittance
Std. Dev, $\pm\sigma$	Standard deviation
Meas.	Measurement
λ_{nm}	Wavelength in nano meter

2 General Information about the Test and Test Objects

2.1 Delivery Condition

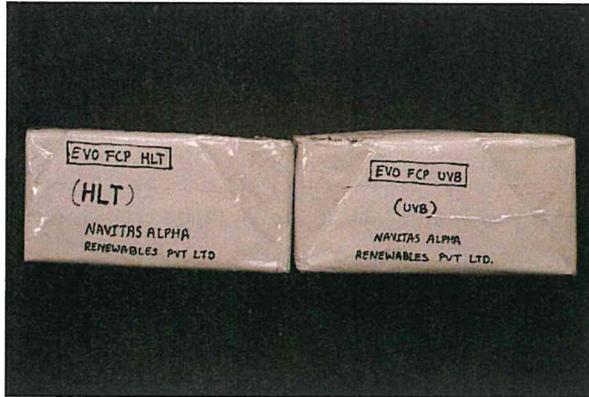


Figure 2-1 (A) Delivery condition (dated:24-08-2021)

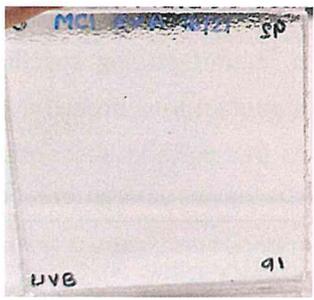
* **Delivery Condition:** No physical damage of the test samples observed.

* **Packaging comments:** Test samples are packing is acceptable

Location: Gate no. 4 , Solar PV Laboratory, Mitsui chemicals India Pvt. Ltd., Ahmedabad, Gujarat 382220.

Note: The PV modules received are Freshly Manufactured samples (as confirmed by the customer.)

2.2 Sample Description

Details of Sample				
Make	:	Navitas alpha Renewables Pvt. Ltd.		
Encapsulant material	:	EVA		
Model no.	:	EVO FCP UVB		
Thickness of Encapsulant used (in mm)	:	0.5 ± 5%		
Overall Sample Thickness including Superstrate/substrate (in mm)	:	6.42 ± 0.015 mm		
Specification of Superstrate – Substrate Material used				
Parameters		Superstrate	Substrate	Unit
Material	:	Low Iron solar Textured glass	Low Iron solar Textured glass	-
Make	:	Borosil Renewables Limited	Borosil Renewables Limited	-
Model type	:	Matt	Matt	-
Dimension (l×b×t) in mm	:	3.2×50×50	3.2×50×50	mm
Details of Coating	:	N/A	N/A	-
Transmittance %*	:	>91	>91	%
Reflectance %*	:	8.0	8.0	%
Test Specimen details				
MCIND Serial Number		Product (Identification) No.	Dimension (l×b) in mm	Tested
MCI EVA 16/21		UVB 91/92	50.84×50.72	✓
MCI EVA 17/21		UVB 32/31	50.70×50.63	✓
MCI EVA 18/21		UVB 95/96	50.56×50.66	✓

*as per Manufacturer datasheet/declaration (see Annex I&II)

3 Performed Tests

3.1 Test Description

Standard:

The test is carried out in accordance with measurement procedure of optical transmittance to cell in IEC 62788-1-4:2016 for Encapsulant.

Purpose:

To determine the optical transmittance to the cell and utilize the findings to compare between different encapsulation material, to estimate module performance (current yield) etc.

Test Procedure:

For conducting the testing, Measurement procedure mentioned under relevant sections of IEC 62788-1-4:2016 has been followed. The wavelength range prescribed from the customer has been used for carrying out relevant analysis and reporting of results.

Sampling Procedure

A minimum of 3 Replicate samples are used for determination of optical transmittance to the cell using the Glass-EVA-Glass Sample of dimension greater than 50 mm × 50 mm or more (with glass thickness 3±0.2 mm). The samples selected are free from any visual defects.

Sample Preparation

For preparation of the sample, nominal thickness of encapsulant should be used and shall be as intended for use in the PV module. The sample specimen should be cured (if applicable) according to manufacturing specification and as similar as possible to the method used in the intended manufacturing procedure.

