

EMC Simulation Application Example

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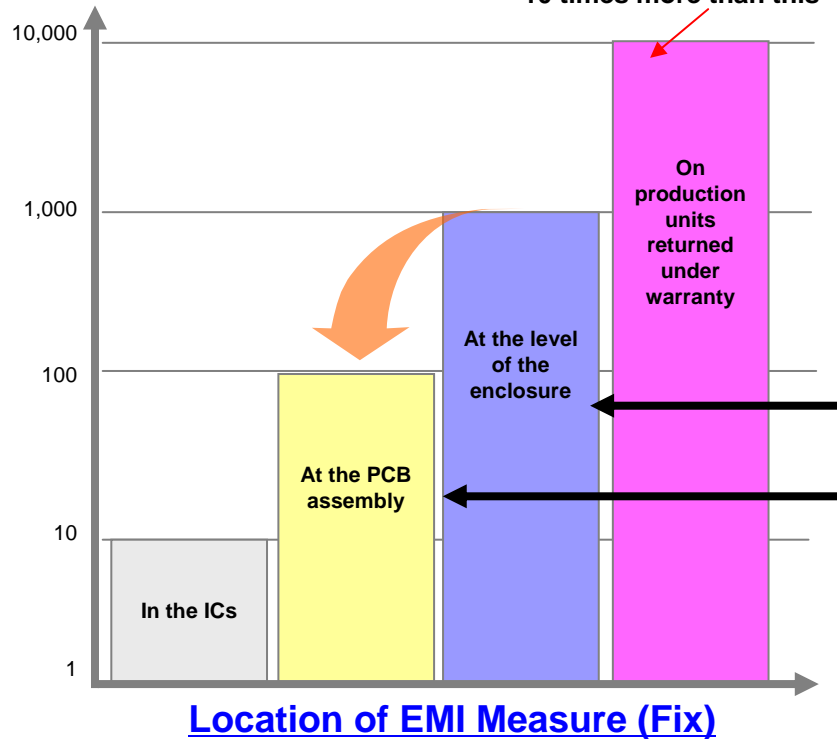


Do-Hyung Kim

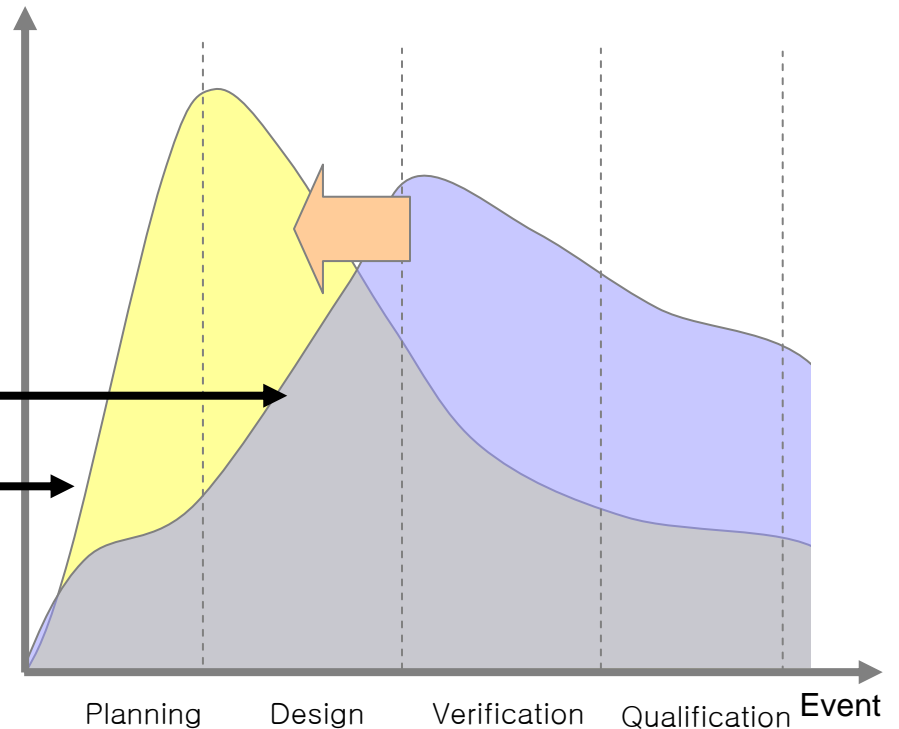
Background

현 EMI 상황을 분석한 결과, 제품 경쟁력을 갖추기 위해선 Simulation을 활용한 초기 설계 단계에서의 분석/개선이 필요함을 알 수 있다.

