



EMxpert **EHX**

User Manual

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.

Warning

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

Warranty

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 3000-1810 or 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: http://www.emscan.com/emxpert/EMx_userManuals.cfm

Training manual: http://www.emscan.com/emxpert/EMx_trainingManual.cfm

Software release notes: http://www.emscan.com/emxpert/EMx_softwrRelease.cfm

Technical bulletins: http://www.emscan.com/emxpert/EMx_TechnicalBulletins.cfm

FAQ: http://www.emscan.com/emxpert/EMx_FAQ.cfm

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

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Contact Information

Serial Number and Software Version

Contact Information

Contact EMSCAN Technical Support for your questions. Have your unit's serial number, software and firmware versions available as well as your PC Windows OS version when you contact EMSCAN Technical Support.

Phone:

Toll Free (North America Only): +1-877-367-2261

International: +1-403-291-0313 ext 2

Fax:

+1-403-250-8786

E-mail:

support@emscan.com

Website:

www.emscan.com

Address:

EMSCAN Corporation

#1, 1715 27th Avenue N.E.

Calgary, Alberta, Canada T2E 7E1

The serial number is located at the bottom of the scanner.



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



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 scanner) and ERX (high-resolution scanner). 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 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 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 self-contained high-resolution very-near-field scanning device which uses the EHX scanner mounted on X and Y stepper motors with 0.12 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
- 128 MB RAM recommended for EHX
- 8 MB Video or more
- Windows XP/Vista/Windows 7/8/8.1 OS
- 10/100 Network Card

Cables and Component Checklist

Components Supplied with the EHX System

1. EHX adaptor



2. EMSCAN's patented scanner



3. 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.



4. Micro-D control cable: It connects the adaptor to the scanner to enable control of the EMSCAN's patented scanner's switched probes and to power the scanner.



5. USB Cable: It connects the PC (laptop or desktop) to the EHX adaptor. The USB Cable provided with the system has ferrites on both ends of the cable



6. SMB-BNC Trigger Cable: It connects EHX adaptor to the spectrum analyzer.



7. Surface wave absorber: is only provided with the EMxpert EHX 8 GHz versions to test above 6 GHz. (part numbers: 3000-1806 and 3000-1808)



8. EMxpert USB Drive includes the EMxpert software installation program and User Manual.



Customer Provided Components

1. Spectrum Analyzer: It must include the necessary options to work with the EMxpert EHX (see [Supported Spectrum Analyzers](#)). It measures the radio frequency (RF) signal received from the EMSCAN's patented scanner, generated by the very-near-field emissions of an adjacent activated PCB and it outputs the data to the PC.

2. PC (Laptop / Desktop): It must support a LAN 10/100 connection to the spectrum analyzer and a USB connection (version 2.0 or higher) to the adaptor or two USB connections, one for the spectrum analyzer and one for the adaptor. It runs the EMxpert software and receives data, which it can display and manipulate immediately or store for future data presentation.

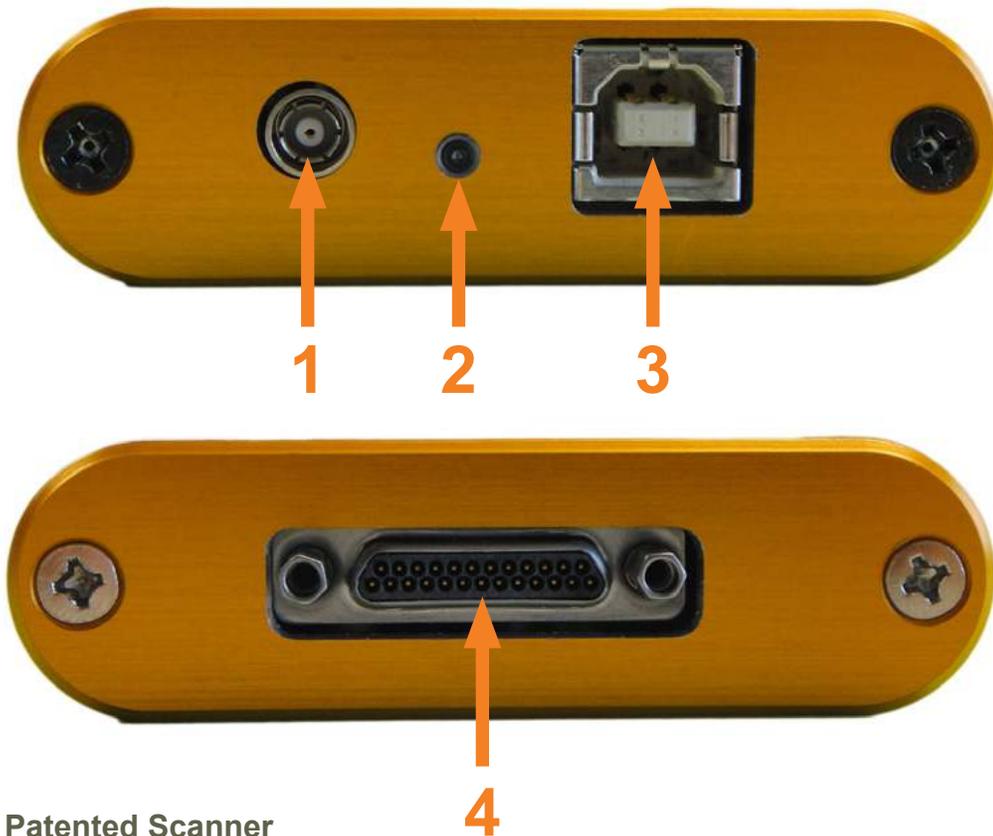
3. Ethernet or USB cable: It connects PC (laptop or desktop) to the spectrum analyzer.

Note:

Spectrum Analyzer, Personal Computer (PC) connected with Ethernet cable must comply CE emission requirements

Connection Overview

EHX Adaptor



EMSCAN's Patented Scanner

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	SMB trigger cable port
2	LED light shows three stages: Red: Boot mode (this stage is fast; you may not even notice it) Orange: Initiation mode (checking adaptor's firmware) Green: User mode (adaptor is connected and ready)
3	USB connection port
4	Micro-D control cable connection
5	Micro-D control cable connection
6	RF output port

Option and Accessories

Part Number	Description
3000-0216	LNA (frequency range: 10 kHz - 2.5 GHz)
3000-0815	Hard Transit Case to carry EHX with customized insert
3000-0817	Large Hard Transit Case to carry FieldFox and EHX with customized insert
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+
3000-1801	EHX 4 GHz - 8 GHz Frequency range extension
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
3000-1810	Additional one year Customer Care Package for the EHX. Includes: - Parts & labour - Software updates - Free shipping to factory for repair and return - Same day technical support - Two 30 minute web training sessions per year
3000-1811	Additional one year Customer Care Package for the EHX+, ERX and ERX+. Includes: - 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+ and ERX+ / Return to EMSCAN / 3 years - 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+ and ERX+ / Return to EMSCAN / 5 years - Annual single calibration event included - Freight to/from EMSCAN factory not included unless unit under original or extended warranty
3000-0814	NRE Charge for custom development of a driver for any spectrum analyzer provided it has the following configuration: Gated sweep, Pre-amplifier, LAN or USB Port, External Trigger Port with BNC Connector and VISA support Customer to loan specific spectrum analyzer for 2 weeks
3000-0816	NRE Charge for custom development of a driver for any spectrum analyzer provided it has the following configuration: Gated sweep, Pre-amplifier, LAN or USB Port, External Trigger Port with BNC Connector and VISA support Equipment rental included provided it is available from rental companies

Option and Accessories

Part Number	Description
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.

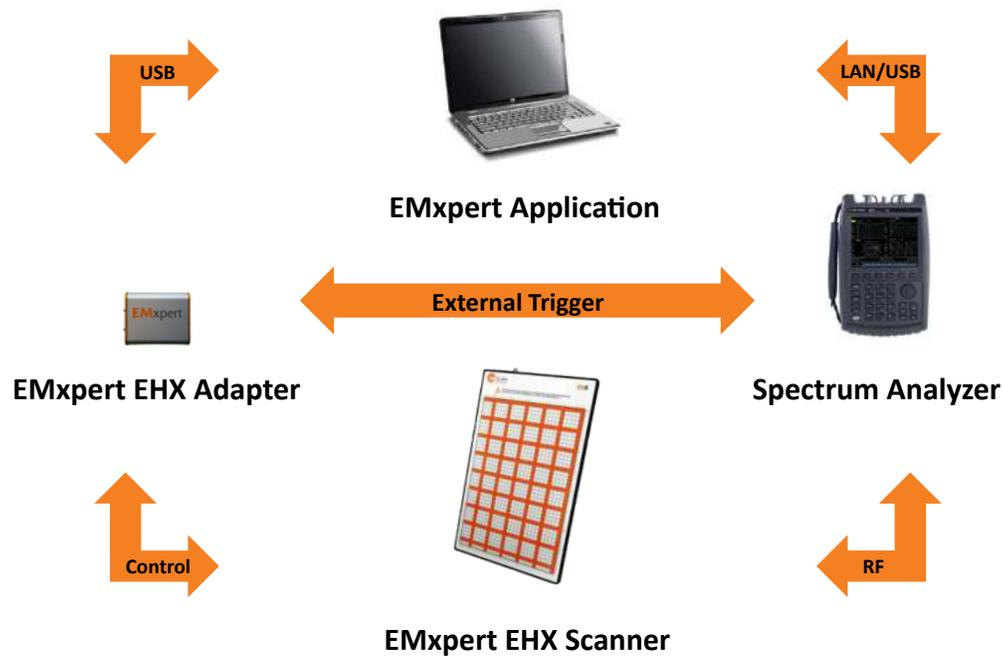
Quick Installation and Checklist

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 software application by double clicking on the Setup application icon. The application must always be installed on the C: drive.
3. Connect PC, scanner, adapter and spectrum analyzer as per the diagram below. If you are using Ethernet between the PC and the spectrum analyzer, use a crossover Ethernet cable.

If the spectrum analyzer has multiple trigger ports, always connect to Trigger 1 IN.



4. If you are using a USB cable to connect the PC to the spectrum analyzer, go to Step 5.

If you are using an Ethernet crossover cable first set up your IP address as follows:

Set your spectrum analyzer to the static IP address 172.16.1.148/255.255.0.0; you will probably have to restart your analyzer.

Set your PC with static IP address 172.16.1.99/255.255.0.0

Best is to set it up in *Alternate Configuration* in the *Local Area Connection Properties / Internet Protocol Version 4 (TCP/IPv4) / Properties* path [in Windows 7 or equivalent path for other Windows OS]

If you want to use another pair of IP addresses (PC + Spectrum Analyzer) you need to discontinue the heartbeat function that is today only able to ping 172.16.1.148. Please make the following change to 'EMxpert.ini' in the directory where EMxpert.exe is: C:\Program Files (x86)\EMSCAN Corporation\EMxpert 5.

Open this file by using notepad; there is the following section at the end:

```
[EMxpert Info]
Spectrum Analyzer Detecting = 1
Scanner Detecting = 1
```

About EMxpert

Quick Installation and Checklist

Just change into:

[EMxpert Info]

Spectrum Analyzer Detecting = 0

Scanner Detecting = 1

5. Install the EMxpert USB driver

Go to *Control Panel / Hardware and Sound / Devices and Printers / Device Manager* [in Windows 7 or equivalent path for other Windows OS]

Expand "USB Custom Driver" and look for EMxpert USB Driver (C) 2014

If it says 2010 or if there is a yellow triangle, right click and select Update driver and then browse to the "EMSCAN EMxpert USB Driver" folder in the install folder on the CD, hard disk or key.

Click on the "EMSCAN EMxpert USB Driver" folder and press OK. Proceed with the installation steps.

Note that you may have to repeat this procedure if you connect the USB cable between the adapter and the PC to another USB port at another occasion.

Note as well that not all USB ports are equal; some are less than others and may not work with the EMxpert adapter. Try various ports until you find one working properly.

The EMxpert driver is a third-party Microsoft approved driver. If the installation fails you must disable the third-party driver enforcement of Windows 8 and 8.1 as follows:

Windows 8.0

On the side START bar, click on "Settings"

Click on "Change PC settings"

In PC Settings, click on "General"

Scroll down to "Advanced startup"

Click on "Restart now"

In "Choose an option", click on "Troubleshoot"

In "Troubleshoot", click on "Advanced options"

In "Advanced options", click on "Startup Settings"

In "Startup settings", click on "Restart"

In "Startup settings", press number 7 on your keyboard to select "Disable driver signature enforcement"

Windows 8.1

On the side START bar, click on "Settings"

Click on "Change PC settings"

In PC settings, click on "Update and recovery"

In "Update and recovery" select "Recovery"

In "Recovery" go to "Advanced startup"

About EMxpert

Quick Installation and Checklist

Click on “Restart now”

In “Choose an option”, click on “Troubleshoot”

In “Troubleshoot”, click on “Advanced options”

In “Advanced options”, click on “Startup Settings”

In “Startup settings”, click on “Restart”

In “Startup settings”, press number 7 on your keyboard to select “Disable driver signature enforcement”

6. 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]

When using a FSH 4 or FHS 8 connected via USB to the PC, go to the install folder on the CD, hard disk or key, open the folder USBDriverFSH8 and run the FSH4_V2_11.exe in order for the Keysight IO library to recognize the FSH.

Keysight IO is good at auto-discovering and configuring. If it is connected properly you will see in the bottom section Messages the following two lines:

Instruments are already discovered and configured
User interface session started

If there is a connection issue, mostly with LAN, select Manual Configuration and then LAN Instrument

In Set LAN Address / Hostname or IP Address

Enter the IP address 172.16.1.148

In Verify Connection

Click on Test this VISA Address

Then click on Accept

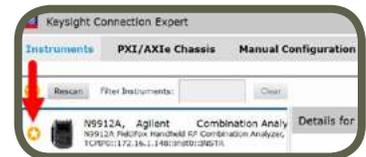
If there is still no connection, disable your PC firewall or set it up to allow traffic to/from 172.16.1.148 and repeat the steps above.

If you are using a Keysight X series spectrum analyzer, please refer to Technical Bulletin #9 for additional help in connecting the analyzer.

7. Close Keysight IO

If you are using an Keysight X series spectrum analyzer, please refer to Technical Bulletin #9 for specific settings before closing Keysight IO.

Once connected, set the analyzer as a favorite. Click on the grey star and it will turn yellow.



8. Double click on the EMxpert5 icon

Look at the bottom left of the EMxpert application and wait until it shows “Connected to the Scanner and Spectrum Analyzer”.

Get ready to scan!

If you have any issue, verify that you are using a compatible spectrum analyzer with the right hardware, firmware and software version:

http://www.emscan.com/emxpert/EMx_supportedSA.cfm

If your EMxpert still does not work, contact us by email at support@emscan.com or call +1-403-291-0313 ext. 2

Hardware Setup

1. Connect the SMB connector to the EHX Adapter and the BNC connector to the external trigger port on the rear panel of the spectrum analyzer



2. Connect the B-end of the USB cable to the USB port on the EHX Adaptor and A-end to any USB port on the computer.



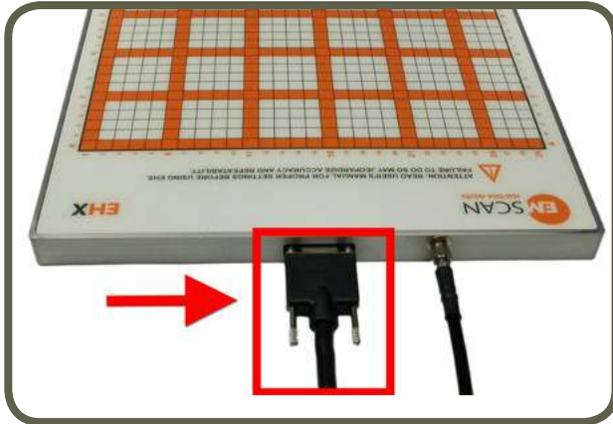
The LED light shows three stages:

- Red: Boot mode (this stage is fast; you may not even notice it)
- Orange: Initiation mode (checking adaptor's firmware)
- Green: User mode (adaptor is connected and ready)

Getting Started

Hardware Setup

3. Connect one end of the Micro-D control cable to the Micro-D control port on the EMSCAN'S patented scanner and the other end of the Micro-D control cable to the EHX Adaptor.



4. Connect the SMA end of the RF cable (RF SMA to type N coaxial cable) to the RF Output port of the patented scanner and the other end to the RF Input port (front) of the spectrum analyzer.



5. Connect Crossover Ethernet cable between the spectrum analyzer (SA) and the PC.
6. Setup the IP address of the SA to 172.16.1.148
7. Setup the Static IP address of the PC to 172.16.1.99

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

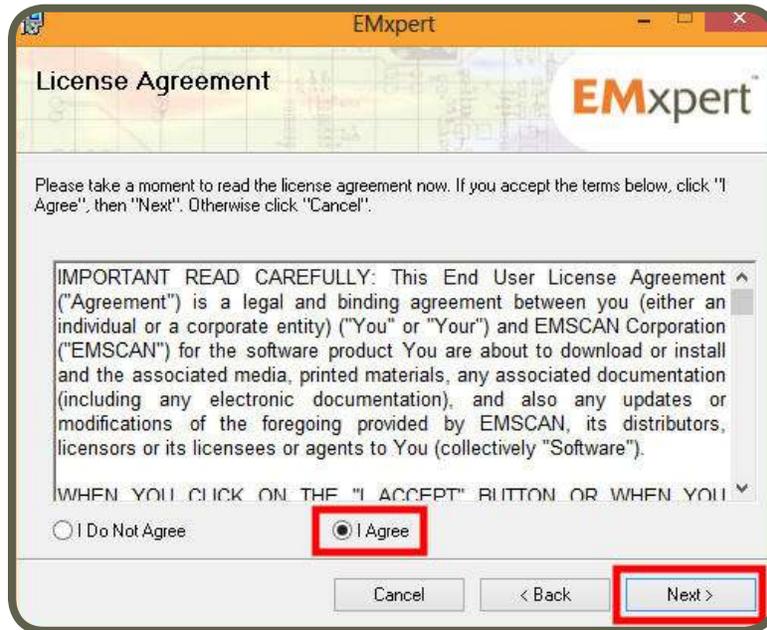


4. Click Next

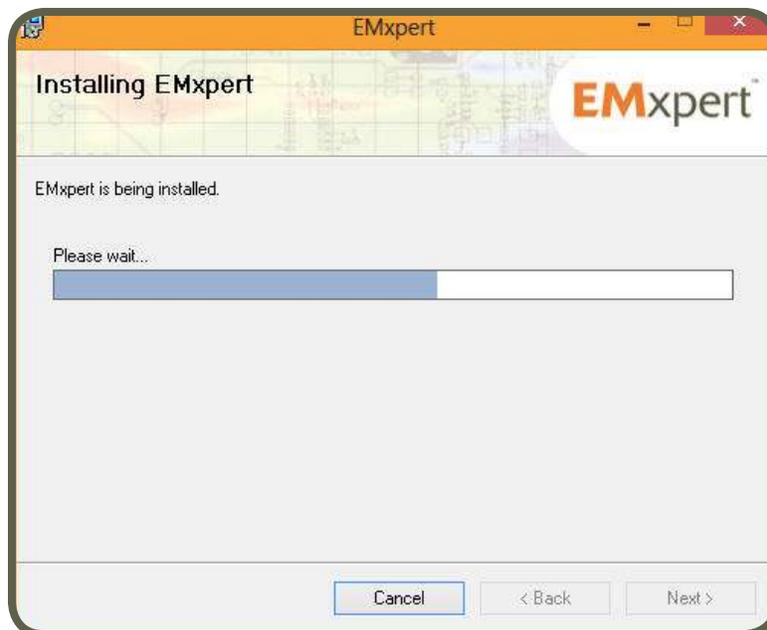


Getting Started Software Installation

5. Select I Agree and click Next

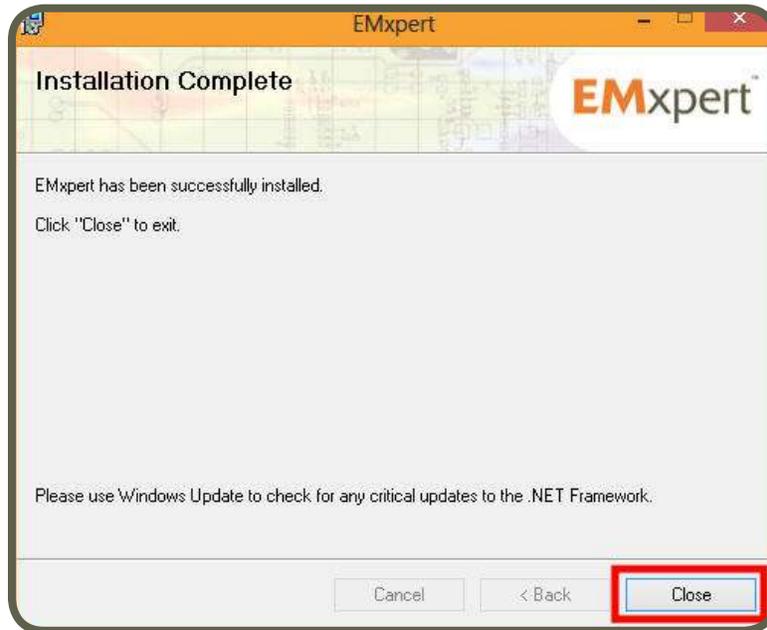


6. Below screen will be displayed

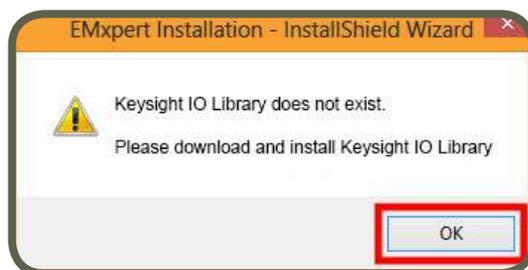


Getting Started Software Installation

7. Click Close



8. If Keysight IO Library is already installed on your PC, you can start using EMxpert software. Otherwise please follow the next steps to install it. You need an internet connection to download Keysight IO Library.

