



# Final Report

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

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

Issue Date: 29.09.2021

### 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

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### Laboratory

Solar PV Laboratory

Mitsui Chemicals India Private Limited

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Lab Management:

Mr. Puneet Kumar – Lab Manager

Mr. Ganesh Gowri – Technical Manager

**Report details**

Report number	MCIND/21-22/LB/xxxx.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
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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
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**Signatures**

<b>Prepared By</b>	<b>Mr. Shubham Kumar</b>	<b>Authorized and Issued by</b>	<b>Mr. Gowri Ganesh</b>
<b>Checked by</b>	<b>Mr. Mayur Nakarani</b>		

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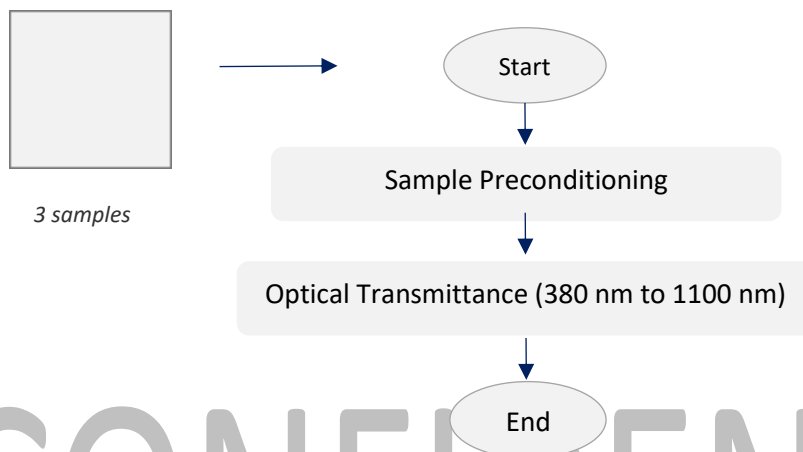
## 1 General Information about the Report

### 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 HLT for which the following test sequence was agreed:



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### 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
$\zeta$	transmittance
Std. Dev, $\pm\sigma$	Standard deviation
Meas.	Measurement

## 2 General Information about the Test and Test Objects

### 2.1 Delivery Condition



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

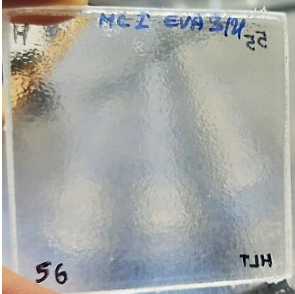
\* **Delivery Condition:** No physical damage of the test samples observed.

\* **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			
<b>Make</b>	: Navitas alpha Renewables Pvt. Ltd.		Sample photograph
<b>Encapsulant material</b>	: EVA		
<b>Model no.</b>	: EVO FCP HLT		
<b>Thickness of Encapsulant used (in mm)</b>	: 0.5 ± 5%		
<b>Overall Sample Thickness including Superstrate/substrate (in mm)</b>	: 6.42 ± 0.015 mm		
Specification of Superstrate – Substrate Material used			
Parameters	Superstrate	Substrate	Unit
<b>Material</b>	: Low Iron solar Textured glass	Low Iron solar Textured glass	-
<b>Make</b>	: Borosil Renewables Limited	Borosil Renewables Limited	-
<b>Model type</b>	: Matt	Matt	-
<b>Dimension (l×b×t) in mm</b>	: 3.2×50×50	3.2×50×50	mm
<b>Details of Coating</b>	: N/A	N/A	-
<b>Transmittance %*</b>	: >91	>91	%
<b>Reflectance %*</b>	: 8.0	8.0	%
Test Specimen details			
MCIND Serial Number	Product (Identification) No.	Dimension (l×b×t) in mm	Tested
MCI EVA 1/21	HLT_87/88	50.61×50.98	✓
MCI EVA 2/21	HLT_43/44	50.17×50.01	✓
MCI EVA 3/21	HLT_56/55	50.32×50.99	✓

\*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 (Single Stage) °C – 142  
Temperature (Double Stage) °C – 143

**Preparation of sample:**

We took the EVA sample of 50mm square and put it down between the 2 glasses (prismatic 3mm) like sandwich and (cured as per the above lamination parameter).

