



# Review of Consensus Standard Spectra for Flat Plate and Concentrating Photovoltaic Performance

D. Myers

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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## Preface

Consensus standard reference terrestrial solar spectra are used to establish nameplate ratings for photovoltaic device performance at standard reporting conditions. This report describes reference solar spectra developed in the United States and international consensus standards community that are widely accepted as of this writing (June 2011).

## Acknowledgments

The work described here is the result of tremendous technical effort on the part of the photovoltaic industry, national and international research organizations, and consensus standards organizations. It is impossible to name every individual and organization that has participated in the 30-year development of these standards. The following partial list is indicative of the effort required to establish and maintain an appropriate level of technical support to meet the photovoltaic industry needs. Any omissions are purely the responsibility of the author.

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† Deceased.

## List of Acronyms and Abbreviations

1976 USSA	U.S. 1976 Standard Atmosphere
AM	air mass
ASTM	formerly American Society for Testing and Materials, now ASTM International
IEC	International Electrotechnical Commission
ISO	International Standards Organization
NREL	National Renewable Energy Laboratory
ppmv	parts per million-volume
PV	photovoltaic
SMARTS	Simple Model for the Atmospheric Radiative Transfer of Sunshine
TC	Technical Committee
UV	ultraviolet

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# 1 Introduction

In 1982, the American Society for Testing and Materials (ASTM), now known as ASTM International, adopted consensus standard solar terrestrial spectra (ASTM E891-82 and E892-82, in 1998 merged into ASTM G159 [1]) to provide standard spectra for photovoltaic (PV) performance applications. The International Standards Organization (ISO) consolidated these spectra into a single ISO standard (ISO 9845-1 [2]), without revision, in 1992. These spectra were based upon older (1980 vintage) spectral solar radiation models [3] and information on atmospheric profiles that were no longer current or up-to-date [4]. Discussion of important issues concerning the definition of atmospheric parameters, spectral range, accuracy, and resolution, and documentation within the consensus standards community, particularly the ASTM committees E44 on Solar, Geothermal, and Alternative Energy, and G03 on Weathering and Durability of the standards resulted in proposed substantial improvements to meet the current and future needs of the various technologies utilizing the reference spectra [5, 6]. In 2008 the International Electrotechnical Commission (IEC) addressed updating the reference spectra for terrestrial PV devices to (almost) be in harmony with the new ASTM reference spectra. These new terrestrial reference spectra are designated ASTM G-173 [7], and IEC 60904-03 [8].

A modern terrestrial spectral radiation model, the Simple Model for the Atmospheric Radiative Transfer of Sunshine (SMARTS) [4, 9], and better knowledge of atmospheric physics and prevailing radiometric quantities in the natural environment were used to develop revisions to the reference spectra. The suggested revisions extend and improve the documentation of the total hemispherical (“global”) 37° south-facing tilted surface reference spectrum (with minor modifications), and provide a more realistic direct normal spectrum for the intended concentrating PV applications. In particular, the newly defined reference spectra include more detailed and reliable spectral information from the ultraviolet (UV) (285 nm) to the near infrared (4,000 nm), better spectral resolution, convenient generation through a standard model and input parameters, and ease of use in terms of importing the spectra into applications programs. It should be noted that the IEC 60904-03 reference spectrum is for total hemispherical on a 37° tilted surface only, and does not include a direct normal spectrum.

Both reference spectral distribution standards are based on the same version of Gueymard’s SMARTS model (Version 2.9.2) and identical atmospheric parameter inputs. However, the IEC standard has several small adjustments to the resulting total hemispherical spectral, which are described below.

## 2 Consensus Standards Organizations

The two organizations that have promulgated the above standards generally strive for harmonization and standardization of documentary standards to avoid duplication of effort and conflicting standards. However, each has different protocols and processes for eventual acceptance (balloting) and publication of the standards. These procedures are beyond the scope of this document, but a brief overview of each organization is provided here.

### 2.1 ASTM International

ASTM develops and publishes international voluntary consensus standards. Today, some 12,000 ASTM standards address product quality, safety, market access and trade, and consumer

confidence. ASTM's standards development is driven by the contributions of more than 30,000 members who are technical experts and business professionals representing 135 countries. The ASTM standards development process is open and transparent. The process uses periodic face-to-face meetings and an internet-based electronic infrastructure to develop, ballot, and deliver test methods, specifications, guides, and practices that support industries and governments worldwide.

Two ASTM committees, E44 on Solar, Geothermal and Alternative Energy and G03 on Weathering and Durability, contributed to the development of the standard reference spectra. The E44 scope of the committee states:

“The promotion of knowledge, stimulation of research and the development of standard test methods, specifications, guides, practices and terminology concerned with the technology for conversion of solar and geothermal renewable energy to directly usable energy forms and the application of such technology for the public benefit.”

The Committee G03 scope states:

“The promotion of knowledge, stimulation of research, and the development of standards related to the durability and performance of organic and inorganic nonmetallic materials, components and combined assemblies that are subjected to various environments.”

The ASTM scope of the standard reference spectra in ASTM G173, “Standard Tables for Reference Solar Spectral Irradiances: Direct Normal and Hemispherical on 37° Tilted Surface,” states:

“These tables contain terrestrial solar spectral irradiance distributions for use in terrestrial applications that require a standard reference spectral irradiance for hemispherical solar irradiance (consisting of both direct and diffuse components) incident on a sun-facing, 37° tilted surface, or the direct normal spectral irradiance. The data contained in these tables reflect reference spectra with uniform wavelength interval (0.5 nanometer (nm) below 400 nm, 1 nm between 400 nm and 1700 nm, an intermediate wavelength at 1702 nm, and 5 nm intervals from 1700 to 4000 nm). The data tables represent reasonable cloudless atmospheric conditions favorable for photovoltaic (PV) energy production, as well as weathering and durability exposure applications.”

## **2.2 International Electrotechnical Commission**

Founded in 1906, the IEC prepares and publishes international standards for all electrical, electronic, and related technologies. These are known collectively as “electrotechnology.” IEC provides a platform to companies, industries and governments for meeting, discussing, and developing the international standards they require. All IEC international standards are consensus-based and represent the needs of key stakeholders of every nation participating in IEC work. Every member country has one vote and a say in what goes into an IEC International Standard.

IEC Technical Committee (TC) IEC TC-82 addresses scope as follows:



“To prepare international standards for systems of photovoltaic conversion of solar energy into electrical energy and for all the elements in the entire photovoltaic energy system. In this context, the concept “photovoltaic energy system” includes the entire field from light input to a solar cell to and including the interface with the electrical system(s) to which energy is supplied.”

The scope of IEC 60904-03, “Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data,” is stated as:

“This part of IEC 60904 applies to the following photovoltaic devices for terrestrial applications:

- Solar cells with or without a protective cover
- Sub assemblies of solar cells
- Modules
- Systems.

Note: the term ‘test specimen’ is used to denote any of these devices.

The principles contained in the standard cover testing in both natural and simulated sunlight.

This standard is not applicable to solar cells designed for operation in concentrated sunlight. Photovoltaic conversion is spectrally selective due to the nature of the semiconductor materials used in PV solar cells and modules. To compare the relative performance of different PV devices and materials a reference standards solar spectral distribution is necessary. This standard includes such a reference solar spectral distribution.

This standard also describes basic measurement principles for determining the electrical output of PV devices. The principles given in this standard are designed to relate the performance rating of PV devices to a common reference terrestrial solar spectral irradiance distribution.

The reference terrestrial solar spectral irradiance distribution given in this standard is required in order to classify solar simulators according to the spectral performance requirements contained in IEC 60904-9.”

### **3 Reference Terrestrial Spectra**

Detailed historical and technical descriptions of the development of the reference spectral distributions are provided in [5, 6, 9, 10]. Here we relate the basis of the most important considerations with respect to the applications of these reference spectra.

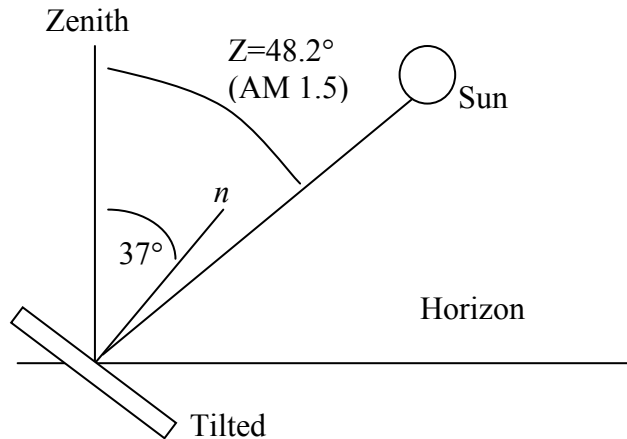
#### **3.1 Geometric Considerations**

The geometric conditions selected for the reference solar spectral irradiance distributions were considered to be reasonable averages for flat plate PV modules deployed in the 48 contiguous states of the United States. The receiving surface is defined as an inclined plane tilted at 37° from the horizontal toward the equator, facing south (azimuth of 180°). The only specification with respect to the solar position is that the air mass (AM), the path length through the atmosphere

relative to the zenith, or overhead position, is equal to 1.5. Previous versions of the standards specified the solar spectral irradiance “that is incident on a surface tilted  $37^\circ$  from the horizontal *toward the sun*” (emphasis added). Although it might have been stated more clearly, this could be construed as a relative sun-plane azimuth of  $0^\circ$  by implication. However, the intent has always been for the tilted surface azimuth to be aligned toward the south, along the local meridian.

Air mass is also defined as the reciprocal of the cosine of the zenith angle,  $Z$ , (angle between the zenith and the sun) or the reciprocal of the sine of the elevation angle. Thus, for  $AM=1.5$ , the zenith angle for the sun is  $48.19^\circ$  and the elevation angle is  $41.81^\circ$  above the horizon. Therefore, there is an  $11.19^\circ$  angle of incidence between the direct normal beam and the normal to the tilted surface, *if the sun’s azimuth is in the plane of the surface normal (azimuth =  $180^\circ$ )*. The incidence angle is larger if the sun is not in the plane of the surface normal.

The tilt angle selected ( $37^\circ$ ) is approximately the average latitude for the contiguous United States. Note that the solar azimuth is not explicitly defined. The rationale for this lack of precision was provided in [3], where it is stated that for a horizontally homogenous atmospheric model, azimuth geometry is not of concern. The geometry selected is shown in Figure 1.



**Figure 1. Reference spectral distribution geometry. The solar azimuth is  $180^\circ$ , in the same plane as the normal to the “south facing” surface tilted toward the equator (in the Northern Hemisphere). Normal to the tilted plane is  $n$ .**

$AM = 1.5$  was selected based on work performed at the Jet Propulsion Laboratory by Gonzalez and Ross [11]. Their work indicated that for locations ranging from Caribou, Maine (latitude  $46^\circ 52'$ ) to Phoenix, Arizona, (latitude  $33^\circ 26'$ ) approximately 50% of solar radiation resources for energy production by PV conversion systems occurred above or below  $AM=1.5$ .

The direct normal irradiance distribution includes not only the irradiance from the sun’s disk, which is truly direct beam irradiance within a  $0.5^\circ$  field-of-view, but also a small contribution (typically less than 1% of the total) of diffuse radiation. This provision is consistent with usual

measuring practices using a “5.8° field-of-view normal incidence pyrheliometer that allows a small amount of circumsolar (diffuse) radiation to be detected.”[1]

### 3.2 Atmospheric Parameters

To establish appropriate atmospheric conditions for the reference standard, the National Renewable Energy Laboratory (NREL) analyzed broadband National Solar Radiation Database [12, 13, 14] 30-year data sets. That analysis [15] indicated that an aerosol optical depth (0.084) is more representative of conditions for economic deployment of both flat plate and concentrator PV applications.

In place of the constant albedo of 0.2 in the historical standards, a measured spectral albedo for light sandy soil (from a list of 38 available albedo files) was used. SMARTS2 was used to compute spectra representing the new conditions at uniform spectral resolution and wavelength step intervals.

By fixing all constraints (U.S. 1976 Standard Atmosphere [1976 USSA] [16] air mass, ozone, water vapor, tilt geometry) other than the aerosol optical depth, spectral albedo, and carbon dioxide concentration (370 ppmv vs. 330 ppmv in 1976 USSA), it was found that the hemispherical tilted spectral irradiance remained essentially unchanged with respect to the 1-kW/m<sup>2</sup> normalized historical hemispherical spectrum, with an integral of 1000.37 W/m<sup>2</sup>. This fortuitously minimized the impact on the flat plate PV community of “changing” the hemispherical reference spectrum, primarily through changing the model used to generate the spectrum.

At these same specified conditions, the direct beam spectral irradiance was substantially increased (~18%), integrating to 900.14 W/m<sup>2</sup>. These results eliminate the need for normalization to “1-sun” of 1 kW/m<sup>2</sup> for flat plates, (see [1, 5, 6]) and are within 6% of the Photovoltaic for Utility Scale Applications, or PVUSA-specified test condition irradiance of 850 W/m<sup>2</sup> for concentrating systems utilizing direct beam irradiance [17].

The reference spectra can be readily reproduced exactly by use of the SMARTS2 v. 2.9.2 model and the proper input files (see next section). The slight differences between “round numbers” of 1,000 W/m<sup>2</sup> (for hemispherical) and 900 W/m<sup>2</sup> for direct normal are far below the present uncertainty associated with either broadband or spectral irradiance measurements, and PV performance measurements in general [18] (e.g., 0.037% and 0.016% for hemispherical and direct irradiance, respectively). Therefore, the rationale of the ASTM committees were to “let the model produce the result” without consideration of adjustment factors to shift the integrated irradiances to “round numbers.”

In contrast, the IEC technical committees, despite using the same input parameters and obtaining the same output files, did decide to add the following additional modifications:

- a) Add one additional “spectral data point” to account for the energy from 4,000 nm to “infinity.”
- b) Adjust the integrated hemispherical spectrum to 1,000 W/m<sup>2</sup> by stating that the spectral model spectral output file irradiance values must be multiplied by 0.9971. This results in the cumulative integrated hemispherical spectral irradiance at 4,000 nm to be 997.47

$W/m^2$ . The additional “4,000 nm to infinity” data point then contributes an additional  $2.53 W/m^2$ , resulting in a total integrated hemispherical irradiance of exactly  $1,000 W/m^2$ .

Note there is no reference or discussion for how adjustment b) was arrived at.

### **3.3 Generating the Reference Spectra**

#### **3.3.1 FORTRAN Executable**

SMARTS was originally written in FORTRAN on an Apple Macintosh platform. For the IBM-PC user, the source code (about 2,500 lines) is compiled using the Lahey FORTRAN LF 90 version 4.5, using the “target processor” switch for Pentium processors, (-tp) and optimization level 0 (-O0) and setting the arithmetic processor “on” (-ap). These settings produce results identical to those on the Macintosh platform. The Apple (Mac-Classical), Windows PC, and Linux versions of the SMARTS model are available free for download at:

<http://www.nrel.gov/rredc/smarts>. A PC-Windows-only Excel spreadsheet graphical user interface for building input files is also included in the download package for both versions 2.9.2 and 2.9.5, making them easier to use by novice users. A description of and access to a LabView implementation is available from <http://www.solarconsultingservices.com/smarts.php>. Complete documentation, including user’s manuals, references, and source code) is available in each package.

The interactive SMARTS executable prompts for a default input file name (SMARTS2.INP) or a user-defined input file name with extension INP. The user may create or edit a pre-existing input file using any text editor and save it either as the default input file SMARTS2.INP or with a unique name. Upon execution, the input file parameters, many ancillary data (absorption and albedo) files are read, and up to three output files are generated. The output files contain an echo of the input parameters with descriptive text and important calculated results, spectral calculation results, and if requested, a “scan” file with data degraded by a user-specified filter. All output files are ASCII and may be imported easily into word processor or spreadsheet applications.

#### **3.3.2 Input file structure**

The SMARTS input file is an assembly of parameters arranged as in a stack of input “cards.” Table 1 is an annotated input file used to generate both the IEC 60904-03 total hemispherical spectrum on a  $37^\circ$  south-facing tilt and the ASTM G173 standard spectra: total hemispherical on a  $37^\circ$  tilted south-facing plane, and direct normal spectral distribution. The only two input fields that are specified differently in the two standards are the “number of spectra to print” (card 12b) and the specifiers for which spectra to print (card 12c), as indicated in the bold entries and in the footnotes to the table.

**Table 1. Annotated SMARTS Text Input File for Generating The Reference Spectral Distributions**

Card ID	VALUE	Parameter/Description/Variable Name
1	ASTM_G173_Std_Spectra	Comment line
2	1	Pressure input mode (1 = pressure and altitude): ISPR
2a	1013.25 0.0	Station Pressure (mb) & altitude (km): SPR, ALT
3	1	Atmosphere Profile Selection (1 = default atmosphere): IATM1
3a	'USSA'	Default Standard Atmosphere Profile: ATM
4	1	Water Vapor Input (1 = Atmospheric Profile): IH2O
5	1	Ozone Calculation (1 = Atmospheric Profile): IO3
6	1	Pollution level mode (1 = standard conditions/no pollution): IGAS
7	370	Carbon Monoxide volume mixing ratio (ppm): qCO2
7a	1	Extraterrestrial Spectrum (1 = SMARTS/Gueymard): ISPCTR
8	'S&F_RURAL'	Aerosol Profile to Use: AEROS
9	0	Specification for aerosol optical depth/turbidity input (0 = AOD at 500 nm): ITURB
9a	0.084	Aerosol Optical Depth @ 500 nm: TAU5
10	38	Far field Spectral Albedo file to use (38= Light Sandy Soil): IALBDX
10b	1	Specify tilt calculation (1 = yes): ITILT
10c	38 37 180	Albedo and Tilt variables—Albedo file to use for near field, Tilt, and Azimuth: IALBDG, TILT, WAZIM
11	280 4000 1.0 1367.0	Wavelength Range—start, stop, mean radius vector correction, integrated solar spectrum irradiance: WLMN, WLMX, SUNCOR, SOLARC
12	2	Output file print mode (2 = yes): IPRT: Spectral & broadband files
12a	280 4000 .5	Output file wavelength—Print limits, start, stop, minimum step size: WPMN, WPMX, INTVL
<b>12b</b>	<b>2</b>	<b>Number of output variables to print: IOTOT(*)</b>
<b>12c</b>	<b>8 9</b>	<b>Output variables to print 8 = Hemispherical tilt, 9 = direct normal + circumsolar(**)</b>
13	1	Circumsolar calculation mode (1 = yes): ICIRC
13a	0 2.9 0	Receiver geometry—Slope, View, Limit half angles: SLOPE, APERT, LIMIT
14	0	Smooth function mode (0 = none):
15	0	Illuminance calculation mode (0 = none): ILLUM
16	0	UV calculation mode (0 = none): IUUV
17	2	Solar Geometry mode (2 = Air Mass): IMASS
17a	1.5	Air mass value: AMASS

\* For IEC 60904-03, this value is 1 (one), as only one spectrum, the tilted hemispherical spectrum, is required for output.

\*\* For IEC 60904-03, this value is 8 (eight) only, indicating the titled hemispherical spectrum. The additional “9” indicates direct normal + circumsolar output spectrum is produced (for ASTM G173).

