



EMxpert **ERX**

User Manual

v7.0.0.0

EMxpert™

Notices

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Caution

A CAUTION notice denotes a hazard. It calls attention to operating procedure, practice, or the like that, if not correctly performed or adhered to, 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.

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EMSCAN warrants to its customers that any EMxpert from the date of delivery will perform substantially in accordance with the specifications provided, when properly installed, operated, maintained and repaired for the duration of warranty purchased by the customer.

During the warranty period, EMSCAN will at its option either repair or replace, at no charge, EMxpert products or parts thereof which do not perform in accordance with the specifications.

For warranty service or repair, EMxpert must be returned to EMSCAN. EMSCAN will pay shipping charges to and from EMSCAN if Buyer is under warranty, original or extended. You can extend your original warranty by purchasing option 3000-1811 (Additional One Year Customer Care Package).

Is your document and EMxpert software up-to-date?

Periodically, we update the documents and EMxpert software. You may access to the latest versions from below links:

User manual: <https://www.emscan.com/products/emc-emi-testing/resource-centre/>

Software release notes: <https://www.emscan.com/products/emc-emi-testing/resource-centre/>

Technical bulletins: <https://www.emscan.com/products/emc-emi-testing/resource-centre/>

FAQ: <https://www.emscan.com/products/emc-emi-testing/erxplus/>

To receive email notifications for the updates, please contact us at emxupdate@emscan.com

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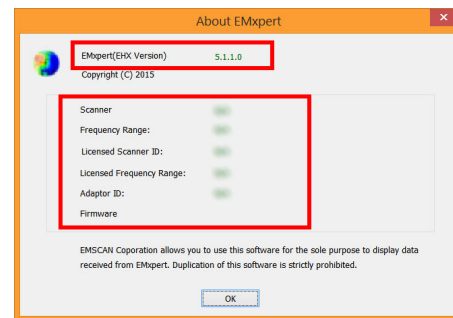
Technical Support

To help us provide fast and seamless technical support, kindly gather the following information and contact Technical Support as instructed further below.

- Serial number of your EMxpert ERX. EMxpert ERX serial number is located at the bottom of the scanner.



- Start EMxpert software and click  to access to software and firmware versions:



- Firmware release: screen shot of the EMSCAN webserver FW Upgrade menu
- Windows OS
- Keysight IO version
- IP address pair of your PC and ERX
- Project file *emx
- Information View data saved as a text file
- Description of the problem including screen shots and videos

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About the EMxpert Products

EMxpert product family provides board-level design teams with world-leading fast very-near-field magnetic data to help diagnose EMC design issues. EMxpert product line consists of EHX (high-frequency scanners) and ERX (high-resolution scanners). These instruments capture and display visual images of spectral and spatial scan results in seconds. This allows the design team to immediately analyze and compare design iterations. PCB designers can scan any board to identify both constant and time-based emission sources in the range of 150 kHz to 8 GHz.

EHX consists of a patented scanner and compact adaptor, and a customer-supplied spectrum analyzer and PC running EMxpert software. Free Keysight IO Libraries Suite software application must also be installed on the customer-supplied PC. The patented scanner consists of 1,218 H-field (magnetic) probes spaced every 7.5 mm into an electronically switched array, which provides an effective 3.75 mm resolution. The system operates from 150 kHz to 1 GHz, or 150 kHz to 4 GHz or 150 kHz to 8 GHz; the upgrade from 4 GHz to 8 GHz is enabled with an optional software license key.

EHX+ is a self-contained very-near-field scanning device which uses the EHX scanner along with a built-in spectrum analyzer. Simply connect the EHX+ into the PC with an Ethernet connection, install the EMxpert software on the customer-supplied PC and begin measurements. The system operates from 150 kHz to 8 GHz.

ERX is a high-resolution very-near-field scanning device which uses the EHX scanner mounted on X and Y stepper motors with 0.06 mm incremental measurement steps. The system operates from 150 kHz to 8 GHz. It connects to a few high-end customer-supplied external spectrum analyzers; [click here](#) for the current list. The free Keysight IO Libraries Suite software application must also be installed on the customer-supplied PC. Connect the PC to the ERX with an Ethernet cable and to the spectrum analyzer with a USB cable.

ERX+ is a self-contained high-resolution very-near-field scanning device which uses the EHX scanner mounted on X and Y stepper motors with 0.06 mm incremental measurement steps. It also has a built-in spectrum analyzer. Simply connect the ERX+ into the PC with an Ethernet connection, install the EMxpert software on the customer-supplied PC and begin measurements. The system operates from 150 kHz to 8 GHz.

Minimum System Requirements

- CPU 333 MHz or faster
- 8 GB recommended for ERX
- 8 MB Video or more
- Windows 10 OS
- 10/100 Network Card. USB 2.x port

ERX Cables and Component Checklist

Components Supplied with the ERX System

1. ERX (integrated scanner with X and Y stepper motors, processing electronics and cables)



2. Universal power supply:



3. Surface wave absorber.



4. Ethernet cable: It connects the PC (laptop or desktop) to the ERX.



5. RF SMA to type N coaxial cable: It is referred as the RF cable in this manual. It connects the scanner to the spectrum analyzer and has a SMA connector for the scanner and a N connector for the spectrum analyzer 50 ohm input port. It transmits RF output of the patented scanner to the spectrum analyzer.



6. BNC-BNC Trigger Cable: It connects the ERX external trigger port to the Trigger IN 1 of the spectrum analyzer.



7. EMxpert USB drive includes the EMxpert software installation program and User Manual.



Customer Provided Components

1. PC (laptop / desktop): must support a LAN 10/100 connection. It runs the EMxpert software and the Keysight IO Libraries Suite, and receives data, which it can display and manipulate immediately or store for future data presentation.
2. Spectrum Analyzer: It must include the necessary options to work with the EMxpert ERX (see Supported Spectrum Analyzers). It measures the radio frequency (RF) signal received from the ERX built-in EMSCAN patented scanner, generated by the very-near-field emissions of an adjacent activated PCB and it outputs the data to the PC.

ERX Connection Overview

Caution:
The surface of the scanner is made of Gorilla® glass. It may shatter if a sharp object is dropped from a distance.



Item Number	Description
1	Scanner LED light shows three stages: Red: Boot mode Orange: Initiation mode (checking adaptor's firmware) Green: User mode (adaptor is connected and ready). The LED will be blinking during the measurements.
2	ON / OFF switch. When ON the switch is lit
3	RF Out port (output directly from scanner)
4	External trigger port
5	Ethernet cable port
6	Universal power supply port
7	Fuse to provide protection against excess current Specs: 8A / 250V, size: 0.177" Dia x 0.570" L (4.50 mm x 14.48 mm) Recommended fuse: 0229003.HXP by Littelfuse Inc. (Please refer to Appendix: Fuse Replacement)
8	Pinhole for the factory settings reset

Option and Accessories

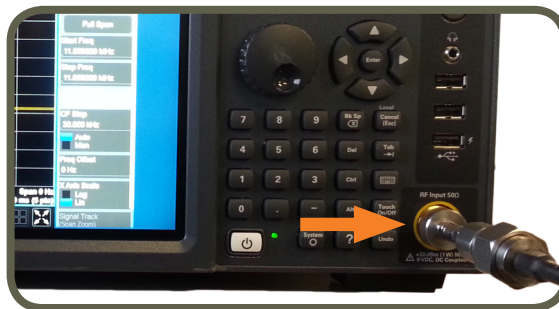
Part Number	Description
3000-0217	LNA 32 dB across frequency range: 9 kHz - 3.0 GHz
3000-0818	Hard Transit Case EHx+, ERX and ERX+ with customized insert
3000-0104	Trade-in of any EMX to an EHx 8 GHz, EHx+, ERX or ERX+
3000-0304	DVT Solutions Far-Field Application Predict the Open Area Test Site (OATS) or Semi Anechoic Chamber (SAC) radiated EMI levels of a printed circuit board (PCB). Far-Field application supports 30 MHz - 1 GHz regulatory compliance limits Class A or Class B FCC, CISPR and Industry Canada, 10 m, 3 m and 1 m test distances TWO-YEAR WARRANTY AND SUPPORT DIRECTLY FROM MANUFACTURER Includes scanner absorber pad from EMSCAN
3000-1811	Additional one year Customer Care Package for the EHx+, ERX and ERX+. Includes: <ul style="list-style-type: none"> - Parts & labour - Software updates - Free shipping to factory for repair and return - Same day technical support - Two 30 minute web training sessions per year
3000-1910	Calibration Assurance Plan for the EHx+, ERX and ERX+ / Return to EMSCAN/3 years <ul style="list-style-type: none"> - Annual single calibration event included - Freight to/from EMSCAN factory not included unless unit under original or extended warranty
3000-1911	Calibration Assurance Plan for the EHx+, ERX and ERX+ / Return to EMSCAN/5 years <ul style="list-style-type: none"> - Annual single calibration event included - Freight to/from EMSCAN factory not included unless unit under original or extended warranty
3000-0900	On-Site customer training per day. Cost of instructor's travel and accommodation additional (inside continental North America p/n 3000-0902 or outside continental North America p/n 3000-0901). Maximum number of participants is 10; participants are to bring their own EMSCAN equipment.
3000-0901	Trainer's travel, accommodations and expenses for travel outside the Continental USA and Canada.
3000-0902	Trainer's travel, accommodations and expenses for travel within the Continental USA and Canada.
3000-0903	Training at EMSCAN's Education Center per participant per day. EMSCAN will provide equipment for the hands-on training, materials and lunch each day. Course scheduling will be determined based on a minimum of 3 confirmed registrants. Participants are responsible for their own travel and accommodation expenses. Every effort will be made to customize the course curriculum to meet participant needs.

Quick Installation and Checklist

1. Install latest version of Keysight IO
Click [here](#) to open the website to download the latest version. On the website click on the Download button and follow the steps.
2. Install the EMxpert ERX software application by double clicking on the Setup application icon. The application must always be installed on the C: drive.
3. Connect an Ethernet cable between the ERX (Arrow #1) and your PC.



4. Your ERX is set by default with the Static IP address 172.16.1.149/255.255.255.0. Change the static IP of your PC to 172.16.1.99 / 255.255.255.0. To modify the connection between your PC and the ERX please consult the User Manual.
5. Connect the RF cable to the external spectrum analyzer RF port.



6. Connect the USB cable from the PC to the external spectrum analyzer



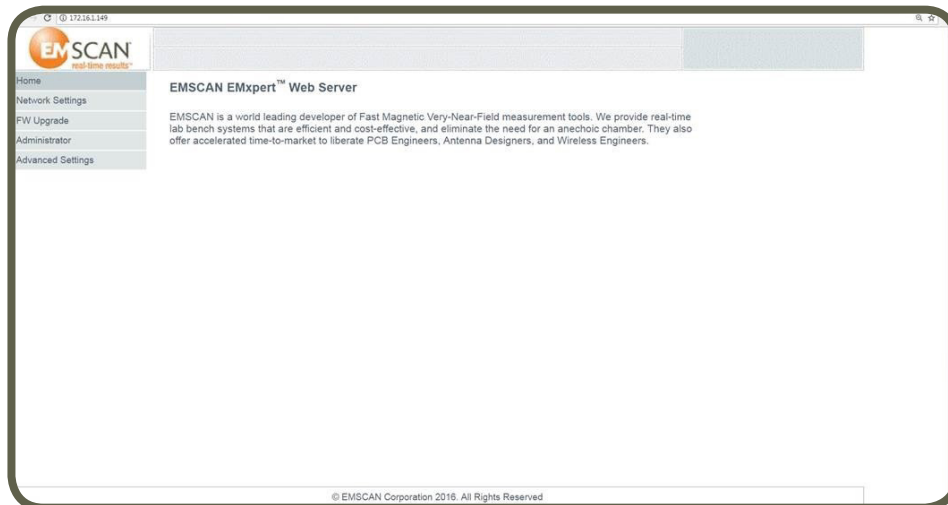
About EMxpert

Quick Installation and Checklist

7. Connect the ERX power supply and turn on the system (Arrow #2). The system status light (Arrow #3) should flash orange and then turn green. You should hear the motors moving and see the scanner reposition itself before the LED turns green. If the LED does not turn green after a few minutes or turns red, cycle the power to the ERX by turning it off and on again. If the problem persists then contact EMSCAN.



8. Open a HTTP session between your PC and your ERX by entering 172.16.1.149 in a Google Chrome browser (PLEASE DO NOT USE INTERNET EXPLORER). If your PC connects to your ERX, you will see the following web page come up; if it does go to step 7.



9. If you do not see a web page like the one above or if it is very slow to come up please follow these troubleshooting steps:
 - a. Can you ping the ERX 172.16.1.149? If yes, go to step "c"
 - b. If not, check again that your PC is on the same subnet as the ERX. Reset the ERX to factory default which will ensure the ERX has the 172.16.1.149 IP address and make sure your PC is set at 172.16.1.99.
 - c. If you are able to ping, try to open the web server page <http://172.16.1.149>. If it opens quickly, go to the next step 7. If it is sluggish or you can't open the web page go to step "d"

About EMxpert

Quick Installation and Checklist

d. You might have a rule that blocks HTTP traffic and/or traffic to 172.16.1.149. Check or ask your IT department to check your PC configuration for general traffic rules. Temporary disable the firewall if possible or set it to let pass all TCP/IP, ICMP and HTTP traffic for both inbound and outbound traffic of 172.16.1.149. Go through every single setting, switch to any “Advanced/Expert” mode as well if it available and look for any rules that could block such traffic.

e. Open Keysight IO

Look at the bottom right of the Keysight IO window and see if it says PRIMARY VISA. If it does not, go to Control Panel / Programs / Select Keysight IO / Change / Modify / Select PRIMARY [in Windows 7 or equivalent path for other Windows OS]

10. When the system status light turns green, open the EMxpert ERX application. After a few moments the software application should indicate that it has connected to the system by displaying the system IP (172.16.1.149) in the status bar at the bottom left of the window.

Try running a scan; if it gets blocked in the middle and/or you see an error message, take a look at the Windows Event Viewer of your computer and search for the event log of the firewall application, which will show if it has blocked something. That is the best way to figure out if something is blocked by most firewall software. Take or ask your IT to take the corrective actions to let TCP/IP, ICMP and HTTP traffic pass for both inbound and outbound traffic of 172.16.1.149; it might be a deep setting that was not obvious at first.

Try changing both the ERX and your PC to a completely different subnet (e.g. 10.10.10.xx, etc.); your IT department may have suggestions as well.


If you are still not able to run, take another laptop with no firewall to make it a test laptop. Change its IP to 172.16.1.149 and connect to the problematic laptop set at 172.16.1.99 with a crossover Ethernet cable and by setting them up in the same Workgroup. Get the two PC to talk to each other by pinging, sending files, etc. Then run a freeware tool e.g. [Wireshark](#) that sends data back and forth. If there are communication issues then you will definitely know something is blocked by the 172.16.1.99 laptop.

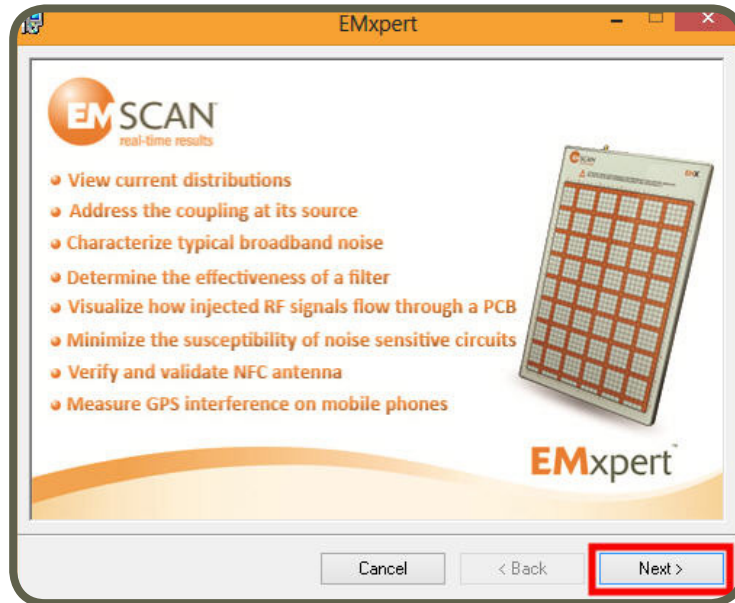
Hardware Setup



1. Connect an Ethernet cable between ERX (Arrow #1) and the client computer.
2. Connect the ERX power supply and turn on the system (Arrow #2). The system status light (Arrow #3) should flash orange for 5 - 10 seconds and then turn green. For your ERX only, you should hear the motors moving and see the scanner reposition itself before the LED turns green. If the LED does not turn green after a few minutes or turns red, then cycle the power to the ERX by turning it off and on again. If the problem persists then contact EMSCAN.

Software Installation

1. Plug-in the EMxpert USB drive. Select the software folder and double click on Setup.exe file  setup
2. When you are prompted “Do you want to allow the following program from an unknown publisher to make changes to this computer” click Yes
3. Click Next



4. Click Next

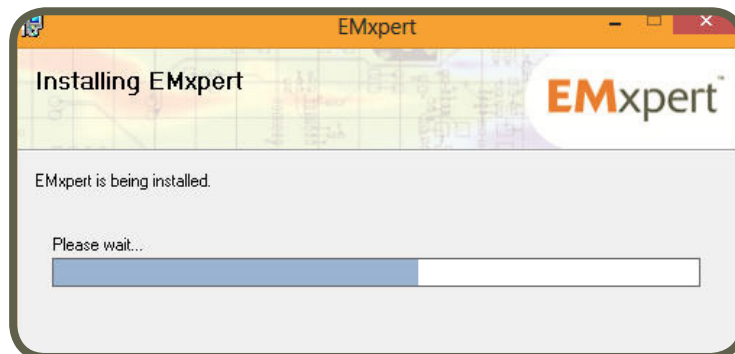


Getting Started Software Installation

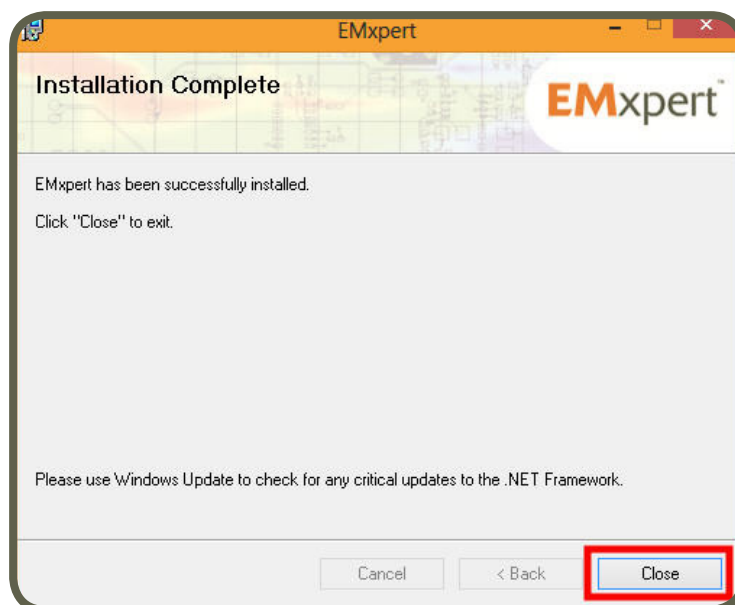
5. Select I Agree and click Next



6. The following screen will be displayed




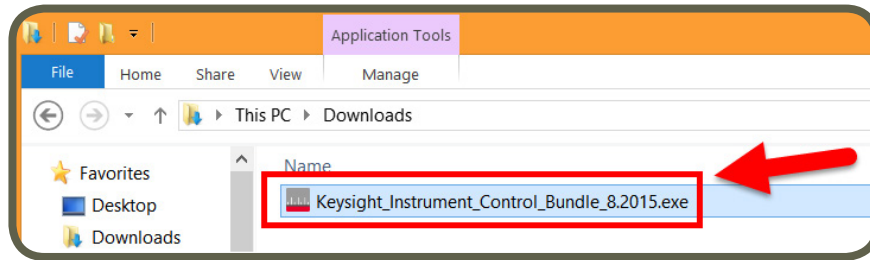
7. Click Close



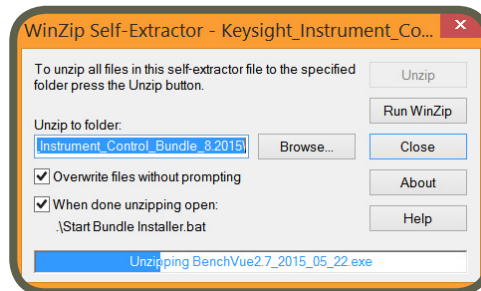
Getting Started

Software Installation

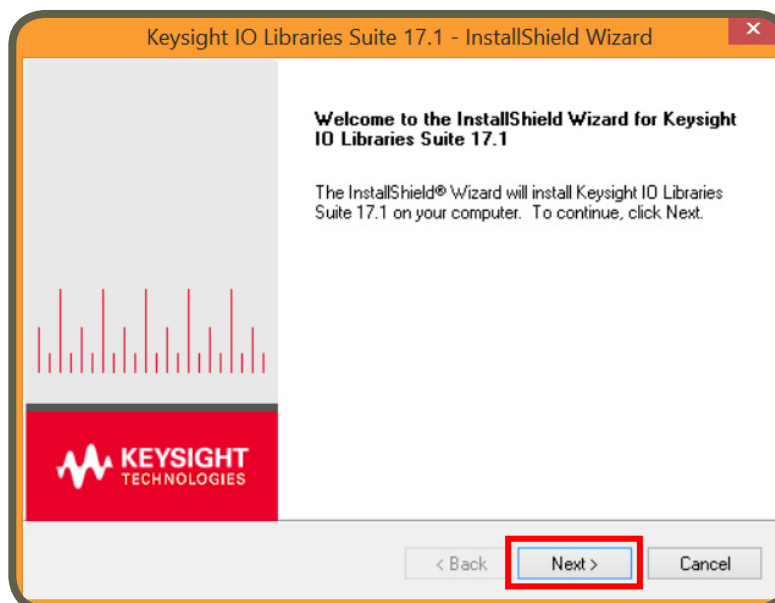
- When using the **EMxpert ERX Software for the first time, Shift + Rick Click + Run as administrator the icon on the Desktop**. Once it has been done, it does not have to be repeated; start the the EMxpert ERX Software by clicking the icon on the Desktop. 
- When the system status light turns green, open the EMxpert ERX application. After a few moments the software application should indicate that it has connected to the system by displaying the system IP (172.16.1.149) in the status bar at the bottom left of the window.
- Once you are directed to the [Keysight website](#) click on the Download button and follow the steps. When the download is complete, open the Downloads folder and double click on the executable.



- The folder will be unzipped.

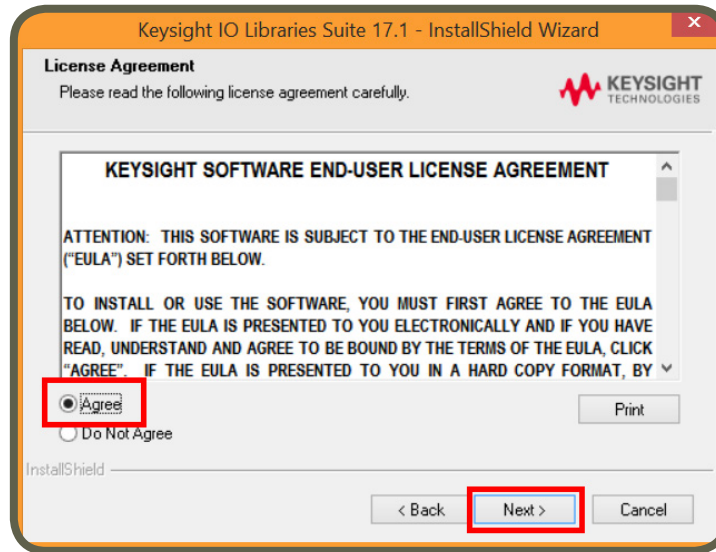


- Click Next.