Relative cost of achieving a given EMC performance



Load

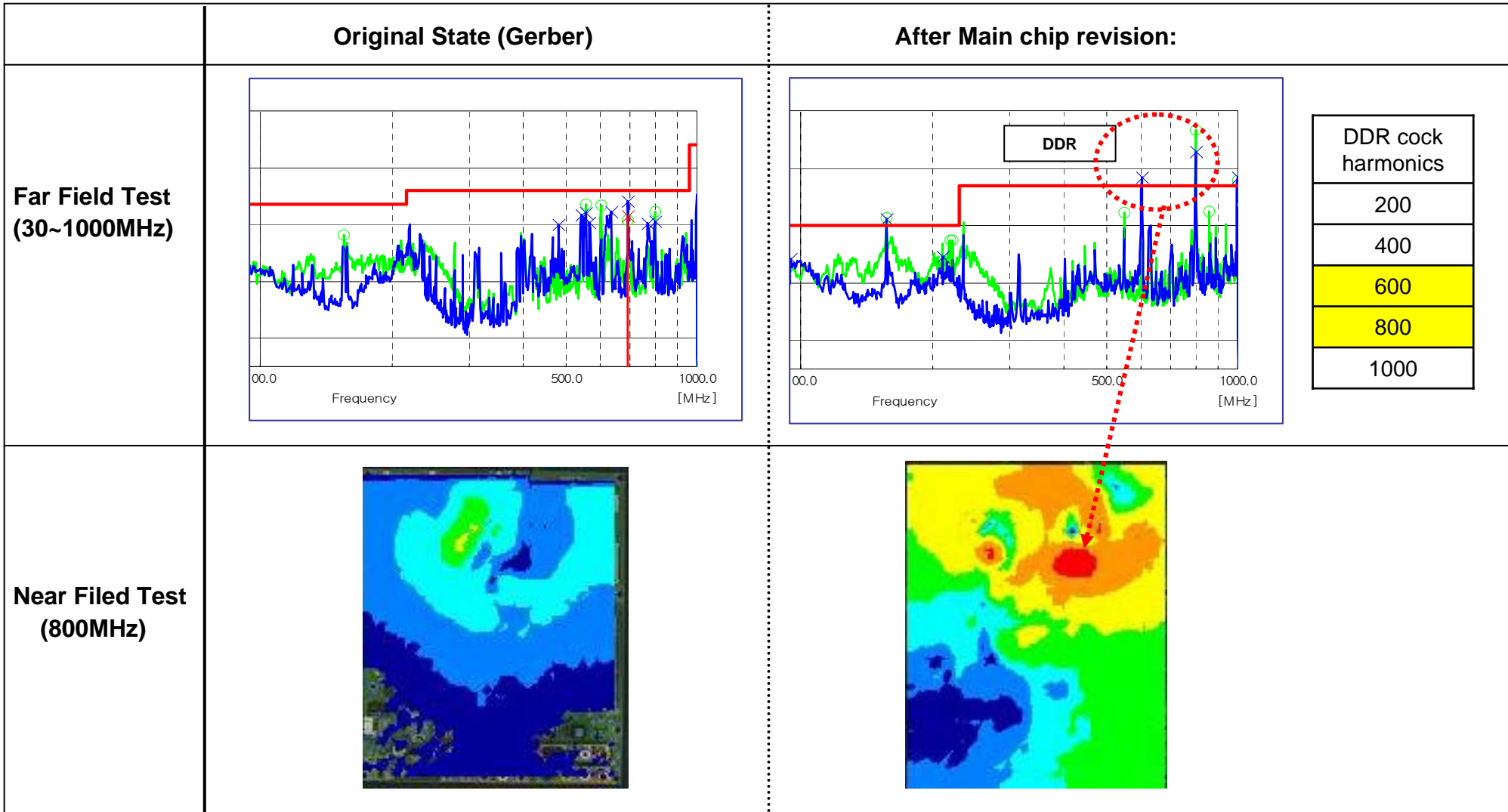


The cost of achieving EMC vs level of assembly

EVENT Load to solve EMI problem

Major objective

Main Chip에서 제공한 data로 초기 설계하였으나 Chip Revision 후 EMI가 문제 되었음.

