

User Manual – v1.0

# SpectraWiz Mobile Apps



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## 1. Linux library and driver

Each Smart-Control and zAP2 will come preprogramed with our latest SpectraWiz Mobile App set written in the form of *.bin* files (Linux executable) and dynamic library for USB drivers as *stellarnet\_driver.so* and *stellarnet.hex* files.

### Example script: *data.py*

We also provide with simple data acquisition script written in python (*data.py*) that can communicate with *stellarnet\_driver.so* and perform simple operation to set device parameter and acquire spectrum, methods and functions for driver callback are explain below in table:

Function name	How to call	Return	Description
<b>print_info ()</b>	<b>spectrometer['device'] .print_info ()</b>	-USB Vendor ID -USB product ID - Manufacture and model -Stored Coefficients	Provide USB device information.
<b>set_config ()</b>	<b>spectrometer['device']. set_config (int_time=inttime, scans_to_avg=scansavg, x_smooth=smooth,x_timing=xtiming)</b>		Set device parameters Such as integration time, no of scans, smoothing level and digitizer rate.
<b>array_spectrum ()</b>	<b>Stellarnet_drivers.array_spectrum (spectrometer, wav)</b>	Raw Spectrum	Return spectrum for selected device and also applied calibration coefficients to spectrum
<b>array_get_spec ()</b>	<b>Stellarnet_drivers.array_get_spec ()</b>	-selected spectrometer as device id -Array of wavelengths after applying coefficients.	Return the spectrometer as class object that need to get data from. -Computed wavelength for the spectrometer that has been selected.



Below is the python script that further elaborates how to use the function from drivers described in the table above:

```
# import the usb driver
import stellarnet_driver as sn

# function to set device parameter and return spectrum
def getSpectrum(spectrometer, wav, inttime, scansavg, smooth):
    spectrometer['device'].set_config(int_time=inttime, scans_to_avg=scansavg,
    x_smooth=smooth, x_timing=xtiming)
    spectrum = sn.array_spectrum(spectrometer, wav)
    return spectrum

spectrometer, wav = sn.array_get_spec()

# Setting Device parameter
inttime = 10
scansavg = 1
smooth = 0
xtiming = 1

# Calling function to get spectrum
data=getSpectrum(spectrometer, wav, inttime, scansavg, smooth)

# printing data in terminal
print(data)
```

## 2. SpectraWiz Mobile Apps for SMART-Control

Using SMART-Control local access point (see *zAP2 user manual for detailed info*) and your own mobile device, you can easily run applications for **General Spectroscopy**, **Radiometry**, **Colorimetry**, and **Concentration** analysis. Using the *Set Export* feature you can select which output protocol suits your requirements.

### SpectraWiz Mobile home page

At the startup of each Smart-Control system you will see the home page of SpectraWiz Mobile apps as shown in **Figure 1** where you can launch the application of your choice by tabbing or clicking corresponding icons such as *Spectroscopy*, *Color*, *Radiometer* and *Concentration* app. The launch time for each app is around 7-8 seconds.

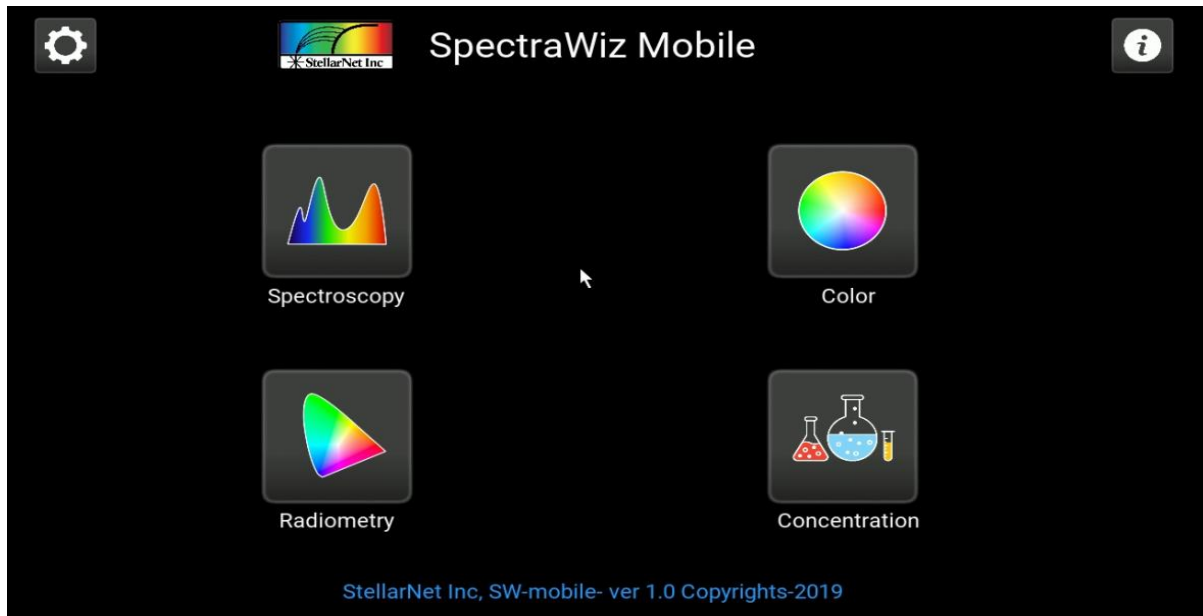


Figure 1. Home page of SpectraWiz Mobile

### Info and Setting menu

At the Top Right corner of the home page there is an *info* button which contain dropdown menu to read the instruction manual, version details, purchase link for buying the source code, FAQ and Exit button. It is recommended not to click on exit button as it takes you to operating system environment as shown in **Figure 2**.

At the Top left corner under cog wheel icon there is an information options such as connected Devices info and their IP Addresses. Note GPS option is not available in current version.



Figure 2. Setting and info menu for Home Page

### 3. Spectroscopy App



To launch the Spectroscopy app, click the icon states spectroscopy from the home page.

The **Spectroscopy** app was designed for general spectroscopic visualization in different modes such as *Scope*, *Absorption*, *Transmission* and *Radiometer*.

User can also change the device setting and parameters like integration time, scan to average, smoothing, digitalizer rate and temperature compensation option which use detector first few pixels to balance out temperature of spectral readout. Moreover, it also has option to take screenshot, save data and export data in various protocols as describe below.

At launch by default you will see the spectrum in scope mode as shown in **Figure 3**.

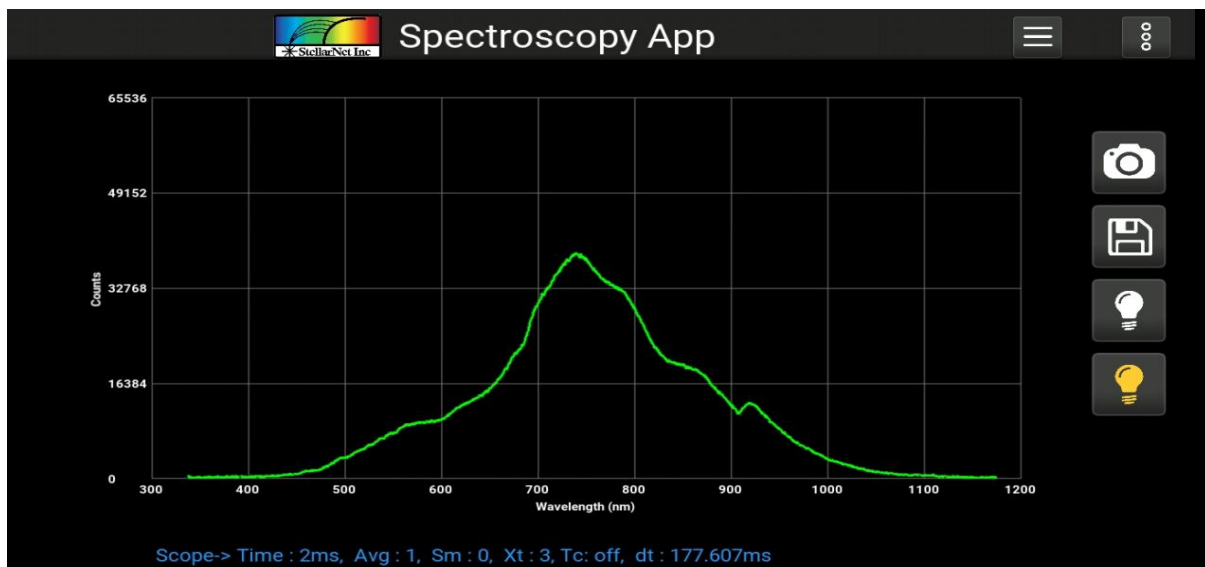


Figure 3. Startup of Spectroscopy app

## Menu bar

You can access the menu items such as Device setting, App setup and view mode, By clicking the menu bar at the right side of main panel as shown in **Figure 4**.

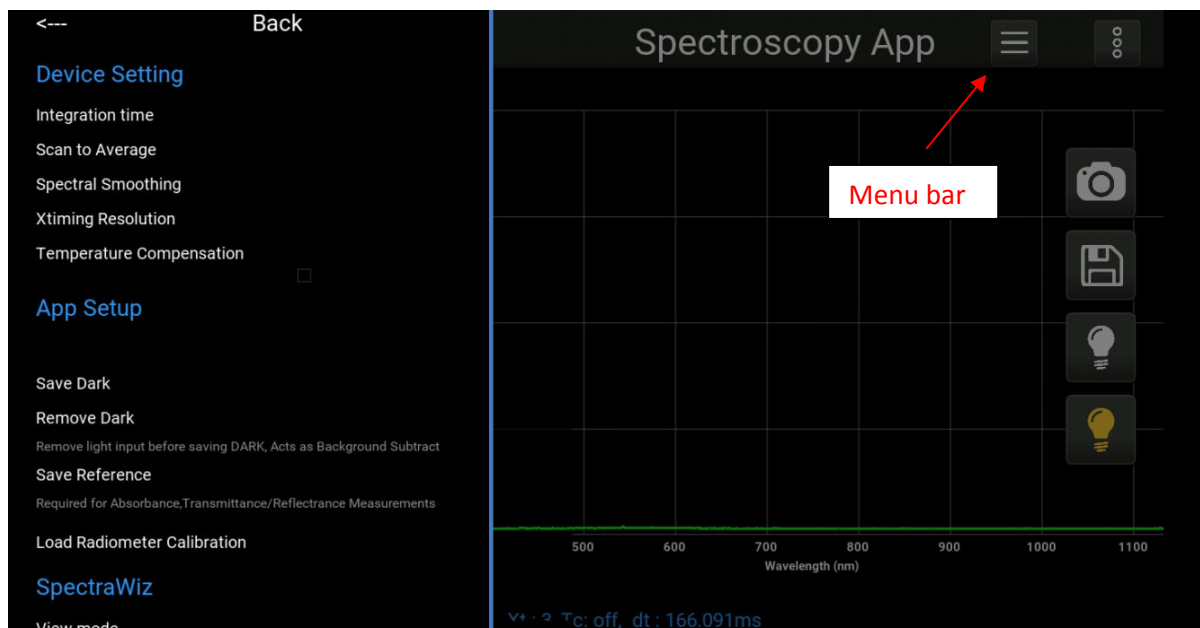


Figure 4. Menu bar of Spectroscopy app

## Integration time

To change the integration time tap integration under Device setting after navigating to menu panel, the pop up will open with text input bar on click on text bar the virtual keyboard will open to type the integration time in milliseconds and then tab on enter button in virtual keyboard to update the integration time and click outside the popup to close the popup as shown in **Figure 5**.