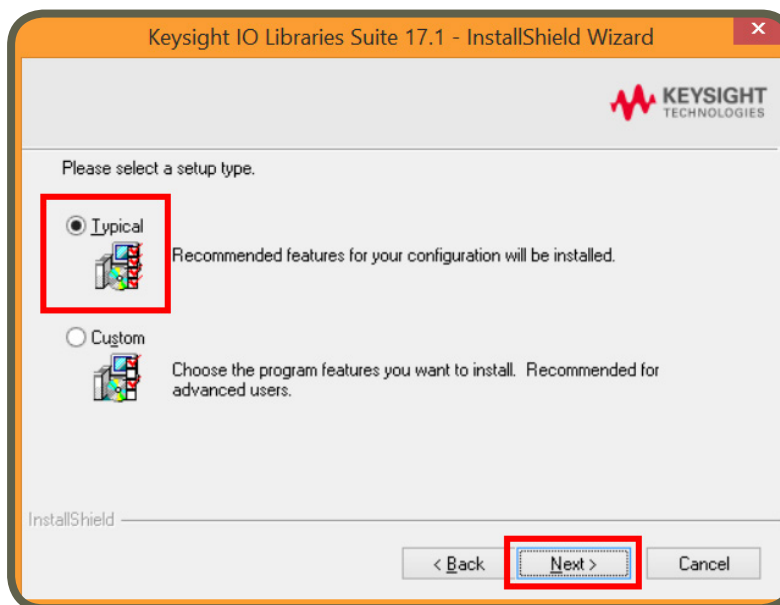


Getting Started Software Installation

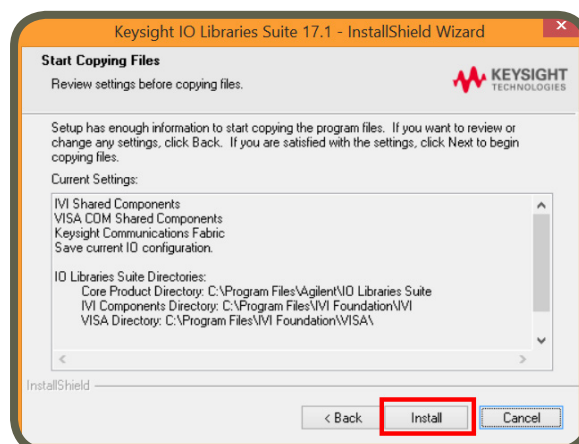
13. Select Agree and click Next.



14. Select Typical and click Next

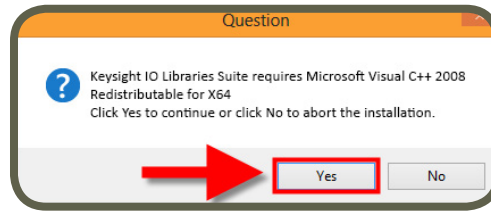


15. Click Install

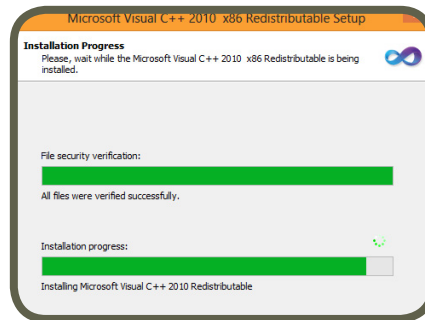


Getting Started Software Installation

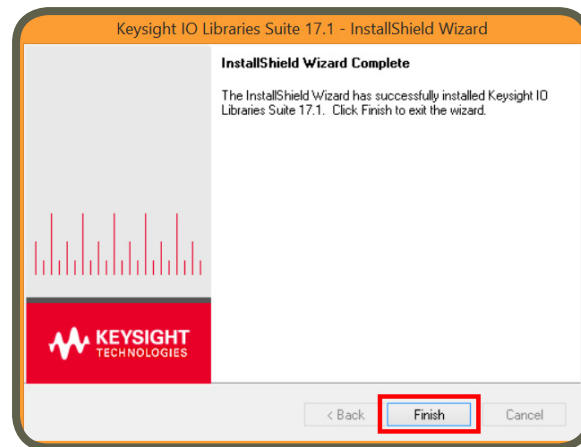
16. If Microsoft Visual C++ is not installed on your PC below screen will be displayed. Click Yes



17. While the software is installing, the following screen will be displayed.



18. Click Finish



Setup and Modes of Operation

Setup

EMxpert is a very-near-field scanning system. It is composed of 1,218 H-field probes that operate between 150 kHz and 8 GHz. Probes are wideband but not very sensitive across this band thus they are very good at rejecting background noise.

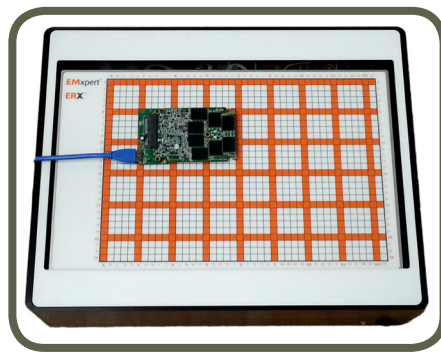
EMxpert does not require a special setup like a shielded room; the Device Under Test (DUT) may sometimes however pick up strong ambient signals like those present in the cell band (850 MHz -2100 MHz) or radio FM band.

It is strongly suggested to measure the ambient noise in the test environment before running any scans with EMxpert. First power off the DUT, start the EMxpert software and then setup a Spectral Scan for the bandwidth of interest. Run the Spectral Scan and analyze the test results. If there is any ambient noise being displayed the EMxpert's comparison features will allow you to filter it from the actual DUT test results.

Modes of Operation

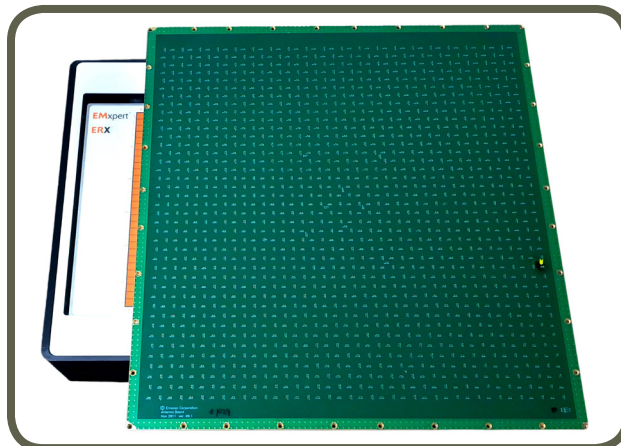
1. PCB testing (smaller than the scan area)

Place the PCB directly anywhere on the grid of the scanner. If there are tall components that prevent the PCB from touching the surface of the scanner, activating the internal pre-amp or inserting a LNA in the RF path is strongly suggested. If the other side of the PCB does not have any high components, you should scan this side.



2. PCB testing (larger than the scan area)

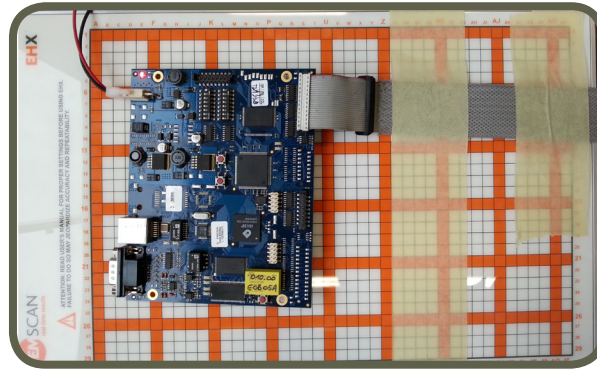
You can take snapshots of the DUT by using the scanner like a hand-held probe. Scan one particular area on the PCB and then move the scanner to the next position.



EMxpert Software Setup and Modes of Operation

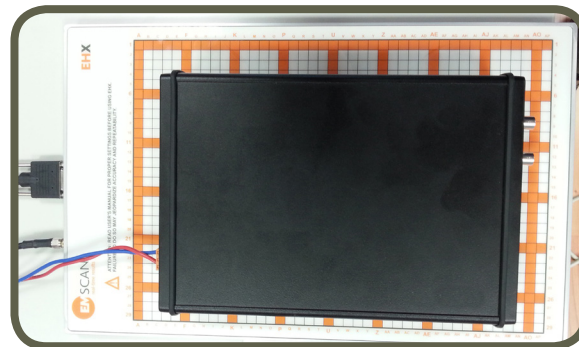
3. Cable testing

Cables from and to the PCB can be tested for emissions. Place the DUT on the scanner and tape the cables on the scanner.



4. System testing

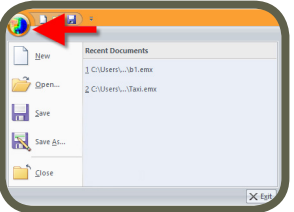
EMxpert will help detect any leakages from a system under test for both frequency and location.



Menu Bar

Menu Bar is shown below. It allows the user to start a project node, to select a scan type, to start a single scan, to scan continuously, and to stop a scan, as well as to specify scan settings.

Quick Access Toolbar

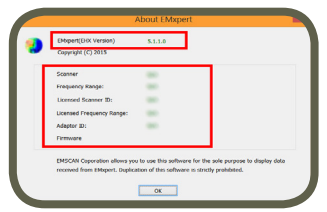


- Start a new project
- Open an existing project
- Save a project
- Close a project
- Access to recent documents

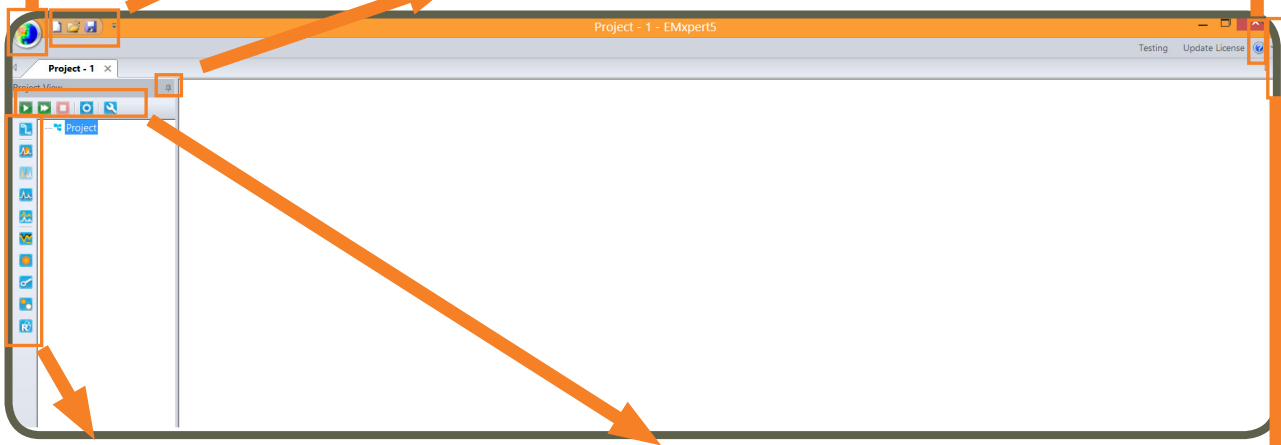
Icons

- Start a new project
- Open an existing project
- Save a project

About EMxpert



Auto-hide or pin the project view



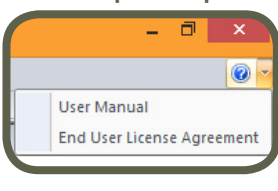
Buttons

Module Node	Handheld Probe
Spectral/Spatial Scan	Spatial Comparison
Spectral Scan	Report Generator
Spectral Overlay	Spatial Scan
Spectral Comparison	

Buttons

- Scan Once
- Scan Continuously
- Stop Scan
- Settings
- Preferences

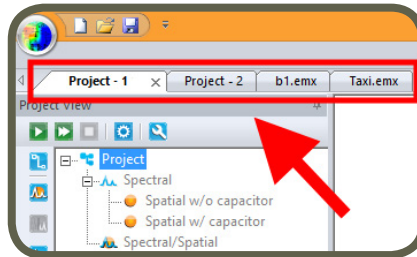
EMxpert Help



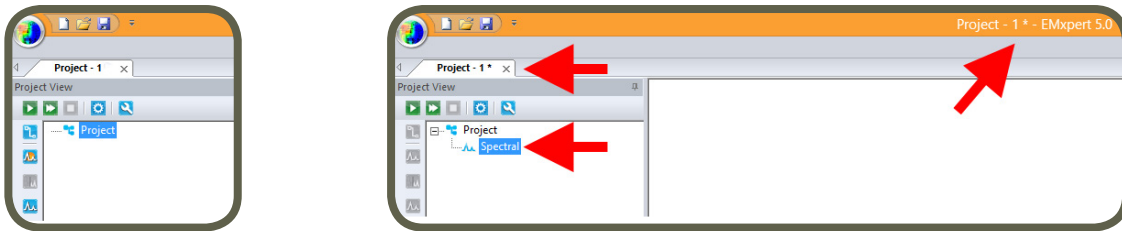
22

Quick Facts about Menu Bar

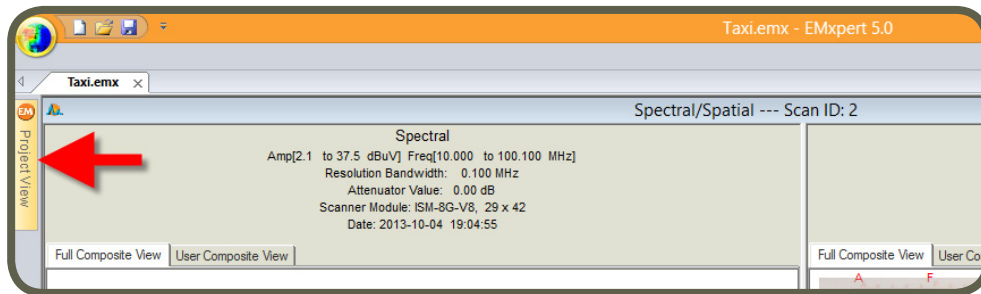
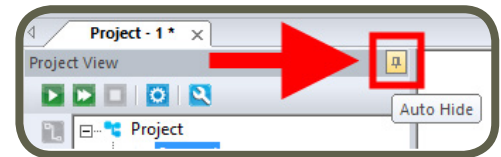
Multiple project files can be opened at the same time. Each file will have a dedicated tab showing the project name. Click on the tab to view the project file.



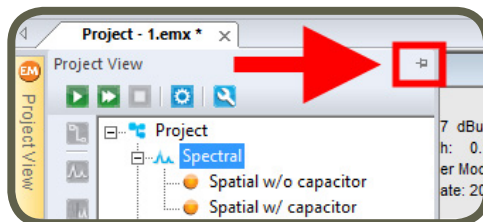
If there are any changes compared to the saved version of the project file this will be indicated by an asterisk (*) behind the file name. If you want to keep your changes, be sure to save the file before you close. In the example below, a new project file is created and then a Spectral node is added to the project file.



By default, Project View is pinned and displayed in the EMxpert software. In order to maximize the space to view the scan results, Project View can be hidden. Click the pin icon to auto hide Project View. Project View will be hidden and now you can maximize the scan window (Spectral/Spatial Scan windows automatically resizes to fit the screen). To display Project View, mouse over on Project View tab. It will be displayed as long as the cursor stays on Project View.



Click on Project View tab to keep the Project View visible even if you don't mouse over it. However, once you click on other part of the EMxpert software, Project View will auto hide. To pin Project View, click on the pin icon.



Viewing Scan Results

Depending on the scan type, you can view the scan results in either spectral or spatial or both views.

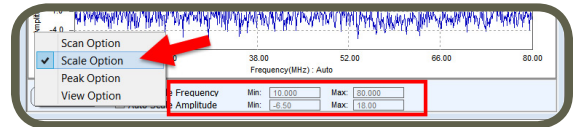
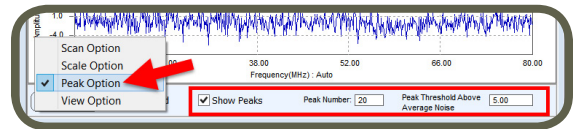
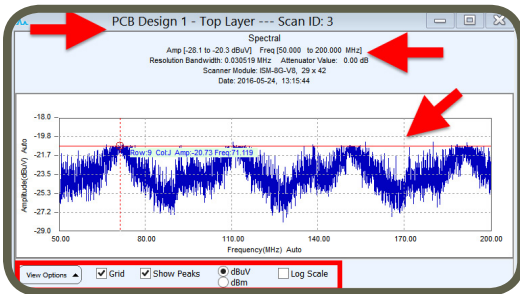
Spectral View

The name of the scan is on the top of the graph. Below the name is the scan type, scan frequencies, minimum and maximum amplitudes of this span, LNA or Attenuator values used, patented scanner model and date and time of the scan.

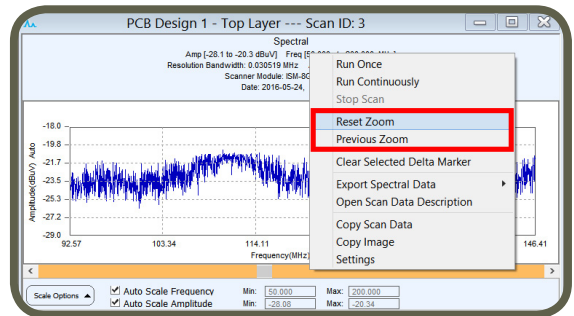
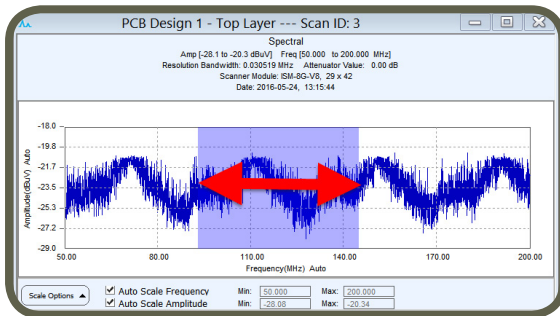
Mouse over the graph to display row / column coordinates, frequency and amplitude values.

To select a peak, mouse over the peak and either left-click the mouse or click the space bar on the keyboard.

Spectral view can be adjusted by the checkmark boxes at the bottom of the graph. Grid and Peaks can be hidden / displayed. Unit can be switched between dBuV and dBm. Linear scale is the default settings of the graph. Log Scale can be selected. Peak, Scale and Scan Options are listed under View Options.

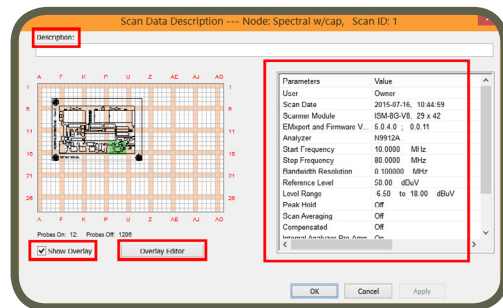
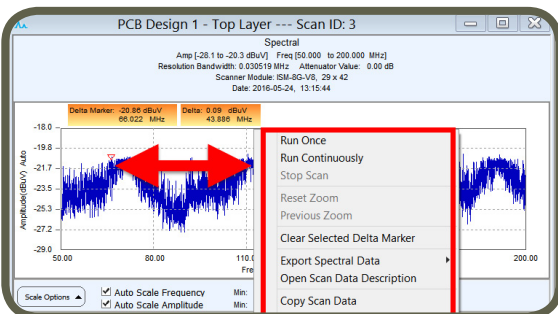


Left click and drag to zoom in. Right click and select Reset Zoom to return to the original view or Previous Zoom to return to the previous zoom level.



A Delta Marker can be set by left clicking anywhere on the spectral graph. It displays the amplitude and frequency difference between the current mouse position and the delta marker position.

Right click on the graph to display menu. You can change some settings of the Spectral Scan via Settings or Open Scan Data Description which will give information about the scan and access to Overlay Editor.

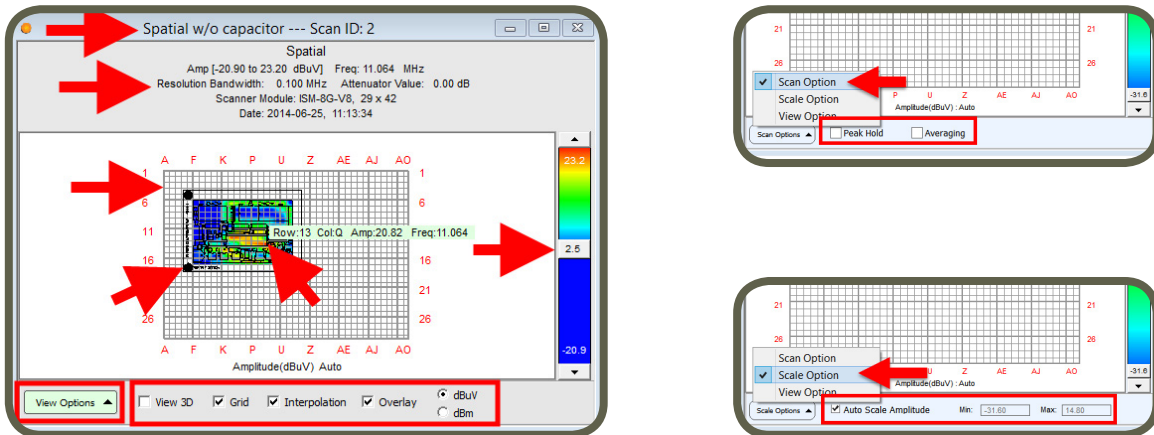


Spatial View

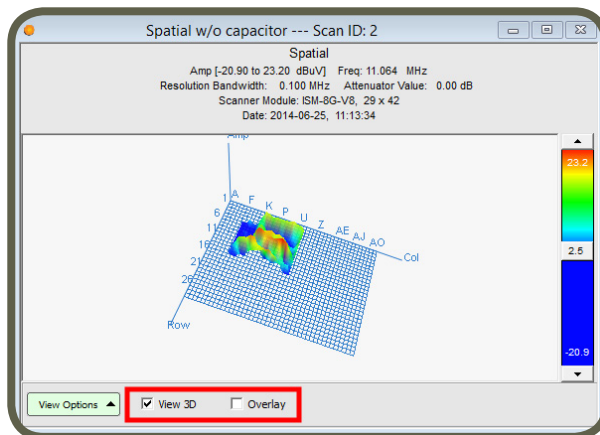
The name of the scan is on the top of the graph. Below name is the scan type, scan frequency, minimum and maximum amplitudes of this frequency, LNA or Attenuator values used, patented scanner model and date and time of the scan.

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

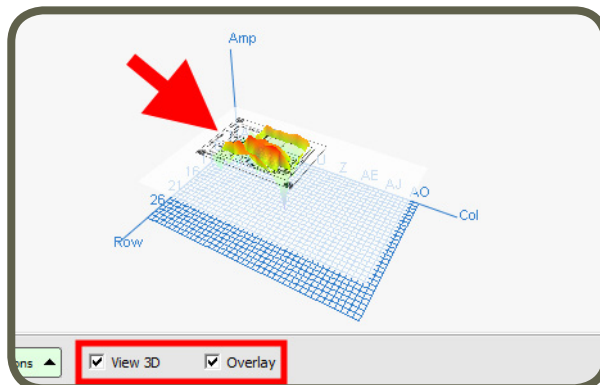
Spatial view can be adjusted by the checkmark boxes at the bottom of the graph. Grid and Overlay can be hidden / displayed. Interpolation (degree of data smoothing in the image) can be turned on / off. By sliding the Set Color Threshold on the right side of the graph, you can increase or decrease the contrast to more clearly identify current loops and peak locations. Scale and Scan Options are listed under View Options.



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.

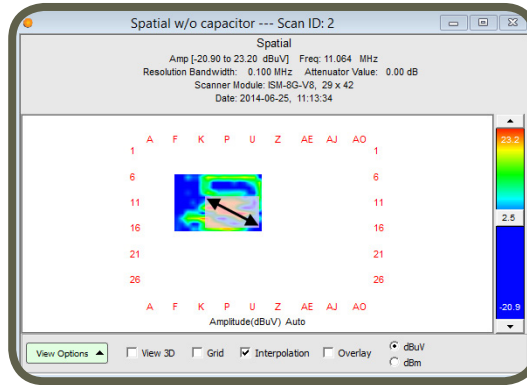


When Overlay is checked in 3D view, the wheel of the mouse will adjust the transparency. But if you press Ctrl key and then use the wheel you can move up and down the overlay to have the tip of the peaks right at the DUT level.

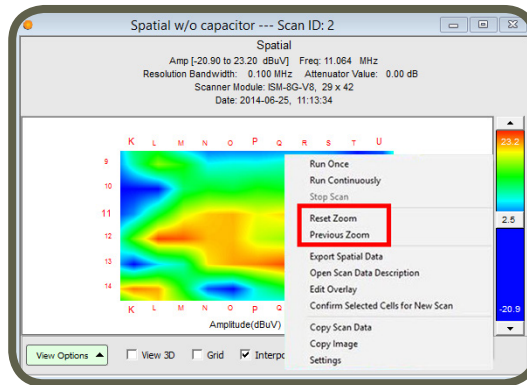


EMxpert Software Viewing Scan Results

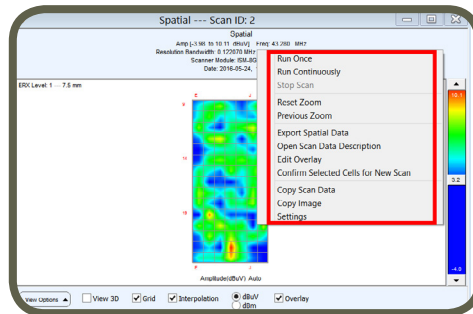
Left click and drag to zoom in.