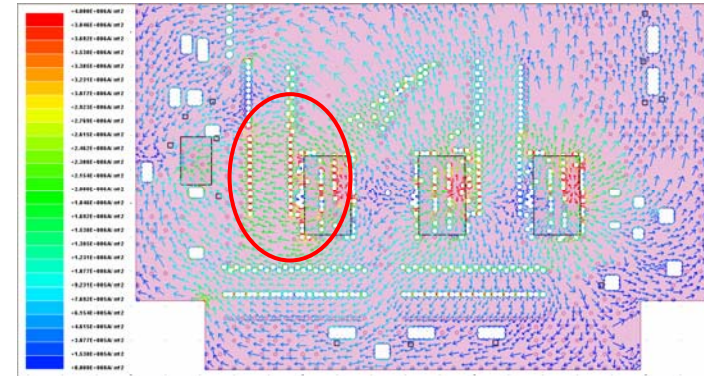


Breakthrough Idea :PI

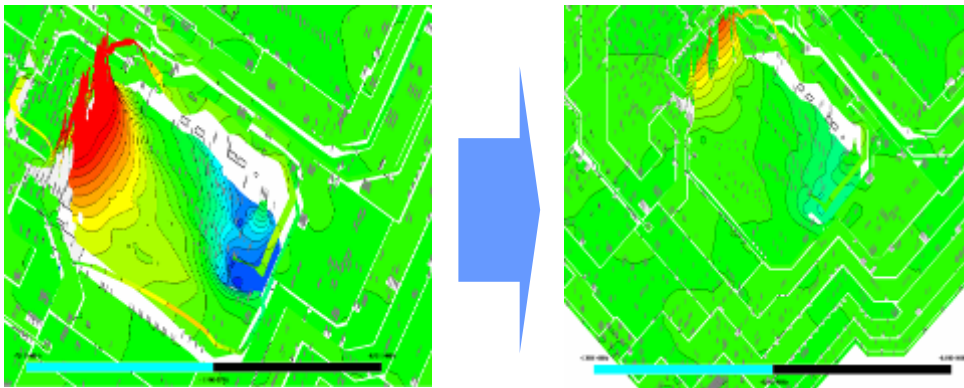
PI를 분석, 개선하여 안정적인 Plane 설계를 한다.



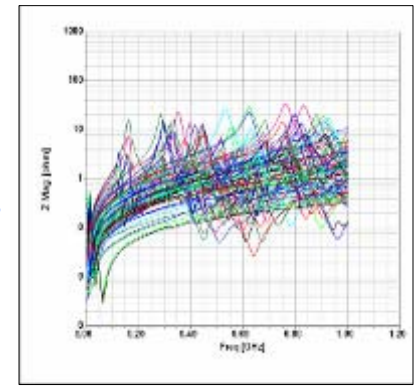
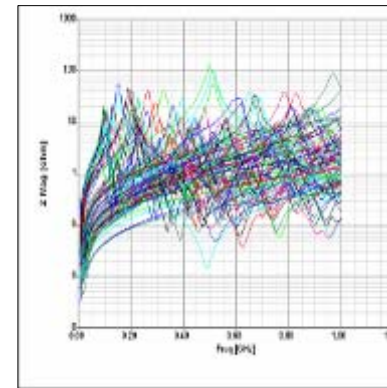
Resonance



DC



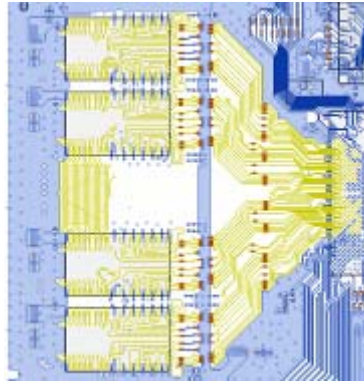
Frequency Sweep



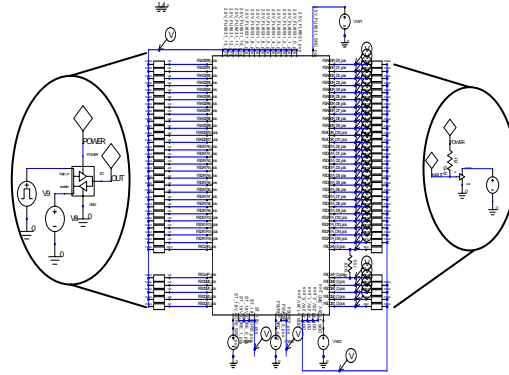
Port Impedance

Breakthrough Idea :SI

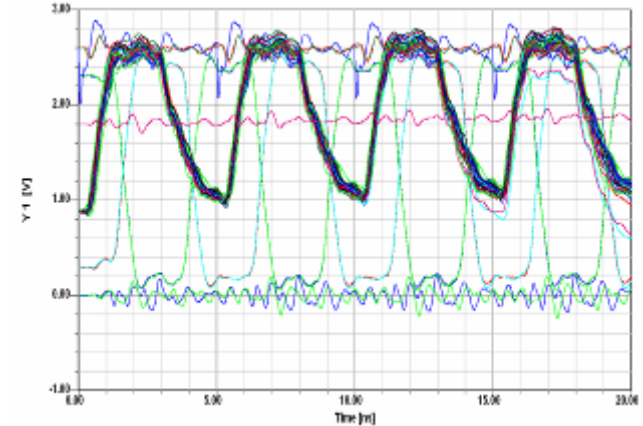
문제 부분의 **Signal**을 분석하여 **EMI** 와 **SI**를 동시 개선 한다.
SI를 통해 분석된 결과를 바탕으로 추가 **EMI** 개선 여부를 판단 할 수 있다.