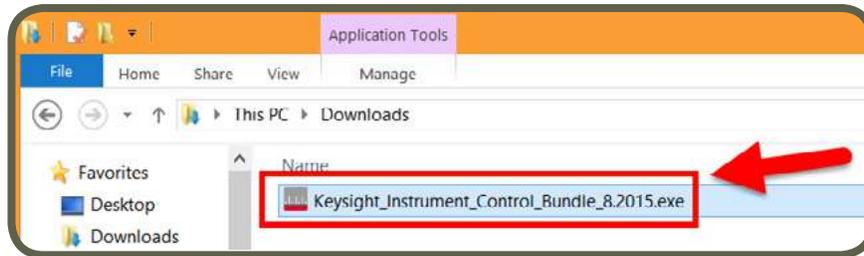


Note:

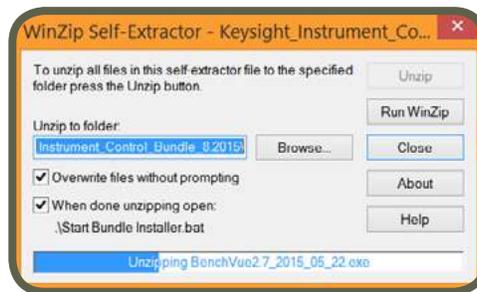
Several visa libraries may already be installed on your PC. After installing Keysight Visa Library, ensure that it is set as primary VISA. You will be guided through the steps on [page 25](#).

Getting Started Software Installation

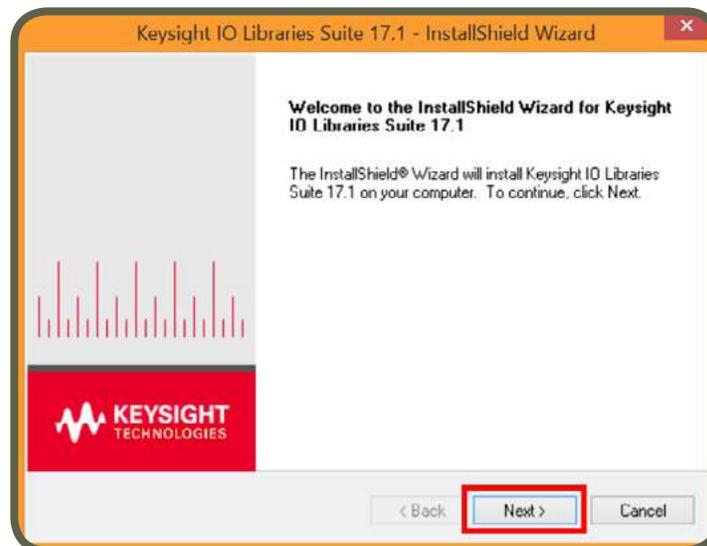
9. Once you are directed to the [Keysight website](#) click on the Download button and follow the steps. When the download is complete, open the Downloads folder and double click IOLibSuite_17_1_19313.



10. The folder will be unzipped.

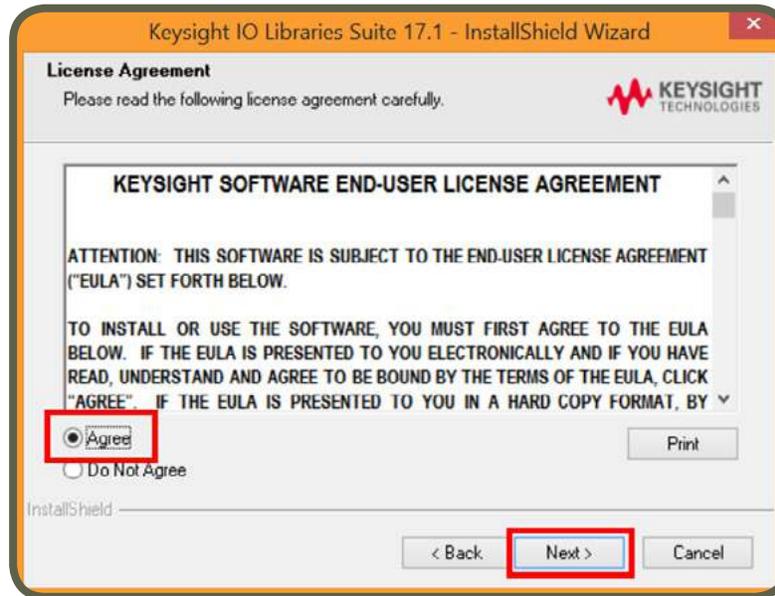


11. Click Next.

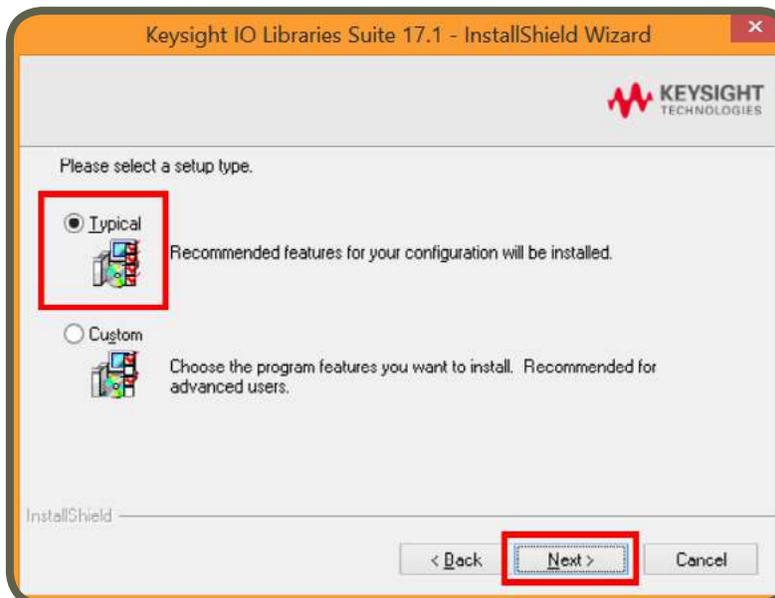


Getting Started Software Installation

12. Select Agree and click Next.

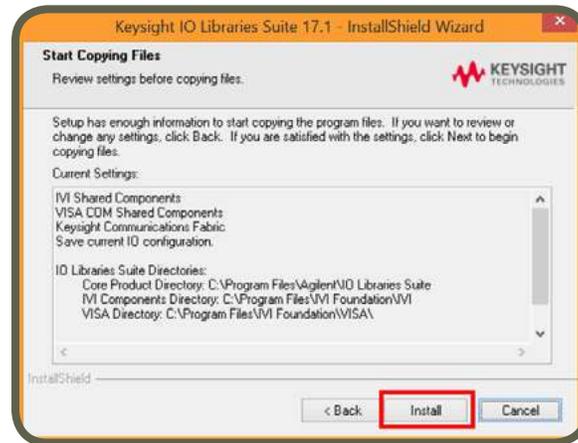


13. Select Typical and click Next

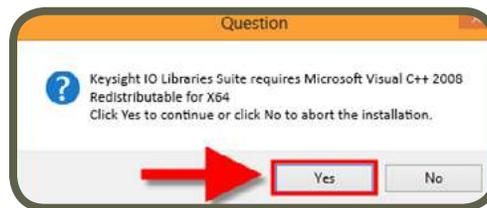


Getting Started Software Installation

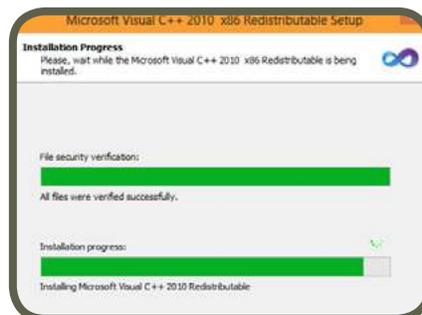
14. Click Install



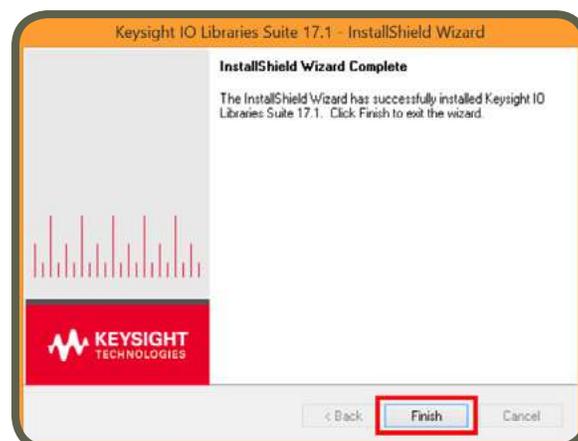
15. If Microsoft Visual C++ is not installed on your PC below screen will be displayed. Click Yes



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



17. Click Finish

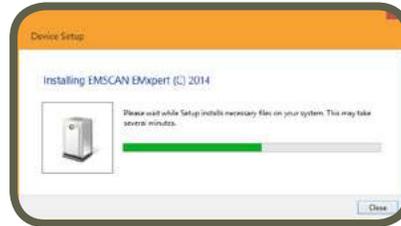


Getting Started

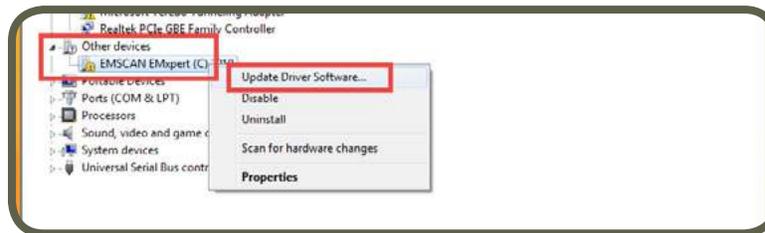
Software Installation

18. Connect the USB Cable to the EHX adaptor and PC

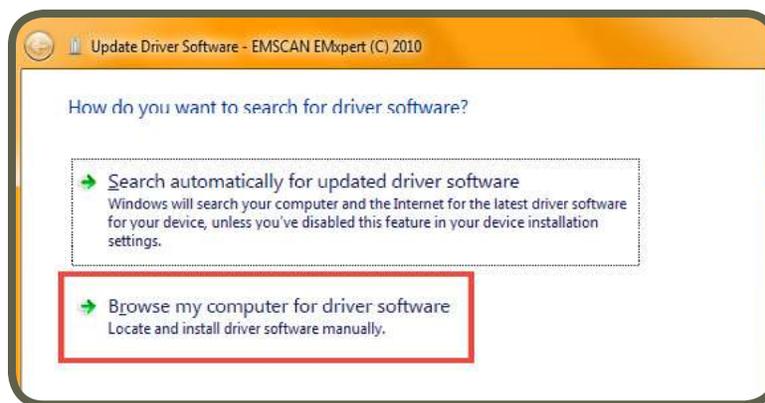
- a. The driver will be automatically installed



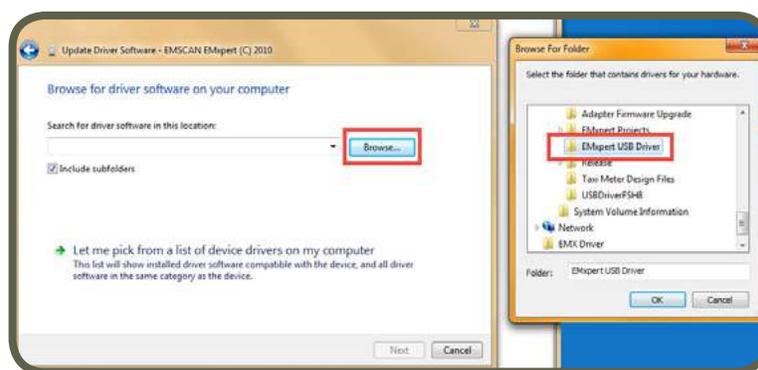
- b. If the installation doesn't start automatically, follow below steps. Open the Device Manager and expand "USB Custom Driver" and right click on EMxpert USB Driver (C) 2014 and select Update Driver Software...



- c. Select Browse my computer for driver software



- d. Select Include subfolders and click Browse and select the EMxpert USB drive and click OK

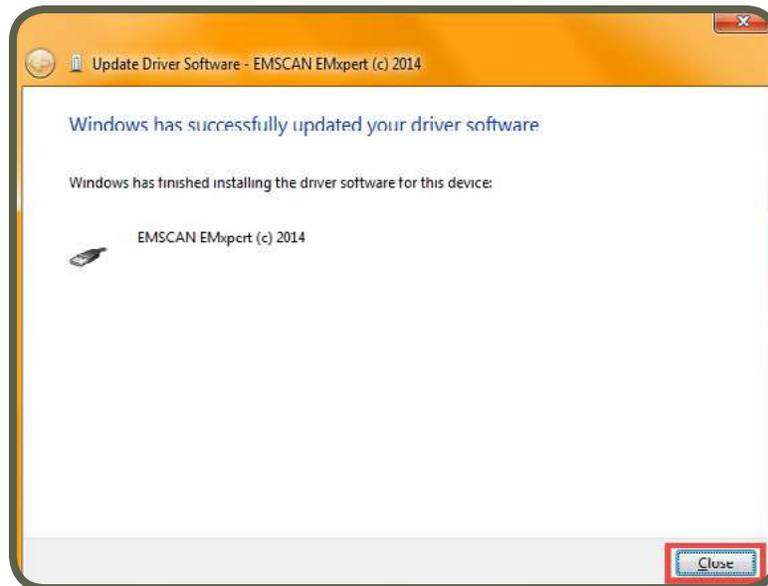


Getting Started Software Installation

e. Click Next



f. Click Close to complete installation



19. Start the EMxpert EHX & EMX Software by clicking the icon on the Desktop



External Spectrum Analyzer Setup for EHX

Attention: An ethernet cross-over cable (static IP must be set for PC and the analyzer) or USB cable can be used for the PC and spectrum analyzer connection.

USB Connection

If the PC and spectrum analyzer are connected via USB cable skip to Step 2

LAN Connection

Step 1 - Spectrum Analyzer Setup

- In order to have an automated connection to the spectrum analyzer, the IP address of the analyzer must be set at 172.16.1.148 and the PC's at 172.16.1.99. If for some reason another IP address needs to be used then please make the following change to 'EMxpert.ini' in the directory where EMxpert.exe is: C:\Program Files (x86)\EMSCAN Corporation\EMxpert 5

Open this file by using notepad; there is the following section at the end:

```
[EMxpert Info]
Spectrum Analyzer Detecting = 1
Scanner Detecting = 1
```

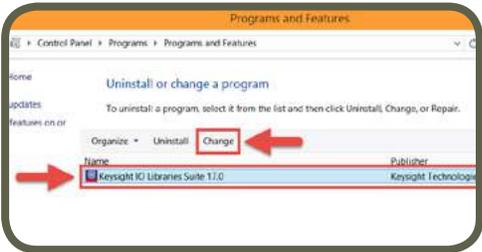
Just change into:

```
[EMxpert Info]
Spectrum Analyzer Detecting = 0
Scanner Detecting = 1
```

- Please check [Technical Bulletin #9](#) if you have a Keysight spectrum analyzer.

Step 2 - PC Setup

- Several visa libraries may already be installed on the PC. Ensure that Keysight Connection Expert is set as primary VISA
- Go to Control Panel and double click Add or Remove Programs
- Select Keysight IO Libraries Suite and click Change



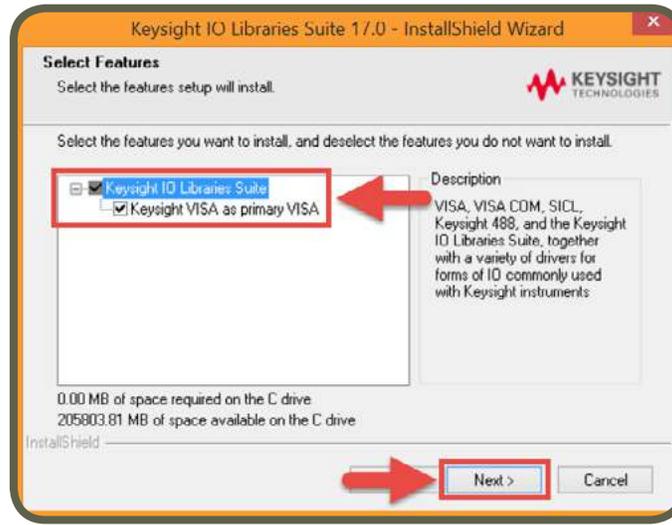
- Select Modify and click Next



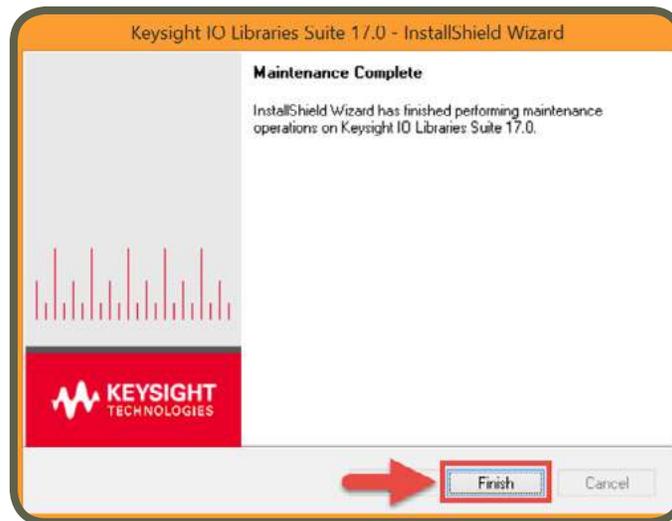
Getting Started

External Spectrum Analyzer Setup for EHX

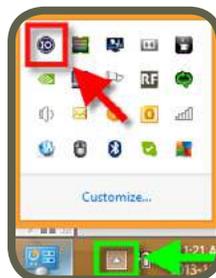
- Select Keysight Visa as primary VISA and click Next



- Click Finish



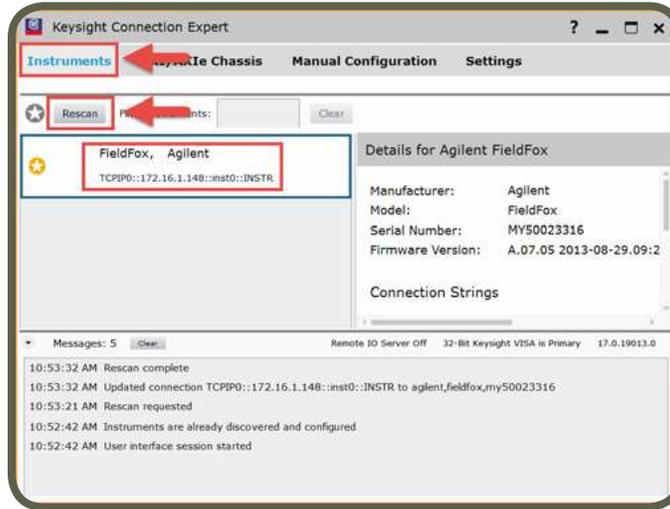
- When you first connect to the spectrum analyzer open Keysight Connection Expert



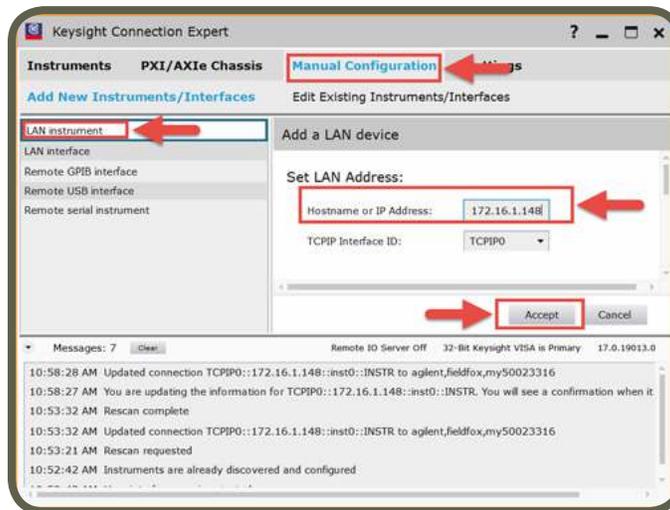
Getting Started

External Spectrum Analyzer Setup for EHX

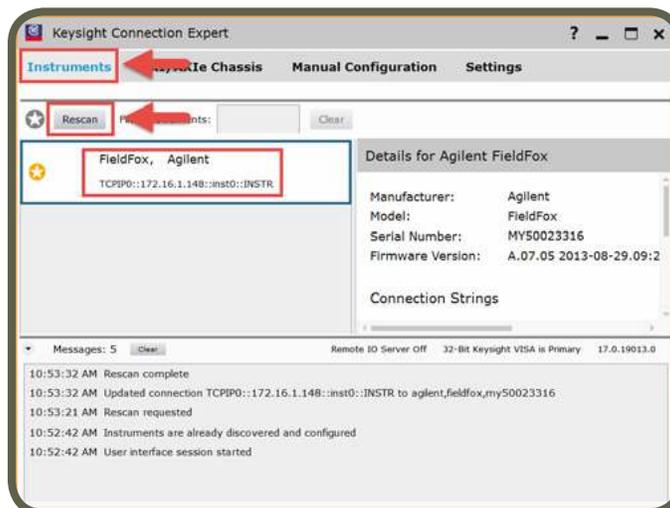
- Keysight IO will automatically detect the spectrum analyzer and display the analyzer model. If it doesn't click Rescan. If it still doesn't detect the analyzer, click Manual Configuration.



