



**Certified Reference  
Materials  
for  
UV, Visible, NIR and IR  
Molecular Spectroscopy**

**RM-1N2N3N**

**Set Serial No: 27550**

**APROVADO**

Responsável: WELLINGTON

Padrão: 9001A03VS

Data: 09/09/2018

Validade: 03/09/2020

**Customer Details:**

Starna Cells Inc  
5950 Traffic Way  
Atascadero  
C.A. 93422  
U.S.A.

The customer information stated on this page,  
number 1 of 3 applies to all certificates.

UKAS accreditation applies to all  
Wavelength,  
Transmission/Absorbance, Stray  
Light references, and those used for  
Resolution measurements.





**Calibration Lab.**  
**Starna Scientific Ltd**  
**52/54 Fowler Rd**  
**HAINAULT**  
**Essex IG6 3UT**  
**England**  
**Tel. +44 (0)20 8501 5550**

Email: sales@starna.com

## Reference Material Certificate of Calibration and Traceability

Starna glass filters for use in the Visible region of the spectrum to verify the transmission and absorbance scales.

### Starna Neutral Density Filter Set

Certificate Number: **72013**  
 Certificate Date: **3 September 2018**  
 Expiration Date: **3 September 2020**  
 Analysis file number: **8719**  
 Set Serial Number: **27550**  
 Blank Serial Number: **76952**



0659

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### Description of Reference Material:

The reference filters are prepared from one of the following Schott optically neutral glass NG-3, NG-4, NG-5 or NG-11 depending on the nominal transmission required for each individual filter. Each filter is mounted in a black-anodized aluminium alloy holder, complete with front and rear slide cover.

All procedures are implemented in accordance with ISO/IEC 17025 and ISO 17034. Additional information can be found on the Starna web site at [www.starna.com](http://www.starna.com)

### Certified Values of Reference Material:

Each individual filter is measured against the empty filter holder (blank). The net absorbance and transmission values are measured at the wavelengths specified in the table below. The results and associated uncertainties at a coverage probability of 95 % as detailed below were obtained using the analytical procedures detailed in NIST Special Publication 260-140.

The combined analytical and instrument uncertainties at a coverage probability of 95 % is:

For Absorbance values less than 1.2 A (greater than 6.3 T/%) the expanded uncertainty =  $\pm 0.0027$  A

For Absorbance value in the range 1.2 to 1.9 A (6.3 - 1.6 T/%) the expanded uncertainty =  $\pm 0.0052$  A

For Absorbance value in the range 1.9 to 2.2 A (1.6 - 0.6 T/%) the expanded uncertainty =  $\pm 0.0059$  A

For Absorbance value in the range 2.2 to 2.7 A (0.6 - 0.2 T/%) the expanded uncertainty =  $\pm 0.011$  A

For Absorbance values greater than 2.7 A (Less than 0.2 T/%) the expanded uncertainty =  $\pm 0.019$  A

*The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. (note net absorbance and transmission values can be measured at additional wavelengths if requested.)*

Serial #	Wavelength (nm)	440.0	465.0	546.1	590.0	635.0
76783	Absorbance	1.0268	0.9651	1.0020	1.0835	1.0539
	%T	9.40	10.84	9.95	8.25	8.83
76016	Absorbance	0.7167	0.6747	0.6995	0.7642	0.7499
	%T	19.20	21.15	19.98	17.21	17.79
76326	Absorbance	0.5686	0.5285	0.5254	0.5589	0.5661
	%T	27.00	29.61	29.83	27.61	27.16

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**UKAS Accredited Calibration Laboratory No. 0659**

### Certifying Instrument Qualification:

All calibration is performed on one of a series of high performance reference spectrophotometers. The instruments are tested and qualified to the manufacturer's published specification over the analytical range used for the reference material certification.

The following primary references and fundamental procedures are used in the qualification of the reference spectrophotometers:

Absorbance: NIST SRM 2031, 1930 & 930e, Double aperture method  
Wavelength: NIST SRM 2034, Emission lines of Hg & deuterium  
Stray Light: NIST SRM 2032, KCl, KI & lithium carbonate  
Resolution: Benzene vapor, half width of D2 656.1 nm line

### Calibration Method:

The conditions of analysis used to generate the certified values on this certificate are as listed in the chart below:

Reference Material: NG-3, NG-4, NG-5 & NG-11 Optically Neutral Glass  
Reference: Empty filter holder (air)  
Scale: Transmission & Absorbance  
Range: See Table on page 2.  
Band width: 1 nm +/- 0.2nm  
Temperature: 22 +/- 1.0 °C

### Instructions for Use:

Remove the sliding window covers from both sides of each filter to be used. Place the empty (blank) filter holder in the blank cell holder in your instrument. Place the filters in the sample compartment as you would for any sample. Determine the absorbance of each filter against the supplied blank at each of the five listed wavelengths. Repeat several times.

To assess photometric accuracy, compare the mean, net absorbance or transmission reading for each filter and wavelength to the published values on this certificate. The absolute difference between the mean measured value and the certified value will not exceed the sum of the certified uncertainty and the specified accuracy of the instrument if the instrument is performing correctly.

### Duration of Certificate:

This certificate is valid for a maximum period of two years from the date of issue or sooner if specified by the user's own protocols. Although the references are covered by a lifetime guarantee this is subject to certain conditions, see guidance notes.

### Re-certification Procedure:

All reference materials are certified and supplied in a useable condition. There is no warranty for fitness beyond receipt by the customer. When references need to be re-certified or inspected for any reason, customers should return them to the Starna ISO/IEC 17025 & ISO 17034 accredited calibration laboratory, where all original data is collated.

On receipt by Starna Scientific the references are measured "As received", before cleaning under the re-certification procedure. "As received" data is available on request.

### Storage and Care:

References should always be stored in the box provided and handled with extreme care. Filters are fragile and should be inserted and removed from the instrument taking care not to twist or apply leverage against the cell holder, as this may crack the filter. Damage in the form of scratches or contamination may alter the certified values significantly such that they need re-certifying or even complete replacement. For cleaning see guidance notes.

### Instrument Dependencies:

The instrument to be checked should have a spectral bandpass not exceeding 6.5 nm. Consult your instrument owners manual for this information.

Calibration performed by:

*A. Wakelin*

**Calibration Manager - A. Wakelin CSci CChem MRSC**

Approved Signatory:

*J. P. Hammond*

**Technical Manager - J. P. Hammond CSci CChem FRSC**

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