As per method description shared by the customer, below mentioned is the sample preparation strategy and parameters used by the manufacturer for preparation of the received test sample: -

Specimen Preparation:

Conditioning: Store in sealed packing at temperature < 30°C & humidity < 60% up to 24 hours.

Lamination Parameters: Evacuation Time Minutes - 4.5 minutes
 Lamination Time Minutes – 8
 Temperature (Double Stage) °C – 143

Preparation of sample:

EVA sample of 50 mm² was taken and placed between 2 pieces of glasses (prismatic/matte glass of 3 mm thickness) and cured as per above lamination parameters.

mfg. date of the sample:

HLT	UVB
06-07-2021	23-07-2021

Sample Preconditioning

Test samples were maintained at $23\pm 2^{\circ}\text{C}$ and $50\pm 5\%RH$ for at least 24 h prior to optical measurement.

Environmental conditions

Test are conducted at an ambient Temperature conditions of $23\pm 2^{\circ}\text{C}$ and Relative Humidity $50\pm 5\%RH$.

Testing Procedure

Measurement of optical transmittance characteristics has been performed under controlled environment using our BBA class steady state sun simulator light source (in compliance with IEC 60904-9:2020) and Avasphere-50-LS-HAL-12V (Make: Avantest) integrating sphere to capture light transmittance in desired wavelength range as per scope of testing requirement from the customer. Test results and Measurement Uncertainty has been computed based on the method suggested in relevant clause of the standard.

Location: Material testing lab, Mitsui Chemicals India Pvt. Ltd. - Solar PV Laboratory, Ahmedabad, Gujarat 382220, INDIA

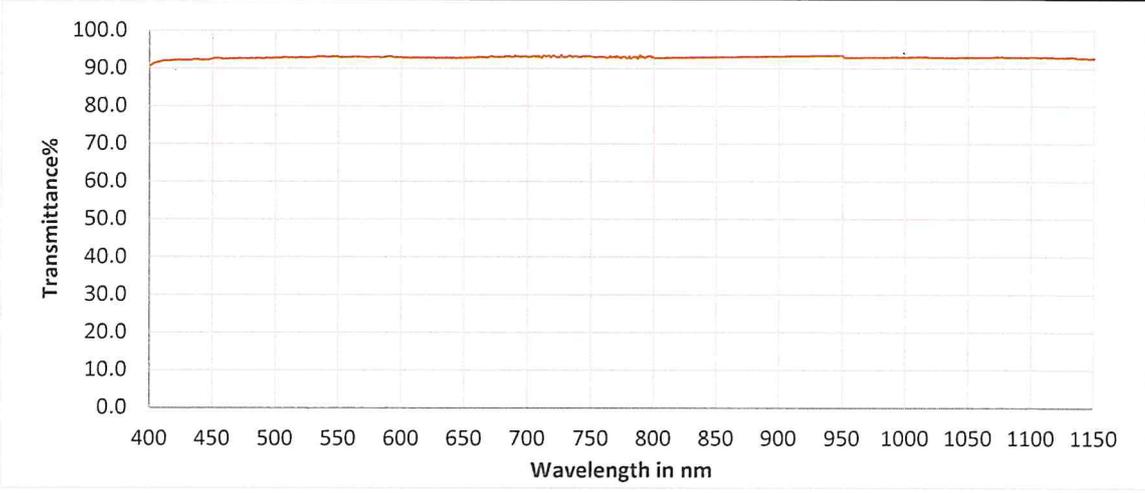
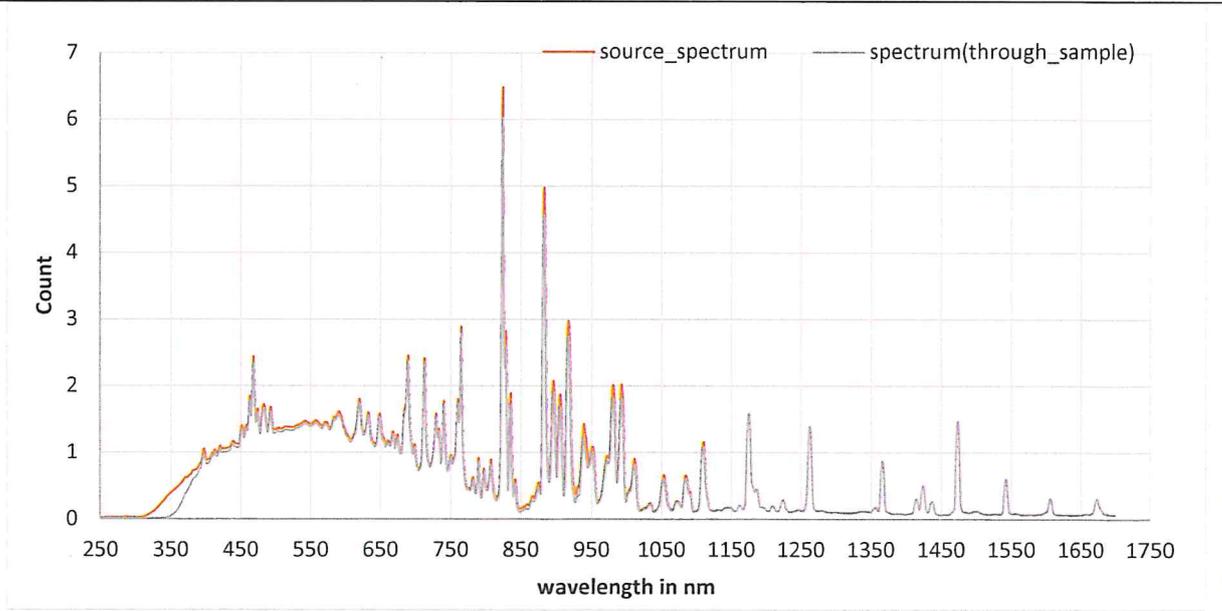
Location Type: Permanent