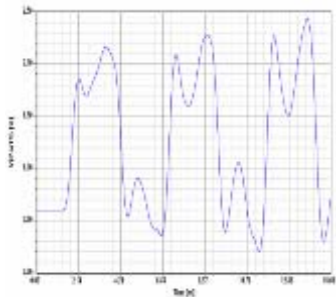
SIWAVE



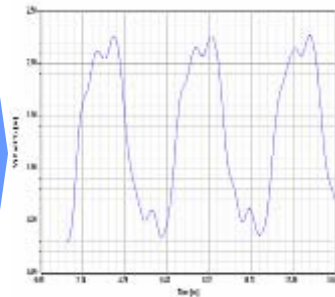
Designer



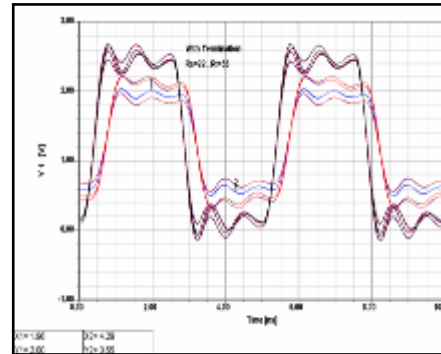
Analyze Signal State



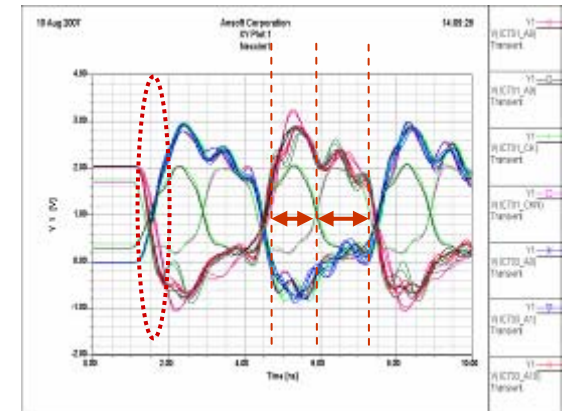
Original State



After Improvement



Optimization

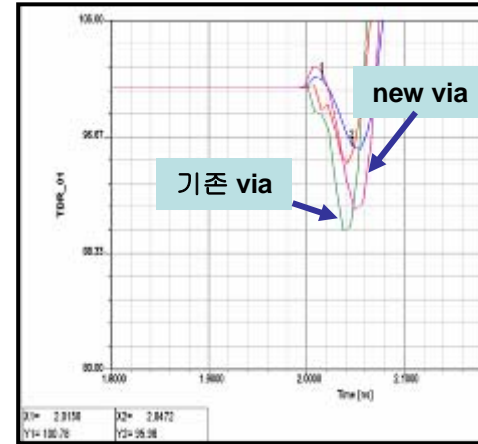
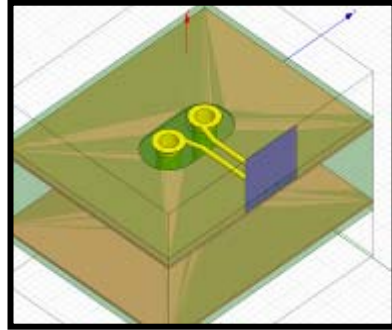
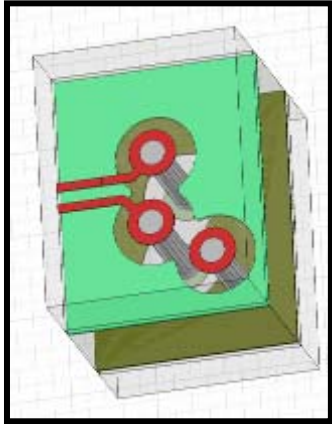


Functional margin Check

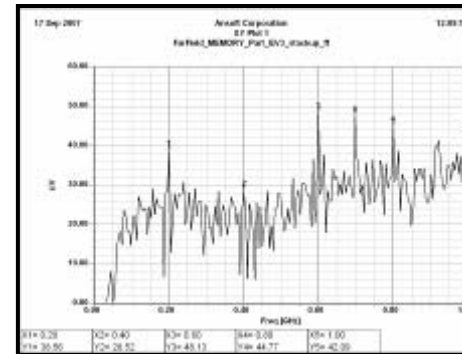
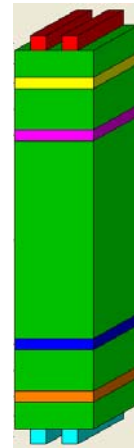
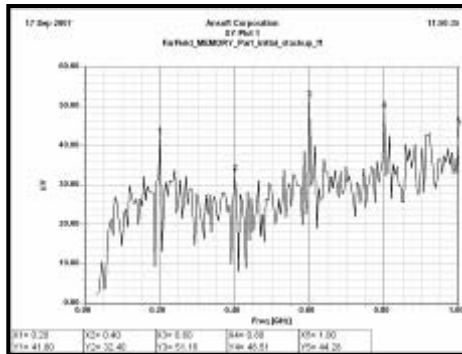
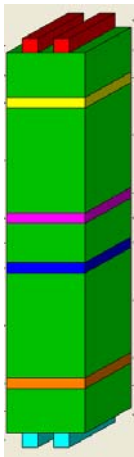
After optimizing, simulation results show that signals have stability and enough timing margin

