SOFTWARE VALIDATION TEST PLAN AND REPORT: SAMS®, Version 3.2

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1 SCOPE OF VALIDATION

SAMS®, developed by the Department of Land, Air, and Water Resources at the University of California, Davis (Rueda and Wrona, 2003), is a program used to import, organize, visualize, manipulate, and export spectral data files. The files are organized in databases, each being managed as an independent entity, having its own spectra metadata definition.

The program allows import and export of spectral data in various formats, including Analytical Spectral Devices (ASD) (the binary variant), Geophysical and Environmental Research Coporation (GER), American Standard Code for Information Interchange (ASCII), and Environment for Visualizing Images (ENVI) Standard Data file; signature groupings; metadata management; and data analysis on single or multiple spectral signatures. SAMS has also visualization and plotting capabilities.

SAMS will be used in a variety of remote sensing-related projects to manage and analyze field and laboratory spectral data.

This test plan and report will validate features such as

- File Management
- Basic Spectra Analysis

Software validation of SAMS should confirm that the software can correctly perform the above listed functions with the provided spectral data.

2 REFERENCES

Rueda, C.A. and A.F. Wrona. "SAMS Spectral Analysis & Management System Users Manual." Davis, California: University of California, Davis. 2003.

ASTER Spectral Library©. "Generic Datasets." Pasadena, California: Jet Propulsion Laboratory, California Institute of Technology. 2006. <http://speclib.jpl.nasa.gov/>

3 ENVIRONMENT

3.1 Software

- Operating Systems: Microsoft® Windows XP Professional and 2000, Version 2002, Service Pack 2; UNIX; LINUX
- Java runtime environment 1.4 or later

3.2 Hardware

- Computer: AMD Athlon™ processor
- CPU 1.10 GHz
- Memory: 512 MB RAM

4 PREREQUISITES

None.

5 ASSUMPTIONS AND CONSTRAINTS

None.

6 TEST CASES

6.1 File Management

6.1.1 Objective

Demonstrate that SAMS can handle a variety of spectral data for analysis. SAMS should be able to identify and read a number of file formats, including ASD, ASCII, and ENVI.

6.1.2 Test Input

The spectral datasets used for this test are

- ASCII: basal1f.txt, conifers.txt, deciduous.txt, grass.txt, and rhyoli1s.txt. These generic datasets are provided by the ASTER Spectral Library (2006).
- ENVI Standard Files: envi_conifers and envi_deciduous. These datasets are based on the above ASTER ASCII files, previously exported to the ENVI Standard File using the ENVI remote sensing image processing software.
- ASD: asd_kaolinite.001 and asd_spectralon.001. These spectra correspond to the Kaolinite sample API#9 and the Spectralon AS-02035-000 CSTM-SRM-990-362 diffuse reflectance material, both available at the Center for Nuclear Waste Regulatory Analyses. Data were produced using the ASD FieldSpec 3 Vis/NIR spectroradiometer.

6.1.3 Test Procedure

1. Open SAMS. The main view page (Figure 1) will give you the options for database setup and importing your data for analysis by using the database menu, selected menu, and plot menu.

2. To map to a directory, open the **Database menu** and select **New** to specify a new directory. A window will open so you can map to your directory where your data is located. Map to rscr0/SAMS_v3. Upon completion click **Open**.

3. To **Import data**, use the **Import signatures from** window under the **Database Menu**. Use the following steps a through c to import data using this menu (Figure 2):

    a. Select ASCII file. A window will open up for you to choose your ASCII files. Navigate to the rscr0/SAMS_v3_2/ASCII_Spectras directory and choose any of

the listed .txt files, and then click **Open.** Click **Ok**. Another window will open showing that the file has been imported into SAMS. Click **Close**. Repeat this procedure for the remaining .txt files.

b. To import the ASD binary files, please select the **Specific Files** option in the **Import signatures from** window. In the **Import spectra files window**, select any ASD file from the rscr0/SAMS_v3_2/ASD_Spectras. Click **OK**. Click **Close**. Repeat this procedure for the second ASD file.

c. To import the ENVI files, please select the **ENVI Standard file** option in the **Import signatures from** window. In the **Import spectrum from ENVI file** window, select any ENVI file (i.e., select the data and not the header file) from the rscr0/SAMS_v3_2/ENVI_Spectras directory. Enter 0 for the Line and Pixel values. Click **OK**. Click **Close**. Repeat this procedure for the second ASD file.