- Select LAN instrument and enter the IP address: 172.16.1.148 and click Accept.



- Click Instruments tab to see that spectrum analyzer is successfully detected. It has to be a "favorite" to operate and must have a yellow star.



Getting Started

External Spectrum Analyzer Setup for EHX

Step 3 – EMxpert Software

The EMxpert software automatically detects the spectrum analyzer.

Turn on the spectrum analyzer, connect it to the PC and start the EMxpert software. As soon as the EMxpert software is launched, two messages are displayed at the bottom of the screen.



The EMxpert software automatically detects first the adaptor/scanner and then the analyzer. If the adaptor is not connected properly, EMxpert software gives an error message about the adaptor connection and it doesn't check the spectrum analyzer connection until the adaptor is connected to the PC properly.



After the adaptor is connected to the PC properly, restart the EMxpert software.

If there is a connection problem between the spectrum analyzer and the PC, an error message will be displayed as shown below. Please refer to [Quick Installation and Check List](#).



Note:

If the IP address of the spectrum analyzer is set to 172.16.1.148, the EMxpert software automatically detects the status of the connection to the spectrum analyzer when it is launched.

Otherwise, if the connection between the spectrum analyzer and the PC breaks, automatic detection does not resume. After re-establishing the connection between the PC and the spectrum analyzer, the EMxpert software must be restarted.

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.

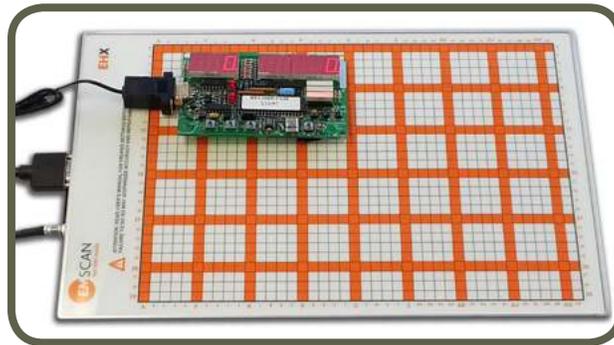
EMxpert does not require a special setup like a shielded room; the Device Under Test (DUT) may sometimes however pick up strong ambient signals like those present in the cell band (850 MHz -2100 MHz) or radio FM band.

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

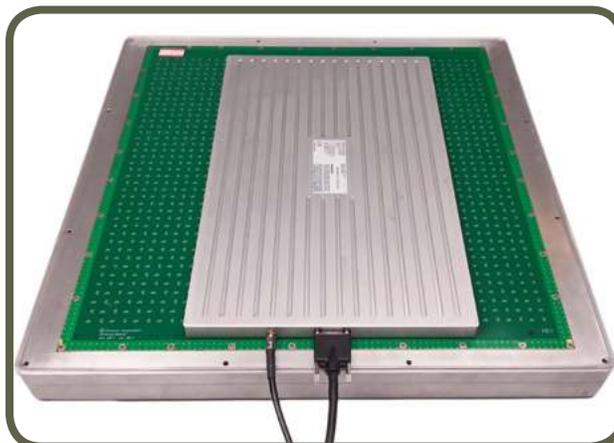
1. PCB testing (smaller than the scan area)

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, use of an LNA is strongly suggested. If the other side of the PCB does not have any high components, you should scan this side.



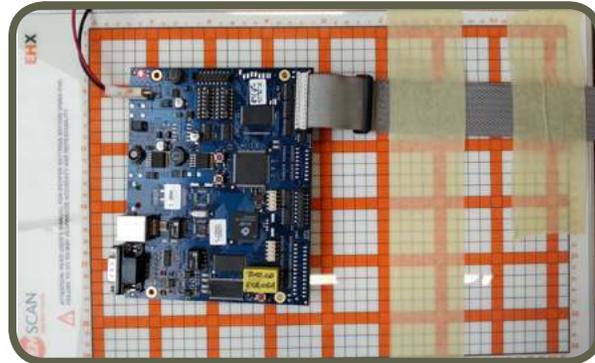
2. PCB testing (larger than the scan area)

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



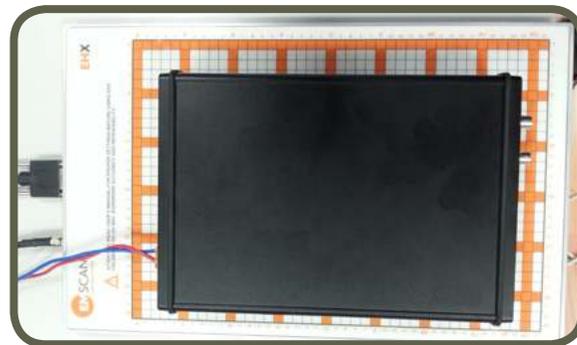
3. Cable testing

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



4. System testing

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



4. In situ testing

EMxpert EHX model is light and compact. The bottom part of EMxpert EHX is made of anodized aluminum making it non-conductive. Care must be taken to not pierce the anodized surface since the underlying aluminum is conductive.

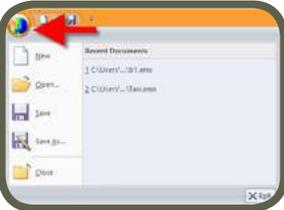
Scanner can easily be placed in a rack-mount system to test the PCBs in their working environment. A mechanical arm may be required to fix the scanner for ease of testing.



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

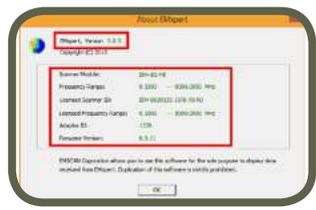


- Start a new project
- Open an existing project
- Save a project
- Close a project
- Access to recent documents

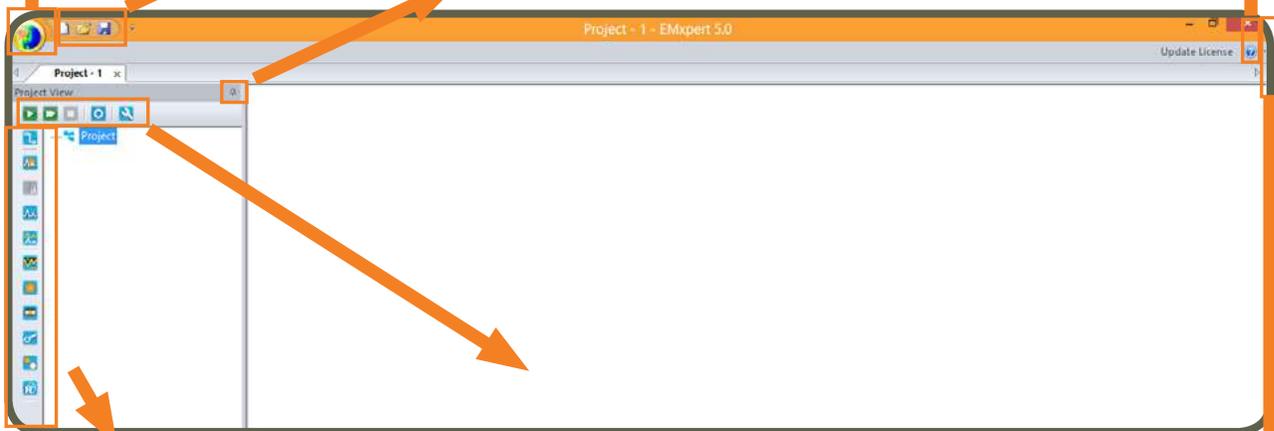
Icons

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

About EMxpert



Auto-hide or pin the project view



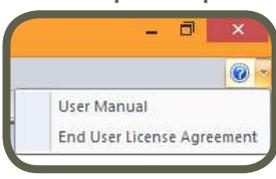
Buttons

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

Buttons

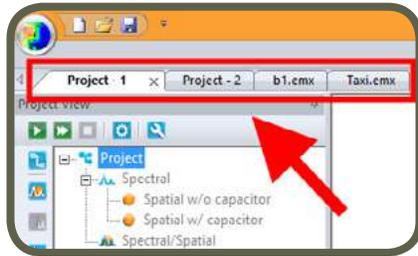
- Scan Once
- Scan Continuously
- Stop Scan
- Settings
- Preferences

EMxpert Help

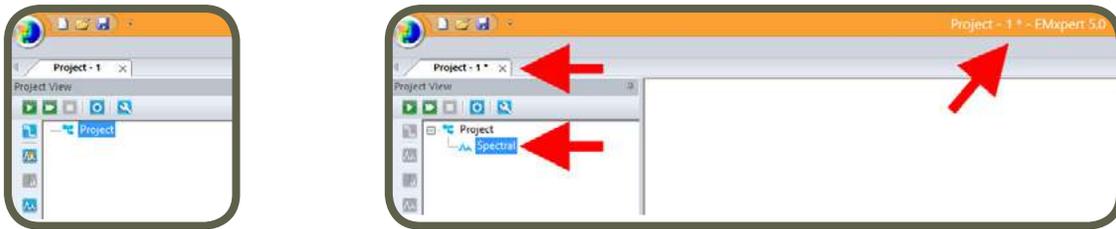


Quick Facts about Menu Bar

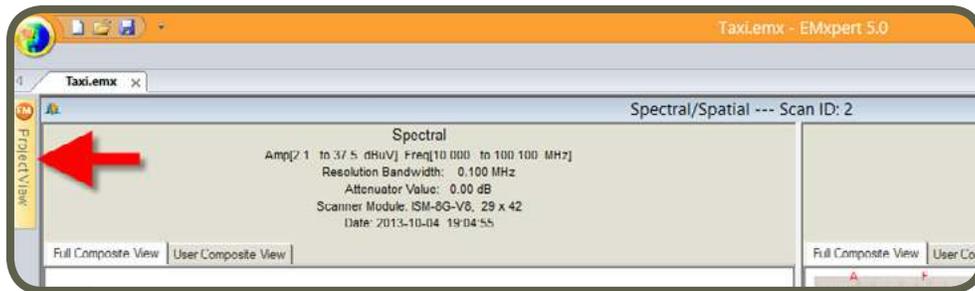
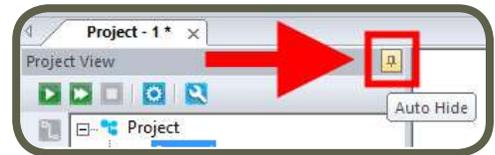
Multiple project files can be opened at the same time. Each file will have a dedicated tab showing the project name. Click on the tab to view the project file.



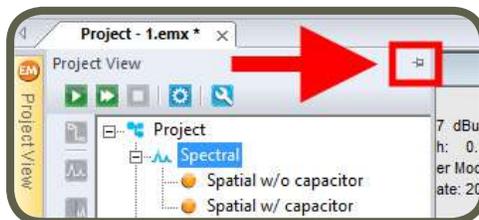
If there are any changes compared to the saved version of the project file this will be indicated by an asterisk (*) behind the file name. If you want to keep your changes, be sure to save the file before you close. In the example below, a new project file is created and then a Spectral node is added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

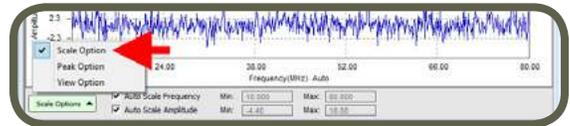
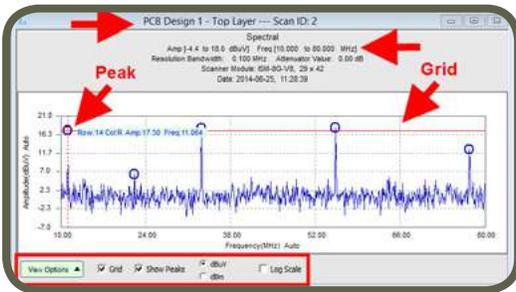
Spectral View

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.

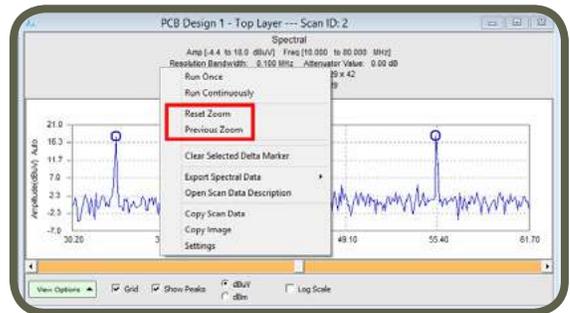
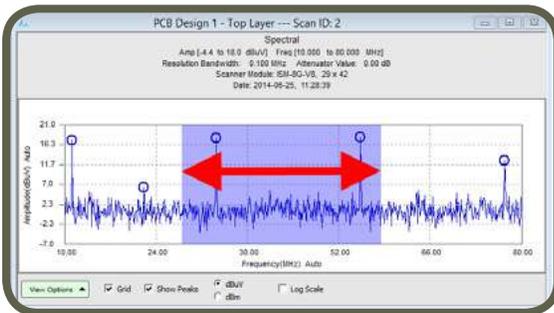
Mouse over the graph to display row / column coordinates, frequency and amplitude values.

A blue circle represents a user-defined marked peak. 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 and Scale Options are listed under View Options.

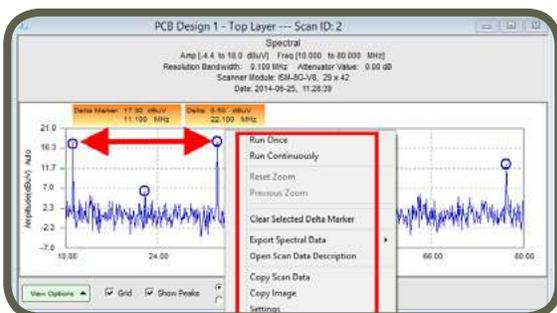


Left click and drag to zoom in. Right click and select Reset Zoom to return to the original view or Previous Zoom to return to the previous zoom level.



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.

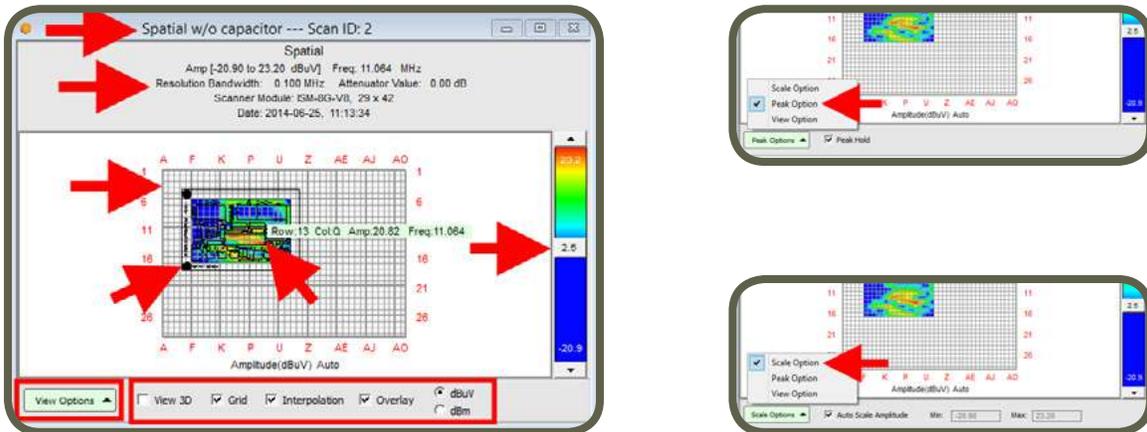


Spatial View

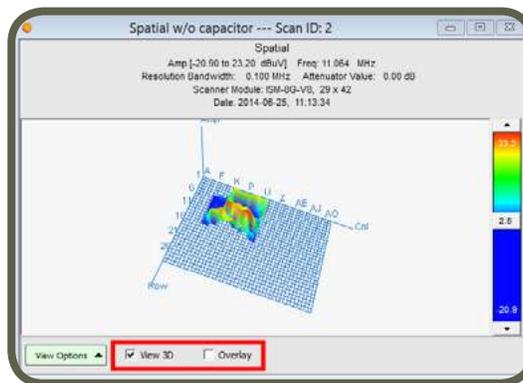
Name of the scan is on the top of the graph. Below name is the scan type, scan frequency, minimum and maximum amplitudes of this frequency, LNA or Attenuator values used, patented scanner model and date and time of the scan.

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

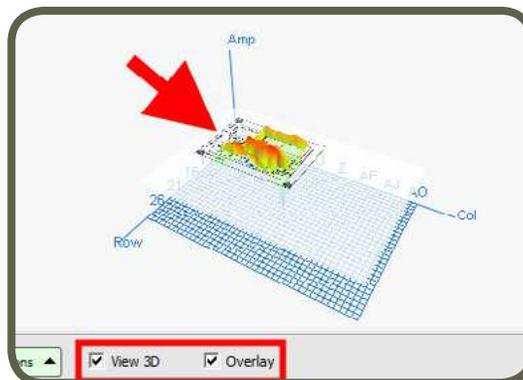
Spatial view can be adjusted by the checkmark boxes at the bottom of the graph. Grid and Overlay can be hidden / displayed. Interpolation (degree of data smoothing in the image) can be turned on / off. By sliding the Set Color Threshold on the right side of the graph, you can increase or decrease the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

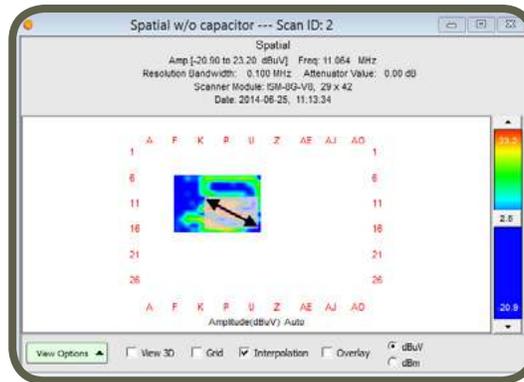


When Overlay is checked in 3D view, the wheel of the mouse will adjust the transparency. But if you press Ctrl key and then use the wheel you can move up and down the overlay to have the tip of the peaks right at the DUT level.