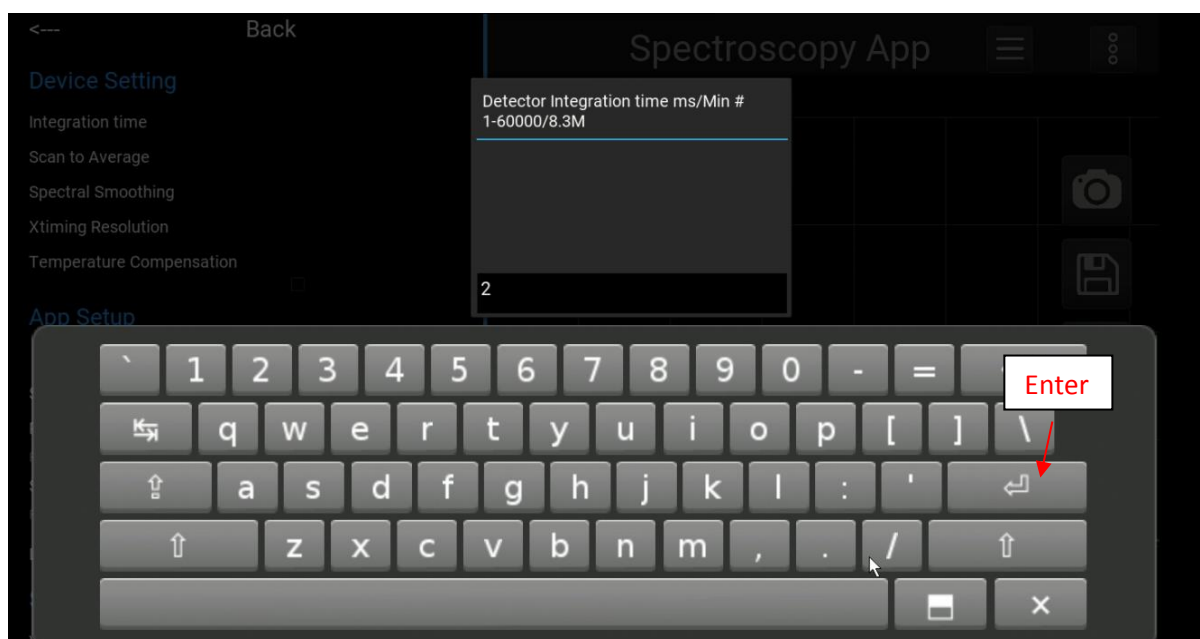


Figure 5. Changing Integration time

## Scan to average

To change the Scan to average, click under Device setting and follow the same process as for changing integration time.

The level of Spectral Smoothing pixel from 0-4 can be changed under device setting simply clicking no of smoothing level you want to use. You can control timing resolution control under device settings (by default x timing is 3), Temperature compensation option can be checked and unchecked as shown in **Figure 6**.

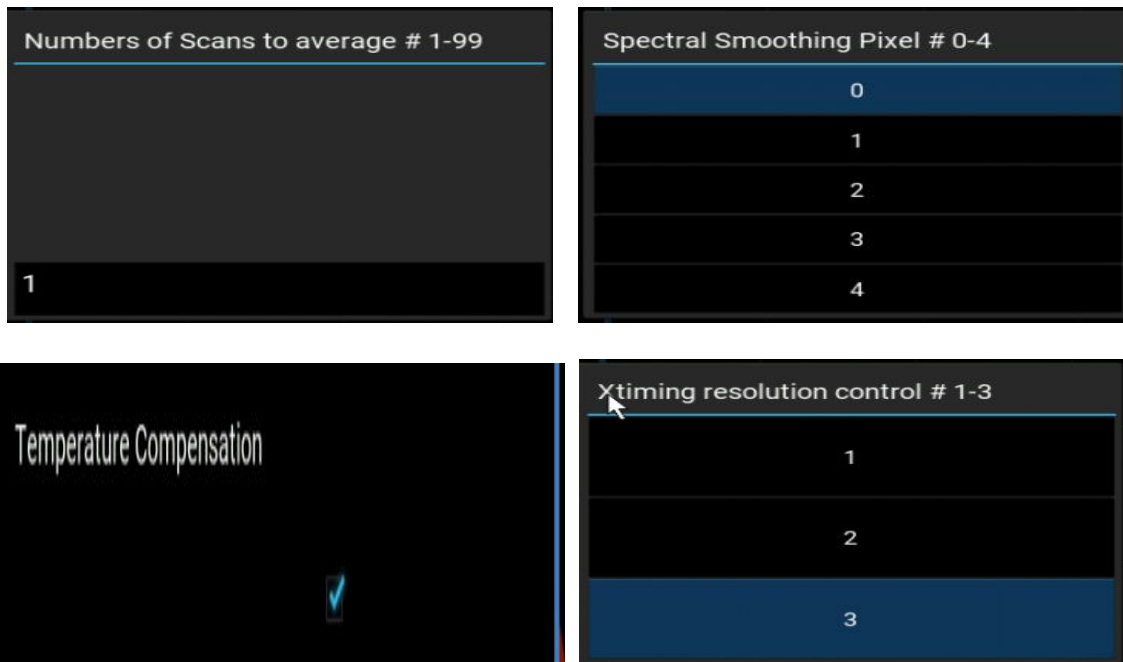


Figure 6. Device Setting parameters



## Modes

In order to choose different modes, you have to click on view mode which can be found in menu bar under Spectrawiz that will open a popup to choose between different modes as shown in **Figure 7**.

*Note: For Absorption and Transmission mode you **must** take Dark and Reference which can be found in App Setup under menu bar, you can also release, take and re take it again. The system will remember the Dark and reference you took last time so if you already took Dark and Reference and close the App or Switch between different apps the software will use last dark and reference by default but user can always change it by retaking it. You can also take Dark and Reference from main panel icon as describe below.*

