

# HP E5200A Broadband Service Analyzer EMC Design

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Electromagnetic compatibility (EMC) is the ability of equipment to function satisfactorily in an electromagnetic environment and not to introduce intolerable disturbances to the environment or other equipment.

With any new product design there are many areas of risk. One significant area of risk is EMC conformance. Conformance to international EMC standards is fast becoming mandatory in the international marketplace. Failure to meet mandatory EMC standards inevitably leads to being locked out of many large markets. More commonly, EMC conformance, or lack thereof, can often cause delays to project schedules and increase the manufacturing cost of a product. These factors make it very important to consider EMC conformance at all stages in the development life cycle.

At the HP Australian Telecom Operation (ATO), management of regulatory compliance is primarily the responsibility of the EMC specialist within the manufacturing engineering group. The EMC specialist is chartered with the role of ensuring that products meet all required regulatory standards. This is achieved by providing EMC design expertise and managing the product qualification process. However, compliance cannot be achieved by activities within the manufacturing engineering group alone. To drive the compliance process, close cooperation between the R&D and manufacturing engineering groups is required. Responsibility for new product compliance needs to be shared by members of both groups.

With responsibility shared across two functional groups it is very important to coordinate EMC risk-reducing activities with a well-defined process. Fig. 1 shows an overview of the process implemented for the HP E5200A broadband service analyzer. The thrust behind this process was to consider EMC throughout development, by building in compliance mechanisms from the beginning and then continually measuring progress at regular discrete stages.

## Product Definition

EMC activities began early in the product definition stage. It was during this stage that many important attributes were decided, such as size, weight, materials, performance, architecture, and technologies. It follows that this stage was one of the most important stages for building in EMC compliance. An informal design and compliance strategy was used to aid the product definition team. This strategy covered the compliance requirements and test plan, risk level trade-offs (i.e., cost versus technologies versus schedule), and EMC design features.

The compliance requirements and test plan were determined from the nature of the product, the target market's legal requirements, and any additional customer requirements. In addition to the hard legal requirements, extra design margin was added. For the service analyzer project, a 10-dB margin was the target for the first prototype, with 6-dB being the target for continuous production.

The risk level was important in estimating and scheduling the amount of resources required for EMC compliance. The estimate of risk accounts for the technologies involved, development time constraints, and cost constraints. For the service analyzer product, risk was higher than ever before.

EMC design features are the mechanisms required to control EMC. Here many decisions were based on experience with EMC design and on research on current techniques and technologies. Credibility of the EMC specialist was of paramount importance. The product development team had to trust and believe in the requirements that the EMC specialist put forward. Many of the requirements clashed with basic product form and function.