Breakthrough Idea :SI

3D tool을 사용하여 보다 정확한 설계 Guide를 작성할 수 있으며,이를 EMI simulation과 연계하여 그 효과를 사전에 검증 할 수 있다.



Differential Signal Via Modeling : TDR

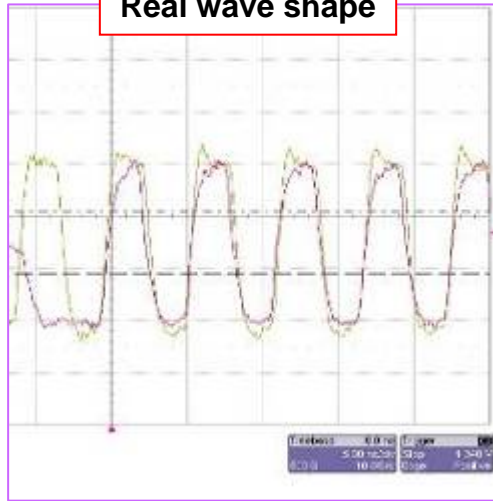


Stack up Change : Far Field Simulation

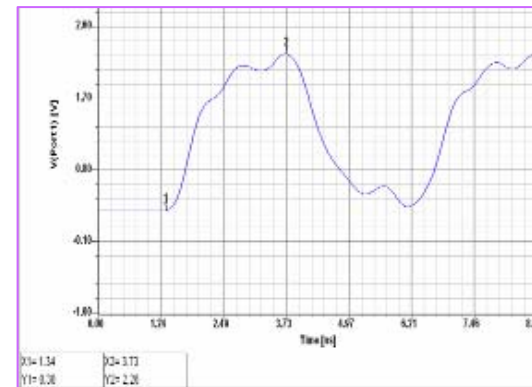
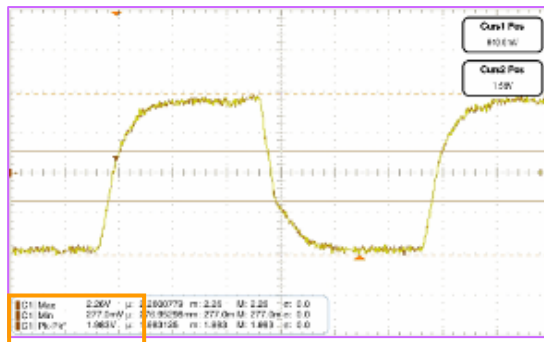
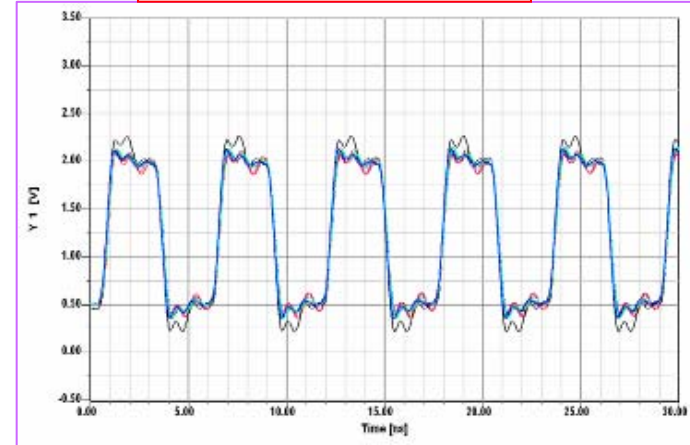
Breakthrough Idea :SI

Comparison between Real wave and Simulation one to check the ability of Simulation.

