

Pre-Compliance EMC Testing Benefits

Designers and product development teams are tasked with hitting many standards, regulations and guidelines throughout the product design and development process. One of the most important — and most challenging — is meeting electromagnetic interference limits.



TOP BENEFITS OF PRE-COMPLIANCE EMC TESTING

To ensure a product's success, it must remain in compliance with the relevant electromagnetic compatibility requirements. The process for checking this is referred to as EMC testing. Planning and preparing for it is called EMC design.

During testing, you look to see if your product(s) and/or product system(s) does not generate electromagnetic emissions more than the prescribed limits, in addition to operating appropriately during EMC immunity tests. The immunity tests are designed to simulate various electrical phenomenon to which the product could potentially be exposed during normal operation within its intended electromagnetic environment.

You must ensure the unintentional generation, propagation or reception of energy doesn't cause unwanted or dire effects. At its worst, electromagnetic interference can ruin or damage equipment. By identifying problems early and eliminating interference sources, you can ensure this doesn't happen.

Why Perform EMC Pre-Compliance Testing?

The cost of testing is high, and the process is often tedious, which can contribute to longer project cycles and ballooned budgets.



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So, why perform EMC pre-compliance testing? Because those burdens increase tenfold if you have to retest because your product doesn't meet standards, especially during the final EMC testing stages. [Nearly 50% of products fail EMC testing](#) during the first round.

Any product or equipment that could potentially emit radiated emissions or conducted emissions — across all industries — should be tested. Testing is typically divided into two categories: emissions testing and immunity testing.

To uphold compliance among product makers and manufacturers, the Federal Communications Commission (FCC) has established guidelines to ensure new products or equipment within the U.S. remains within safe EMC boundaries. The European Conformity (CE) mark, also known as CE marking, is a symbol found on products within the European Economic Area (EEA) and outside the EEA, and denotes whether a product has been carefully vetted by the manufacturer to ensure it meets the EEA's relevant protection standards.

How Can You Avoid EMC Failure?

One way to ensure failure doesn't happen is to implement pre-compliance testing. Having pre-compliance testing methods and procedures ingrained in your project plan can help ensure your platform is compliant before you seek official approval.

There are many benefits of getting the jump on your testing to ensure your product meets all required standards. Let's look at what EMC compliance is, the benefits of pre-compliance testing and how tests for EMC compliance can work in practice.

What Is EMC Compliance?

EMC compliance — or the adherence to EMC limits — is regulated by the FCC under Title 47 of the Code of Federal Regulations, or 47CFR. Requirements relate to conducted and radiated emissions. Europe and a small handful of other countries are unique in that they require immunity testing, but most markets require only emissions testing like the United States.

EMC restrictions are required by national law and demanded in various industries. They exist to protect both consumers and manufacturers from the unwanted effects of electromagnetic interference. EMC isn't strictly regulatory. Some customers in the enterprise or commercial industry may request self-imposed standards and testing procedures for products.

Electromagnetic compatibility testing is driven by teams of compliance experts and requires exclusive testing facilities — the appropriate environment is vital to the testing and approval process.

Consequences of Failure: What Happens When You Don't Comply?

During development, many engineers and designers emphasize performance, reliability, form, function and even appearance. One of the last things a designer often thinks about is compliance, despite its importance, as there are so many elements of a new product or device to worry about.



CONSEQUENCES OF FAILURE: What Happens When You Don't Comply?

Consequences can appear when it's time to launch, or nearing it, and compliance testing has not been factored into the entire process. You must get your equipment or product in the hands of a certified and reliable testing lab to ensure it meets the proper specifications and limits.

If you wait until a late point in your timeline to worry about compliance, specifically electromagnetic compliance, you may run into more than a few problems. In testing, you may fail to meet requirements. This can be expensive because of the added test time incurred while troubleshooting and engineering potential fixes — not to mention delayed product schedules. If you can't find a "band-aid" fix, you may have to go back to the drawing board and come up with a more efficient design.

No matter how hard you try, you can't plan for everything — which is why it's better to take pre-compliance steps, so you can have confidence your product, device or equipment will be ready and compliant when it's time to launch.