## Consultation and Review

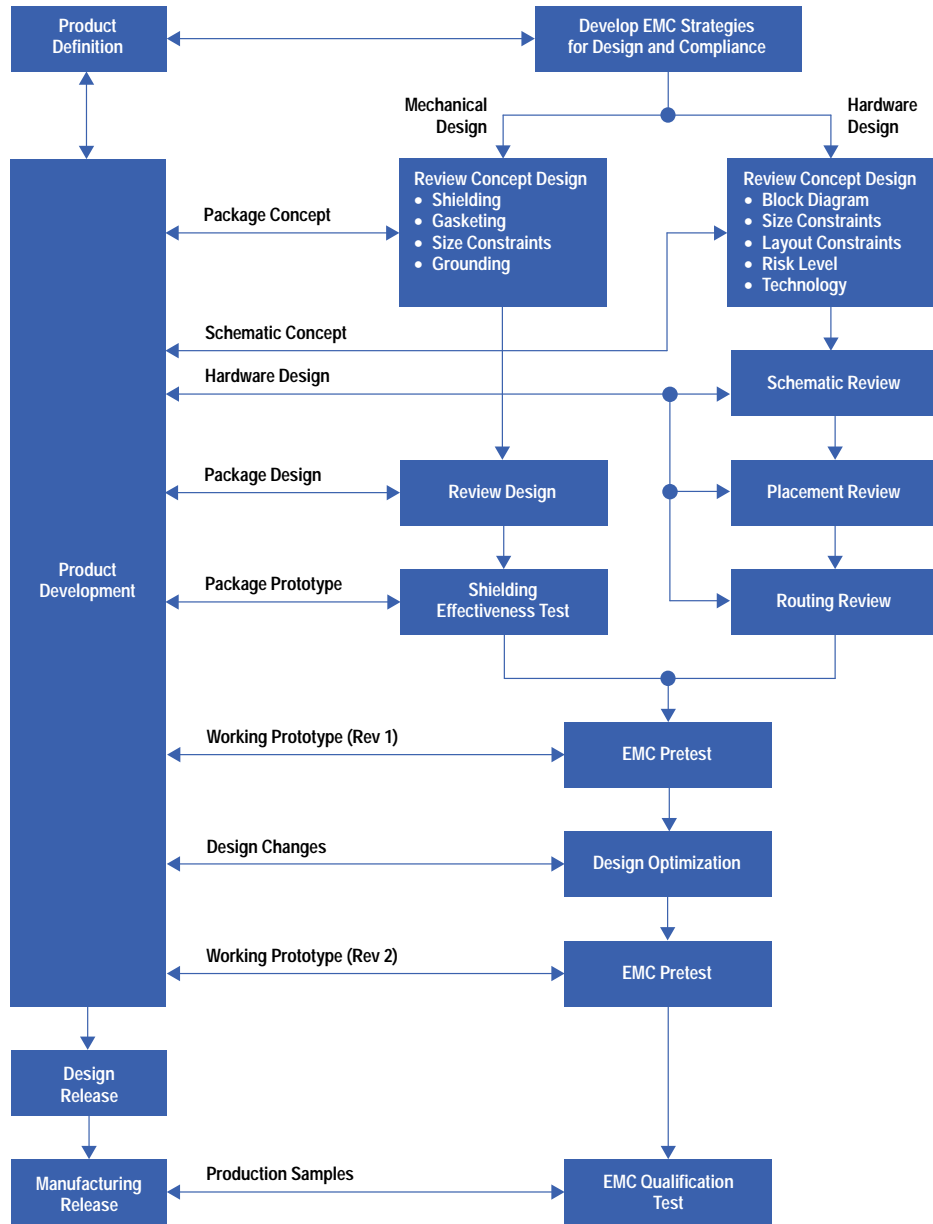
During the implementation or product development stage, the EMC specialist assumed the role of consultant and reviewer. Designers were making many important decisions that could compromise or enhance EMC conformance. Informal review and consultation occurred regularly. The EMC specialist was required to work as part of the development team to ensure full knowledge transfer and continual feedback and review.

## Pretesting and Prototype Evaluation

Later in the development phase, when prototypes became available, pretesting became the main method of risk reduction. Pretesting initially took the form of shielding effectiveness tests for enclosures and conducted emissions tests for power supplies.

Later, as functionality was added, pretesting covered most of the risky EMC tests such as radiated emissions. This testing occurred at regular intervals to catch potential problems at an early stage and to evaluate design changes and tuning.

The number of iterations of pretesting and design optimization depended on factors such as product cost, time to market, level of risk, and technology used. A strategy still commonly observed is to overdesign for EMC and then use iterations to remove unnecessary components. Because time was critical, this was the approach used for the service analyzer product.



*Fig. 1. EMC design process for the HP E5200A broadband service analyzer.*

### Qualification Testing

Qualification testing was conducted on a number of typical production samples in calibrated test environments at certified traceable laboratories. This testing was approached with confidence after pretesting.

### Conclusion

The risks presented by compliance with EMC standards can be significantly reduced by careful planning and constant feedback and review throughout product development. Acknowledgment must go to the service analyzer hardware design team. Despite pressing schedules and many constraints, they always considered EMC conformance an important priority. As a result, conformance targets were achieved without last-minute complications.

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