**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: Avantes) 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

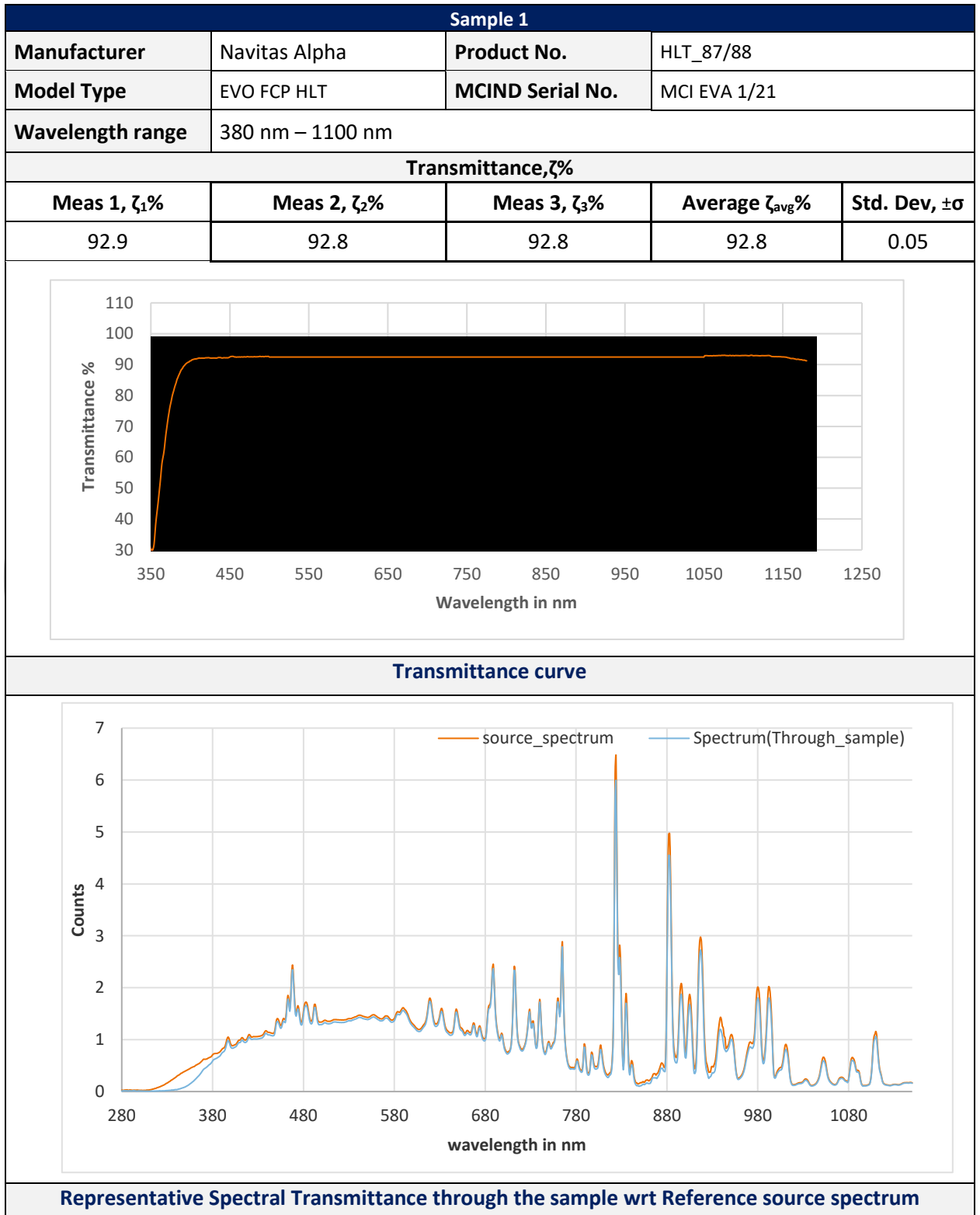
**Location Type:** Permanent

<b>Test &amp; Operations Engineer:</b>	<b>Shubham Kumar</b>	<b>Date of Test (DD/MM/YYYY)</b>	23-09-2021
