Thermal and Solar Energy Performance Report

for

Breezway Altair Louvre Window with Western Red Cedar Blades (Rebated and Straight-Cut), in Easyscreen Frame

26 October 2010

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1. Introduction

This document reports the simulated U-value, solar heat gain coefficient (SHGC) and visible transmittance (VT) of the Breezway Altair 152 Louvre Window with Western Red Cedar blades in an Easyscreen frame. All final properties are system properties including frame, in accordance with NFRC procedures.

The results in this report apply equally to rebated and straight-cut timber blades.

The optical properties of cedar are not contained in the International Glazing Database (IGDB). Instead, known, default properties for cedar were used to create an entry in the User Database of Optics 5.1. This information was then exported to WINDOW 6.3 to enable the 'centre of louvre' properties to be calculated.

The louvre window performance indices (U, SHGC, VT) were determined using the Optics 5.1 and WINDOW 6.3 software in the normal way [1]. All calculations were at NFRC 100-2010 environmental conditions, which are the reference conditions used by the Australian Fenestration Rating Council and are a mandatory requirement of the Building Code of Australia (BCA). The AFRC follows procedures of the U.S. National Fenestration Rating Council (NFRC).

> *This report is based on calculations that are beyond those of current AFRC procedures. Therefore it does not meet all AFRC requirements for a whole-window energy rating report. While the calculated performance indices are suitable for comparison with information on the Australian Window Association's WERS database, this report is not an authorised WERS rating. Instead, it should be regarded as a research report.*

2. Methodology

2.1 Optical properties of cedar

Spectral data for cedar was imported into Optics 5.1. These data are shown in Table 1. Default values (from NFRC 101-2010) were used for surface emittance. A surface solar reflectance of 0.7 was used, which corresponds to a solar absorptance of 0.3. This absorptance is consistent with that used for window frames and the opaque portion of garage doors, as rated under NFRC 200-2010.

[1] Note that WINDOW 6.3 and Optics 5.1 from Lawrence Berkeley National Laboratory (http://windows.lbl.gov/software) are unrelated to Microsoft Windows.

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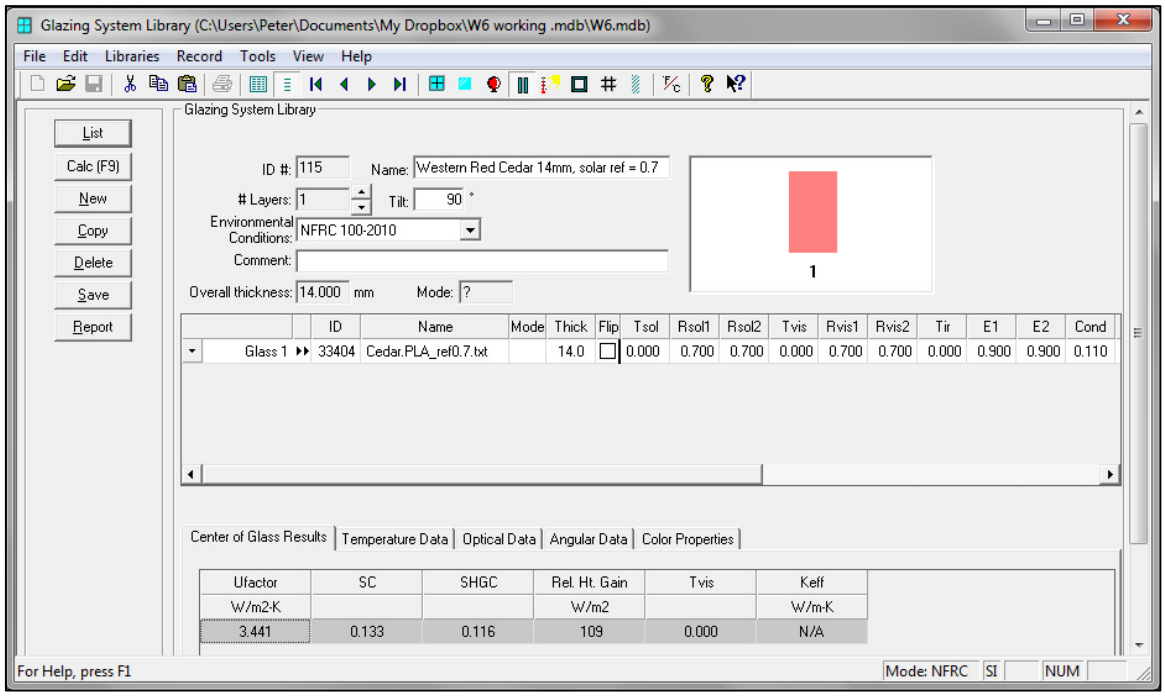
Table 1: Optical characteristics of Western Red Cedar, used in Optics 5.1 and WINDOW 6.3.