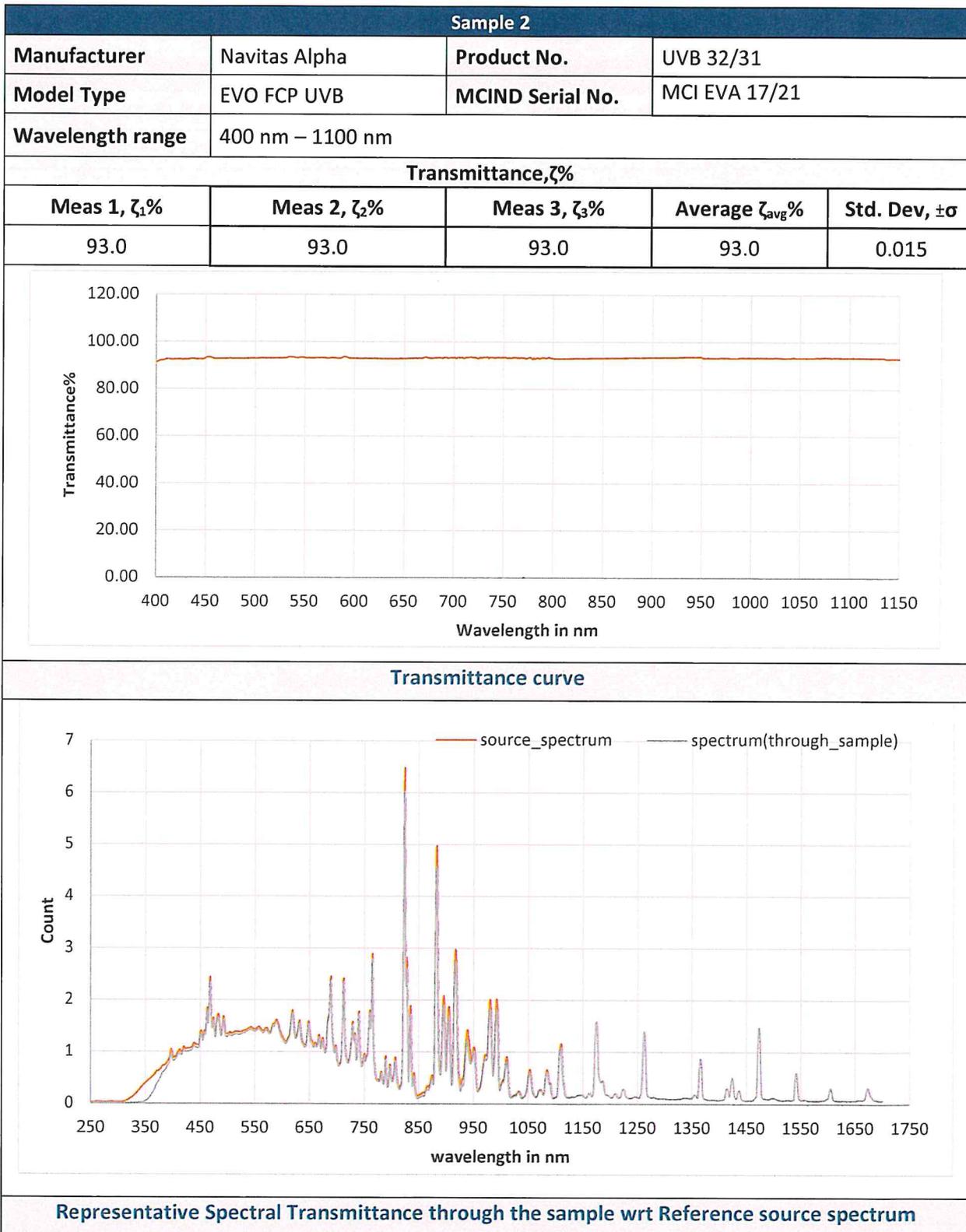
Test & Operations Engineer:	Shubham Kumar	Date of Test (DD/MM/YYYY)	23-09-2021
--	----------------------	--------------------------------------	------------