### 3.3.3 Special considerations for IEC-60904-03

As described in section 3.2, there is an additional step to producing the IEC-60904-3 hemispherical reference spectrum. The hemispherical spectral distribution data must be multiplied by 0.9971. This is to adjust the 280 nm to 4,000 nm spectrum to reflect the fact that there is an additional energy beyond 4,000 nm (amounting to 2.53 W/m<sup>2</sup>), which is not accounted for in the modeled spectrum. Note that this amounts to 0.253% of the total 1,000 W/m<sup>2</sup> total integrated power in the spectrum. This “error” is smaller than the 0.3% quoted total absolute uncertainty in the measurement of direct beam solar irradiance accomplished by the Working Standard Group of the World Radiometric Reference maintained by the World Meteorological Organization [19]. This is also far smaller than many other sources of error in the estimation of the uncertainty in PV performance measurements [18].

In addition, the IEC spectrum provides a calculation of the photon flux at each wavelength derived from the calculation of  $\Phi = (W * \lambda) / hc$  where  $W$  is spectral power in W/m<sup>2</sup>/nm,  $\lambda$  is wavelength in meters,  $h=6.626 \times 10^{-34}$  J-s (Planck’s constant), and  $c=2.998 \times 10^8$  m/s (the speed of light in a vacuum).

## 4 Summary

Two very similar but slightly different terrestrial spectral irradiance distribution standards are widely used: International Electrotechnical Commission standard IEC-60904-03 and ASTM International standard G-173. The IEC standard addresses only the hemispherical tilt reference spectrum, while the ASTM standard addresses both hemispherical and direct normal spectra. Both standards rely on the version 2.9.2 SMARTS spectral model of Gueymard to produce the reference spectra. The only differences in the model input files for the two standards are with respect to the number of spectra to be produced and which (hemispherical, direct beam, or both) are to be produced in the output file. Lastly, the IEC standard includes post-model run corrections to a) reduce the overall hemispherical by a factor of 0.9971, and b) to add in one additional “data point” representing the integrated value from 4,000 nm to “infinity,” with a value of 2.53 W/m<sup>2</sup>. The resulting spectra are reproduced in the appendix.

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# Appendix. Spectral Distribution Tables

Table A1. ASTM G173-03 Reference Spectra Derived from SMARTS v. 2.9.2

Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
280.0	4.73E-23	2.54E-26	4.72E-23	6.65E-05	308.0	0.0378	0.0208	0.0377	5.85E+16
280.5	1.23E-21	1.09E-24	1.23E-21	1.73E-03	308.5	0.0414	0.0228	0.0413	6.42E+16
281.0	5.69E-21	6.13E-24	5.67E-21	8.03E-03	309.0	0.0405	0.0223	0.0404	6.29E+16
281.5	1.57E-19	2.75E-22	1.56E-19	2.21E-01	309.5	0.0433	0.0237	0.0432	6.73E+16
282.0	1.19E-18	2.83E-21	1.19E-18	1.69E+00	310.0	0.0509	0.0278	0.0508	7.93E+16
282.5	4.54E-18	1.33E-20	4.53E-18	6.44E+00	310.5	0.0655	0.0359	0.0653	1.02E+17
283.0	1.85E-17	6.76E-20	1.84E-17	2.62E+01	311.0	0.0829	0.0454	0.0827	1.29E+17
283.5	3.54E-17	1.46E-19	3.53E-17	5.03E+01	311.5	0.0841	0.0462	0.0838	1.32E+17
284.0	7.27E-16	4.98E-18	7.25E-16	1.04E+03	312.0	0.0934	0.0509	0.0931	1.46E+17
284.5	2.49E-15	2.16E-17	2.48E-15	3.55E+03	312.5	0.099	0.0538	0.0987	1.55E+17
285.0	8.01E-15	9.00E-17	7.99E-15	1.15E+04	313.0	0.1073	0.0583	0.107	1.69E+17
285.5	4.26E-14	6.44E-16	4.25E-14	6.11E+04	313.5	0.1076	0.059	0.1073	1.69E+17
286.0	1.37E-13	2.35E-15	1.36E-13	1.96E+05	314.0	0.1197	0.0653	0.1193	1.89E+17
286.5	8.38E-13	1.85E-14	8.36E-13	1.21E+06	314.5	0.1306	0.0705	0.1302	2.06E+17
287.0	2.74E-12	7.25E-14	2.73E-12	3.94E+06	315.0	0.1363	0.0737	0.1359	2.15E+17
287.5	1.09E-11	3.66E-13	1.09E-11	1.57E+07	315.5	0.1184	0.0648	0.118	1.88E+17
288.0	6.23E-11	2.81E-12	6.22E-11	9.01E+07	316.0	0.1235	0.0671	0.1231	1.96E+17
288.5	1.72E-10	9.07E-12	1.71E-10	2.49E+08	316.5	0.1504	0.0811	0.1499	2.39E+17
289.0	5.63E-10	3.50E-11	5.61E-10	8.16E+08	317.0	0.1716	0.093	0.1711	2.73E+17
289.5	2.07E-09	1.54E-10	2.07E-09	3.02E+09	317.5	0.1825	0.0997	0.1819	2.91E+17
290.0	6.02E-09	5.15E-10	6.00E-09	8.76E+09	318.0	0.1759	0.0958	0.1754	2.81E+17
290.5	1.38E-08	1.33E-09	1.37E-08	2.01E+10	318.5	0.1859	0.1001	0.1854	2.97E+17
291.0	3.51E-08	3.90E-09	3.50E-08	5.12E+10	319.0	0.2047	0.1097	0.2041	3.28E+17
291.5	1.09E-07	1.44E-08	1.09E-07	1.60E+11	319.5	0.1959	0.1069	0.1953	3.14E+17
292.0	2.68E-07	4.08E-08	2.68E-07	3.93E+11	320.0	0.2053	0.1128	0.2047	3.30E+17
292.5	4.27E-07	7.04E-08	4.26E-07	6.27E+11	320.5	0.2453	0.1331	0.2445	3.95E+17
293.0	8.65E-07	1.58E-07	8.62E-07	1.27E+12	321.0	0.2502	0.1341	0.2495	4.03E+17
293.5	2.27E-06	4.71E-07	2.26E-06	3.35E+12	321.5	0.2384	0.1282	0.2377	3.85E+17
294.0	4.17E-06	9.46E-07	4.16E-06	6.16E+12	322.0	0.222	0.122	0.2214	3.59E+17
294.5	6.59E-06	1.60E-06	6.57E-06	9.74E+12	322.5	0.2171	0.1197	0.2165	3.51E+17
295.0	1.23E-05	3.22E-06	1.23E-05	1.82E+13	323.0	0.2123	0.1162	0.2116	3.44E+17
295.5	2.78E-05	8.02E-06	2.77E-05	4.13E+13	323.5	0.2486	0.1339	0.2479	4.04E+17
296.0	4.79E-05	1.47E-05	4.78E-05	7.12E+13	324.0	0.2754	0.1485	0.2746	4.48E+17
296.5	7.13E-05	2.33E-05	7.11E-05	1.06E+14	324.5	0.2832	0.1547	0.2824	4.61E+17
297.0	9.68E-05	3.32E-05	9.65E-05	1.44E+14	325.0	0.2789	0.155	0.2781	4.55E+17
297.5	1.86E-04	6.79E-05	1.86E-04	2.78E+14	325.5	0.3244	0.1794	0.3234	5.30E+17
298.0	2.90E-04	1.11E-04	2.89E-04	4.34E+14	326.0	0.3812	0.2087	0.3801	6.24E+17
298.5	3.58E-04	1.43E-04	3.57E-04	5.36E+14	326.5	0.4072	0.2216	0.406	6.67E+17
299.0	4.92E-04	2.03E-04	4.91E-04	7.39E+14	327.0	0.3981	0.2183	0.3969	6.53E+17
299.5	8.61E-04	3.74E-04	8.58E-04	1.29E+15	327.5	0.3847	0.2129	0.3835	6.32E+17
300.0	1.02E-03	4.56E-04	1.02E-03	1.54E+15	328.0	0.3512	0.1977	0.3501	5.78E+17
300.5	0.0012	0.0006	0.0012	1.88E+15	328.5	0.3716	0.2068	0.3706	6.13E+17
301.0	0.0019	0.0009	0.0019	2.92E+15	329.0	0.4224	0.233	0.4211	6.98E+17
301.5	0.0027	0.0013	0.0027	4.07E+15	329.5	0.4688	0.2586	0.4674	7.75E+17
302.0	0.0029	0.0015	0.0029	4.43E+15	330.0	0.4714	0.2619	0.47	7.81E+17
302.5	0.0043	0.0022	0.0043	6.51E+15	330.5	0.428	0.241	0.4268	7.10E+17
303.0	0.0071	0.0037	0.0071	1.08E+16	331.0	0.4026	0.2284	0.4015	6.69E+17
303.5	0.009	0.0048	0.009	1.37E+16	331.5	0.4181	0.2364	0.4168	6.96E+17
304.0	0.0095	0.0051	0.0094	1.45E+16	332.0	0.4362	0.2451	0.435	7.27E+17
304.5	0.012	0.0065	0.0119	1.83E+16	332.5	0.4392	0.2466	0.4379	7.33E+17
305.0	0.0165	0.0089	0.0164	2.52E+16	333.0	0.4294	0.2426	0.4282	7.18E+17
305.5	0.0187	0.0102	0.0187	2.87E+16	333.5	0.4072	0.2327	0.4061	6.82E+17
306.0	0.0186	0.0102	0.0185	2.85E+16	334.0	0.415	0.2382	0.4138	6.96E+17
306.5	0.0211	0.0116	0.021	3.25E+16	334.5	0.4451	0.2543	0.4438	7.47E+17
307.0	0.0278	0.0152	0.0278	4.29E+16	335.0	0.4639	0.2648	0.4625	7.80E+17
307.5	0.0356	0.0195	0.0355	5.50E+16	335.5	0.4531	0.2589	0.4518	7.63E+17

Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
336.0	0.4152	0.2381	0.414	7.00E+17	367.0	0.7229	0.4887	0.7208	1.33E+18
336.5	0.3821	0.221	0.381	6.46E+17	367.5	0.7091	0.4804	0.7071	1.31E+18
337.0	0.3738	0.2177	0.3727	6.32E+17	368.0	0.6676	0.4532	0.6657	1.23E+18
337.5	0.4005	0.2343	0.3993	6.79E+17	368.5	0.6631	0.4511	0.6612	1.23E+18
338.0	0.4341	0.2532	0.4329	7.37E+17	369.0	0.6932	0.4724	0.6911	1.28E+18
338.5	0.4553	0.2655	0.4539	7.74E+17	369.5	0.7447	0.5086	0.7425	1.38E+18
339.0	0.4636	0.271	0.4622	7.89E+17	370.0	0.7551	0.5167	0.7529	1.40E+18
339.5	0.4745	0.2785	0.4731	8.09E+17	370.5	0.6826	0.468	0.6806	1.27E+18
340.0	0.5018	0.2966	0.5003	8.56E+17	371.0	0.6934	0.4763	0.6914	1.29E+18
340.5	0.5007	0.2967	0.4993	8.56E+17	371.5	0.7205	0.4959	0.7184	1.34E+18
341.0	0.4714	0.2793	0.47	8.07E+17	372.0	0.6744	0.4651	0.6725	1.26E+18
341.5	0.4694	0.2785	0.468	8.05E+17	372.5	0.6425	0.4439	0.6407	1.20E+18
342.0	0.4893	0.2912	0.4879	8.40E+17	373.0	0.6189	0.4283	0.6171	1.16E+18
342.5	0.5077	0.303	0.5062	8.73E+17	373.5	0.5579	0.3868	0.5562	1.05E+18
343.0	0.5149	0.3086	0.5134	8.87E+17	374.0	0.5564	0.3865	0.5548	1.05E+18
343.5	0.4861	0.2925	0.4847	8.38E+17	374.5	0.5523	0.3844	0.5507	1.04E+18
344.0	0.4184	0.2535	0.4172	7.23E+17	375.0	0.5893	0.4109	0.5876	1.11E+18
344.5	0.4031	0.2444	0.4019	6.97E+17	375.5	0.6516	0.4551	0.6497	1.23E+18
345.0	0.459	0.2785	0.4576	7.95E+17	376.0	0.6748	0.4722	0.6728	1.27E+18
345.5	0.4893	0.2976	0.4879	8.49E+17	376.5	0.6639	0.4654	0.662	1.26E+18
346.0	0.4778	0.2913	0.4764	8.30E+17	377.0	0.7123	0.5001	0.7102	1.35E+18
346.5	0.4866	0.2975	0.4852	8.46E+17	377.5	0.7946	0.5589	0.7922	1.51E+18
347.0	0.494	0.3032	0.4926	8.61E+17	378.0	0.856	0.6031	0.8535	1.62E+18
347.5	0.4767	0.2935	0.4754	8.32E+17	378.5	0.8342	0.5889	0.8318	1.59E+18
348.0	0.4751	0.2931	0.4737	8.30E+17	379.0	0.7439	0.5262	0.7417	1.42E+18
348.5	0.4834	0.2988	0.482	8.46E+17	379.5	0.6668	0.4726	0.6649	1.27E+18
349.0	0.4656	0.2886	0.4643	8.16E+17	380.0	0.7008	0.4975	0.6987	1.34E+18
349.5	0.4781	0.2972	0.4767	8.39E+17	380.5	0.7508	0.534	0.7486	1.43E+18
350.0	0.528	0.3291	0.5264	9.28E+17	381.0	0.7638	0.5442	0.7616	1.46E+18
350.5	0.5674	0.3547	0.5658	9.98E+17	381.5	0.6884	0.4914	0.6864	1.32E+18
351.0	0.5517	0.346	0.5501	9.72E+17	382.0	0.5868	0.4196	0.5851	1.13E+18
351.5	0.5302	0.3339	0.5287	9.36E+17	382.5	0.5076	0.3636	0.5061	9.75E+17
352.0	0.5179	0.3267	0.5164	9.15E+17	383.0	0.455	0.3265	0.4537	8.75E+17
352.5	0.4896	0.3095	0.4882	8.66E+17	383.5	0.4405	0.3166	0.4392	8.48E+17
353.0	0.5204	0.3298	0.5189	9.22E+17	384.0	0.5097	0.3669	0.5082	9.82E+17
353.5	0.5723	0.3635	0.5706	1.02E+18	384.5	0.6136	0.4424	0.6118	1.18E+18
354.0	0.605	0.3852	0.6032	1.08E+18	385.0	0.6736	0.4864	0.6716	1.30E+18
354.5	0.6116	0.3904	0.6098	1.09E+18	385.5	0.6436	0.4655	0.6418	1.25E+18
355.0	0.6114	0.3914	0.6096	1.09E+18	386.0	0.621	0.4498	0.6192	1.20E+18
355.5	0.5903	0.3788	0.5886	1.05E+18	386.5	0.6457	0.4685	0.6438	1.25E+18
356.0	0.5539	0.3563	0.5523	9.90E+17	387.0	0.6515	0.4734	0.6496	1.27E+18
356.5	0.5194	0.335	0.5179	9.30E+17	387.5	0.642	0.4673	0.6402	1.25E+18
357.0	0.4567	0.2953	0.4554	8.18E+17	388.0	0.6122	0.4478	0.6104	1.19E+18
357.5	0.4622	0.2995	0.4608	8.29E+17	388.5	0.6314	0.461	0.6295	1.23E+18
358.0	0.4301	0.2794	0.4288	7.73E+17	389.0	0.6854	0.5012	0.6834	1.34E+18
358.5	0.3993	0.26	0.3981	7.19E+17	389.5	0.7597	0.5564	0.7575	1.49E+18
359.0	0.4695	0.3065	0.4682	8.46E+17	390.0	0.797	0.5846	0.7947	1.56E+18
359.5	0.5655	0.3701	0.5639	1.02E+18	390.5	0.8037	0.5904	0.8014	1.58E+18
360.0	0.5982	0.3924	0.5964	1.08E+18	391.0	0.8514	0.6263	0.8489	1.67E+18
360.5	0.5653	0.3717	0.5637	1.02E+18	391.5	0.8634	0.6362	0.8609	1.70E+18
361.0	0.5202	0.3428	0.5187	9.43E+17	392.0	0.7949	0.5866	0.7926	1.56E+18
361.5	0.5096	0.3365	0.5081	9.25E+17	392.5	0.6626	0.4896	0.6606	1.31E+18
362.0	0.5342	0.3535	0.5327	9.71E+17	393.0	0.4798	0.355	0.4784	9.46E+17
362.5	0.5851	0.388	0.5834	1.07E+18	393.5	0.3815	0.2827	0.3804	7.54E+17
363.0	0.6019	0.4001	0.6002	1.10E+18	394.0	0.4957	0.3678	0.4942	9.80E+17
363.5	0.5854	0.3899	0.5837	1.07E+18	394.5	0.6839	0.5081	0.6819	1.35E+18
364.0	0.6063	0.4047	0.6045	1.11E+18	395.0	0.8077	0.601	0.8054	1.60E+18
364.5	0.6006	0.4018	0.5988	1.10E+18	395.5	0.8604	0.641	0.8579	1.71E+18
365.0	0.6236	0.4181	0.6218	1.14E+18	396.0	0.7566	0.5644	0.7544	1.50E+18
365.5	0.6863	0.4611	0.6843	1.26E+18	396.5	0.5502	0.411	0.5486	1.10E+18
366.0	0.7353	0.4951	0.7332	1.35E+18	397.0	0.4262	0.3188	0.425	8.49E+17
366.5	0.7366	0.4969	0.7344	1.36E+18	397.5	0.6295	0.4715	0.6276	1.26E+18

