# NFPKit
## User Manual

# Disclaimer

## *Warranty*

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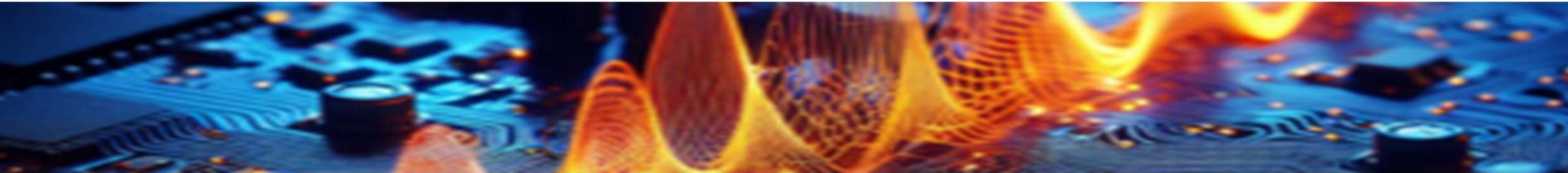
# Safety Notices

## *Caution*

A CAUTION notice denotes a hazard. It calls attention to operating procedure, practice, or the like. Not correctly performing or adhering to the notice could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

## *Warning*

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like. Not correctly performing or adhering to the notice could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

## About the NFPKit

**NFP**Kit is designed for measuring near field radiated emissions for EMC/EMI pre-compliance testing. The probes can be used to locate, identify, measure, and characterize potential sources of electromagnetic radiation and interference radiated from traces or components of electronic PCBs, assemblies, or products. The probe output is proportional to the magnetic field (H) strength present at the probe location.

## Minimum System Requirements

Operating System: Windows 11 / Windows 10 (latest update)
CPU: 1 GHz or faster with two or more cores, on a compatible 64-bit processor
Memory: 8 GB or more
Storage: 200 MB for installation, and 1 GB for project saves
Graphics card: Compatible with OpenGL 4.2

## Technical Support

*For fast and seamless technical support, please gather the following information and contact Y.I.C. Technologies technical support as instructed further below:*

1. *(Scanner only) Serial number of your unit, shown in the scanner device list.*
2. *Software version (Menu: Help -> About).*
3. *Your analyzer control software (eg. NI-MAX or Keysight Connection Expert)*
4. *Spectrum Analyzer model and manufacturer (or *IDN output)*
5. *The log file stored in %appdata%/YIC Technologies/EMViewer2/log.txt*
6. *A detailed description of the problem, including screenshots and video footage.*

[support@yictechnologies.com](mailto:support@yictechnologies.com)

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## Setup

For detailed information regarding the setup of the **NFP**Kit and **EM**Viewer, refer to the **NFP**Kit setup guide. You can also download any documents you need from the yictechnologies.com website or our Partner Portal. This user manual assumes you have connected all devices as stated in the setup guide.

Once you have connected the spectrum analyzer, and launched the **EM**Viewer software, it will appear on the bottom-left of the screen.



No scanner connected; 1 analyzer connected (DSA875); 1 total
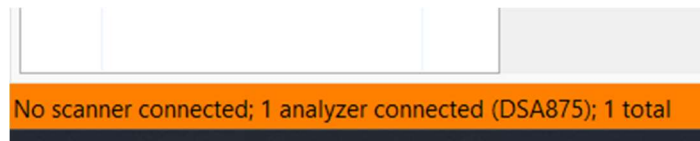
The **EM**Viewer software automatically searches for devices. If a device is not connected properly, **EM**Viewer will not display it:



No scanner connected; No analyzer connected; 0 total
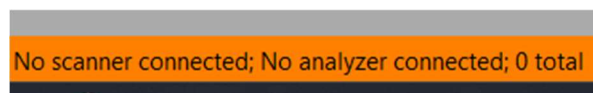
If you are having trouble connecting to the spectrum analyzer, try closing the **EM**Viewer software, ensure the connection is stable, and then start the **EM**Viewer software again.

## User Interface



The toolbar is located at the top of the screen. Controls are from left to right:

- Creating a new project.
- Opening an existing project.
- Saving your project.
- Starting a scan.
- Starting a continuous (repeating) scan.
- Stopping scans.
- Modify node properties.
- Create a module node.
- Create a spectral node.
- Create a spatial node.
- Create a combined node.
- Create an immunity node.

### Module Nodes

Module nodes, like project nodes contain scanner and analyzer options. Create a spectral, spatial, or combined node under a module node to inherit the module node's settings, analyzer settings and overlay information. This is helpful if you want to make multiple nodes with similar settings and overlays quickly.
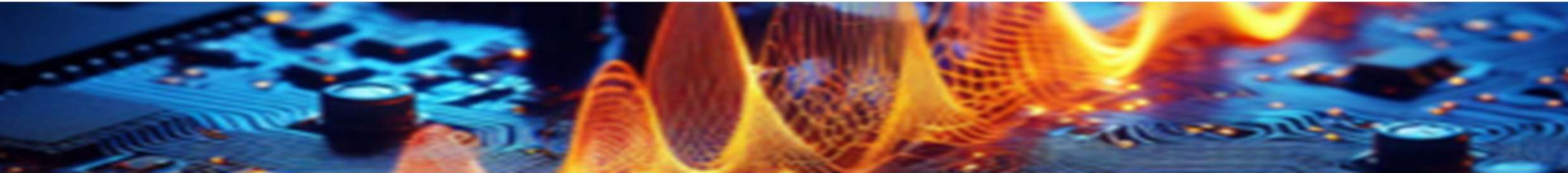
### Spectral