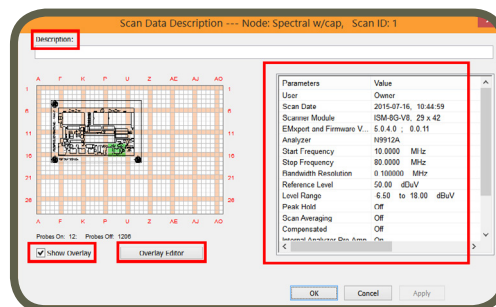
Right click and select Reset Zoom to return to the original view or Previous Zoom to return to the previous zoom level.



Right click on the graph to display menu.





You can change all the settings of the Spatial Scan before a new scan via Settings or after a first scan by using Edit Overlay and/or by zooming on some cells and selecting Confirm Selected Cells for New Scan. You can change the overlay of an indexed spatial scan by selecting Open Scan Data Description and clicking on Overlay Editor or much easier by simply selecting Edit Overlay.



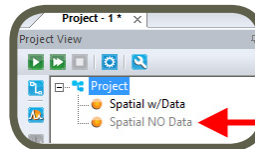
Nodes

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.

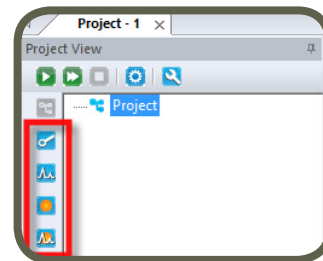
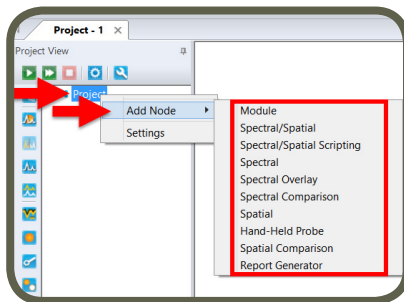
A module  is the sub-root node. It can be considered as a subfolder like in Windows directories to store related data. You can add different types of scans and/or notes to a project node. You can rename, copy and paste a node or node settings only. Module's settings are inherited throughout the module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

Nodes that don't contain any data are light colored.



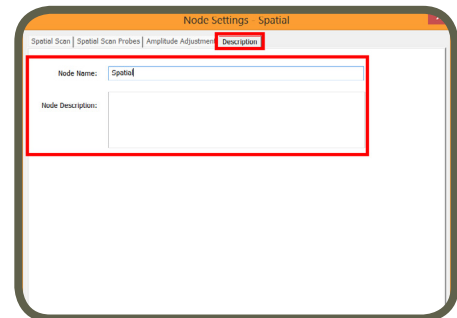
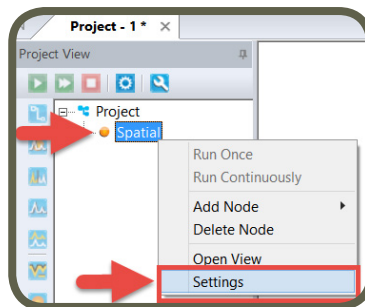
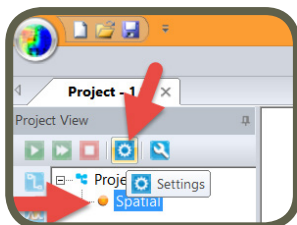
How to Add a Node?

To add a node either right click on the Project node, click on Add Node and then select one of the scans, or click on one of the icons on the side bar on the left of the Project node.



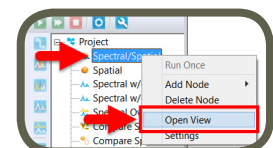
How to Name a Node?

To name a node open the Settings of the node and click on the "Description" tab. When you add a node for the first time, the Settings window opens automatically. If you want to rename a node after you add the node, either right click on the node and select Settings or select the node and then click the Settings button on the task bar.



How to View a Node?

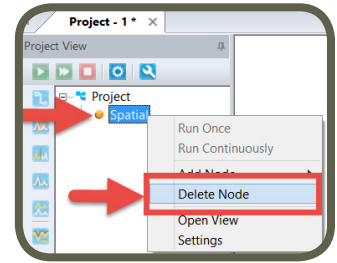
Double click on the node that you want to view or right click and select Open View.



How to Delete a Node?

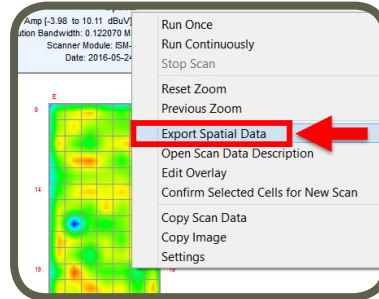
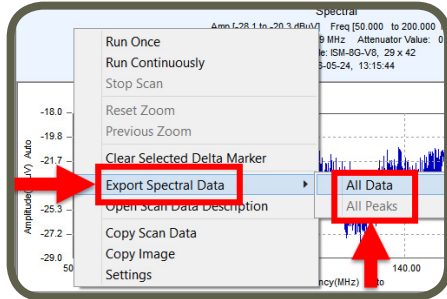
Double click on the node that you want to view.

Right click on the node that you want to delete and then select "Delete Node".




How to Export Data?

You can export any data in .txt format. To export data right click on the scan image, and select Export Spectral Data (then select All Data or Peaks) or Export Spatial Data.



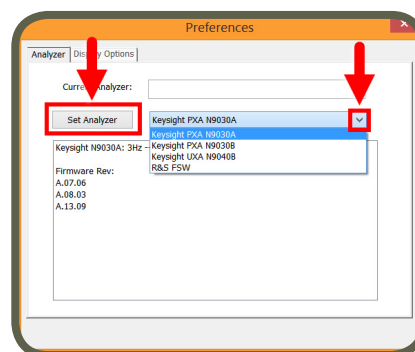
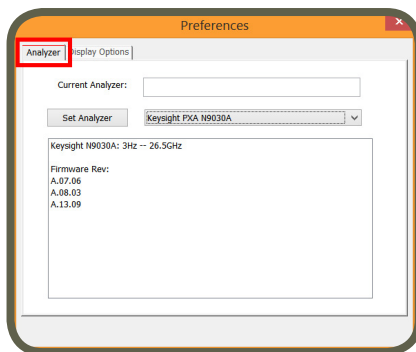
Preferences: Analyzer and Display Options

Preferences present the options for the user's selection of the Spectrum Analyzer, Display Options and Probe Compensation. To access Preferences click on . There are two tabs: Analyzer and Display Options.

Analyzer Tab

The Analyzer Tab lists models and firmware versions of the supported spectrum analyzers.

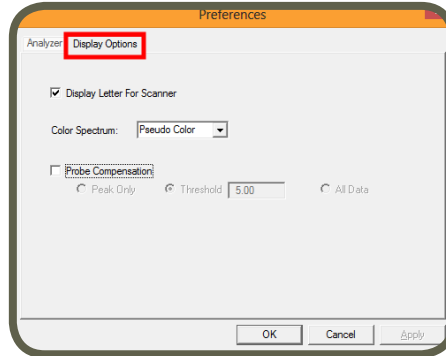
Although the EMxpert software detects the spectrum analyzer automatically, you can override it by manually selecting the spectrum analyzer from the drop down menu.



If you connect a different spectrum analyzer after the EMxpert software is launched, EMxpert software will not recognize the connection. EMxpert software must be relaunched to establish the connection between the spectrum analyzer and the PC.

Display Options Tab

Letters/Numbers: EMxpert recent scanner's columns are indicated by letters and all prior models' columns are indicated by numbers. Check box Display Letter for Scanner for the software to display columns with letters to match your scanner grid format.





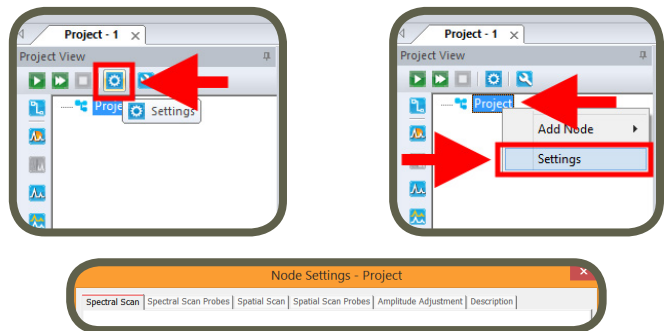
Color Spectrum: Color options for the spatial display.

Probe Compensation: This feature will take the calibration data for each of the 1218 probes and apply it to measured signals. You can select Peaks or All data. Compensation will normalize the individual probe response across the operating frequency and compensate for the antenna response and the air, switches and path losses. It is turned OFF by default as it only matters for far-field prediction and comparison with handheld or automated probe measurements.

Compensation can be quite high at some frequencies. If you select Peaks, noise peaks above the threshold are compensated while the noise floor is not, making any peak look like strong signals. If there is any doubt as to whether a compensated peak is in fact present, turn off the compensation altogether or select All data.

Project Node Settings

To select Project Node settings, either click on  in the main control bar or right click on the Project Node and then left click on Settings. Nodes will inherit the settings from the Project settings e.g. start/stop frequency, RBW, amplitude adjustment, overlay etc. To change settings of a particular scan, select the scan and click  or right click on the scan and select Settings.



The tabs in the Project Settings window are covered in the following pages.

Spectral Scan, Spectral/Spatial Scan and Handheld Probe Scan settings inherit from the Spectral Scan and Spectral Scan Probes tabs of the Node Settings.

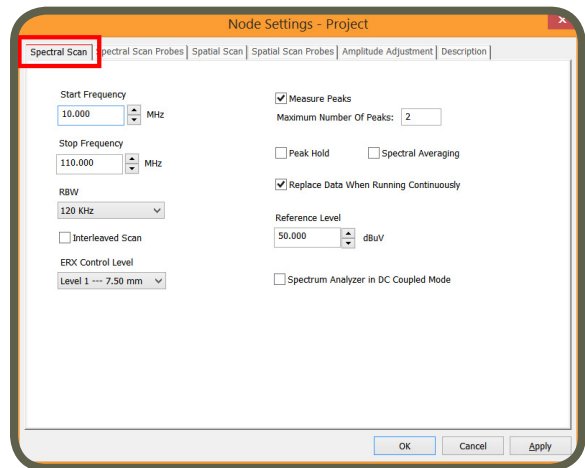
Spatial Scan inherits from Spatial Scan and Spatial Scan Probes tabs of the Node Settings.

All scan types inherit from Amplitude Adjustment tab of the Node Settings

Spectral Scan Tab

Enter *Start Frequency* and *Stop Frequency* to identify the span of the Spectral Scan to be implemented.

RBW (Resolution Bandwidth): It is set by default at 122 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.




Interleaved Scan: This mode will only work for the Spectral/Spatial scan. It has no purpose and is not functional for a Spectral Scan. This scan is meant to overcome the limitations of the probe polarizations. By measuring a DUT twice with a small physical shift between the two scans this blind spot can be eliminated (please refer to [page 59](#)).


ERX Control Level: is not functional for spectral scan but is functional for a Spectral/Spatial scan order to select the resolution of the spatial scan.

Measure Peaks: It activates the peak marking feature whereby peaks are rescanned at a tighter bandwidth in order to accurately measure the frequency and then marked as long as the peak's value is 5 dB above the average noise floor of the scan. By default the number of peaks is set to 2. The maximum number peaks that can be measured is 30.

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.

Spectral Averaging: In the Run Continuously mode, the Spectral Scan is constantly updated with the average between the new measurement and the average of the previous measurements. It is a very important feature to help you identify the more persistent noise that could affect pre-compliance.

Replace Data When Running Continuously: If you Scan Continuously  when this option is checked, EMxpert software replaces the previous scan data and keeps the last scan data. In order to keep all scan data, uncheck this option.

Spectrum Analyzer in 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. 

Spectral Scan Probes Tab

Select and activate the probes under the DUT. You can activate the probes by either a left click on individual cells or by left clicking and dragging the mouse and choosing Select Cells; or clicking on Select All to activate all of the probes. Green indicates the activated probes.

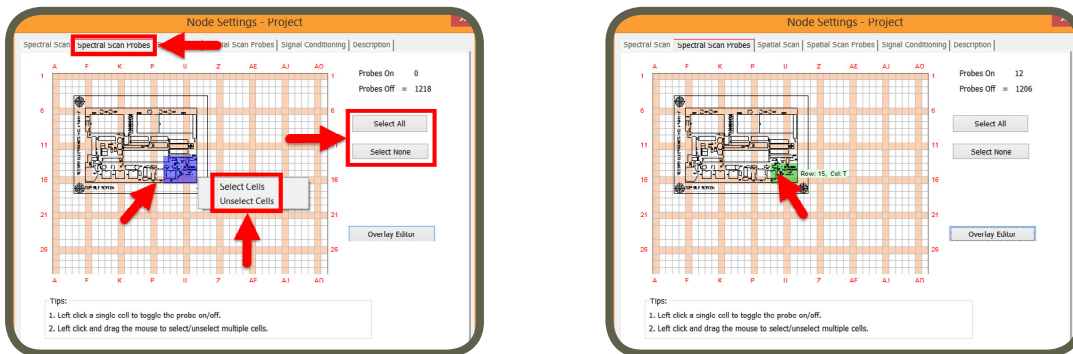
Note:

Importing design file or the picture of the DUT is highly recommended. Please refer to [Overlay Editor](#) section.

You can deactivate the probes; either left click on already selected cells or by left clicking and dragging the mouse and choosing Unselect Cells; or by clicking on Select None to deactivate all of the probes.

When you mouse over the grid, row and column coordinates are displayed.

Using the wheel of the mouse will adjust the transparency of the JPG file to help set the probes.




By limiting the scan area, you reduce the scan time. In the case of Spectral Scan, ensure to at least have 20% to 30% of the probes selected.

Overlay Editor (How to Superimpose Graphical Image of a DUT)

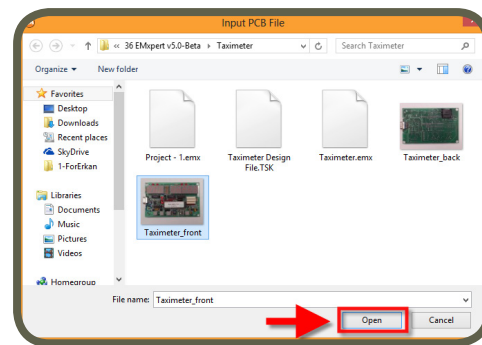
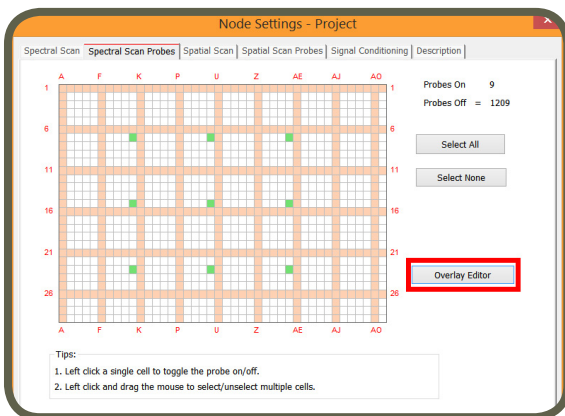
Overlay Editor superimposes the graphical image of the device under test (DUT) onto Spectral Scan Probes to guide you in activating the probes.

EMxpert software supports three file formats: JPG, HPGL and Gerber RS-274x. Design files (HPGL and Gerber RS-274x) are imported at actual size. Once you import the design file, you can rotate or mirror it, and/or drag it to a desired position. JPG needs to be rotated and mirrored outside the EMxpert application to match the actual DUT size and orientation; it can be resized inside the Overlay Editor.

Note:
 HPGL2 files can not be directly imported into EMxpert software. Please contact [EMSCAN](#) for conversion instructions.

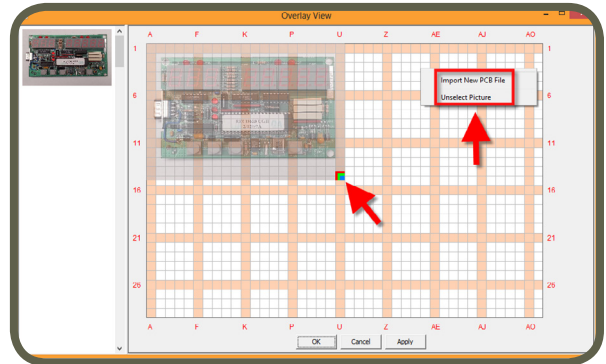
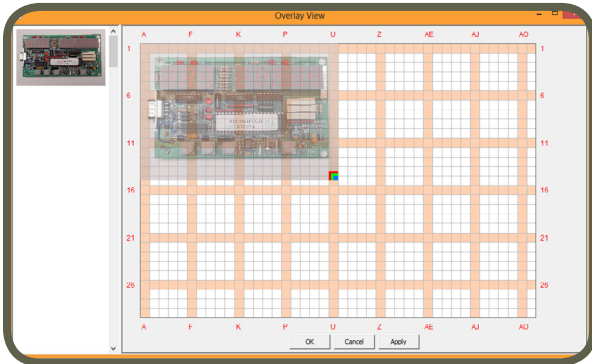
All scan types will inherit the overlay imported in this step. To change overlay for a particular scan, select the scan and click  or right click on the scan and select Settings.

To import an overlay file, click Overlay Editor, select design file or JPG and click open.



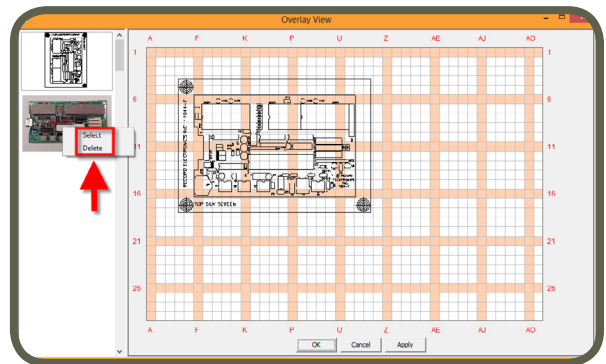
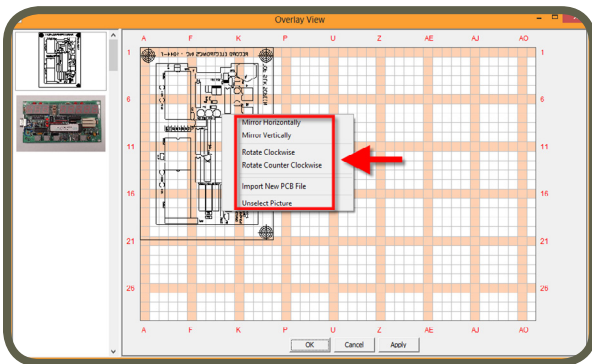
EMxpert Software Nodes

Once the file is imported, a window as shown below will open. You need to position the image to match the actual DUT position on the EMSCAN's patented scanner. Precise positioning of Gerber or picture is done with Arrow keys. You can resize the JPG file by left clicking and dragging the bottom right corner of the image (red/green/blue colored corner). Precise resizing of pictures is also possible with Ctrl+Arrow keys. To import a new PCB file or to remove the image file on the grid view, right click anywhere on the grid view and select from the menu. Using the wheel of the mouse will adjust the transparency of the JPG file to help set the probes.



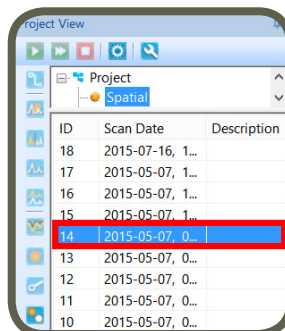
Once you select to import new PCB file, it replaces the previous image on the grid. To match a design file (HPGL and Gerber RS-274x) to the real DUT as positioned on the EMSCAN's patented scanner, right click on the image and select from the menu.

Thumbnail view of the files are listed on the left hand column. Right click on any image to Select to view it on the grid view or to Delete it from the thumbnail view.

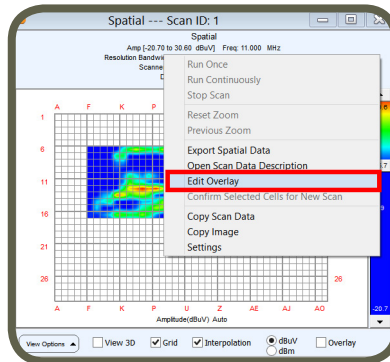


How to Import Overlay After a Scan (Spatial or Spectral/Spatial or Handheld Probe Scan)

To add an overlay after a scan, open the scan view by left clicking on any scan.



Then right click on the Spatial Scan window and select Edit Overlay which takes you directly to the original Edit Overlay setting. You can change the overlay to see if a new Gerber for example is a better match for the emissions. To import an overlay in the Overlay Editor view follow the steps on [page 31](#).

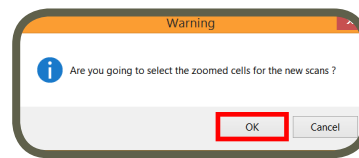
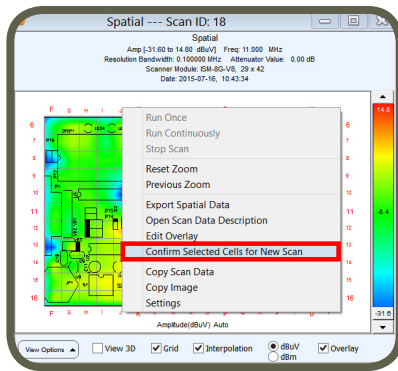


Note: If there are multiple scans, overlay must be imported for each scan separately.

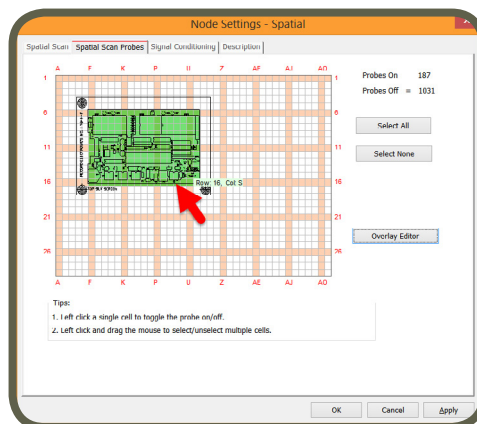
Spatial Scan Zooming Feature for ERX

The zooming function enables the user to start a new Spatial Scan with a new settings for only the zoomed in cells. This is very practical to select the area of interest for a high resolution scan without having to remember the row and column of the area of interest if the user was using the traditional Settings function.

Zoom in the Spatial Scan view and right click on the Spatial Scan window and select Confirm Selected Cells for New Scan and click Yes.



Spatial Scan node settings window will open for further setting adjustments.



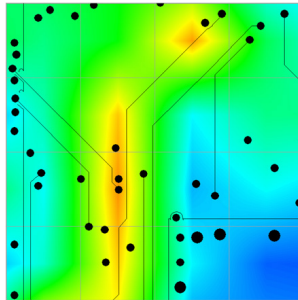
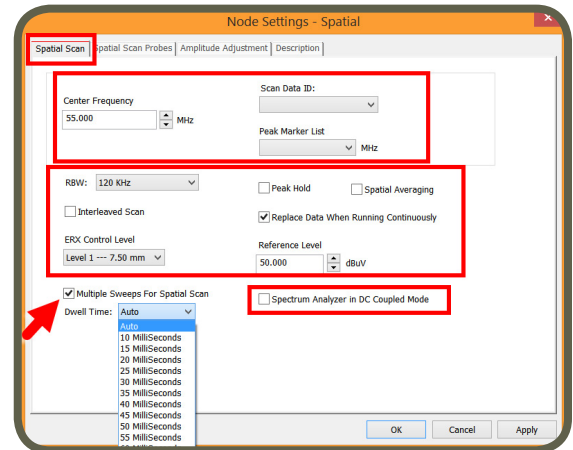
Spatial Scan Tab

Enter *Center Frequency* manually

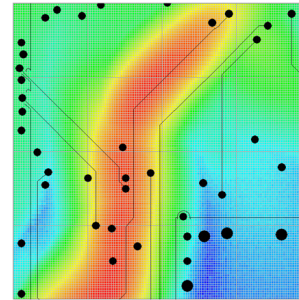
RBW (Resolution Bandwidth): It is set by default at 122 kHz and can be reduced to the lowest level allowed by the spectrum analyzer. Decreasing the bandwidth will increase the sensitivity; the scan will however take more time to complete.