Material	Thick-ness (mm)	Thermal conduct-ivity (W/m.K)	Direct solar trans-mittance	Solar outdoor reflect-ance	Solar indoor reflect-ance	Visible trans-mittance (VT)	Visible outdoor reflect-ance	Visible indoor reflect-ance	Infrared trans-mittance	Front emit-ance	Back emit-ance
Western Red Cedar	14	0.11	0.000	0.700	0.700	0.000	0.700	0.700	0.000	0.900	0.900

2.2 Centre-of-louvre properties of cedar blades

Following standard NFRC procedures, the data were added to the User Database of Optics 5.1 before being exported to the glass library of WINDOW 6.3. Finally, a calculation was performed in WINDOW 6.3 to determine the 'centre-of-louvre' properties of cedar blades in a vertical orientation. The low SHGC is due to the opaque nature of the cedar and its thermal resistance (0.13 m^2.K/W for 14mm thickness). Similarly, the relatively low U-value, compared to 6mm glass, is due to its thickness. As noted above, the centre-of-louvre properties apply equally to rebated and straight-cut blades, since from a thermal point of view there is no difference.

Figure 1: Thermal, solar and optical indices of Western Red Cedar, calculated in WINDOW 6.3.



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2.3 Modelled U-value of aluminium frame and polypropylene clips

Based on CAD drawings supplied by Breezway, THERM 6.3 was used to model sections for the head, jambs and sill. Screenshots and results are shown in Figures 2, 3 and 4. Note that under NFRC modelling rules, jambs are modelled with the glass in an apparently vertical orientation. This is just convention; the attributes of each cross-section type are correctly defined so that THERM accounts for the gravity vector in each case. Similarly, in Figures 1-4 the cedar blades appear as 'glass' but this is merely a consequence of WINDOW 6 convention. Per standard practice, discontinuous components such as bearings are not modelled.

Figure 2: THERM 6.3 results for head.