Real wave shape



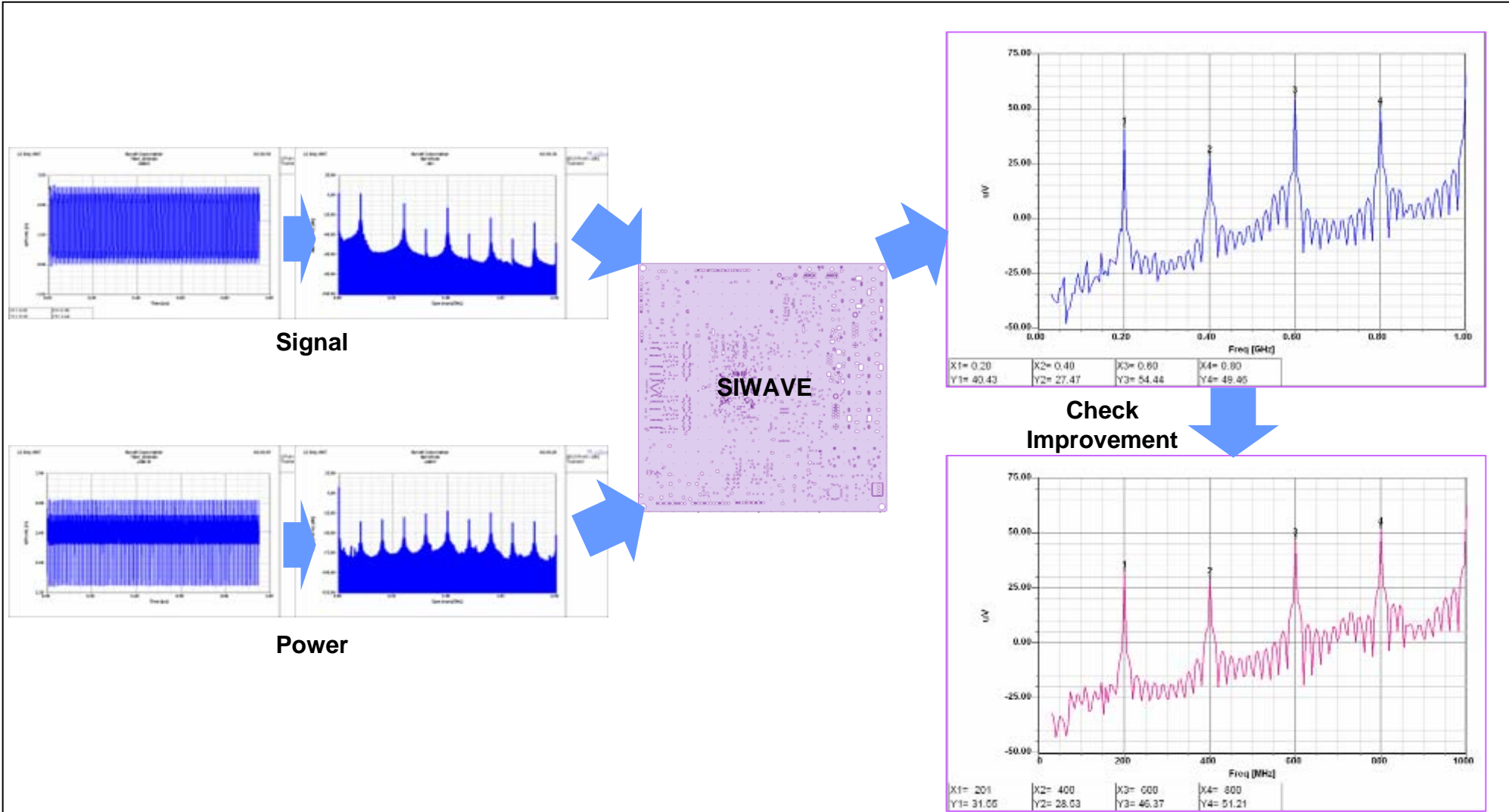
Simulation wave shape



The results show that Sim's data and Real data are almost SAME.
So simulation data is reliable.