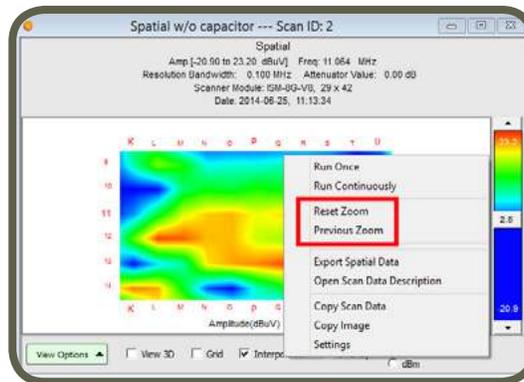


EMxpert Software Viewing Scan Results

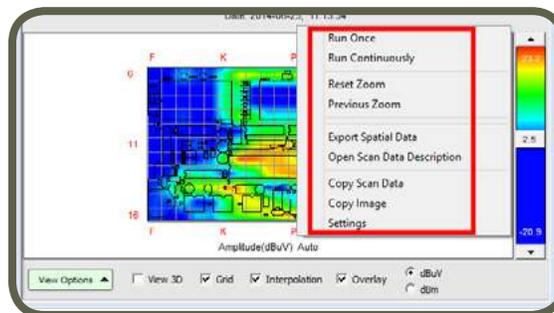
Left click and drag to zoom in.



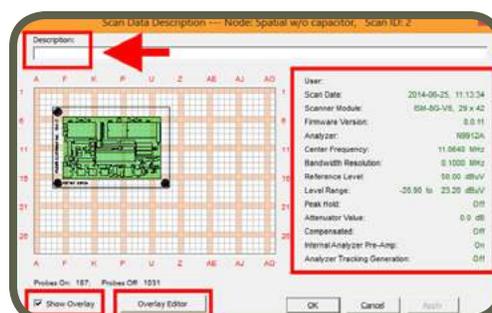
Right click and select Reset Zoom to return to the original view or Previous Zoom to return to the previous zoom level.



Right click on the graph to display menu.



You can change some settings of the Spatial Scan via Settings or Open Scan Data Description which will give information about the scan and access to the Overlay Editor after a scan.



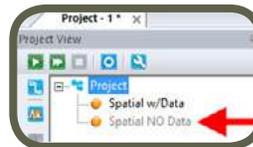
Nodes

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.

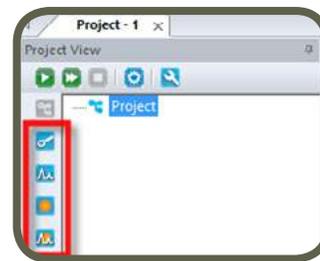
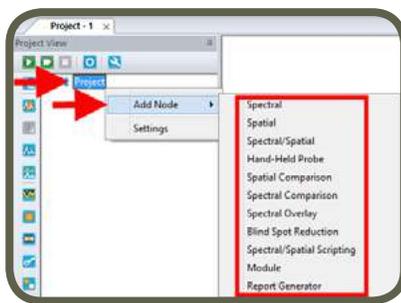
A module  is the sub-root node. It can be considered as a subfolder like in Windows directories to store related data. You can add different types of scans and/or notes to a project node. You can rename, copy and paste a node or node settings only. Module's settings are inherited throughout the module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



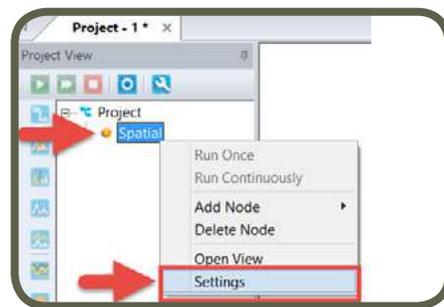
How to Add a Node?

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 to the left of the Project node.



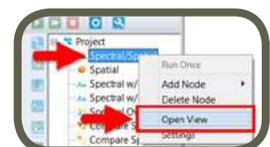
How to Name a Node?

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?

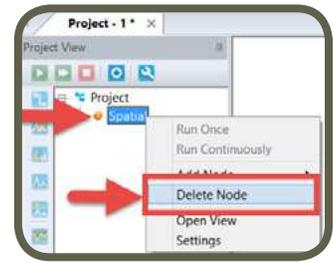
Double click on the node that you want to view or right click and select Open View.



How to Delete a Node?

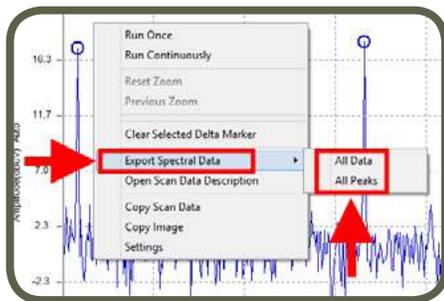
Double click on the node that you want to view.

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.



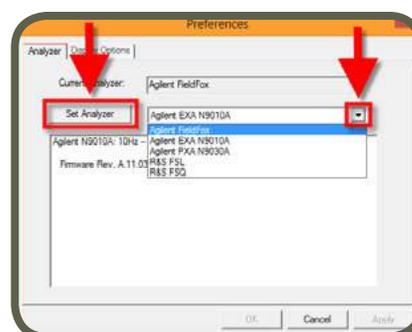
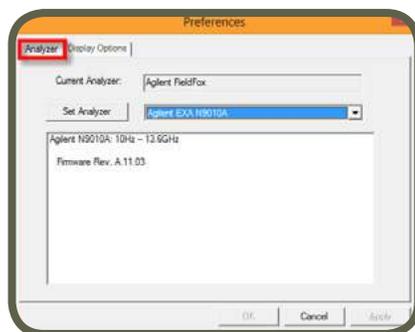
Preferences: Analyzer and Display Options

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.

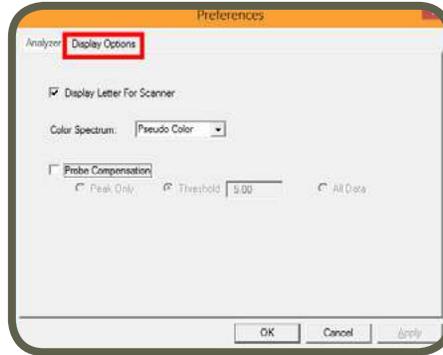
Although the EMxpert software detects the spectrum analyzer automatically, you can override it by manually selecting the spectrum analyzer from the drop down menu.



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.



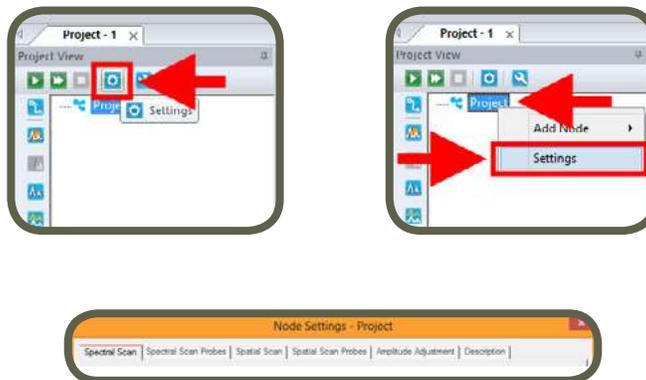
Color Spectrum: Color options for the spatial display.

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 settings from 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.

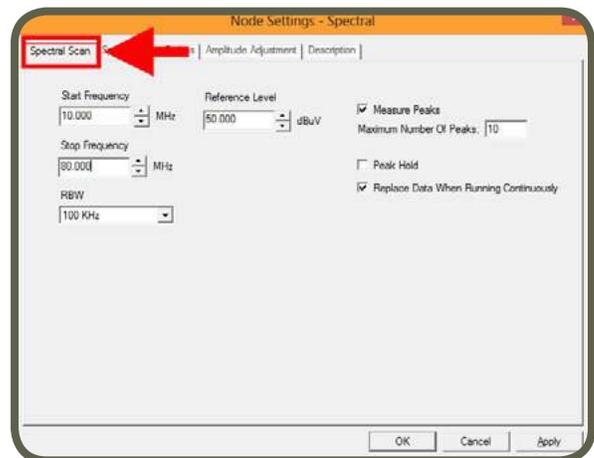


The tabs in the Project Settings window are covered in the following pages.

Spectral Scan 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 120 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.



Caution:

INFORMATION REGARDING ALL ROHDE & SCHWARZ SPECTRUM ANALYZERS EXCEPT FSU AND FSL: The RBW is only selected from the list of available filters in the Gaussian (3dB) aka Normal folder. The EMxpert settings will default to the closest RBW if the requested filter is not available. For the FSL and FSU, the end-user can pre-select the Gaussian or the EMI folder on the spectrum analyzer before connecting to the EMxpert application. The EMxpert will then use the filters available in the selected folder.

Reference Level: This feature is no longer relevant and will be removed at the next software release.

Measure Peaks: It activates the peak marking feature whereby peaks are rescanned at a tighter bandwidth in order to accurately measure the frequency as long as the peak's value is 5 dB above the average noise floor of the scan. By default the maximum number of peaks is set to 10. 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.

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.

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.

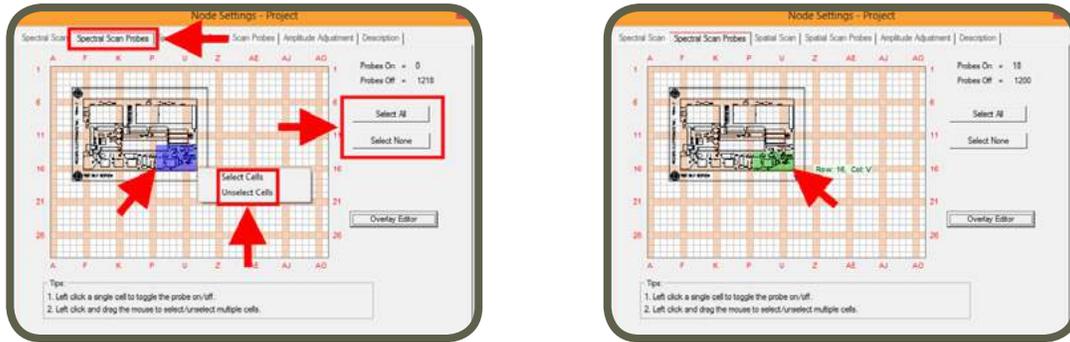
You can deactivate the probes; either left click on already selected cells or by left clicking and dragging the mouse and choosing Unselect Cells; or by clicking on Select None to deactivate all of the probes.

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

Note:

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

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.



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.

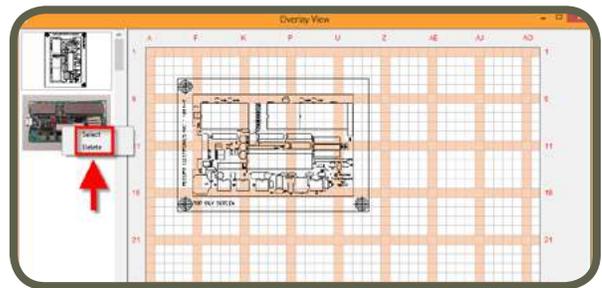
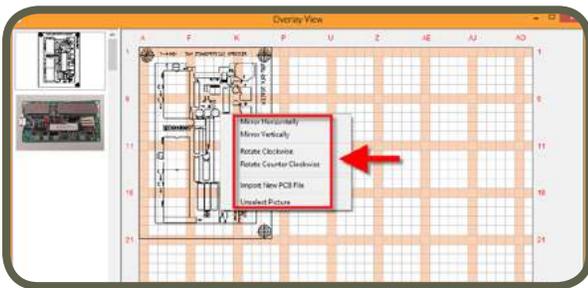
EMxpert Software

Nodes



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.

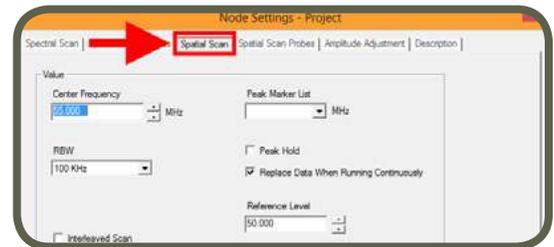
Thumbnail view of the files are listed on the left hand column. Right click on any image to Select to view it on the grid view or to Delete it from the thumbnail view.



Spatial Scan Tab

Enter *Center Frequency* manually or select it from the *Peak Marker List*. The Center Frequency will be set automatically to the chosen frequency.

RBW (Resolution Bandwidth): It is set by default at 120 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 <math><10,000</math> 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.



Caution:

INFORMATION REGARDING ALL ROHDE & SCHWARZ SPECTRUM ANALYZERS EXCEPT FSU AND FSL: The RBW is only selected from the list of available filters in the Gaussian (3dB) aka Normal folder. The EMxpert settings will default to the closest RBW if the requested filter is not available. For the FSL and FSU, the end-user can pre-select the Gaussian or the EMI folder on the spectrum analyzer before connecting to the EMxpert application. The EMxpert will then use the filters available in the selected folder.

Interleaved Scan: This is the automated version of the Blind Spot Reduction Node. 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 70](#)).

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.

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.

Reference Level: This feature is no longer relevant and will be removed at the next software release.

Spatial Scan Probes Tab

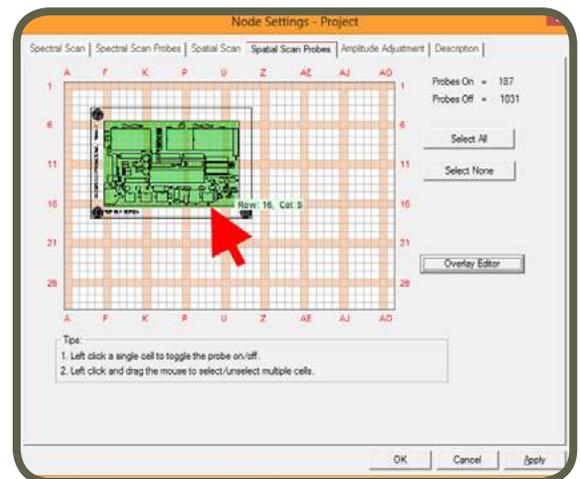
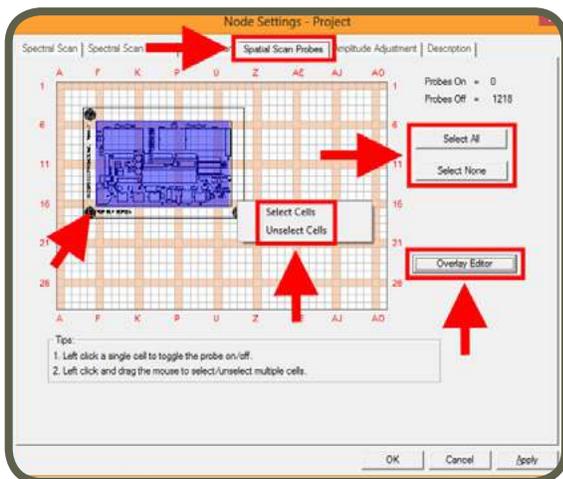
Select and activate the probes under the DUT. You can activate the probes by either a left click on individual cells or by left clicking and dragging the mouse and choosing Select Cells; or clicking on Select All to activate all of the probes. Green indicates the activated probes.

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.



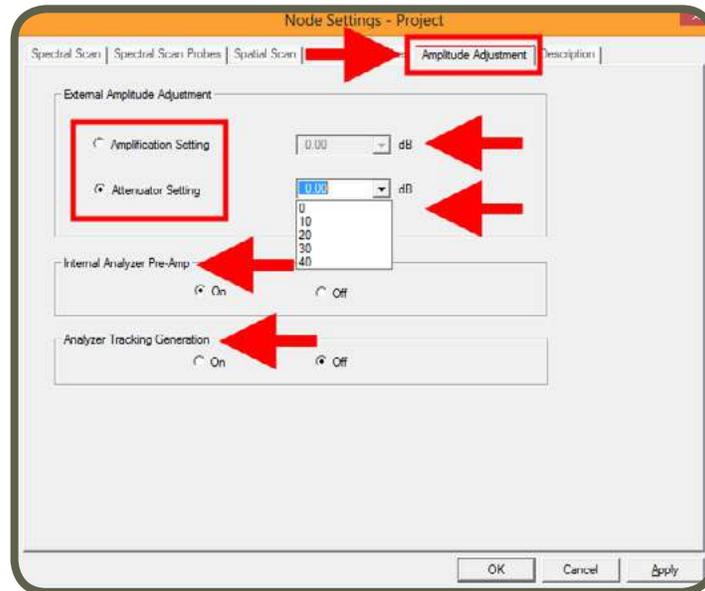
It is important to activate all of the probes under the DUT to have a complete view of the emissions on the DUT.

Overlay Editor

Please refer to [page 40](#).

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.

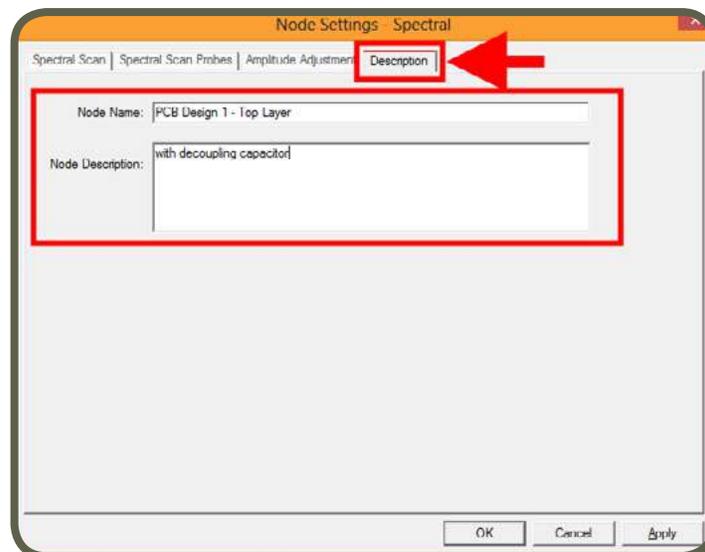


Internal Analyzer Pre-Amp: This feature provides extra sensitivity. It is ON by default. Turn this feature OFF if your spectrum analyzer is not equipped with a Pre-Amp.

Analyzer Tracking Generation: This feature will remotely turn on the tracking generator of the FieldFox N9912A spectrum analyzer. When you run Spectral or Spectral/Spatial Scan, the tracking generator will output a frequency that tracks the swept frequency.

Description Tab

You can name the node and add a description.

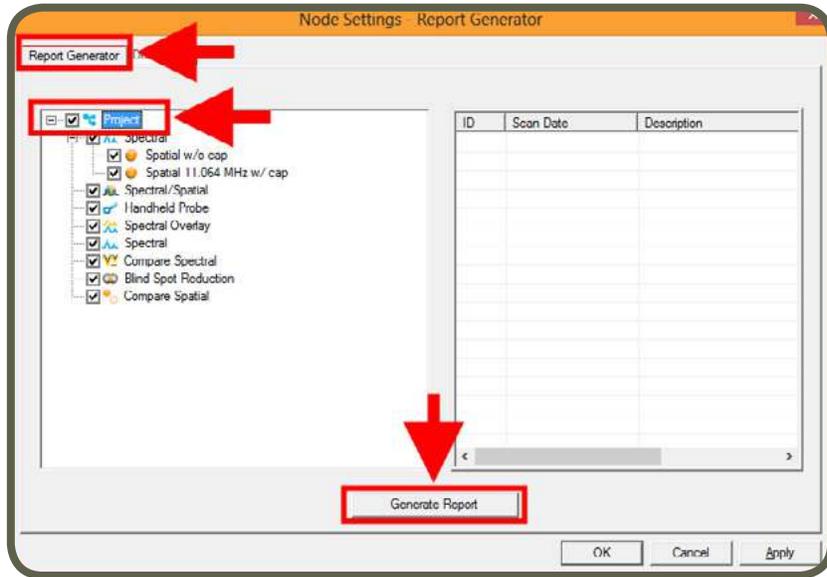


Report Generator

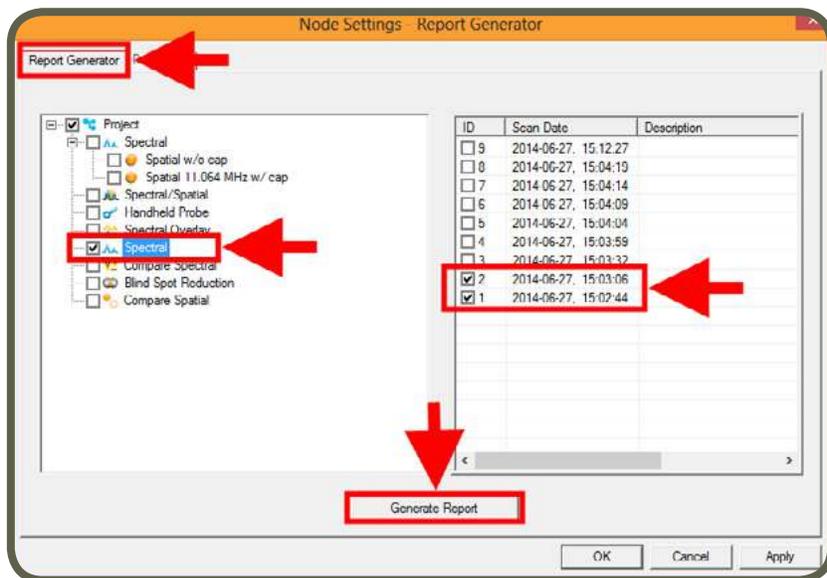
The Report Generator Node allows the user to generate standard scan reports by exporting the scans into Microsoft Office Word for Windows report template.