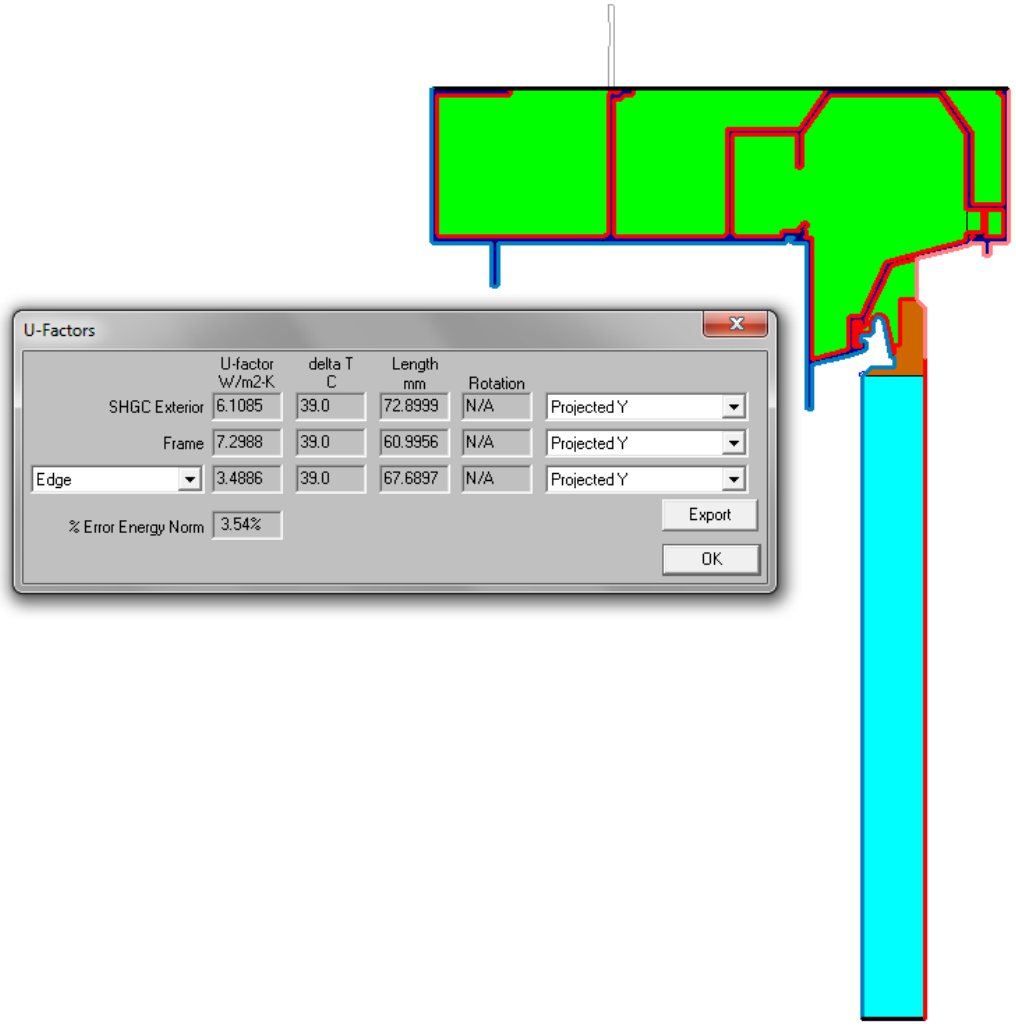

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Figure 3: THERM 6.3 results for jamb.