4. To view spectra, double click location, found under the **Database Menu** with the file named **location:**. Here you will find the **imported** and **computed** data directories. To view the imported data, double click the **Imported file**. The directory will open to show the imported ASCII files, ASD files, and ENVI files. To view a spectral signature of one of the files, click on any of the imported spectral files. The spectral signature will show up as a plot in the plot window. Repeat the previous steps for the remaining files.

5. To clear a plot from the plot view, click the **Plot** menu, then click **Clear.**

6.1.4 Test Results

PASS/FAIL: The test is successful if all required results are obtained in Section 6.1.3.

Tester: _____ Test Date: _____

6.2 Basic Spectral Analysis

6.2.1 Objective

Demonstrate that SAMS can correctly analyze spectral signatures. Statistical methods such as sum, minimum, maximum, and standard deviation will be employed in this test.

6.2.2 Test Input

Two spectral datasets, conifers.txt and deciduous.txt, provided by the ASTER Spectral Library (2006) will be used for the test procedure. These datasets were imported in the SAMS database in Section 6.1

6.2.3 Test Procedure

1. SAMS offers several options for evaluating spectral signatures. To compute the average, select the conifers and deciduous spectral signatures as a group. To select and view multiple spectral files, push **ctrl & click the left mouse button** at the same

time while choosing each spectral file. Each file will be highlighted to show the selection (Figure 3). To perform the tasks for calculating the average, open the Selected menu. Select **Compute**. Click **Average** from the computed menu (Figure 4). A window will open and ask you to give the computed signature name. Type in **Average**. Click **OK**. Then click **Close.** To access and view the calculated average, go to the **Computed** signatures folder in the location directory and click the file. The computed average will be plotted in the plot window. To view the calculated average in the plotted area with the imported spectral signatures, push **ctrl & click the left mouse** button at the same time while choosing each spectral file and the calculated average. Repeat the previous steps for standard deviation, sum, max, and min for the conifers.txt and deciduous.txt files (Figure 5).

2. Plot Area. To zoom in, drag the left mouse button down and to the right. This will draw a box around the area you want to view. To zoom out, drag the left mouse button up and to the right. To return to the normal viewing scale, go to the **Plot** menu, click **Range**, and then click **Full scale**. Other options for viewing the scale range are as followed. Visible, NDVI, and Chlorophyll. At the top of the plot area, there are four icons. Here you can select to print the plot, reset X and Y to their original values, set the plot format, and rescale the plot to fit the data.

3. The spectra table is located at the top of the page. The spectra table shows the imported and computed spectra data. To change a name, status, or type, double click inside the box that needs changing and then type in the preferred label. Double click on the name **Average**. Change it to **Calculated Average** and hit **Return**. The renamed average file will be listed in the computed file directory which will replace the original file. If the plot is not visible, click **Plot Menu**, **Range**, then **Full Scale**.

<u>Comparison of SAMS vs. Excel calculation results</u>

4. Minimize the SAMS window and open Microsoft Excel.

5. Open the deciduous.txt and conifer.txt files as tab delimited files. Open a new spreadsheet and copy the spectral data from both .txt files starting with line 27. The new spreadsheet columns will be set up as followed (Figure 6). Add the spectral column (i.e., the second column, which is reflectance) from the deciduous sheet and the conifer sheet. You also will need to copy the first column, which contains the wavelength data. Using Excel's formulas for mean [i.e., =AVERAGE(B2:C2)], minimum [i.e., =MIN(B2:C2)], maximum [i.e., =MAX(B2:C2)], and standard deviation [i.e., =STDEVA(B2:C2)], calculate these statistics on the deciduous and conifer spectras.