Report generator needs Microsoft Office Word.

To create a report, add Report Generator node to any node (please refer to [page 36](#)). 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:** effective spatial resolution of the EMxpert EHX model is 3.75 mm. EMxpert 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 EMxpert probes. 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.

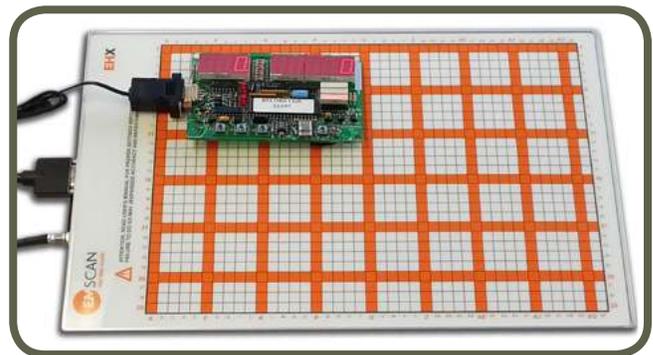
There are four methods to further analyze the scanned data:

- **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.
- **Spatial Blind Spot Reduction:** is now available as the Interleaved function in Spatial Scan. Spatial Blind Spot Reduction is kept to analyze in the future the data from projects prior to 5.0.
- **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

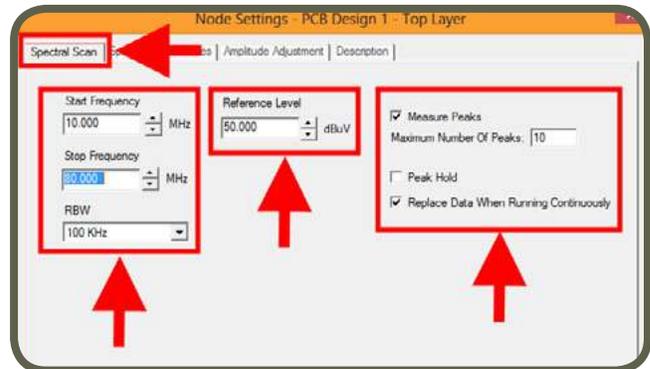
Spectral Scan measures and displays the maximum amplitude vs. frequency of the magnetic field strength over the scanned area.

Add Spectral Scan node to Project node (please refer to [page 36](#)). 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 39](#)). 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 120 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.



Caution:

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3. *Reference Level*: This feature is no longer relevant and will be removed at the next software release.
4. *Measure Peaks*: It activates the Peak marking feature whereby peaks are rescanned at a tighter bandwidth in order to accurately measure the frequency as long as the peak's value is 5 dB above the average noise floor of the scan. By default the maximum number of peaks is set to 10. The maximum number peaks that can be measured is 30.
5. *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.
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

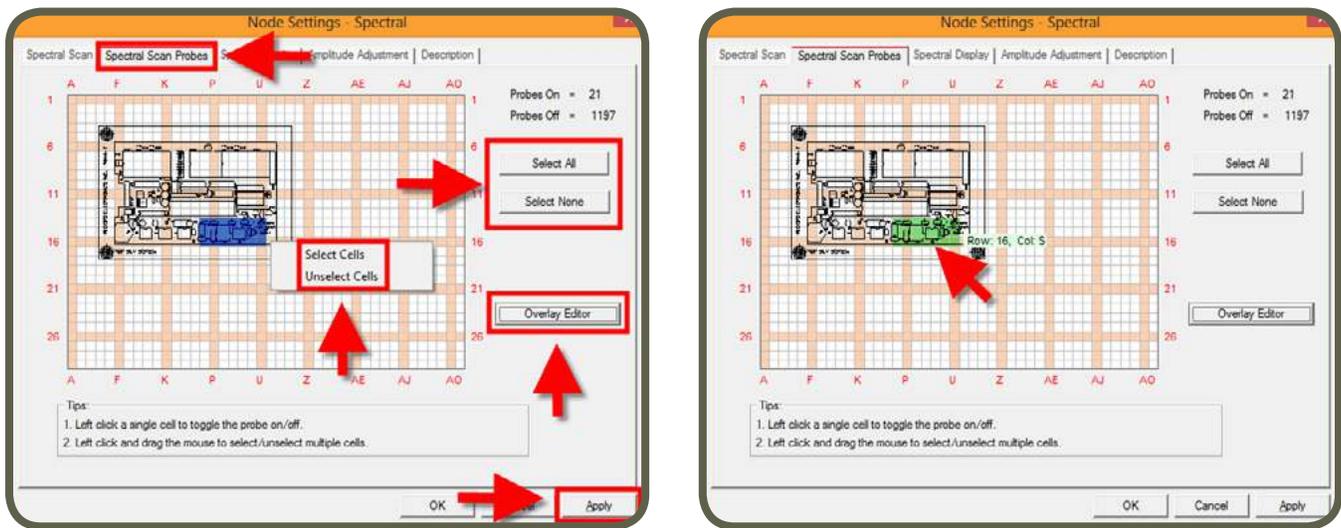
Select and activate the probes under the DUT. You can activate the probes by either a left click on individual cells or by left clicking and dragging the mouse and choosing Select Cells; or clicking on Select All to activate all of the probes. Green indicates the activated probes.

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 Scans, ensure to at least have 20% to 30% of the probes selected.

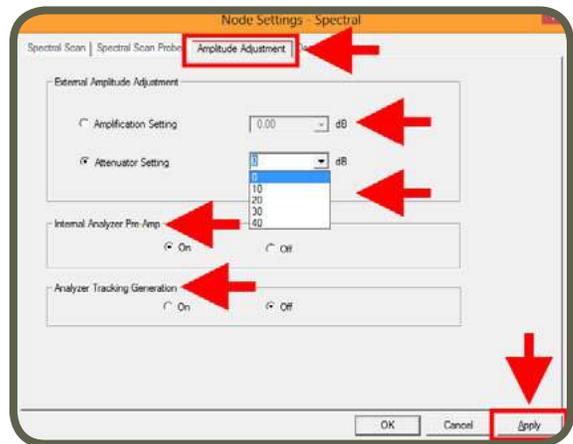
Overlay Editor

Please refer to [page 40](#).

Amplitude Adjustment Tab

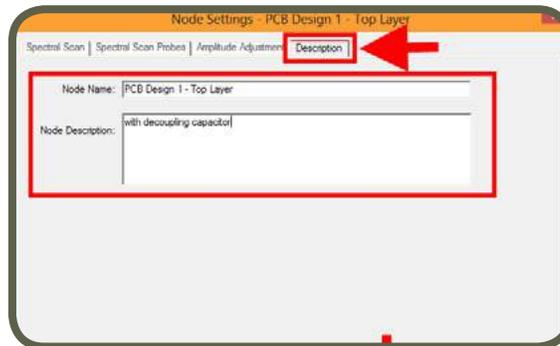
You can use an LNA or attenuator with EMxpert to increase or decrease the power level of the signals coming from the scanner and going to the spectrum analyzer. To activate click on Amplification Setting or Attenuator Setting and then select the value from the drop down menu or type the value. The displayed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

Internal 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. Click OK.

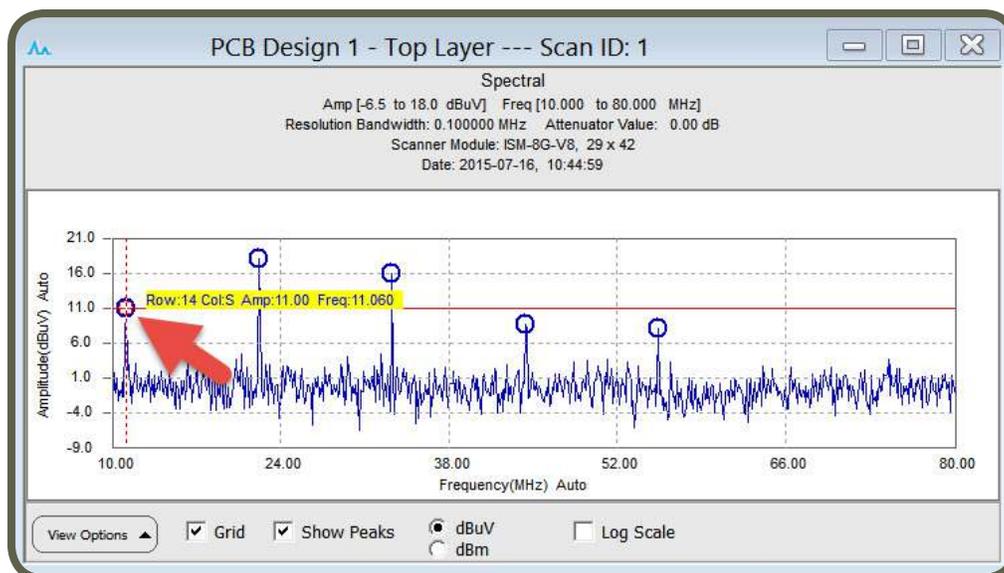


To run the scan once click  or to run the scan continuously click .

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).

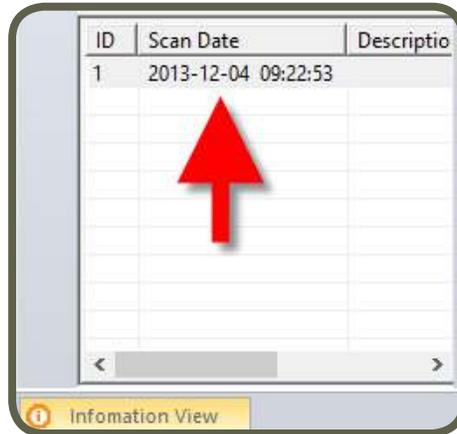


Once the scan is completed, an image of the scan will be displayed. You can mouse over the graph to see coordinates, frequency and amplitude data.

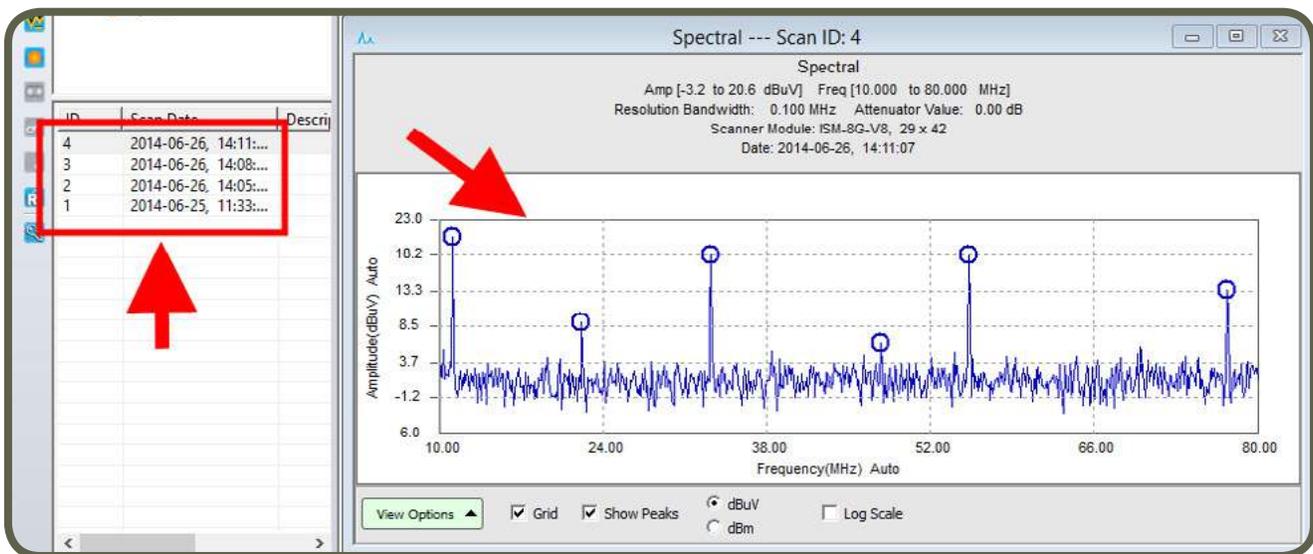


EMxpert Software Spectral Scan

When running the scan continuously , if *Replace Data When Running Continuously* in the Spectral Scan settings is selected (please refer to [page 46](#)), 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 when running the scan continuously , uncheck *Replace Data When Running Continuously* in the Spectral Scan settings (please refer to [page 46](#)). You can display spectral graphs of all the scan data. Simply click on the scan and the graph will immediately update.



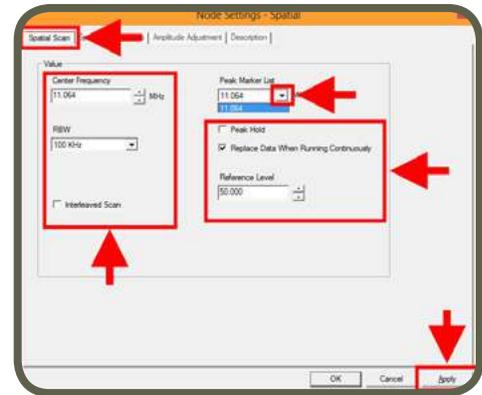
Spatial Scan

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 36](#)). 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 41](#)). 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 or select it from the *Peak Marker List*. The Center Frequency will be set automatically to the chosen frequency.
2. *RBW (Resolution Bandwidth)*: It is set by default at 120 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.



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3. *Interleaved Scan*: This is the automated version of the Blind Spot Reduction Node. This scan is meant to overcome the limitations of the probe polarizations. By measuring a DUT twice with a one row physical shift between the two scans this blind spot can be eliminated.
4. *Peak Marker List: 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 possible peak that was not peak marked it will not have the '—X' after it but it will still show up in this list..
5. *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.
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. *Reference Level*: This feature is no longer relevant and will be removed at the next software release.
8. Click Apply

Spatial Scan Probes Tab

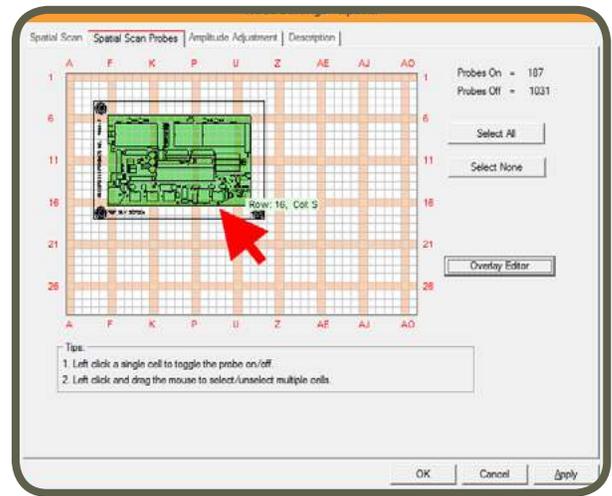
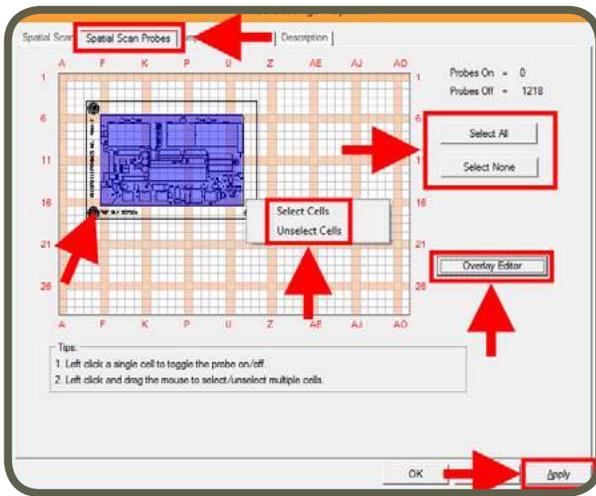
Select and activate all of the probes under the DUT. You can activate the probes by either left click on individual cells or left click and drag the mouse and choose Select Cells or click Select All to activate all of the probes. Green indicates the activated probes.

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.

Overlay Editor

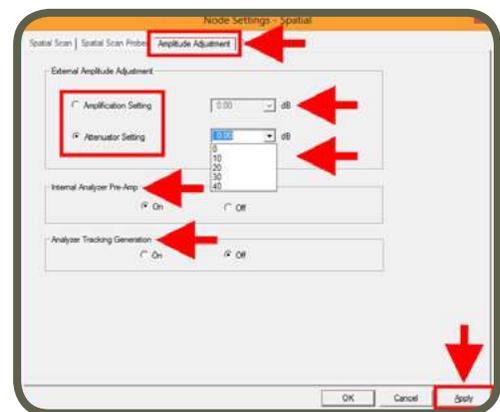
Please refer to [page 40](#).

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.

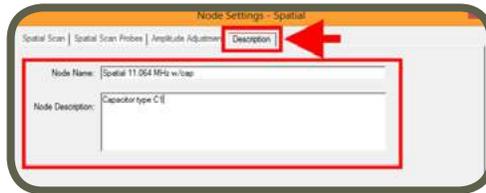
Internal Analyzer Pre-Amp: This feature provides extra sensitivity. It is ON by default. Turn this feature OFF if your spectrum analyzer is not equipped with a Pre-Amp.

Analyzer Tracking Generation: This feature will remotely turn on the tracking generator of the FieldFox N9912A spectrum analyzer. When you run Spectral or Spectral/Spatial Scan, the tracking generator will output a frequency that tracks the swept frequency.

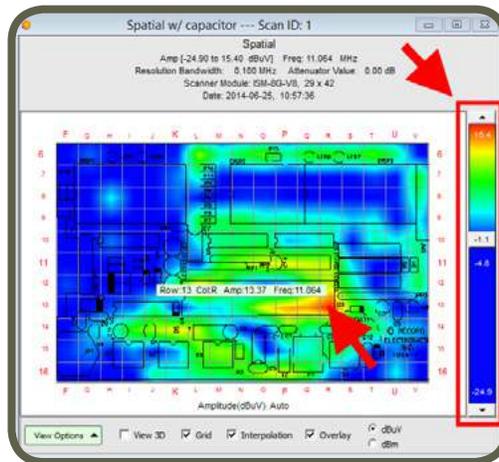


Description Tab

You can name the node and add a description.

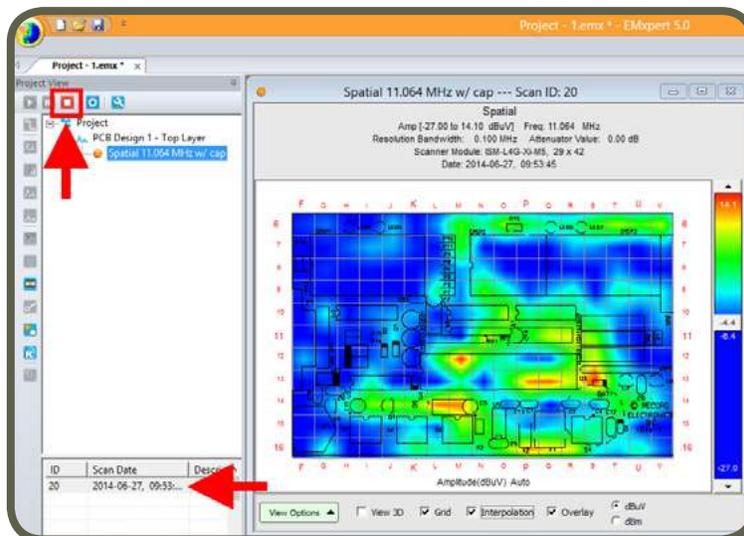


To run the scan once click or to run the scan continuously click .



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 4 to 10 times per second on the EHX depending on the spectrum analyzer's performance. If you wish, you could move the PCB on the scanner and see the result of the movement in real-time (the overlay does not move as you have fixed it to a position). 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.



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.

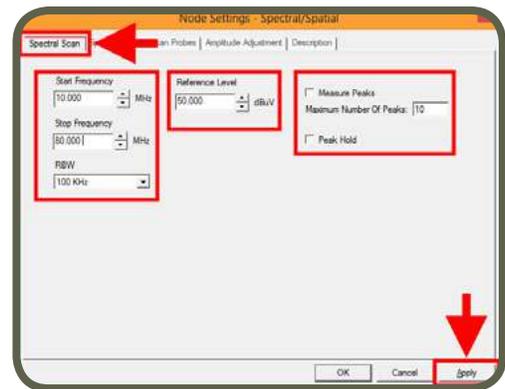
Add Spectral/Spatial Scan node to Project node (please refer to [page 36](#)). Node settings window automatically opens.