Spectral scans show you what frequencies are present in the selected area. Here is an example of some spectral scan data:
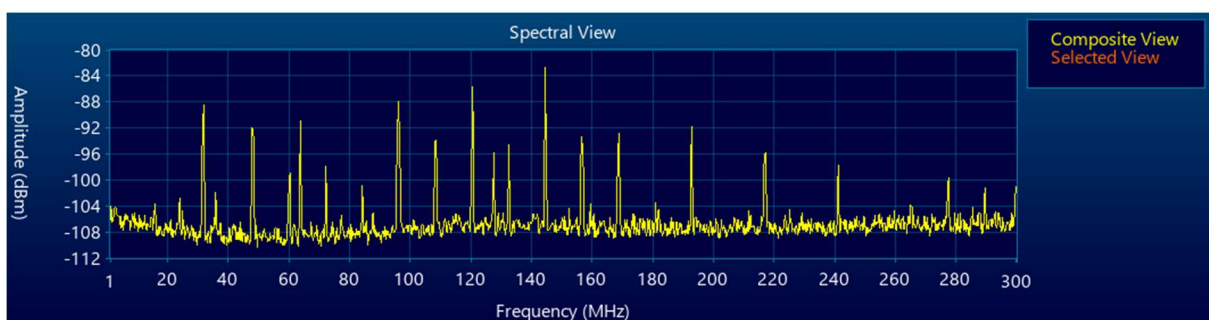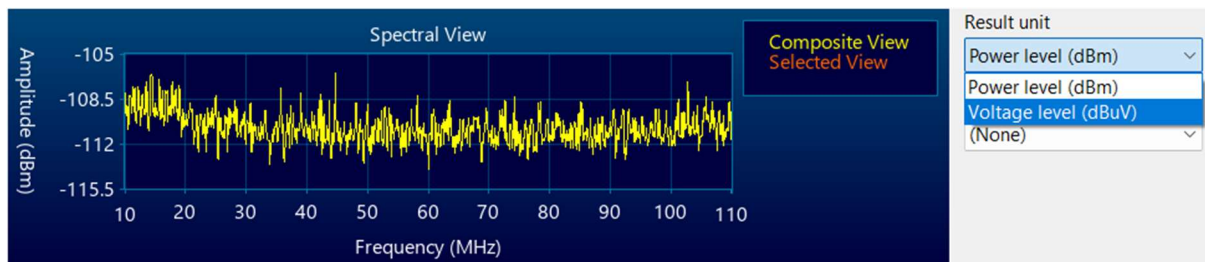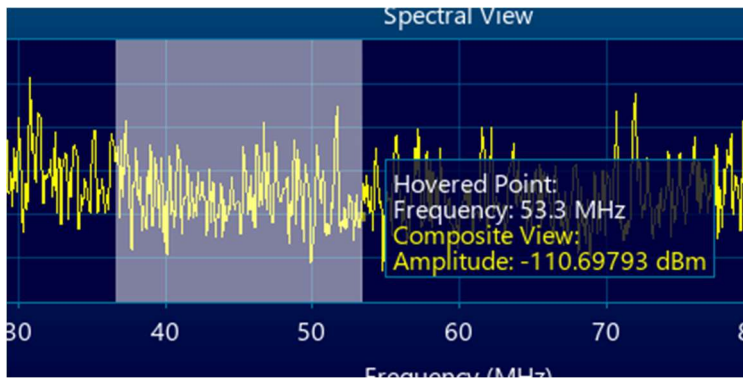


Mouse over the graph to display the frequency and amplitude values. To select a peak, mouse over the peak and left click.
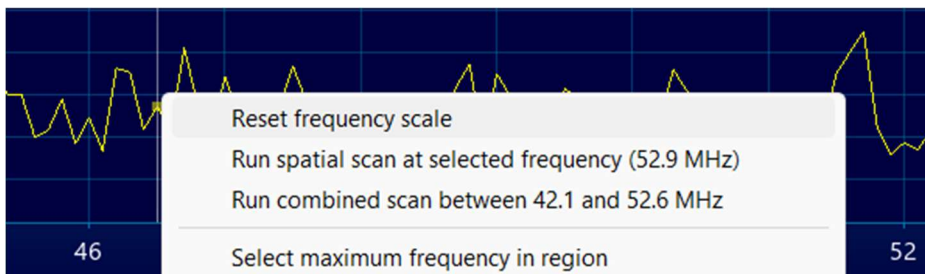
The spectral view can be adjusted by the checkboxes and dropdowns to the right of the graph. You can change the unit of amplitude between dBm and dBuV or apply a compensation file.
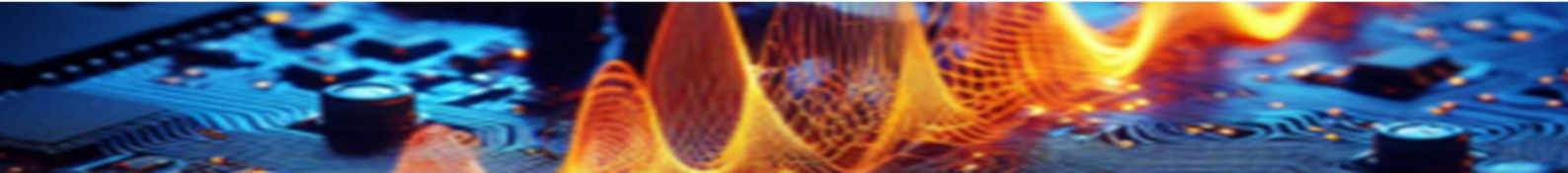
Left click and drag to zoom in. Right click and select "Reset frequency scale" to return to the original view.





You can also run a spatial scan or combined scan directly from a spectral by selecting "Run spatial scan at selected frequency (X MHz)" or "Run combined scan between X and Y MHz"
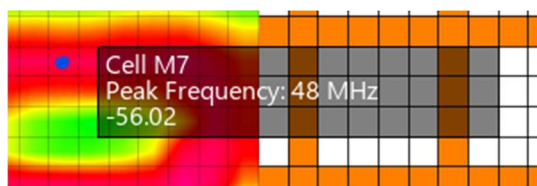
**Spatial View**