3. 2. Detailed Test Results

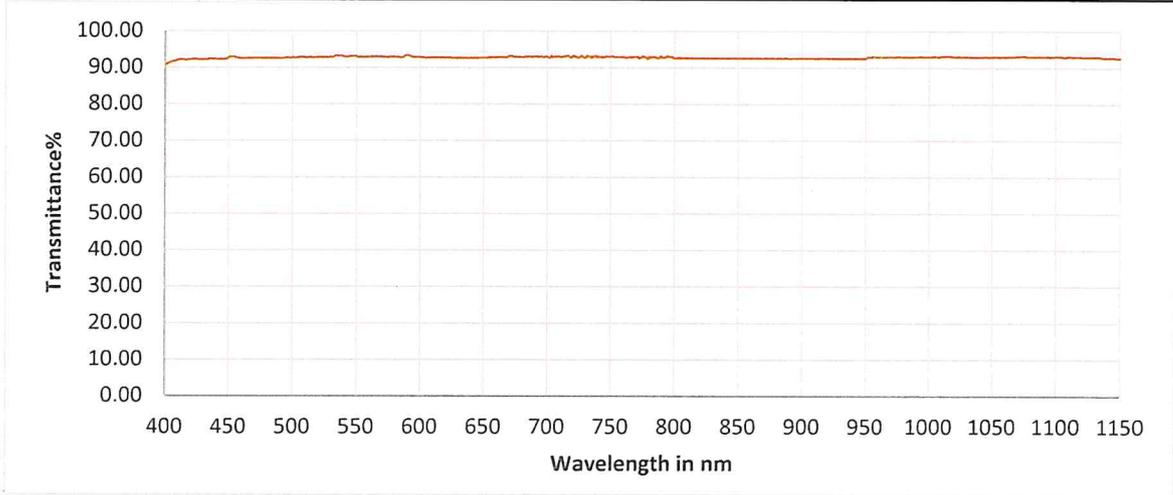
3.2.1 Optical Transmittance as per IEC 62788-1-4:2016

Test Result: (Individual Sample)