Spectral/Spatial Scan inherits the setting parameters that were selected in the settings of the Project node (please refer to [page 39](#)). 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 120 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.



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3. *Reference Level*: This feature is no longer relevant and will be removed at the next software release.
4. *Measure Peaks*: It activates the peak marking feature whereby peaks are rescanned at a tighter bandwidth in order to accurately measure the frequency as long as the peak's value is 5 dB above the average noise floor of the scan. By default the maximum number of peaks is set to 10. The maximum number peaks that can be measured is 30. There is little value in activating this function in the Spectral/Spatial node.
5. *Peak Hold*: This feature is not active for Spectral/Spatial Scan.
6. Click Apply

Spectral/Spatial Scan Probes Tab

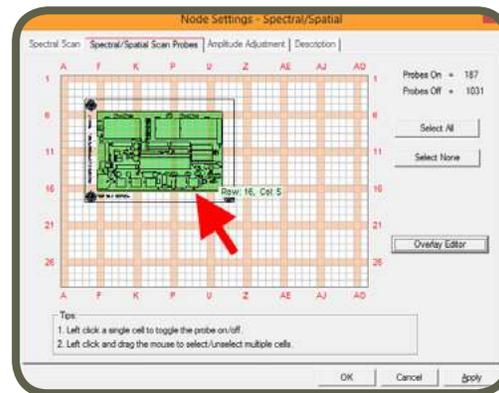
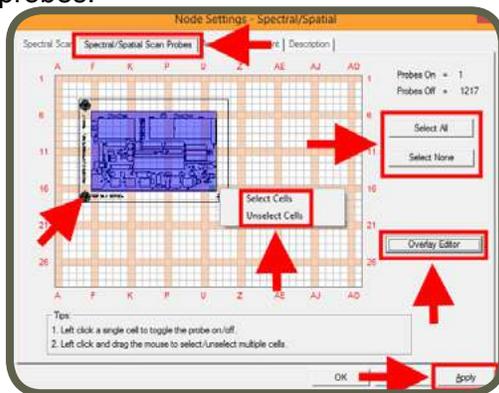
Select and activate the probes under the DUT. You can activate the probes by either a left click on individual cells or by left clicking and dragging the mouse and choosing Select Cells; or clicking on Select All to activate all of the probes. Green indicates the activated probes.

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 the probes under the DUT to have a complete view of the emissions from the DUT.

Overlay Editor

Please refer to [page 40](#).

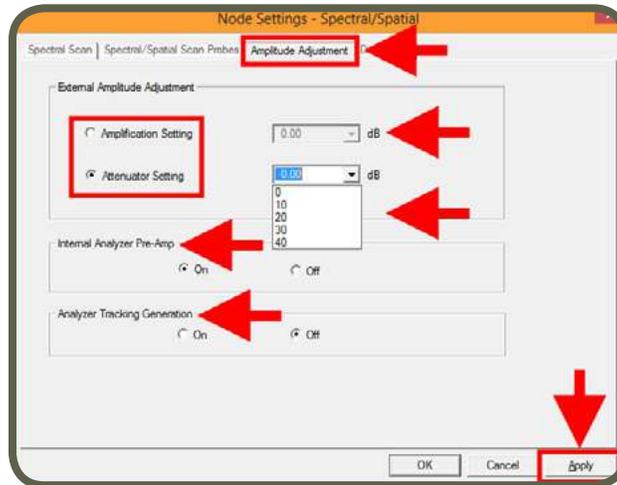
Amplitude Adjustment Tab

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 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.

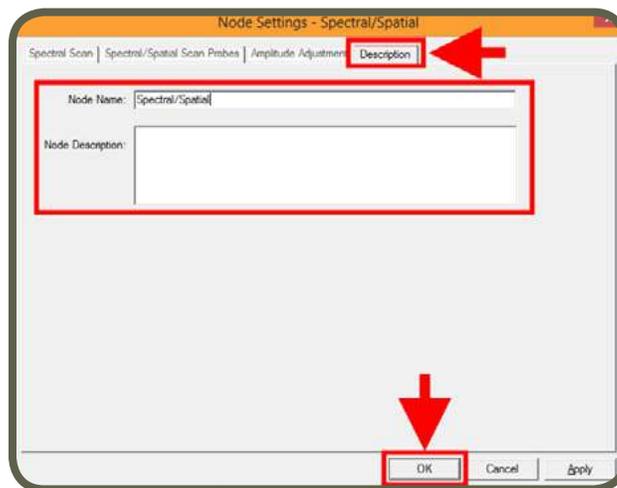
EMxpert Software Spectral/Spatial Scan

Analyzer Tracking Generation: This feature will remotely turn on the tracking generator of the FieldFox N9912A spectrum analyzer. When you run Spectral or Spectral/Spatial Scan, the tracking generator will output a frequency that tracks the swept frequency.

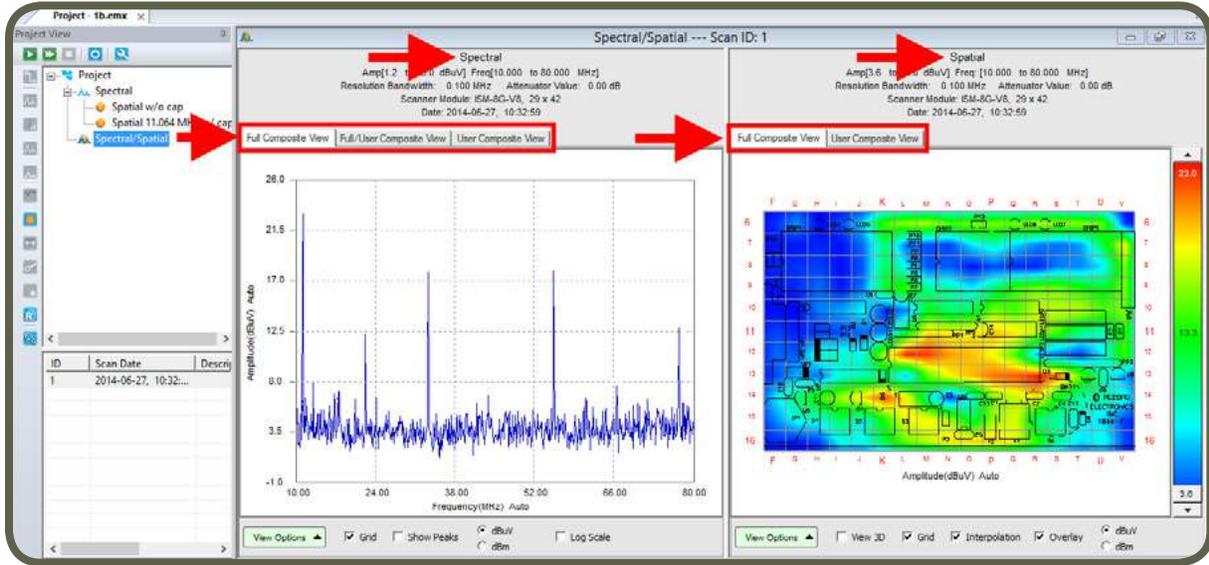


Description Tab

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.

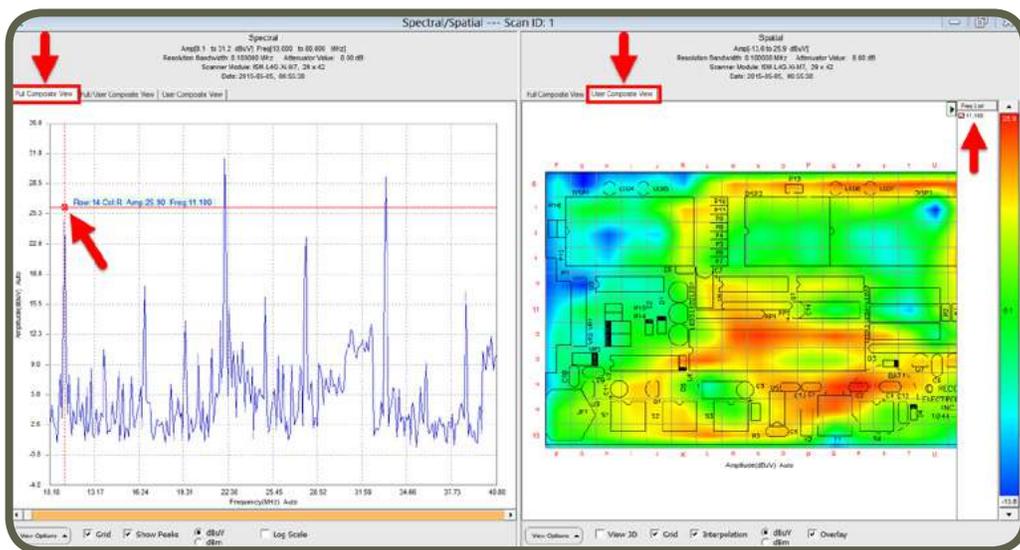


Full Composite Spectral View

Composite Spectral looks like a normal Spectral Scan however it is a gateway to 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.

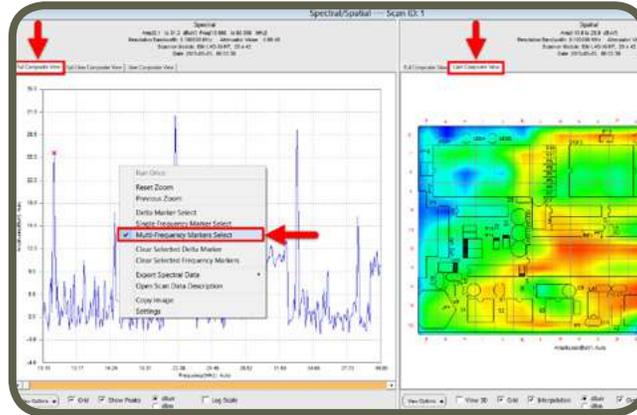
Single Frequency Marker

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.

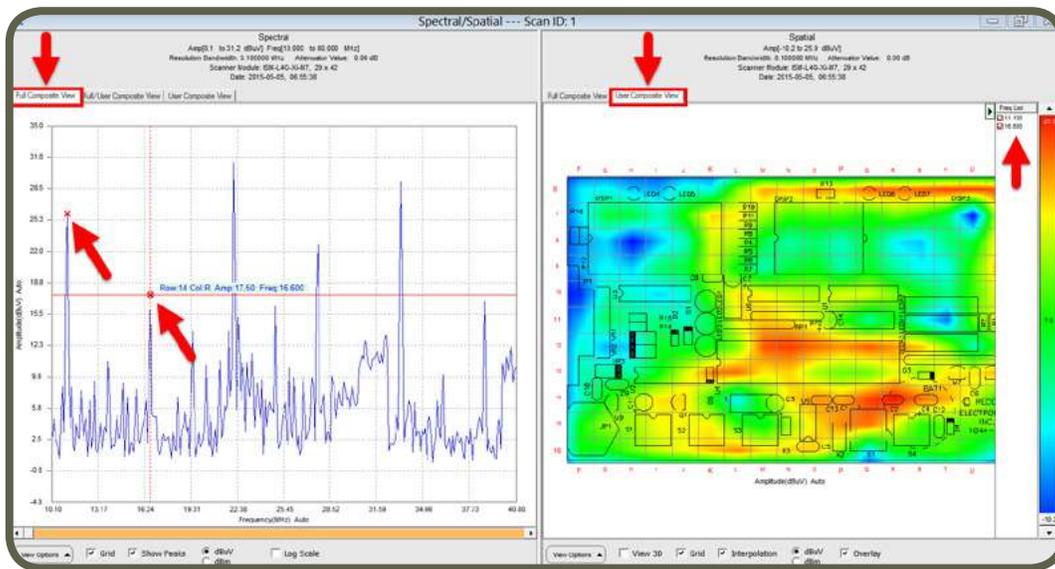


Multi Frequency Marker

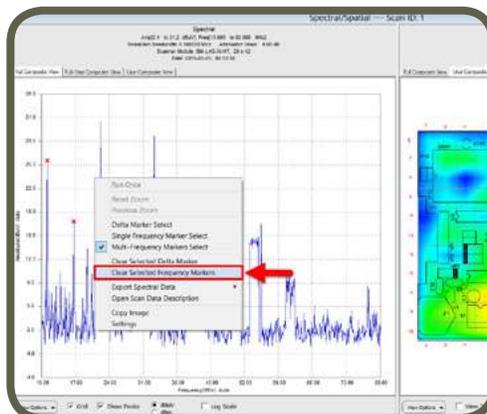
Right click on the spectral graph and select Multi Frequency Marker.



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.



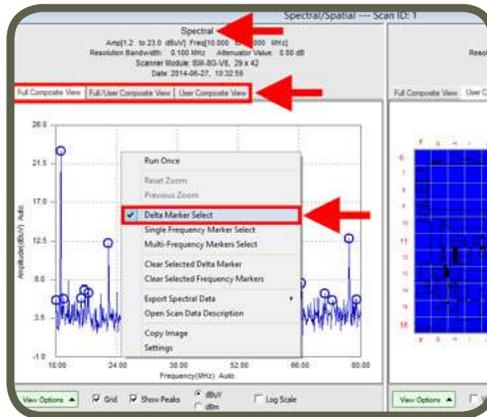
To clear frequency markers, right click on the spectral graph and select Clear Selected Frequency Marker.



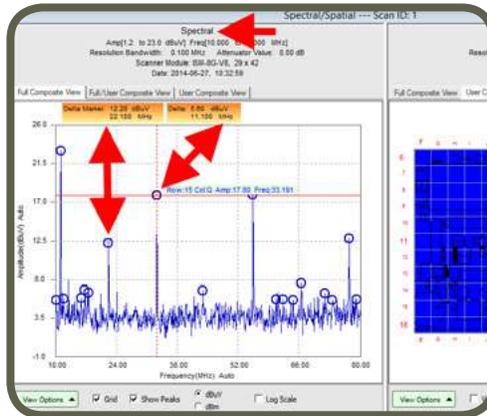
Delta Marker

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

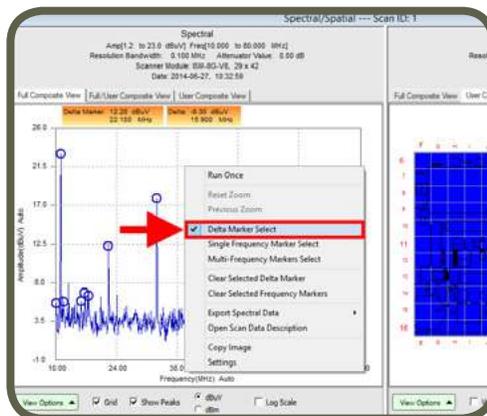
1. Select either Full Composite View or User Composite View on spectral graph
2. Right click on the spectral view
3. Select Delta Marker Select



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 33.100 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

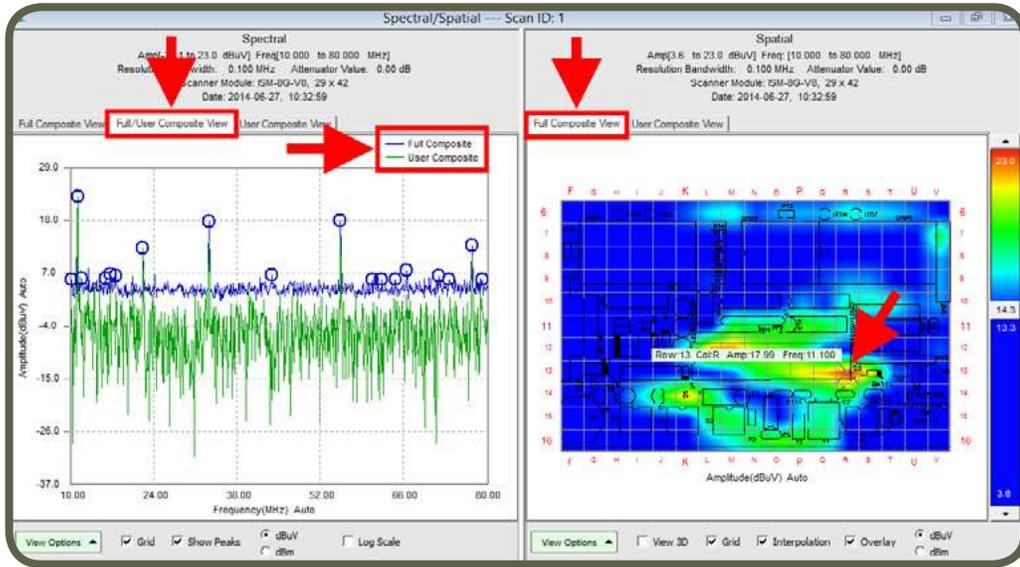


Full Composite Spatial View

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.

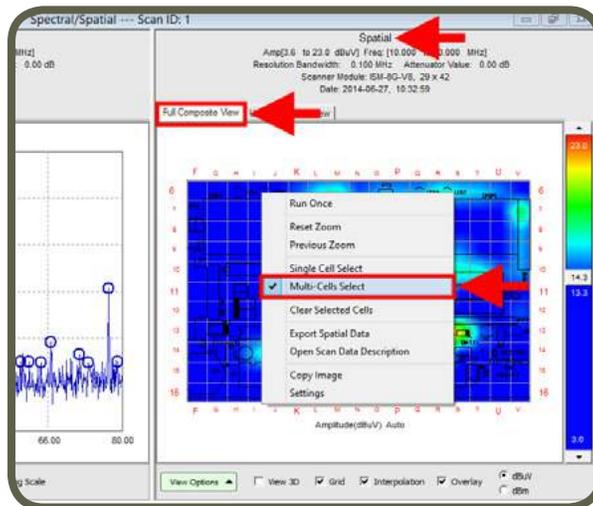
Single Frequency Marker

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.

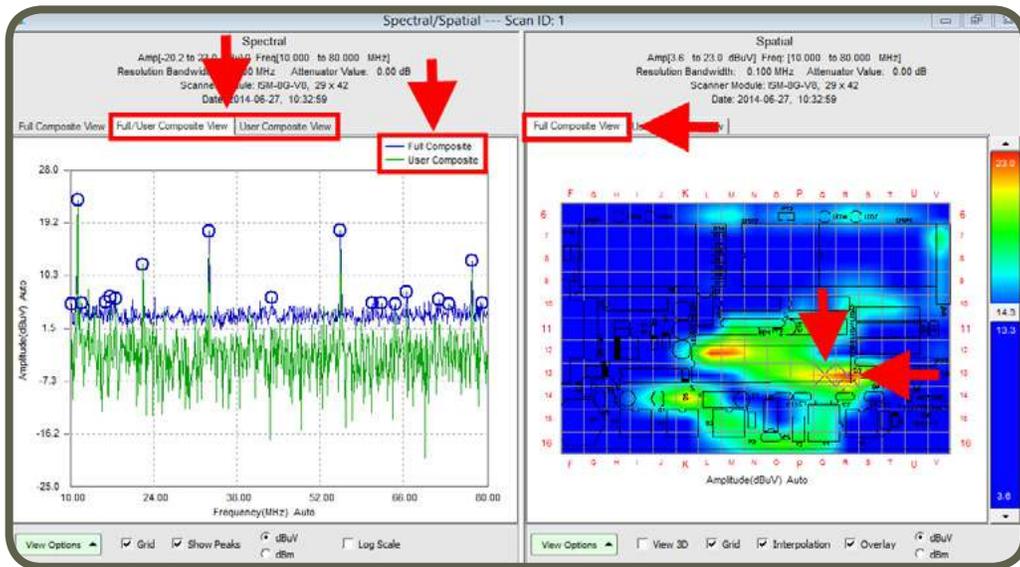


Multi Frequency Marker

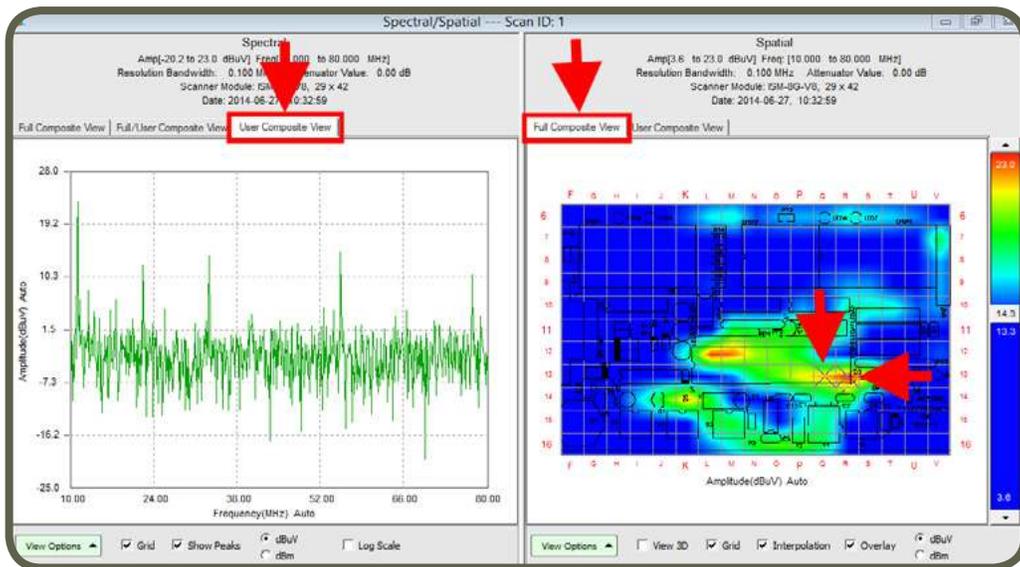
Right click on the spatial graph and select Multi-Cells Select.