Breakthrough Idea :EMC

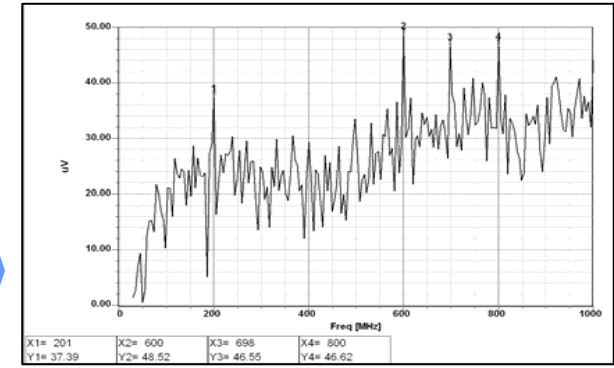
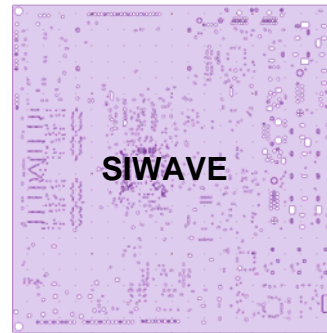
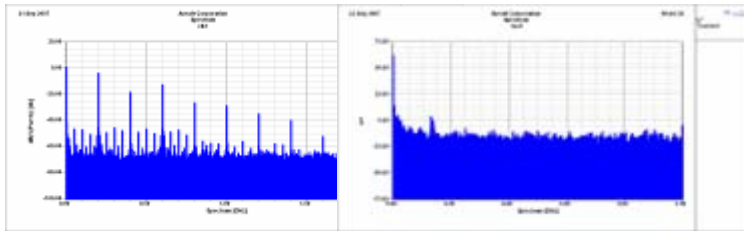
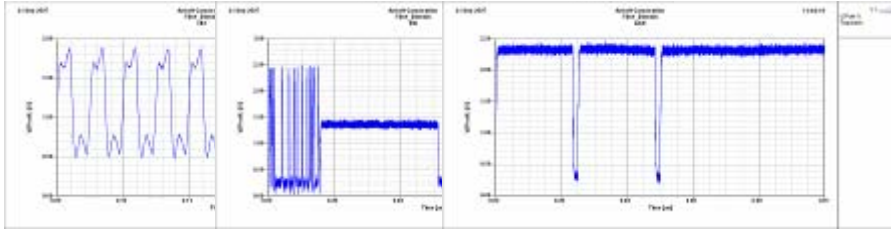
Simulation으로 추출된 각 Signal 과 Power의 파형을 FFT 변환하여 SIWAVE에 인가하여 Far Filed test를 수행한다.



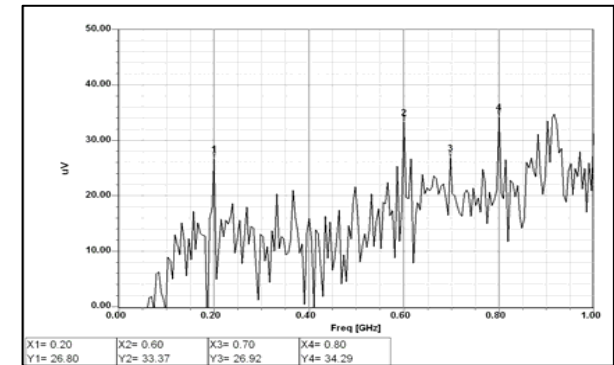
Breakthrough Idea :EMC

실제 측정한 결과를 인가하여 Far Field Simulation을 수행 하여 개선작업을 수행 한다.