Save and name this file as trees_calculations.txt as a tab deliminated file in your directory where the other .txt are shared and import it into SAMS. When imported, it will come in as six separate .txt files in the numerical order that correspond to the following

tree_calculations.txt_0003	—	Mean value
tree_calculations.txt_0004	—	Minimum
tree_calculations.txt_0005	—	Maximum
tree_calculations.txt_0006	—	Standard deviations

Visually compare these results with SAMS by overlaying spectras one on top of another. The results should be the same.

6.2.4 Test Results

PASS/FAIL: The test is successful if all required results are obtained in Section 6.2.3.

Tester: _____ Test Date: _____

7 CONCLUSION

The SAMS, Version 3.2 software has completed all tested features successfully.

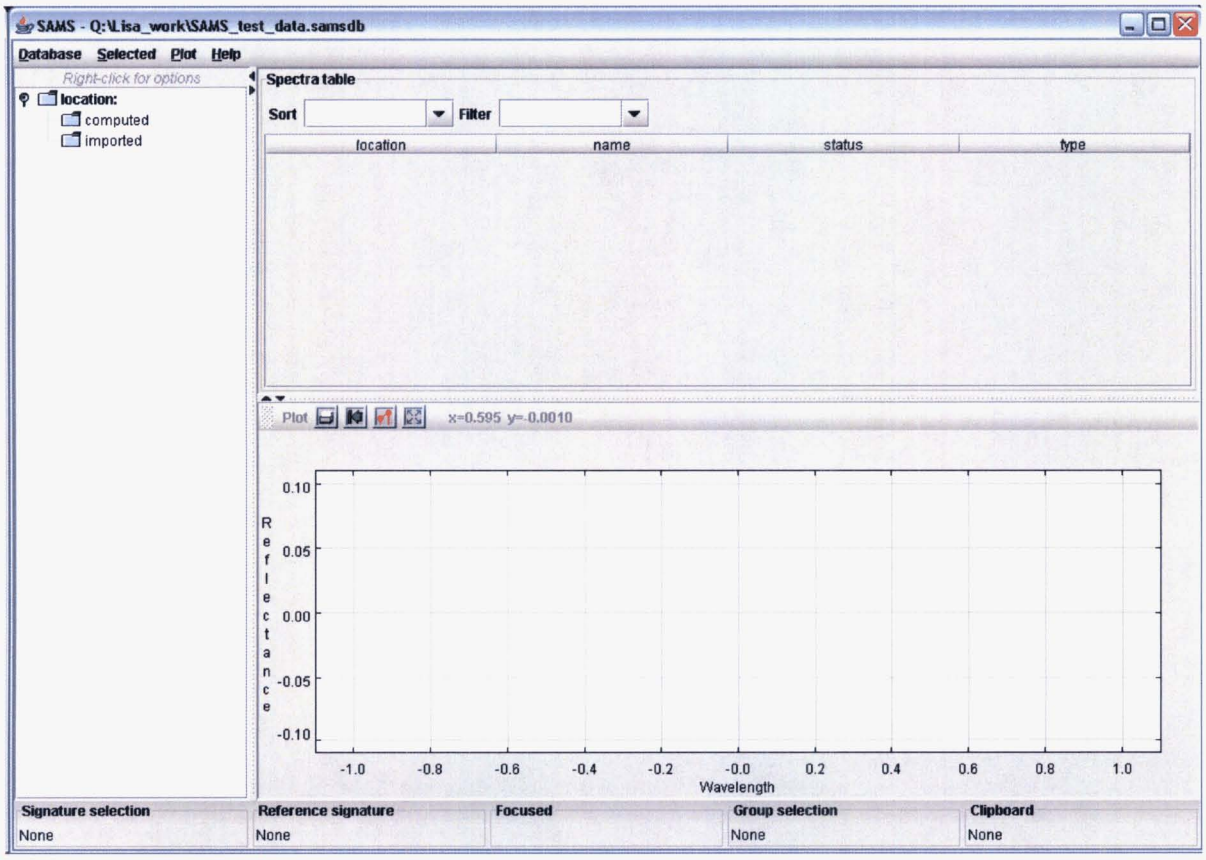

Figure 1. SAMS Main View Page

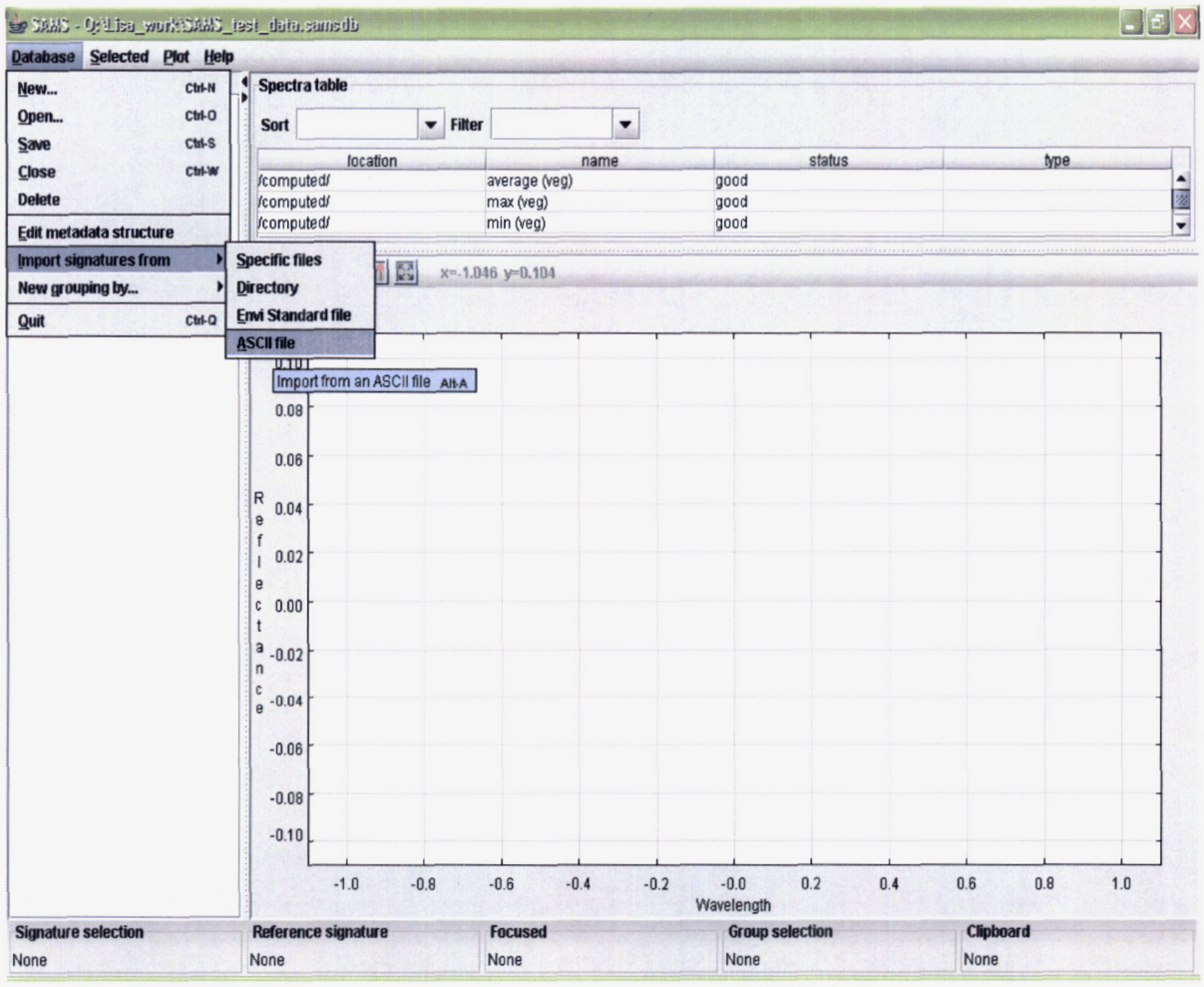

Figure 2. This Is ONLY an Example Screen Showing How to Import Data

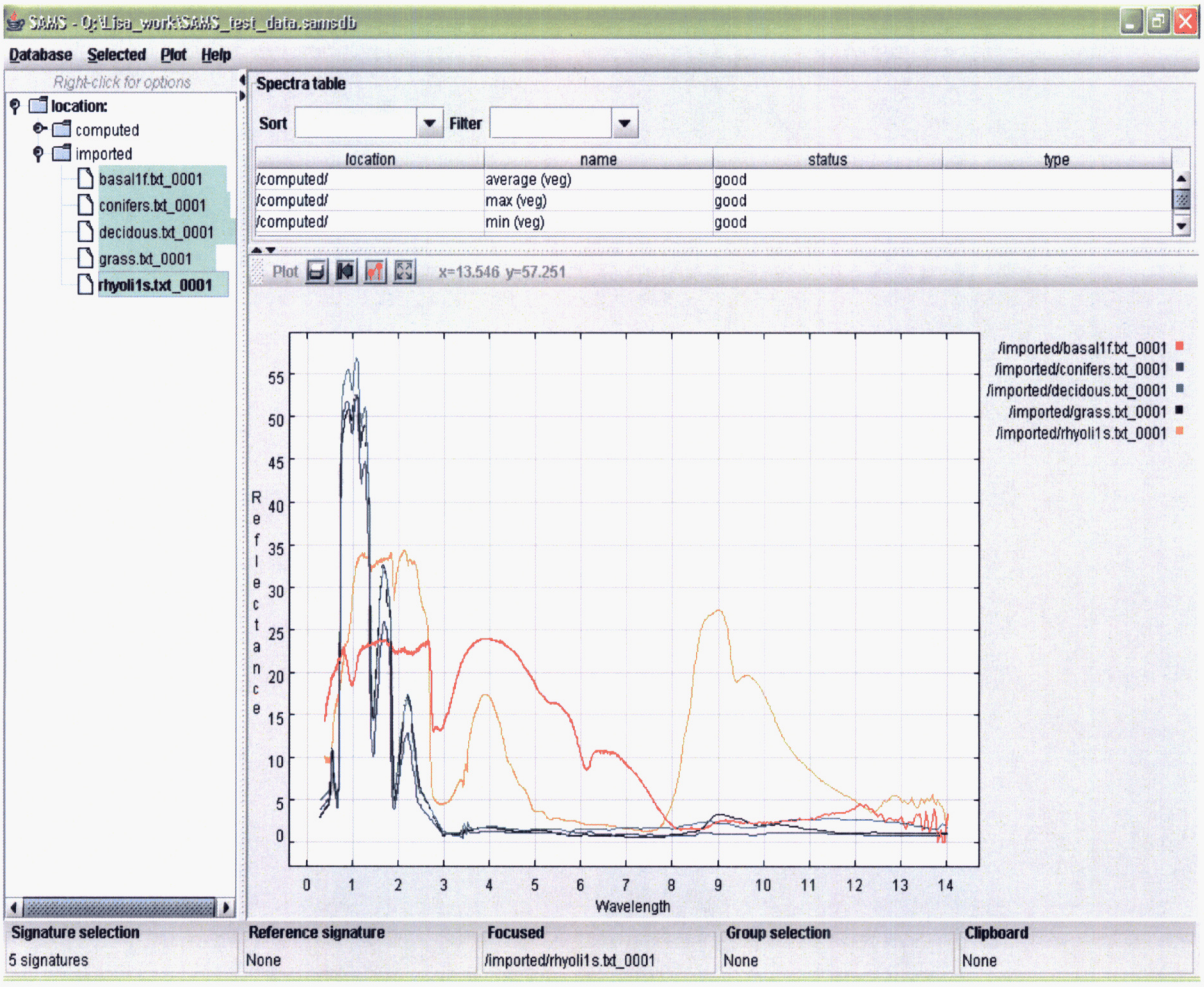

Figure 3. Multiple Spectral Signature Selection