The spatial view displays a scanner grid or camera video with the maximum amplitude of each cell displayed as a color. The lowest values of the scan are displayed as blue, and the highest values are displayed as red.
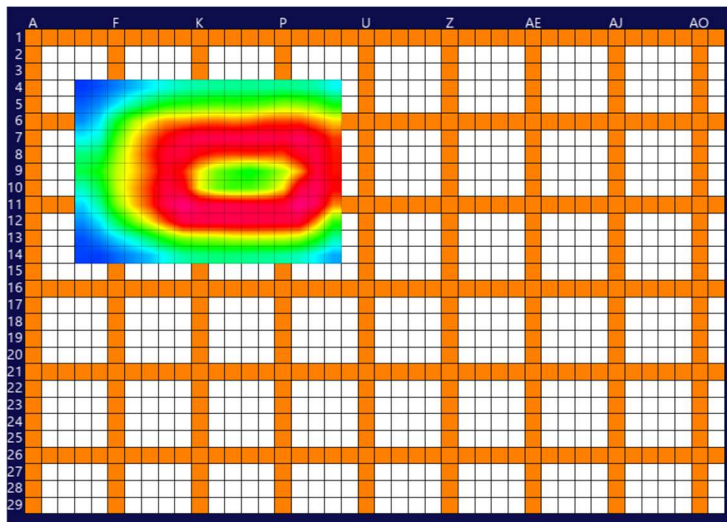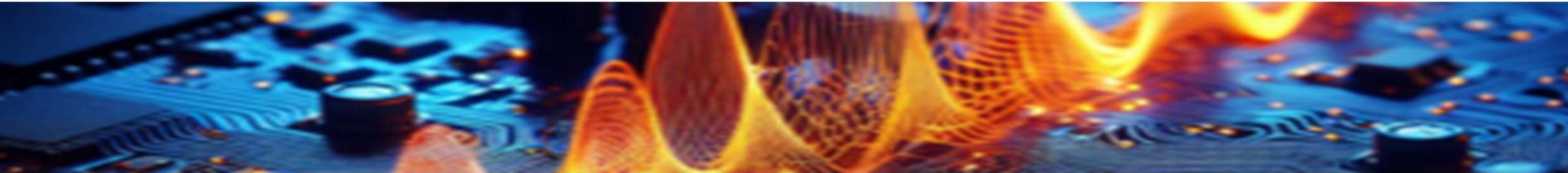


Mouse over the graph to display row / column coordinates, frequency, and amplitude values.



Spatial view can be adjusted by the checkboxes and dropdowns to the right of the graph.
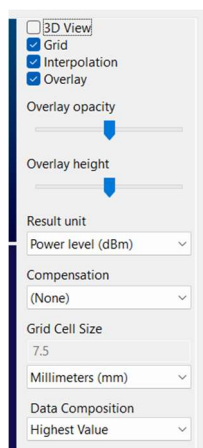


Grid and Overlay can be shown or hidden. Interpolation (data smoothing) can be disabled. You can also change the unit of amplitude or apply a compensation file.
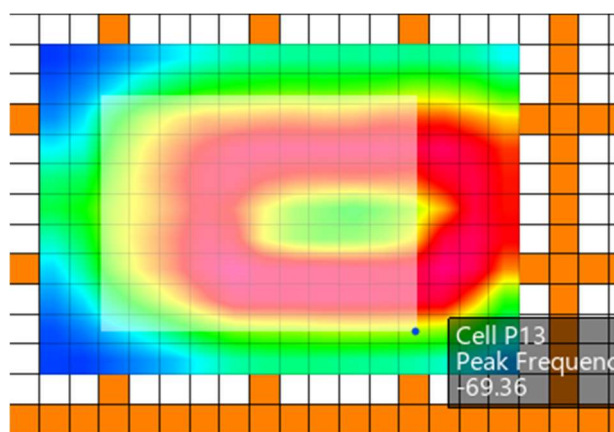
View can be changed to 3D by clicking on the check box. You can rotate the 3D view by left clicking on the graph and moving the mouse.
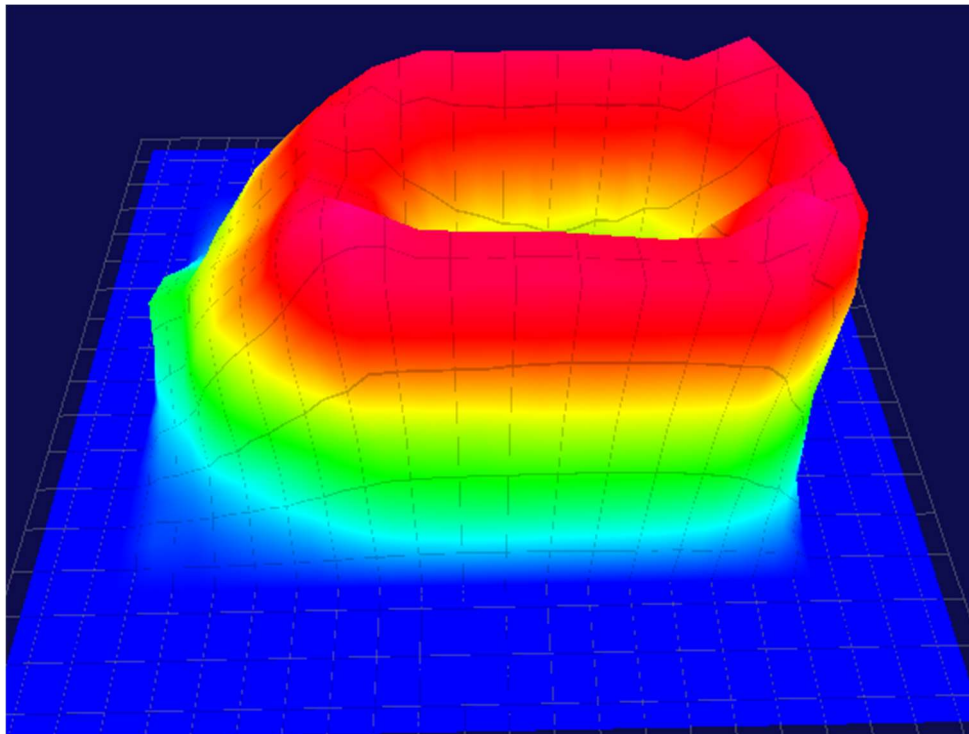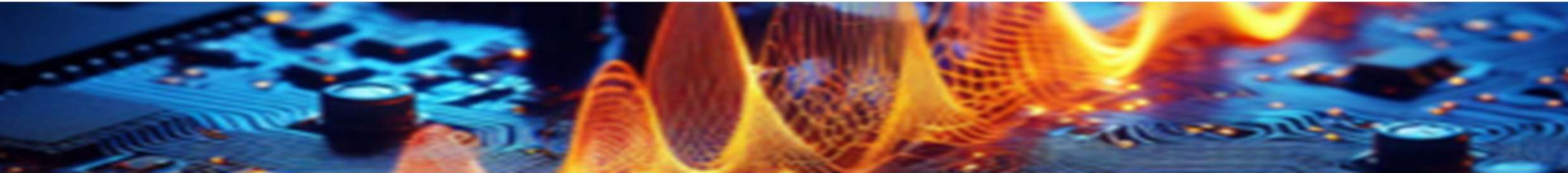