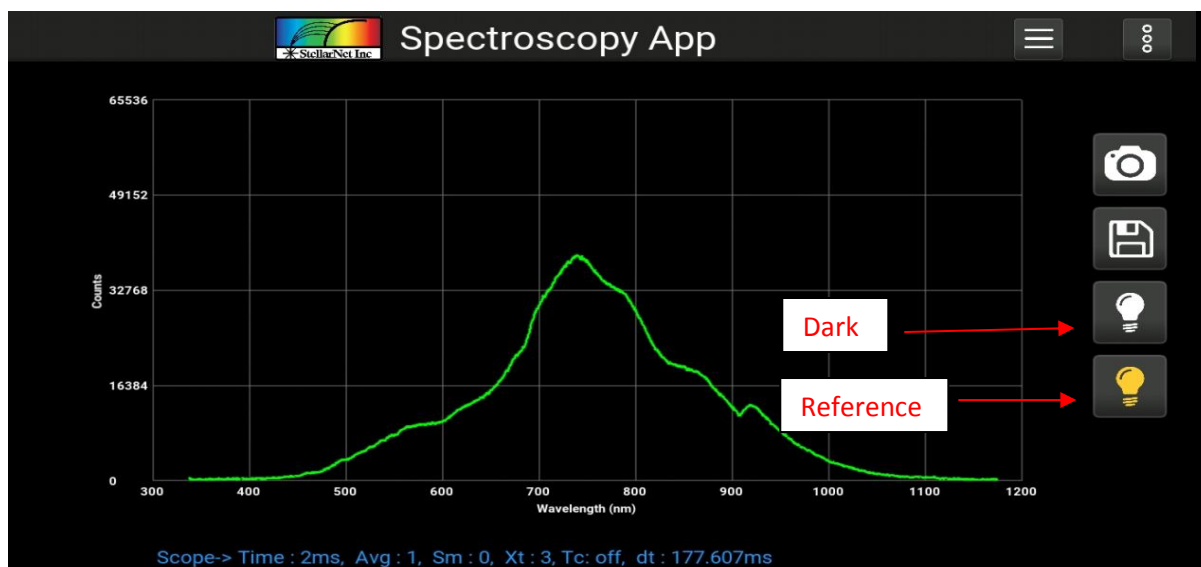


Figure 7. Dark and Reference

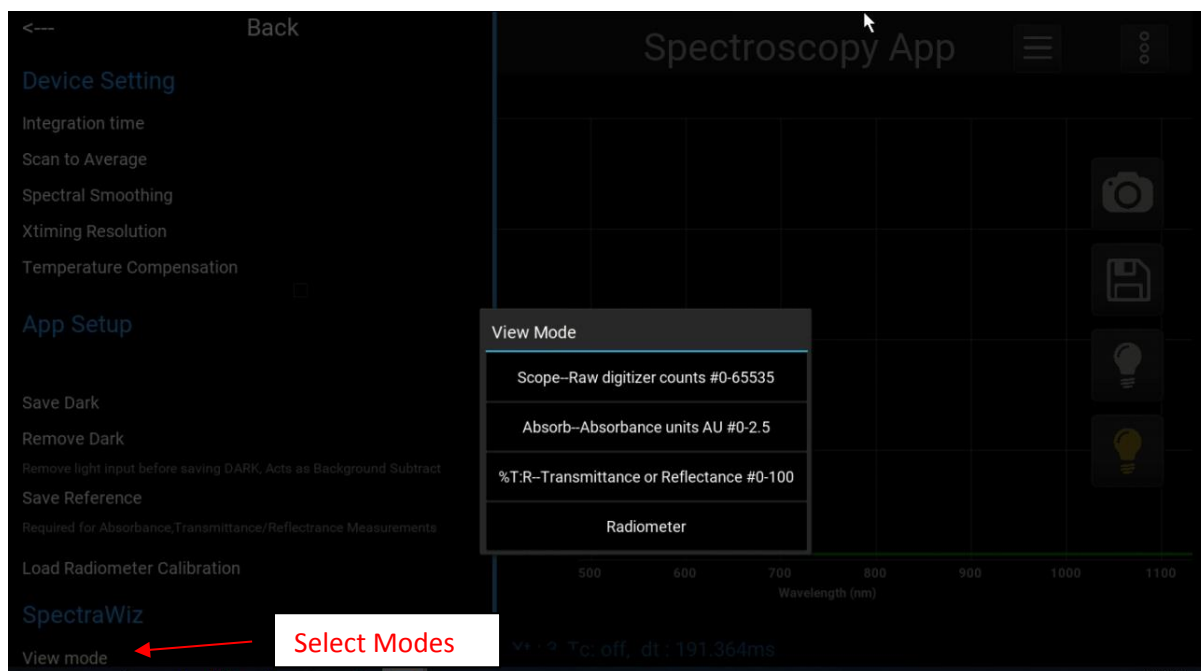


Figure 8. Modes

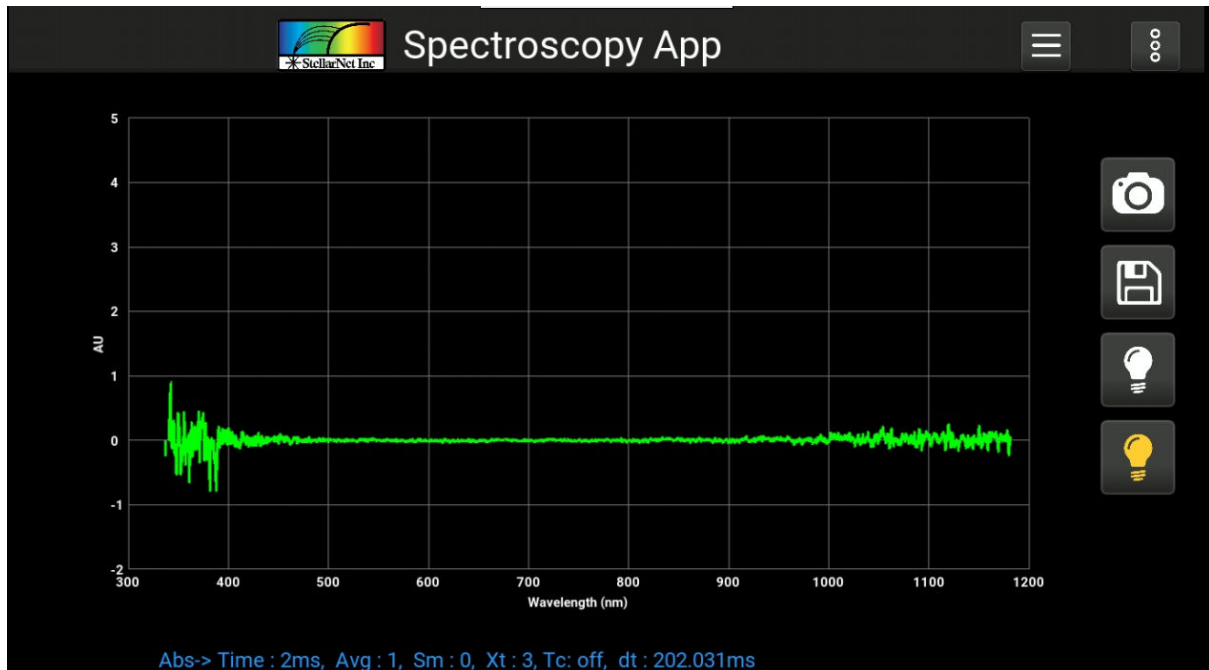


Figure 9. Absorption mode

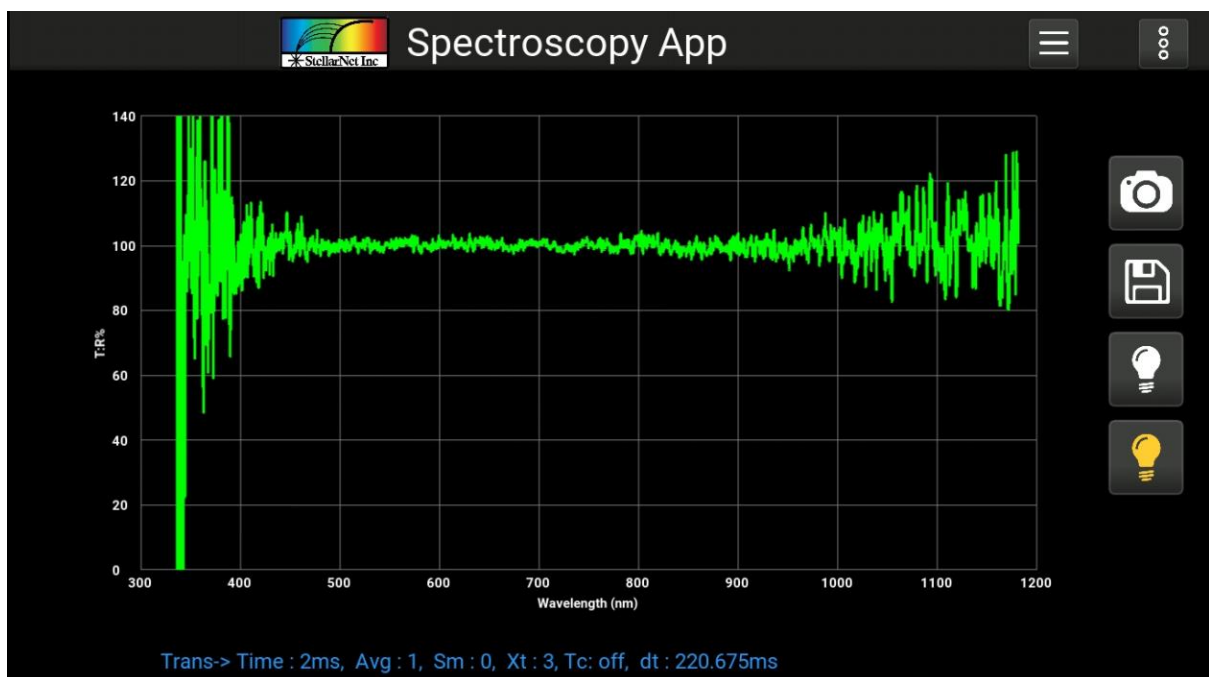


Figure 10. Transmission app

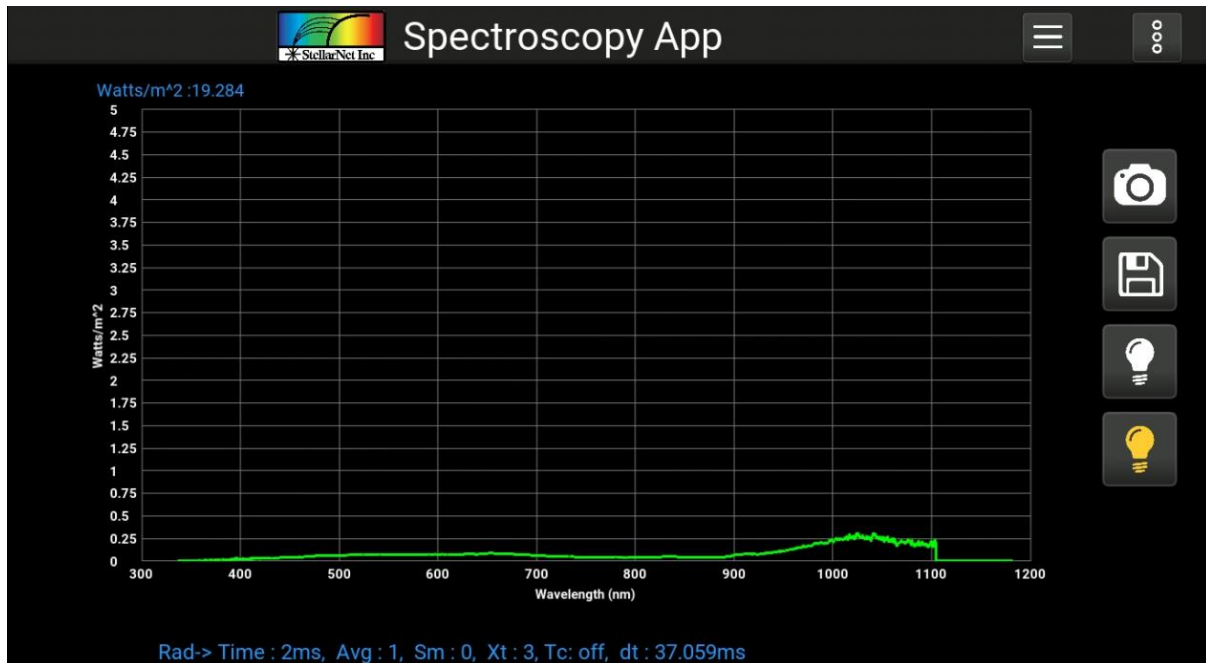


Figure 11. Radiometer mode

### Load Radiometer Calibration file

To run the Radiometer app you can load .CAL file under App setup by default it comes with CAL file.

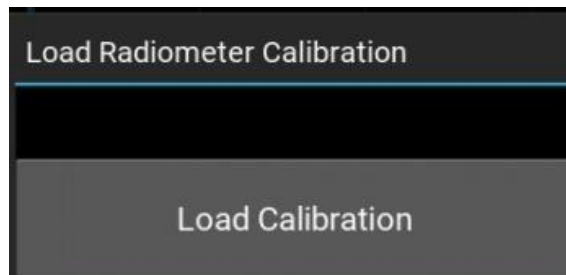


Figure 12. Load Calibration file

## Screenshots and data saving

From the main panel/page you can take a Screenshot of main panel and rename it by typing through virtual keyboard as you click on text box and you can also save the data and rename it too, save data will have extension based on the the mode you are using i.e:

Scope→.SSM

Absorption→.ABS

Transmission →.TRM

Radiometer →.IRR

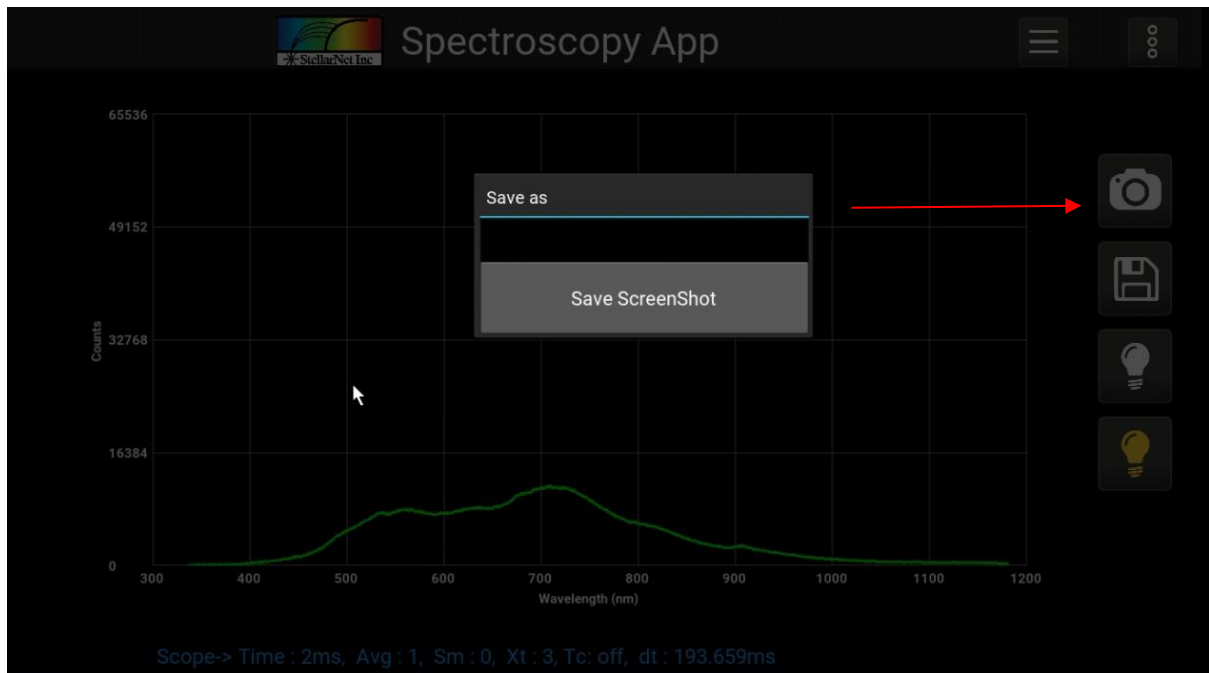


Figure 13. Save screenshots

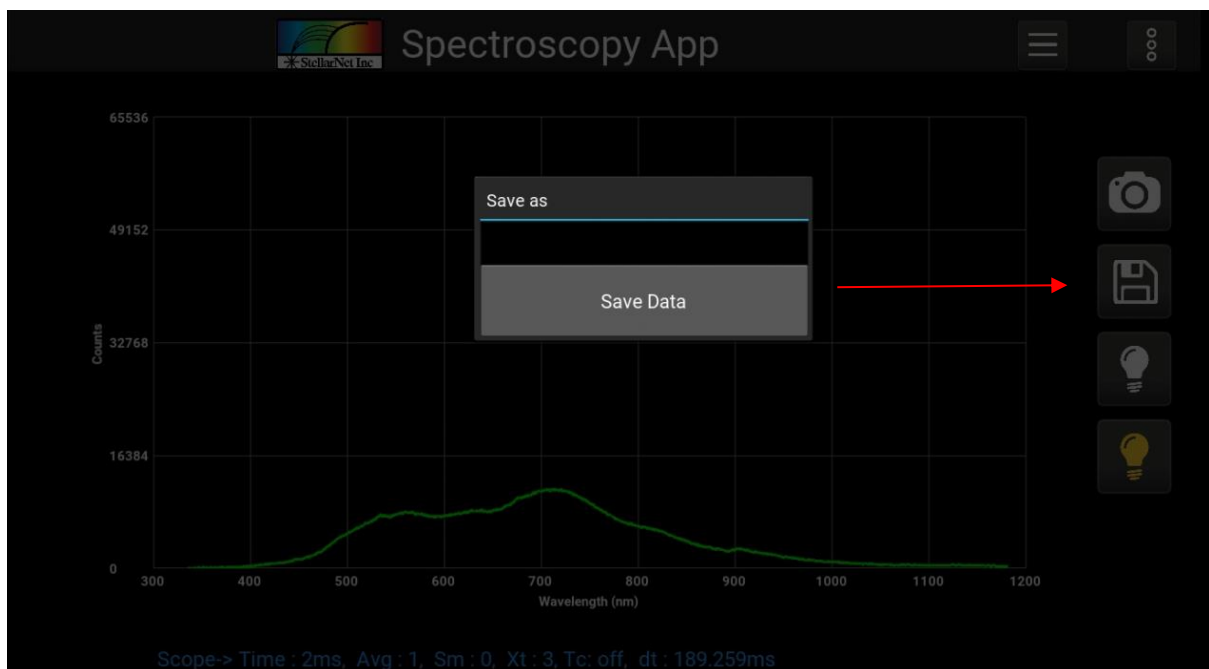


Figure 14. Save data

## Export data

Data can be export through different protocols by clicking under vertical 3 dots beside menu bar as shown in **Figure 15** and clicking on export data which will open the popup with the switches for protocols to transmits data, simply click the switch to turn on and off to start and stop data transmission.

*Note: Please make sure to have a proper setup for each protocol refers to data transmission manual, By default data transmission protocols are set to transmit data for one time but this can be customize and change to data steam as per customer needs.*

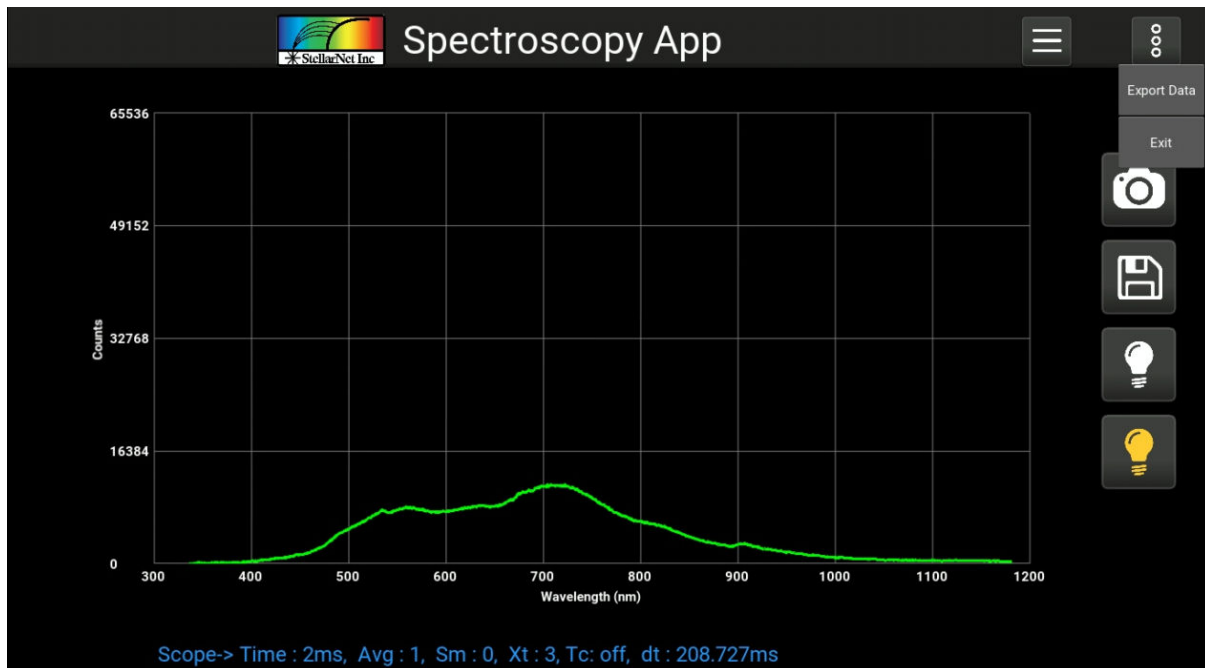


Figure 15. Export data

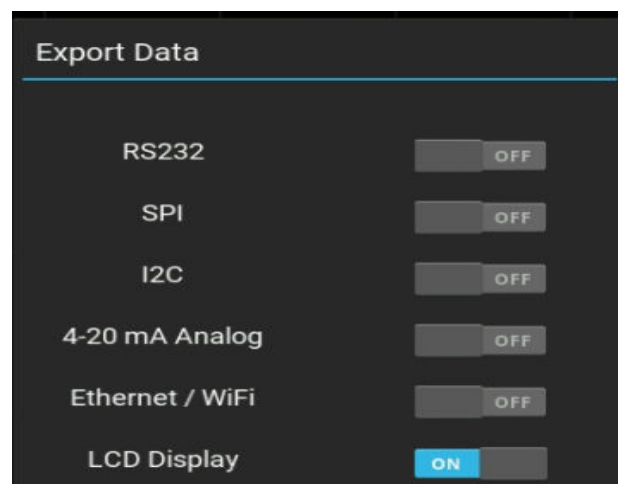


Figure 16. Protocols enable list

## 4. Color App



User can launch *Color* app by clicking or tabbing the icon above the color from the home page. Color app is design to give CIELAB D65 reference values for  $L^*$ ,  $a^*$ ,  $b^*$  in numeric and graphical form. Additionally, it also gives information about  $x$ ,  $y$  chroma and *hue*.

Since color app uses Transmission data it's important to take Dark and Reference to start the app but if the Dark and Reference has been taken before from the color app or any other app on particular SMART-Control it will used the previous values.

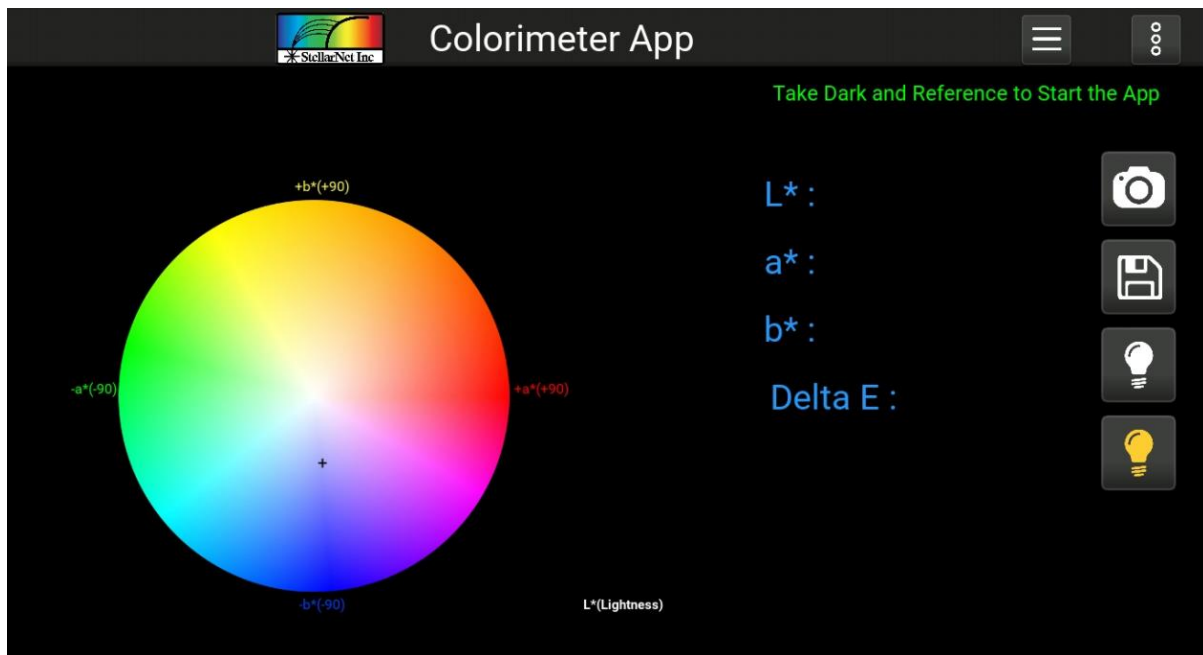


Figure 17. Colorimeter App: Take dark and reference

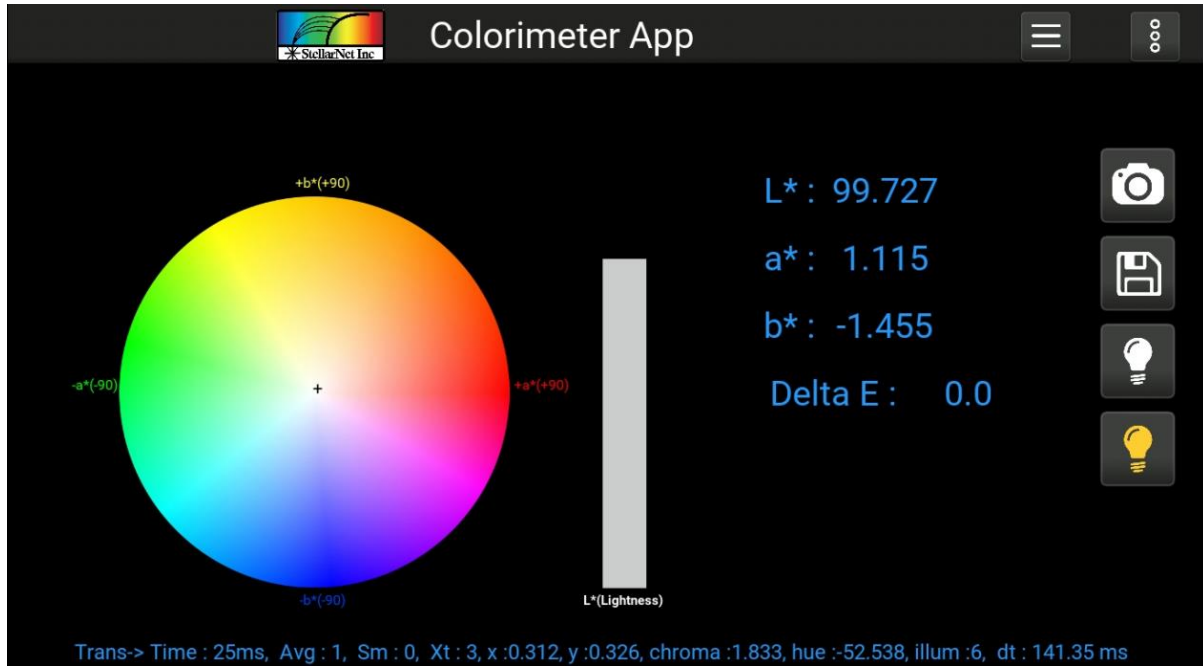


Figure 18. Colorimeter app main panel

Color app follows the same layout as the spectroscopy app and it has same menu bar and same way to change the device setting (*Integration time, Scan to Average, Smoothing, Xtiming and Temperature Compensation*), which has been described in section **3. Spectroscopy App**.