Interleaved Scan: It has no purpose and is not functional for a Spectral Scan. This scan is meant to overcome the limitations of the probe polarizations. By measuring a DUT twice with a small physical shift between the two scans this blind spot can be eliminated (please refer to [page 59](#)).

ERX Control Level: Select resolution level from 7.50 mm or Level 1 to 0.06 mm or Level 8.



Physical 7.50 mm With Interpolation



Effective 0.12 mm No Interpolation


Multiple Sweeps for Spatial Scans: A standard spatial scan, using the gated Sweep mode of the spectrum analyzer operates by successively sampling the output from each selected cell in the scanner. If an intermittent signal is being measured then a single sample could easily miss the signal. The Multiple Sweeps for Spatial Scans option will force the scanner to stay longer at one location and sample multiple times with the output the maximum value of all the sweeps. The user selects how long each measurement has to be. The Spatial Scan defaults automatically to the Multiple Sweeps when 16 or less probes have been selected or when RBW is below 1 kHz; because in both cases such Multiple Sweeps scan is faster than the Gated Sweep scan.

Scan Data ID: Each spectral scan is indexed automatically and by selecting the ID of a scan you get the Peak Marker List automatically populated with the marked peaks.

Peak Marker List: This is the list of frequencies that were detected as being possible peaks in the parent spectral scan. If the frequency was peak marked it will show up in the list with an '—X' after it. If it was a peak that was not peak marked it will not have the '—X' after it but it will still show up in this list.

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

Spatial Averaging: In the Run Continuously mode, the Spatial Scan is constantly updated with the average between the new measurement and the average of the previous measurements. It is a very important feature to help you identify the more persistent noise that could affect pre-compliance.

Replace Data When Running Continuously: If you Scan Continuously  when this option is checked, EMxpert software replaces the previous scan data and keeps the last scan data. In order to keep all scan data, uncheck this option.

Spatial Scan Probes Tab

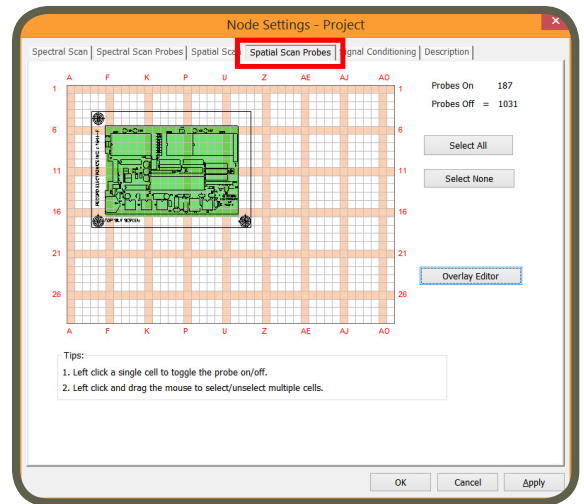
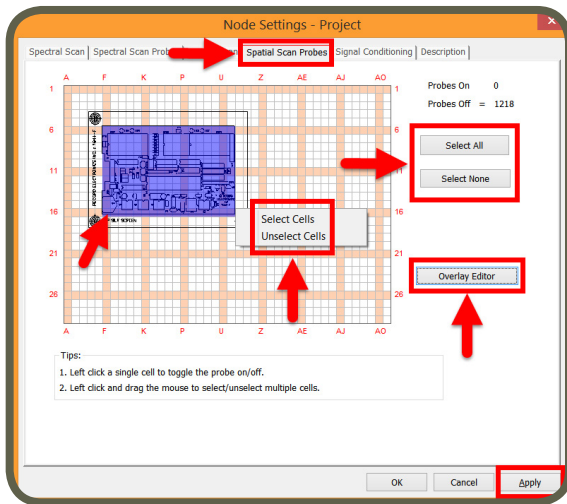
Select and activate the probes under the DUT. You can activate the probes by either a left click on individual cells or by left clicking and dragging the mouse and choosing Select Cells; or clicking on Select All to activate all of the probes. Green indicates the activated probes.

You can deactivate the probes; either left click on already selected cells or by left clicking and dragging the mouse and choosing Unselect Cells; or by clicking on Select None to deactivate all of the probes.

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

When you mouse over the grid, row and column coordinates are displayed.

Using the wheel of the mouse will adjust the transparency of the JPG file to help set the probes.



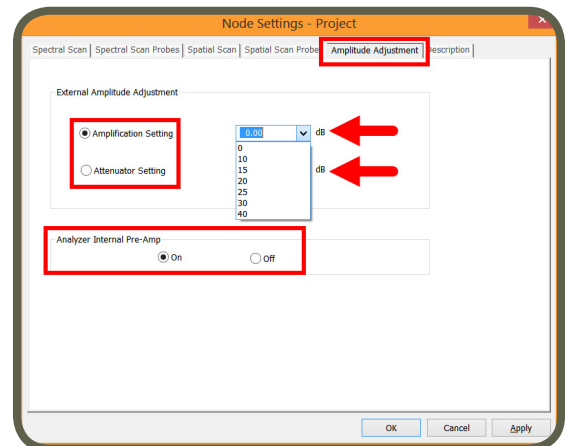
It is important to activate all of the probes under the DUT to have a complete view of the emissions on the DUT at Level 1; once the specific source of emissions needs further analysis at higher resolution only select the cells underneath the are of interest.

Overlay Editor

Please refer to [page 31](#).

Amplitude Adjustment Tab

You can use an LNA or attenuator with EMxpert to increase or decrease the power level of the signals coming from the scanner and going to the spectrum analyzer. To activate, click on Amplification Setting or Attenuator Setting and then select the value from the drop down menu or type the value. The displayed value of the signal will be corrected for the value of the gain or attenuation.

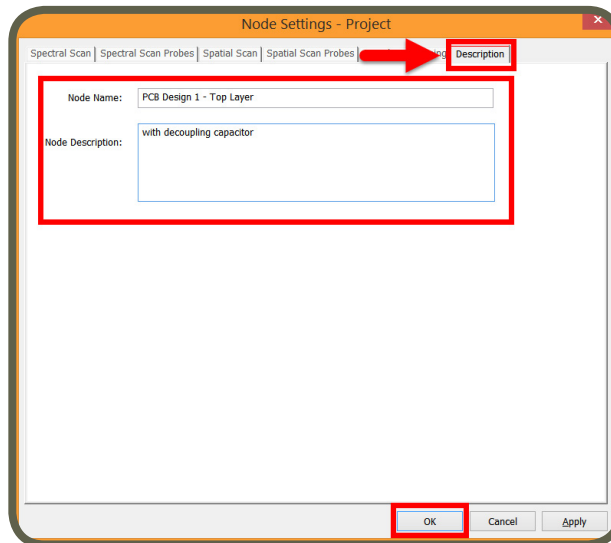


EMxpert Software Nodes

Internal Analyzer Pre-Amp: This feature provides extra sensitivity. It is ON by default. Turn this feature OFF if your spectrum analyzer is not equipped with a Pre-Amp.

Description Tab

You can name the node and add a description.

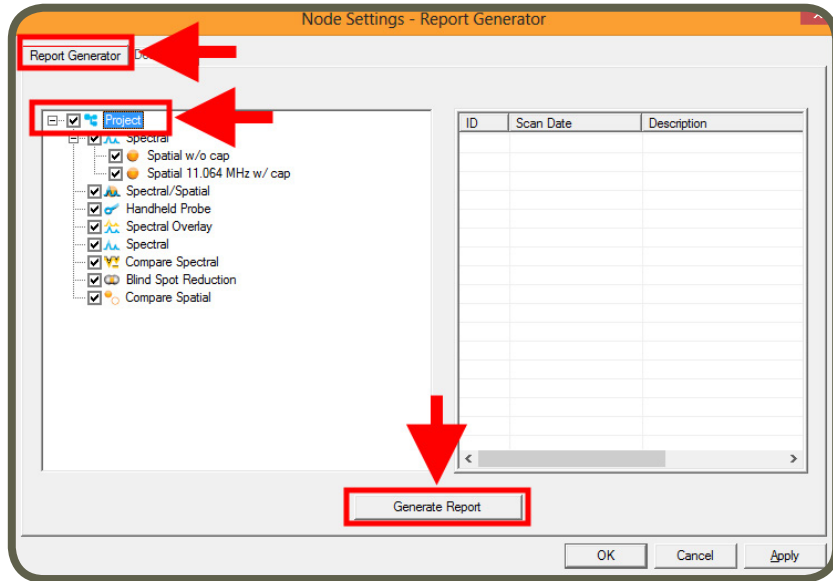


Report Generator

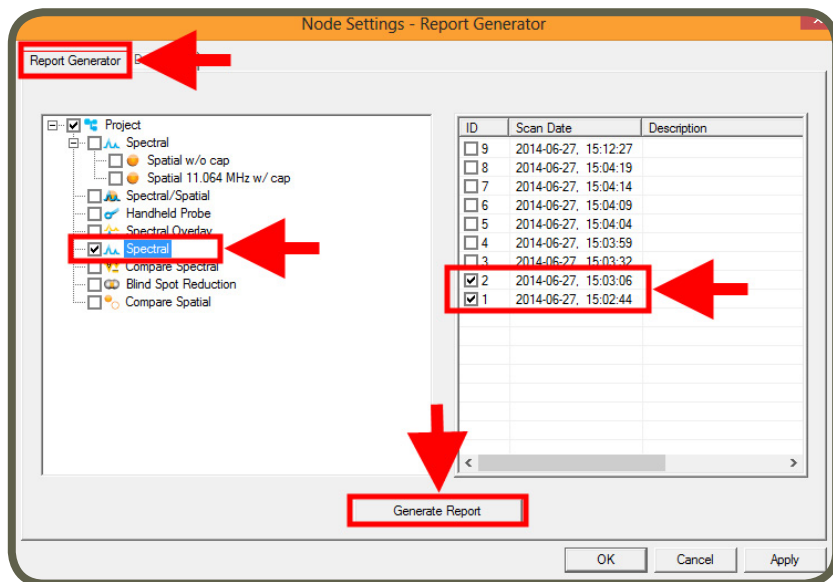
The Report Generator Node allows the user to generate standard scan reports by exporting the scans into Microsoft Office Word for Windows report template.

Report generator needs Microsoft Office Word.

To create a report, add Report Generator node to any node (please refer to [page 27](#)). Node settings window automatically opens. Click on the box next to Project to be able to subsequently select any of the node data to export by clicking on each node and scan ID. Or simply click on the one scan you wish by first checking the box on the node and then selecting the the Scan ID you wish to see in the report.



You can select any particular scan and any particular data of that scan to generate the report.



Scan Types

There are four scan types:

- **Spectral Scan:** measures and displays the maximum amplitude vs. frequency of the magnetic field strength over the scanned area.
- **Spatial Scan:** measures the magnetic field of radiated electromagnetic emissions from the DUT at a single frequency as a function of position. It can be a single scan or interleaved scan. *Interleaved Scan* is meant to overcome the limitations of the probe polarizations. By measuring a DUT twice with a small physical shift between the two scans this blind spot can be eliminated.
- **Spectral / Spatial Scan:** measures the magnetic field strength of radiated electromagnetic emissions from an object as a function of both frequency and position on the PCB. It collects a series of Spatial Scans over the entire frequency range of interest as opposed to a Spatial Scan (which gathers data at single frequency) or a Spectral Scan (which saves only the composite maximum data set over the scan area).
- **Handheld Probe Scan:** The ERX allows use of a hand-held probe to achieve finer resolution. Handheld Probe Scan provides a method to easily collect and display data from sensors other than the ERX scanner. It is compatible with any sensor that the user wishes to use and that can be connected to a supported spectrum analyzer. You can carefully synchronize the positioning of the probe with the manual triggering and create high resolution spatial plots of the DUT.

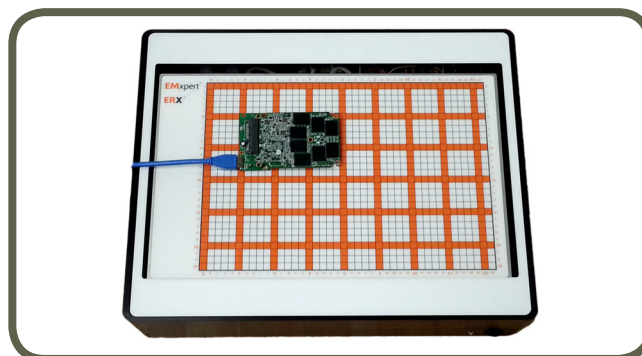
There are four methods to further analyze the scanned data:

- **Spectral Overlay:** is a qualitative comparison of two frequency spectra. It superimposes one frequency spectrum over another.
- **Compare Spectral:** is a quantitative comparison between two frequency spectra. It is generated by subtracting the values of one spectrum from the values of the second spectrum at each frequency.
- **Interleaved Scan:** is meant to overcome the limitations of the probe polarizations. By measuring a DUT twice with a small physical shift between the two scans blind spots can be eliminated.
- **Compare Spatial:** is a quantitative comparison between two Spatial Scans that is generated by subtracting the values of the first scan from the values of the second scan cell by cell.

To run a scan:

1. Place the PCB or other device under test (DUT) on the patented scanner
2. Select the scan type on EMxpert software
3. Run the scan

Power up the PCB or DUT and place it on the scanner aligning as closely as possible to the vertical and horizontal guidelines. Lining up with the squares assists you when importing overlays.



Placing PCB on EMSCAN's patented scanner


Spectral Scan

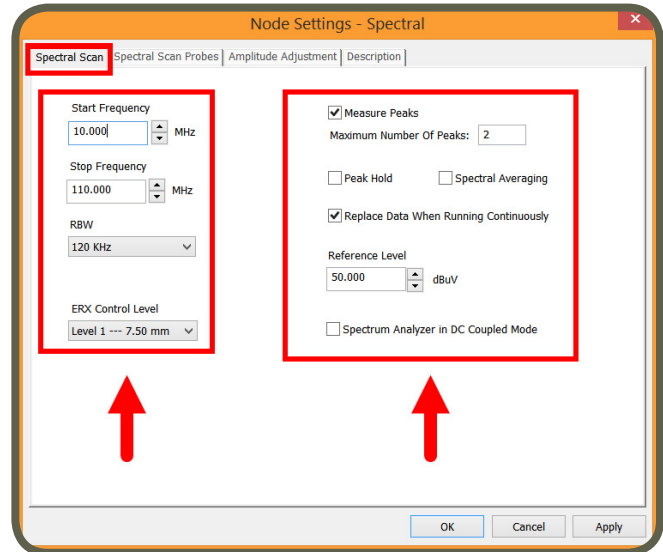
Spectral Scan measures and displays the maximum amplitude vs. frequency of the magnetic field strength over the scanned area.

Add Spectral Scan node to Project node (please refer to [page 27](#)). Node settings window automatically opens.

Spectral Scan inherits the setting parameters that were selected in the settings of the Project node (please refer to [page 31](#)). You can override any of the inherited setting parameters by modifying the tabs in the Spectral Scan settings window. The tabs in the Spectral Scan Settings window are covered in the following pages.

Spectral Scan Tab

1. Enter *Start Frequency* and *Stop Frequency* to identify the span of the Spectral Scan to be implemented.
2. *RBW (Resolution Bandwidth)*: It is set by default at 122 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.
3. *Measure Peaks*: It activates the peak marking feature whereby peaks are rescanned at a tighter bandwidth in order to accurately measure the frequency and then marked as long as the peak's value is 5 dB above the average noise floor of the scan. By default the number of peaks is set to 2. The maximum number peaks that can be measured is 30.
4. *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.
5. *Spectral Averaging*: In the Run Continuously mode, the Spectral Scan is constantly updated with the average between the new measurement and the average of the previous measurements. It is a very important feature to help you identify the more persistent noise that could affect pre-compliance.
6. *Replace Data When Running Continuously*: If you Scan Continuously  when this option is checked, EMxpert software replaces the previous scan data and keeps the last scan data. In order to keep all scan data, uncheck this option.
7. Click Apply



Spectral Scan Probes Tab

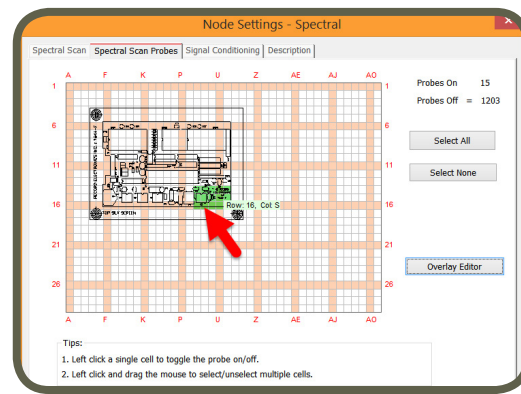
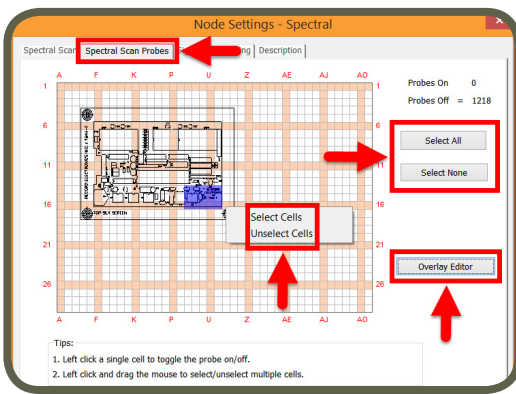
Select and activate the probes under the DUT. You can activate the probes by either a left click on individual cells or by left clicking and dragging the mouse and choosing Select Cells; or clicking on Select All to activate all of the probes. Green indicates the activated probes.

You can deactivate the probes; either left click on already selected cells or by left clicking and dragging the mouse and choosing Unselect Cells; or by clicking on Select None to deactivate all of the probes.

When you mouse over the grid, row and column coordinates are displayed.

Using the wheel of the mouse will adjust the transparency of the JPG file to help set the probes.

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



By limiting the scan area, you reduce the scan time. In the case of Spectral Scans, ensure to at least have 20% to 30% of the probes selected.

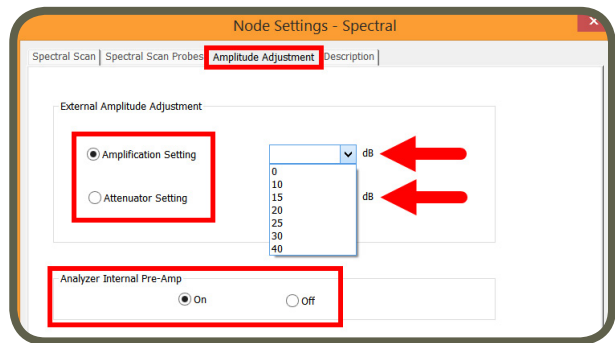
Overlay Editor

Please refer to [page 31](#).

Amplitude Adjustment Tab

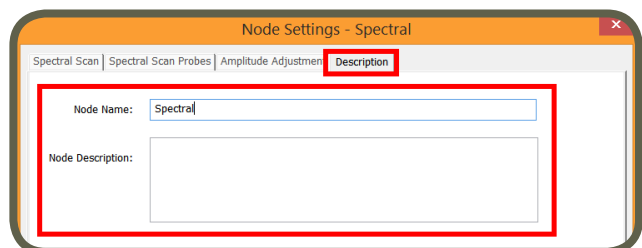
You can use an LNA or attenuator with EMxpert to increase or decrease the power level of the signals coming from the scanner and going to the spectrum analyzer. To activate, click on Amplification Setting or Attenuator Setting and then select the value from the drop down menu or type the value. The displayed value of the signal will be corrected for the value of the gain or attenuation.

Internal Pre-Amp: This feature provides extra sensitivity. It is ON by default. Turn this feature OFF if your spectrum analyzer is not equipped with a Pre-Amp.





Description Tab

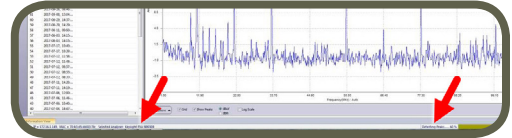
You can name the node and add a description. Click OK.



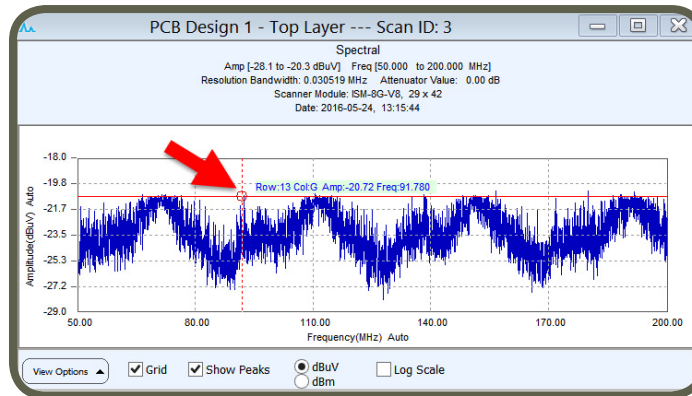
EMxpert Software Spectral Scan


To run the scan once click  or to run the scan continuously click .

The progress bar on the lower right of the screen will indicate the progress of the scan. The system will take a few more seconds for marking peaks (EMxpert rescans at a smaller span around the entire major peaks to more accurately identify the peaks and mark them with a blue circle. This is done to overcome the 1% to 2% of span spectrum analyzer error and to verify the existence of the peaks).




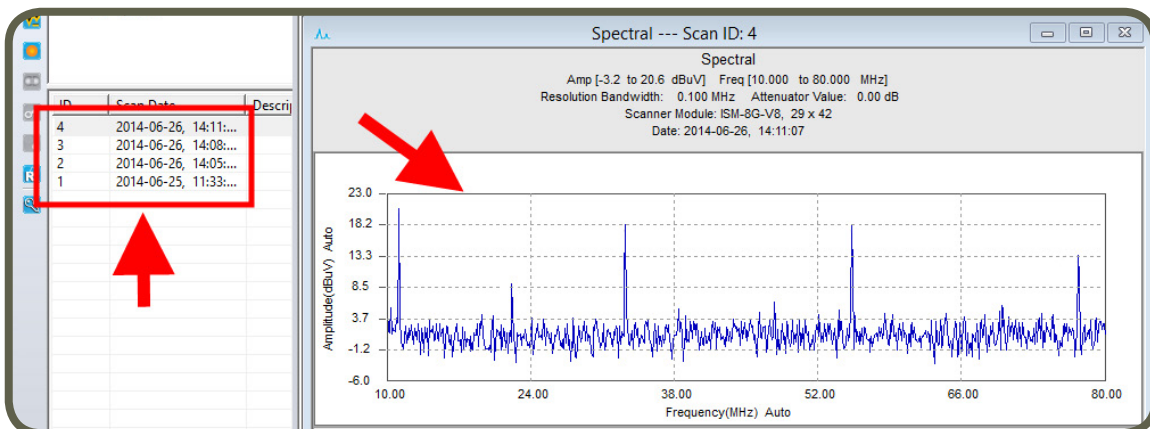
Once the scan is completed, an image of the scan will be displayed. You can mouse over the graph to see coordinates, frequency and amplitude data.



When running the scan continuously , if *Replace Data When Running Continuously* in the Spectral Scan settings is selected ([page 40](#)), the EMxpert software replaces the previous scan data and keeps the last scan data. You will only see the last scan data and display the spectral graph of this data.

ID	Scan Date	Descriptio
1	2013-12-04 09:22:53	

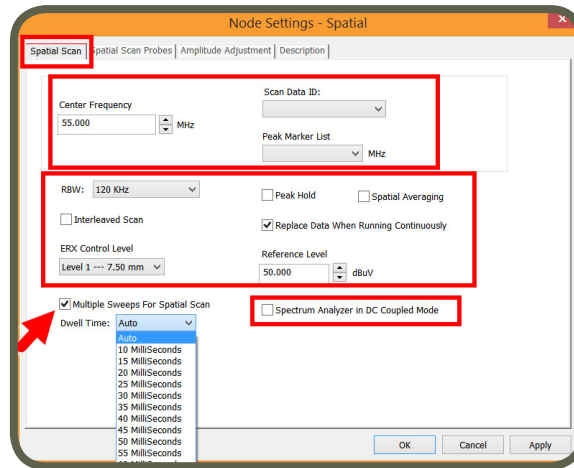
In order to keep all scan data when running the scan continuously , uncheck *Replace Data When Running Continuously* in the Spectral Scan settings ([page 40](#)). You can display spectral graphs of all the scan data. Simply click on the scan and the graph will immediately update.



Spatial Scan

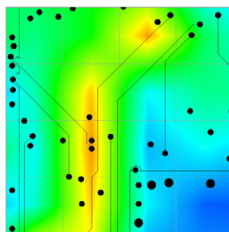
A Spatial Scan measures the magnetic field of radiated electromagnetic emissions from the DUT at a single frequency as a function of position.