When Overlay is checked in 3D view, you can use the overlay height slider to move the overlay up and down on the graph.
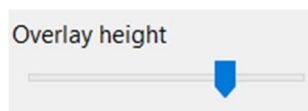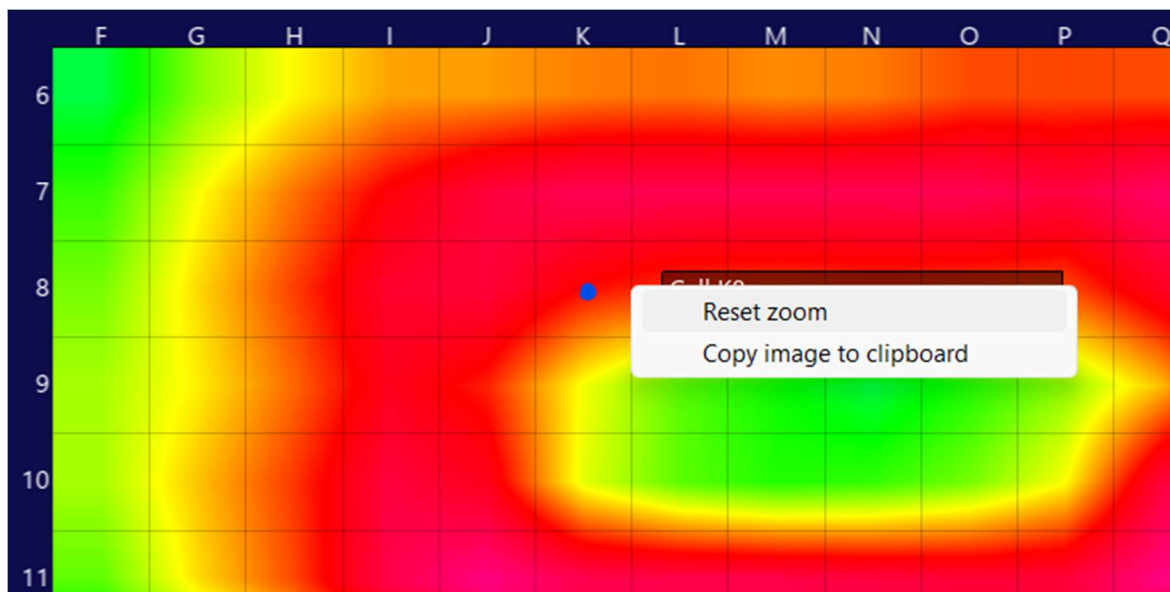


When in 2D view, you can left click on the graph and drag to zoom in.

Right click and select Reset Zoom to return to the original.



## Nodes

All scan types in a project are called nodes.

A project is the root node. It can be considered a folder like in Windows directories to store related data. You can add different types of scans and/or notes to a project node. You can rename, copy, and paste a node or node settings only. Project's settings are inherited throughout the entire project tree.

A module is the sub-root node. It can be considered as a subfolder like in Windows directories to store related data. You can add different types of scans and/or notes to a project node. Module's settings are inherited throughout the module tree only. Modules can be used to store data for different revisions of the PCB.
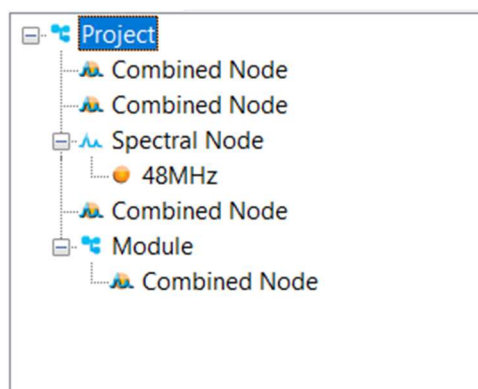
**How to Add a Node?**

To add a node either right click on the Project node, click on Spectral/Spatial/Combined node, and then select one of the scans, or click the relevant icon on the tool bar.
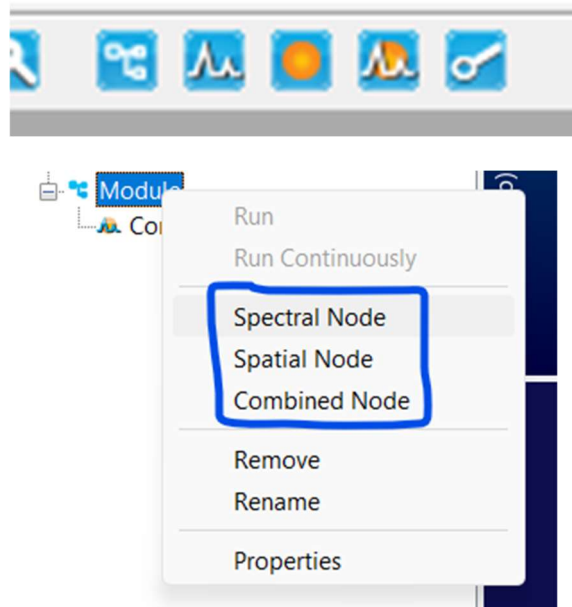