Under App Setup user can save the standard color while taking the reading and then load that standard to compare with real time  $L^*$ ,  $a^*$  and  $b^*$  reading and calculate Delta E values.

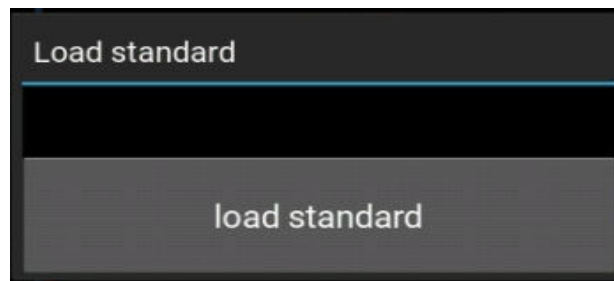


Figure 19. Load standard color

## Dark and Reference

By clicking the Dark/Reference under App Setup on Menu Bar or the Reference icon from the main panel user can see a popup that shows the reference spectra in scope mode.

Here reference spectra can be adjusted and take a reference by clicking the button in popup window. If the user want to access Dark and reference that has been taken previously without taking the new one on start up all they need to do is to get into menu bar and click more and change the mode to Transmission from scope as demonstrated in section 3. **Spectroscopy App**.

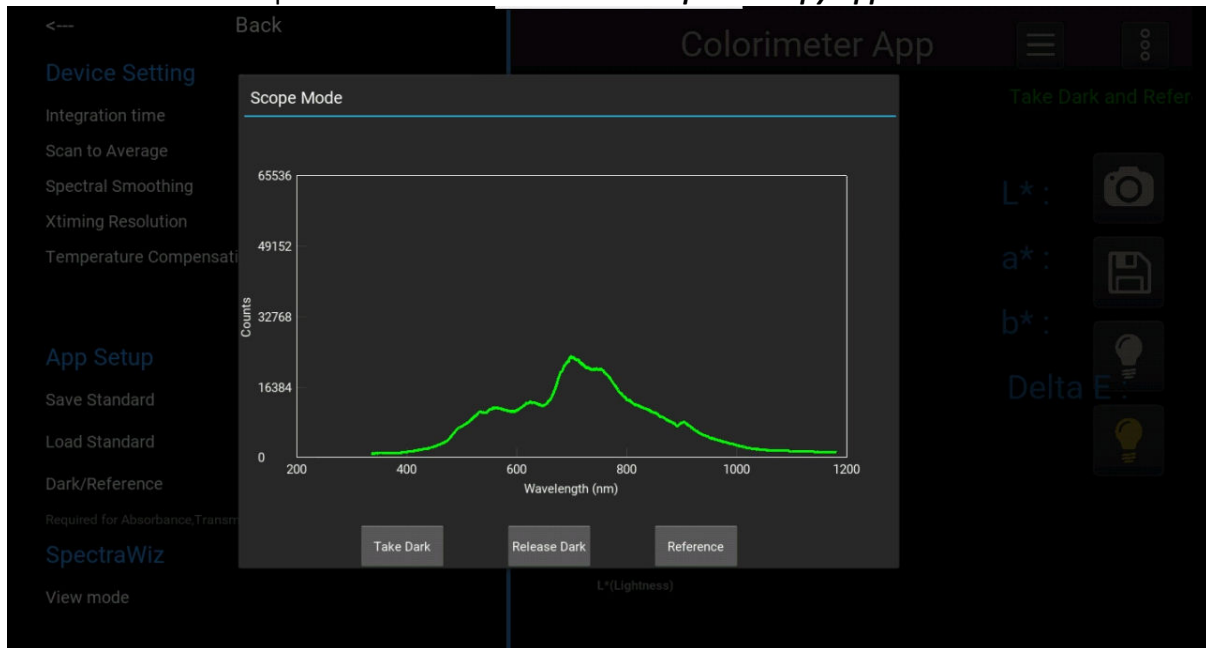


Figure 20. Scope mode on Colorimeter app

## Export data

Under vertical 3 dots icon beside menu bar user can find menu for **export data** and **exit** to the home page.

By clicking the export data user can access to send data through different protocols by turning on the corresponding switches by a simple tab.

The data transmitted is  $L^*$ ,  $a^*$ ,  $b^*$  and Delta E value as predefined but it can be change based on user need (please Refer to Data transmission manual).



Figure 21. Export data and Exit menu



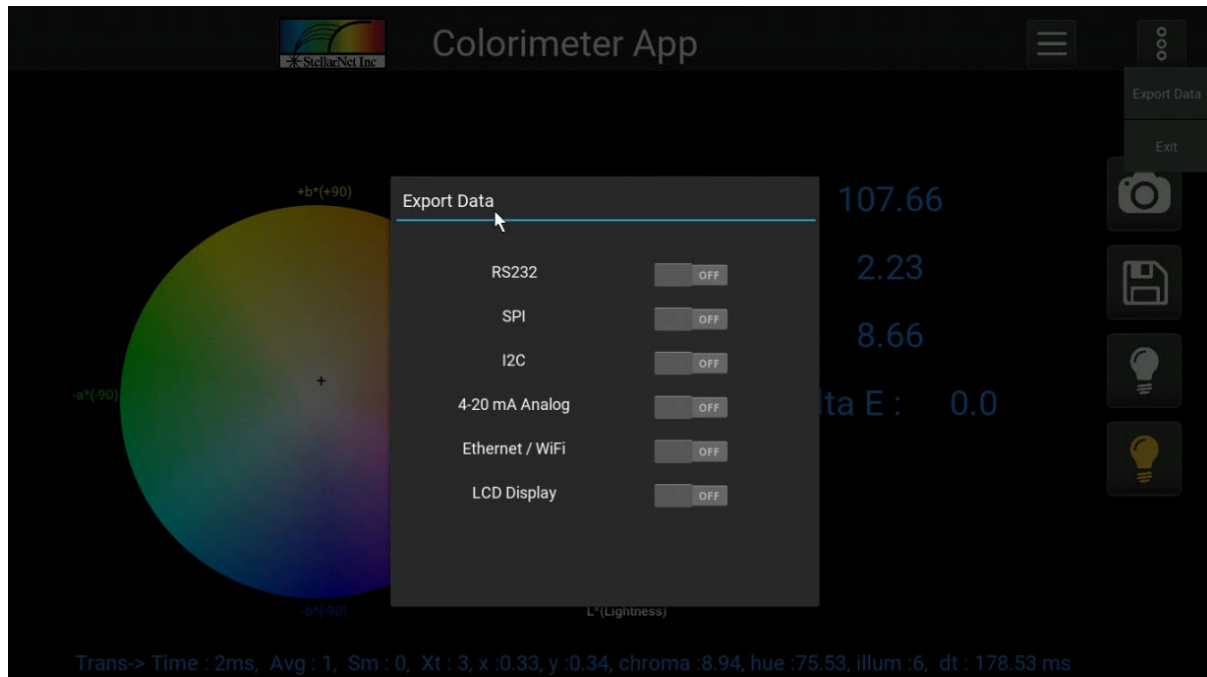


Figure 22. Export data menu

## 5. Radiometer App



By click the Radiometer app form the home page you can launch the radiometer app which is design to give  $x$ ,  $y$ , *dominant wavelength*, *purity* and *correlated color temperature* using the radiometer calibration.

In order to start the app you have to take Dark but if the dark spectrum has been already taken before then user can simply change the mode from menu bar as demonstrated in previously described apps.

Device parameters can be changed the same way as described in other apps.