Add Spatial Scan node to Project node (please refer to [page 27](#)). Node settings window automatically opens. Spatial Scan inherits the setting parameters that were selected in the settings of the Project node (please refer to [page 35](#)). You can override any of the inherited setting parameters by modifying the tabs in the Spatial Scan settings window. The tabs in the Spatial Scan Settings window are covered in the following pages.

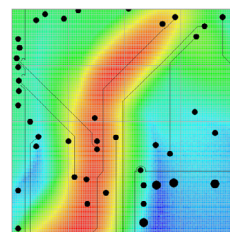


Spatial Scan Tab

1. Enter *Center Frequency* manually.
2. *RBW (Resolution Bandwidth)*: It is set by default at 122 kHz and can be reduced to the lowest level allowed by the spectrum analyzer. Decreasing the bandwidth will increase the sensitivity; the scan will however take more time to complete. *Interleaved Scan*: This scan is meant to overcome the limitations of the probe polarizations. By measuring a DUT twice with a small physical shift between the two scans, blind spots can be eliminated (please refer to [page 59](#)).
3. *ERX Control Level*: Select resolution level from 7.50 mm or Level 1 to 0.06 mm or Level 8. It is only available on the ERX and ERX+.





Physical 7.50 mm With Interpolation



Effective 0.12 mm No Interpolation

4. *Multiple Sweeps for Spatial Scans*: A standard spatial scan, using the gated Sweep mode of the spectrum analyzer operates by successively sampling the output from each selected cell in the scanner. If an intermittent signal is being measured then a single sample could easily miss the signal. The Multiple Sweeps for Spatial Scans option will force the scanner to stay longer at one location and sample multiple times with the output the maximum value of all the sweeps. The user selects how long each measurement has to be. The Spatial Scan defaults automatically to the Multiple Sweeps when 16 or less probes have been selected or when RBW is below 1 kHz; because in both cases such Multiple Sweeps scan is faster than the Gated Sweep scan.

5. **Scan Data ID:** Each spectral scan is indexed automatically and by selecting the ID of a scan you get the Peak Marker List automatically populated with the marked peaks.
6. **Peak Marker List:** This is the list of frequencies that were detected as being possible peaks in the parent spectral scan. If the frequency was peak marked it will show up in the list with an '—X' after it. If it was a peak that was not peak marked it will not have the '—X' after it but it will still show up in this list.
7. **Peak Hold:** Also known as Max-Hold this is a very important feature as it allows you to run a Spatial Scan continually replacing the peak amplitude at each location with each successive higher measurement. This is an excellent way to find the location of an intermittent signal at a single frequency.
8. **Spatial Averaging:** In the Run Continuously mode, the Spatial Scan is constantly updated with the average between the new measurement and the average of the previous measurements. It is a very important feature to help you identify the more persistent noise that could affect pre-compliance.
9. **Replace Data When Running Continuously:** If you Scan Continuously  when this option is checked, EMxpert software replaces the previous scan data and keeps the last scan data. In order to keep all scan data, uncheck this option.
10. **Spectrum Analyzer in 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. 

11. Click Apply

Spatial Scan Probes Tab

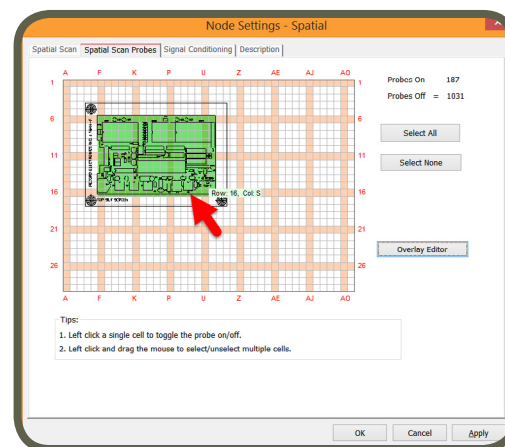
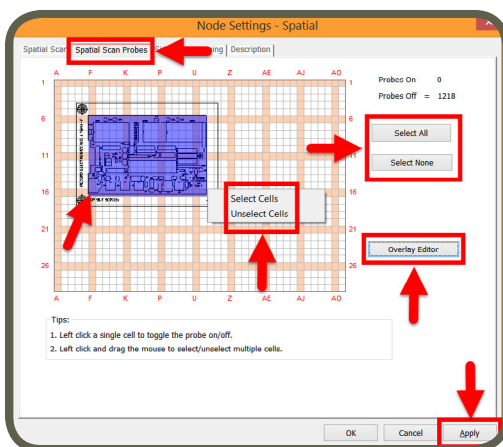
Select and activate all of the probes under the DUT. You can activate the probes by either left click on individual cells or left click and drag the mouse and choose Select Cells or click Select All to activate all of the probes. Green indicates the activated probes.

You can deactivate the probes either left click on already selected cells or left click and drag the mouse and choose Unselect Cells or click Select None to deactivate all of the probes.

When you mouse over the grid, row and column coordinates are displayed.

Using the wheel of the mouse will adjust the transparency of the JPG file to help set the probes.

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



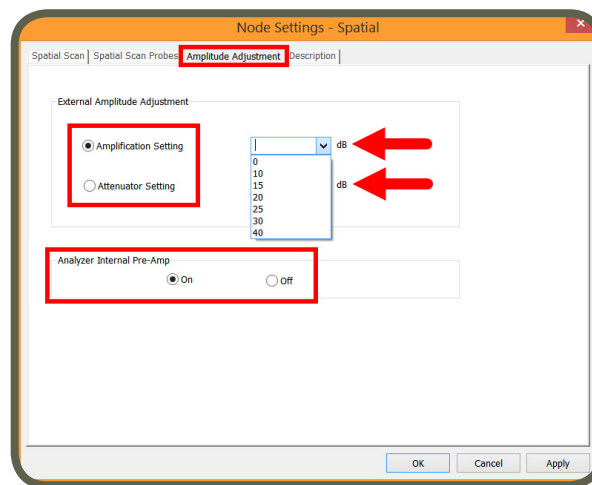
It is important to activate all of the probes under the DUT to have a complete view of the emissions on the DUT at Level 1; once the specific source of emissions needs further analysis at higher resolution only select the cells underneath the are of interest.

Overlay Editor

Please refer to [page 31](#).

Amplitude Adjustment Tab

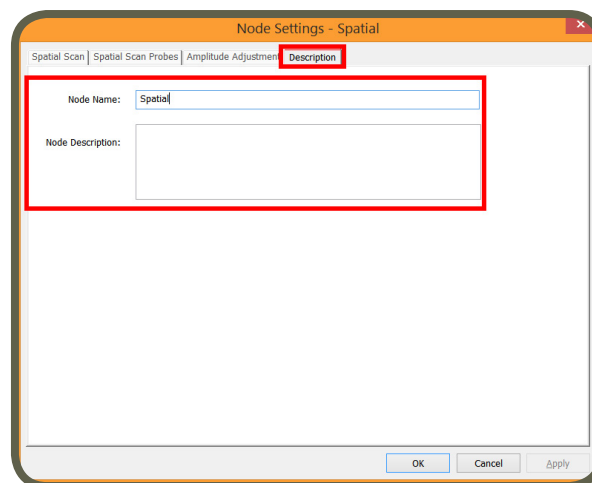
You can use an LNA or attenuator with EMxpert to increase or decrease the power level of the signals coming from the scanner and going to the spectrum analyzer. To activate, click on Amplification Setting or Attenuator Setting and then select the value from the drop down menu or type the value. The displayed value of the signal will be corrected for the value of the gain or attenuation.



Internal Pre-Amp: This feature provides extra sensitivity. It is ON by default. Turn this feature OFF if your spectrum analyzer is not equipped with a Pre-Amp.

Description Tab


You can name the node and add a description.

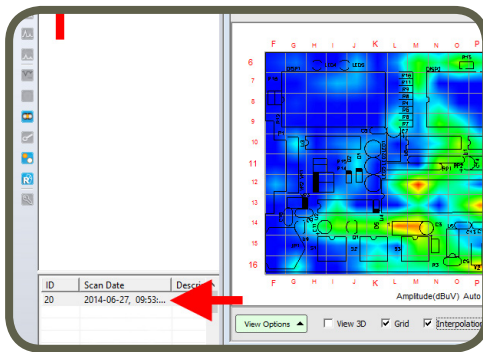
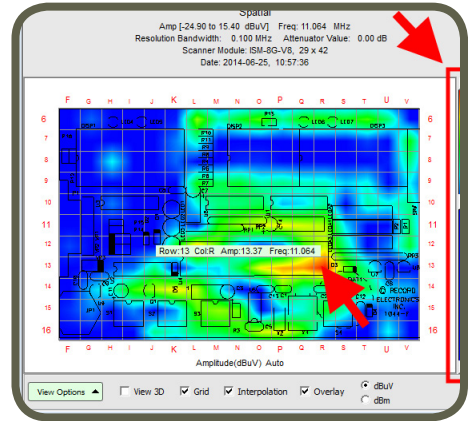


EMxpert Software Spatial Scan

To run the scan once click  or to run the scan continuously.

Once the scan is completed, an image of the scan will be displayed. You can mouse over the graph to see coordinates, frequency and amplitude data. By sliding the Set Color Threshold, you can increase or decrease the contrast to more clearly identify current loops and peak locations.

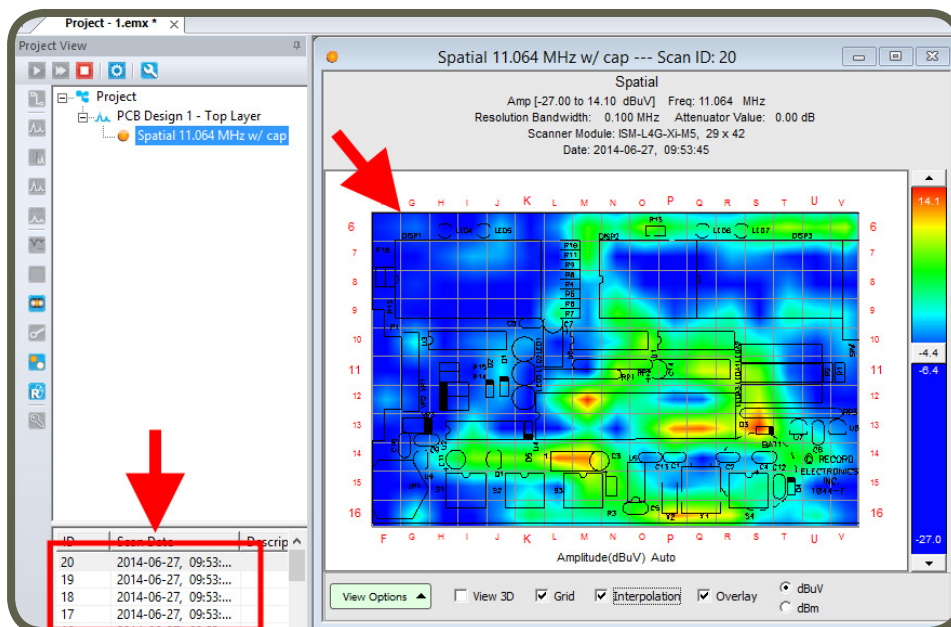
If you choose Scan Continuously  the screen will refresh as fast as possible. You can click the red stop sign in the icon bar or select Stop from the Controller Menu to stop the scan. You must stop one scan before you run any successive scans.



ID	Scan Date	Description
1	2013-12-04 10:19:01	

If *Replace Data When Running Continuously* in the Spatial Scan settings is selected ([page 43](#)), the EMxpert software replaces the previous scan data and keeps the last scan data. You will only see the last scan data and display the spectral graph of this data.

In order to keep all scan data, uncheck *Replace Data When Running Continuously* in the Spatial Scan settings. You can display spatial graphs of all the scan data. Simply click on the scan and the graph will immediately update.



Spectral/Spatial Scan

A Spectral/Spatial Scan measures the magnetic field strength of radiated electromagnetic emissions from an object as a function of both frequency and position on the PCB.

The Spectral/Spatial Scan collects a series of Spatial Scans over the entire frequency range of interest as opposed to a Spatial Scan (which gathers data at single frequency) or a Spectral Scan (which saves only the composite maximum data set over the scan area).

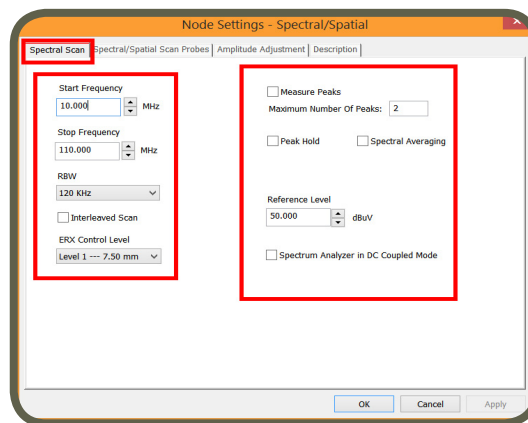
Using the viewers included in Spectral/Spatial nodes, you can:

- view spectral data on a cell or group of cells
- view spatial data at a single frequency or several different frequencies
- link together data from the two views i.e., any cell or collection of cells in a spatial view can be selected and the composite spectral can be displayed

Previously we used a Spectral Scan to detect the frequencies of interest then individual Spatial Scans to gather data about each frequency of interest. In a sweep that takes no longer than a Spectral Scan, a Spectral/Spatial Scan collects all of the frequency, amplitude and location data at the same time. This results in a large data base of information that can be manipulated. It however can only run once; it is not possible to run continuously.

Add Spectral/Spatial Scan node to Project node (please refer to [page 27](#)). Node settings window automatically opens.

Spectral/Spatial Scan inherits the setting parameters that were selected in the settings of the Project node (please refer to [page 31](#)). You can override any of the inherited setting parameters by modifying the tabs in the Spectral/Spatial Scan settings window.

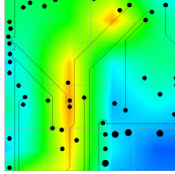


The tabs in the Spectral/Spatial Scan Settings window are covered in the following pages.

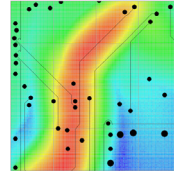
Spectral Scan Tab

1. Enter *Start Frequency* and *Stop Frequency* to identify the span of the Spectral Scan to be implemented.
2. *RBW (Resolution Bandwidth)*: It is set by default at 122 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.


3. *Interleaved Scan*: This scan is meant to overcome the limitations of the probe polarizations. By measuring a DUT twice with a small physical shift between the two scans, blind spots can be eliminated (please refer to [page 59](#)).
4. *ERX Control Level*: Select resolution level from 7.50 mm or Level 1 to 0.06 mm or Level 8 for the spatial scan.



Physical 7.50mm With Interpolation



Effective 0.12 mm No Interpolation

5. *Multiple Sweeps for Spatial Scans*: Multiple Sweeps for Spatial Scans: A standard spatial scan, using the gated Sweep mode of the spectrum analyzer operates by successively sampling the output from each selected cell in the scanner. If an intermittent signal is being measured then a single sample could easily miss the signal. The Multiple Sweeps for Spatial Scans option will force the scanner to stay longer at one location and sample multiple times with the output the maximum value of all the sweeps. The user selects how long each measurement has to be. The Spatial Scan defaults automatically to the Multiple Sweeps when 16 or less probes have been selected or when RBW is below 1 kHz; because in both case such Multiple Sweeps scan is faster than the Gated Sweep scan.
6. *Measure Peaks*: **NOT RECOMMENDED IN THIS MODE**. It activates the peak marking feature whereby peaks are re-scanned at a tighter bandwidth in order to accurately measure the frequency and then marked as long as the peak's value is 5 dB above the average noise floor of the scan. By default the number of peaks is set to 2. The maximum number peaks that can be measured is 30. 
7. *Peak Hold*: This feature is not active for Spectral/Spatial Scan.
8. *Spectral Averaging*: This feature is not active for Spectral/Spatial Scan.
9. Click Apply

Spectral/Spatial Scan Probes Tab

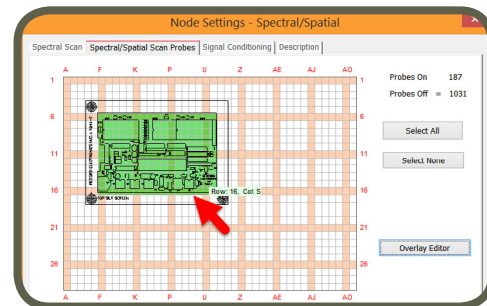
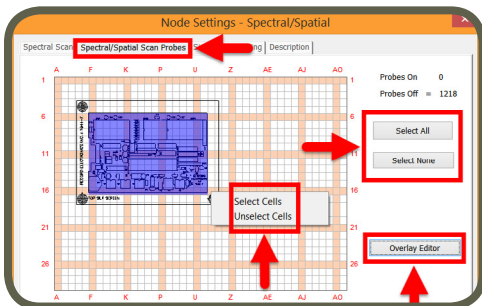
Select and activate the probes under the DUT. You can activate the probes by either a left click on individual cells or by left clicking and dragging the mouse and choosing Select Cells; or clicking on Select All to activate all of the probes. Green indicates the activated probes.

You can deactivate the probes; either left click on already selected cells or by left clicking and dragging the mouse and choosing Unselect Cells; or by clicking on Select None to deactivate all of the probes.

When you mouse over the grid, row and column coordinates are displayed.

Using the wheel of the mouse will adjust the transparency of the JPG file to help set the probes.

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



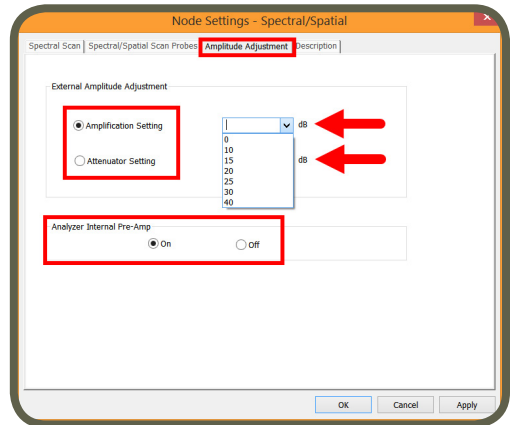
It is important to activate all of the probes under the DUT to have a complete view of the emissions from the DUT.

Overlay Editor

Please refer to [page 31](#).

Amplitude Adjustment Tab

You can use an LNA or attenuator with EMxpert to increase or decrease the power level of the signals coming from the scanner and going to the spectrum analyzer. To activate, click on Amplification Setting or Attenuator Setting and then select the value from the drop down menu or type the value. The displayed value of the signal will be corrected for the value of the gain or attenuation.

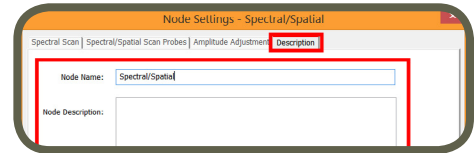


Internal Pre-Amp: This feature provides extra sensitivity. It is ON by default. Turn this feature OFF if your spectrum analyzer is not equipped with a Pre-Amp.

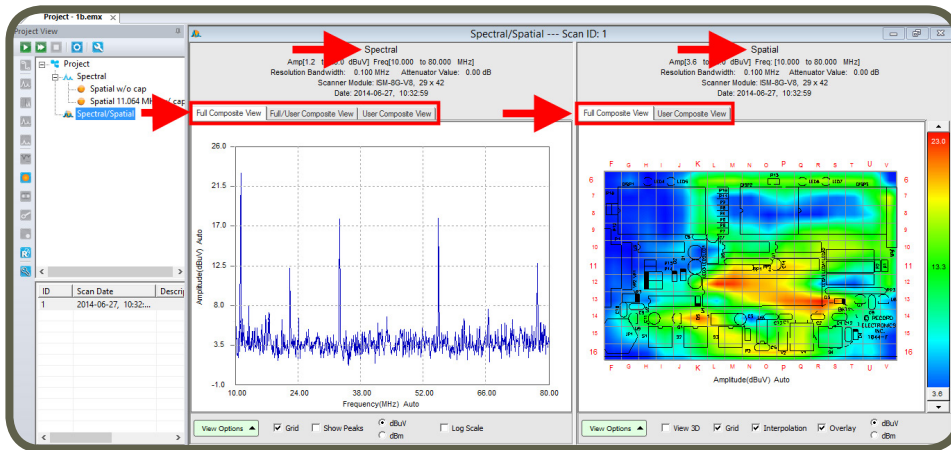
Description Tab

You can name the node and add a description.

Click OK.



To run the scan click . Once the scan is completed, a spectral view and a spatial view will be displayed. By default view tabs are set to full composite spectral and spatial views for the entire selected frequency.

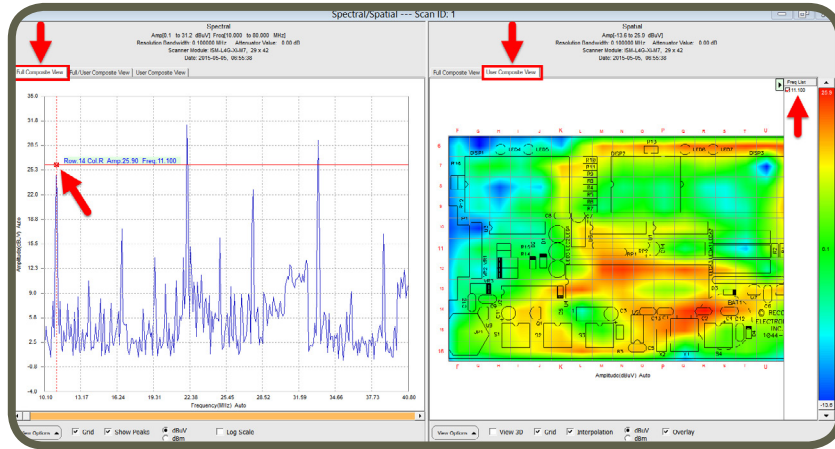


Full Composite Spectral View

Composite Spectral looks like a normal Spectral Scan; it however is gateway to the archived spatial data for each frequency. You can select single or multiple frequencies on the Composite Spectral view to analyze the location of them on the board. Select Full Composite View under spectral graph and User Composite View under spatial view.

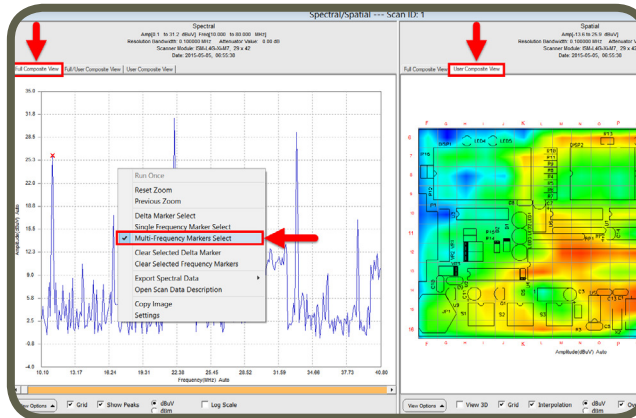
Single Frequency Marker

Single Frequency Marker is selected by default. Click on the frequency of interest on spectral graph. A red cross will indicate the selection. Spatial graph will update to display the emissions on the board at the selected frequency. Selected frequency will be displayed under Freq List (Frequency List) next to the spatial graph.

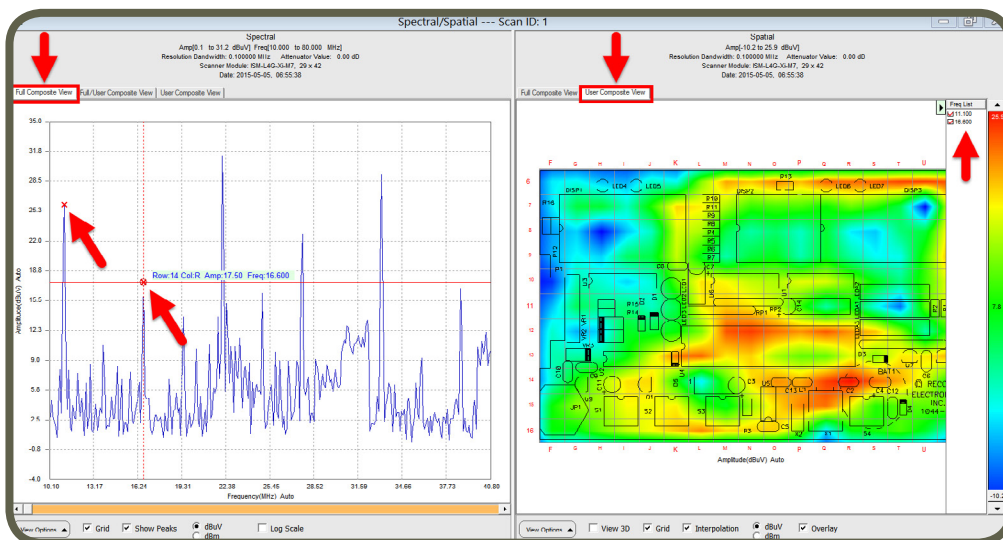


Multi Frequency Marker

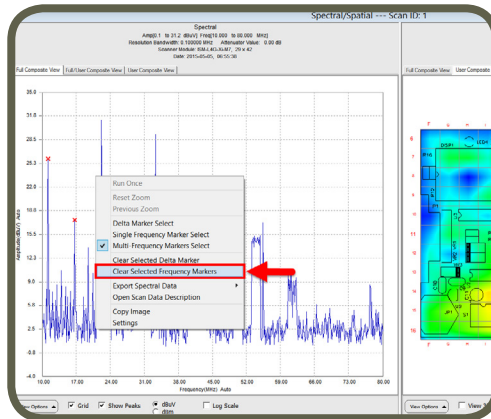
Right click on the spectral graph and select Multi Frequency Marker.