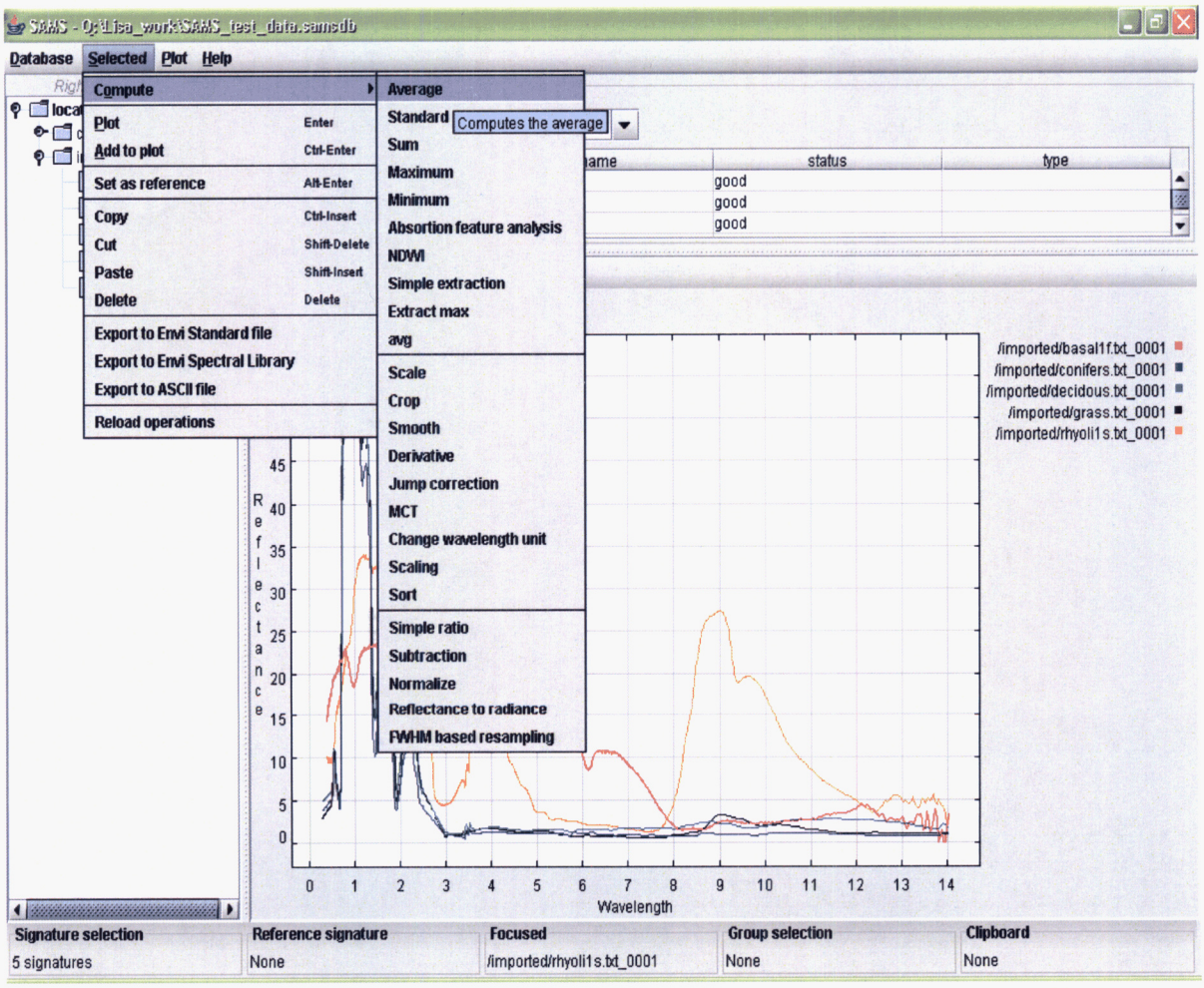

Figure 4. Selection of Computed Average

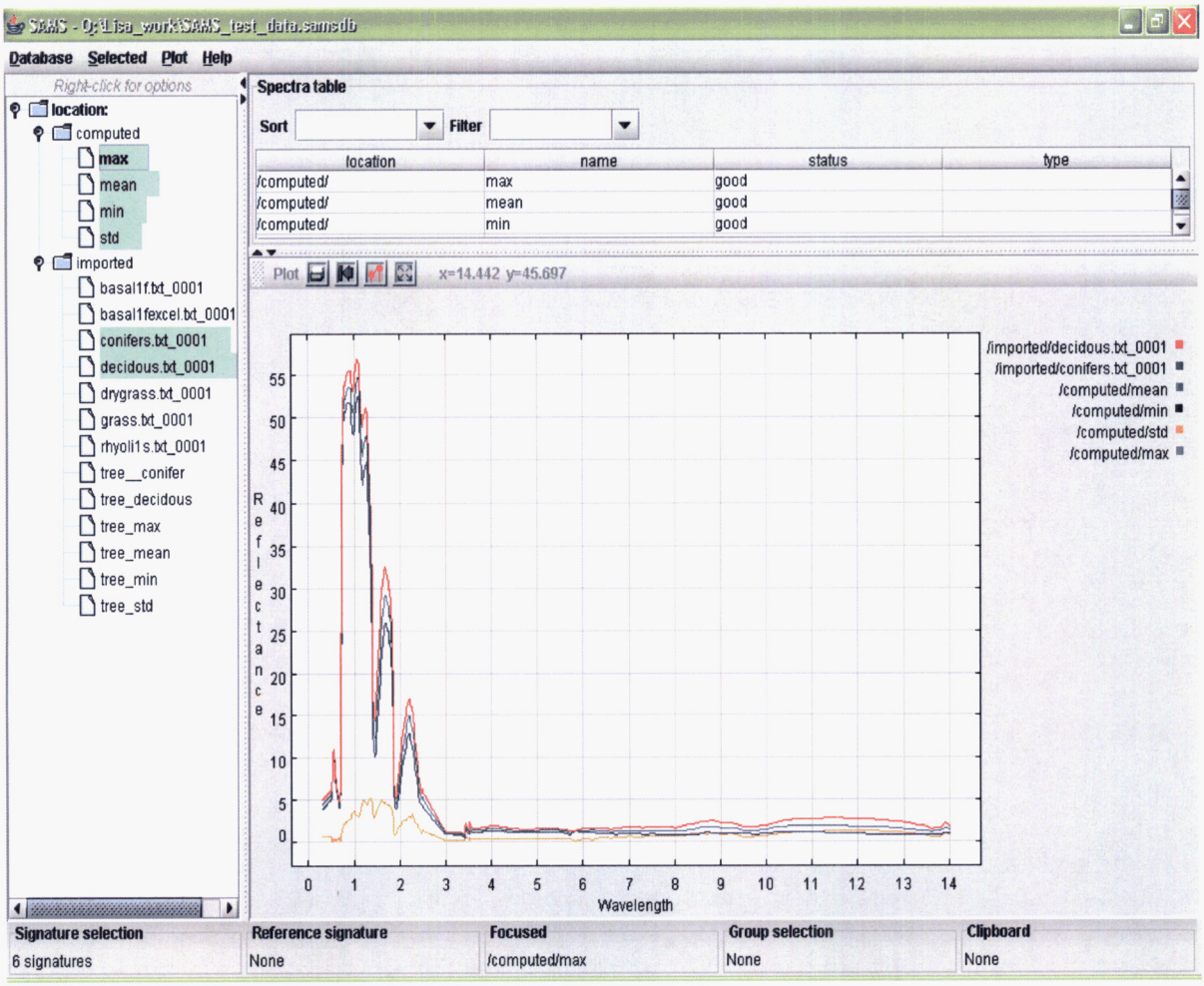

Figure 5. This Is ONLY an Example Screen of What the Screen Should Look Like When Viewing the Calculations With Spectral Signatures