**How to Name a Node?**

To name a node open the settings of the node and click on the Node tab. When you add a node for the first time, the Settings window opens automatically. By default, the node name is blank, which means a name will be automatically selected. If you want to rename a node after you add it, either right click on the node and select Properties or select the node and then click the properties button on the task bar.
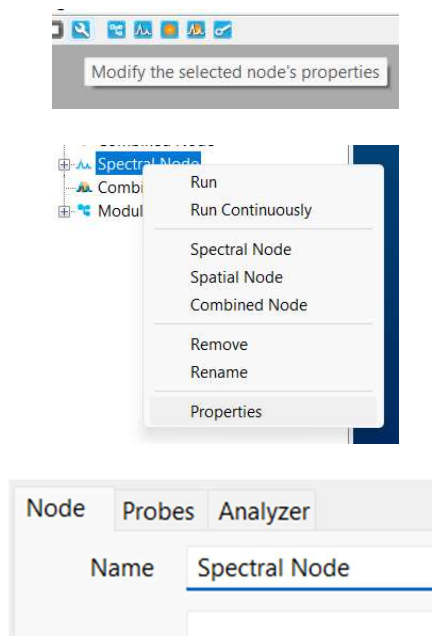
**How to Delete a Node?**

Double click on the node that you want to view.
Right click on the node that you want to delete and then select "Remove"
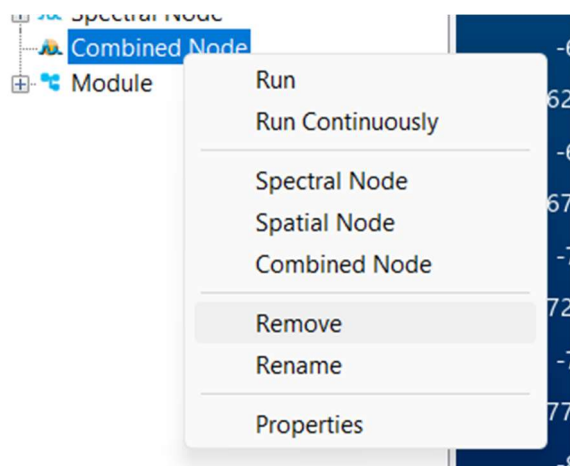


**How to Export Data?**

You can export any data in .csv format. To export data right click on a scan data and select Export to CSV.
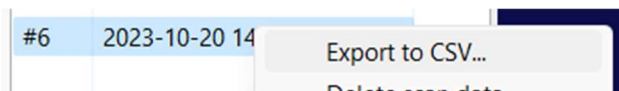


**Node Settings**

**Probes Tab**

The Probes/Scanner tab is where you will select your scanning device, scanning location and scanning method. Devices such as the EMScanner, EMScannerR, EMProbe and NFPKit are configured here.

Note:
Importing design file or the picture of the DUT is highly recommended. Please refer to Overlay Editor section.

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For the EMScanner and EMScannerR, you can select your scan area by left click and dragging across the grid. You can right click and drag to remove cells.



*Interleaved:* The scan will be performed twice to cover the blind spots of the scanner. For the EMS original model, the user will have to move the DUT down by 1 cell when the software prompts them to do so. For the EMSR, this movement is done automatically by the internal motors.

*Control level (EMScannerR only):* You can perform a high-resolution scan by increasing the control level. Each control level perfor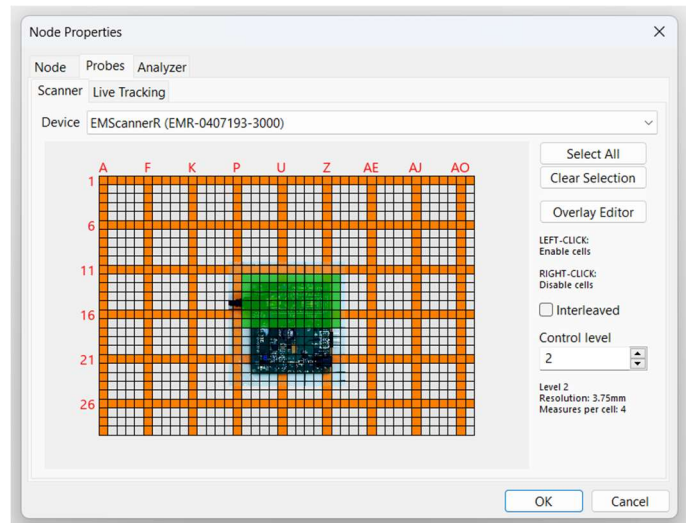ms 4x the number of sweeps than the previous level. The resolution of the scan and how many measurements taken per cell is shown below the control level control.

**Analyzer Tab**

Enter *Start Frequency* and *Stop Frequency* to identify the span of the scan to be implemented. *RBW (Resolution Bandwidth):* It is set by default at 100 kHz and can be reduced to the lowest level allowed by the spectrum analyzer. Decreasing the bandwidth will improve the amplitude accuracy and increase the sensitivity; the scan will however take more time to complete. The bandwidth you choose should not be disproportionate to the span. The suggested ratio of Span/RBW should be <10,000 e.g. 10 kHz bandwidth with a 100 MHz span, 100 kHz bandwidth with a 1 GHz span so that the scan can finish in a reasonable time.

*Reference Level:* The maximum signal intensity that the spectrum analyzer can acquire at a given frequency without clipping, this setting does not need to be changed except when measuring very strong signals.

*Peak Hold:* Also known as Max-Hold this is a very important feature as it allows you to run a Spectral Scan continually replacing the peak amplitude with each successive higher measurement. This is an excellent way to find the frequency of an intermittent or random signal.

*DC Coupled Mode:* When this option is checked, the analyzer goes from the protected AC mode to the unprotected DC mode. This enables a much lower noise floor in the low frequency range, usually below 10 MHz, depending on the spectrum analyzer. DC voltage applied to the spectrum analyzer input can however cause damage to the internal circuitry.