Wavelength nm	ASTM G173 Global Tilt W $\text{m}^{-2} \text{nm}^{-1}$	ASTM G173 Direct Beam $\text{W m}^{-2} \text{nm}^{-1}$	IEC-60904-03 Global Tilt $\text{W m}^{-2} \text{nm}^{-1}$	IEC-60904-03 Spectral Photon Irradiance $\text{m}^{-2} \text{S}^{-1} \text{nm}^{-1}$		Wavelength nm	ASTM G173 Global Tilt $\text{W m}^{-2} \text{nm}^{-1}$	ASTM G173 Direct Beam $\text{W m}^{-2} \text{nm}^{-1}$	IEC-60904-03 Global Tilt $\text{W m}^{-2} \text{nm}^{-1}$	IEC-60904-03 Spectral Photon Irradiance $\text{m}^{-2} \text{S}^{-1} \text{nm}^{-1}$
398.0	0.8525	0.6394	0.85	1.70E+18		458.0	1.5514	1.2946	1.5469	3.57E+18
398.5	1.0069	0.7562	1.004	2.01E+18		459.0	1.5391	1.2859	1.5346	3.55E+18
399.0	1.0693	0.8041	1.0662	2.14E+18		460.0	1.5291	1.2791	1.5247	3.53E+18
399.5	1.1021	0.8298	1.0989	2.21E+18		461.0	1.5827	1.3255	1.5781	3.66E+18
400.0	1.1141	0.8399	1.1109	2.24E+18		462.0	1.5975	1.3392	1.5929	3.71E+18
401.0	1.1603	0.8769	1.1569	2.34E+18		463.0	1.6031	1.3452	1.5985	3.73E+18
402.0	1.2061	0.9139	1.2026	2.43E+18		464.0	1.5544	1.3055	1.5499	3.62E+18
403.0	1.1613	0.8821	1.1579	2.35E+18		465.0	1.535	1.2905	1.5305	3.58E+18
404.0	1.1801	0.8985	1.1767	2.39E+18		466.0	1.5673	1.319	1.5628	3.67E+18
405.0	1.1511	0.8785	1.1478	2.34E+18		467.0	1.4973	1.2616	1.493	3.51E+18
406.0	1.1227	0.8588	1.1194	2.29E+18		468.0	1.5619	1.3178	1.5574	3.67E+18
407.0	1.1026	0.8455	1.0994	2.25E+18		469.0	1.5682	1.3247	1.5637	3.69E+18
408.0	1.1514	0.8849	1.1481	2.36E+18		470.0	1.5077	1.2749	1.5033	3.56E+18
409.0	1.2299	0.9472	1.2263	2.53E+18		471.0	1.5331	1.2975	1.5287	3.62E+18
410.0	1.0485	0.8091	1.0455	2.16E+18		472.0	1.6126	1.3661	1.6079	3.82E+18
411.0	1.1738	0.9077	1.1704	2.42E+18		473.0	1.5499	1.3144	1.5454	3.68E+18
412.0	1.2478	0.9669	1.2442	2.58E+18		474.0	1.5671	1.3304	1.5626	3.73E+18
413.0	1.1971	0.9295	1.1936	2.48E+18		475.0	1.6185	1.3755	1.6138	3.86E+18
414.0	1.1842	0.9213	1.1808	2.46E+18		476.0	1.5631	1.3299	1.5586	3.74E+18
415.0	1.2258	0.9557	1.2222	2.55E+18		477.0	1.5724	1.3392	1.5678	3.77E+18
416.0	1.2624	0.9863	1.2587	2.64E+18		478.0	1.623	1.3839	1.6183	3.89E+18
417.0	1.2312	0.9639	1.2276	2.58E+18		479.0	1.5916	1.3586	1.587	3.83E+18
418.0	1.1777	0.9239	1.1743	2.47E+18		480.0	1.6181	1.3825	1.6134	3.90E+18
419.0	1.2258	0.9635	1.2222	2.58E+18		481.0	1.6177	1.3836	1.613	3.91E+18
420.0	1.1232	0.8847	1.1199	2.37E+18		482.0	1.6236	1.3899	1.6189	3.93E+18
421.0	1.2757	1.0067	1.272	2.70E+18		483.0	1.6038	1.3742	1.5991	3.89E+18
422.0	1.2583	0.995	1.2547	2.67E+18		484.0	1.5734	1.3492	1.5688	3.82E+18
423.0	1.2184	0.9653	1.2149	2.59E+18		485.0	1.5683	1.3457	1.5638	3.82E+18
424.0	1.2117	0.9618	1.2082	2.58E+18		486.0	1.2716	1.0918	1.2679	3.10E+18
425.0	1.2488	0.9931	1.2452	2.66E+18		487.0	1.4241	1.2235	1.42	3.48E+18
426.0	1.2135	0.9667	1.21	2.60E+18		488.0	1.5413	1.3252	1.5368	3.78E+18
427.0	1.1724	0.9355	1.169	2.51E+18		489.0	1.4519	1.2492	1.4477	3.56E+18
428.0	1.1839	0.9463	1.1805	2.54E+18		490.0	1.6224	1.3968	1.6177	3.99E+18
429.0	1.0963	0.8777	1.0931	2.36E+18		491.0	1.5595	1.3435	1.555	3.84E+18
430.0	0.8746	0.7013	0.8721	1.89E+18		492.0	1.4869	1.2818	1.4826	3.67E+18
431.0	0.7939	0.6378	0.7916	1.72E+18		493.0	1.5903	1.3719	1.5857	3.94E+18
432.0	1.3207	1.0628	1.3169	2.86E+18		494.0	1.5525	1.3402	1.548	3.85E+18
433.0	1.2288	0.9905	1.2252	2.67E+18		495.0	1.6485	1.4238	1.6437	4.10E+18
434.0	1.1352	0.9165	1.1319	2.47E+18		496.0	1.5676	1.3548	1.5631	3.90E+18
435.0	1.2452	1.007	1.2416	2.72E+18		497.0	1.5944	1.3788	1.5898	3.98E+18
436.0	1.3659	1.1061	1.3619	2.99E+18		498.0	1.5509	1.3421	1.5464	3.88E+18
437.0	1.3943	1.1306	1.3903	3.06E+18		499.0	1.5507	1.3429	1.5462	3.88E+18
438.0	1.2238	0.9937	1.2203	2.69E+18		500.0	1.5451	1.3391	1.5406	3.88E+18
439.0	1.1775	0.9575	1.1741	2.60E+18		501.0	1.4978	1.299	1.4935	3.77E+18
440.0	1.3499	1.0993	1.346	2.98E+18		502.0	1.4966	1.2991	1.4923	3.77E+18
441.0	1.3313	1.0859	1.3274	2.95E+18		503.0	1.5653	1.3597	1.5608	3.95E+18
442.0	1.425	1.164	1.4209	3.16E+18		504.0	1.4587	1.2682	1.4545	3.69E+18
443.0	1.4453	1.1823	1.4411	3.21E+18		505.0	1.5635	1.3598	1.559	3.96E+18
444.0	1.4084	1.1537	1.4043	3.14E+18		506.0	1.6264	1.4153	1.6217	4.13E+18
445.0	1.4619	1.1992	1.4577	3.27E+18		507.0	1.556	1.3548	1.5515	3.96E+18
446.0	1.3108	1.0766	1.307	2.93E+18		508.0	1.5165	1.321	1.5121	3.87E+18
447.0	1.4903	1.2257	1.486	3.34E+18		509.0	1.5893	1.385	1.5847	4.06E+18
448.0	1.5081	1.2422	1.5037	3.39E+18		510.0	1.5481	1.3497	1.5436	3.96E+18
449.0	1.5045	1.2409	1.5001	3.39E+18		511.0	1.5769	1.3753	1.5723	4.05E+18
450.0	1.5595	1.2881	1.555	3.52E+18		512.0	1.6186	1.4125	1.6139	4.16E+18
451.0	1.6173	1.3376	1.6126	3.66E+18		513.0	1.5206	1.3277	1.5162	3.92E+18
452.0	1.5482	1.2822	1.5437	3.51E+18		514.0	1.4885	1.3003	1.4842	3.84E+18
453.0	1.4297	1.1854	1.4256	3.25E+18		515.0	1.5314	1.3385	1.527	3.96E+18
454.0	1.5335	1.273	1.5291	3.50E+18		516.0	1.5455	1.3514	1.541	4.00E+18
455.0	1.5224	1.2655	1.518	3.48E+18		517.0	1.2594	1.1017	1.2557	3.27E+18
456.0	1.5724	1.3088	1.5678	3.60E+18		518.0	1.4403	1.2605	1.4361	3.75E+18
457.0	1.5854	1.3213	1.5808	3.64E+18		519.0	1.3957	1.2222	1.3917	3.64E+18

Wavelength nm	ASTM G173 Global Tilt W $\text{m}^{-2} \text{nm}^{-1}$	ASTM G173 Direct Beam $\text{W m}^{-2} \text{nm}^{-1}$	IEC-60904-03 Global Tilt $\text{W m}^{-2} \text{nm}^{-1}$	IEC-60904-03 Spectral Photon Irradiance $\text{m}^{-2} \text{S}^{-1} \text{nm}^{-1}$	Wavelength nm	ASTM G173 Global Tilt $\text{W m}^{-2} \text{nm}^{-1}$	ASTM G173 Direct Beam $\text{W m}^{-2} \text{nm}^{-1}$	IEC-60904-03 Global Tilt $\text{W m}^{-2} \text{nm}^{-1}$	IEC-60904-03 Spectral Photon Irradiance $\text{m}^{-2} \text{S}^{-1} \text{nm}^{-1}$
520.0	1.5236	1.3349	1.5192	3.98E+18	582.0	1.532	1.3729	1.5276	4.48E+18
521.0	1.5346	1.3452	1.5301	4.01E+18	583.0	1.5479	1.3872	1.5434	4.53E+18
522.0	1.569	1.376	1.5644	4.11E+18	584.0	1.5448	1.3845	1.5403	4.53E+18
523.0	1.4789	1.2976	1.4746	3.88E+18	585.0	1.5324	1.3737	1.528	4.50E+18
524.0	1.5905	1.3962	1.5859	4.18E+18	586.0	1.4953	1.3409	1.491	4.40E+18
525.0	1.5781	1.3859	1.5735	4.16E+18	587.0	1.5281	1.3708	1.5237	4.50E+18
526.0	1.5341	1.3479	1.5297	4.05E+18	588.0	1.4934	1.3403	1.4891	4.41E+18
527.0	1.3417	1.1795	1.3378	3.55E+18	589.0	1.2894	1.1582	1.2857	3.81E+18
528.0	1.5357	1.3508	1.5312	4.07E+18	590.0	1.3709	1.2316	1.3669	4.06E+18
529.0	1.6071	1.4142	1.6024	4.27E+18	591.0	1.4662	1.3171	1.4619	4.35E+18
530.0	1.5446	1.3598	1.5401	4.11E+18	592.0	1.4354	1.29	1.4312	4.27E+18
531.0	1.6292	1.4348	1.6245	4.34E+18	593.0	1.4561	1.3086	1.4519	4.33E+18
532.0	1.5998	1.4094	1.5952	4.27E+18	594.0	1.4491	1.3029	1.4449	4.32E+18
533.0	1.4286	1.259	1.4245	3.82E+18	595.0	1.4308	1.287	1.4267	4.27E+18
534.0	1.5302	1.3491	1.5258	4.10E+18	596.0	1.4745	1.326	1.4702	4.41E+18
535.0	1.5535	1.3701	1.549	4.17E+18	597.0	1.4788	1.3303	1.4745	4.43E+18
536.0	1.6199	1.4292	1.6152	4.36E+18	598.0	1.4607	1.3142	1.4565	4.38E+18
537.0	1.4989	1.3229	1.4946	4.04E+18	599.0	1.4606	1.3145	1.4564	4.39E+18
538.0	1.5738	1.3896	1.5692	4.25E+18	600.0	1.4753	1.3278	1.471	4.44E+18
539.0	1.5352	1.3558	1.5307	4.15E+18	601.0	1.4579	1.3123	1.4537	4.40E+18
540.0	1.4825	1.3096	1.4782	4.02E+18	602.0	1.436	1.2928	1.4318	4.34E+18
541.0	1.4251	1.2595	1.421	3.87E+18	603.0	1.4664	1.3205	1.4621	4.44E+18
542.0	1.5511	1.3714	1.5466	4.22E+18	604.0	1.4921	1.3439	1.4878	4.52E+18
543.0	1.5256	1.3493	1.5212	4.16E+18	605.0	1.4895	1.3418	1.4852	4.52E+18
544.0	1.5792	1.3971	1.5746	4.31E+18	606.0	1.4822	1.3353	1.4779	4.51E+18
545.0	1.5435	1.3657	1.539	4.22E+18	607.0	1.4911	1.3434	1.4868	4.54E+18
546.0	1.5291	1.3536	1.5247	4.19E+18	608.0	1.4862	1.3392	1.4819	4.54E+18
547.0	1.549	1.3717	1.5445	4.25E+18	609.0	1.4749	1.3292	1.4706	4.51E+18
548.0	1.5049	1.3331	1.5005	4.14E+18	610.0	1.4686	1.3237	1.4643	4.50E+18
549.0	1.552	1.3752	1.5475	4.28E+18	611.0	1.4611	1.317	1.4569	4.48E+18
550.0	1.5399	1.3648	1.5354	4.25E+18	612.0	1.4831	1.337	1.4788	4.56E+18
551.0	1.5382	1.3639	1.5337	4.25E+18	613.0	1.4621	1.3182	1.4579	4.50E+18
552.0	1.5697	1.3923	1.5651	4.35E+18	614.0	1.4176	1.2783	1.4135	4.37E+18
553.0	1.525	1.3533	1.5206	4.23E+18	615.0	1.4697	1.3254	1.4654	4.54E+18
554.0	1.5549	1.3802	1.5504	4.32E+18	616.0	1.431	1.2906	1.4269	4.43E+18
555.0	1.5634	1.3883	1.5589	4.36E+18	617.0	1.4128	1.2744	1.4087	4.38E+18
556.0	1.5366	1.3651	1.5321	4.29E+18	618.0	1.4664	1.3228	1.4621	4.55E+18
557.0	1.4988	1.3321	1.4945	4.19E+18	619.0	1.4733	1.3292	1.469	4.58E+18
558.0	1.531	1.3613	1.5266	4.29E+18	620.0	1.4739	1.3299	1.4696	4.59E+18
559.0	1.4483	1.2885	1.4441	4.06E+18	621.0	1.4802	1.3359	1.4759	4.61E+18
560.0	1.474	1.3118	1.4697	4.14E+18	622.0	1.4269	1.2882	1.4228	4.46E+18
561.0	1.5595	1.3885	1.555	4.39E+18	623.0	1.4165	1.2793	1.4124	4.43E+18
562.0	1.4847	1.3225	1.4804	4.19E+18	624.0	1.4118	1.2751	1.4077	4.42E+18
563.0	1.5408	1.3731	1.5363	4.35E+18	625.0	1.4026	1.2667	1.3985	4.40E+18
564.0	1.5106	1.3466	1.5062	4.28E+18	626.0	1.4012	1.2655	1.3971	4.40E+18
565.0	1.5201	1.3555	1.5157	4.31E+18	627.0	1.4417	1.3022	1.4375	4.54E+18
566.0	1.4374	1.2823	1.4332	4.08E+18	628.0	1.3631	1.2328	1.3591	4.30E+18
567.0	1.532	1.3673	1.5276	4.36E+18	629.0	1.4114	1.2758	1.4073	4.46E+18
568.0	1.518	1.3554	1.5136	4.33E+18	630.0	1.3924	1.2589	1.3884	4.40E+18
569.0	1.4807	1.3228	1.4764	4.23E+18	631.0	1.4161	1.2799	1.412	4.49E+18
570.0	1.4816	1.324	1.4773	4.24E+18	632.0	1.3638	1.2327	1.3598	4.33E+18
571.0	1.4331	1.281	1.4289	4.11E+18	633.0	1.4508	1.311	1.4466	4.61E+18
572.0	1.5134	1.3534	1.509	4.35E+18	634.0	1.4284	1.2907	1.4243	4.55E+18
573.0	1.5198	1.3595	1.5154	4.37E+18	635.0	1.4458	1.3065	1.4416	4.61E+18
574.0	1.5119	1.3527	1.5075	4.36E+18	636.0	1.4128	1.2768	1.4087	4.51E+18
575.0	1.4777	1.3225	1.4734	4.27E+18	637.0	1.461	1.3204	1.4568	4.67E+18
576.0	1.4654	1.3118	1.4612	4.24E+18	638.0	1.4707	1.3292	1.4664	4.71E+18
577.0	1.5023	1.3452	1.4979	4.35E+18	639.0	1.4646	1.3238	1.4604	4.70E+18
578.0	1.456	1.304	1.4518	4.22E+18	640.0	1.434	1.2962	1.4298	4.61E+18
579.0	1.477	1.323	1.4727	4.29E+18	641.0	1.4348	1.297	1.4306	4.62E+18
580.0	1.502	1.3455	1.4976	4.37E+18	642.0	1.4376	1.2995	1.4334	4.63E+18
581.0	1.5089	1.3518	1.5045	4.40E+18	643.0	1.4525	1.313	1.4483	4.69E+18