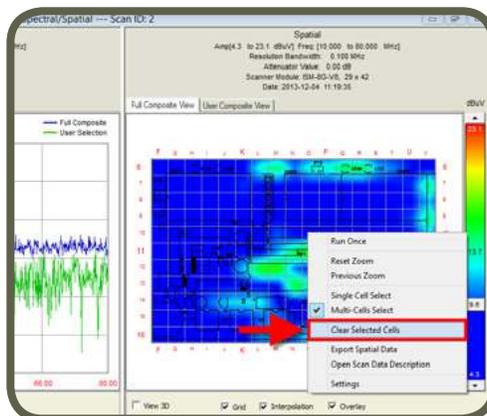
Select multiple cells of interest on spatial graph. A cross will indicate the selection. Full/User Composite View tab overlays spectral graph of user selected cells on to the full spectral graph. Spectral graph of the selected cell will be displayed in green on the spectral graph.



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 and that can be connected to a supported spectrum analyzer.

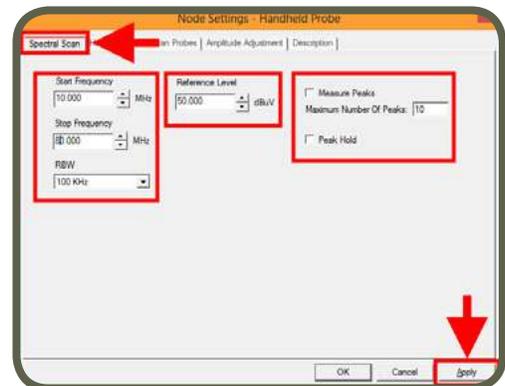
Note that the function and operation of the Handheld Probe Scan is very similar to the Spectral Spatial Scan function. We will ask the user to refer to this section for many of the advanced features of the node and only deal with the data collection and differences in this section.

Add Handheld Probe Scan node to Project node (please refer to [page 36](#)). 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 39](#)). 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. The Stop Frequency can be any frequency supported by the handheld probe and spectrum analyzer; it is not limited to the 4 GHz or 8 GHz limit of the EMxpert scanner.
2. *RBW (Resolution Bandwidth)*: It is set by default at 120 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.



Caution:

INFORMATION REGARDING ALL ROHDE & SCHWARZ SPECTRUM ANALYZERS EXCEPT FSU AND FSL: The RBW is only selected from the list of available filters in the Gaussian (3dB) aka Normal folder. The EMxpert settings will default to the closest RBW if the requested filter is not available. For the FSL and FSU, the end-user can pre-select the Gaussian or the EMI folder on the spectrum analyzer before connecting to the EMxpert application. The EMxpert will then use the filters available in the selected folder.

3. *Reference Level*: This feature is no longer relevant and will be removed at the next software release.
4. *Measure Peaks*: It activates the peak marking feature whereby peaks are rescanned at a tighter bandwidth in order to accurately measure the frequency as long as the peak's value is 5 dB above the average noise floor of the scan. By default the maximum number of peaks is set to 10. The maximum number peaks that can be measured is 30. There is little value in activating this feature in the Handheld Probe node.
5. *Peak Hold*: This feature is not active for Handheld Probe Scan.
6. Click Apply

Handheld Probe Scan Probes Tab

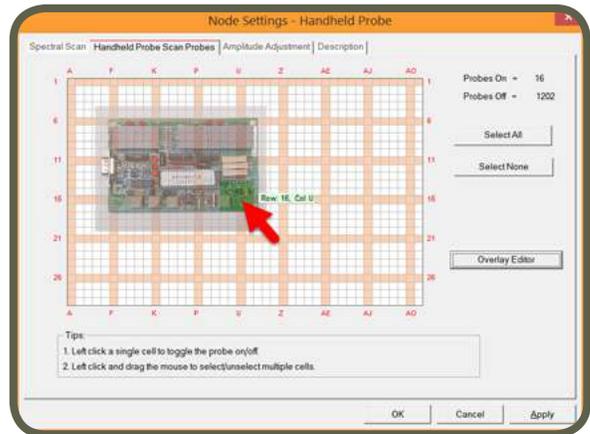
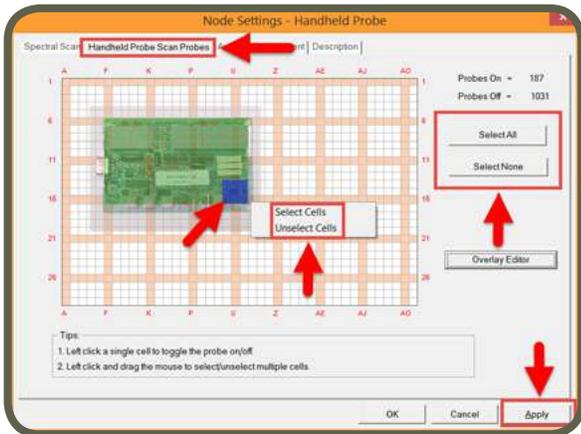
Select and activate the scan area that you want to manually measure. Note that you are not selecting probes on the EMxpert but rather an array of measurements that you will do with the handheld probe. The EMxpert software will organize the data into an equivalent array for display but this will only 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 but you do need the scanner connected to the adaptor.

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 probes position is correct for each manual trigger. Please refer to [page 65](#).

Overlay Editor

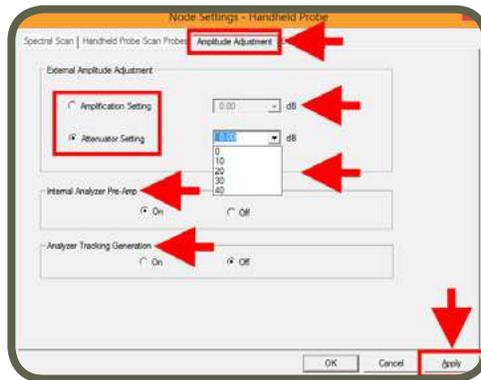
Please refer to [page 40](#).

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.

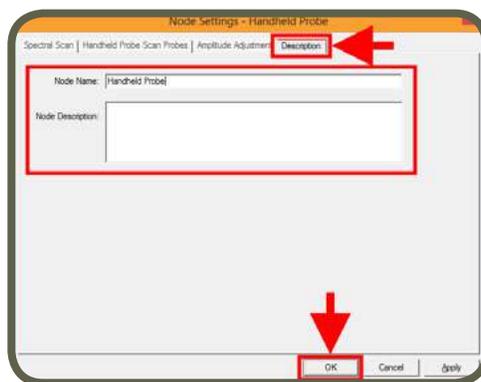
Internal Analyzer Pre-Amp: This feature provides extra sensitivity. It is ON by default. Turn this feature OFF if your spectrum analyzer is not equipped with a Pre-Amp.

Analyzer Tracking Generation: This feature will remotely turn on the tracking generator of the FieldFox N9912A spectrum analyzer. When you run Spectral or Spectral/Spatial Scan, the tracking generator will output a frequency that tracks the swept frequency.



Description Tab

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

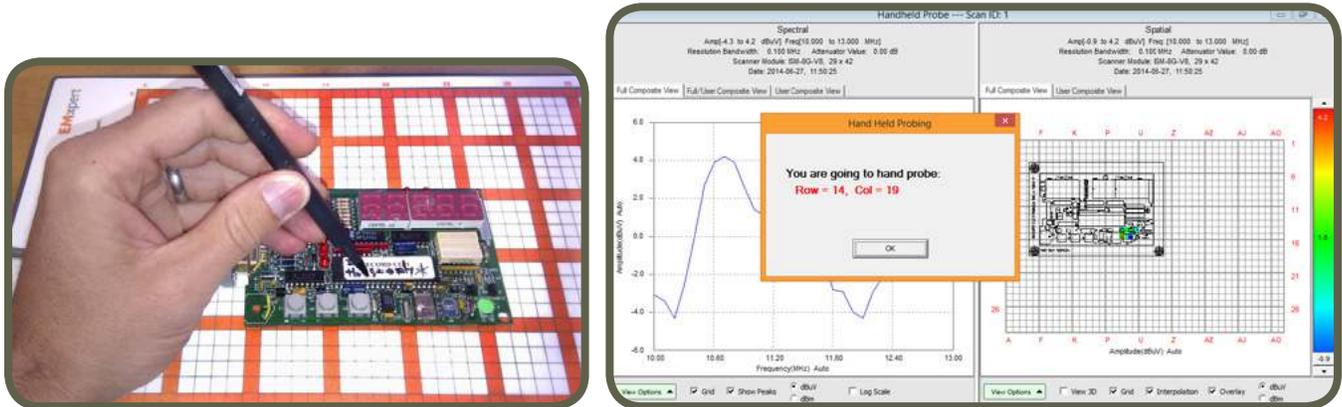


To run the scan close the settings and run once . Immediately upon running the scan you see a message describing where you need to position the handheld probe.



EMxpert Software Handheld Probe Scan

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

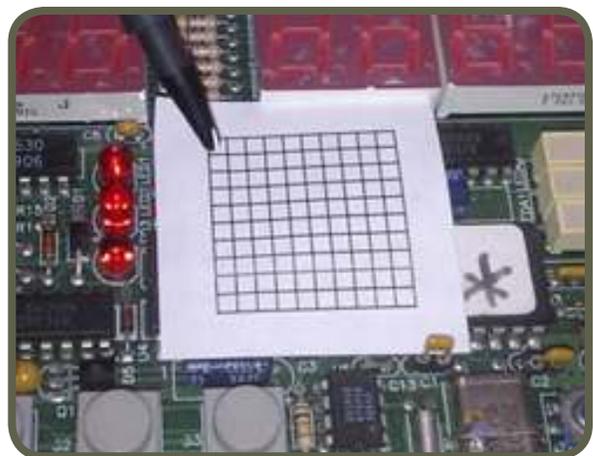
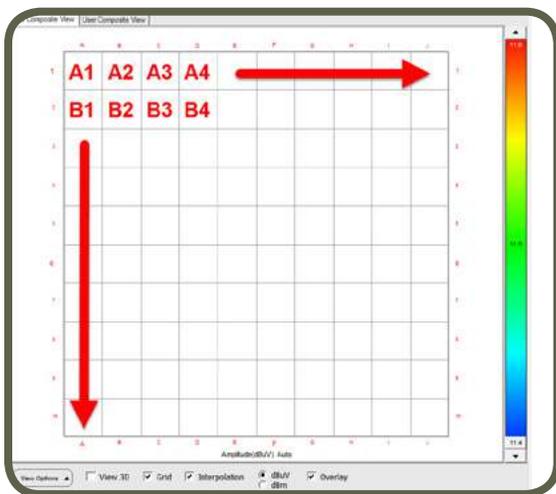


Continue with re-placement of probe and triggering until all locations selected have been triggered. You can also make use of a simple grid to help place the probe.

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.



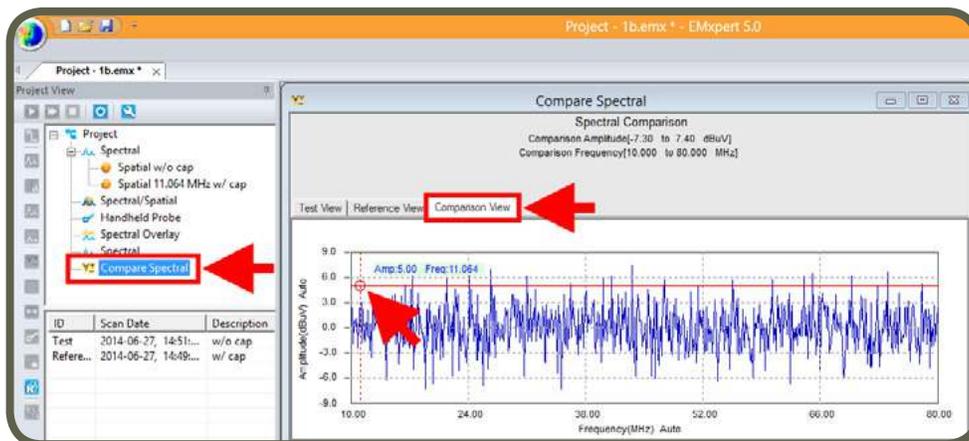
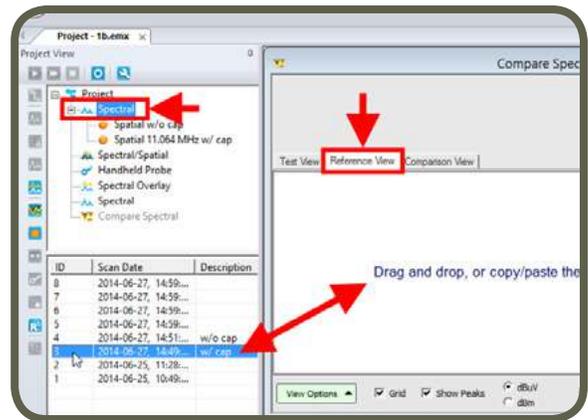
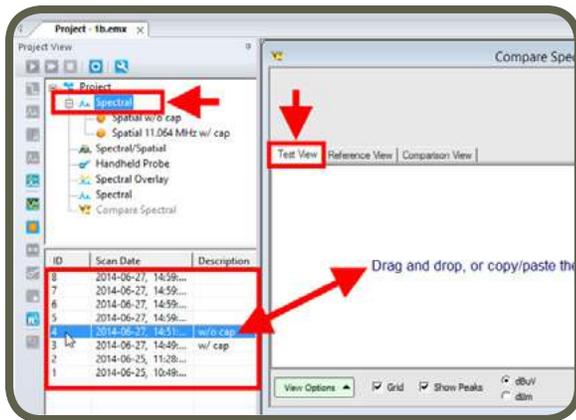
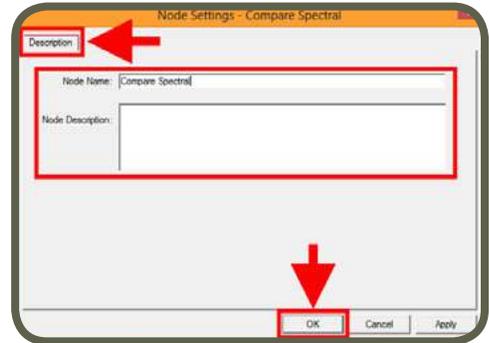
Review that data: The spatial measurements of the handheld probe are arranged as selected in the Spatial Scan area. At this point the results can be treated exactly like a regular Spectral/Spatial scan with all of the post analysis that implies.

Spectral 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 same resolution bandwidth and overlapping frequency 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 36](#)). 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.

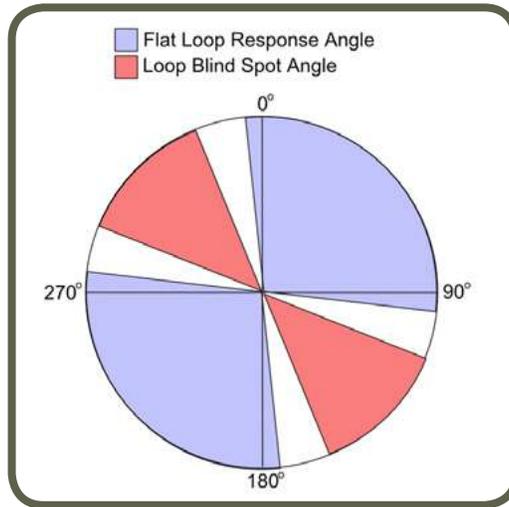


Spatial Blind Spot Reduction

For EMxpert EHX Models

The Interleaved Scan is meant to overcome the limitations of the probe polarizations. Each of the 1218 probes on the EMxpert EHX 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 below.

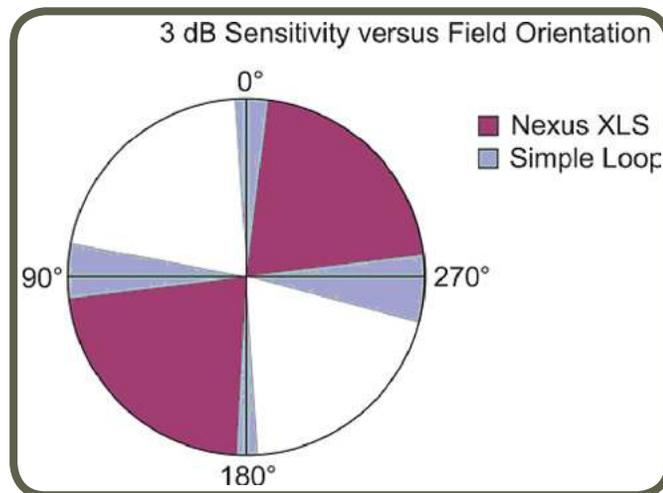
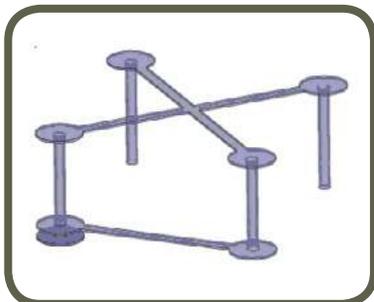


It was chosen to orient this blind spot at 45° and further to rotate every other row by 90° so that consecutive rows do not have the same blind spots. Because of this arrangement the blind spot can be eliminated by measuring a DUT twice with a small physical shift between scans.

For EMxpert EMX Model

Each of the 1218 probes on the EMxpert EMX scanner is created from two overlapping loops to increase their angular coverage. Even with this hybrid approach they do not have 360 degree coverage. There is one orientation of magnetic field that the probes do not respond to, essentially creating a blind spot. This blind spot can be eliminated by measuring a DUT twice with a small physical shift between two scans.

A scale model of the probes is shown below. It effectively combines two separate loop probes into one "X Loop".

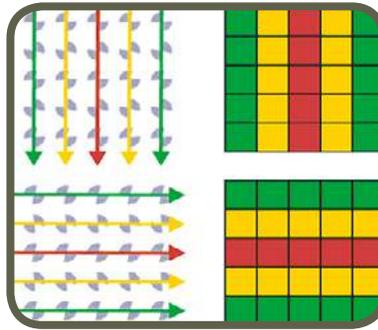
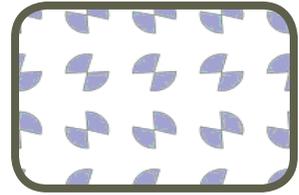


EMxpert Software
Spatial Blind Spot Reduction

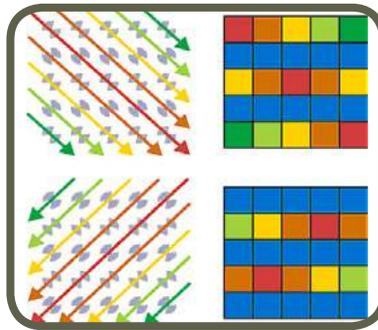
For All EMxpert Models

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.

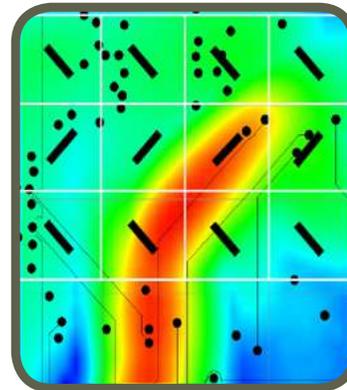
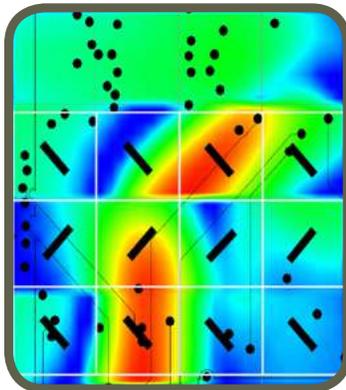
The effect of this different sensitivity on scan results sometimes shows up when a device is rotated. If the device has only H-field components, the scan results will be as shown in the top right of the graph on the right. If this device is rotated 90° then results are as expected and as shown below.



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.