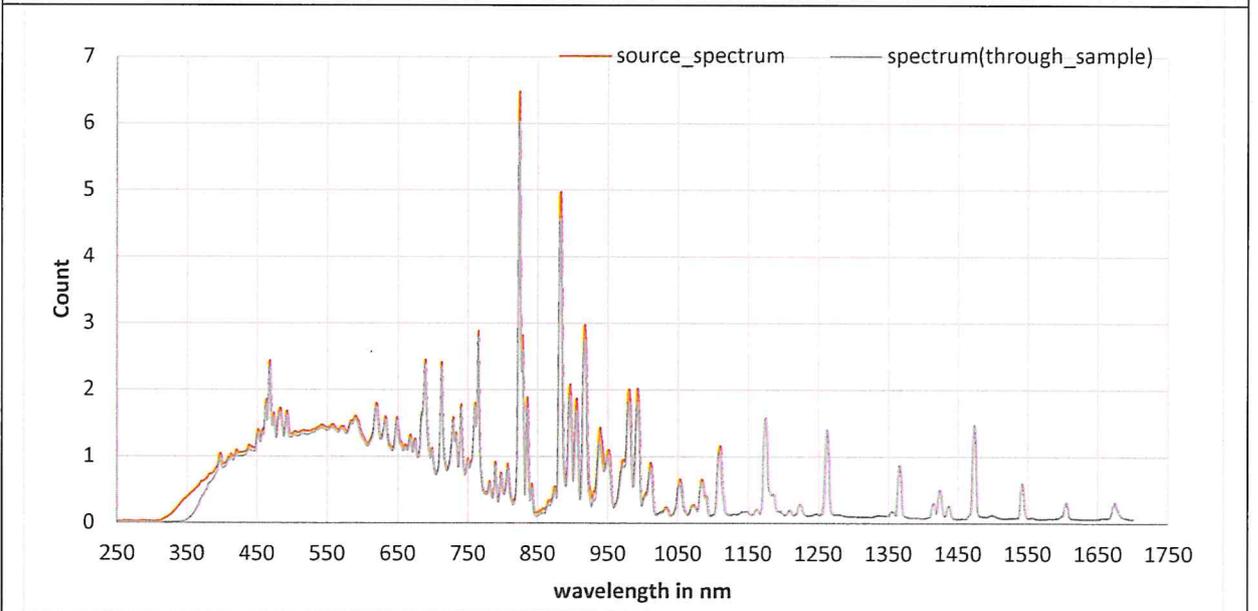
Sample 1				
Manufacturer	Navitas Alpha	Product No.	UVB 91/92	
Model Type	EVO FCP UVB	MCIND Serial No.	MCI EVA 16/21	
Wavelength range	400 nm – 1100 nm			
Transmittance, ζ%				
Meas 1, ζ ₁ %	Meas 2, ζ ₂ %	Meas 3, ζ ₃ %	Average ζ _{avg} %	Std. Dev, ±σ
92.7	92.7	92.6	92.7	0.057
				
Transmittance curve				
				
Representative Spectral Transmittance through the sample wrt Reference source spectrum				



Sample 3				
Manufacturer	Navitas Alpha	Product No.	UVB 95/96	
Model Type	EVO FCP UVB	MCIND Serial No.	MCI EVA 18/21	
Wavelength range	380 nm – 1100 nm			
Transmittance, ζ%				
Meas 1, ζ ₁ %	Meas 2, ζ ₂ %	Meas 3, ζ ₃ %	Average ζ _{avg} %	Std. Dev, ±σ
92.6	92.6	92.6	92.6	0.015



Transmittance curve



Representative Spectral Transmittance through the sample wrt Reference source spectrum

Test Result: (summary of results of all the tested samples with identical characteristics)

Transmittance,ζ%			
MCIND Serial No.	Product Identification No.	Average Transmittance ζ _{avg} %	Std. Dev, ±σ
MCI EVA 16/21	UVB 91/92	92.7	0.057
MCI EVA 17/21	UVB 32/31	93.0	0.015
MCI EVA 18/21	UVB 95/96	92.6	0.015
Reproducibility between Replicates,%		0.21	
Measurement Uncertainty,(at k=2)		0.59%	
Transmittance minima λ_ε(290 nm to 1150 nm)		15.0 % at λ _{nm} ~350 nm	

Note: The Samples are not exposed to any stress test condition prior to measurement of Transmittance.

Note: All The sample are tested on front side as the deviation% between measurement of both sides has been verified to be well in range of 0.1%.

----- End of Test Report -----