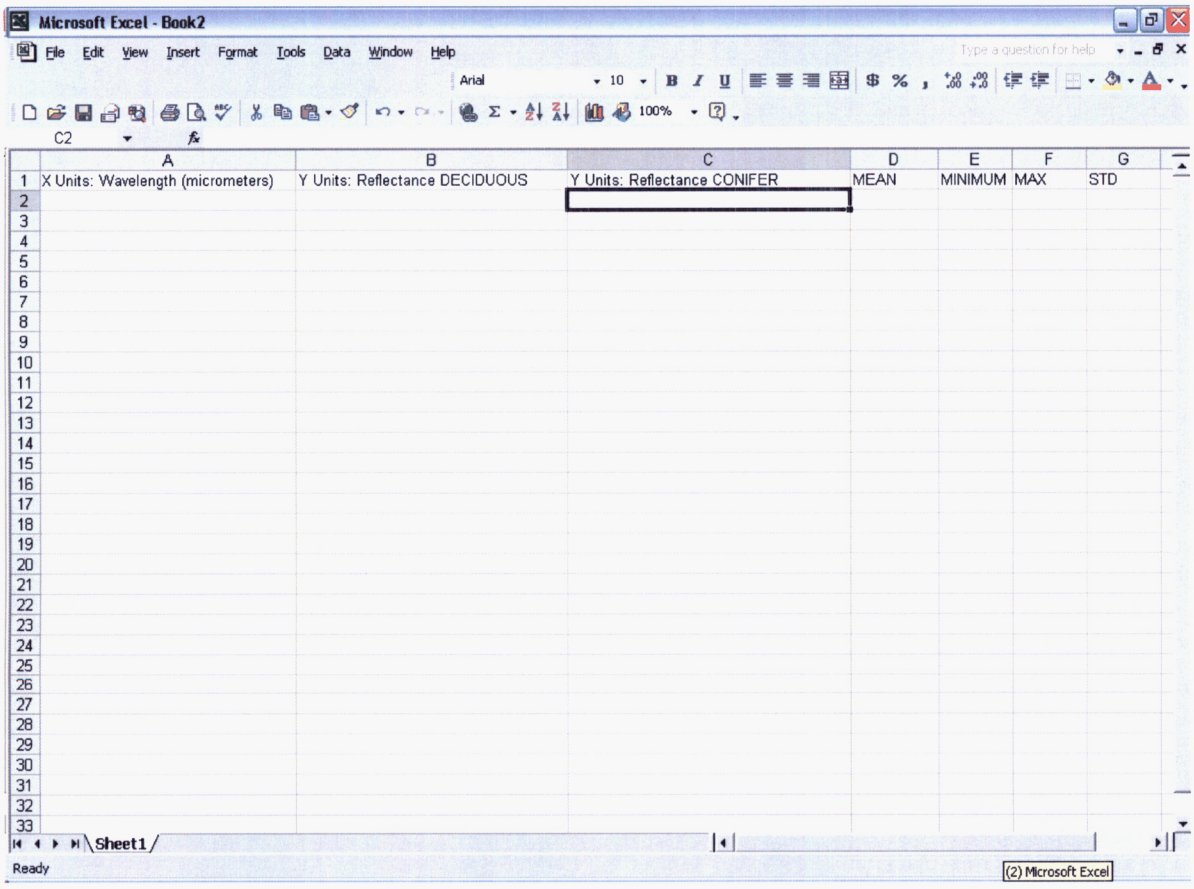

Figure 6. Example of Excel Spreadsheet Format