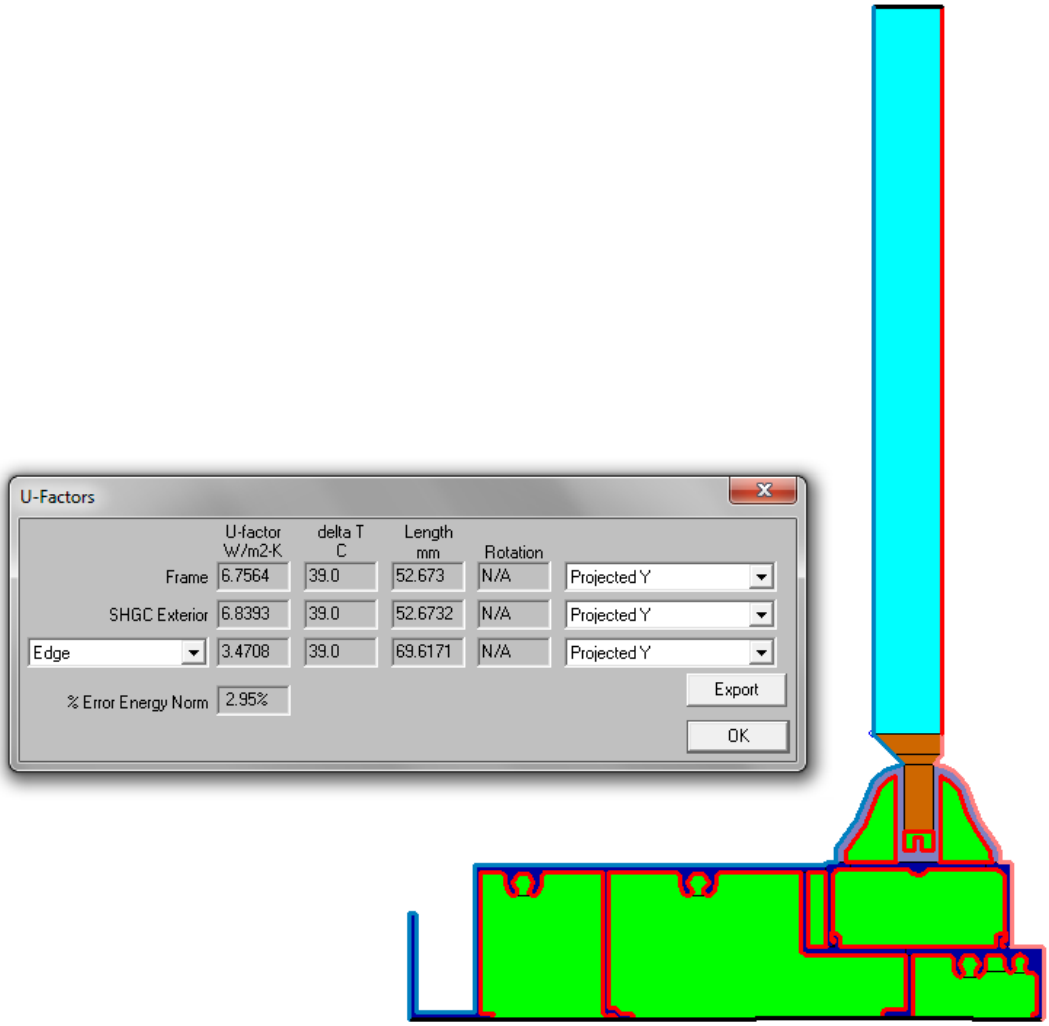

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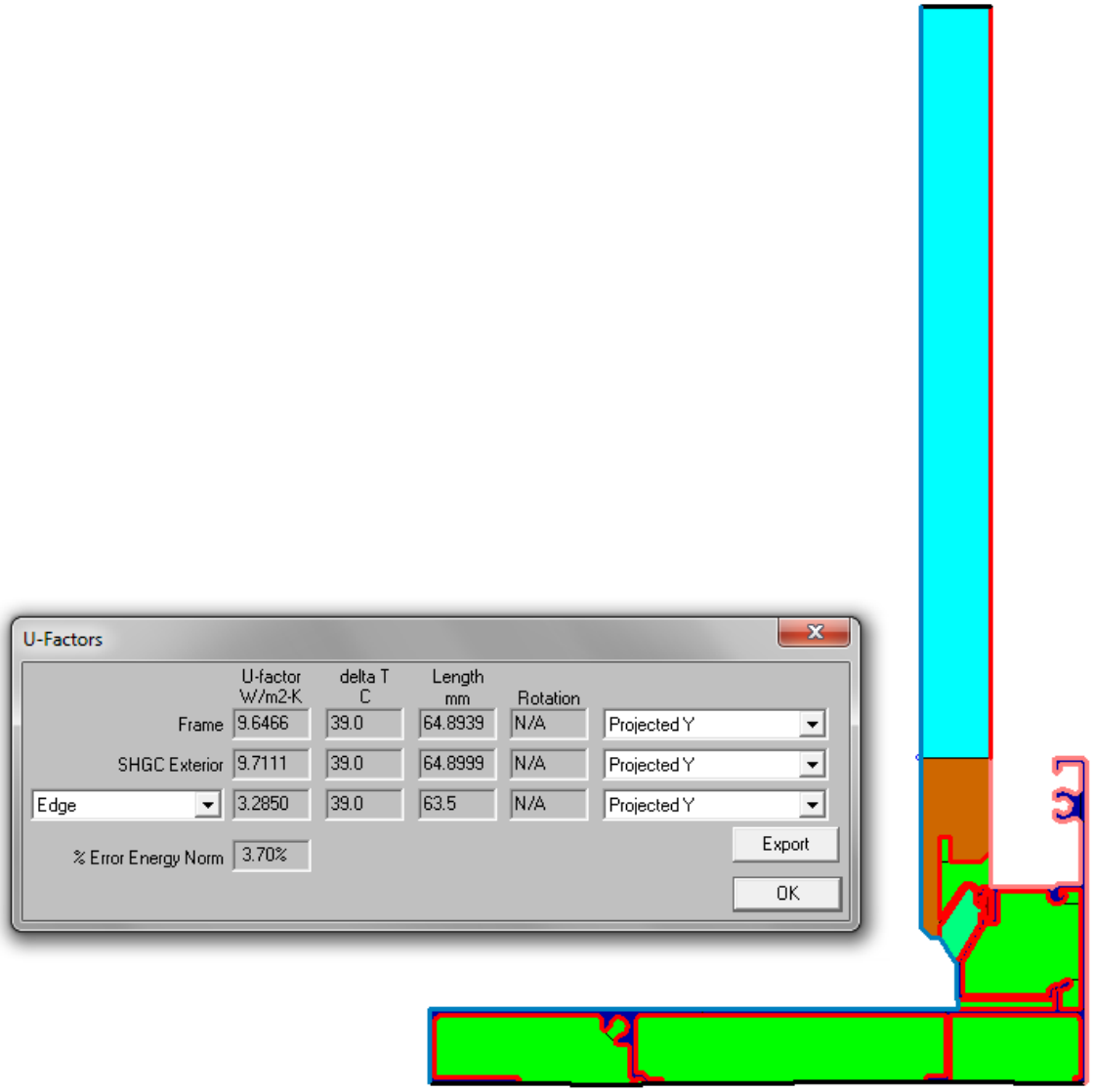
Figure 4: THERM 6.3 results for sill.