Signal



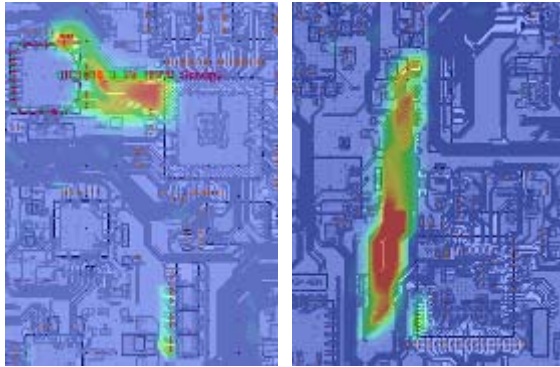
Check Improvement



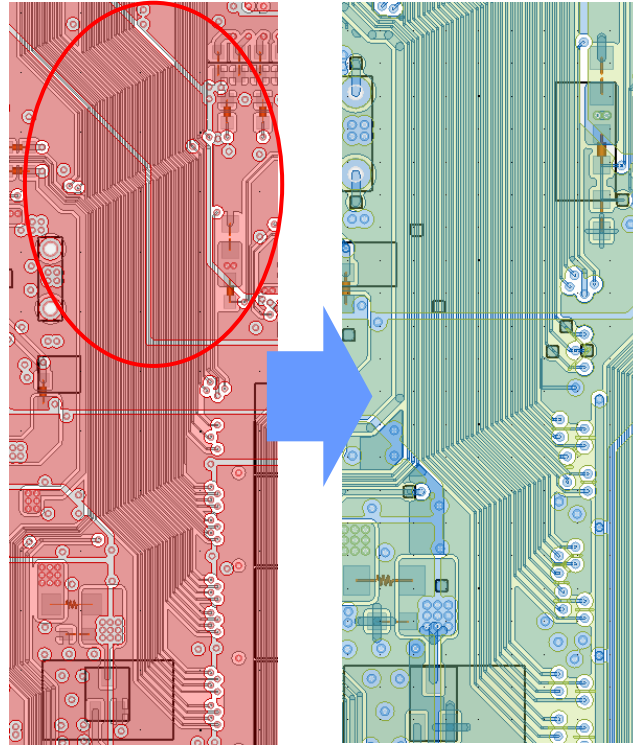
Power

Breakthrough Idea :EMC

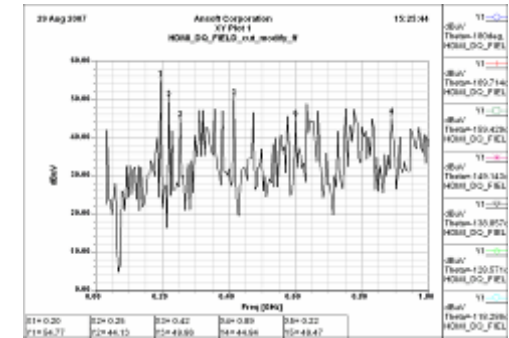
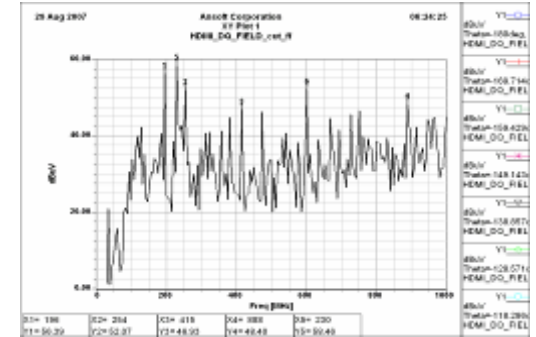
다양한 EMC Simulation tool을 이용해 원인을 분석/개선 할 수 있다.



Near Field Simulation



Improvement



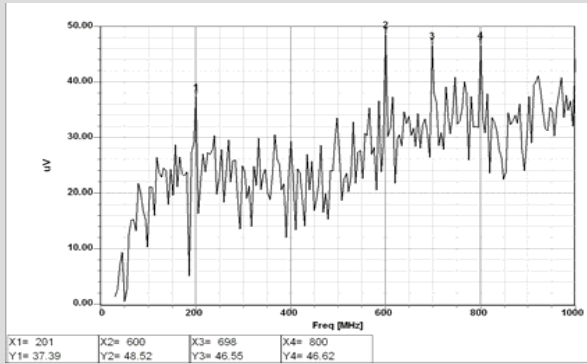
Far Field Simulation

Result

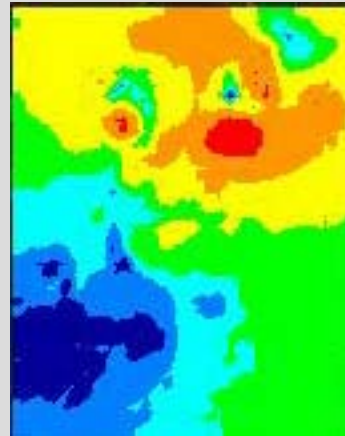
Simulation 및 실측 결과 문제 주파수가 개선됨을 알 수 있다.

B
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F
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R
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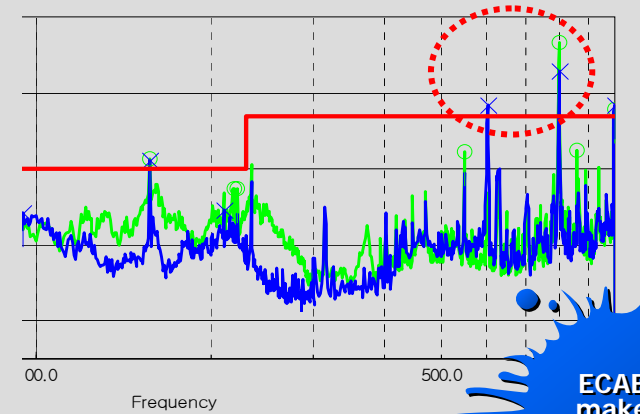
Simulation



Near Field



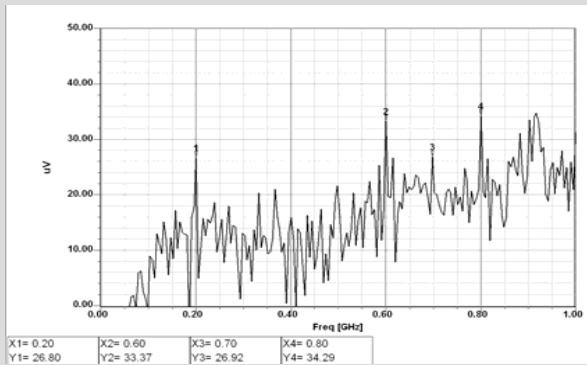
EMI Test results



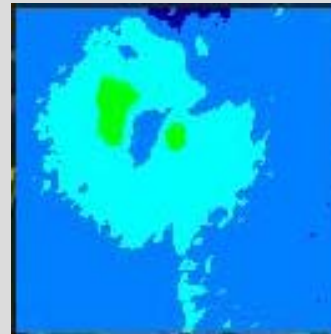
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Simulation



Near Field



EMI Test results