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### 3. 2. Detailed Test Results

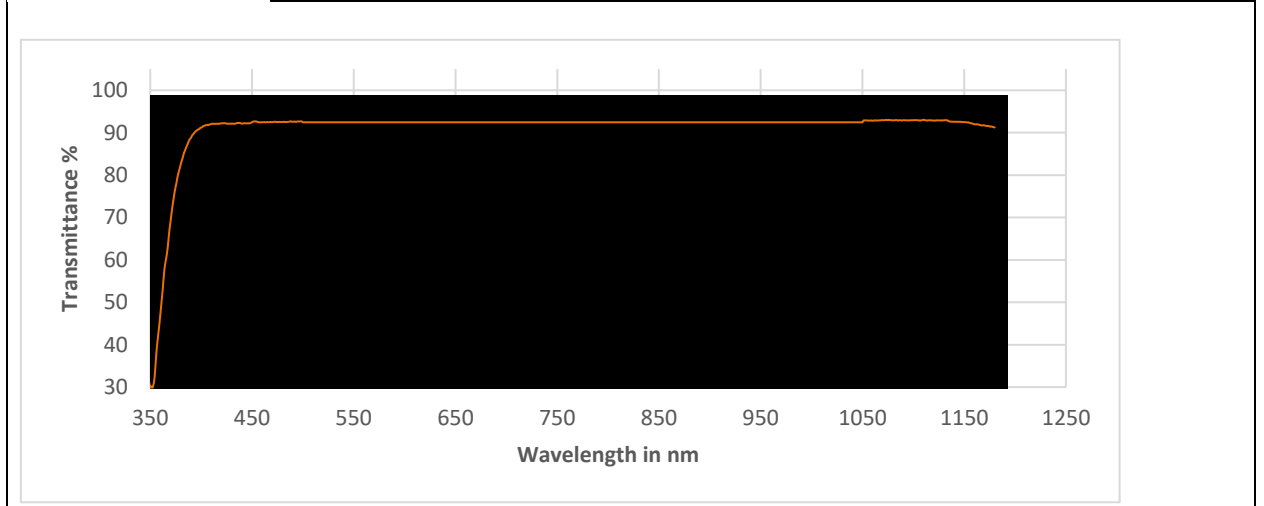
#### 3.2.1 Optical Transmittance as per IEC 62788-1-4:2016

Test Result: (Individual Sample)