Wavelength nm	ASTM G173 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>2</sup> S <sup>-1</sup> nm <sup>-1</sup>
644.0	1.4462	1.3074	1.442	4.68E+18	706.0	1.3144	1.1925	1.3106	4.66E+18
645.0	1.4567	1.317	1.4525	4.72E+18	707.0	1.309	1.1875	1.3052	4.65E+18
646.0	1.415	1.2797	1.4109	4.59E+18	708.0	1.3048	1.1839	1.301	4.64E+18
647.0	1.4086	1.2744	1.4045	4.58E+18	709.0	1.3095	1.188	1.3057	4.66E+18
648.0	1.3952	1.2625	1.3912	4.54E+18	710.0	1.3175	1.1954	1.3137	4.70E+18
649.0	1.3519	1.2234	1.348	4.40E+18	711.0	1.3155	1.1934	1.3117	4.70E+18
650.0	1.3594	1.2299	1.3555	4.44E+18	712.0	1.3071	1.1856	1.3033	4.67E+18
651.0	1.4447	1.3071	1.4405	4.72E+18	713.0	1.2918	1.1719	1.2881	4.62E+18
652.0	1.3871	1.2558	1.3831	4.54E+18	714.0	1.3029	1.1823	1.2991	4.67E+18
653.0	1.4311	1.295	1.4269	4.69E+18	715.0	1.2587	1.1428	1.255	4.52E+18
654.0	1.4153	1.2807	1.4112	4.65E+18	716.0	1.2716	1.1548	1.2679	4.57E+18
655.0	1.3499	1.222	1.346	4.44E+18	717.0	1.1071	1.0081	1.1039	3.98E+18
656.0	1.1851	1.0727	1.1817	3.90E+18	718.0	1.0296	0.9387	1.0266	3.71E+18
657.0	1.2393	1.1218	1.2357	4.09E+18	719.0	0.9232	0.8427	0.9205	3.33E+18
658.0	1.3855	1.254	1.3815	4.58E+18	720.0	0.9855	0.8994	0.9826	3.56E+18
659.0	1.3905	1.2586	1.3865	4.60E+18	721.0	1.0861	0.9897	1.083	3.93E+18
660.0	1.3992	1.2668	1.3951	4.64E+18	722.0	1.2407	1.1281	1.2371	4.50E+18
661.0	1.3933	1.2618	1.3893	4.62E+18	723.0	1.1444	1.0423	1.1411	4.15E+18
662.0	1.3819	1.2518	1.3779	4.59E+18	724.0	1.0555	0.9631	1.0524	3.84E+18
663.0	1.3844	1.2539	1.3804	4.61E+18	725.0	1.038	0.9474	1.035	3.78E+18
664.0	1.3967	1.2647	1.3926	4.66E+18	726.0	1.0813	0.9864	1.0782	3.94E+18
665.0	1.4214	1.2871	1.4173	4.75E+18	727.0	1.085	0.9899	1.0819	3.96E+18
666.0	1.4203	1.286	1.4162	4.75E+18	728.0	1.04	0.9497	1.037	3.80E+18
667.0	1.4102	1.2767	1.4061	4.72E+18	729.0	1.0466	0.955	1.0436	3.83E+18
668.0	1.415	1.281	1.4109	4.74E+18	730.0	1.1285	1.0294	1.1252	4.14E+18
669.0	1.4394	1.3032	1.4352	4.83E+18	731.0	1.0703	0.977	1.0672	3.93E+18
670.0	1.4196	1.2853	1.4155	4.77E+18	732.0	1.1534	1.052	1.1501	4.24E+18
671.0	1.4169	1.2829	1.4128	4.77E+18	733.0	1.1962	1.0901	1.1927	4.40E+18
672.0	1.3972	1.2651	1.3931	4.71E+18	734.0	1.2357	1.1261	1.2321	4.55E+18
673.0	1.4094	1.276	1.4053	4.76E+18	735.0	1.2178	1.1101	1.2143	4.49E+18
674.0	1.4074	1.2742	1.4033	4.76E+18	736.0	1.2059	1.0994	1.2024	4.46E+18
675.0	1.3958	1.2639	1.3918	4.73E+18	737.0	1.2039	1.0978	1.2004	4.45E+18
676.0	1.412	1.2786	1.4079	4.79E+18	738.0	1.2269	1.1184	1.2233	4.55E+18
677.0	1.3991	1.2669	1.395	4.75E+18	739.0	1.1905	1.0855	1.187	4.42E+18
678.0	1.4066	1.2737	1.4025	4.79E+18	740.0	1.2195	1.1119	1.216	4.53E+18
679.0	1.3947	1.2629	1.3907	4.75E+18	741.0	1.2148	1.1078	1.2113	4.52E+18
680.0	1.3969	1.265	1.3928	4.77E+18	742.0	1.2153	1.1084	1.2118	4.53E+18
681.0	1.3915	1.2601	1.3875	4.76E+18	743.0	1.2405	1.1316	1.2369	4.63E+18
682.0	1.3981	1.2662	1.394	4.79E+18	744.0	1.2503	1.1408	1.2467	4.67E+18
683.0	1.383	1.2526	1.379	4.74E+18	745.0	1.2497	1.1404	1.2461	4.67E+18
684.0	1.3739	1.2445	1.3699	4.72E+18	746.0	1.247	1.1381	1.2434	4.67E+18
685.0	1.3748	1.2454	1.3708	4.73E+18	747.0	1.2477	1.1389	1.2441	4.68E+18
686.0	1.3438	1.2174	1.3399	4.63E+18	748.0	1.2401	1.1323	1.2365	4.66E+18
687.0	0.9682	0.8829	0.9654	3.34E+18	749.0	1.2357	1.1286	1.2321	4.65E+18
688.0	1.1206	1.0195	1.1174	3.87E+18	750.0	1.2341	1.1273	1.2305	4.65E+18
689.0	1.1278	1.026	1.1245	3.90E+18	751.0	1.2286	1.1224	1.225	4.63E+18
690.0	1.1821	1.0746	1.1787	4.09E+18	752.0	1.233	1.1265	1.2294	4.65E+18
691.0	1.2333	1.1201	1.2297	4.28E+18	753.0	1.2266	1.121	1.223	4.64E+18
692.0	1.2689	1.1516	1.2652	4.41E+18	754.0	1.242	1.1353	1.2384	4.70E+18
693.0	1.2609	1.1446	1.2572	4.39E+18	755.0	1.2383	1.1321	1.2347	4.69E+18
694.0	1.2464	1.1318	1.2428	4.34E+18	756.0	1.2232	1.1185	1.2197	4.64E+18
695.0	1.2714	1.1538	1.2677	4.44E+18	757.0	1.2221	1.1176	1.2186	4.64E+18
696.0	1.2684	1.1513	1.2647	4.43E+18	758.0	1.2295	1.1246	1.2259	4.68E+18
697.0	1.3403	1.2151	1.3364	4.69E+18	759.0	1.1945	1.0932	1.191	4.55E+18
698.0	1.3192	1.1961	1.3154	4.62E+18	760.0	0.266	0.2472	0.2653	1.02E+18
699.0	1.2918	1.1721	1.2881	4.53E+18	761.0	0.154	0.1433	0.1535	5.88E+17
700.0	1.2823	1.1636	1.2786	4.51E+18	762.0	0.6877	0.6349	0.6857	2.63E+18
701.0	1.2659	1.1489	1.2622	4.45E+18	763.0	0.3795	0.3522	0.3784	1.45E+18
702.0	1.2674	1.15	1.2637	4.47E+18	764.0	0.5388	0.4989	0.5372	2.07E+18
703.0	1.2747	1.1567	1.271	4.50E+18	765.0	0.686	0.6338	0.684	2.63E+18
704.0	1.3078	1.1864	1.304	4.62E+18	766.0	0.8146	0.7508	0.8122	3.13E+18
705.0	1.3214	1.1989	1.3176	4.68E+18	767.0	0.9742	0.8957	0.9713	3.75E+18

Wavelength nm	ASTM G173 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>2</sup> S <sup>-1</sup> nm <sup>-1</sup>
768.0	1.1138	1.0222	1.1106	4.29E+18	830.0	0.916	0.8493	0.9134	3.82E+18
769.0	1.1278	1.0347	1.1245	4.35E+18	831.0	0.9239	0.8567	0.9212	3.85E+18
770.0	1.1608	1.0646	1.1574	4.49E+18	832.0	0.8943	0.8296	0.8917	3.74E+18
771.0	1.1686	1.0716	1.1652	4.52E+18	833.0	0.9565	0.8862	0.9537	4.00E+18
772.0	1.1778	1.0802	1.1744	4.56E+18	834.0	0.9341	0.8661	0.9314	3.91E+18
773.0	1.1771	1.0797	1.1737	4.57E+18	835.0	1.0032	0.9292	1.0003	4.21E+18
774.0	1.1771	1.08	1.1737	4.57E+18	836.0	0.9723	0.9014	0.9695	4.08E+18
775.0	1.1771	1.0801	1.1737	4.58E+18	837.0	1.0092	0.9349	1.0063	4.24E+18
776.0	1.1798	1.0827	1.1764	4.60E+18	838.0	0.999	0.9259	0.9961	4.20E+18
777.0	1.1727	1.0764	1.1693	4.57E+18	839.0	1.0013	0.9278	0.9984	4.22E+18
778.0	1.1713	1.0754	1.1679	4.57E+18	840.0	1.0157	0.9412	1.0128	4.28E+18
779.0	1.1765	1.0803	1.1731	4.60E+18	841.0	1.0101	0.9363	1.0072	4.26E+18
780.0	1.1636	1.0687	1.1602	4.56E+18	842.0	0.997	0.9241	0.9941	4.21E+18
781.0	1.1607	1.0662	1.1573	4.55E+18	843.0	1.0053	0.9317	1.0024	4.25E+18
782.0	1.1662	1.0714	1.1628	4.58E+18	844.0	0.9863	0.9143	0.9834	4.18E+18
783.0	1.1614	1.0672	1.158	4.57E+18	845.0	1.0165	0.9423	1.0136	4.31E+18
784.0	1.1536	1.0602	1.1503	4.54E+18	846.0	1.0187	0.9445	1.0157	4.33E+18
785.0	1.1586	1.0649	1.1552	4.57E+18	847.0	0.9917	0.9195	0.9888	4.22E+18
786.0	1.1592	1.0656	1.1558	4.57E+18	848.0	0.9922	0.9201	0.9893	4.22E+18
787.0	1.145	1.053	1.1417	4.52E+18	849.0	0.986	0.9145	0.9831	4.20E+18
788.0	1.1305	1.0399	1.1272	4.47E+18	850.0	0.9837	0.829	0.8911	3.81E+18
789.0	1.1257	1.0359	1.1224	4.46E+18	851.0	0.9749	0.9045	0.9721	4.16E+18
790.0	1.091	1.0045	1.0878	4.33E+18	852.0	0.9693	0.8994	0.9665	4.15E+18
791.0	1.1058	1.0179	1.1026	4.39E+18	853.0	0.9649	0.8954	0.9621	4.13E+18
792.0	1.0953	1.0084	1.0921	4.35E+18	854.0	0.8511	0.79	0.8487	3.65E+18
793.0	1.0875	1.0015	1.0843	4.33E+18	855.0	0.913	0.8475	0.9104	3.92E+18
794.0	1.0972	1.0101	1.094	4.37E+18	856.0	0.9732	0.9034	0.9703	4.18E+18
795.0	1.0932	1.0066	1.09	4.36E+18	857.0	0.9917	0.9206	0.9888	4.27E+18
796.0	1.0742	0.9899	1.0711	4.29E+18	858.0	0.992	0.9209	0.9891	4.27E+18
797.0	1.0913	1.0057	1.0881	4.37E+18	859.0	0.9917	0.9208	0.9888	4.28E+18
798.0	1.1121	1.0245	1.1089	4.46E+18	860.0	0.9882	0.9176	0.9853	4.27E+18
799.0	1.0905	1.0048	1.0873	4.37E+18	861.0	0.9868	0.9165	0.9839	4.27E+18
800.0	1.0725	0.9886	1.0694	4.31E+18	862.0	0.9945	0.9237	0.9916	4.30E+18
801.0	1.0843	0.9998	1.0812	4.36E+18	863.0	1.0005	0.9293	0.9976	4.33E+18
802.0	1.0856	1.0011	1.0825	4.37E+18	864.0	0.9792	0.9096	0.9763	4.25E+18
803.0	1.0657	0.9829	1.0626	4.30E+18	865.0	0.9632	0.8949	0.9604	4.18E+18
804.0	1.0782	0.9945	1.0751	4.35E+18	866.0	0.849	0.7888	0.8465	3.69E+18
805.0	1.0545	0.9727	1.0514	4.26E+18	867.0	0.9155	0.8507	0.9128	3.98E+18
806.0	1.0974	1.0122	1.0942	4.44E+18	868.0	0.9592	0.8914	0.9564	4.18E+18
807.0	1.0859	1.0018	1.0828	4.40E+18	869.0	0.9496	0.8825	0.9468	4.14E+18
808.0	1.0821	0.9984	1.079	4.39E+18	870.0	0.9676	0.8993	0.9647	4.23E+18
809.0	1.0548	0.9735	1.0517	4.28E+18	871.0	0.9539	0.8867	0.9511	4.17E+18
810.0	1.0559	0.9749	1.0528	4.29E+18	872.0	0.9669	0.8989	0.9641	4.23E+18
811.0	1.0533	0.9727	1.0502	4.29E+18	873.0	0.9572	0.89	0.9544	4.19E+18
812.0	1.0268	0.9488	1.0238	4.19E+18	874.0	0.9404	0.8745	0.9377	4.13E+18
813.0	1.0086	0.9324	1.0057	4.12E+18	875.0	0.9269	0.862	0.9242	4.07E+18
814.0	0.9036	0.8368	0.9009	3.69E+18	876.0	0.9528	0.8863	0.95	4.19E+18
815.0	0.8952	0.8293	0.8926	3.66E+18	877.0	0.9562	0.8895	0.9534	4.21E+18
816.0	0.8322	0.7717	0.8297	3.41E+18	878.0	0.9524	0.8861	0.9496	4.20E+18
817.0	0.8518	0.7898	0.8494	3.49E+18	879.0	0.9366	0.8714	0.9338	4.13E+18
818.0	0.8226	0.763	0.8202	3.38E+18	880.0	0.9396	0.8743	0.9368	4.15E+18
819.0	0.9052	0.8384	0.9026	3.72E+18	881.0	0.9086	0.8456	0.906	4.02E+18
820.0	0.8619	0.799	0.8594	3.55E+18	882.0	0.9325	0.8679	0.9297	4.13E+18
821.0	0.9976	0.9229	0.9947	4.11E+18	883.0	0.9293	0.8649	0.9266	4.12E+18
822.0	0.9516	0.8808	0.9488	3.93E+18	884.0	0.9331	0.8686	0.9303	4.14E+18
823.0	0.6727	0.6258	0.6708	2.78E+18	885.0	0.9442	0.8791	0.9415	4.19E+18
824.0	0.9351	0.8662	0.9323	3.87E+18	886.0	0.9075	0.8452	0.9049	4.04E+18
825.0	0.9694	0.8975	0.9665	4.01E+18	887.0	0.9106	0.848	0.908	4.05E+18
826.0	0.9338	0.8653	0.9311	3.87E+18	888.0	0.9223	0.859	0.9196	4.11E+18
827.0	0.9847	0.9118	0.9818	4.09E+18	889.0	0.9346	0.8704	0.9318	4.17E+18
828.0	0.8498	0.7887	0.8473	3.53E+18	890.0	0.9239	0.8608	0.9213	4.13E+18
829.0	0.9293	0.8614	0.9266	3.87E+18	891.0	0.9258	0.8626	0.9232	4.14E+18

Wavelength nm	ASTM G173 Global Tilt W $m^{-2} nm^{-1}$	ASTM G173 Direct Beam $W m^{-2} nm^{-1}$	IEC-60904-03 Global Tilt $W m^{-2} nm^{-1}$	IEC-60904-03 Spectral Photon Irradiance $m^{-2} S^{-1} nm^{-1}$	Wavelength nm	ASTM G173 Global Tilt $W m^{-2} nm^{-1}$	ASTM G173 Direct Beam $W m^{-2} nm^{-1}$	IEC-60904-03 Global Tilt $W m^{-2} nm^{-1}$	IEC-60904-03 Spectral Photon Irradiance $m^{-2} S^{-1} nm^{-1}$
892.0	0.9088	0.8469	0.9062	4.07E+18	954.0	0.4241	0.3999	0.4229	2.03E+18
893.0	0.8733	0.8141	0.8707	3.91E+18	955.0	0.3412	0.322	0.3402	1.64E+18
894.0	0.8513	0.7941	0.8488	3.82E+18	956.0	0.3282	0.31	0.3273	1.58E+18
895.0	0.8136	0.7596	0.8112	3.66E+18	957.0	0.2707	0.2559	0.2699	1.30E+18
896.0	0.7625	0.7127	0.7603	3.43E+18	958.0	0.461	0.4345	0.4597	2.22E+18
897.0	0.6657	0.6231	0.6637	3.00E+18	959.0	0.3739	0.3529	0.3728	1.80E+18
898.0	0.7178	0.6714	0.7157	3.24E+18	960.0	0.4207	0.3969	0.4194	2.03E+18
899.0	0.5487	0.5146	0.5471	2.48E+18	961.0	0.4612	0.4348	0.4599	2.23E+18
900.0	0.7426	0.6943	0.7404	3.36E+18	962.0	0.4417	0.4166	0.4405	2.13E+18
901.0	0.5993	0.5616	0.5976	2.71E+18	963.0	0.505	0.4759	0.5036	2.44E+18
902.0	0.6679	0.625	0.666	3.02E+18	964.0	0.4586	0.4324	0.4573	2.22E+18
903.0	0.6889	0.6448	0.6869	3.12E+18	965.0	0.5037	0.4747	0.5023	2.44E+18
904.0	0.8446	0.7886	0.8421	3.83E+18	966.0	0.5028	0.4738	0.5013	2.44E+18
905.0	0.8171	0.7634	0.8147	3.71E+18	967.0	0.5024	0.4735	0.5009	2.44E+18
906.0	0.7756	0.725	0.7733	3.53E+18	968.0	0.6521	0.613	0.6502	3.17E+18
907.0	0.6385	0.5983	0.6367	2.91E+18	969.0	0.6862	0.6448	0.6842	3.34E+18
908.0	0.6522	0.6109	0.6503	2.97E+18	970.0	0.6346	0.5969	0.6328	3.09E+18
909.0	0.7043	0.6591	0.7023	3.21E+18	971.0	0.714	0.6706	0.7119	3.48E+18
910.0	0.6247	0.5855	0.6229	2.85E+18	972.0	0.6877	0.6463	0.6857	3.36E+18
911.0	0.6681	0.6258	0.6661	3.06E+18	973.0	0.6065	0.5708	0.6047	2.96E+18
912.0	0.6889	0.6451	0.6869	3.15E+18	974.0	0.5753	0.5417	0.5736	2.81E+18
913.0	0.6283	0.5891	0.6265	2.88E+18	975.0	0.5899	0.5554	0.5882	2.89E+18
914.0	0.6265	0.5874	0.6247	2.87E+18	976.0	0.5719	0.5387	0.5703	2.80E+18
915.0	0.6784	0.6355	0.6764	3.12E+18	977.0	0.6386	0.6008	0.6368	3.13E+18
916.0	0.5765	0.541	0.5748	2.65E+18	978.0	0.6151	0.579	0.6133	3.02E+18
917.0	0.7302	0.6835	0.7281	3.36E+18	979.0	0.6382	0.6005	0.6363	3.14E+18
918.0	0.5927	0.5561	0.591	2.73E+18	980.0	0.6047	0.5694	0.6029	2.97E+18
919.0	0.7388	0.6916	0.7366	3.41E+18	981.0	0.7134	0.6706	0.7113	3.51E+18
920.0	0.7441	0.6966	0.742	3.44E+18	982.0	0.6922	0.651	0.6902	3.41E+18
921.0	0.7805	0.73	0.7782	3.61E+18	983.0	0.6687	0.6292	0.6667	3.30E+18
922.0	0.7003	0.6558	0.6982	3.24E+18	984.0	0.7373	0.6929	0.7352	3.64E+18
923.0	0.745	0.697	0.7429	3.45E+18	985.0	0.6882	0.6473	0.6862	3.40E+18
924.0	0.7215	0.6757	0.7194	3.35E+18	986.0	0.7508	0.7055	0.7487	3.72E+18
925.0	0.7111	0.6662	0.709	3.30E+18	987.0	0.7393	0.6949	0.7371	3.66E+18
926.0	0.7033	0.6588	0.7013	3.27E+18	988.0	0.7346	0.6906	0.7325	3.64E+18
927.0	0.7874	0.7368	0.7851	3.66E+18	989.0	0.7491	0.7039	0.7469	3.72E+18
928.0	0.5897	0.5536	0.588	2.75E+18	990.0	0.7323	0.6884	0.7301	3.64E+18
929.0	0.5513	0.5179	0.5497	2.57E+18	991.0	0.7536	0.7083	0.7514	3.75E+18
930.0	0.4321	0.4068	0.4308	2.02E+18	992.0	0.751	0.706	0.7488	3.74E+18
931.0	0.4092	0.3854	0.408	1.91E+18	993.0	0.7373	0.6933	0.7351	3.68E+18
932.0	0.3009	0.2839	0.3	1.41E+18	994.0	0.7541	0.7089	0.7519	3.76E+18
933.0	0.2484	0.2346	0.2477	1.16E+18	995.0	0.7518	0.7067	0.7496	3.76E+18
934.0	0.1438	0.136	0.1434	6.74E+17	996.0	0.7488	0.7041	0.7467	3.74E+18
935.0	0.2508	0.2369	0.2501	1.18E+18	997.0	0.7397	0.6956	0.7376	3.70E+18
936.0	0.1614	0.1527	0.161	7.58E+17	998.0	0.7389	0.6948	0.7367	3.70E+18
937.0	0.1634	0.1545	0.1629	7.68E+17	999.0	0.7386	0.6946	0.7364	3.70E+18
938.0	0.2006	0.1896	0.2	9.44E+17	1000.0	0.7353	0.6916	0.7332	3.69E+18
939.0	0.3989	0.3759	0.3977	1.88E+18	1001.0	0.7444	0.7001	0.7423	3.74E+18
940.0	0.4718	0.4441	0.4704	2.23E+18	1002.0	0.7281	0.685	0.7259	3.66E+18
941.0	0.372	0.3507	0.3709	1.76E+18	1003.0	0.7344	0.6909	0.7323	3.70E+18
942.0	0.4053	0.3819	0.4041	1.92E+18	1004.0	0.7234	0.6806	0.7213	3.65E+18
943.0	0.2783	0.2629	0.2775	1.32E+18	1005.0	0.6817	0.6414	0.6798	3.44E+18
944.0	0.2858	0.2699	0.285	1.35E+18	1006.0	0.7125	0.6705	0.7105	3.60E+18
945.0	0.3682	0.3473	0.3671	1.75E+18	1007.0	0.7275	0.6846	0.7254	3.68E+18
946.0	0.1946	0.1841	0.194	9.24E+17	1008.0	0.7269	0.6841	0.7247	3.68E+18
947.0	0.3711	0.3501	0.37	1.76E+18	1009.0	0.7197	0.6774	0.7176	3.65E+18
948.0	0.2742	0.2591	0.2734	1.31E+18	1010.0	0.7191	0.677	0.7171	3.65E+18
949.0	0.494	0.4651	0.4925	2.35E+18	1011.0	0.7228	0.6803	0.7207	3.67E+18
950.0	0.1473	0.1394	0.1468	7.02E+17	1012.0	0.7188	0.6767	0.7167	3.65E+18
951.0	0.4838	0.4556	0.4824	2.31E+18	1013.0	0.7176	0.6756	0.7155	3.65E+18
952.0	0.2689	0.2542	0.2681	1.29E+18	1014.0	0.7207	0.6785	0.7186	3.67E+18
953.0	0.3436	0.3244	0.3426	1.64E+18	1015.0	0.7082	0.6668	0.7061	3.61E+18