But what happens when or if failure occurs? Here are five consequences:

1. Non-Compliant Products Could Be Stopped at Customs

This is especially true of products manufactured outside Europe that don't meet the continent's slightly stricter regulations. Immunity testing is required to pass European regulations, which isn't a necessary component of testing elsewhere.

Products stopped at customs pose issues to the manufacturer and brand behind the product, hurting their reputation and image. Customers and clients will be dissatisfied with the delays, especially for something that should have been remedied during development.

2. National Law, Consumer and Professional Industries Demand Compliance

If you're caught with a non-compliant device or product on the market, you most likely will incur minor to severe fines and repercussions. Penalties can range from a warning to millions of dollars in fines.

While there are risks related to non-compliant devices in civil and criminal law scenarios, it's also a concern for consumers and professionals alike. It's easy to fall into the trap of thinking it's a regulatory and legal concern, but it's also an ethical one. Poor compliance can result in less-safe, less-reliable products, while also damaging the reputation of a brand or business. Remember, many levels demand compliance.

3. Multiple Test Stages and Submissions Result in Excessive Costs

EMC testing isn't what many would consider cheap or affordable, and that's true even if you must go through the testing process a single time. More than likely, however, you'll be forced to deal with the EMC testing process multiple times, which includes:

- Taking a product back to the design and development phase
- Doing internal tests through an accredited lab
- Sending it out for additional official testing

Not only can this be a drawn-out process, but the more times you are unable to comply, the more times you'll start over. This can balloon costs on many levels, including associated costs with testing itself.

4. Damaged Product and Brand Reputation

EMC compliance exists to protect consumers and clients, yes, but also to protect you and your products. A malfunction or issue could result in an unsafe product or worse. It could harm someone or cause damage to equipment and property. There's no argument about the problems this would cause for your brand's reputation.

5. Decreased Reliability and Safety

Safety and reliability become a huge concern for equipment and products that don't comply. A malfunction can ruin your product and cause additional damage and harm. This directly affects the life cycle and reliability of a product or equipment, which in turn can impact customer loyalty and satisfaction. No one is going to buy your products if they're deemed unsafe.

Average Compliance Costs

Because there are so many different types of products and categories of compliance, we can only give a broad range of costs. EMC testing can cost anywhere from \$1500 to \$2500 a day depending what's checked and what kind of product or equipment it involves, and the type of industry that product will serve. A commercial product, for instance, might take less time to pass through testing than something military compliant.

If you're applying for CE, smaller, simple electronic gadgets without RF functions cost start around \$700 and take three to four weeks. However, when you consider the two to three days of lab time and documentation — which could cost anywhere from \$3000 to \$8000 — the actual cost is much more than the price of the physical item. Safety also costs from \$4500 and takes three to four weeks.

Prices will be higher for more complicated electronics. You can see from these estimates how the cost of multiple testing times can add up.

Rules and Regulations

The easiest way to discern what regulations are appropriate for your product is to ask an expert or test lab directly. Often, they'll offer a detailed walkthrough of the rigorous tests and checks your product or equipment will be subject to. Always check your work and get information from multiple sources. Testing professionals aren't infallible, and it's in your best interest to doublecheck all information.

If you want a more specific representation of standards, you can call the Telecommunications Certification Body for FCC regulations or a Notified Body for a CE Mark in European markets. CFR Title 47 are the rules and regulations set forth by the FCC for U.S.-based products and equipment.

CFR Part 15 of Title 47 relates to radio frequency devices, defined as devices that use timing impulses greater than 9000 pulses using digital techniques — this applies to intentional, unintentional and incidental radiators. The commission notes this includes nearly any product with a microprocessor, such as printers and electronic games. It prohibits advertising or selling these products until they have shown to be in compliance with radiated and conducted emissions.