Select multiple frequencies of interest on spectral graph. A red cross will indicate the selection. Spatial graph will update to display the emissions on the board at the selected frequencies. Selected frequencies will be displayed under Freq List (Frequency List) next to the spatial graph. The amplitude and frequency displayed for each cell will be the maximum amplitude for that cell across the selected frequencies.



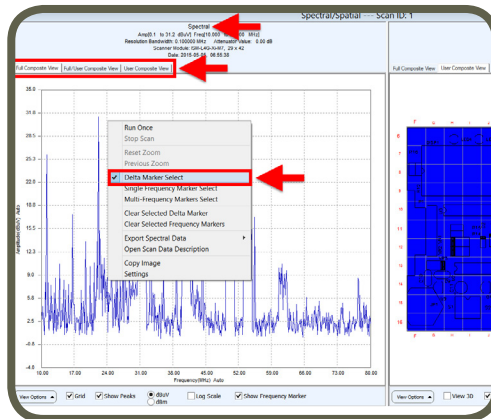
To clear frequency markers, right click on the spectral graph and select Clear Selected Frequency Marker.



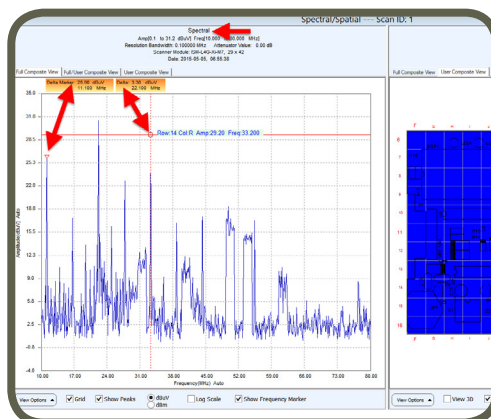
Delta Marker

It displays the amplitude and frequency difference between the current mouse position and the delta marker position in the frequency spectrum viewed.

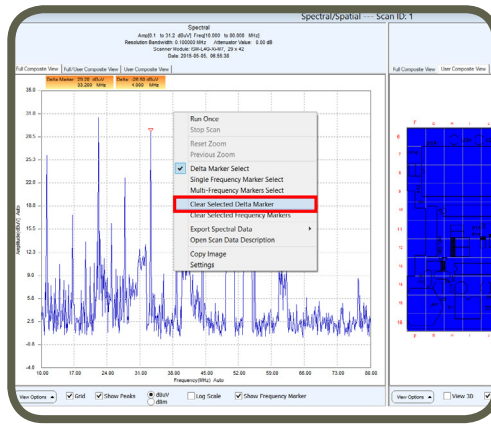
1. Select either Full Composite View or User Composite View on spectral graph
2. Right click on the spectral view
3. Select Delta Marker Select



4. Move the mouse to the desired position to measure the delta. In the example below, delta marker is set at 11.100 MHz and the mouse is moved over to 33.200 MHz. Both are displayed above the spectral graph.



5. To clear delta markers, right click on the spectral graph and select Clear Selected Delta Marker

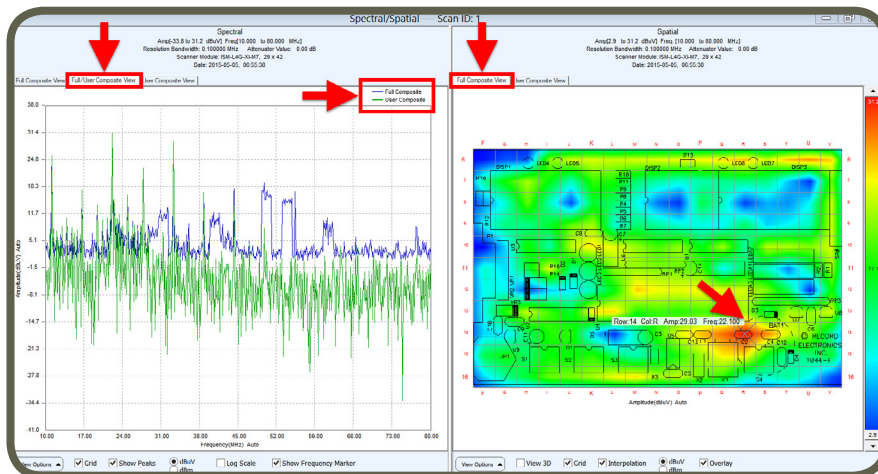


Full Composite Spatial View

Composite Spatial looks like a normal Spatial Scan; it however is a gateway to the archived spectral data for each frequency. You can select single or multiple cells on the Composite Spatial view to analyze their amplitudes and frequencies. Select Full Composite View under spatial graph and User Composite View under spectral view.

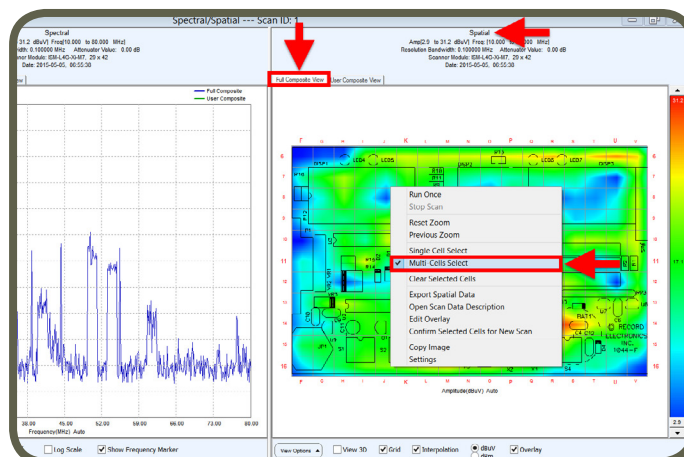
Single Frequency Marker

Single Frequency Marker is selected by default. Click on the cell of interest on spatial graph. A cross will indicate the selection. Spectral graph of the selected cell will be displayed in green on the spectral graph.

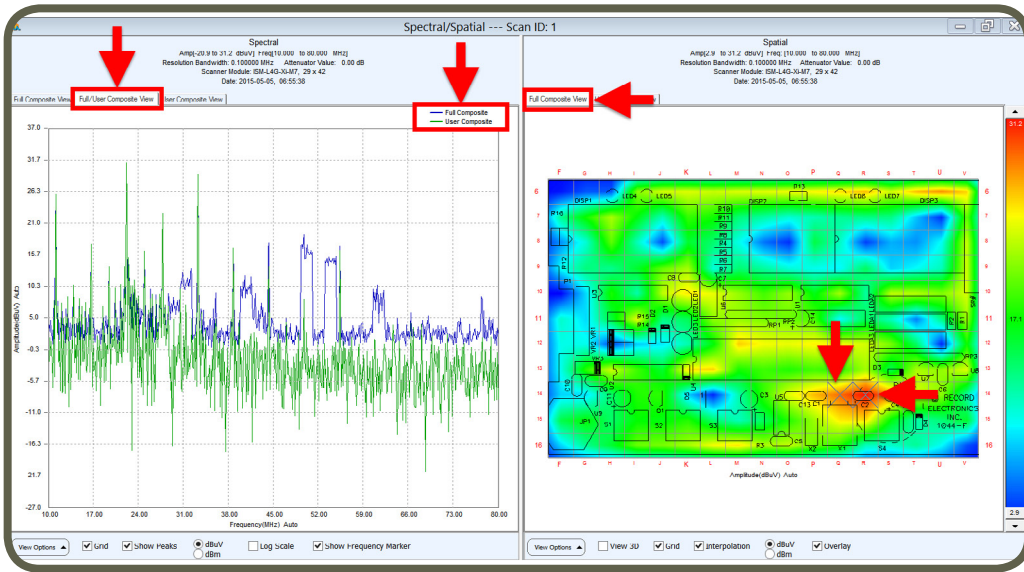


Multi Frequency Marker

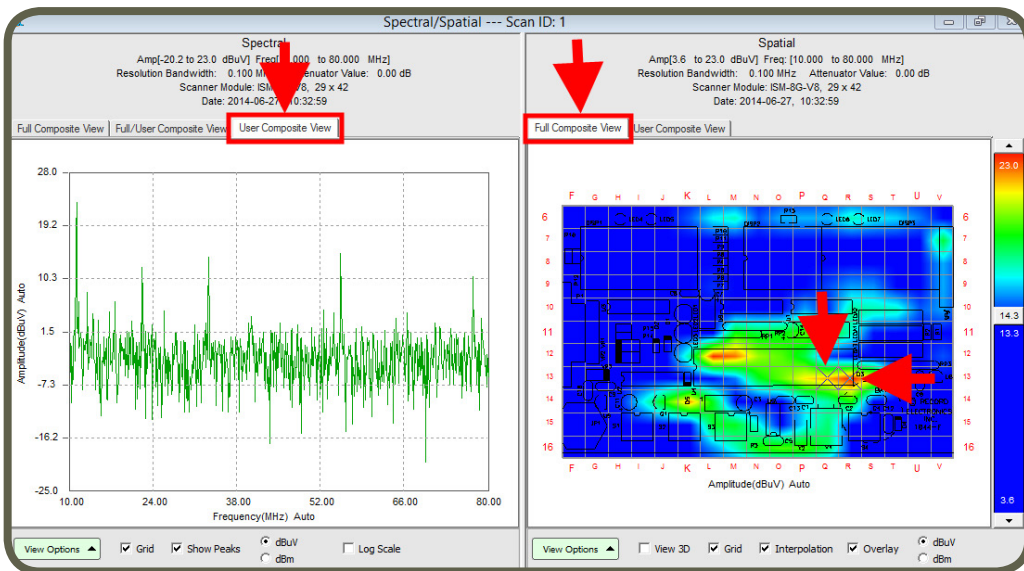
Right click on the spatial graph and select Multi-Cells Select.



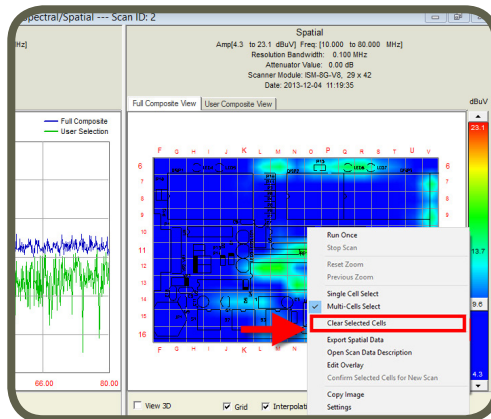
Select multiple cells of interest on spatial graph. A cross will indicate the selection. Full/User Composite View tab overlays spectral graph of user selected cells on to the full spectral graph. Spectral graph of the selected cell will be displayed in green on the spectral graph.



User Composite View tab displays the spectral graph of user selected cells.



To clear frequency markers, right click on the spatial graph and select Clear Selected Frequency Marker.



Handheld Probe Scan

The handheld probe is meant to provide the user with a method to easily collect and display data from sensors other than the EMxpert probes. EMxpert is compatible with any sensor that the user wishes to use once connected to the RF IN port.

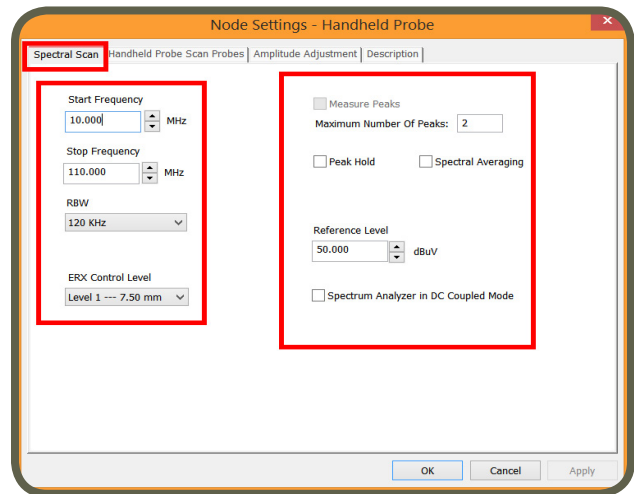
Note that the function and operation of the Handheld Probe Scan is very similar to the Spectral/Spatial Scan. We will ask the user to refer to this section for many of the advanced features of the node and only deal with the data collection and differences in this section.

Add Handheld Probe Scan node to Project node (please refer to [page 27](#)). Node settings window automatically opens.

Handheld Probe Scan inherits the setting parameters that were selected in the settings of the Project node (please refer to [page 31](#)). You can override any of the inherited setting parameters by modifying the tabs in the Handheld Probe Scan settings window. The tabs in the Handheld Scan Settings window are covered in the following pages.

Spectral Scan Tab

1. Enter *Start Frequency* and *Stop Frequency* to identify the span of the Spectral Scan to be implemented.
2. *RBW (Resolution Bandwidth)*: It is set by default at 122 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.
3. *ERX Control Level*: is not functional for spectral scan but is functional for a Spectral/Spatial scan order to select the resolution of the spatial scan.
4. *Measure Peaks*: This feature is not functional for a Handheld Probe Scan.
5. *Peak Hold*: This feature is not functional for a Handheld Probe Scan.
6. *Spectral Averaging*: This feature is not functional for a Handheld Probe Scan.
7. *Spectrum Analyzer in 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.
8. Click Apply



Handheld Probe Scan Probes Tab

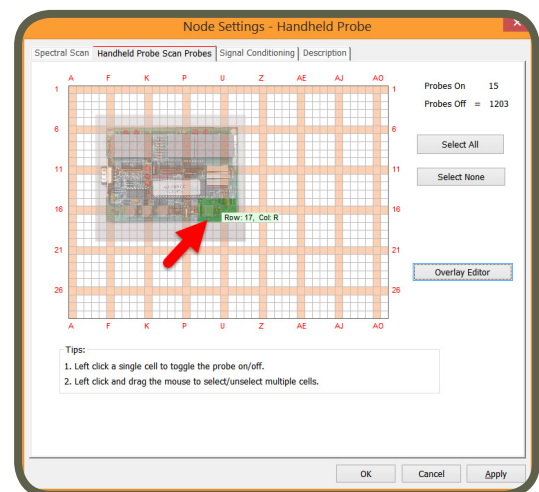
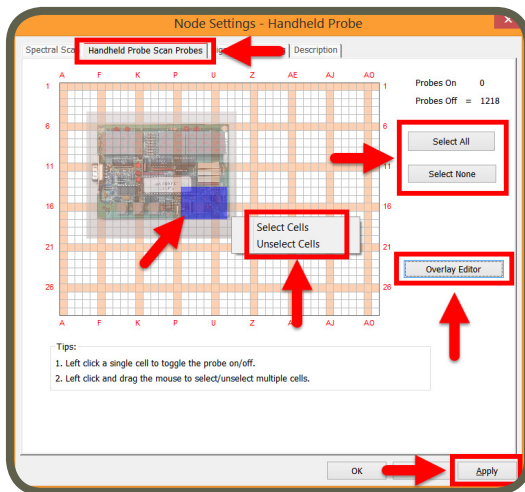
Select and activate the scan area that you want to manually measure. Note that you are not selecting probes on the EMxpert but rather an array of measurements that you will do with the handheld probe. The EMxpert software will organize the data into an equivalent array for display but this will only be as accurate as the positioning of the probe. The number of active probes is the number of manual probe measurements that you are required to complete. You can activate the probes by either left click on individual cells or left click and drag the mouse and choose Select Cells or click Select All to activate all of the probes. Green indicates the activated probes.

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

Note:
The Handheld Probe Scan node is not using the patented scanner to measure. You do not need to position the DUT on the scanner.

You can deactivate the probes either left click on already selected cells or left click and drag the mouse and choose Unselect Cells or click Select None to deactivate all of the probes.

Using the wheel of the mouse will adjust the transparency of the JPG file to help set the probes.



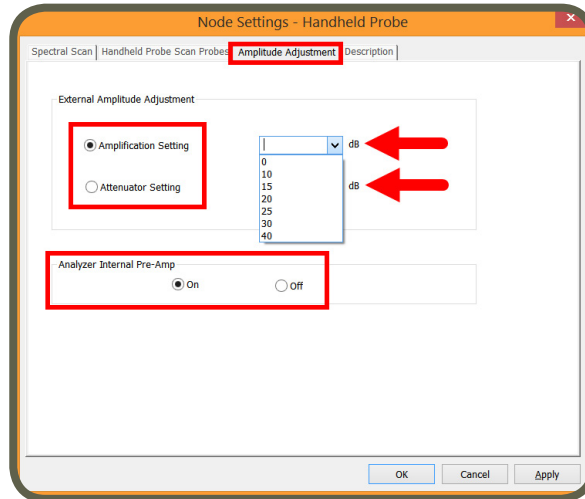
Note:
The handheld scan node will organize the measurements into the correct physical layout if the handheld probe's position is correct for each manual trigger. Please refer to [page 56](#).

Overlay Editor

Please refer to [page 31](#).

Amplitude Adjustment Tab

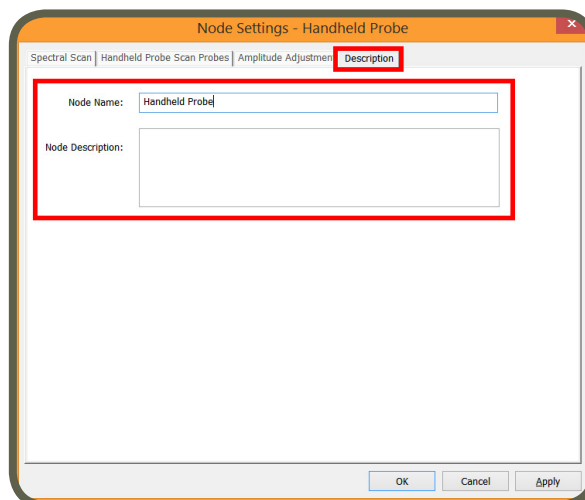
You can use an LNA or attenuator with EMxpert to increase or decrease the power level of the signals coming from the scanner and going to the spectrum analyzer. To activate, click on Amplification Setting or Attenuator Setting and then select the value from the drop down menu or type the value. The displayed value of the signal will be corrected for the value of the gain or attenuation.




Internal Pre-Amp: This feature provides extra sensitivity. It is ON by default. Turn this feature OFF if your spectrum analyzer is not equipped with a Pre-Amp.

Description Tab

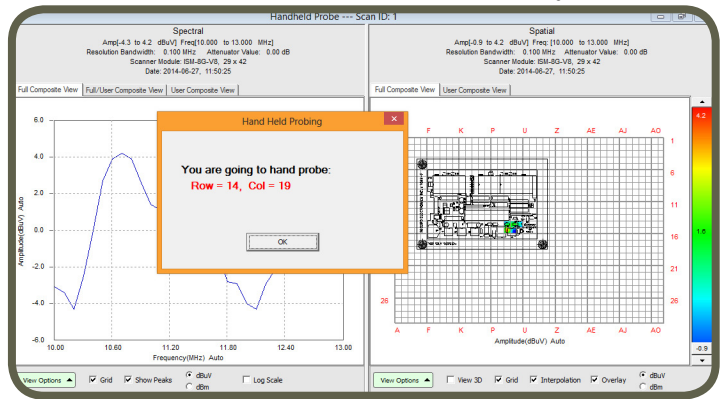
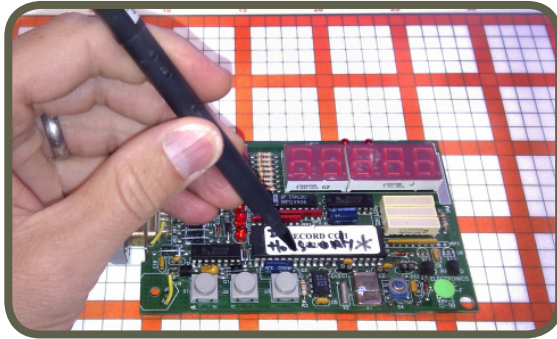
You can name the node and add a description. Click OK.



EMxpert Software Handheld Probe Scan

To run the scan close the settings and run once . Immediately upon running the scan you see a message describing where you need to position the handheld probe.



Once the probe is in place, press the space bar or click OK and wait for the spatial display to update.

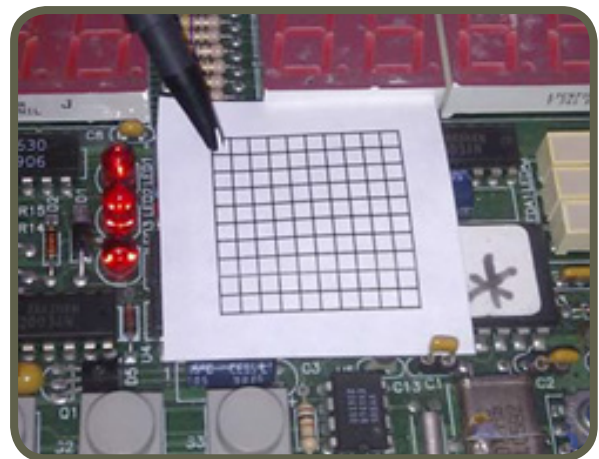
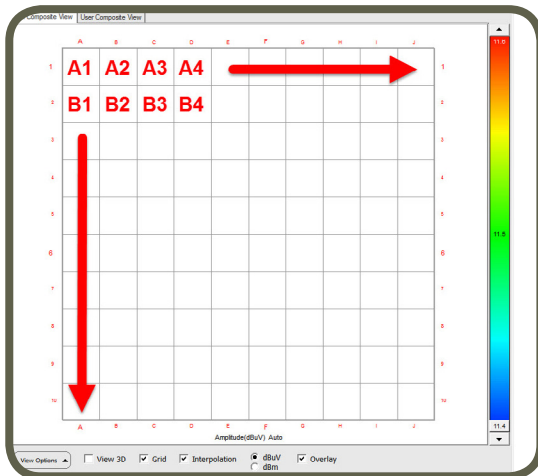


Continue with re-placement of probe and triggering until all locations selected have been triggered. You can also make use of a simple grid to help place the probe.

Note:

The spacing of the measurement points does not need to be 7.5 mm. The grid can have whatever step size you wish e.g. 5 mm, 1 mm, 0.5 mm.

In the example below, 100 cells are selected. Position the handheld probe corresponding to A1 on the DUT. Click run once  and then click OK or space bar. Once the scan is completed, move the handheld probe to position B1. Click  and then click OK or space bar. Repeat these steps until the first row is done. Return the handheld probe to A2 and then click OK or space bar. Repeat these steps until all the cells are done.



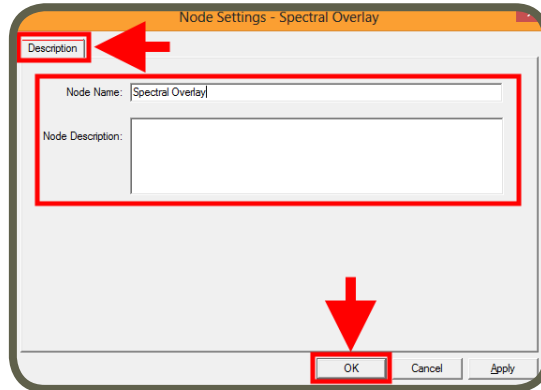
Review that data: The spatial measurements of the handheld probe are arranged as selected in the Spatial Scan area. At this point the results can be treated exactly like a regular Spectral/Spatial scan with all of the post analysis that implies.