Wavelength nm	ASTM G173 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>2</sup> S <sup>-1</sup> nm <sup>-1</sup>
1016.0	0.7113	0.6698	0.7092	3.63E+18	1078.0	0.6032	0.5708	0.6015	3.26E+18
1017.0	0.7034	0.6624	0.7013	3.59E+18	1079.0	0.6047	0.5721	0.603	3.28E+18
1018.0	0.7142	0.6726	0.7121	3.65E+18	1080.0	0.5972	0.5652	0.5955	3.24E+18
1019.0	0.6888	0.6488	0.6868	3.52E+18	1081.0	0.5808	0.5497	0.5791	3.15E+18
1020.0	0.699	0.6584	0.6969	3.58E+18	1082.0	0.5894	0.5577	0.5877	3.20E+18
1021.0	0.7018	0.6611	0.6997	3.60E+18	1083.0	0.5981	0.566	0.5964	3.25E+18
1022.0	0.6897	0.6498	0.6877	3.54E+18	1084.0	0.5785	0.5478	0.5768	3.15E+18
1023.0	0.6951	0.6549	0.6931	3.57E+18	1085.0	0.5933	0.5616	0.5916	3.23E+18
1024.0	0.6906	0.6508	0.6886	3.55E+18	1086.0	0.5541	0.525	0.5525	3.02E+18
1025.0	0.6975	0.6573	0.6955	3.59E+18	1087.0	0.567	0.5369	0.5653	3.09E+18
1026.0	0.6964	0.6563	0.6943	3.59E+18	1088.0	0.5932	0.5616	0.5914	3.24E+18
1027.0	0.6931	0.6532	0.691	3.57E+18	1089.0	0.5792	0.5486	0.5775	3.17E+18
1028.0	0.6939	0.654	0.6918	3.58E+18	1090.0	0.5557	0.5266	0.5541	3.04E+18
1029.0	0.6863	0.6469	0.6843	3.55E+18	1091.0	0.5884	0.5572	0.5866	3.22E+18
1030.0	0.6906	0.6509	0.6885	3.57E+18	1092.0	0.5812	0.5505	0.5796	3.19E+18
1031.0	0.6874	0.648	0.6854	3.56E+18	1093.0	0.5106	0.4842	0.5091	2.80E+18
1032.0	0.6879	0.6485	0.6859	3.56E+18	1094.0	0.5397	0.5112	0.5381	2.96E+18
1033.0	0.6761	0.6375	0.6742	3.51E+18	1095.0	0.5207	0.4936	0.5192	2.86E+18
1034.0	0.6802	0.6414	0.6782	3.53E+18	1096.0	0.5032	0.4773	0.5018	2.77E+18
1035.0	0.6823	0.6435	0.6804	3.55E+18	1097.0	0.5785	0.5481	0.5768	3.19E+18
1036.0	0.682	0.6432	0.68	3.55E+18	1098.0	0.5029	0.4771	0.5015	2.77E+18
1037.0	0.675	0.6366	0.673	3.51E+18	1099.0	0.5077	0.4816	0.5062	2.80E+18
1038.0	0.6717	0.6336	0.6698	3.50E+18	1100.0	0.4858	0.4611	0.4844	2.68E+18
1039.0	0.6764	0.638	0.6744	3.53E+18	1101.0	0.497	0.4717	0.4955	2.75E+18
1040.0	0.6717	0.6337	0.6698	3.51E+18	1102.0	0.4688	0.4451	0.4675	2.59E+18
1041.0	0.6718	0.6338	0.6698	3.51E+18	1103.0	0.4664	0.4429	0.465	2.58E+18
1042.0	0.672	0.6341	0.6701	3.52E+18	1104.0	0.4677	0.4441	0.4663	2.59E+18
1043.0	0.6653	0.6277	0.6633	3.48E+18	1105.0	0.5064	0.4807	0.505	2.81E+18
1044.0	0.6683	0.6307	0.6664	3.50E+18	1106.0	0.3979	0.3784	0.3968	2.21E+18
1045.0	0.6645	0.6271	0.6626	3.49E+18	1107.0	0.483	0.4587	0.4816	2.68E+18
1046.0	0.6471	0.6108	0.6453	3.40E+18	1108.0	0.4157	0.3952	0.4144	2.31E+18
1047.0	0.6569	0.6201	0.655	3.45E+18	1109.0	0.4128	0.3925	0.4116	2.30E+18
1048.0	0.6627	0.6256	0.6608	3.49E+18	1110.0	0.479	0.455	0.4776	2.67E+18
1049.0	0.659	0.6221	0.657	3.47E+18	1111.0	0.3315	0.3157	0.3306	1.85E+18
1050.0	0.6546	0.618	0.6527	3.45E+18	1112.0	0.4136	0.3933	0.4124	2.31E+18
1051.0	0.6552	0.6186	0.6533	3.46E+18	1113.0	0.2685	0.256	0.2677	1.50E+18
1052.0	0.6512	0.6149	0.6493	3.44E+18	1114.0	0.2999	0.2858	0.299	1.68E+18
1053.0	0.6492	0.613	0.6473	3.43E+18	1115.0	0.2499	0.2383	0.2491	1.40E+18
1054.0	0.6465	0.6105	0.6446	3.42E+18	1116.0	0.2014	0.1922	0.2008	1.13E+18
1055.0	0.6485	0.6124	0.6466	3.43E+18	1117.0	0.0796	0.0762	0.0794	4.46E+17
1056.0	0.6464	0.6106	0.6445	3.43E+18	1118.0	0.2175	0.2076	0.2169	1.22E+18
1057.0	0.6448	0.6091	0.643	3.42E+18	1119.0	0.1132	0.1082	0.1128	6.36E+17
1058.0	0.6382	0.6029	0.6363	3.39E+18	1120.0	0.1419	0.1356	0.1415	7.98E+17
1059.0	0.6188	0.5845	0.617	3.29E+18	1121.0	0.1859	0.1775	0.1853	1.05E+18
1060.0	0.6359	0.6007	0.634	3.38E+18	1122.0	0.0817	0.0782	0.0814	4.60E+17
1061.0	0.6212	0.5869	0.6194	3.31E+18	1123.0	0.1282	0.1226	0.1278	7.23E+17
1062.0	0.6327	0.5978	0.6308	3.37E+18	1124.0	0.1087	0.104	0.1084	6.13E+17
1063.0	0.6224	0.5882	0.6206	3.32E+18	1125.0	0.1443	0.1379	0.1439	8.15E+17
1064.0	0.632	0.5972	0.6301	3.38E+18	1126.0	0.0516	0.0494	0.0514	2.92E+17
1065.0	0.6291	0.5946	0.6273	3.36E+18	1127.0	0.1573	0.1503	0.1568	8.90E+17
1066.0	0.6171	0.5833	0.6153	3.30E+18	1128.0	0.0992	0.0949	0.0989	5.62E+17
1067.0	0.6203	0.5864	0.6185	3.32E+18	1129.0	0.1059	0.1013	0.1056	6.00E+17
1068.0	0.6194	0.5856	0.6176	3.32E+18	1130.0	0.0706	0.0676	0.0704	4.00E+17
1069.0	0.5863	0.5543	0.5846	3.15E+18	1131.0	0.2956	0.282	0.2947	1.68E+18
1070.0	0.6047	0.5718	0.6029	3.25E+18	1132.0	0.2341	0.2236	0.2334	1.33E+18
1071.0	0.6166	0.583	0.6148	3.32E+18	1133.0	0.1533	0.1466	0.1529	8.72E+17
1072.0	0.6154	0.5819	0.6136	3.31E+18	1134.0	0.0417	0.04	0.0416	2.38E+17
1073.0	0.6036	0.5709	0.6019	3.25E+18	1135.0	0.0155	0.0148	0.0154	8.81E+16
1074.0	0.6216	0.5878	0.6198	3.35E+18	1136.0	0.1288	0.1232	0.1284	7.34E+17
1075.0	0.5925	0.5605	0.5908	3.20E+18	1137.0	0.2879	0.2747	0.287	1.64E+18
1076.0	0.6147	0.5814	0.6129	3.32E+18	1138.0	0.2033	0.1943	0.2027	1.16E+18
1077.0	0.6043	0.5718	0.6026	3.27E+18	1139.0	0.2985	0.2848	0.2976	1.71E+18



Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
1140.0	0.256	0.2445	0.2552	1.47E+18	1202.0	0.4372	0.4174	0.4359	2.64E+18
1141.0	0.1934	0.1849	0.1928	1.11E+18	1203.0	0.4341	0.4144	0.4328	2.62E+18
1142.0	0.2248	0.2148	0.2241	1.29E+18	1204.0	0.3625	0.3465	0.3614	2.19E+18
1143.0	0.3118	0.2976	0.3109	1.79E+18	1205.0	0.4369	0.4171	0.4357	2.64E+18
1144.0	0.1133	0.1084	0.1129	6.50E+17	1206.0	0.4809	0.4587	0.4795	2.91E+18
1145.0	0.146	0.1398	0.1456	8.39E+17	1207.0	0.4299	0.4104	0.4286	2.60E+18
1146.0	0.1576	0.1509	0.1572	9.07E+17	1208.0	0.4335	0.4138	0.4322	2.63E+18
1147.0	0.0592	0.0567	0.059	3.41E+17	1209.0	0.4143	0.3955	0.4131	2.51E+18
1148.0	0.2711	0.259	0.2703	1.56E+18	1210.0	0.4534	0.4327	0.452	2.75E+18
1149.0	0.2185	0.2089	0.2179	1.26E+18	1211.0	0.4223	0.4032	0.4211	2.57E+18
1150.0	0.1216	0.1165	0.1213	7.02E+17	1212.0	0.4249	0.4057	0.4237	2.59E+18
1151.0	0.2034	0.1945	0.2028	1.18E+18	1213.0	0.4696	0.448	0.4682	2.86E+18
1152.0	0.2476	0.2367	0.2469	1.43E+18	1214.0	0.4341	0.4144	0.4328	2.65E+18
1153.0	0.2381	0.2276	0.2374	1.38E+18	1215.0	0.4278	0.4085	0.4266	2.61E+18
1154.0	0.1425	0.1364	0.1421	8.25E+17	1216.0	0.4664	0.4451	0.465	2.85E+18
1155.0	0.3132	0.299	0.3123	1.63E+18	1217.0	0.4553	0.4346	0.454	2.78E+18
1156.0	0.2809	0.2684	0.2801	1.82E+18	1218.0	0.4593	0.4384	0.458	2.81E+18
1157.0	0.3146	0.3004	0.3137	1.83E+18	1219.0	0.4466	0.4264	0.4453	2.73E+18
1158.0	0.3117	0.2977	0.3108	1.81E+18	1220.0	0.4581	0.4372	0.4567	2.81E+18
1159.0	0.3369	0.3216	0.336	1.96E+18	1221.0	0.4653	0.4441	0.464	2.85E+18
1160.0	0.2865	0.2737	0.2856	1.67E+18	1222.0	0.4514	0.431	0.4501	2.77E+18
1161.0	0.3475	0.3317	0.3465	2.03E+18	1223.0	0.4441	0.424	0.4428	2.73E+18
1162.0	0.35	0.3341	0.349	2.04E+18	1224.0	0.4481	0.4279	0.4468	2.75E+18
1163.0	0.4686	0.4464	0.4672	2.74E+18	1225.0	0.4624	0.4414	0.461	2.84E+18
1164.0	0.4019	0.3833	0.4007	2.35E+18	1226.0	0.4682	0.447	0.4668	2.88E+18
1165.0	0.3886	0.3708	0.3875	2.27E+18	1227.0	0.433	0.4136	0.4318	2.67E+18
1166.0	0.3749	0.3578	0.3739	2.19E+18	1228.0	0.4666	0.4454	0.4652	2.88E+18
1167.0	0.41	0.3911	0.4088	2.40E+18	1229.0	0.4672	0.4461	0.4659	2.88E+18
1168.0	0.4195	0.4002	0.4183	2.46E+18	1230.0	0.46	0.4393	0.4587	2.84E+18
1169.0	0.4231	0.4035	0.4219	2.48E+18	1231.0	0.472	0.4507	0.4707	2.92E+18
1170.0	0.4587	0.4373	0.4574	2.69E+18	1232.0	0.4663	0.4453	0.465	2.88E+18
1171.0	0.4483	0.4275	0.447	2.64E+18	1233.0	0.454	0.4336	0.4527	2.81E+18
1172.0	0.4548	0.4337	0.4535	2.68E+18	1234.0	0.4702	0.4489	0.4688	2.91E+18
1173.0	0.4564	0.4352	0.4551	2.69E+18	1235.0	0.465	0.4441	0.4637	2.88E+18
1174.0	0.3369	0.3219	0.3359	1.99E+18	1236.0	0.4691	0.448	0.4677	2.91E+18
1175.0	0.4524	0.4314	0.4511	2.67E+18	1237.0	0.4634	0.4426	0.462	2.88E+18
1176.0	0.4768	0.4545	0.4754	2.81E+18	1238.0	0.468	0.4469	0.4666	2.91E+18
1177.0	0.4724	0.4504	0.471	2.79E+18	1239.0	0.4627	0.4419	0.4614	2.88E+18
1178.0	0.36	0.3439	0.359	2.13E+18	1240.0	0.4608	0.4401	0.4594	2.87E+18
1179.0	0.4837	0.4611	0.4823	2.86E+18	1241.0	0.462	0.4413	0.4606	2.88E+18
1180.0	0.4407	0.4205	0.4394	2.61E+18	1242.0	0.4625	0.4418	0.4611	2.88E+18
1181.0	0.4551	0.4342	0.4538	2.70E+18	1243.0	0.4575	0.4371	0.4562	2.86E+18
1182.0	0.3232	0.309	0.3222	1.92E+18	1244.0	0.4553	0.435	0.454	2.84E+18
1183.0	0.4387	0.4185	0.4374	2.61E+18	1245.0	0.4566	0.4362	0.4552	2.85E+18
1184.0	0.4199	0.4008	0.4186	2.50E+18	1246.0	0.4595	0.439	0.4581	2.87E+18
1185.0	0.4074	0.3891	0.4062	2.42E+18	1247.0	0.4575	0.4372	0.4561	2.86E+18
1186.0	0.4772	0.4552	0.4758	2.84E+18	1248.0	0.4586	0.4383	0.4573	2.87E+18
1187.0	0.4558	0.4349	0.4544	2.72E+18	1249.0	0.4597	0.4393	0.4583	2.88E+18
1188.0	0.335	0.3204	0.3341	2.00E+18	1250.0	0.4571	0.4368	0.4557	2.87E+18
1189.0	0.4157	0.3969	0.4145	2.48E+18	1251.0	0.4526	0.4326	0.4513	2.84E+18
1190.0	0.4624	0.4412	0.461	2.76E+18	1252.0	0.451	0.4311	0.4497	2.83E+18
1191.0	0.4466	0.4264	0.4453	2.67E+18	1253.0	0.4477	0.428	0.4464	2.82E+18
1192.0	0.4734	0.4517	0.472	2.83E+18	1254.0	0.4436	0.4242	0.4423	2.79E+18
1193.0	0.4543	0.4337	0.453	2.72E+18	1255.0	0.4507	0.4309	0.4494	2.84E+18
1194.0	0.4689	0.4475	0.4675	2.81E+18	1256.0	0.4402	0.421	0.439	2.78E+18
1195.0	0.447	0.4267	0.4457	2.68E+18	1257.0	0.4353	0.4163	0.4341	2.75E+18
1196.0	0.4313	0.4119	0.4301	2.59E+18	1258.0	0.445	0.4255	0.4437	2.81E+18
1197.0	0.4772	0.4553	0.4758	2.87E+18	1259.0	0.4273	0.4087	0.426	2.70E+18
1198.0	0.4339	0.4143	0.4327	2.61E+18	1260.0	0.4311	0.4124	0.4298	2.73E+18
1199.0	0.3649	0.3487	0.3638	2.20E+18	1261.0	0.4115	0.3937	0.4103	2.60E+18
1200.0	0.4483	0.4279	0.447	2.70E+18	1262.0	0.3957	0.3787	0.3945	2.51E+18
1201.0	0.4371	0.4174	0.4358	2.64E+18	1263.0	0.4002	0.383	0.399	2.54E+18

Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
1264.0	0.3715	0.3557	0.3704	2.36E+18	1326.0	0.2805	0.2696	0.2797	1.87E+18
1265.0	0.3957	0.3787	0.3946	2.51E+18	1327.0	0.2663	0.2559	0.2655	1.77E+18
1266.0	0.3853	0.3688	0.3842	2.45E+18	1328.0	0.2345	0.2256	0.2338	1.56E+18
1267.0	0.3882	0.3716	0.3871	2.47E+18	1329.0	0.1776	0.171	0.1771	1.19E+18
1268.0	0.3705	0.3548	0.3694	2.36E+18	1330.0	0.2292	0.2205	0.2286	1.53E+18
1269.0	0.2465	0.2366	0.2458	1.57E+18	1331.0	0.1448	0.1395	0.1444	9.67E+17
1270.0	0.3874	0.3709	0.3863	2.47E+18	1332.0	0.1458	0.1405	0.1454	9.75E+17
1271.0	0.4083	0.3906	0.4071	2.61E+18	1333.0	0.203	0.1955	0.2025	1.36E+18
1272.0	0.4088	0.3911	0.4076	2.61E+18	1334.0	0.1693	0.163	0.1688	1.13E+18
1273.0	0.4063	0.3887	0.4051	2.60E+18	1335.0	0.2312	0.2224	0.2305	1.55E+18
1274.0	0.4061	0.3886	0.405	2.60E+18	1336.0	0.1835	0.1767	0.1829	1.23E+18
1275.0	0.4123	0.3946	0.4111	2.64E+18	1337.0	0.1645	0.1585	0.1641	1.10E+18
1276.0	0.4169	0.399	0.4157	2.67E+18	1338.0	0.178	0.1715	0.1775	1.20E+18
1277.0	0.42	0.4019	0.4188	2.69E+18	1339.0	0.1768	0.1703	0.1763	1.19E+18
1278.0	0.4276	0.4092	0.4264	2.74E+18	1340.0	0.1683	0.1622	0.1678	1.13E+18
1279.0	0.4246	0.4063	0.4233	2.73E+18	1341.0	0.1704	0.1642	0.1699	1.15E+18
1280.0	0.422	0.4039	0.4208	2.71E+18	1342.0	0.178	0.1715	0.1775	1.20E+18
1281.0	0.4134	0.3955	0.4122	2.66E+18	1343.0	0.1271	0.1226	0.1267	8.57E+17
1282.0	0.3731	0.357	0.372	2.40E+18	1344.0	0.0756	0.073	0.0754	5.10E+17
1283.0	0.4073	0.3898	0.4061	2.62E+18	1345.0	0.109	0.1052	0.1087	7.36E+17
1284.0	0.4208	0.4027	0.4196	2.71E+18	1346.0	0.0582	0.0562	0.058	3.93E+17
1285.0	0.424	0.4058	0.4228	2.74E+18	1347.0	0.0601	0.0581	0.0599	4.07E+17
1286.0	0.4271	0.4088	0.4259	2.76E+18	1348.0	0.0047	0.0046	0.0047	3.21E+16
1287.0	0.4221	0.4041	0.4209	2.73E+18	1349.0	0.0162	0.0156	0.0161	1.09E+17
1288.0	0.4199	0.4019	0.4187	2.72E+18	1350.0	0.016	0.0155	0.016	1.09E+17
1289.0	0.4094	0.3919	0.4082	2.65E+18	1351.0	0.0046	0.0045	0.0046	3.14E+16
1290.0	0.4129	0.3952	0.4117	2.67E+18	1352.0	0.0015	0.0015	0.0015	1.03E+16
1291.0	0.4179	0.4	0.4166	2.71E+18	1353.0	0.0001	0.0001	0.0001	6.53E+14
1292.0	0.3962	0.3795	0.395	2.57E+18	1354.0	0.0003	0.0003	0.0003	1.97E+15
1293.0	0.4126	0.3951	0.4114	2.68E+18	1355.0	0	0	0	2.45E+13
1294.0	0.4042	0.3871	0.403	2.63E+18	1356.0	0	0	0	3.27E+14
1295.0	0.4051	0.388	0.404	2.63E+18	1357.0	0.0001	0.0001	0.0001	4.89E+14
1296.0	0.3896	0.3732	0.3884	2.53E+18	1358.0	0	0	0	2.86E+13
1297.0	0.3713	0.3558	0.3702	2.42E+18	1359.0	0	0	0	5.01E+12
1298.0	0.3918	0.3754	0.3907	2.55E+18	1360.0	0	0	0	1.46E+13
1299.0	0.4085	0.3913	0.4073	2.66E+18	1361.0	0	0	0	3.29E+10
1300.0	0.3531	0.3386	0.3521	2.30E+18	1362.0	0	0	0	1.24E+08
1301.0	0.3623	0.3473	0.3612	2.37E+18	1363.0	0	0	0	2.16E+13
1302.0	0.3918	0.3754	0.3907	2.56E+18	1364.0	0	0	0	9.30E+12
1303.0	0.3462	0.332	0.3452	2.26E+18	1365.0	0	0	0	6.22E+07
1304.0	0.3006	0.2885	0.2997	1.97E+18	1366.0	0	0	0	8.77E+13
1305.0	0.3838	0.3678	0.3827	2.51E+18	1367.0	0	0	0	3.42E+13
1306.0	0.3845	0.3685	0.3834	2.52E+18	1368.0	0	0	0	1.02E+06
1307.0	0.3059	0.2936	0.3051	2.01E+18	1369.0	0	0	0	3.55E+12
1308.0	0.347	0.3328	0.346	2.28E+18	1370.0	0	0	0	2.01E+12
1309.0	0.3841	0.3682	0.383	2.52E+18	1371.0	0	0	0	1.36E+11
1310.0	0.3011	0.2891	0.3003	1.98E+18	1372.0	0	0	0	1.89E+13
1311.0	0.3337	0.3201	0.3327	2.20E+18	1373.0	0	0	0	3.06E+14
1312.0	0.3334	0.3199	0.3324	2.20E+18	1374.0	0.0002	0.0002	0.0002	1.24E+15
1313.0	0.3135	0.3009	0.3126	2.07E+18	1375.0	0.0003	0.0003	0.0003	2.23E+15
1314.0	0.2883	0.2769	0.2875	1.90E+18	1376.0	0.0003	0.0002	0.0003	1.78E+15
1315.0	0.2858	0.2745	0.285	1.89E+18	1377.0	0.0001	0.0001	0.0001	8.48E+14
1316.0	0.3242	0.3111	0.3232	2.14E+18	1378.0	0.0011	0.0011	0.0011	7.67E+15
1317.0	0.3122	0.2997	0.3113	2.06E+18	1379.0	0.0001	0.0001	0.0001	3.61E+14
1318.0	0.3333	0.3198	0.3323	2.21E+18	1380.0	0.0001	0.0001	0.0001	5.65E+14
1319.0	0.2686	0.258	0.2678	1.78E+18	1381.0	0	0	0	1.64E+13
1320.0	0.2587	0.2486	0.258	1.71E+18	1382.0	0	0	0	1.78E+13
1321.0	0.2987	0.2868	0.2978	1.98E+18	1383.0	0	0	0	3.06E+11
1322.0	0.3022	0.2902	0.3013	2.01E+18	1384.0	0	0	0	4.29E+12
1323.0	0.2328	0.2239	0.2321	1.55E+18	1385.0	0	0	0	1.45E+13
1324.0	0.2625	0.2523	0.2617	1.74E+18	1386.0	0	0	0	1.75E+13
1325.0	0.3222	0.3094	0.3213	2.14E+18	1387.0	0.0002	0.0002	0.0002	1.39E+15

Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
1388.0	0	0	0	2.81E+13	1450.0	0.0274	0.0267	0.0273	2.00E+17
1389.0	0.0006	0.0006	0.0006	4.05E+15	1451.0	0.0113	0.011	0.0112	8.21E+16
1390.0	0.0005	0.0005	0.0005	3.44E+15	1452.0	0.0624	0.0607	0.0622	4.55E+17
1391.0	0.0003	0.0003	0.0003	2.40E+15	1453.0	0.082	0.0798	0.0817	5.98E+17
1392.0	0	0	0	1.66E+14	1454.0	0.1376	0.1338	0.1372	1.00E+18
1393.0	0.0001	0.0001	0.0001	8.10E+14	1455.0	0.0662	0.0644	0.066	4.83E+17
1394.0	0.0001	0.0001	0.0001	5.29E+14	1456.0	0.0885	0.0862	0.0883	6.47E+17
1395.0	0	0	0	4.70E+12	1457.0	0.117	0.1139	0.1167	8.56E+17
1396.0	0	0	0	4.43E+10	1458.0	0.1364	0.1327	0.136	9.98E+17
1397.0	0	0	0	3.44E+14	1459.0	0.1631	0.1586	0.1626	1.19E+18
1398.0	0.0013	0.0012	0.0013	8.92E+15	1460.0	0.0854	0.0832	0.0852	6.26E+17
1399.0	0.0008	0.0008	0.0008	5.70E+15	1461.0	0.0903	0.0879	0.09	6.62E+17
1400.0	0	0	0	2.28E+10	1462.0	0.1306	0.1271	0.1302	9.58E+17
1401.0	0	0	0	7.40E+10	1463.0	0.0432	0.0421	0.0431	3.17E+17
1402.0	0.0018	0.0018	0.0018	1.29E+16	1464.0	0.1518	0.1477	0.1514	1.12E+18
1403.0	0.0024	0.0023	0.0024	1.68E+16	1465.0	0.0934	0.0909	0.0931	6.87E+17
1404.0	0.0007	0.0007	0.0007	5.21E+15	1466.0	0.0652	0.0635	0.065	4.80E+17
1405.0	0	0	0	2.57E+12	1467.0	0.0361	0.0351	0.0359	2.66E+17
1406.0	0.002	0.002	0.002	1.44E+16	1468.0	0.0769	0.0749	0.0767	5.67E+17
1407.0	0.0002	0.0002	0.0002	1.23E+15	1469.0	0.0948	0.0923	0.0946	6.99E+17
1408.0	0.0016	0.0016	0.0016	1.17E+16	1470.0	0.0497	0.0484	0.0495	3.67E+17
1409.0	0.0006	0.0006	0.0006	4.38E+15	1471.0	0.0178	0.0174	0.0178	1.32E+17
1410.0	0.0005	0.0005	0.0005	3.30E+15	1472.0	0.0468	0.0456	0.0466	3.46E+17
1411.0	0.0021	0.0021	0.0021	1.50E+16	1473.0	0.0702	0.0684	0.07	5.19E+17
1412.0	0.0026	0.0026	0.0026	1.87E+16	1474.0	0.0973	0.0948	0.0971	7.20E+17
1413.0	0.0234	0.0227	0.0233	1.66E+17	1475.0	0.1846	0.1795	0.1841	1.37E+18
1414.0	0.0004	0.0004	0.0004	2.58E+15	1476.0	0.0688	0.067	0.0686	5.10E+17
1415.0	0.0002	0.0002	0.0002	1.30E+15	1477.0	0.0697	0.0679	0.0695	5.17E+17
1416.0	0.0356	0.0346	0.0355	2.53E+17	1478.0	0.0635	0.0618	0.0633	4.71E+17
1417.0	0.0118	0.0114	0.0117	8.36E+16	1479.0	0.12	0.1168	0.1197	8.91E+17
1418.0	0.0136	0.0132	0.0135	9.65E+16	1480.0	0.0606	0.0591	0.0605	4.51E+17
1419.0	0.0021	0.0021	0.0021	1.53E+16	1481.0	0.1153	0.1122	0.115	8.57E+17
1420.0	0.0083	0.008	0.0082	5.90E+16	1482.0	0.0585	0.057	0.0583	4.35E+17
1421.0	0.0092	0.0089	0.0091	6.54E+16	1483.0	0.1486	0.1445	0.1482	1.11E+18
1422.0	0.0463	0.045	0.0462	3.31E+17	1484.0	0.1375	0.1338	0.1371	1.02E+18
1423.0	0.0092	0.009	0.0092	6.59E+16	1485.0	0.125	0.1217	0.1247	9.32E+17
1424.0	0.017	0.0165	0.0169	1.21E+17	1486.0	0.1234	0.1201	0.123	9.20E+17
1425.0	0.0259	0.0251	0.0258	1.85E+17	1487.0	0.0606	0.059	0.0605	4.53E+17
1426.0	0.0278	0.027	0.0277	1.99E+17	1488.0	0.0942	0.0917	0.0939	7.03E+17
1427.0	0.0495	0.0482	0.0494	3.55E+17	1489.0	0.1897	0.1844	0.1892	1.42E+18
1428.0	0.0046	0.0044	0.0045	3.27E+16	1490.0	0.1748	0.1699	0.1743	1.31E+18
1429.0	0.038	0.037	0.0379	2.73E+17	1491.0	0.1978	0.1922	0.1972	1.48E+18
1430.0	0.0616	0.0599	0.0614	4.42E+17	1492.0	0.1644	0.1599	0.1639	1.23E+18
1431.0	0.0502	0.0488	0.05	3.60E+17	1493.0	0.1816	0.1765	0.181	1.36E+18
1432.0	0.0025	0.0025	0.0025	1.81E+16	1494.0	0.2037	0.1979	0.2031	1.53E+18
1433.0	0.0358	0.0349	0.0357	2.58E+17	1495.0	0.1825	0.1775	0.182	1.37E+18
1434.0	0.021	0.0204	0.0209	1.51E+17	1496.0	0.1685	0.1639	0.168	1.27E+18
1435.0	0.0214	0.0208	0.0214	1.54E+17	1497.0	0.2285	0.222	0.2278	1.72E+18
1436.0	0.0384	0.0373	0.0382	2.76E+17	1498.0	0.1897	0.1844	0.1891	1.43E+18
1437.0	0.0299	0.0291	0.0298	2.16E+17	1499.0	0.2176	0.2114	0.217	1.64E+18
1438.0	0.0133	0.0129	0.0132	9.57E+16	1500.0	0.2506	0.2434	0.2499	1.89E+18
1439.0	0.051	0.0497	0.0509	3.69E+17	1501.0	0.2655	0.2578	0.2647	2.00E+18
1440.0	0.0396	0.0385	0.0395	2.86E+17	1502.0	0.2336	0.2269	0.2329	1.76E+18
1441.0	0.0318	0.031	0.0317	2.30E+17	1503.0	0.1849	0.1797	0.1844	1.40E+18
1442.0	0.0363	0.0354	0.0362	2.63E+17	1504.0	0.1603	0.1559	0.1598	1.21E+18
1443.0	0.0451	0.0439	0.0449	3.26E+17	1505.0	0.184	0.1789	0.1835	1.39E+18
1444.0	0.0618	0.0601	0.0616	4.48E+17	1506.0	0.2577	0.2503	0.257	1.95E+18
1445.0	0.0498	0.0484	0.0496	3.61E+17	1507.0	0.2551	0.2478	0.2544	1.93E+18
1446.0	0.0231	0.0225	0.023	1.68E+17	1508.0	0.243	0.2361	0.2423	1.84E+18
1447.0	0.0362	0.0353	0.0361	2.63E+17	1509.0	0.1869	0.1817	0.1864	1.42E+18
1448.0	0.1157	0.1125	0.1154	8.41E+17	1510.0	0.2705	0.2627	0.2697	2.05E+18
1449.0	0.1021	0.0994	0.1018	7.43E+17	1511.0	0.2647	0.2571	0.264	2.01E+18

Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
1512.0	0.2607	0.2532	0.2599	1.98E+18	1574.0	0.2415	0.2346	0.2407	1.91E+18
1513.0	0.2424	0.2354	0.2417	1.84E+18	1575.0	0.2397	0.2329	0.239	1.90E+18
1514.0	0.2257	0.2193	0.2251	1.72E+18	1576.0	0.2468	0.2398	0.2461	1.95E+18
1515.0	0.2657	0.258	0.265	2.02E+18	1577.0	0.216	0.2099	0.2154	1.71E+18
1516.0	0.2568	0.2494	0.2561	1.95E+18	1578.0	0.2352	0.2285	0.2345	1.86E+18
1517.0	0.2493	0.2421	0.2486	1.90E+18	1579.0	0.2367	0.2301	0.236	1.88E+18
1518.0	0.2521	0.2449	0.2514	1.92E+18	1580.0	0.2446	0.2377	0.2439	1.94E+18
1519.0	0.2444	0.2374	0.2437	1.86E+18	1581.0	0.2487	0.2417	0.248	1.97E+18
1520.0	0.2645	0.2569	0.2637	2.02E+18	1582.0	0.242	0.2351	0.2412	1.92E+18
1521.0	0.2751	0.2671	0.2743	2.10E+18	1583.0	0.2476	0.2405	0.2468	1.97E+18
1522.0	0.2638	0.2562	0.263	2.02E+18	1584.0	0.249	0.2419	0.2483	1.98E+18
1523.0	0.28	0.2719	0.2792	2.14E+18	1585.0	0.2587	0.2514	0.258	2.06E+18
1524.0	0.2754	0.2674	0.2746	2.11E+18	1586.0	0.2557	0.2484	0.2549	2.04E+18
1525.0	0.2588	0.2514	0.2581	1.98E+18	1587.0	0.253	0.2458	0.2523	2.02E+18
1526.0	0.2675	0.2598	0.2667	2.05E+18	1588.0	0.2511	0.2439	0.2503	2.00E+18
1527.0	0.2622	0.2547	0.2614	2.01E+18	1589.0	0.2323	0.2257	0.2317	1.85E+18
1528.0	0.2793	0.2712	0.2785	2.14E+18	1590.0	0.2418	0.2349	0.2411	1.93E+18
1529.0	0.2724	0.2646	0.2716	2.09E+18	1591.0	0.242	0.235	0.2413	1.93E+18
1530.0	0.2552	0.2479	0.2545	1.96E+18	1592.0	0.2523	0.245	0.2515	2.02E+18
1531.0	0.2697	0.262	0.2689	2.07E+18	1593.0	0.2583	0.2509	0.2576	2.07E+18
1532.0	0.2784	0.2704	0.2776	2.14E+18	1594.0	0.2562	0.2489	0.2555	2.05E+18
1533.0	0.2771	0.2692	0.2763	2.13E+18	1595.0	0.2582	0.2508	0.2575	2.07E+18
1534.0	0.2689	0.2612	0.2681	2.07E+18	1596.0	0.2445	0.2375	0.2438	1.96E+18
1535.0	0.2669	0.2592	0.2661	2.06E+18	1597.0	0.2469	0.2399	0.2462	1.98E+18
1536.0	0.2746	0.2668	0.2738	2.12E+18	1598.0	0.2542	0.2469	0.2535	2.04E+18
1537.0	0.2734	0.2656	0.2726	2.11E+18	1599.0	0.242	0.2351	0.2413	1.94E+18
1538.0	0.272	0.2643	0.2712	2.10E+18	1600.0	0.2381	0.2313	0.2374	1.91E+18
1539.0	0.273	0.2652	0.2722	2.11E+18	1601.0	0.2232	0.2169	0.2226	1.79E+18
1540.0	0.2649	0.2574	0.2641	2.05E+18	1602.0	0.2241	0.2178	0.2235	1.80E+18
1541.0	0.269	0.2614	0.2683	2.08E+18	1603.0	0.224	0.2177	0.2233	1.80E+18
1542.0	0.2693	0.2617	0.2685	2.08E+18	1604.0	0.2284	0.222	0.2278	1.84E+18
1543.0	0.2721	0.2644	0.2713	2.11E+18	1605.0	0.2368	0.2301	0.2361	1.91E+18
1544.0	0.2721	0.2644	0.2713	2.11E+18	1606.0	0.2414	0.2345	0.2407	1.95E+18
1545.0	0.2771	0.2692	0.2762	2.15E+18	1607.0	0.233	0.2264	0.2323	1.88E+18
1546.0	0.2748	0.2671	0.274	2.13E+18	1608.0	0.2299	0.2234	0.2292	1.86E+18
1547.0	0.2731	0.2654	0.2723	2.12E+18	1609.0	0.2273	0.2209	0.2266	1.84E+18
1548.0	0.2668	0.2592	0.266	2.07E+18	1610.0	0.2176	0.2115	0.217	1.76E+18
1549.0	0.2734	0.2657	0.2726	2.13E+18	1611.0	0.2268	0.2204	0.2261	1.83E+18
1550.0	0.2699	0.2623	0.2691	2.10E+18	1612.0	0.2308	0.2242	0.2301	1.87E+18
1551.0	0.2706	0.2629	0.2698	2.11E+18	1613.0	0.2372	0.2305	0.2365	1.92E+18
1552.0	0.2718	0.2642	0.271	2.12E+18	1614.0	0.2384	0.2316	0.2377	1.93E+18
1553.0	0.2713	0.2637	0.2705	2.12E+18	1615.0	0.241	0.2342	0.2403	1.95E+18
1554.0	0.2647	0.2573	0.264	2.07E+18	1616.0	0.2305	0.224	0.2298	1.87E+18
1555.0	0.2676	0.2601	0.2668	2.09E+18	1617.0	0.2347	0.228	0.234	1.91E+18
1556.0	0.2631	0.2557	0.2623	2.06E+18	1618.0	0.2435	0.2366	0.2428	1.98E+18
1557.0	0.2706	0.263	0.2698	2.12E+18	1619.0	0.241	0.2342	0.2403	1.96E+18
1558.0	0.2685	0.2609	0.2677	2.10E+18	1620.0	0.2345	0.2278	0.2338	1.91E+18
1559.0	0.2681	0.2605	0.2673	2.10E+18	1621.0	0.2343	0.2277	0.2336	1.91E+18
1560.0	0.2657	0.2582	0.2649	2.08E+18	1622.0	0.2375	0.2308	0.2369	1.93E+18
1561.0	0.27	0.2624	0.2692	2.12E+18	1623.0	0.2425	0.2356	0.2418	1.98E+18
1562.0	0.2676	0.26	0.2668	2.10E+18	1624.0	0.2427	0.2358	0.242	1.98E+18
1563.0	0.2667	0.2592	0.2659	2.09E+18	1625.0	0.2378	0.2311	0.2371	1.94E+18
1564.0	0.2626	0.2553	0.2619	2.06E+18	1626.0	0.2397	0.2329	0.239	1.96E+18
1565.0	0.2673	0.2598	0.2665	2.10E+18	1627.0	0.2408	0.234	0.2401	1.97E+18
1566.0	0.2625	0.2551	0.2617	2.06E+18	1628.0	0.2413	0.2345	0.2406	1.97E+18
1567.0	0.2631	0.2557	0.2623	2.07E+18	1629.0	0.2414	0.2346	0.2407	1.97E+18
1568.0	0.2572	0.25	0.2565	2.02E+18	1630.0	0.2365	0.2298	0.2358	1.94E+18
1569.0	0.2545	0.2474	0.2538	2.00E+18	1631.0	0.2381	0.2314	0.2374	1.95E+18
1570.0	0.2418	0.235	0.241	1.91E+18	1632.0	0.2382	0.2315	0.2375	1.95E+18
1571.0	0.2351	0.2285	0.2344	1.85E+18	1633.0	0.2327	0.2261	0.232	1.91E+18
1572.0	0.2378	0.2311	0.2371	1.88E+18	1634.0	0.2328	0.2263	0.2321	1.91E+18
1573.0	0.2341	0.2275	0.2334	1.85E+18	1635.0	0.2337	0.2271	0.233	1.92E+18

Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
1636.0	0.2354	0.2288	0.2347	1.93E+18	1698.0	0.2074	0.2021	0.2068	1.77E+18
1637.0	0.227	0.2206	0.2263	1.87E+18	1699.0	0.2055	0.2002	0.2049	1.75E+18
1638.0	0.2201	0.2139	0.2194	1.81E+18	1700.0	0.1998	0.1946	0.1992	1.70E+18
1639.0	0.2203	0.2141	0.2196	1.81E+18	1702.0	0.204	0.1987	0.2034	1.74E+18
1640.0	0.2151	0.2091	0.2145	1.77E+18	1705.0	0.1978	0.1928	0.1972	1.69E+18
1641.0	0.2196	0.2135	0.219	1.81E+18	1710.0	0.1879	0.1832	0.1874	1.61E+18
1642.0	0.2208	0.2147	0.2202	1.82E+18	1715.0	0.1897	0.1849	0.1891	1.63E+18
1643.0	0.2154	0.2094	0.2147	1.78E+18	1720.0	0.187	0.1823	0.1864	1.61E+18
1644.0	0.2236	0.2173	0.2229	1.85E+18	1725.0	0.1781	0.1737	0.1776	1.54E+18
1645.0	0.2182	0.2122	0.2176	1.80E+18	1730.0	0.1741	0.1698	0.1736	1.51E+18
1646.0	0.2175	0.2115	0.2169	1.80E+18	1735.0	0.1615	0.1576	0.1611	1.41E+18
1647.0	0.2277	0.2214	0.227	1.88E+18	1740.0	0.1682	0.1641	0.1677	1.47E+18
1648.0	0.2166	0.2106	0.2159	1.79E+18	1745.0	0.1548	0.1511	0.1544	1.36E+18
1649.0	0.2187	0.2126	0.218	1.81E+18	1750.0	0.1657	0.1616	0.1652	1.46E+18
1650.0	0.2253	0.219	0.2246	1.87E+18	1755.0	0.153	0.1493	0.1526	1.35E+18
1651.0	0.2086	0.2028	0.2079	1.73E+18	1760.0	0.16	0.1561	0.1595	1.41E+18
1652.0	0.2237	0.2175	0.2231	1.86E+18	1765.0	0.1328	0.1297	0.1325	1.18E+18
1653.0	0.2228	0.2166	0.2221	1.85E+18	1770.0	0.1417	0.1383	0.1413	1.26E+18
1654.0	0.2158	0.2099	0.2152	1.79E+18	1775.0	0.1148	0.1121	0.1145	1.02E+18
1655.0	0.2223	0.2162	0.2217	1.85E+18	1780.0	0.1005	0.0981	0.1002	8.98E+17
1656.0	0.221	0.2149	0.2204	1.84E+18	1785.0	0.077	0.0752	0.0768	6.90E+17
1657.0	0.2222	0.2161	0.2216	1.85E+18	1790.0	0.0889	0.0868	0.0886	7.99E+17
1658.0	0.2249	0.2187	0.2242	1.87E+18	1795.0	0.0469	0.0459	0.0468	4.23E+17
1659.0	0.2212	0.2151	0.2206	1.84E+18	1800.0	0.0318	0.0311	0.0317	2.88E+17
1660.0	0.2233	0.2172	0.2227	1.86E+18	1805.0	0.0148	0.0145	0.0148	1.34E+17
1661.0	0.2238	0.2177	0.2232	1.87E+18	1810.0	0.0097	0.0095	0.0097	8.81E+16
1662.0	0.2191	0.2131	0.2184	1.83E+18	1815.0	0.0033	0.0032	0.0033	2.99E+16
1663.0	0.2224	0.2163	0.2217	1.86E+18	1820.0	0.001	0.001	0.001	9.02E+15
1664.0	0.221	0.215	0.2203	1.85E+18	1825.0	0.0013	0.0012	0.0013	1.17E+16
1665.0	0.2118	0.2061	0.2112	1.77E+18	1830.0	0	0	0	4.78E+13
1666.0	0.1788	0.1741	0.1783	1.50E+18	1835.0	0	0	0	5.91E+13
1667.0	0.2107	0.205	0.2101	1.76E+18	1840.0	0	0	0	5.79E+11
1668.0	0.2146	0.2088	0.214	1.80E+18	1845.0	0	0	0	5.80E+13
1669.0	0.2152	0.2094	0.2145	1.80E+18	1850.0	0	0	0	2.79E+13
1670.0	0.2217	0.2157	0.221	1.86E+18	1855.0	0	0	0	2.64E+12
1671.0	0.2188	0.2129	0.2182	1.84E+18	1860.0	0	0	0	1.04E+14
1672.0	0.2115	0.2058	0.2109	1.78E+18	1865.0	0	0	0	1.59E+14
1673.0	0.2163	0.2105	0.2157	1.82E+18	1870.0	0	0	0	2.50E+09
1674.0	0.2158	0.21	0.2151	1.81E+18	1875.0	0	0	0	4.25E+09
1675.0	0.2136	0.2079	0.213	1.80E+18	1880.0	0.0001	0.0001	0.0001	7.31E+14
1676.0	0.2115	0.2058	0.2108	1.78E+18	1885.0	0	0	0	4.15E+14
1677.0	0.2123	0.2067	0.2117	1.79E+18	1890.0	0.0002	0.0002	0.0002	2.12E+15
1678.0	0.2092	0.2037	0.2085	1.76E+18	1895.0	0.0001	0.0001	0.0001	1.23E+15
1679.0	0.213	0.2074	0.2124	1.80E+18	1900.0	0	0	0	8.22E+12
1680.0	0.2056	0.2002	0.205	1.73E+18	1905.0	0	0	0	5.42E+12
1681.0	0.1945	0.1894	0.1939	1.64E+18	1910.0	0	0	0	2.21E+14
1682.0	0.2037	0.1983	0.2031	1.72E+18	1915.0	0	0	0	1.92E+14
1683.0	0.2091	0.2036	0.2085	1.77E+18	1920.0	0.0005	0.0004	0.0004	4.34E+15
1684.0	0.198	0.1928	0.1974	1.67E+18	1925.0	0.0009	0.0009	0.0009	9.05E+15
1685.0	0.2132	0.2076	0.2126	1.80E+18	1930.0	0.0006	0.0005	0.0006	5.35E+15
1686.0	0.2103	0.2048	0.2097	1.78E+18	1935.0	0.0036	0.0035	0.0036	3.49E+16
1687.0	0.2048	0.1995	0.2042	1.74E+18	1940.0	0.0033	0.0032	0.0033	3.20E+16
1688.0	0.2101	0.2047	0.2095	1.78E+18	1945.0	0.0109	0.0107	0.0108	1.06E+17
1689.0	0.2072	0.2018	0.2066	1.76E+18	1950.0	0.0167	0.0165	0.0167	1.64E+17
1690.0	0.2052	0.1999	0.2046	1.74E+18	1955.0	0.01	0.0099	0.01	9.85E+16
1691.0	0.193	0.1881	0.1925	1.64E+18	1960.0	0.0219	0.0216	0.0218	2.16E+17
1692.0	0.2071	0.2017	0.2065	1.76E+18	1965.0	0.0286	0.0281	0.0285	2.82E+17
1693.0	0.2113	0.2059	0.2107	1.80E+18	1970.0	0.0488	0.0481	0.0487	4.83E+17
1694.0	0.2048	0.1995	0.2042	1.74E+18	1975.0	0.0679	0.0667	0.0677	6.73E+17
1695.0	0.2097	0.2043	0.2091	1.78E+18	1980.0	0.0755	0.0742	0.0753	7.51E+17
1696.0	0.2092	0.2038	0.2086	1.78E+18	1985.0	0.0831	0.0816	0.0828	8.28E+17
1697.0	0.1811	0.1765	0.1805	1.54E+18	1990.0	0.0856	0.0841	0.0854	8.55E+17

Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
1995.0	0.0812	0.0798	0.081	8.13E+17	2305.0	0.0592	0.0585	0.059	6.85E+17
2000.0	0.0382	0.0375	0.038	3.83E+17	2310.0	0.0639	0.0632	0.0637	7.41E+17
2005.0	0.015	0.0147	0.015	1.51E+17	2315.0	0.0581	0.0575	0.058	6.76E+17
2010.0	0.0397	0.0391	0.0396	4.01E+17	2320.0	0.052	0.0515	0.0519	6.06E+17
2015.0	0.0266	0.0262	0.0266	2.70E+17	2325.0	0.0562	0.0556	0.0561	6.56E+17
2020.0	0.045	0.0442	0.0449	4.56E+17	2330.0	0.0568	0.0562	0.0567	6.65E+17
2025.0	0.074	0.0728	0.0738	7.52E+17	2335.0	0.058	0.0574	0.0578	6.79E+17
2030.0	0.0849	0.0835	0.0846	8.65E+17	2340.0	0.0458	0.0454	0.0457	5.38E+17
2035.0	0.0964	0.0948	0.0961	9.85E+17	2345.0	0.0514	0.0509	0.0513	6.05E+17
2040.0	0.0898	0.0883	0.0895	9.19E+17	2350.0	0.0415	0.0411	0.0414	4.90E+17
2045.0	0.0911	0.0896	0.0908	9.35E+17	2355.0	0.0475	0.047	0.0473	5.61E+17
2050.0	0.0679	0.0669	0.0677	6.99E+17	2360.0	0.0502	0.0497	0.0501	5.95E+17
2055.0	0.0549	0.0541	0.0547	5.66E+17	2365.0	0.0494	0.0489	0.0493	5.87E+17
2060.0	0.0692	0.0682	0.069	7.16E+17	2370.0	0.0308	0.0305	0.0307	3.67E+17
2065.0	0.0619	0.061	0.0617	6.41E+17	2375.0	0.0441	0.0437	0.044	5.26E+17
2070.0	0.0657	0.0647	0.0655	6.82E+17	2380.0	0.0426	0.0421	0.0424	5.08E+17
2075.0	0.0774	0.0763	0.0772	8.07E+17	2385.0	0.0308	0.0305	0.0307	3.69E+17
2080.0	0.0868	0.0855	0.0866	9.06E+17	2390.0	0.0371	0.0367	0.037	4.45E+17
2085.0	0.0851	0.0838	0.0849	8.91E+17	2395.0	0.0406	0.0402	0.0405	4.88E+17
2090.0	0.0891	0.0878	0.0888	9.35E+17	2400.0	0.0442	0.0437	0.044	5.32E+17
2095.0	0.0897	0.0884	0.0895	9.44E+17	2405.0	0.0336	0.0333	0.0335	4.06E+17
2100.0	0.0861	0.0849	0.0859	9.08E+17	2410.0	0.0338	0.0335	0.0337	4.09E+17
2105.0	0.0932	0.0918	0.0929	9.84E+17	2415.0	0.0273	0.0271	0.0272	3.31E+17
2110.0	0.0897	0.0883	0.0894	9.50E+17	2420.0	0.0266	0.0264	0.0265	3.23E+17
2115.0	0.0917	0.0903	0.0914	9.73E+17	2425.0	0.0331	0.0328	0.033	4.03E+17
2120.0	0.0876	0.0863	0.0873	9.32E+17	2430.0	0.0451	0.0447	0.045	5.50E+17
2125.0	0.0886	0.0873	0.0884	9.45E+17	2435.0	0.0149	0.0148	0.0148	1.82E+17
2130.0	0.0898	0.0884	0.0895	9.60E+17	2440.0	0.0432	0.0429	0.0431	5.30E+17
2135.0	0.09	0.0887	0.0898	9.65E+17	2445.0	0.0208	0.0207	0.0207	2.55E+17
2140.0	0.0908	0.0894	0.0905	9.75E+17	2450.0	0.0136	0.0135	0.0136	1.67E+17
2145.0	0.0895	0.0881	0.0892	9.64E+17	2455.0	0.0249	0.0247	0.0248	3.06E+17
2150.0	0.0846	0.0834	0.0844	9.13E+17	2460.0	0.0334	0.0332	0.0333	4.12E+17
2155.0	0.0848	0.0836	0.0846	9.18E+17	2465.0	0.0241	0.024	0.0241	2.99E+17
2160.0	0.0842	0.0829	0.0839	9.13E+17	2470.0	0.0167	0.0166	0.0167	2.07E+17
2165.0	0.0763	0.0752	0.0761	8.29E+17	2475.0	0.0165	0.0164	0.0164	2.04E+17
2170.0	0.082	0.0808	0.0818	8.93E+17	2480.0	0.008	0.008	0.008	1.00E+17
2175.0	0.0804	0.0793	0.0802	8.78E+17	2485.0	0.0056	0.0056	0.0056	7.00E+16
2180.0	0.0818	0.0806	0.0816	8.95E+17	2490.0	0.0035	0.0035	0.0035	4.39E+16
2185.0	0.0746	0.0735	0.0743	8.18E+17	2495.0	0.0029	0.0029	0.0029	3.60E+16
2190.0	0.0791	0.0779	0.0788	8.69E+17	2500.0	0.0071	0.007	0.007	8.87E+16
2195.0	0.079	0.0778	0.0788	8.70E+17	2505.0	0.0015	0.0015	0.0015	1.91E+16
2200.0	0.0712	0.0702	0.071	7.86E+17	2510.0	0.0022	0.0022	0.0022	2.79E+16
2205.0	0.074	0.0729	0.0738	8.19E+17	2515.0	0.0005	0.0005	0.0005	6.55E+15
2210.0	0.0793	0.0782	0.0791	8.80E+17	2520.0	0.0004	0.0004	0.0004	4.69E+15
2215.0	0.0763	0.0752	0.0761	8.48E+17	2525.0	0	0	0	5.25E+14
2220.0	0.0777	0.0766	0.0775	8.66E+17	2530.0	0	0	0	8.08E+12
2225.0	0.0755	0.0744	0.0752	8.43E+17	2535.0	0	0	0	2.23E+12
2230.0	0.0758	0.0747	0.0756	8.48E+17	2540.0	0	0	0	4.81E+12
2235.0	0.0743	0.0733	0.0741	8.34E+17	2545.0	0	0	0	6.87E+08
2240.0	0.0731	0.0721	0.0729	8.22E+17	2550.0	0	0	0	3.61E+06
2245.0	0.0708	0.0699	0.0706	7.98E+17	2555.0	0	0	0	1.34E+10
2250.0	0.0719	0.071	0.0717	8.12E+17	2560.0	0	0	0	3.99E+08
2255.0	0.0677	0.0669	0.0675	7.66E+17	2565.0	0	0	0	2.05E+05
2260.0	0.0669	0.0661	0.0667	7.59E+17	2570.0	0	0	0	1.97E+01
2265.0	0.0681	0.0674	0.0679	7.75E+17	2575.0	0	0	0	1.39E-08
2270.0	0.0649	0.0641	0.0647	7.39E+17	2580.0	0	0	0	4.95E-03
2275.0	0.064	0.0633	0.0638	7.31E+17	2585.0	0	0	0	2.23E-15
2280.0	0.0663	0.0656	0.0661	7.59E+17	2590.0	0	0	0	7.12E-12
2285.0	0.0631	0.0624	0.0629	7.24E+17	2595.0	0	0	0	2.98E-14
2290.0	0.0632	0.0625	0.063	7.27E+17	2600.0	0	0	0	5.86E-09
2295.0	0.0613	0.0606	0.0611	7.06E+17	2605.0	0	0	0	7.59E-16
2300.0	0.0588	0.0582	0.0587	6.79E+17	2610.0	0	0	0	7.79E-15

Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
2615.0	0	0	0	1.47E-18	2925.0	0.0011	0.0011	0.0011	1.59E+16
2620.0	0	0	0	7.43E-10	2930.0	0.0059	0.006	0.0059	8.66E+16
2625.0	0	0	0	5.10E-09	2935.0	0.0065	0.0066	0.0065	9.56E+16
2630.0	0	0	0	3.70E-26	2940.0	0.0016	0.0016	0.0016	2.40E+16
2635.0	0	0	0	5.16E+03	2945.0	0.0014	0.0015	0.0014	2.14E+16
2640.0	0	0	0	1.56E+03	2950.0	0.0052	0.0053	0.0052	7.74E+16
2645.0	0	0	0	1.20E+01	2955.0	0.0023	0.0024	0.0023	3.47E+16
2650.0	0	0	0	1.90E+00	2960.0	0.0046	0.0047	0.0046	6.83E+16
2655.0	0	0	0	1.75E-08	2965.0	0.0074	0.0075	0.0074	1.11E+17
2660.0	0	0	0	3.48E-06	2970.0	0.0004	0.0004	0.0004	5.25E+15
2665.0	0	0	0	1.49E-18	2975.0	0.0009	0.0009	0.0009	1.28E+16
2670.0	0	0	0	0.00E+00	2980.0	0.0013	0.0014	0.0013	2.00E+16
2675.0	0	0	0	0.00E+00	2985.0	0.007	0.007	0.0069	1.04E+17
2680.0	0	0	0	0.00E+00	2990.0	0.0103	0.0104	0.0103	1.54E+17
2685.0	0	0	0	0.00E+00	2995.0	0.0043	0.0043	0.0043	6.43E+16
2690.0	0	0	0	1.38E-10	3000.0	0.0078	0.0079	0.0078	1.18E+17
2695.0	0	0	0	9.64E-14	3005.0	0.0029	0.0029	0.0029	4.36E+16
2700.0	0	0	0	0.00E+00	3010.0	0.0068	0.0069	0.0068	1.04E+17
2705.0	0	0	0	3.98E-23	3015.0	0.0056	0.0056	0.0055	8.41E+16
2710.0	0	0	0	1.53E-16	3020.0	0.0006	0.0006	0.0006	9.61E+15
2715.0	0	0	0	5.25E-07	3025.0	0.0075	0.0076	0.0075	1.14E+17
2720.0	0	0	0	7.65E-26	3030.0	0.0061	0.0061	0.0061	9.24E+16
2725.0	0	0	0	9.98E-03	3035.0	0.0025	0.0025	0.0025	3.81E+16
2730.0	0	0	0	8.32E+00	3040.0	0.002	0.002	0.002	3.09E+16
2735.0	0	0	0	7.54E-02	3045.0	0.0042	0.0043	0.0042	6.43E+16
2740.0	0	0	0	3.21E-08	3050.0	0.001	0.001	0.001	1.58E+16
2745.0	0	0	0	1.81E-04	3055.0	0.0003	0.0003	0.0003	4.44E+15
2750.0	0	0	0	2.30E-09	3060.0	0.0063	0.0064	0.0063	9.68E+16
2755.0	0	0	0	9.30E-25	3065.0	0.0029	0.0029	0.0029	4.48E+16
2760.0	0	0	0	0.00E+00	3070.0	0.0017	0.0018	0.0017	2.70E+16
2765.0	0	0	0	3.72E-08	3075.0	0.006	0.0061	0.006	9.30E+16
2770.0	0	0	0	1.17E-04	3080.0	0.0036	0.0037	0.0036	5.60E+16
2775.0	0	0	0	5.57E-19	3085.0	0.0018	0.0018	0.0018	2.74E+16
2780.0	0	0	0	6.71E-15	3090.0	0.0024	0.0024	0.0024	3.69E+16
2785.0	0	0	0	5.43E-08	3095.0	0.0007	0.0007	0.0007	1.02E+16
2790.0	0	0	0	1.70E+03	3100.0	0.0044	0.0045	0.0044	6.85E+16
2795.0	0	0	0	5.08E+03	3105.0	0.0009	0.0009	0.0009	1.44E+16
2800.0	0	0	0	2.32E+07	3110.0	0.0008	0.0009	0.0008	1.32E+16
2805.0	0	0	0	9.50E+05	3115.0	0.0023	0.0023	0.0023	3.55E+16
2810.0	0	0	0	5.68E+09	3120.0	0.0098	0.0099	0.0098	1.54E+17
2815.0	0	0	0	4.05E+09	3125.0	0.003	0.0031	0.003	4.75E+16
2820.0	0	0	0	2.91E+08	3130.0	0.0058	0.0058	0.0057	9.05E+16
2825.0	0	0	0	2.50E+12	3135.0	0.0114	0.0116	0.0114	1.80E+17
2830.0	0	0	0	5.54E+13	3140.0	0.0033	0.0034	0.0033	5.24E+16
2835.0	0	0	0	3.03E+09	3145.0	0.0033	0.0033	0.0032	5.13E+16
2840.0	0	0	0	2.80E+12	3150.0	0.0067	0.0067	0.0067	1.06E+17
2845.0	0	0	0	5.79E+14	3155.0	0.0056	0.0057	0.0056	8.93E+16
2850.0	0	0	0	1.66E+13	3160.0	0.0092	0.0093	0.0092	1.46E+17
2855.0	0	0	0	6.43E+12	3165.0	0.014	0.0142	0.014	2.23E+17
2860.0	0	0	0	3.64E+14	3170.0	0.0125	0.0126	0.0125	1.99E+17
2865.0	0.0002	0.0002	0.0002	2.41E+15	3175.0	0.0092	0.0093	0.0092	1.47E+17
2870.0	0	0	0	9.09E+13	3180.0	0.0106	0.0107	0.0106	1.70E+17
2875.0	0.0004	0.0004	0.0004	5.65E+15	3185.0	0.0081	0.0082	0.0081	1.29E+17
2880.0	0.0002	0.0003	0.0002	3.57E+15	3190.0	0.0042	0.0043	0.0042	6.79E+16
2885.0	0.0005	0.0005	0.0005	6.57E+15	3195.0	0.0027	0.0027	0.0027	4.32E+16
2890.0	0.0002	0.0002	0.0002	2.70E+15	3200.0	0.0004	0.0004	0.0004	7.04E+15
2895.0	0.0027	0.0027	0.0027	3.87E+16	3205.0	0.0003	0.0003	0.0003	4.98E+15
2900.0	0.0008	0.0008	0.0008	1.18E+16	3210.0	0.0001	0.0001	0.0001	2.20E+15
2905.0	0.0001	0.0001	0.0001	1.62E+15	3215.0	0.0005	0.0005	0.0005	8.03E+15
2910.0	0.0027	0.0028	0.0027	3.98E+16	3220.0	0.0016	0.0016	0.0016	2.60E+16
2915.0	0.0013	0.0013	0.0013	1.84E+16	3225.0	0.0002	0.0002	0.0002	3.22E+15
2920.0	0.0029	0.0029	0.0029	4.24E+16	3230.0	0.0003	0.0003	0.0003	5.53E+15

Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>	Wavelength nm	ASTM G173 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	ASTM G173 Direct Beam W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Global Tilt W m <sup>-2</sup> nm <sup>-1</sup>	IEC-60904-03 Spectral Photon Irradiance m <sup>-2</sup> S <sup>-1</sup> nm <sup>-1</sup>
3235.0	0.0073	0.0074	0.0073	1.18E+17	3545.0	0.0095	0.0096	0.0095	1.70E+17
3240.0	0.0037	0.0038	0.0037	6.09E+16	3550.0	0.0105	0.0106	0.0105	1.88E+17
3245.0	0.0007	0.0007	0.0007	1.20E+16	3555.0	0.0091	0.0091	0.009	1.62E+17
3250.0	0.0026	0.0026	0.0026	4.25E+16	3560.0	0.0108	0.0109	0.0108	1.93E+17
3255.0	0.0099	0.01	0.0099	1.62E+17	3565.0	0.0109	0.0109	0.0108	1.94E+17
3260.0	0.0012	0.0012	0.0012	2.00E+16	3570.0	0.0083	0.0084	0.0083	1.49E+17
3265.0	0.0024	0.0025	0.0024	4.01E+16	3575.0	0.0086	0.0087	0.0086	1.55E+17
3270.0	0.0012	0.0012	0.0012	2.00E+16	3580.0	0.0102	0.0103	0.0102	1.83E+17
3275.0	0.0059	0.006	0.0059	9.74E+16	3585.0	0.0092	0.0092	0.0091	1.65E+17
3280.0	0.0029	0.0029	0.0029	4.72E+16	3590.0	0.0095	0.0095	0.0094	1.70E+17
3285.0	0.0111	0.0112	0.0111	1.84E+17	3595.0	0.0097	0.0097	0.0096	1.75E+17
3290.0	0.0088	0.0088	0.0087	1.45E+17	3600.0	0.0103	0.0103	0.0102	1.85E+17
3295.0	0.0012	0.0012	0.0012	2.02E+16	3605.0	0.0104	0.0104	0.0103	1.87E+17
3300.0	0.0018	0.0018	0.0018	2.95E+16	3610.0	0.0095	0.0095	0.0095	1.72E+17
3305.0	0.0039	0.004	0.0039	6.54E+16	3615.0	0.0095	0.0095	0.0094	1.72E+17
3310.0	0.0039	0.004	0.0039	6.52E+16	3620.0	0.0116	0.0117	0.0116	2.11E+17
3315.0	0	0	0	2.68E+14	3625.0	0.0102	0.0103	0.0102	1.86E+17
3320.0	0.0001	0.0001	0.0001	1.00E+15	3630.0	0.01	0.01	0.0099	1.81E+17
3325.0	0.0035	0.0035	0.0035	5.87E+16	3635.0	0.0103	0.0104	0.0103	1.88E+17
3330.0	0.0047	0.0047	0.0046	7.79E+16	3640.0	0.0115	0.0115	0.0114	2.10E+17
3335.0	0.0091	0.0091	0.009	1.52E+17	3645.0	0.0106	0.0107	0.0106	1.94E+17
3340.0	0.0035	0.0035	0.0035	5.80E+16	3650.0	0.0101	0.0102	0.0101	1.86E+17
3345.0	0.0035	0.0036	0.0035	5.95E+16	3655.0	0.011	0.011	0.0109	2.01E+17
3350.0	0.008	0.0081	0.008	1.35E+17	3660.0	0.0109	0.011	0.0109	2.01E+17
3355.0	0.0036	0.0037	0.0036	6.11E+16	3665.0	0.0103	0.0103	0.0102	1.89E+17
3360.0	0.0052	0.0053	0.0052	8.84E+16	3670.0	0.0079	0.0079	0.0079	1.46E+17
3365.0	0.0072	0.0073	0.0072	1.22E+17	3675.0	0.0048	0.0049	0.0048	8.91E+16
3370.0	0.0039	0.004	0.0039	6.66E+16	3680.0	0.0083	0.0084	0.0083	1.54E+17
3375.0	0.0085	0.0085	0.0084	1.43E+17	3685.0	0.0094	0.0095	0.0094	1.75E+17
3380.0	0.0051	0.0052	0.0051	8.67E+16	3690.0	0.0097	0.0097	0.0097	1.80E+17
3385.0	0.0075	0.0076	0.0075	1.27E+17	3695.0	0.0101	0.0102	0.0101	1.88E+17
3390.0	0.0099	0.01	0.0098	1.68E+17	3700.0	0.0109	0.0109	0.0108	2.02E+17
3395.0	0.0095	0.0096	0.0095	1.63E+17	3705.0	0.0108	0.0108	0.0107	2.00E+17
3400.0	0.0125	0.0126	0.0125	2.14E+17	3710.0	0.0094	0.0094	0.0093	1.74E+17
3405.0	0.0045	0.0045	0.0044	7.62E+16	3715.0	0.0092	0.0093	0.0092	1.72E+17
3410.0	0.0071	0.0072	0.0071	1.21E+17	3720.0	0.0104	0.0104	0.0103	1.94E+17
3415.0	0.0073	0.0074	0.0073	1.25E+17	3725.0	0.0107	0.0108	0.0107	2.00E+17
3420.0	0.0132	0.0133	0.0131	2.26E+17	3730.0	0.0093	0.0093	0.0092	1.74E+17
3425.0	0.01	0.0101	0.01	1.72E+17	3735.0	0.0086	0.0086	0.0086	1.61E+17
3430.0	0.0087	0.0088	0.0087	1.50E+17	3740.0	0.0088	0.0089	0.0088	1.66E+17
3435.0	0.0116	0.0117	0.0115	1.99E+17	3745.0	0.0103	0.0104	0.0103	1.94E+17
3440.0	0.008	0.0081	0.008	1.39E+17	3750.0	0.0093	0.0093	0.0093	1.75E+17
3445.0	0.0113	0.0114	0.0113	1.96E+17	3755.0	0.009	0.009	0.009	1.70E+17
3450.0	0.0112	0.0113	0.0111	1.93E+17	3760.0	0.0089	0.0089	0.0088	1.67E+17
3455.0	0.0083	0.0084	0.0083	1.44E+17	3765.0	0.0086	0.0086	0.0085	1.62E+17
3460.0	0.0125	0.0127	0.0125	2.18E+17	3770.0	0.0091	0.0092	0.0091	1.73E+17
3465.0	0.0098	0.0099	0.0098	1.71E+17	3775.0	0.0091	0.0091	0.009	1.72E+17
3470.0	0.0123	0.0124	0.0122	2.14E+17	3780.0	0.0096	0.0096	0.0095	1.82E+17
3475.0	0.0109	0.0111	0.0109	1.91E+17	3785.0	0.0088	0.0088	0.0088	1.67E+17
3480.0	0.0112	0.0113	0.0112	1.96E+17	3790.0	0.0078	0.0078	0.0077	1.48E+17
3485.0	0.0121	0.0122	0.0121	2.12E+17	3795.0	0.0089	0.0089	0.0088	1.69E+17
3490.0	0.0104	0.0105	0.0104	1.83E+17	3800.0	0.0099	0.0099	0.0098	1.88E+17
3495.0	0.0123	0.0124	0.0122	2.15E+17	3805.0	0.0093	0.0093	0.0093	1.78E+17
3500.0	0.0119	0.012	0.0119	2.09E+17	3810.0	0.0082	0.0083	0.0082	1.58E+17
3505.0	0.0118	0.0119	0.0118	2.08E+17	3815.0	0.0078	0.0078	0.0077	1.49E+17
3510.0	0.012	0.0121	0.0119	2.11E+17	3820.0	0.0097	0.0097	0.0096	1.85E+17
3515.0	0.0115	0.0116	0.0115	2.03E+17	3825.0	0.0095	0.0095	0.0095	1.83E+17
3520.0	0.0121	0.0122	0.0121	2.14E+17	3830.0	0.0096	0.0096	0.0096	1.84E+17
3525.0	0.0114	0.0115	0.0114	2.02E+17	3835.0	0.0077	0.0077	0.0077	1.48E+17
3530.0	0.0111	0.0112	0.0111	1.97E+17	3840.0	0.009	0.009	0.0089	1.73E+17
3535.0	0.0095	0.0095	0.0094	1.68E+17	3845.0	0.0088	0.0088	0.0088	1.70E+17
3540.0	0.009	0.0091	0.009	1.61E+17	3850.0	0.0088	0.0089	0.0088	1.71E+17



Wavelength nm	ASTM G173 Global Tilt $W m^{-2} nm^{-1}$	ASTM G173 Direct Beam $W m^{-2} nm^{-1}$	IEC-60904-03 Global Tilt $W m^{-2} nm^{-1}$	IEC-60904-03 Spectral Photon Irradiance $m^{-2} S^{-1} nm^{-1}$	Wavelength nm	ASTM G173 Global Tilt $W m^{-2} nm^{-1}$	ASTM G173 Direct Beam $W m^{-2} nm^{-1}$	IEC-60904-03 Global Tilt $W m^{-2} nm^{-1}$	IEC-60904-03 Spectral Photon Irradiance $m^{-2} S^{-1} nm^{-1}$
3860.0	0.008	0.008	0.008	1.55E+17	3935.0	0.0074	0.0074	0.0073	1.45E+17
3865.0	0.0081	0.0081	0.0081	1.57E+17	3940.0	0.0074	0.0074	0.0074	1.46E+17
3870.0	0.0074	0.0074	0.0073	1.43E+17	3945.0	0.0075	0.0076	0.0075	1.49E+17
3875.0	0.0068	0.0068	0.0067	1.32E+17	3950.0	0.0076	0.0076	0.0076	1.51E+17
3880.0	0.0065	0.0066	0.0065	1.27E+17	3955.0	0.0077	0.0077	0.0077	1.53E+17
3885.0	0.0068	0.0068	0.0068	1.32E+17	3960.0	0.0077	0.0078	0.0077	1.54E+17
3890.0	0.0069	0.0069	0.0069	1.34E+17	3965.0	0.0078	0.0078	0.0078	1.55E+17
3895.0	0.0075	0.0075	0.0075	1.46E+17	3970.0	0.0077	0.0077	0.0077	1.53E+17
3900.0	0.0079	0.0079	0.0079	1.55E+17	3975.0	0.0075	0.0075	0.0075	1.50E+17
3905.0	0.0079	0.008	0.0079	1.55E+17	3980.0	0.0074	0.0074	0.0074	1.48E+17
3910.0	0.0071	0.0072	0.0071	1.40E+17	3985.0	0.0074	0.0075	0.0074	1.49E+17
3915.0	0.007	0.007	0.007	1.37E+17	3990.0	0.0074	0.0074	0.0074	1.48E+17
3920.0	0.0069	0.007	0.0069	1.37E+17	3995.0	0.0072	0.0072	0.0072	1.45E+17
3925.0	0.0069	0.0069	0.0068	1.35E+17	4000.0	0.0071	0.0071	0.0071	1.43E+17
3930.0	0.0071	0.0071	0.007	1.39E+17	∞	---	---	---	---

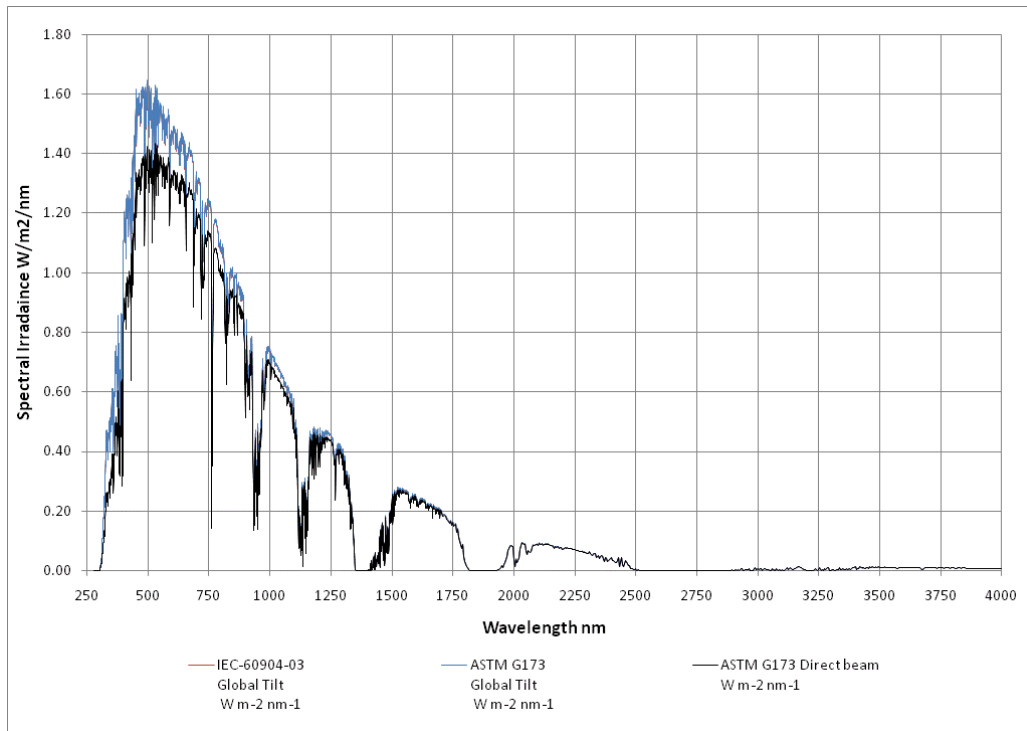


Figure A.1. Plot of IEC-60904-03 and ASTM G173 Hemispherical on 37° South-Facing Tilt Reference Spectra and ASTM G173 Direct Normal (Beam) Spectrum.