

Keysight Technologies EMI Pre-Compliance Testing

X-series signal analyzers with the EMI measurement application offer a cost-effective pre-compliance testing solution

Application Note





Overview

Getting products to market on time and within budget is critical to business success. Companies know that failing electromagnetic interference (EMI) compliance testing late in the development phase can result in product release delays and additional development cost. To ensure successful EMI compliance testing, many companies have added pre-compliance testing to their development process. In pre-compliance testing, the EMI performance is evaluated throughout the design phase, prior to the final compliance verification.

While some design centers and manufacturers can afford full EMI compliance systems with approved facilities and equipment to perform radiated and conducted pre-compliance testing, many others are looking for a more cost-effective solution.

The X-Series signal analyzers with the EMI measurement application offer pre-compliance conducted and radiated emissions testing for both commercial and MIL-STD requirements at a variety of performance levels and price points.

From the high-performance PXA, through the mid-performance MXA and EXA, to the cost-effective CXA, each analyzer offers a combination of measurement sensitivity, accuracy and usability for both the EMI professional and the occasional user.

The CXA with the EMI measurement application represents the most cost-effective pre-compliance test solution of the X-Series. The CXA is a leading low-cost tool for essential signal characterization. It can run a variety of measurement applications, making it a cost-effective laboratory tool as well as an EMI pre-compliance test solution.

Typical Pre-Compliance Emission Measurement Configurations

Figure 1 shows a typical configuration for pre-compliance conducted emission testing. A line impedance stabilization network (LISN) is the specified transducer used to couple conducted signals emanating from the device under test (DUT) to the signal analyzer. LISNs filter out signal coming from the power source and provide a controlled impedance match for the DUT. A transient limiter is used to prevent the analyzer or receiver from being damaged by high transient levels that can come from the LISN.

While there are no requirements on DUT layout or measurement environment for pre-compliance measurements, it is good practice to perform pre-compliance measurements in an environment that is as similar as possible to the compliance configuration requirement defined in the appropriate commercial or military requirements document.

CXA signal analyzer with the EMI measurement application

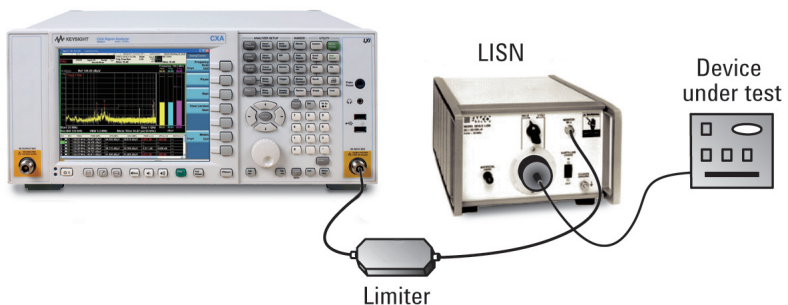


Figure 1. Conducted emission measurement configuration using the cost-effective N9000A CXA X-Series signal analyzer with the W6141A EMI measurement application. Choose the appropriate X-Series analyzer based on your measurement requirements.

CXA signal analyzer with the EMI measurement application

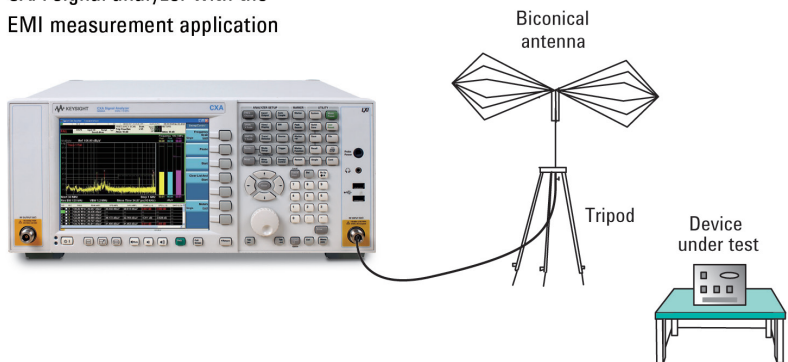


Figure 2. Radiated emission measurement setup

Figure 2 shows typical connections for pre-compliance radiated conducted emission testing. Biconical and log-periodic antennas are common transducers used for radiated emission testing in the 30 MHz to 1 GHz frequency range. Broadband horn antennas are typically used for the higher frequencies.

While pre-compliance testing can be done in an anechoic chamber, testing in an open environment (indoor or outdoor) is more common. Open environments, while conventional and inexpensive, can contain ambient signals which complicate pre-compliance testing. These ambient signals can mask and be mistaken for actual DUT performance.

Using ambient discrimination testing techniques and the list-sorting capability of the EMI measurement application can help reduce the effects of these ambient signals on the pre-compliance measurement. For example, suspect signals can be collected by the EMI measurement application with the DUT turned on and off. The user can then use the features of the EMI measurement application to remove duplicate ambient signals from the list, leaving only DUT emissions.

EMC pre-compliance measurements should be made with the same detectors, resolution bandwidths (RBWs) and physical spacings required by the appropriate commercial and military compliance regulation documents. Commercial testing requires specific detectors (quasi-peak, EMI-Average, RMS-Average) and resolution bandwidths as recommended by the Special International Committee on Radio Interference (CISPR). Military testing requires a peak detector and 6 dB resolution bandwidths.