For Europe, common CISPR standards include:

- **CISPR 11:** Industrial, scientific and medical (ISM) radio-frequency equipment
- **CISPR 12:** Vehicles, boats and internal combustion engine-driven devices
- **CISPR 14-1:** Electromagnetic compatibility requirements for household appliances, electric tools and similar devices, as well as emissions testing
- **CISPR 14-2:** Electromagnetic compatibility requirements for household appliances, electric tools and similar devices, as well as immunity testing
- **CISPR 20:** Sound and television broadcast receivers and associated equipment and their immunity characteristics
- **CISPR 24:** Information technology equipment and its immunity characteristics

When a standard — CISPR, IEC or another — is adopted with or without modification by one of the three recognized European Standardization Organizations — CEN, CENELEC or ETSI — it's given an EN (European Norm) title. Only EN standards are listed as harmonized standards to be used for CE marking. For example, when CISPR 24 was adopted, it was then republished as EN 55024.

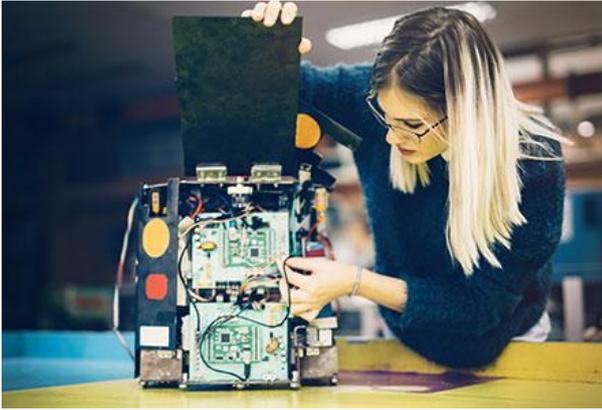
You can read and see more about the [standards from the International Electrotechnical Commission](#).

Why Pre-Compliance Testing Exists

While pre-design, testing and EMC compliance may seem like more of a hassle than it's worth, it exists for several reasons:

1. Detects Errors Early, Fixing Potential Issues

If you're concerned with compliance before submitting a product or device to accredited labs, you can identify problems early. This allows you to remedy and fix an issue right away, rather than send something through testing, waiting to get it back and returning to the design phase.



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2. Lowers Testing and Design Costs

Multiple testing phases increase costs. After a non-compliant device goes through testing and returns to you, there may need to be a redesign or you might need to overhaul functions to meet regulations.

Following pre-compliance procedures means you can ensure your product meets regulations before shipping it off for testing. It's no secret why this would help lower and maintain ballooning costs.

3. Projects Become More Agile

Time is always of the essence when gearing up for a product launch. You don't want to reach a projected date and realize your product is non-compliant. This could set you back months and destroy your schedule.

Any financial plans you had in place for the launch of a product may be in flux until you can get the device up to standard again. It will also take time to fix any issues, send it through another phase of testing and receive the necessary certifications.

4. Lowers Risk of Failure and Leads to Assured Compliance

There are no guarantees a product will make it through EMC testing — that's the reality. However, you can improve the likelihood by ensuring the product or equipment is compliant from the outset.

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Though it's not fun or convenient to consider compliance and regulations during the entire development phase, it's beneficial.

5. Addresses Both Over and Under Design and Engineering

Overdesign, over-engineering, under-design and under-engineering are extreme ends of the spectrum that deal with either putting too much work or not enough work in during the design and development phase.

Over-design and over-engineering happen when a team doesn't entirely understand the regulations and requirements. They may follow one set of principles and guidelines, slowing development and increasing the cost of manufacturing the product unnecessarily.

An under-designed or under-engineered product will lead to additional costs due to repetitive reengineering and retesting. So, whether design and engineering is overdone or underdone, costs increase in both cases. Pre-compliance testing can eliminate both problems.

6. Reduces Future Warranty Issues

You're expected to provide a limited warranty for all products you offer. This does wonders for your brand and reputation, but it also builds confidence and loyalty amongst your customer base.

More importantly, if something goes wrong and you need to fix a product or deliver a replacement, you'll have a better understanding for the how and why. Electromagnetic interference has the potential to ruin a product, which is why these regulations exist. Pre- and post-compliance can ensure warranty issues are reduced when it comes to EMC.