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3. Results and Conclusions

Table 2 and Figure 5 show the final WINDOW 6.3 results for cedar blade louvre window. It is rated at the standard AFRC size for a louvre product (1500mm high x 600mm wide, AFRC Technical Interpretation Report). Table 3 presents a full WINDOW 6.3 detailed report for the product.

Table 2: Thermal, solar and optical performance results for Easyscreen frame, Altair 152, WRC Blades. Results were determined at standard NFRC 100-2010 environmental conditions and simulated using WINDOW 6.3.

Description	U-value (W/m².K)	Solar heat gain coefficient (SHGC)	Visible transmittance (VT)
Easyscreen frame, Altair 152, WRC Blades	4.39	0.095	0.000

Figure 5: WINDOW 6.3 summary results, Easyscreen frame, Altair 152, WRC Blades.

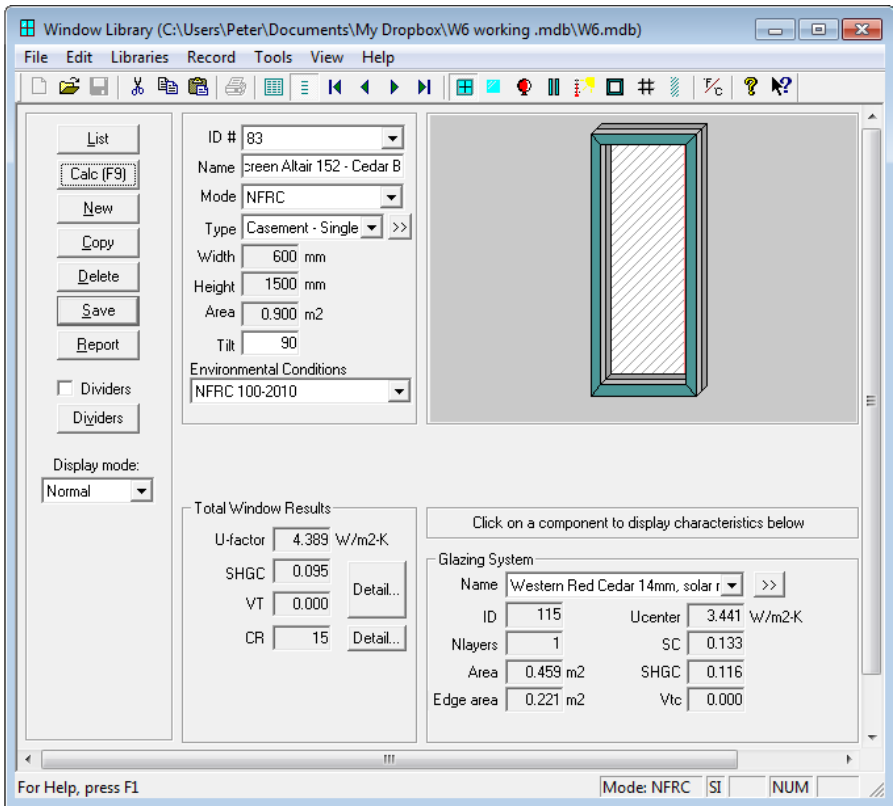

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Table 3.