**Live Tracking**

We will describe how to confirm the live tracking functionality using the EMViewer software.
- Launch the software.
- Either from a blank project or with no project open, click the **combined node** button.
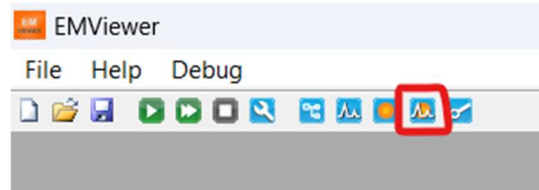


- In the Node Properties window, select the Probes tab, and the Live Tracking tab under that.
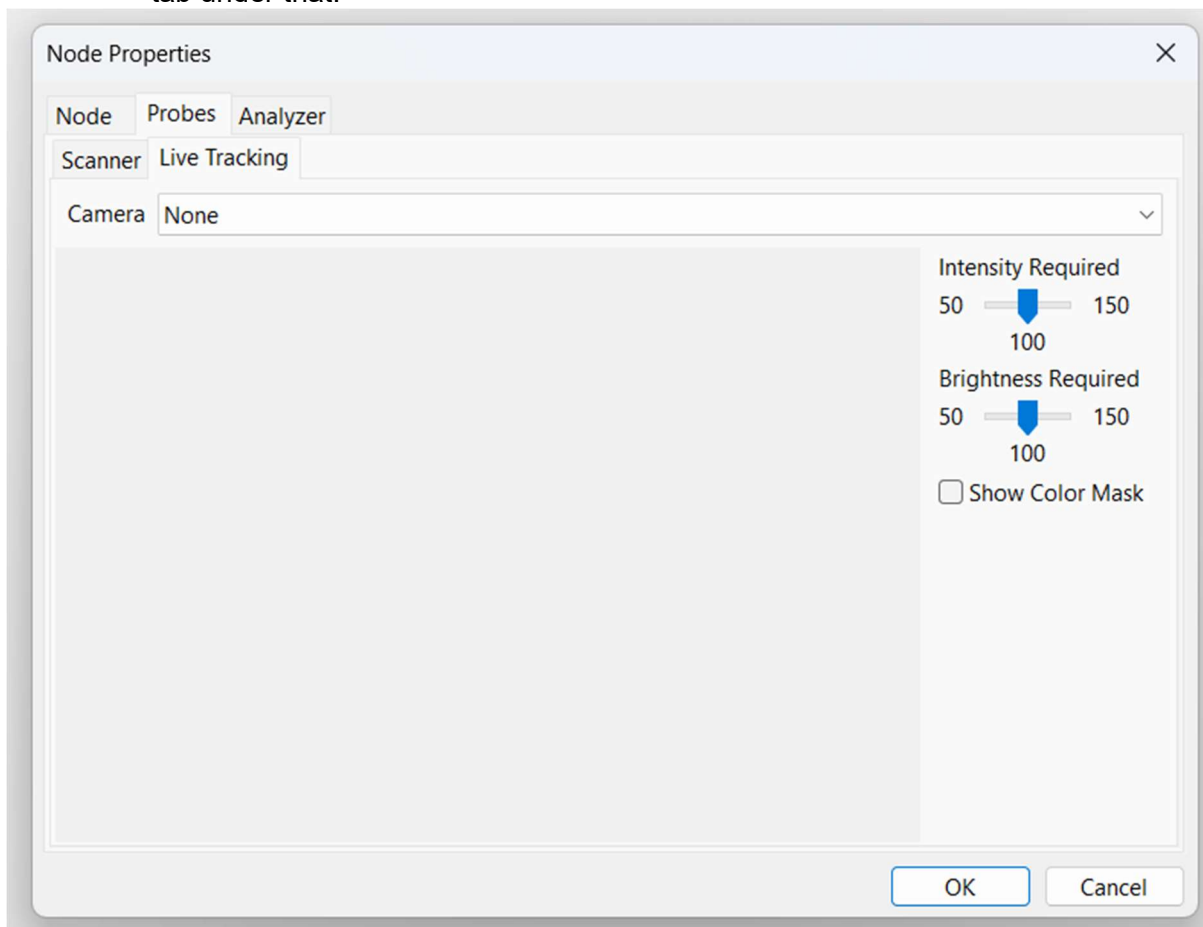


- Select your camera from the camera dropdown.
- If your camera does not appear, try closing the node properties window, and opening it again. (Right click on the Combined Node and click Properties)
- If you cannot see any video from the camera, your device may be in use by another application.
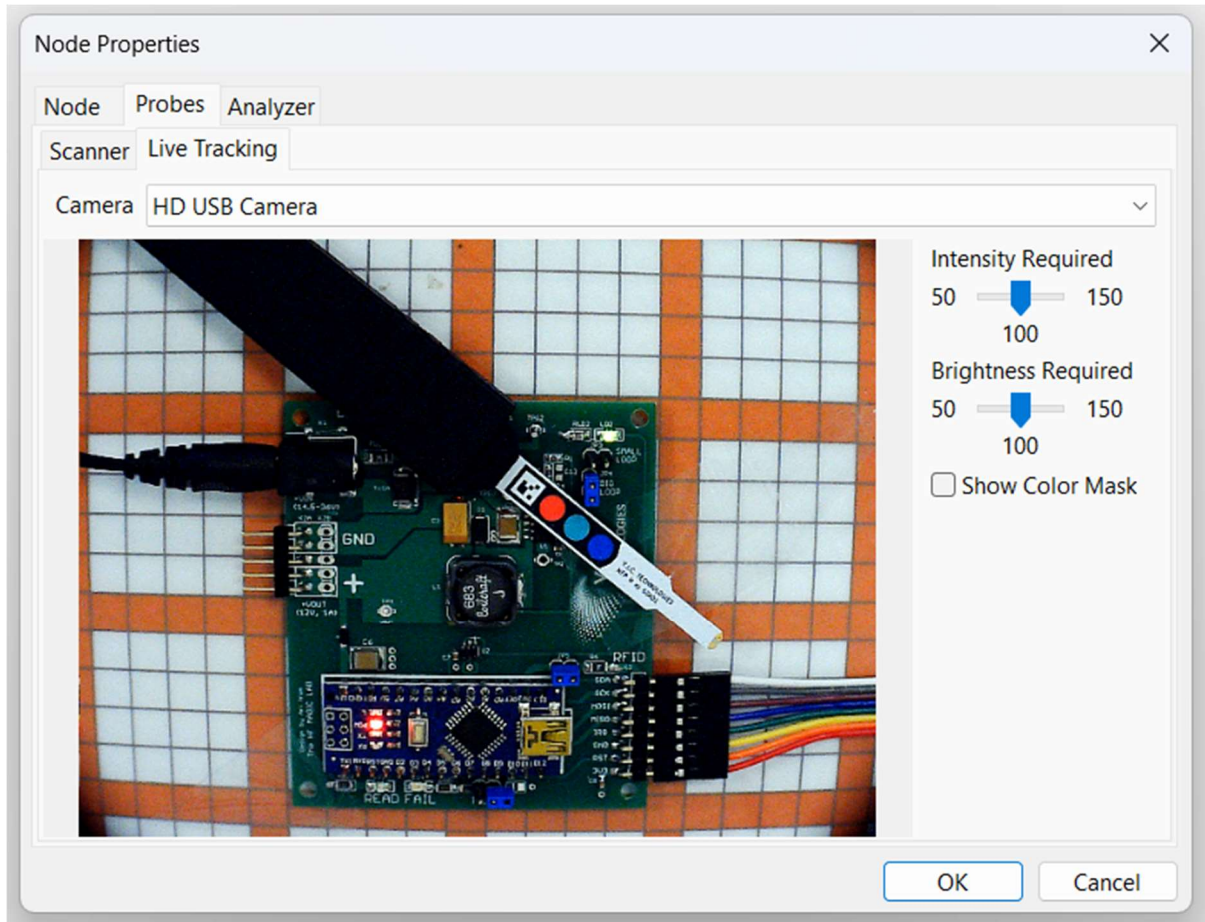
- You must see the 3 coloured circles, the marker and the tip of the probe on camera. There must be adequate lighting and they must be in focus. Adjust the aperture on the provided camera if there is not enough light.
- The tracking is stable if squares appear on the coloured circles and the tip of the probe.