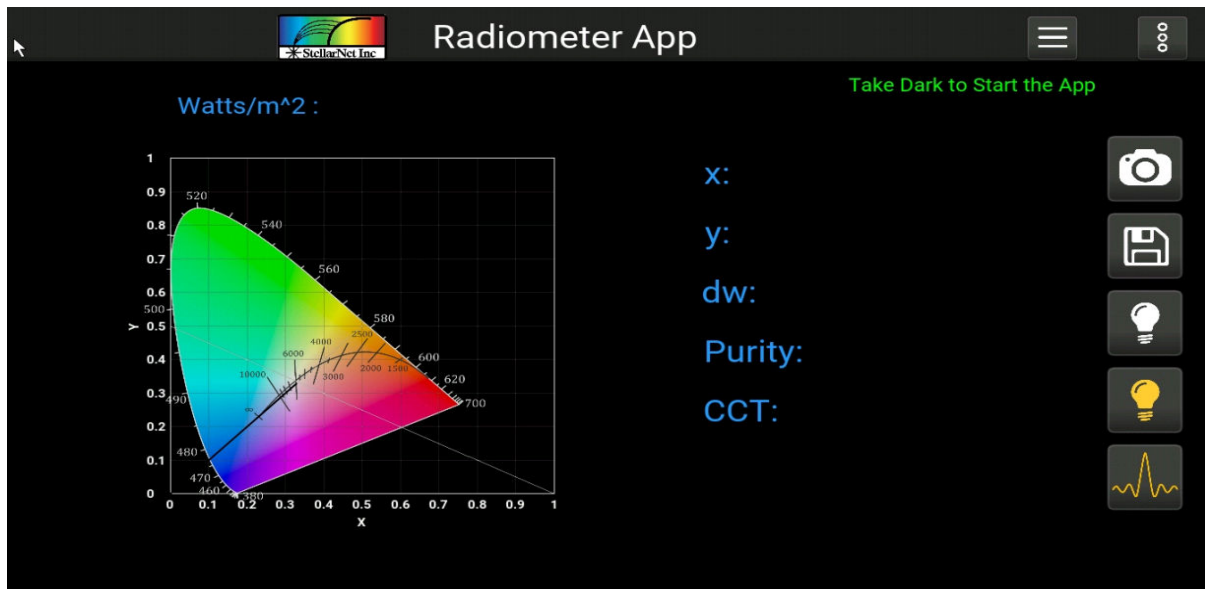


Figure 23. Radiometer app

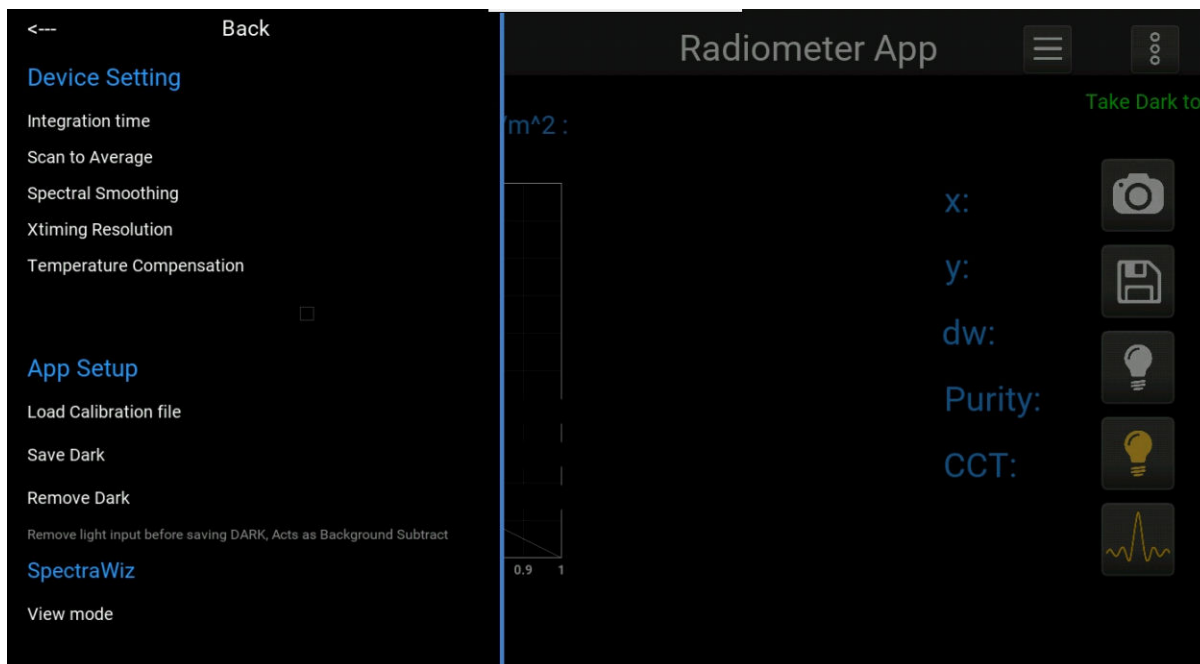


Figure 24. Main menu

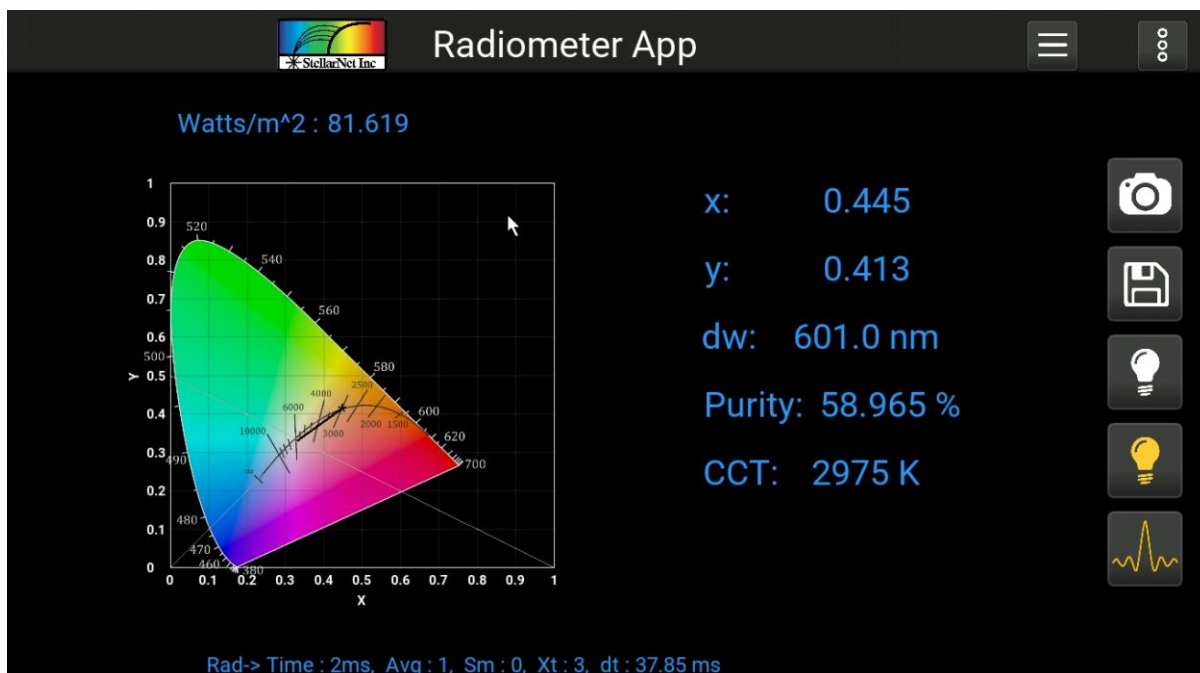


Figure 25. Radiometer app after take dark and reference

## Uploading Calibration file

The app come with the predefined and upload radiometer calibration file but user can change .CAL by typing the name of the *Cal* file to be uploaded (*no need to type the file extension*), just make sure that the new .CAL file has been uploaded to the *Saved\_Data* folder using the access point portal (*refer to zAP2 user manual for detailed information*).

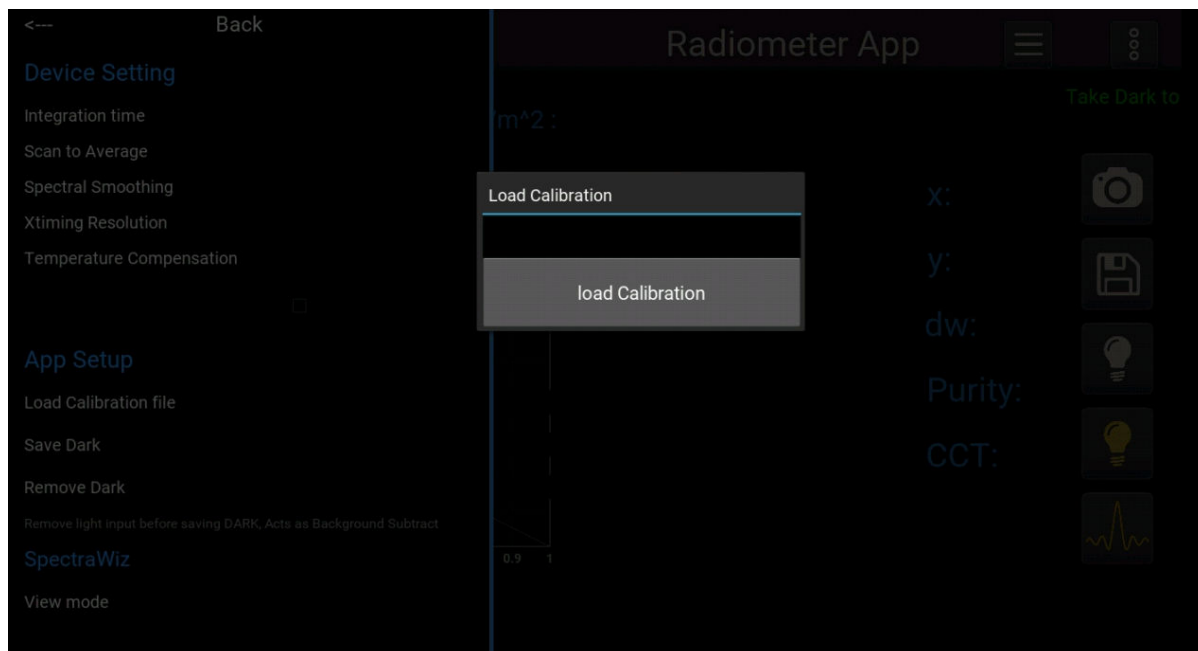


Figure 26. Load calibration file

If the Integration time for the CAL file is different than the current Integration time a dialogue will pop up to the user that allows to either automatically change the integration time as .CAL file or continue by clicking yes button to normalize the spectrum based on the integration time as shown in **Figure 27**.

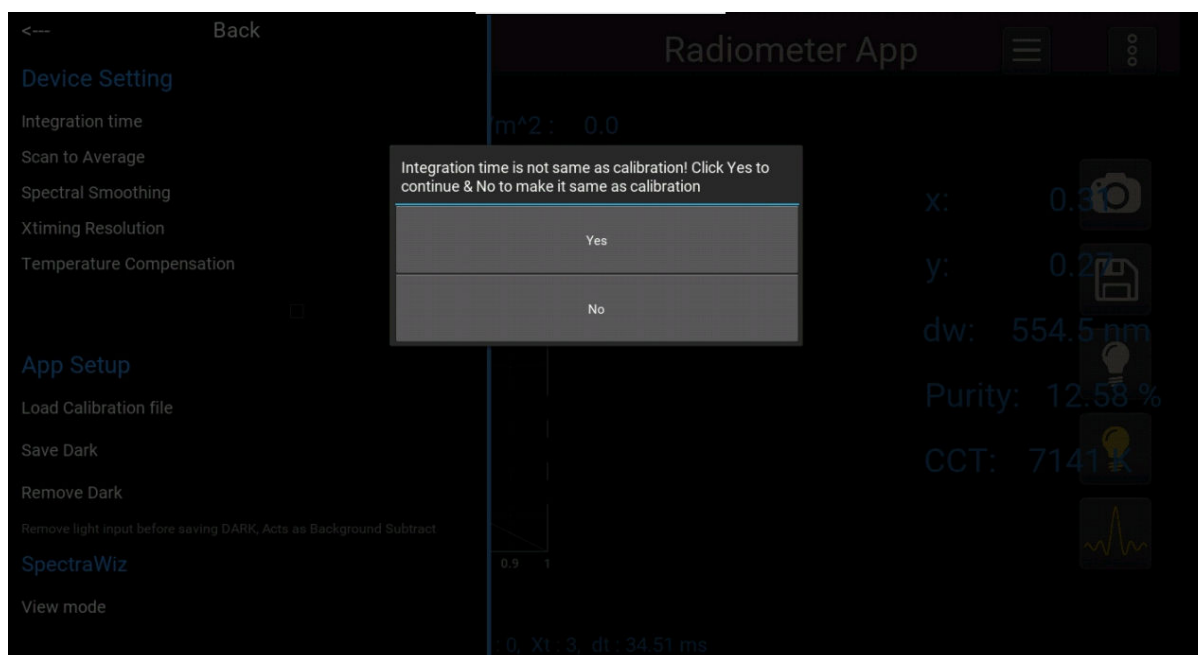


Figure 27. Different time warning

## Take dark: Radiometer mode

As described above if user wishes to use old dark spectrum, they need to change the mode to *radiometer* in order to run the app as shown in **Figure 28**.

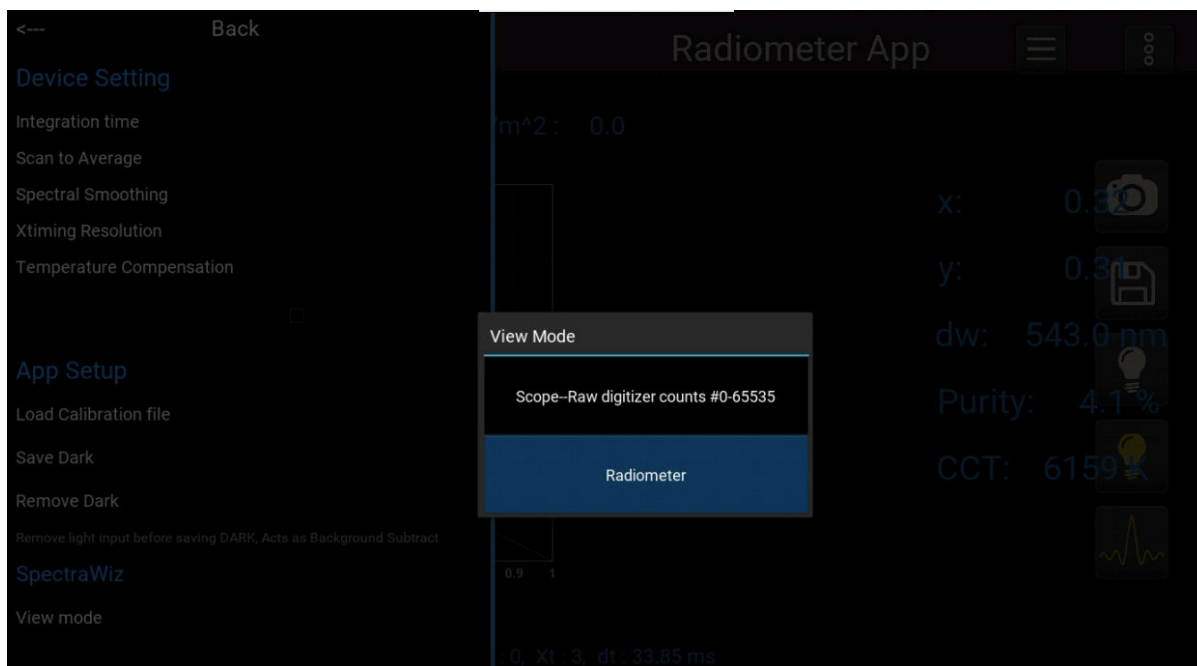


Figure 28. Modes

By Clicking the Dark under app setup or main panel dark icon, a pop up shows the dark spectrum in scope mode so user can see the dark spectrum and also release the dark to re take it.