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Window v6.3.9.0  Report              Page 1                    09/08/11 09:59:02
      ID: 83
    Name: EasyScreen Altair 152 - Cedar Blades, sol ref=0.7, ATIR size
 EnvCond: 1 NFRC 100-2010

    Type: Casement - Single
    Tilt:  90
   Width: 600.0  mm
  Height: 1500.0  mm
    Area:   0.90 m2


 U-value: 4.389 W/m2-K
    SHGC: 0.095
      Vt: 0.000
      CI: 14.7   (Condensation Resistance)


Data for Glazing Systems

                        COG
ID     Name             Area #Lay  Tilt      Uc      SCc   SHGCc   Vtc    RHG
                         m2                  W/m2
------ --------------- ----- ----  ----   -------   -----  -----  -----  -----
   115 Western Red Ced 0.459    1    90      3.441   0.133  0.116  0.000    109

Layer Data for Glazing System '115 Western Red Cedar 14mm, solar ref = 0.7'

ID     Name            D(mm) Tsol  1 Rsol 2 Tvis  1 Rvis 2  Tir  1 Emis 2 Keff
------ --------------- ----- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
Outside
 33404 Cedar.PLA_ref0.# 14.0 .000 .700 .700 .000 .700 .700 .000 .900 .900 .110
Inside

Frame Data
                                                    Frame   Edge
Location         ID      Name          Source       Area    Area    Uframe   Uedge
                                                     m2      m2       W/m2-K
---------------- ------  ------------ ------------ -----   -----  -------  ------
Header              238  Altair 152 Lo Therm         0.033   0.027   7.2988  3.4886
Left Jamb           239  Altair 152 Lo Therm         0.076   0.083   6.7564  3.4708
Right Jamb          239  Altair 152 Lo Therm         0.076   0.083   6.7564  3.4708
Sill                240  Altair 152 Lo Therm         0.036   0.027   9.6466  3.2850


Gas Data

ID      Name                       Type   Cond    Visc    Cp      Dens    Pran

                                                  x e-6
______  _________________________  _____ ______ _______ _______ _______ ______


No gas data for Single Glazing
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Window v6.3.9.0  Report              Page 2                    09/08/11 09:59:02
Environmental Conditions: 1 NFRC 100-2010

          Tout   Tin  WndSpd   Wnd Dir   Solar  Tsky  Esky
          (C)    (C)   (m/s)            (W/m2)  (C)
         -----  ----  ------  --------  ------  ----  ----
Uvalue   -18.0  21.0    5.50  Windward     0.0 -18.0  1.00
Solar     32.0  24.0    2.80  Windward   783.0  32.0  1.00


Frame Library Data
                                      U-value    Edge GlzSys GlzSys Width
ID     Name            Source       Frame   Edge  Corr Width    Uc   (PFD)  Abs

______ _____________  ____________  ______ ______ ____ ______ ______ _____  ____

   238 Altair 152 Lo  Therm         7.2988 3.4886  N/A 14.000  3.441 61.00  0.30
   239 Altair 152 Lo  Therm         6.7564 3.4708  N/A 14.000  3.441 52.67  0.30
   240 Altair 152 Lo  Therm         9.6466 3.2850  N/A 14.000  3.441 64.89  0.30


Divider Library Data
                                      U-value    Edge GlzSys GlzSys Width
ID     Name            Source        Div    Edge  Corr Width    Uc   (PFD)  Abs

______ _____________  ____________  ______ ______ ____ ______ ______ _____  ____

No Dividers for this Glazing System

Optical Properties for Glazing System '115 Western Red Ced'

Angle      0    10    20    30    40    50    60    70    80    90 Hemis

Vtc  : 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
Rf   : 0.700 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 0.990
Rb   : 0.700 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 0.990

Tsol : 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
Rf   : 0.700 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 0.990
Rb   : 0.700 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 0.990

Abs1 : 0.300 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

SHGCc: 0.116 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

Tdw-K  :  0.000
Tdw-ISO:  0.000
Tuv    :  0.000


  Window v6.3.9.0  Report              Page 3                    09/08/11 09:59:02

      Temperature Distribution (degrees C)
        Winter         Summer
       Out   In       Out   In
      ----  ----     ----  ----
Lay1 -13.4   3.6     37.6  37.7


  Window v6.3.9.0  Report              Page 3                    09/06/11 14:32:04

      Temperature Distribution (degrees C)
        Winter         Summer
       Out   In       Out   In
      ----  ----     ----  ----
Lay1 -13.4   3.6     37.6  37.7
```


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