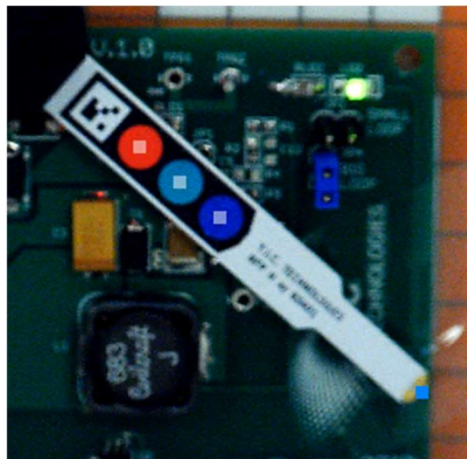- **NOTE:** Only two circles are required to be tracked. For example, EMViewer may not recognise the green circle if the DUT is also green. This is to prevent false positives for the live tracking.

- If there are problems with the detection, try the following:

- Enable the ☑ Show Color Mask feature:
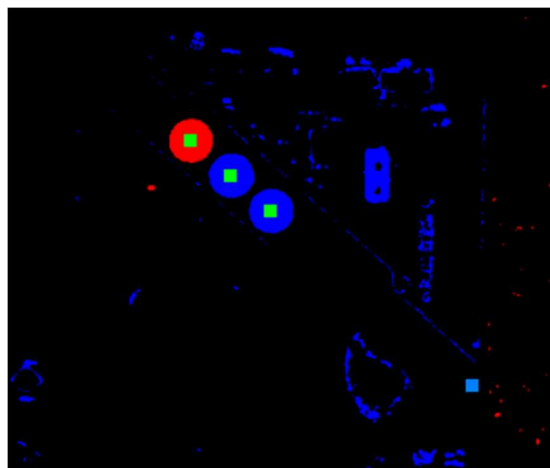
The color mask shows what EMViewer is looking for. We want to see 3 distinct colored circles. If there is too much noise or the circles have holes, EMViewer will fail to recognise them.
Left: the image is too dark, and we fail to recognise the green and blue circles.
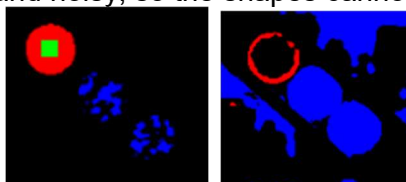Right: the image is too bright and noisy, so the shapes cannot be identified.



- Try adjusting the manual camera settings:
  - Adjust the focus of the camera until the marker appears sharp
  - Adjust the zoom of the camera so the colored markers appear larger
  - Adjust the aperture of the camera to make the image brighter/darker
- Adjust the brightness and intensity required sliders in the software:
  - Intensity required increases how colorful the circles must appear. If the circles appear washed out on video, decrease this slider.
  - Brightness required increases how light the circles must appear. If the circles appear dark, decrease this slider. (It is recommended to adjust the aperture instead.
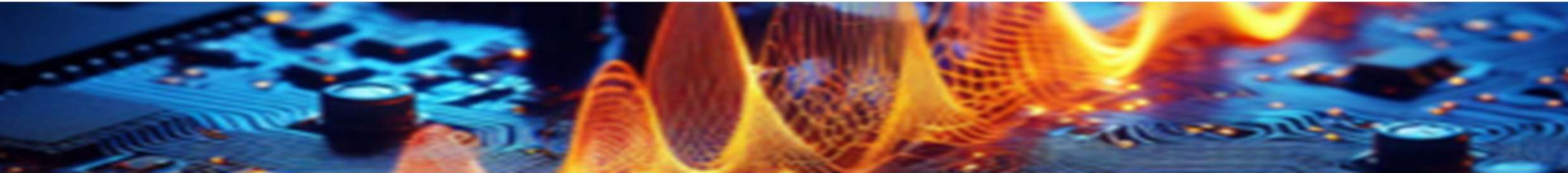
### Scanning a PCB