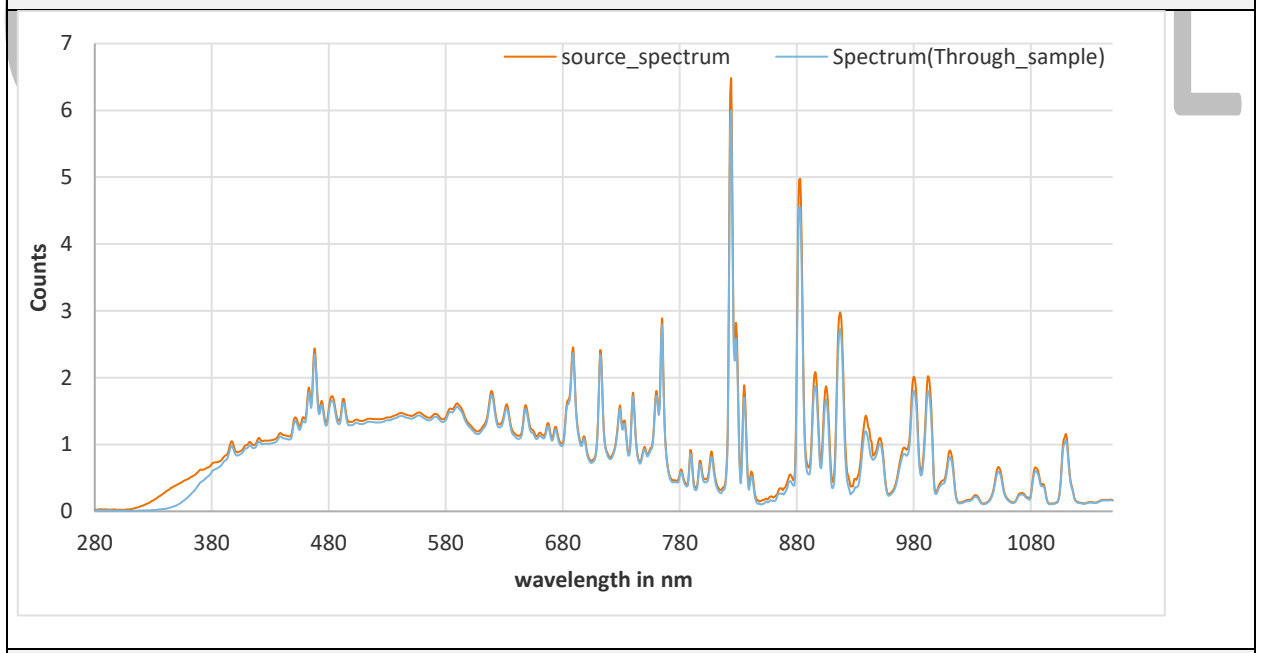




Sample 2				
Manufacturer	Navitas Alpha	Product No.	HLT_43/44	
Model Type	EVO FCP HLT	MCIND Serial No.	MCI EVA 2/21	
Wavelength range	380 nm – 1100 nm			
Transmittance, ζ%				
Meas 1, ζ <sub>1</sub> %	Meas 2, ζ <sub>2</sub> %	Meas 3, ζ <sub>3</sub> %	Average ζ <sub>avg</sub> %	Std. Dev, ±σ
92.7	92.7	92.8	92.7	0.05

