IEEE SPCE 2024

IEEE SYMPOSIUM ON PRODUCT COMPLIANCE ENGINEERING

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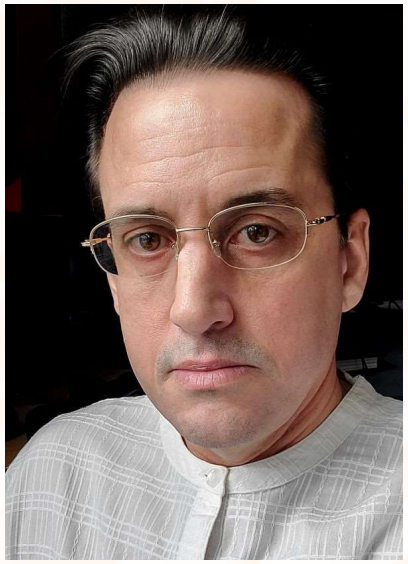
Mastering EMC

The Importance of Pre-Compliance Testing



David Connor

Mastering EMC:

The Importance of Pre-Compliance Testing

Mr. Connor is a seasoned IEEE product consultant with over three decades experience in product development for domestic and international markets. As president of Striper Solutions LLC, he specializes in product regulatory compliance, guiding businesses through the complexities of regulatory standards and providing solutions for critical EMC and safety product issues.

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EMC Regulatory Compliance

- Electromagnetic Compatibility (EMC) testing is a critical part of product regulatory compliance and an expensive part of product development.
- Most products fail first-pass EMC testing
- Pre-compliance testing can reduce EMC failures, save product development time and cost

What is EMC Pre-Compliance?

EMC Compliance

- Rigorous testing process conducted after the product is finalized and ready for market.
- Used to verify/certify product compliance to published standards and regulations.
- Typically conducted by accredited third-party testing laboratory.

EMC Pre-Compliance

- Informal EMC testing of product components and prototypes
- Used to identify EMC issues during the product development phase
- Can be performed by third-party testing laboratory or in-house engineering.

Why Do Pre-Compliance Testing?

Cost Savings

- Find and address EMC issues early in the design cycle
- Reduce design cycle time
- Reduce trips to the test house

Improved Product Performance

- Identify and reduce product susceptibility to EMC interference

Regulatory Compliance

- Identify and resolve EMC issues prior to official testing

In-House Pre-Compliance

REQUIRES:

Some specialized equipment

- The amount, complexity, and cost of specialized equipment depends on the level of in-house testing needed

Some specialized knowledge

- Knowledge of EMC standards and regulations required for the product
- Ability to operate the equipment, interpret the results and resolve EMC issues

Basic Equipment (Radiated Emissions)

Spectrum Analyzer

- Used to identify and analyze frequency spectrum issues.

Near Field Probes (E & H Field)

- Measure the electromagnetic fields in close proximity to product being tested.
- Identify potential sources of interference.

Mid-Level Equipment (Radiated Emissions)

EMC Antenna

- Used to measure radiated emissions
- Different antenna types depending on frequency being measured.

Shielded Enclosure (tabletop)

- Reduces external interference

High-Level Equipment (Radiated Emissions)

EMI Pre-Compliance Analyzer

- Used for pre-compliance EMI measurements to established standards

Shielded Walk-In Tent

- Large enough for far-field EMI measurements

Conducted Emissions/Immunity Equipment

ESD Simulator

- Used to determine product sensitivity to electrostatic discharge

Line Impedance Stabilization Network (LISN)

- Used for conducted emissions and immunity testing on power leads

Pre-Compliance Cost Justification

Autonomous industrial cleaning robot

Time and cost estimates from March 24, 2020, *Signal Integrity Journal* (4)

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Without Pre-Compliance

EMC Engineering Schedule and Cost

ITEM	WEEKS	COST
TEST 1: Engineering, product support, and shipping	3	$24,000
Engineering cost for troubleshooting EMC issues from Test 1	5	$16,000
TEST 2: Engineering, product support, and shipping	3	$24,000
Engineering cost for troubleshooting EMC issues from Test 2	2	$6,400
TEST 3: Engineering, product support, and shipping to lab	2	$20,600
TOTAL	**15**	**$91,000**

With Pre-Compliance

EMC Engineering Schedule and Cost

ITEM	WEEKS	COST
TEST 1: Engineering support for in-house testing	1	$3,200
Engineering cost for troubleshooting EMC issues from Test 1	4	$12,800
TEST 2: Engineering support for in-house testing	1	$3,200
Engineering cost for troubleshooting EMC issues from Test 2	1	$3,200
TEST 3: Engineering, product support, and shipping to lab	2	$20,600
TOTAL	**9**	**$43,000**

Pre-Compliance Savings

EMC Engineering Schedule and Cost Savings Per Design Cycle

ITEM	WEEKS	COST
Without pre-compliance	15	$91,000
With pre-compliance	9	$43,000
TOTAL	**6**	**$48,000**

Equipment Cost

EMI Equipment

ITEM	RENT/MO	BUY COST RANGE
EMI Test Receiver	$1700	$20K-$35K ($27,000)
EMI Antenna, Tripod, Cables	$600	$8,000
EMI Tent	$4,000	$10K-$30K ($20,000)
Near Field Probes	$200	$300-$2,000 ($1,150)
TOTAL	**$6,500**	**$56,150**

Equipment Cost

EMC Equipment

ITEM	RENT/MO	BUY COST RANGE
ESD Gun	$500	$10K-$15K ($12,500)
Ground Plane	N/A	$200
LISN	$350	$4K-$10K ($7,000)
TOTAL	**$850**	**$19,500**

Cost Comparison

In-House Pre-Compliance Design Cycle Payback Period

ITEM	3-MONTH RENTAL	AVERAGE BUY COST
EMI Equipment	$19,500	$56,150
EMC Equipment	$2,550	$19,500
TOTAL	**$22,050**	**$75,500**
Design Cycle Payback	**0.46**	**1.6**

$48,000 Pre-Compliance Cost Savings Per Design Cycle

QUESTIONS?

References

1. "Electromagnetic Compatibility Engineering" by Henry W. Ott (published by John Wiley & Sons): This book states that "in many cases, up to 50% of products fail on the first attempt to pass EMC tests."
2. "A Guide to EMC Testing" by Keith Armstrong (published by EMC Standards): This guide states that "many products do not pass EMC tests on the first attempt, with estimates varying between 30% and 50%."
3. "Understanding EMC Testing in the Product Design Cycle" by Intertek: This report states that "as many as 50% of products may fail EMC compliance testing on the first try.“
4. “Addressing EMC Challenges with In-house EMC Pre-compliance Testing” by Benjamin Dannan. Published in Signal Integrity Journal, March 24, 2020.