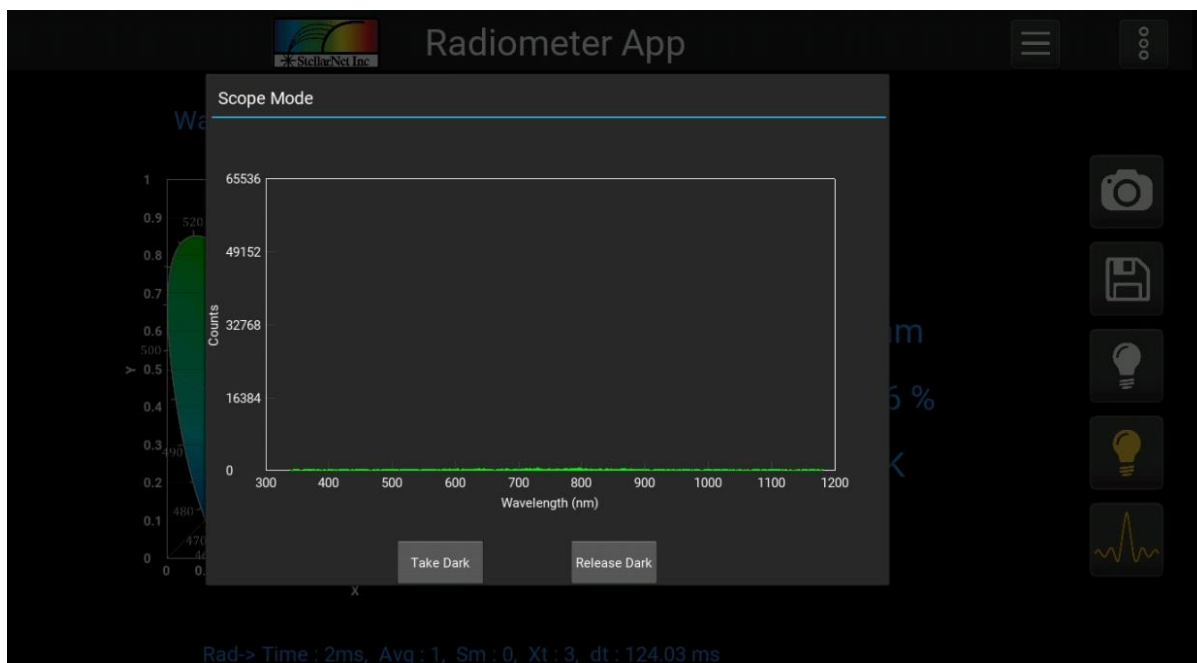


Figure 29. Scope mode

## Radiometer view

By clicking the Radiometer view icon at the main panel user can visualize the radiometer data in  $\text{Watts/m}^2$  as shown in **Figure 30**.

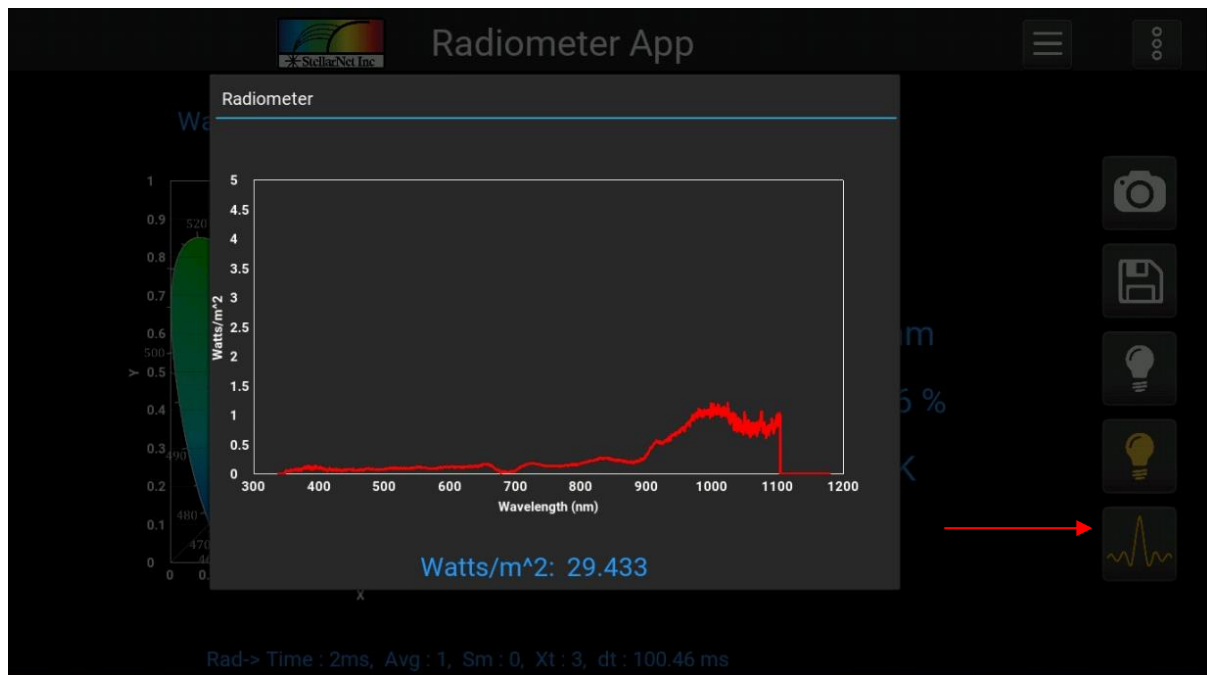


Figure 30. Radiometer mode

## 6. Concentration App



By Clicking the *Concentration* icon from the home page the Concentration app will launch which is design to use *absorption data* and the *linear model* to give concentration values for the defined wavelengths.

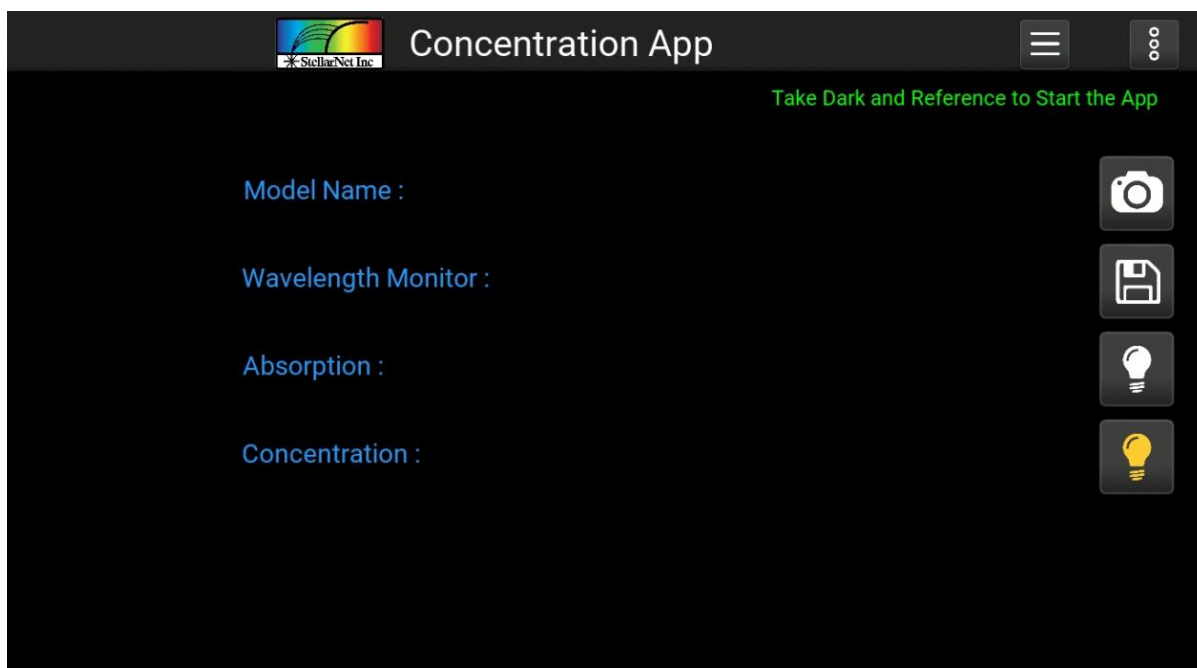


Figure 31. Concentration app

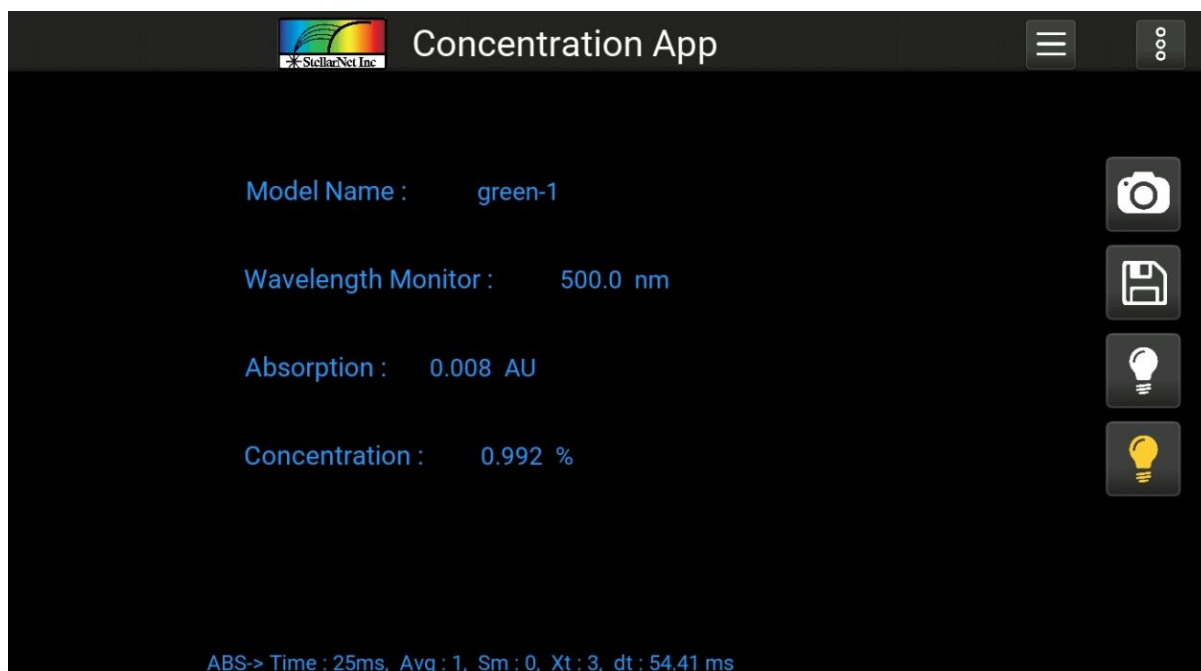


Figure 32. Concentration app after dark and reference

## Menu bar

The Menu bar for the concentration is similar to the other app that we have discussed in earlier topics. The Device setting operate in similar fashion as other apps and dark and reference has been taken and displayed the same way as color app, i.e. by clicking the reference button from either main panel or menu bar the pop up will be displayed that shows the reference spectrum in scope mode to take dark and reference.