The detectors and resolution bandwidths available in the EMI measurement application conform to those defined in the CISPR and MIL STD equipment specification documents. In addition, the EMI measurement application contains a variety of powerful functions and features that can assist in making these difficult measurements, such as:

- Built-in Scan, Search and Measure algorithms to quickly identify signals over the emission limit
- Built-in limit and margin lines; display up to six separate limit lines and set desired margins for each line
- Extensive library of commercial and military emissions standards for quick reference
- Built-in amplitude correction to adjust measured signal levels for the transducers, cables and external preamps
- Ability to display up to three simultaneously-updating detectors to view peak, quasi-peak and average detectors
- Pre-defined scan tables configurable to the specific testing you wish to perform
- Instrument state recall capability to simplify instrument setup when used by a number of individuals.

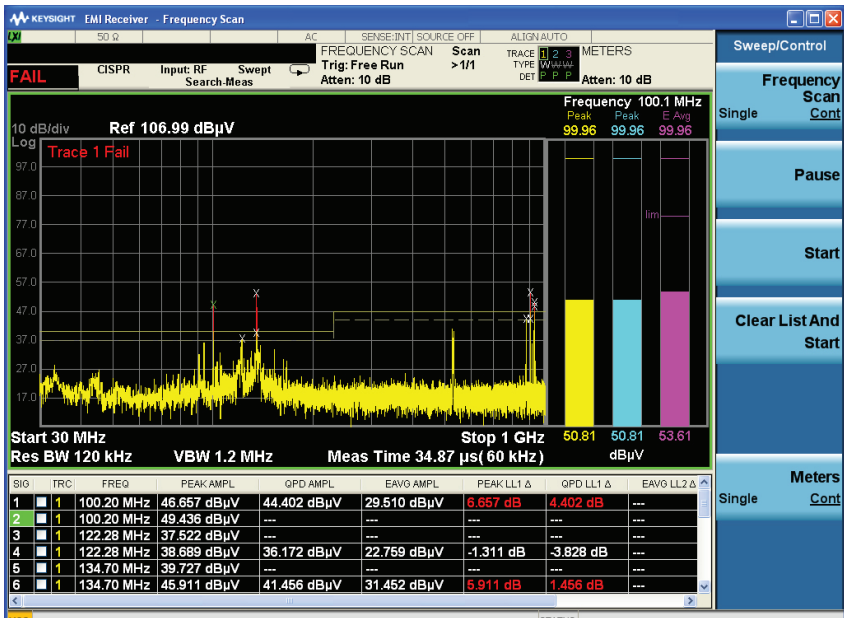


Figure 3. EMI measurement application display highlighting simultaneous detectors, limit lines and margins, and signal list features

Perform EMI Design Troubleshooting with a Close-Field Probe

When devices fail compliance or pre-compliance testing, it is necessary to track down and eliminate the causes of the emissions. X-Series signal analyzers, with the appropriate close-field probe, are powerful diagnostic tools for identifying sources of EMI emissions.

The addition of the Keysight 11940/45A or N9311X-100 close-field probes enhances the diagnostic capability of a full-featured pre-compliance solution. Close-field probes help pinpoint the sources of the emissions on either the DUT enclosure or the circuit boards inside the DUT. Once the source of the emission is understood, engineers can then design the appropriate solution.

CXA signal analyzer with the
EMI measurement application

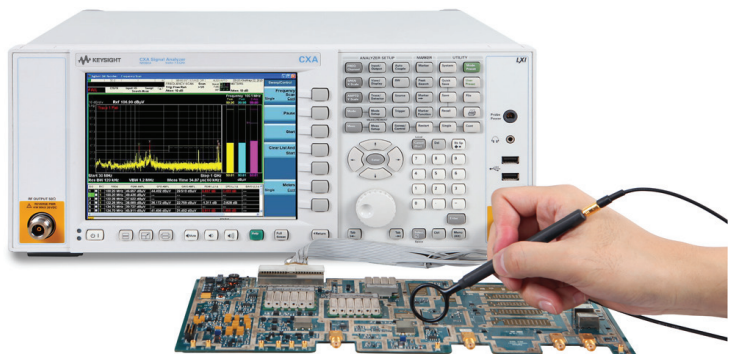


Figure 4. Troubleshooting with a close-field probe

Conclusion

X-Series signal analyzers, combined with the EMI measurement application, offer you a powerful and cost-effective EMI pre-compliance measurement solution. You can select from a range of models to meet your performance and budget requirements – from the high-performance PXA, through the mid-performance MXA and EXA, to the very cost-effective CXA.

Contact an Agilent representative to identify a pre-compliance package that best suits your requirements.

Additional Resources

EMI receiver for full-compliance measurements



The Keysight N9038A MXE EMI receiver is fully-compliant with CISPR 16-1-1 2010 and military standards and includes:

- All required detectors – peak, quasi-peak, EMI average, and RMS average
- CISPR, MIL-STD 6 dB and standard 3 dB resolution bandwidths
- Up to three simultaneous, real-time detectors for continuous signal monitoring

More information is available at: www.keysight.com/find/mxe

Literature

For a more detailed discussion of radiated and conducted emissions measurements and information about the EMI measurement application, visit www.keysight.com and download the following documents:

Making Conducted and Radiated Emissions Measurements, application note, literature number 5990-6152EN

N6141A and W6141A X-Series EMI measurement application, technical overview, literature number 5990-6035EN

Web

X-Series signal analyzers:
www.keysight.com/find/x-series

N6141A EMI measurement application (for PXA, MXA and EXA):
www.keysight.com/find/n6141a

W6141A EMI measurement application (for CXA):
www.keysight.com/find/w6141a

11940A, 11945A and N9311X-100 close-field probes:
www.keysight.com; then enter model number in the search box



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