What Are Examples of Pre-Compliance Testing in Practice?

Still skeptical about why you should consider compliance from the beginning of your design process?



Here are three companies using EMC measurement equipment to track compliance that might change your opinion.

1. Texas Instruments Tail Light LED Board

Texas Instruments was tasked with creating a [PCB LED board for automotive tail lights](#). However, the board pictured was developed and designed for testing and performance validation. This is one way to ensure pre-compliance with EMC regulations and standards. Obviously, a subsequent product available on the market would follow the same guidelines and design principles to ensure a passing grade.



This is a great example of how you can and should structure your own pre-compliance process. It's better to develop something and move on only when you know it's ready for testing and market impact.

2. Johnson Controls Auto Pre-Compliance Testing

Johnson Controls, an automotive parts and electronics supplier, [put together a detailed workshop and benchmark process](#) for its own pre-compliance process. It points out pre-compliance testing ensures confidence in EMC testing compliance at a lower cost with optimal designs, issue troubleshooting and fixes before major problems appear and implement quantitative performance measurements.

3. Flame Boss and Danger of Reducing Costs of Circuit Board for EMC Compliance

Flame Boss, a manufacturer of aftermarket meat smoking controllers and systems, [ran into some issues with EMC compliance for a recent product](#). This cautionary tale relates to the dangers of reducing circuit board or PCB capacity and how that can affect EMC performance.

The company started with a four-layer design that passed EMC testing. It later reduced the board to a two-layer design, which failed compliance. The goal was to reduce the cost of circuit boards by cutting down on the size of the bare board.

The result was a serious reduction in costs, especially for large orders of the product. The resulting circuit board was smaller and took less to produce. Unfortunately, the reduction in size — which parsed down the previous design — resulted in higher noise ratings.

Always assess the **risk factor** before making changes to a product and its internals, **especially when you've already passed EMC testing.**

The cost of reducing a PCB can lead to some significant EMC challenges affecting the product's bottom line. Always assess the risk factor before making changes to a product and its internals, especially when you've already passed EMC testing. Flame Boss would have been better off addressing this issue before launching the four-layer PCB design. Additional problems could have been remedied by following pre-compliance procedures.

Don't Tackle Pre-Compliance Alone

Pre-compliance testing can help ensure your product and equipment meets legal and customer demands. You can reduce the associated design, development and testing costs by planning ahead. You remain ahead of the curve, so to speak.

THE GOAL IS TO **OVERCOME**
COMMON OBSTACLES OR FAILURES
THAT OCCUR DURING TESTING.



The first step in tackling your EMC pre-compliance testing is securing reliable, high-quality equipment — why not get yours from pre-compliance experts? Buying your equipment from a company that understands the tricky, time-consuming pre-compliance testing process will allow you to keep your development timeline on track.

Com-Power offers high-quality, reliable EMC pre-compliance testing equipment to help you overcome common obstacles or failures that occur during testing. This includes:

- Reducing RF noise
- Ensuring power, ground, and static I/O signals are clean
- Identifying and monitoring ESD testing locations
- Measuring ESD levels
- Choosing and testing the appropriate power adapter
- Optimizing functional equipment, such as LCDs
- Checking auxiliary equipment for compliance, a step that is often overlooked
- Choosing and adhering to the appropriate protection rating
- Shielding sensitive analog and RF circuitry
- And much more

What Is Com-Power?

Com-Power is an [EMC test equipment](#) supplier, comprised of a team of experts on the EMC regulations and electromagnetic compatibility. We offer a variety of products that will aid you in the measurement and suppression of potential interference.



CONTACT US

for a quote or to learn more about
pre-compliance testing and design.

With equipment from Com-Power, you can safely conduct pre-compliance tests to help ensure a passing rating. All our testing equipment will help manufacturers and new products meet the regulatory requirements for EMC.

How Can I Get in Touch With Com-Power?

[Contact us](#) for a quote or to learn more about pre-compliance testing and design. We'll cover EMC and pre-compliance on a case-by-case basis with you and your team. Email, call or fax to connect with one of our representatives — we look forward to hearing from you.
