Wideband Very-Near-Field Array of Probes for Efficient EMI Measurements

EMSCAN EMxpert ERX+

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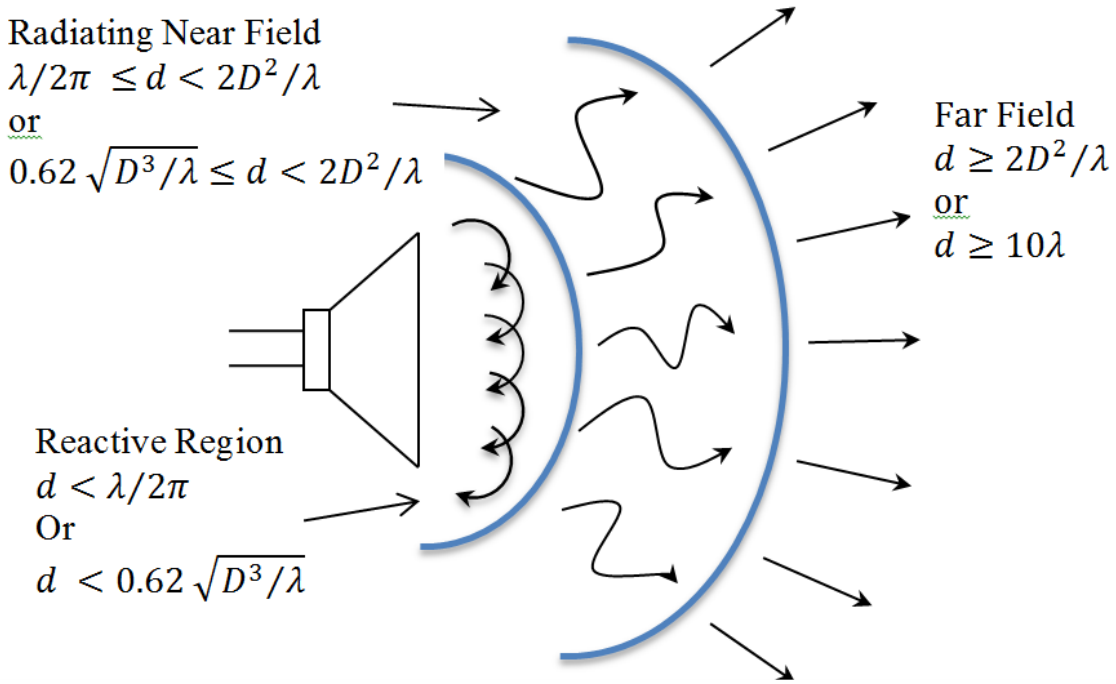
EMSCAN Corporation

KEYSIGHT TECHNOLOGIES
Solutions Partner

Very-near-field magnetic measurements expert since 1989

Unique patented products for RF/MW and EMC/EMI

- **Far-field = pattern is not changing with the distance**
- **Near-field = anything not in the far-field**
- **Stay out of the reactive region? Not EMSCAN!**
  - Very-near-field



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Introduction

World Leading Developer of Visual **Real-Time** EM and RF **Pre-Compliance** Test Solutions

Antenna and PCB **Designers**

Product Integration and Verification **Engineers**

Diagnostic Tool

Manufacturing Quality Control

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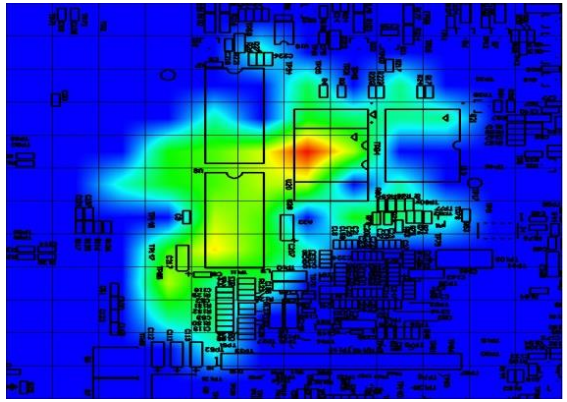
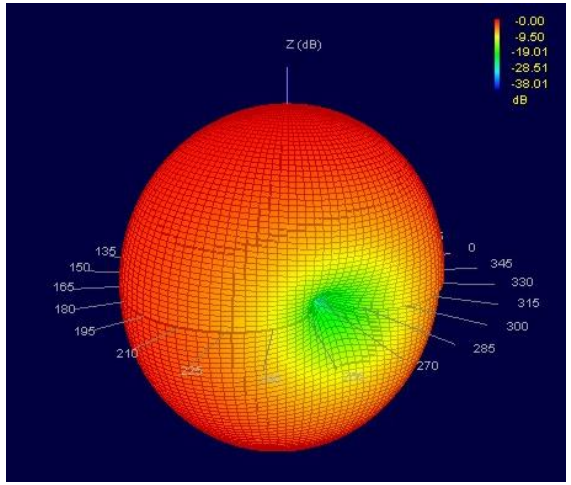
Chamber on your Desktop