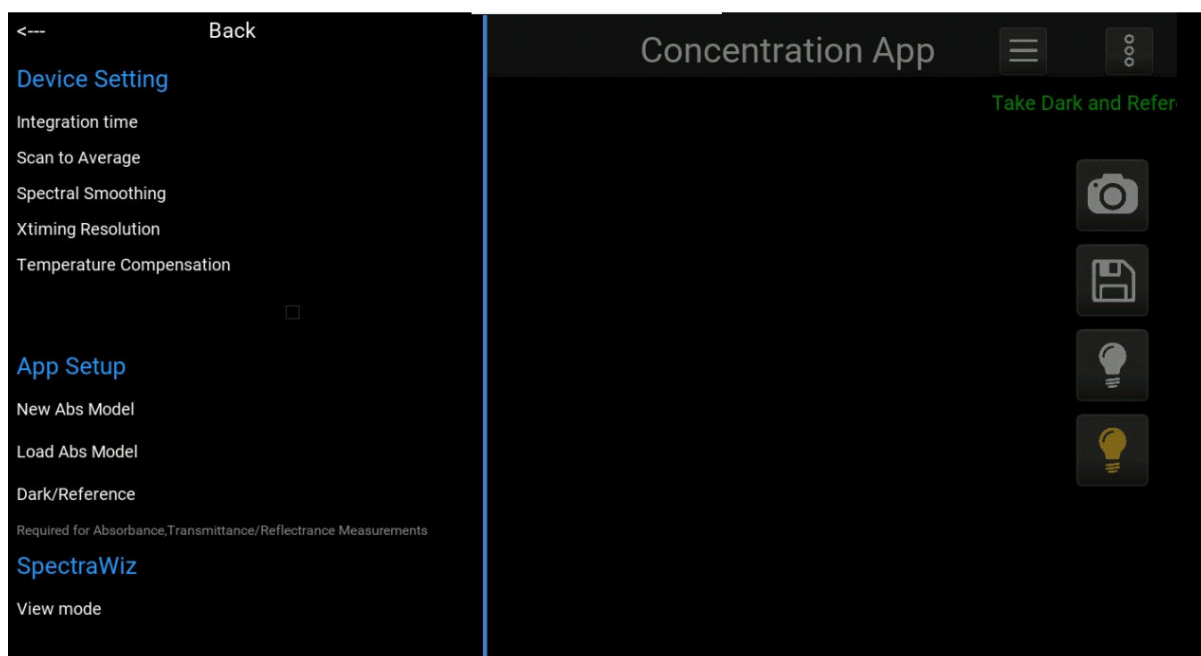


Figure 33. Concentration app main page



## Model

The app can also create the model by taking the coordinates of linear equations under app setup in menu bar. Type the name of the model you want to save with and also type in the *slope* and *constant* value of the line equation followed by any wavelength input from 350-1100 nm and click **save model**. It will save the model with .MTD file under *Saved data* folder which can be downloaded via access point (refer to zAP2 user manual for detailed information).

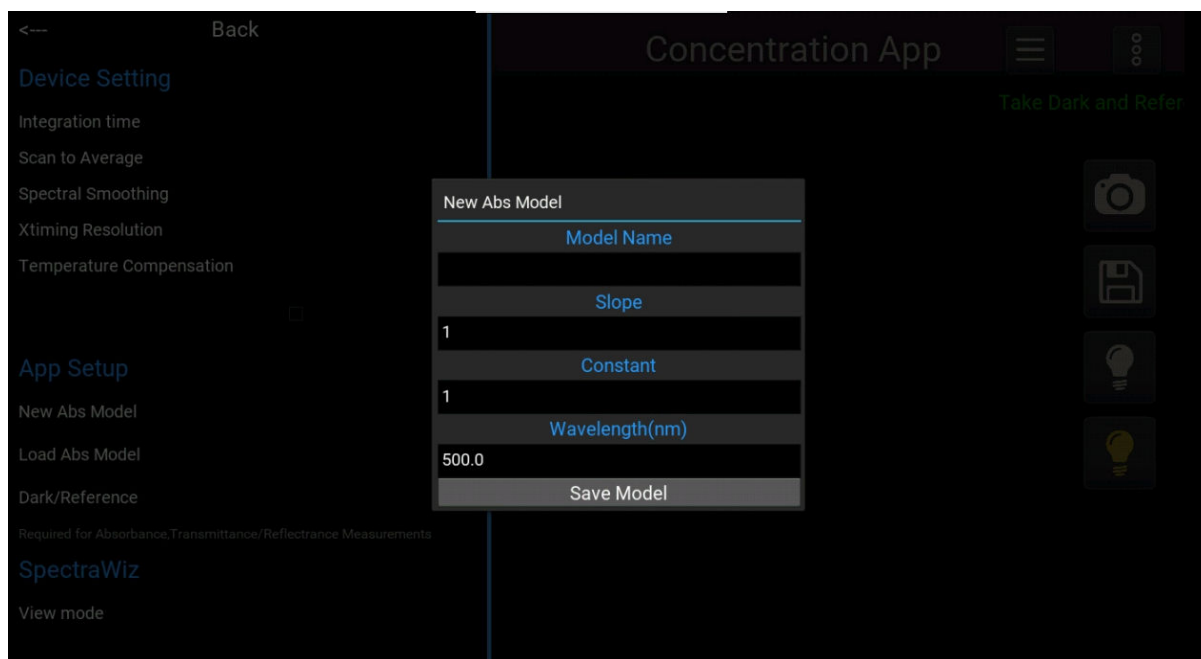


Figure 34. New model

The Saved models can be loaded by simply typing the name of the model (no extension need) by clicking **load model** button under app setup.

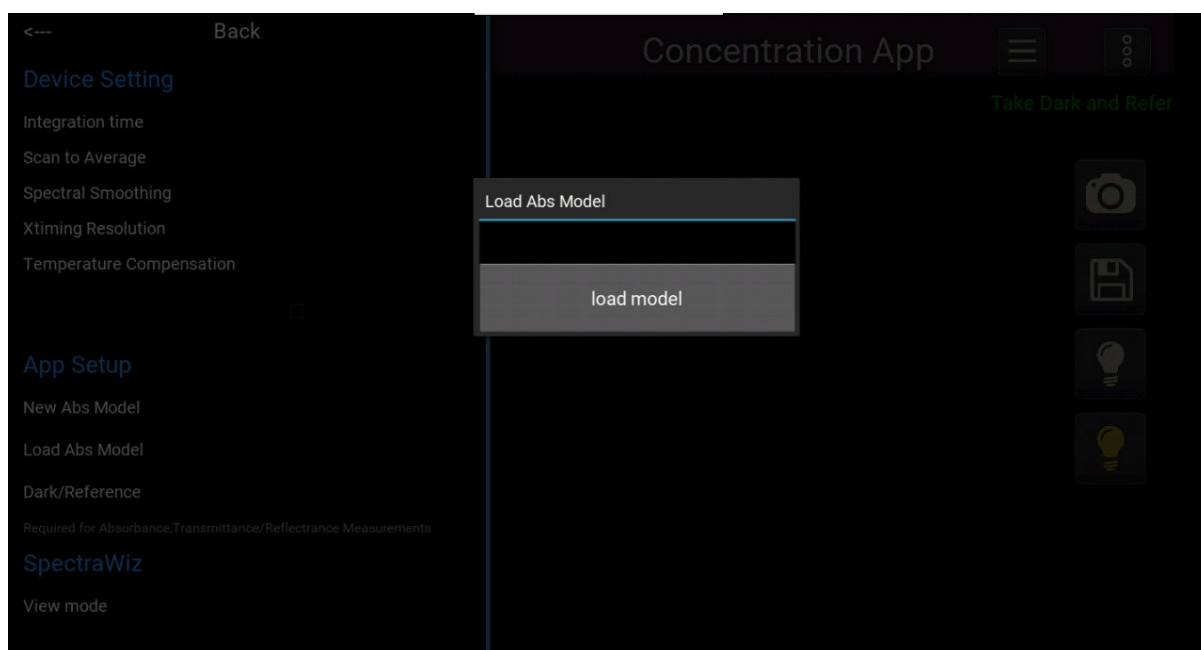


Figure 35. Load model

If user prefers to use old dark and reference simply go to *view* mode to change mode to absorption and app will start running. Make sure to load a model before start the app otherwise it will warn use that no model loaded.

## Export data

Export data function is similar to all the other apps which can be accessed under vertical 3 dot menu. The default data for transmission is set to be as *model name*, *wavelength*, *absorption* and *concentration* in % but can be changed as per user needs.

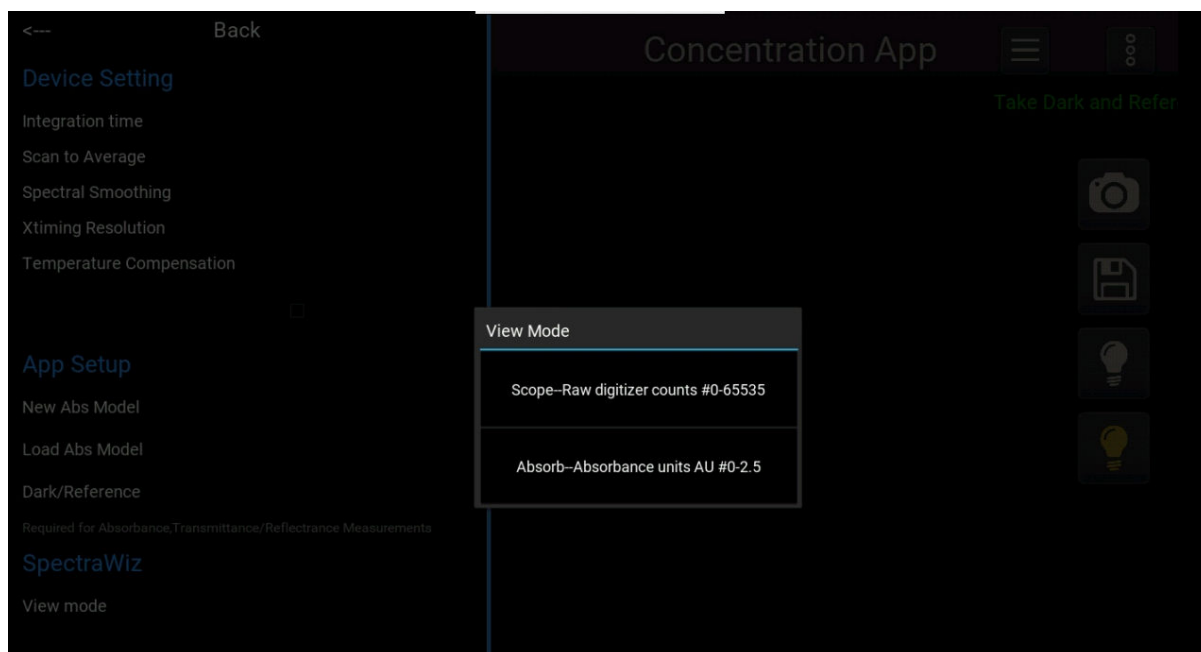


Figure 36. Modes