Spectral Overlay

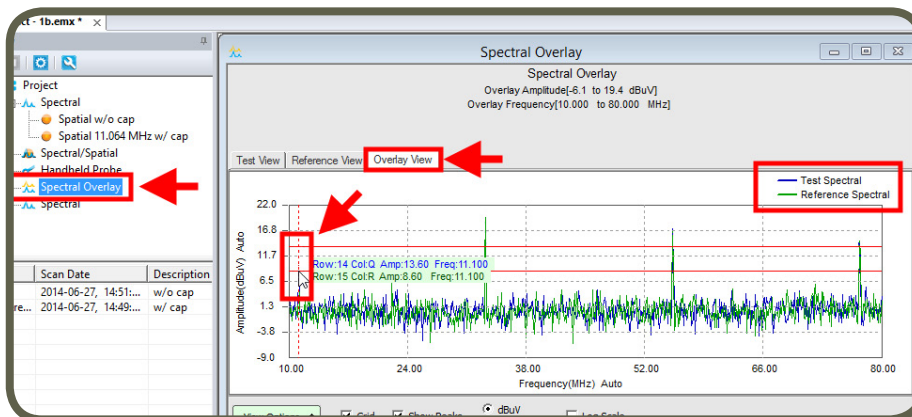
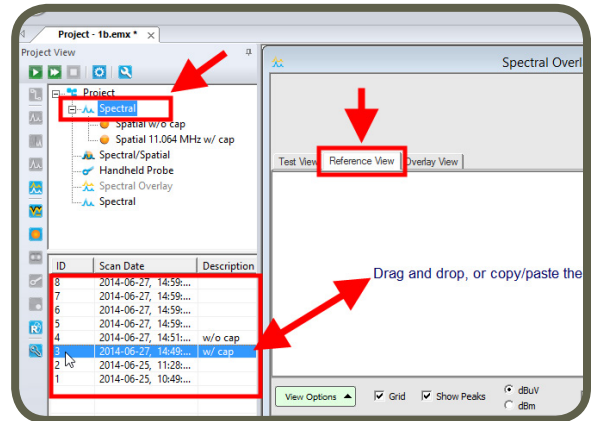
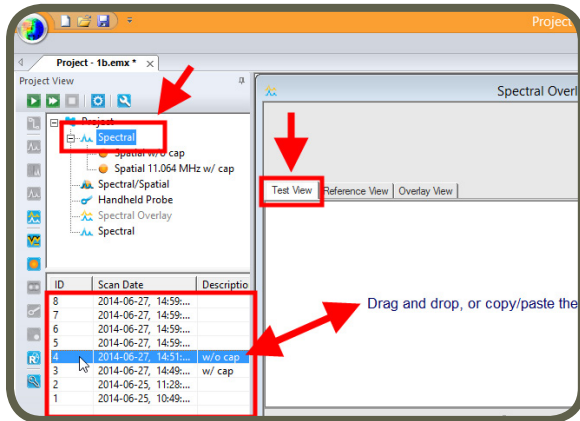
A Spectral Overlay is a qualitative comparison of two frequency spectra. It displays two data sets superimposed on each other, which allows you to visually inspect data for differences, i.e. presenting a qualitative view.

The Spectral Overlay node allows you to observe and compare two Spectral Scans with the same resolution bandwidth within their common overlapping range even though they may have different frequency ranges e.g.: Spectral 1: 10 MHz - 80 MHz and Spectral 2: 30 MHz - 120 MHz.

Add Spectral Overlay node to Project node (please refer to [page 27](#)). Node settings window automatically opens.



After you click OK, Spectral Overlay window opens. Go to the Spectral View. Select the data from the datalist that you want to overlay and click & drag & drop it on to Test View. Repeat these steps for the second data and drop it on to Reference View. Click Overlay View tab and mouse over the graph.

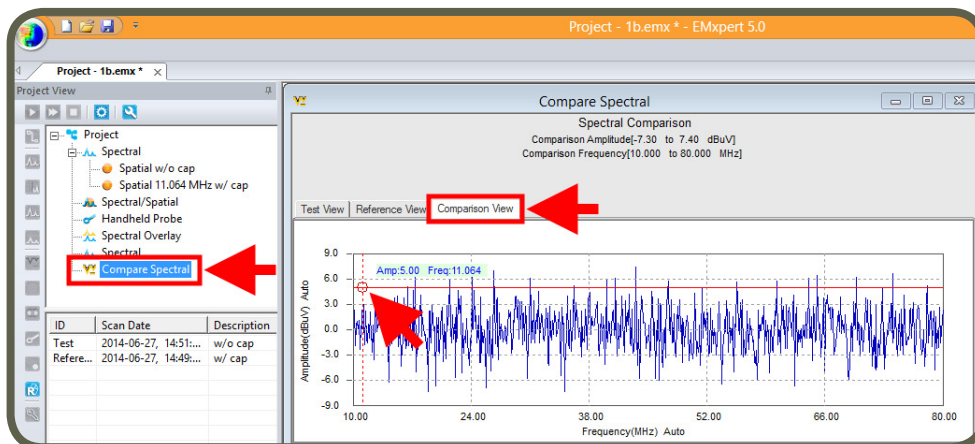
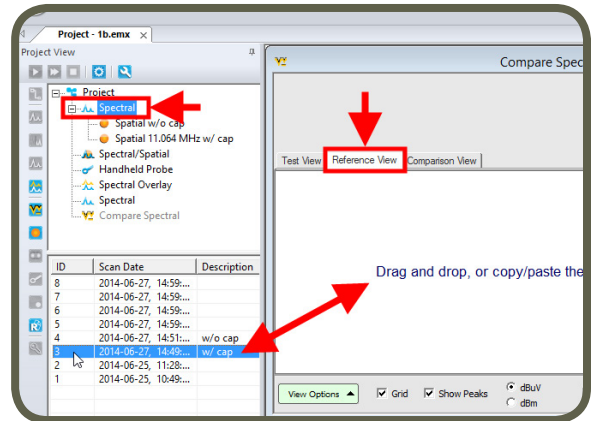
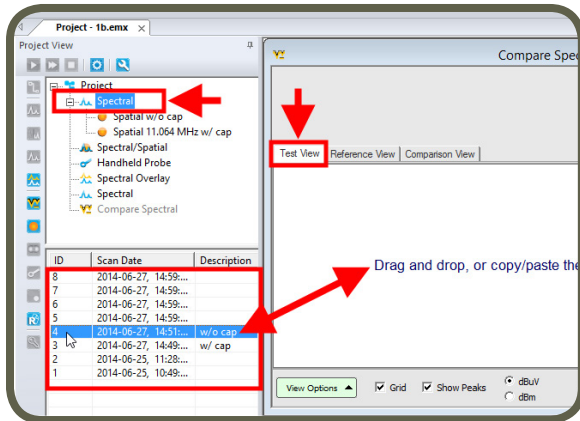
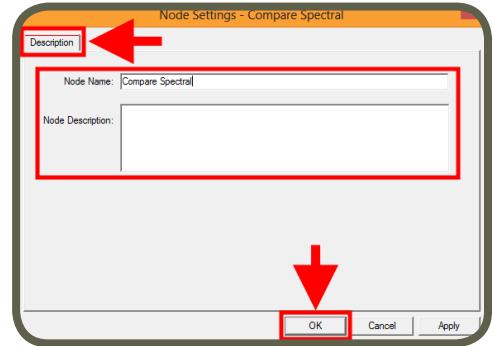


Spectral Comparison

A Spectral Comparison is a quantitative comparison between two frequency spectra. It is generated by subtracting the values of one spectrum (Test View) from the values of the second spectrum (Reference View) at each frequency. The Compare Spectral node allows you to observe and compare two Spectral Scans with the same resolution bandwidth within their common overlapping range even though they may have different frequency ranges e.g.: Spectral 1: 10 MHz - 80 MHz and Spectral 2: 30 MHz - 120 MHz.

A common use for this is to compare the spectral of a production device with the prototype device. This is especially important for conformance testing, where a prototype has received EMC approval and you want to compare production units to it. You would link the prototype spectrum to the reference node and compare the spectra from various production units against it by linking them to the test node.

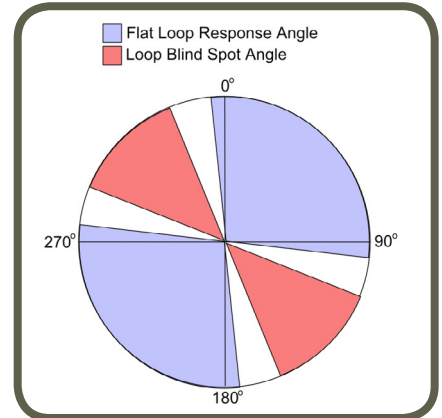
Add Spectral Comparison node to Project node (please refer to [page 27](#)). Node settings window automatically opens. After you click OK, Spectral Comparison window opens. Go to the Spectral View. Select the data from the datalist that you want to subtract from and click & drag & drop it on to Test View. Repeat these steps for the second data and drop it on to Reference View. Click Compare Spectral View tab and mouse over the graph to analyze the difference.



Interleaved Scan

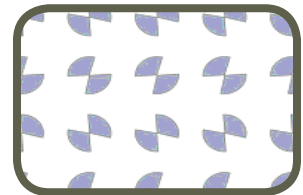
The Interleaved Scan node is meant to overcome the limitations of the probe polarizations and remove blind spots. Each of the 1218 probes on the EMxpert scanner is created by using the vias and traces in a PCB to form a loop. This small loop does not respond well to magnetic fields parallel to it, essentially creating a blind spot.

The response of a single probe to magnetic fields in a given orientation is shown in the right image.

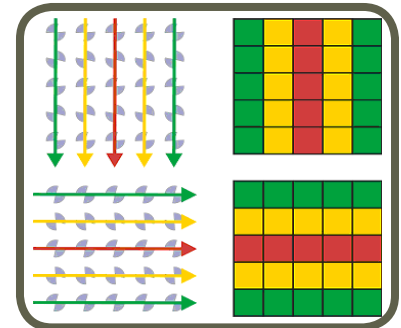


It was chosen to orient this blind spot at 45° and further to rotate every other row by 90° so that consecutive rows do not have the same blind spots. Because of this arrangement the blind spot can be eliminated by measuring a DUT twice with the scanner moving up one row automatically for the second scan.

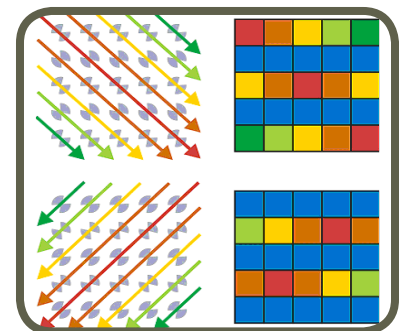
This setup is to provide a cumulative sensitivity as shown in the figure below. This is a small 5x5 array taken from the larger 29x42 scanner.



The effect of this different sensitivity on scan results sometimes shows up when a device is rotated. If the device has only H-field components, the scan results will be as shown in the top right of the graph on the right. If this device is rotated 90° then results are as expected and as shown in the bottom right.

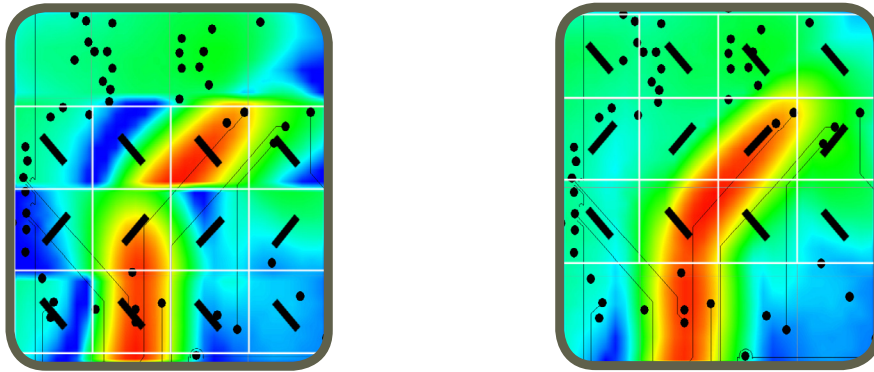


However if the device has H-field components then every other row will have very low reception sensitivity. The scan results are shown below in the top right. Now if this device is rotated 90° then dead spots will switch to the alternate row. Although the high level results are as expected, the presence of these low values distracts the eye. Furthermore, since the dead spots do not rotate, they may give the impression that the scan results are completely different.



EMxpert Software Interleaved Scan

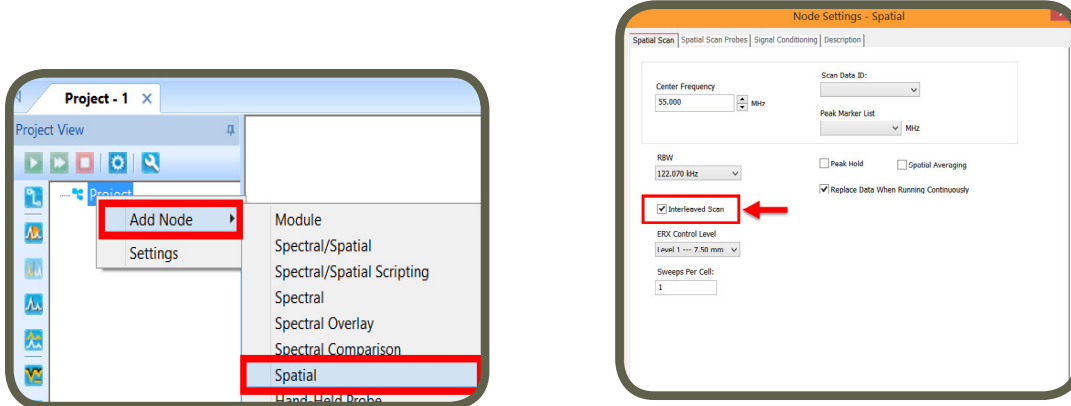
In certain situations the presence of dead spots can create misleading results. An example of this is shown below. The image on the left shows a diagonal trace with one standard scan. The image on the right shows the same trace after two interleaved scans.



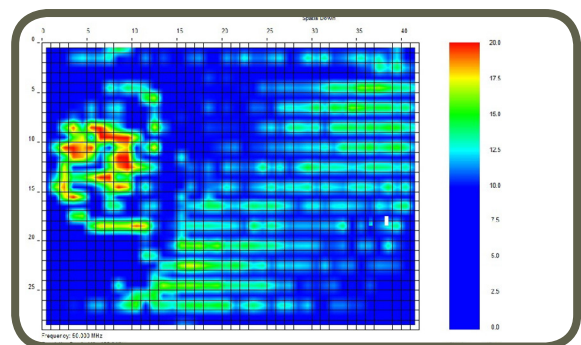
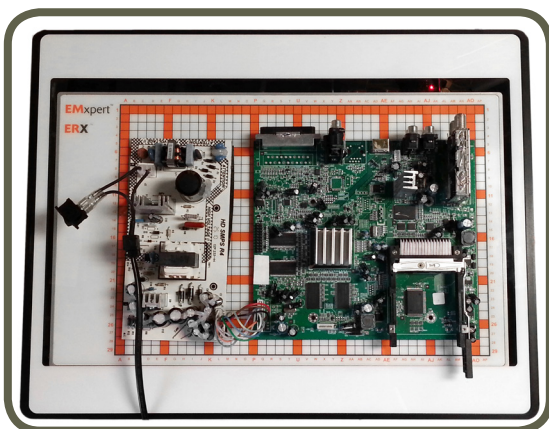
EMxpert ERX

1. Interleaved Scan:

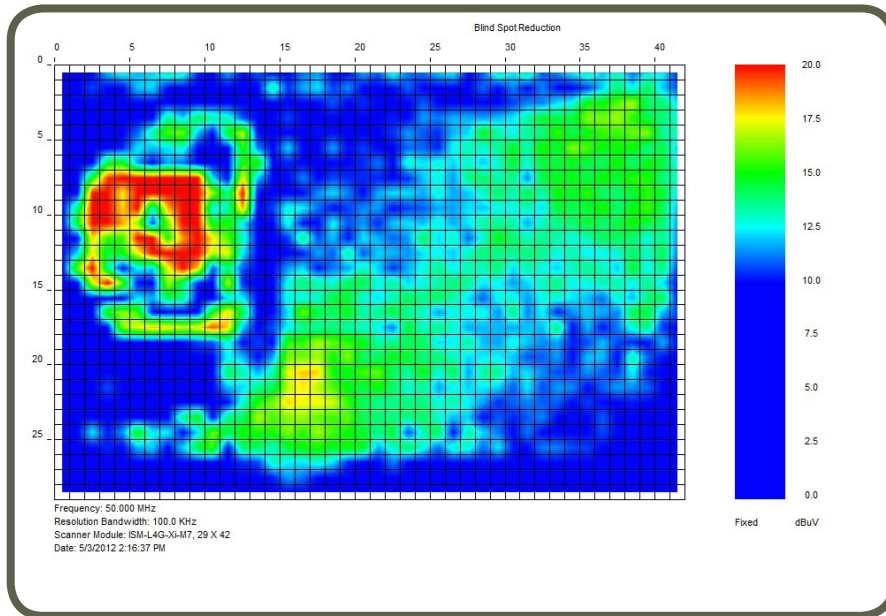
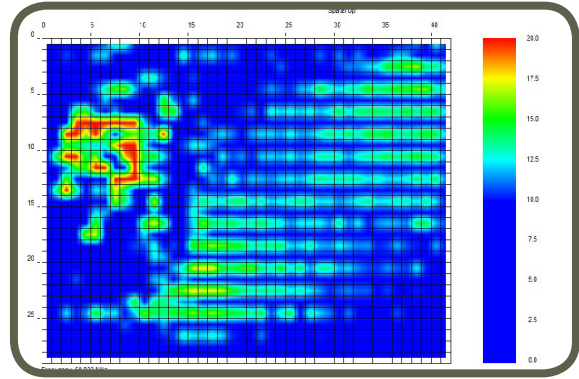
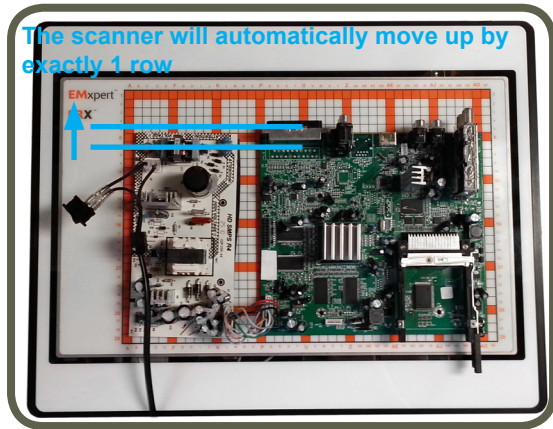
- a. Right click on the project node and select Add Node and then Spatial Scan node and check Interleaved Scan box



- b. Place the DUT on the scanner at the desired position. This position should align with the Gerber file overlay. Run the scan.



EMxpert Software Interleaved Scan

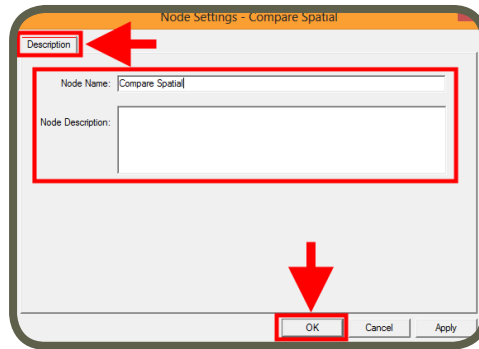


Spatial Comparison

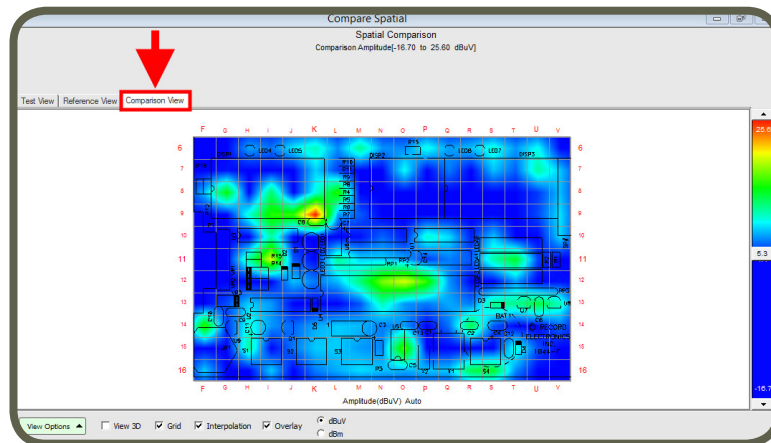
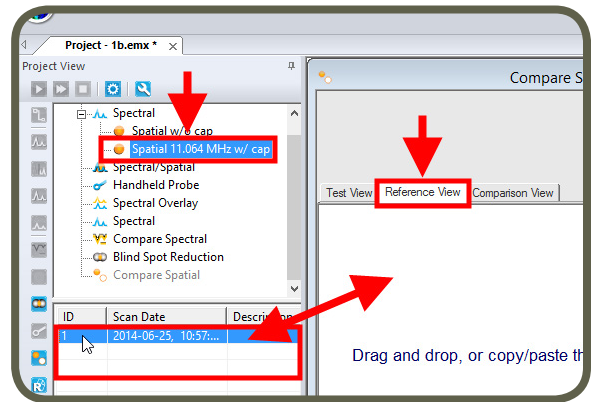
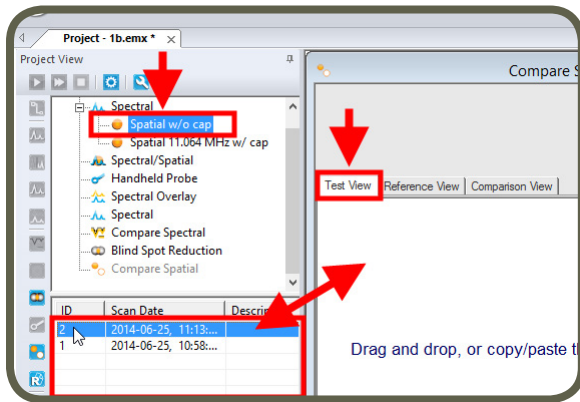
Spatial Comparison is a quantitative comparison between two Spatial Scans that is generated by subtracting the values of the first scan (Test View) from the values of the second scan (Reference View) cell by cell. The Spatial Comparison node allows you to see the difference between two Spatial Scans at the same frequency.

You can use this feature to for example, find the failure point position in a production circuit board after a spectral difference has pinpointed a frequency that is significantly different between the two PCBs. This is useful for repairing faulty boards or pinpointing manufacturing process problems

Two Spatial Scans that will be compared must have overlapping cells. Add Spatial Comparison node to Project node (please refer to [page 27](#)). Node settings window automatically opens. After you click OK, Compare Spatial window opens.



Select the data from the datalist of the Spatial Scan that you want to subtract from and click & drag & drop it on to Test View. Repeat these steps for the second data and drop it on to Reference View. Click Compare Spectral View tab and mouse over the graph to analyze the difference.



Measurement Tips

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 signals are actually being emitted from the DUT and are not ambient background signals being retransmitted by the DUT:

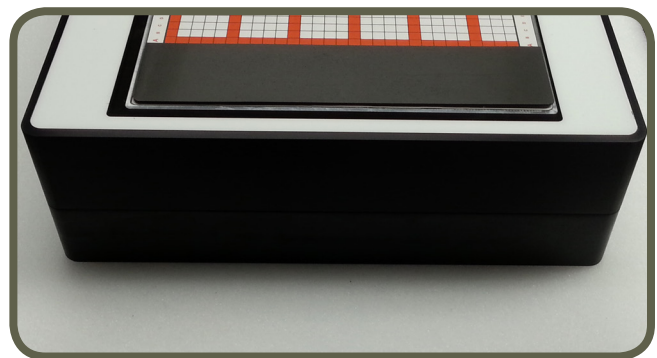
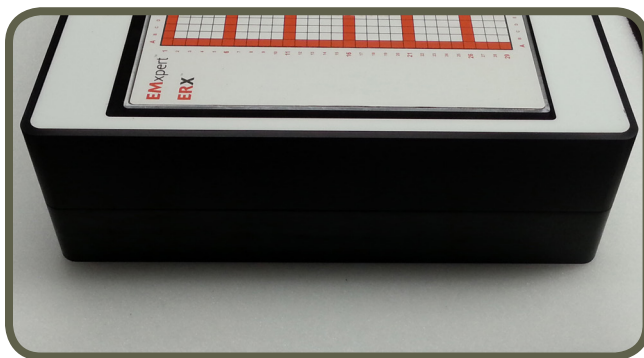
1. Run a Spectral Scan over the frequency range of interest with the unpowered PCB on scanner.
This is to verify if the DUT is acting like an antenna or signal conduit for non-local sources.
2. Power on the PCB and go through step 1
3. Compare the powered and unpowered scans taken with the DUT in the same position and with identical scanning parameters.