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.

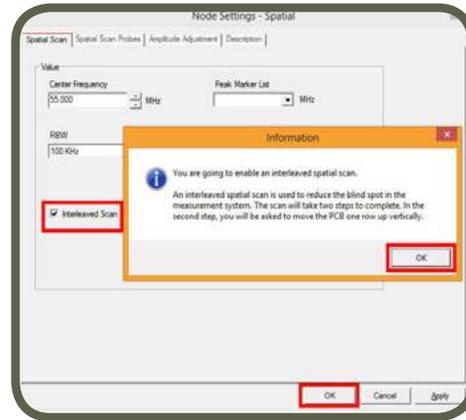
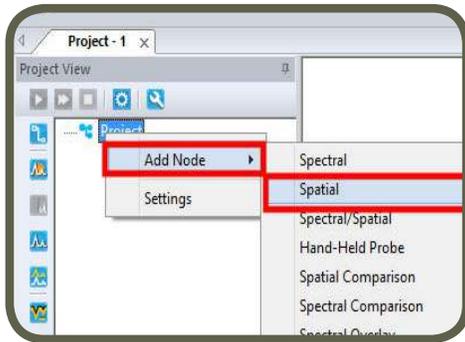


Creating a Blind Spot Reduction Node

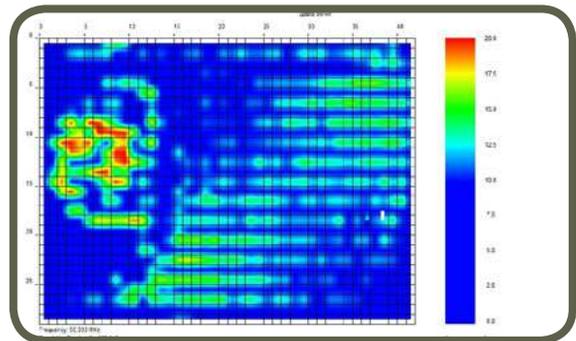
EMxpert v5.x

1. *Interleaved Scan:*

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

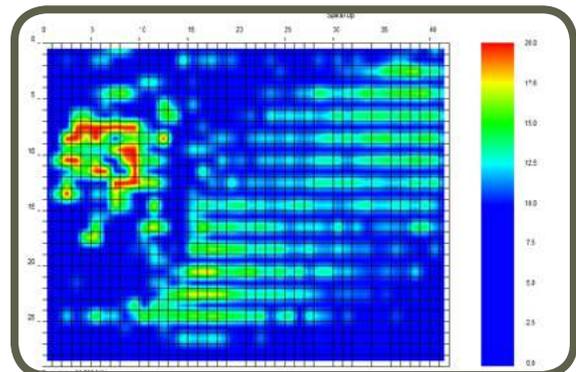


- b. Run the first spatial scan: Place the DUT on the scanner at the desired position. This position should align with the Gerber file overlay. Run the first scan.

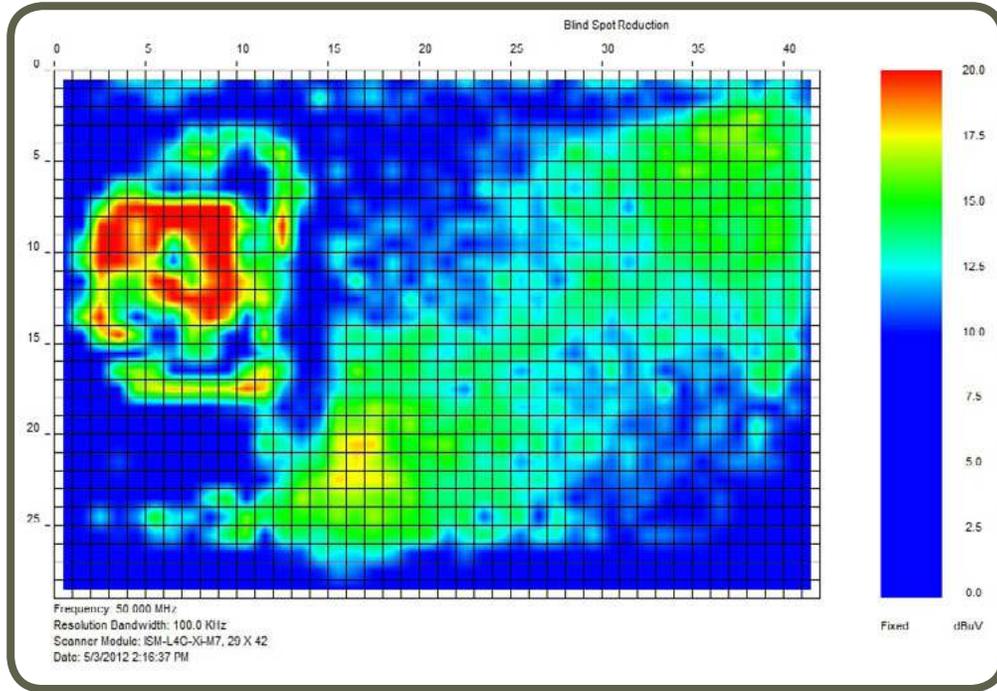


- c. Run the second spatial scan: After the first scan, a message box will pop-up indicating to move the DUT up by exactly 1 row. Another way to describe the direction up is along the shorter axis towards the lower row numbers. Do not change the orientation or position along the longer axis of the board. After you move the DUT, click OK to run the second scan

Move the DUT up by exactly 1 row



EMxpert Software
Spatial Blind Spot Reduction

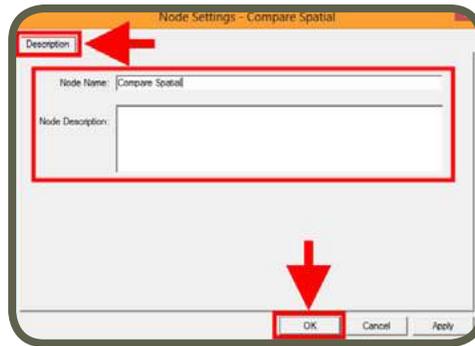


Spatial Comparison

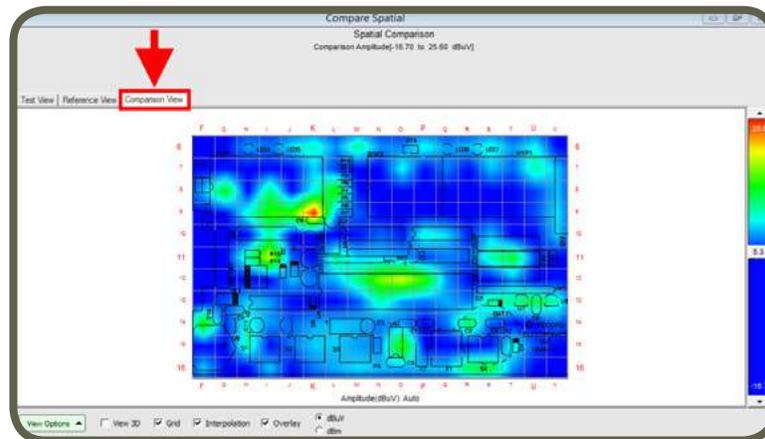
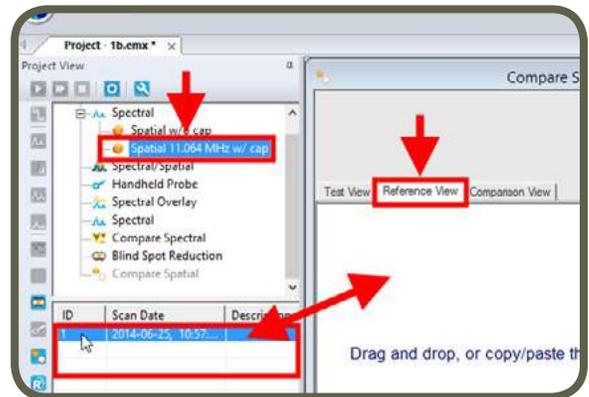
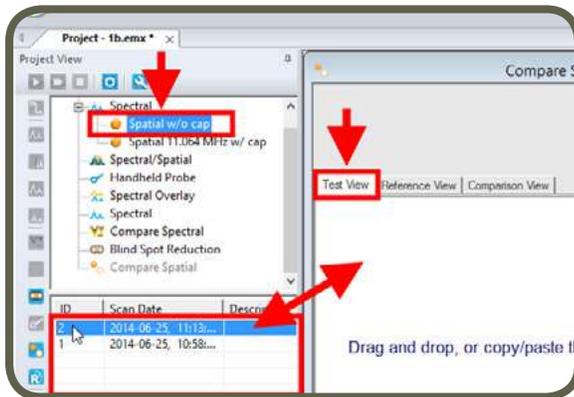
Spatial Comparison is a quantitative comparison between two Spatial Scans that is generated by subtracting the values of the first scan (Test View) from the values of the second scan (Reference View) cell by cell. The Spatial Comparison node allows you to see the difference between two Spatial Scans 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 compared must have overlapping cells. Add Spatial Comparison node to Project node (please refer to [page 36](#)). 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:

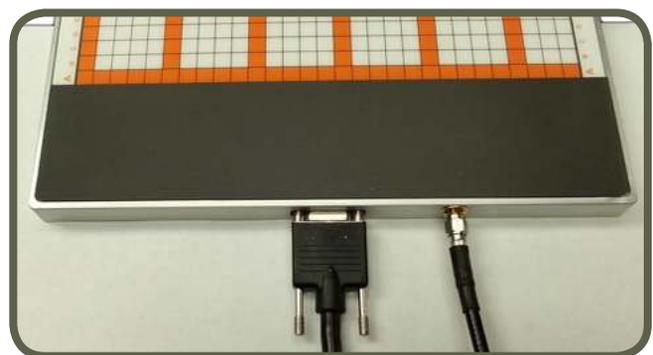
1. Run a Spectral Scan over the frequency range of interest with the unpowered PCB on scanner.
This is to eliminate the possibility that the DUT is acting like an antenna or signal conduit for non-local sources.
2. Perform a wide-frequency range Spectral/Spatial Scan or several Spectral/Spatial Scans to cover the entire frequency range of interest.
3. Power on the PCB and go through step 3
4. Review the resulting data to identify frequencies that have emissions emanating from the DUT.
5. Compare the powered and unpowered scans taken with the DUT in the identical positions and with identical scanning parameters.

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

6. Run Spatial Scans at the same frequencies used in Steps 1 through 5.

If the peaks have not been measured accurately:

7. 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.
8. 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 the EMxpert EHX 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)

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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 EHX does not require calibration after shipment. The scanner elements are passive and will not require further calibration. If you believe that one or more of the probes have been damaged, the unit can be returned to EMSCAN for verification and repair.

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

Frequency Accuracy: Marked Peaks – Typically accurate to 1 kHz

A calibrated spectrum analyzer or EMC analyzer normally has a frequency error of between 1% and 2% of span. During the process of marking peaks, EMxpert conducts several rescans of identified peaks after the initial scan is completed. The final accuracy is 1-2% of the final scan bandwidth shown on the spectrum analyzer display.

Some supported models of spectrum analyzer provide higher accuracy frequency measurements using an internal counter. For these spectrum analyzers the final accuracy is the specified accuracy of the counter.

Amplitude Accuracy: Spectral or Spatial Scans: approximately +/- 3 dB

This is a combination of spectrum analyzer accuracy and probe factor responses from cell to cell across all frequencies from scanner to scanner.

4. How do I achieve higher frequency accuracy?

Frequency accuracy is compromised by the spectrum analyzer frequency measurement accuracy of 1% to 2% of span, unless the spectrum analyzer is equipped with a higher accuracy frequency counter. Therefore, by decreasing the span, the user can increase the frequency accuracy. Since EMxpert final rescan for peak detection is set at a span of 5 x RBW, reducing the RBW has the effect of improving the frequency accuracy.

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

If your spectrum analyzer is not on the supported spectrum analyzer list, please contact your local representative or EMSCAN at support@emscan.com to discuss the development of a custom driver.

Spectrum Analyzer must be configured with the following options to be supported: gated sweep, pre-amplifier, LAN or USB port, external trigger port with BNC connector and VISA support.

6. How do I make sure that I see all the peaks that might cause me problems in the far-field?

There are instances where components of the DUT are some distance away from EMSCAN's patented scanner, and signals from these devices may be mixed with the noise floor. We recommend that a low noise amplifier be placed in series between the scanner and the spectrum analyzer to differentiate the signal from the noise floor. We also recommend that you reduce the RBW to improve the signal to noise ratio. It is important to recognize that some of the emissions may originate within the DUT, and then couple onto the connectors and cables (which may act as an antenna). The signals, at the DUT

level, can be of low amplitude, while their far-field value (when conducted out and radiated), could be up to 100,000 times as large ([for further details refer to the Common Mode section in the Applications Report](#)).

7. What are the Minimum System Requirements?

- CPU 333 MHz or faster
- 128 MB RAM, 256 MB recommended for EHX and EHX+, and 8 GB recommended for ERX+
- 8 MB Video or more
- Windows XP/Vista/Windows 7/8/8.1 OS
- 10/100 Network Card

8. 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.

9. How sensitive is EMSCAN’s patented scanner?

EMX sensitivity: -135 dBm to 35 dBm (Dependant on spectrum analyzer performance)

Frequency (MHz)	0.05	1	300	696	1500	2000	2600	3000	3500	4000
Sensitivity	-3	-50	-100	-108	-107	-100	-95	-85	-85	-80
Sensitivity with 40 dB LNA	-20	-60	-135	-120	-135	-115	-115	-105	-100	-90

(* 30 dB LNA)

EHX sensitivity: -130 dBm to 35 dBm (Dependant on spectrum analyzer performance)

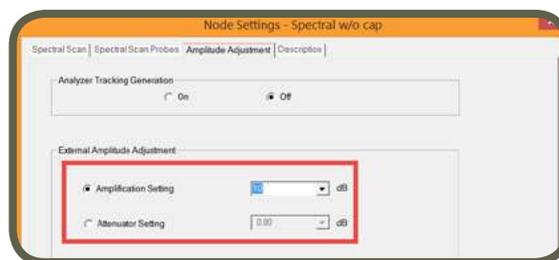
Frequency (MHz)	0.15	0.5	1	300	696	1500	2000	2600	3000	3500
Sensitivity	0	-15	-25	-68	-75	-79	-83	-85	-85	-86
Sensitivity with 40 dB LNA	-10	-25	-45	-90	-95	-100	-100	-130	-95	-100

Frequency (MHz)	4000	4500	5000	5500	6000	6500	7000	7500	8000
Sensitivity	-78	-68	-70	-75	-70	-65	-70	-60	-60
Sensitivity with 38 dB Power Amp.	-91	-85	-90	-88	-85	-90	-85	-70	-63

(* 40 dB LNA; ** 38 dB Power amplifier (Please refer to [Technical Bulletin #15](#) for the test setup))

10. I added a low noise amplifier (or an attenuator) between the EHX 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.



11. 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.

12. Why does the peak marking process take longer than the estimated time?

EMxpert build a peak list initially during the Spectral Scan. Then it goes back to each and every peak and zooms in to make a more accurate measurement.

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

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

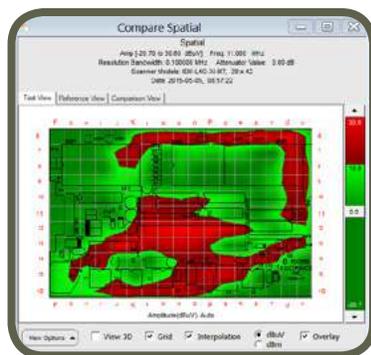
14. Can I predict the Open Area Test Site (OATS) or Semi Anechoic Chamber (SAC) radiated EMI levels of a printed circuit board (PCB)?

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](#).

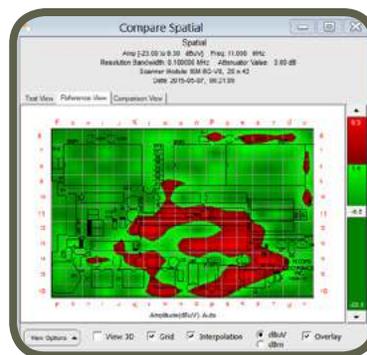
15. I want to do a Pass or Fail test. What feature should I use?

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.

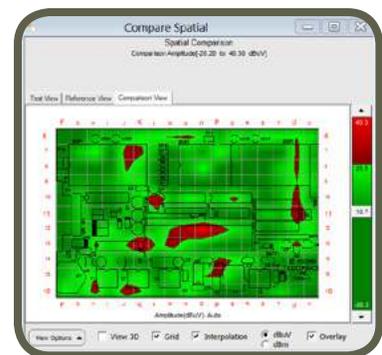
To change the display color to Threshold (Red/Green), click Preferences icon  and go to the Display Options tab ([please refer to page 38](#)).



Defective PCB



Golden Sample



Pass/Fail Test

16. Why is the result of the Spectral Scan different than the image displayed on the spectrum analyzer?

EMxpert measures the DUT's emission on the surface of the scanner. The spectrum analyzer records the signal that is coupled by the scanner and transmitted to its RF input. However, there is an insertion loss and probe loss between the DUT and the RF input into the SA. These losses are different for each and every cell because the path is slightly different. EMxpert can compensate for this loss in each cell and across all frequencies.

The default for the software is to not compensate for these losses in which case the view in the EMxpert software and the image displayed on the spectrum analyzer should be the same. The user has the option of turning on this compensation and adjusting the measured results to account for these losses. If the compensation is set to ON in the setting then this results in the EMxpert software viewer and the SA not showing the same magnitude in a spectral and spatial scan. The frequency of the peaks should be the same in either case.

17. How long does a typical Spectral Scan take?

EMxpert EHX: It depends on the spectrum analyzer performance; for example to scan a 4" x 4" PCB with a span of 100 MHz and an RBW of 100 kHz with an Agilent MXA or a PXA takes a few seconds, close to 1; and if you remove peak marking which is a separate function of Spectral Scan it is even faster. Scanning area, span and RBW are user selectable.

18. How long does a typical Spatial Scan take?

EMxpert EHX: Less than one second though highly dependent on the spectrum analyzer performance.

19. 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 - Error Messages

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

Error Messages	Possible Causes	Action
No appropriate spectrum analyzer is connected.	This occurs when the connected spectrum is not supported.	Please contact EMSCAN Technical Support.
Failed to read adaptor EID	Driver cannot read EID from adaptor.	<ol style="list-style-type: none"> 1) Check the connection between the adaptor and the PC. 2) Try one more time. 3) If you get the same error message again, please contact EMSCAN Technical Support.
Failed to read adaptor firmware version	Driver cannot read firmware version of adaptor.	<ol style="list-style-type: none"> 1) Check the connection between the adaptor and the PC. 2) Try one more time. 3) If you get the same error message again, please contact EMSCAN Technical Support.
Failed to query instrument type. Please calibrate spectrum analyzer.	Driver cannot query the connected spectrum analyzer type.	<ol style="list-style-type: none"> 1) Calibrate spectrum analyzer (see Spectrum Analyzer Setup) 2) Try one more time. 3) If you get the same error message again, uninstall and reinstall EMxpert software.
Failed to read scanner type	Driver cannot read scanner type on the adaptor.	<ol style="list-style-type: none"> 1) Check the connection between the scanner and the adaptor. 2) Check the connection between the adaptor and the PC. 3) Try one more time. 4) If you get the same error message again, please contact EMSCAN Technical Support.
EMxpert does not support this scanner type	EMxpert only supports the 29 x 42 size scanners	Please contact EMSCAN Technical Support.
There is a problem with the license file, please update the license.	The license file is not present, cannot be decrypted or is incorrect for this hardware. The system cannot run any scans in this state	Please contact EMSCAN Technical Support.

EMxpert Software
Appendix - Error Messages

Error Messages	Possible Causes	Action
Failed to read license	Driver cannot read license on the adaptor because of data transfer error.	1) Check the connection between the adaptor and the PC. 2) Try one more time. 3) If you get the same error message again, the license should be updated. Please contact EMSCAN Technical Support.
Failed to write license	Driver cannot write license to adaptor because of data transfer error.	1) Check the connection between the adaptor and the PC. 2) Try one more time. 3) If you get the same error message again, please contact EMSCAN Technical Support.
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

The Spectrum Analyzer connected with an Ethernet cable to the Personal Computer (PC) must all together comply with CE emission requirements



- 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 400 C and lower than 150 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.

CSA Certification

Documentation includes the following:

Pollution degree 2

- Installation category II
- Altitude < 2000 m
- Humidity up to 95% R.H. (non-condensing)
- Electrical supply 100 - 240 V, 50 - 60 Hz
- Temperature 0 - 40 C
- Statement advising that mains supply voltage fluctuations are not to exceed 10 percent of the nominal supply voltage

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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