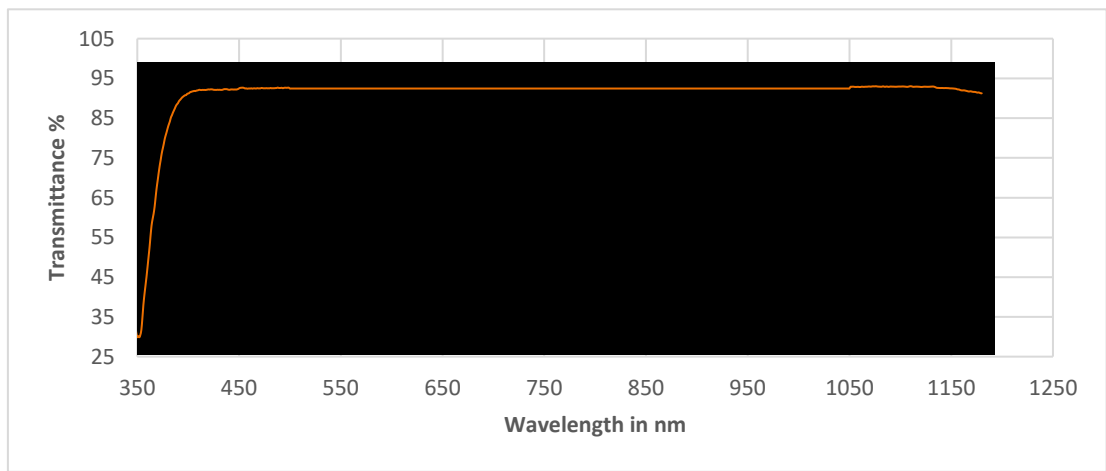


**Transmittance curve**

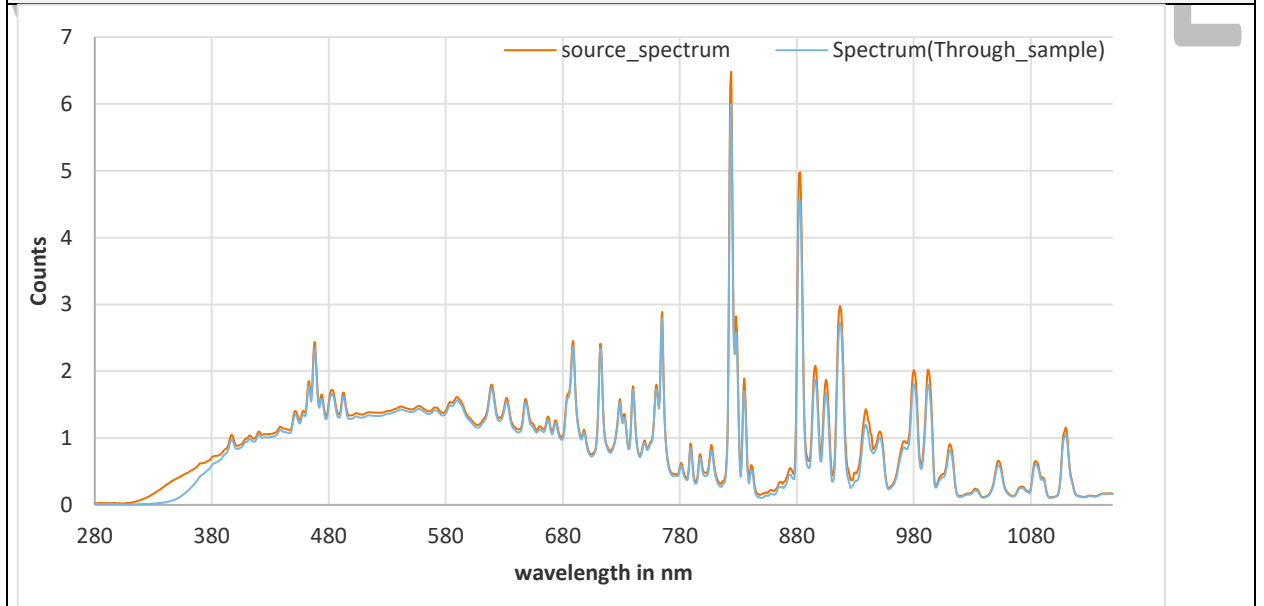


**Representative Spectral Transmittance through the sample wrt Reference source spectrum**

Sample 3				
Manufacturer	Navitas Alpha	Product No.	HLT_56/55	
Model Type	EVO FCP HLT	MCIND Serial No.	MCI EVA 3/21	
Wavelength range	380 nm – 1100 nm			
Transmittance, ζ%				
Meas 1, ζ <sub>1</sub> %	Meas 2, ζ <sub>2</sub> %	Meas 3, ζ <sub>3</sub> %	Average ζ <sub>avg</sub> %	Std. Dev, ±σ
92.8	92.8	92.8	92.8	0.01



**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 ζavg;%	Std. Dev, ±σ
MCI EVA 1/21	HLT_87/88	92.8	0.05
MCI EVA 2/21	HLT_43/44	92.7	0.05
MCI EVA 3/21	HLT_56/55	92.8	0.01
<b>Reproducibility between Replicates,%</b>		0.05	
<b>Measurement Uncertainty,(at k=2)</b>		0.59%	

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 -----

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