To determine the significant emission areas on the DUT at the frequencies of interest:

4. Run Spatial Scans at the relevant frequencies found in Step 3.

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. This absorber is provided by EMSCAN with any 8 GHz EMxpert system. If you are missing your absorber please contact [EMSCAN](#).



Scanning a System Level Device

1. Choosing which scan to use. Is the device expected to have continuous emissions or intermittent activity? All devices have software based activity and EMxpert's ability to capture time based feature can be very helpful.
 - a. If the device has some intermittent activity, select Continuous Spectral Scan with Peak Hold ON followed by a Continuous Spatial Scan with Peak Hold applied for each of the frequencies of interest.
 - b. If the device emits continuously, select Spectral/Spatial Scan.
2. Choosing Spans and Resolution Bandwidths (RBW). It is recommended that you scan a small frequency span with a RBW in the 120 kHz to 10 kHz range as it provides you with more immediate feedback. EMxpert has the capability of scanning all 1218 probes at a large span and a tight RBW but such scans can take a long time to complete.
3. Tips:
 - a. Take extra care during the set up 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 final packaging).
 - b. Import a Gerber or HPGL 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 regarding 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 quickly and easily identify the purpose of the scan.
 - 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 EMxpert scans at the same frequencies. There will be differences in the far-field and near-field values but they will be 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 EMSCAN) and reduce the Resolution Bandwidth.
 - g. We take measures 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 Spectral/Spatial Scan was used. The Continuous Spatial with peak hold will almost always provide a different picture than a single Spatial or a single User Spatial of a Spectral/Spatial Scan (as all boards have time variances). The ability to capture time-based events is a benefit unique to EMxpert.
 - j. If you have a very strong intentional radiator, it may be advantageous to either conduct scans 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 - Frequently Asked Questions (FAQ)

1. [How can I correlate the scan results to PCB design?](#)
2. [Does the system require annual calibration?](#)
3. [What is the frequency and amplitude accuracy of the EMxpert measurements?](#)
4. [What are the Minimum System Requirements?](#)
5. [What is the maximum power level that EMSCAN's patented scanner can receive without being damaged?](#)
6. [How sensitive is EMSCAN's patented scanner?](#)
7. [I added a low noise amplifier \(or an attenuator\) between the scanner and the spectrum analyzer and forgot to enter the value in the Amplitude Adjustment menu. Can I correct this without rescanning?](#)
8. [How can I find the frequency of an intermittent or random signal?](#)
9. [I am doing Before and After testing. What feature should I use?](#)
10. [Can I create Limit Lines for FCC requirements?](#)
11. [I want to do a Pass or Fail test. What feature should I use?](#)
12. [How long does a typical Spectral Scan take?](#)
13. [How long does a typical Spatial Scan take?](#)
14. [I am designing multiple layer boards. How can EMxpert help to diagnose EM problems?](#)

1. How can I correlate the scan results to PCB design?

EMxpert support three types of file formats: Gerber file format RS-274x, HPGL and JPG. On rare occasions, a Gerber file may not be in a pure RS-274x format and cannot be read by EMxpert software. This file can often be read by a third party Gerber reader such as GerbView and converted to an RS-274x format that can be used. GerbView can be obtained at <http://www.softwarecompanions.com/>.

2. Does the system require annual calibration?

The EMxpert ERX could require calibration after shipment. In the ERX, the step motors are tested. Please refer to the 3-year (part number 3000-1910) and 5-year Calibration Assurance Plans (part number 3000-1911).

3. What is the frequency and amplitude accuracy of the EMxpert measurements?

The accuracy of the probe compensation values is $\pm 3\text{dB}$ from 150kHz to 8GHz.

4. What are the Minimum System Requirements?

- CPU 333 MHz or faster
- 8 GB recommended for ERX
- 8 MB Video or more
- Windows10 OS
- 10/100 Network Card

5. What is the maximum power level that EMSCAN's patented scanner can receive without being damaged?

The surface of the scanner can handle thousands of volts. The scanner is rated for a radiated load of 10 W or 40 dB. If a transmission line carrying RF power of more that 10 W / 40 dBm is placed close to the scanner probe for extended periods, it is likely to damage the scanner.

6. How sensitive is EMSCAN's patented scanner?

Dependent on spectrum analyzer performance

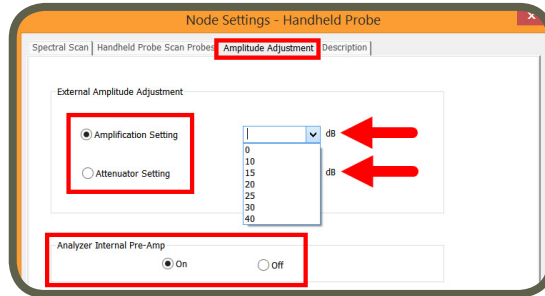
Frequency (MHz)	0.15	0.5	1	10	50	300	1000	1500	2000
Internal Preamp (dBm)	-15	-25	-35	-55	-65	-85	-85	-90	-90
with 50x Averaging (dBm)*	-20	-35	-45	-65	-75	-95	-95	-100	-100
with 50x Averaging and preamp (dBm)*	-25	-40	-45	-70	-85	-100	-100	-105	-105

Frequency (MHz)	3000	4000	5000	6000	7000	8000
Internal Preamp (dBm)	-90	-85	-80	-80	-80	-70
with 50x Averaging (dBm)**	-100	-95	-90	-90	-90	-90
with 50x Averaging and preamp (dBm)**	-106	-105	-105	-102	-98	-97

(* 40 dB LNA; ** 20 dB Power amplifier (Please refer to [Technical Bulletin #15](#) for the test setup))

7. I added a low noise amplifier (or an attenuator) between the ERX scanner and the spectrum analyzer and forgot to enter the value in the Amplitude Adjustment menu. Can I correct this without rescanning?

If you forget to set the amplitude adjustment, you can re-enter the Amplitude Adjustment area and modify the processed scans without rescanning for all the types of scans.



8. How can I find the frequency of an intermittent or random signal?

Run a continuous Spectral or Spatial Scan with Peak Hold. It will replace the peak amplitude with each successive higher measurement. Start with a large RBW to increase the speed of the spectrum analyzer. Once you have captured the signal, reduce the frequency span and decrease the RBW if you want to improve the accuracy of the measurements.

9. I am doing Before and After testing. What feature should I use?


Use either [Spectral Overlay](#) or [Spectral Comparison](#) feature.

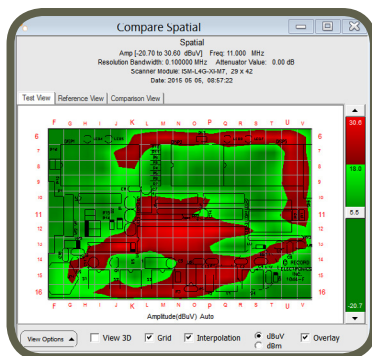
10. Can I predict the Open Area Test Site (OATS) or Semi Anechoic Chamber (SAC) radiated EMI levels of a printed circuit board (PCB)?

The Far-Field Application supports regulatory compliance limits Class A or Class B FCC, CISPR and Industry Canada, 10 m, 3 m and 1 m test distances. This is an optional feature (Part #: 3000-0304) that can be purchased separately. Please contact [EMSCAN](#).

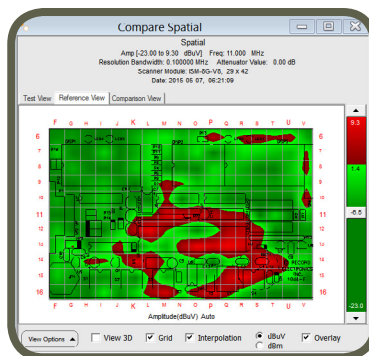
11. I want to do a Pass or Fail test. What feature should I use?

Use either [Spectral Overlay](#) or [Spectral Comparison](#) feature. You can also use the Threshold (Red/Green) display with Auto-scale off and set to the reference PCB emissions to see if a PCB under test is better or worse than the reference PCB.

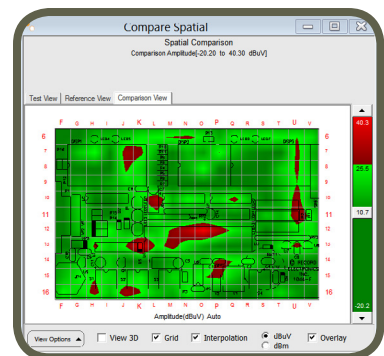
To change the display color to Threshold (Red/Green), click Preferences icon  and go to the Display Options tab ([please refer to page 29](#)).



Defective PCB



Golden Sample



Pass/Fail Test

12. How long does a typical Spectral Scan take?

It is highly dependent on the spectrum analyzer performance and the number of probes selected and the RBW setting.

13. How long does a typical Spatial Scan take?

Less than one second though highly dependent on the spectrum analyzer performance and the number of probes selected and the RBW setting.

14. I am designing multiple layer boards. How can EMxpert help to diagnose EM problems?

Currently, there are no measurement techniques on the market that can exactly see what is going on inside a multi-layer board. A chamber for example, will only deal with far-field and will not differentiate between what is coming from the edge, the most external layer, the internal layers, and the interaction between the layers. It is the most blind of all EMI test solutions to help design a better PCB with EMI reduction at the source. Automated single probe, handheld probe, and EMxpert can differentiate at least between the emission from the edge (where emissions from the internal layers will most likely escape and emit) and from the surface of the external PCB layers.

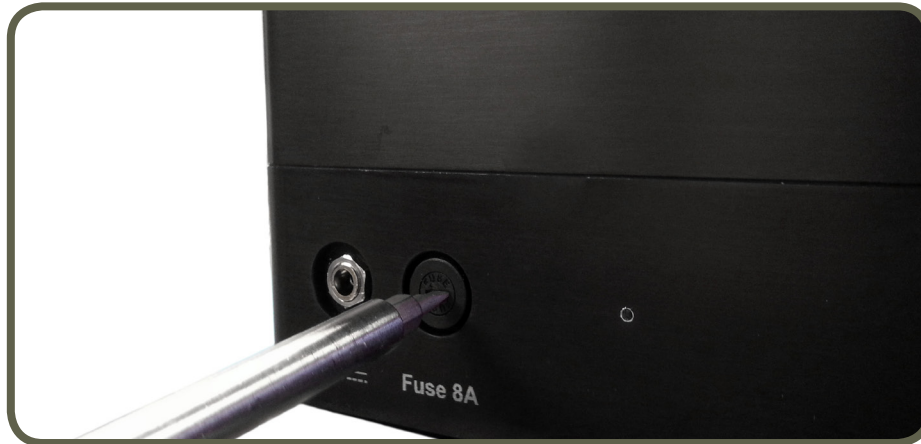
If one uses a pre-amplifier, the scanner or probe could pick weaker signals from the internal layers leaking through the external layers. A comparison of the spectral and spatial analysis with or without amplification could then help point the source (frequency may help specify a component, and the location will do as well). Using the Gerber of the inner layers as overlay could help confirm the weaker emissions comes from a known PCB feature. The EMxpert and automated single probe could handle that; the handheld probe will not work.

Clearly, the EMxpert and the automated single probe are the only adequate tools for multi-layer PCB EMI measurements. However, the fact that the EMxpert is much faster and can track intermittent events through peak hold with continuous scanning, makes it the best solution overall.

Appendix - Fuse Replacement

If the switch light does not turn on after connecting the power supplies and turning the switch to ON position, you may need to replace the fuse. To replace the fuse:

1. Unscrew the fuse



2. Take out the burnt fuse and place the new fuse (Fuse specs: 8A / 250V, size: 0.177" Dia x 0.570" L (4.50 mm x 14.48 mm))

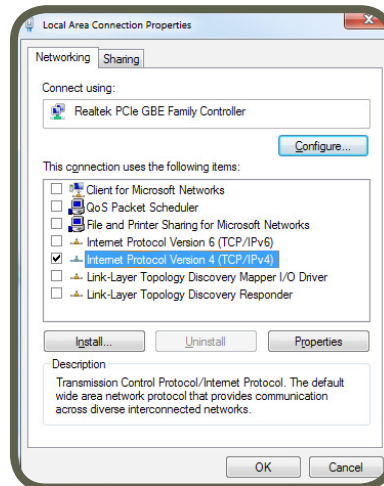


3. Screw the fuse back into the scanner.

Appendix - How to Update Firmware

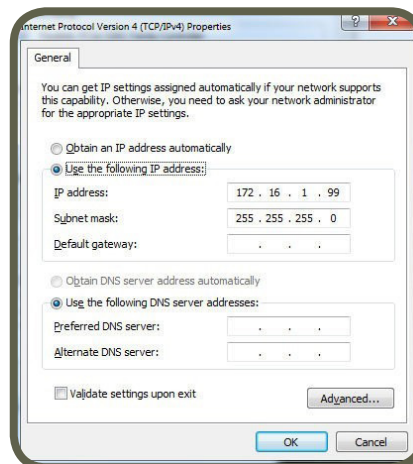
We are continuously improving the performance and adding new features. Please contact [EMSCAN](#) to get the latest firmware and follow the steps below to upgrade the ERX firmware:

1. Connect a LAN cable provided into the LAN port of the ERX and the LAN port of a computer running Windows 10 or later. Attach the power cable and turn the device on. The ERX LED will blink several times and turn green.
2. LED has turned solid green go to the control panel in Windows and access network configuration. Control Panel-> Network and Sharing Center->Change Adapter Settings-> Local Area Connection



Select the “Internet Protocol Version 4 (TCP/IPv4)” and click on Properties.

Click “Use the following IP address” and enter the following information:



Click OK

3. Obtain the latest ERX firmware from EMSCAN. You will need to unzip this file and obtain two firmware images.

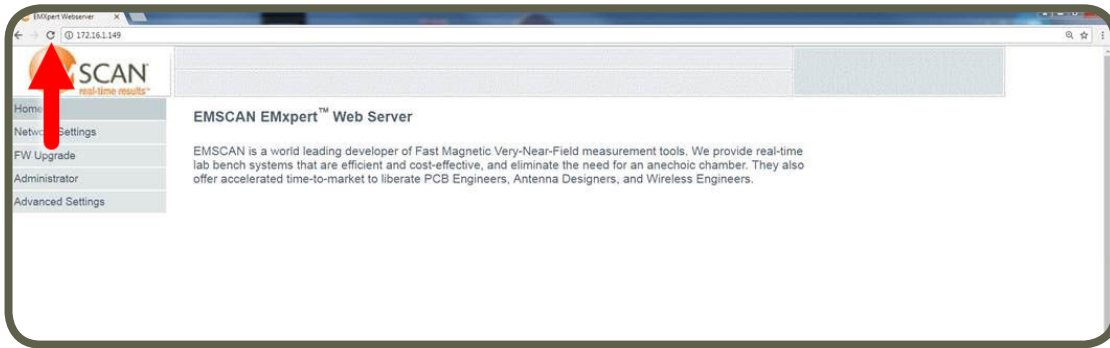
emsrv_a5.bin

emsrv_m4.bin

4. Open Chrome or Firefox web browser (**not Internet Explorer**) and enter the unit’s IP address (default 172.16.1.149).

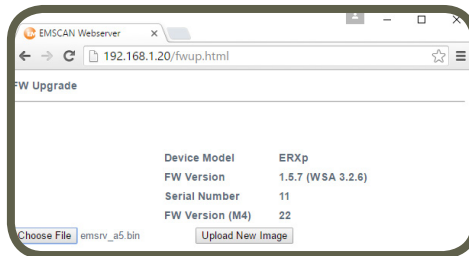
EMxpert Software
Appendix - How to Update Firmware

5. Refresh the web page by pressing the F5 key or clicking the “refresh” icon:

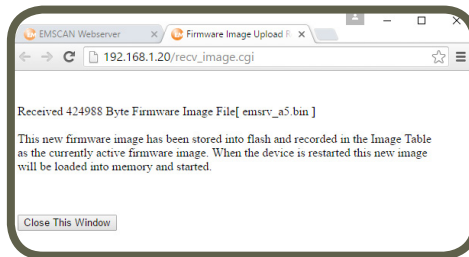


6. Select FW Upgrade page.

7. Select the **emsrv_a5.bin** file:



8. Click the “Upload New Image” button, then click “OK” in the message box and wait for the following screen:



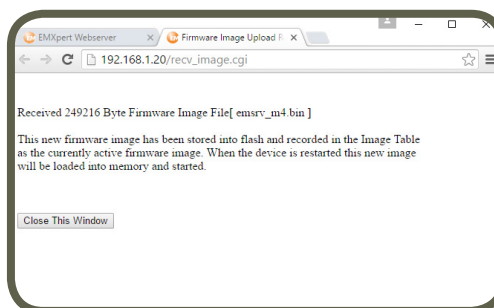
9. Wait for a blinking Green color LED on the unit’s front panel.

10. Close all the browser’s open tabs and windows, then reopen the web browser to the main page.

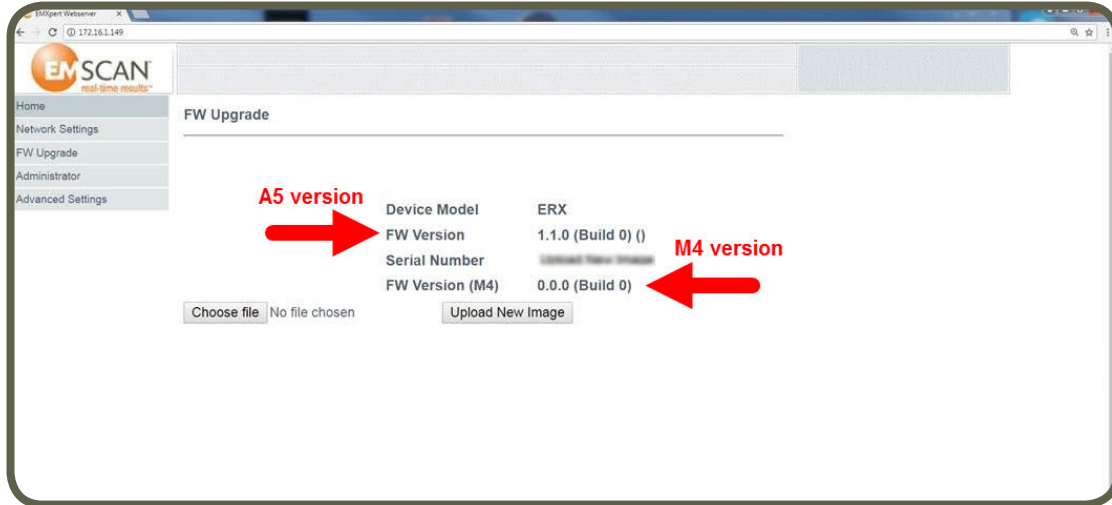
11. Refresh the page as described in #5 ← **VERY IMPORTANT**

12. Repeat steps 3 and 4, but in step 4 select **emsrv_m4.bin** file instead.

13. Click the “Upload New Image” button, then click “OK” in the message box and wait for the following screen:



- 14. Click “Close This Window” button.
- 15. Verify the correct version by refreshing the FW upgrade page as done in steps 2 and 8, then verify the versions of both the A5 and the M4 images:



- 16. Restart the unit by turning off the power completely then turning on.
You have just upgraded your ERX firmware.

Appendix - Error Messages

If you receive other error messages please contact [EMSCAN](#) Technical Support

Error Message/Condition	Possible Causes	Action
The EMxpert ERX software lost connection with the ERX scanner.	Ethernet cable connection	Unplug and replug the Ethernet cable. Reboot the ERX scanner. Restart the EMxpert ERX software.
The EMxpert ERX software lost connection with the ERX scanner during a scan.	Ethernet cable connection	Unplug and replug the Ethernet cable. Reboot the ERX scanner. Restart the EMxpert ERX software.
The Spectrum Analyzer stops working during a scan.	Spectrum analyzer related issue	Reboot the spectrum analyzer. Reset the connection between PC and the spectrum analyzer. Reset the connection in the Keysight IO Library.
Error #338: The requested bandwidth is outside the capabilities of the spectrum analyzer. <detailed bandwidth information>	The spectrum analyzer is not capable of running with the requested resolution bandwidth. The <detailed bandwidth information> details what has been requested and the bandwidth capabilities of the attached spectrum analyzer.	Change the RBW (resolution bandwidth) in the settings to a supported value and rerun the scan.
Error #340: The requested frequency range is outside the capabilities of the spectrum analyzer <detailed range information>	The spectrum analyzer is not capable of running with the requested frequencies. The <detailed range information> details what has been requested and the frequency capabilities of the attached spectrum analyzer.	Change the frequency limits in the settings to supported values and rerun the scan.
The start frequency is lower than the licensed low frequency <detailed range information>	The frequency setting is out of the licensed frequency range	Change the lower frequency limit in the settings to a supported value and rerun the scan. If you wish to change the licensed frequency limits please contact EMSCAN Technical Support.
The stop frequency is higher than the licensed high frequency <detailed range information>	The frequency setting is out of the licensed frequency range	Change the upper frequency limit in the settings to a supported value and rerun the scan. If you wish to change the licensed frequency limits please contact EMSCAN Technical Support.
There is a problem with the JPG file, EMxpert can't read it.	File is corrupted or it is not a JPG format file.	
There is a problem with the image file, EMxpert can't read it.	File is corrupted or it is not a Gerber format file.	

Appendix -Regulatory Compliance

Safety and Regulatory Information

- Read all of the instructions listed here and/or in the user manual before you operate this device. Give particular attention to all safety precautions. Retain the instructions for future reference.
- This device must be installed and used in strict accordance with manufacturer's instructions, as described in the user documentation that is included with this device.
- User must comply with all warning and caution statements in the instructions. Observe all warning and caution symbols that are affixed to this device.
- To prevent shock or fire hazard, do not expose this device to rain or moisture. The device must not be exposed to dripping or splashing. Do not place objects filled with liquids or chemicals on the device.
- This device was qualified under test conditions that included the use of the specified cables, between system components. To ensure regulatory and safety compliance, use only the provided power and interface cables and install them properly.
- Different types of cord sets may be used for connections to the main supply circuit. Use only a main line cord that complies with all applicable device safety requirements of the country of use.
- Installation this device must be in accordance with national wiring codes and confirm to local power company instructions and guidelines.
- Do not overload outlets or extension cords, as this can result in a risk of fire or electric shock. Overloaded AC outlets, extension cords, frayed power cords, damaged or cracked wire insulation, and broken plugs are dangerous. They may result in a shock or fire hazard.
- Route power supply cords so that they are not likely to be walked on or pinched by items placed upon or against them. Pay particular attention to cords where they are attached to plugs and convenience receptacles, and examine the point where they exist from the device.
- Place this device in a location that is close enough to an electrical outlet to accommodate the length of the power cord.
- Place the device to allow for easy access when disconnecting the power cord of the device from the AC wall outlet.
- Do not connect the plug into an extension cord, receptacle, or other outlet unless the plug can be fully inserted with no parts of blades exposed.
- Place the device on a stable surface.
- It is recommended that the customers install an AC surge protector in the AC outlet to which this device is connected. This is to avoid damaging the device by local lightning strikes and other electrical surges.
- Postpone installation until there is no risk of thunderstorm or lightning activity in the area.
- Do not cover the device or block the airflow to the device with any other objects. Keep the device away from excessive heat and humidity and keep the device free from vibration and dust.
- Wipe the device with a clean, dry cloth. Never use cleaning fluid or similar chemicals. Do not spray cleaners directly on the device or use forced air to remove dust.
- Do not use this product near water: for example near a washbowl, or a laboratory sink.

- Do not open the device. Do not perform any servicing other than that contained in the installation and troubleshooting instructions. Refer all servicing to qualified service personnel.
- This device should not be used in an environment that exceeds 40° C and lower than 15° C.

FCC Class B Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/television technician for help

Modifications: Any modifications made to this device that are not approved by EMSCAN Corporation may void the authority granted to the user by the FCC to operate this equipment.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Pursuant to Part 15.21 of the FCC Rules, any changes or modifications to this product not expressly approved by party responsible for compliance might cause harmful interference and void the FCC authorization to operate this product.

CE mark

EMxpert conforms to the following standards and other related normative documents:

- Electromagnetic emissions:
(Council Directive 2004/108/EC–EN61326-1 Ed 2.0 2012-07. CISPR 11:2009,A1:2010)
FCC Part 15 B
- Electromagnetic immunity:
(Council Directive 2004/108/EC–EN61326-1 Ed 2.0 2012-07 IEC61000-4-2:2008, IEC61000-4-3:2006 A1:2007, A2:2010, IEC61000-4-4:2004 A1:2010, EN61000-4-5:2005, EN61000-4-6:2008, IEC61000-4-8:2009)
- Safety:
(Council Directive 2006/95/EC-IEC/EN 61010-1)

Marks of Compliance



Notes



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EM/JUMERX/7.0.0.0