Place the PCB on the scanner aligning it as closely as possible to the vertical and horizontal guidelines. Lining it up squarely assists you when importing overlays or images (JPG).
When analyzing the emissions produced by a printed circuit board or device (DUT), verify that the signals are actually being emitted from the DUT and are not ambient background signals being retransmitted by the DUT:
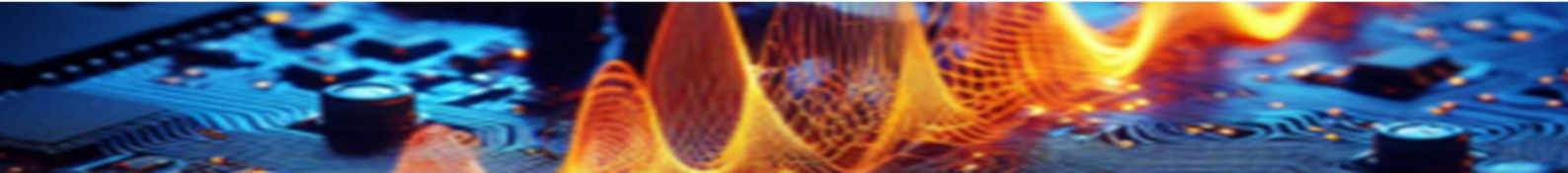1. Run a Spectral Scan over the frequency range of interest with the unpowered PCB on scanner. This is to eliminate the possibility that the DUT is acting like an antenna or signal conduit for non-local sources.
2. Power on the PCB and go through step 1.
3. Compare the powered and unpowered scans taken with the DUT in the identical positions and with identical scanning parameters to identify frequencies that have emissions emanating from the DUT. To determine the significant emission areas on the DUT at the frequencies of interest:
4. Perform a wide-frequency range Combined Scan or several Combined Scans to cover the entire frequency range of interest. Run Spatial Scans at the same frequencies used in Steps 1 and 2. If the peaks have not been measured accurately:
5. Run narrow Spectral Scans so that the frequency error of the spectrum analyzer is less than the bandwidth used for the Spatial Scan; e.g., for a spectrum analyzer with a frequency error of 1% of a scan, a Spectral Scan with a span of less than 10 MHz should be used for a Spatial Scan using a bandwidth of 100 kHz.

6. When measuring emissions above 6 GHz there is the possibility that surface waves on the scanner will degrade the rated isolation. To combat this effect a small surface wave absorber must be placed on the edge of the scanner.

### Scanning Best Practices

1. Choosing Spans and Resolution Bandwidths (RBW). It is recommended that you scan a small frequency span with an RBW in the 120 kHz to 10 kHz range as it provides you with more immediate feedback. The EMViewer software has the capability of scanning many probes at a large span and a tight RBW but such scans can take a long time to complete.

2. Tips:
   a. Take extra care during the setup of the DUT to ensure that the DUT is fully exercised in the fashion that will be sent off to a compliance test site (although it may not be in the packaging).
   b. Import an overlay whenever possible. Carefully locate the overlay to coincide with the DUT as slight variations can be misleading. Make sure that the overlay is properly oriented. If the overlay file will be added afterwards take careful notes the DUT placement on the scanner (coordinates), its orientation and the side of the DUT being scanned.
   c. Set up a separate module or project for your DUT and use the 'Description' portion of the setup to identify the purpose of the scan quickly and easily.

d.  Use the note facility for descriptions and possible explanations for emissions on the DUT. This could come in very handy later when writing a follow up report.
e.  If you already have visited a compliance facility and have a report, it is a good idea to include this data in the notes and conduct the scans at the same frequencies. There will be differences in the far-field and near-field values, but they will relative.
f.  If the scan amplitudes are below 20 dBuV and the noise floor is high, use a low noise amplifier (your own or one provided by Y.I.C. Technologies) and reduce the RBW.
g.  Take measurements to compensate for spectrum analyzer noise.
h.  Make special note of low amplitude current loops that are coupling onto the connectors.
i.  Conduct Spatial Scans using continuous scan and peak hold at some of the frequencies of interest, even if a Combined Scan was used. The Continuous Spatial with peak will almost always provide a different picture than a single Spatial or a single User of a Spectral/Spatial Scan (as all boards have time variances). The ability to time-based events is a benefit unique to Y.I.C. Technologies.
j.  If you have a very strong intentional radiator; it may be advantageous to either conduct excluding this frequency (a scan below the frequency and a scan above the frequency) or add a passband filter (customer-provided) that selectively excludes this frequency.
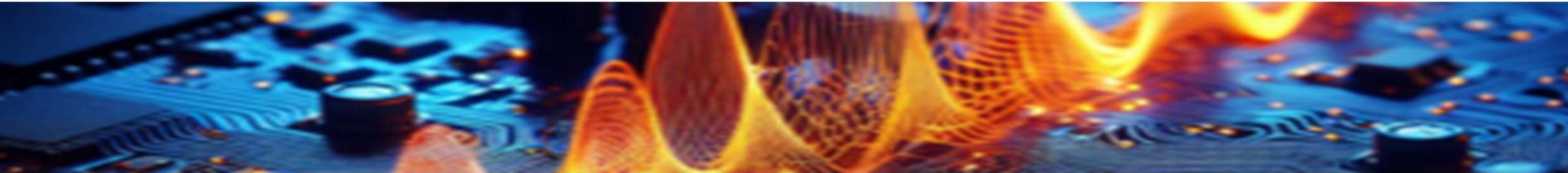k.  If you are scanning very high amplitude intentional radiator an attenuator may be required.

## Appendix – Spectrum Analyzer Support

**I have a spectrum analyzer that is not on the list of supported analyzers. Can it be supported?**

If your spectrum analyzer is not supported, you can add support yourself by writing a JSON file. For a JSON driver, the spectrum analyzer must be configured with the following options: preamplifier, LAN or USB port and VISA support. Download the "Writing drivers for EMV2" manual or visit our GitHub page.

Alternatively, please contact Y.I.C Technologies (support@yictechnologies.com)  to discuss the development of a custom driver.

## About Y.I.C. Technologies

Y.I.C. Technologies is a world leading developer of FAST magnetic very-near-field measurement technologies and applications, providing real-time test solutions to antenna and PCB designers and verification engineers, without the need for a chamber. The EMScanner is a compact EMC and EMI diagnostic tool. Y.I.C. Technologies solutions dramatically increase designer productivity and substantially reduce time-to-market and project development costs.