- **EMxpert**
  - EMC diagnostic tool to rapidly diagnose and solve EMC/EMI problems with real-time PCB emission analysis



- **RFxpert**
  - APM tool enabling to quickly evaluate performance and optimize designs with real-time antenna performance characterization



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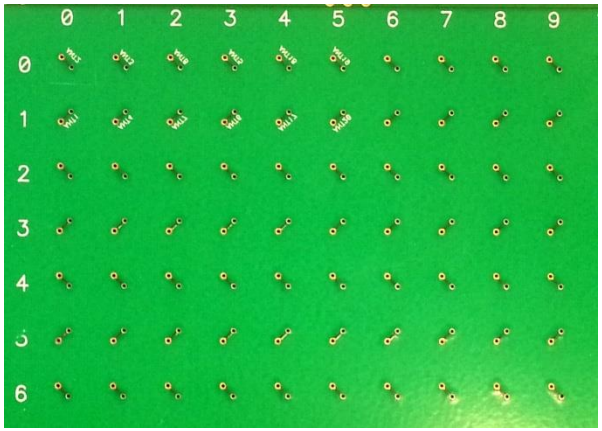
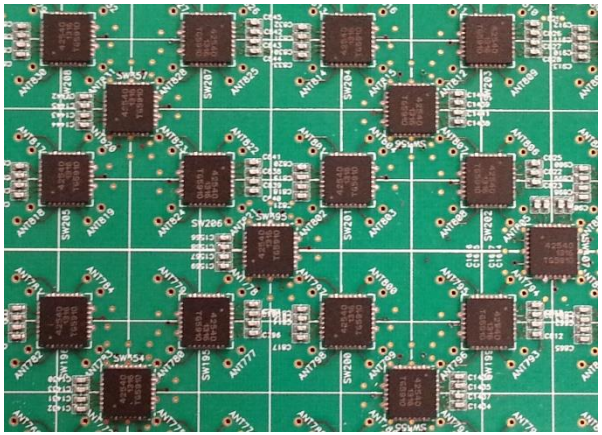
Fundamentals

- High-density planar antenna array
- High-speed electronic switching
- Very-near-field measurements
- Far-field predictions
- “Real-time” real-fast
- No chamber





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Overview

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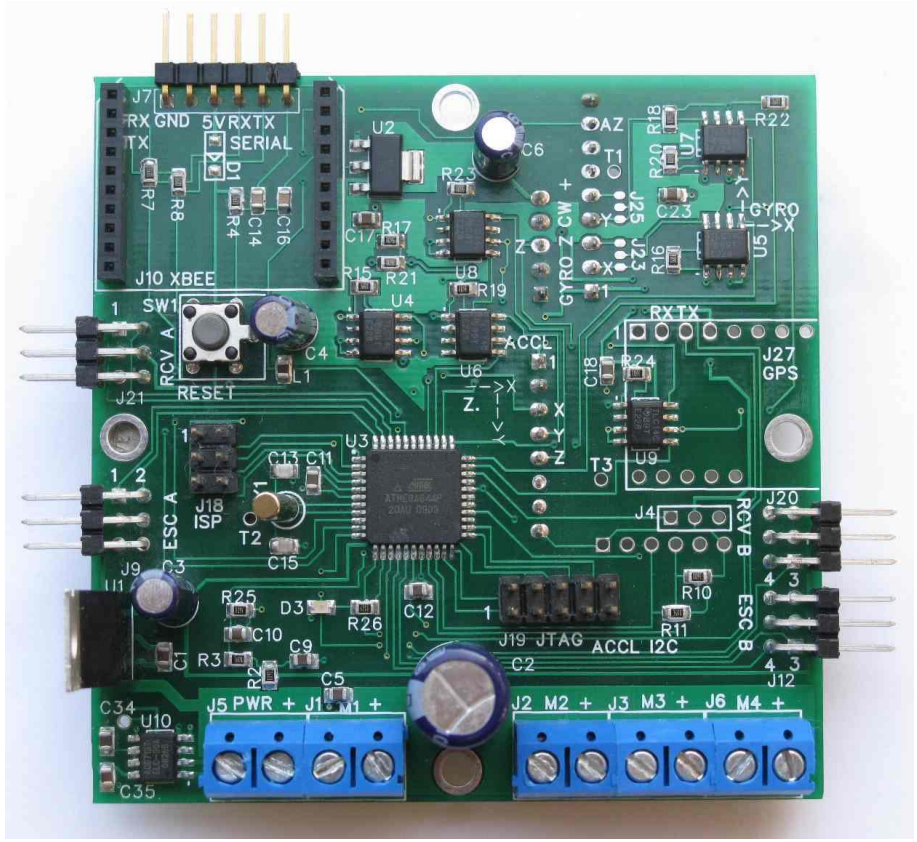
PCB and IC Radiated EMC/EMI Issues



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EMxpert Family

EHX

EHX+

ERX+

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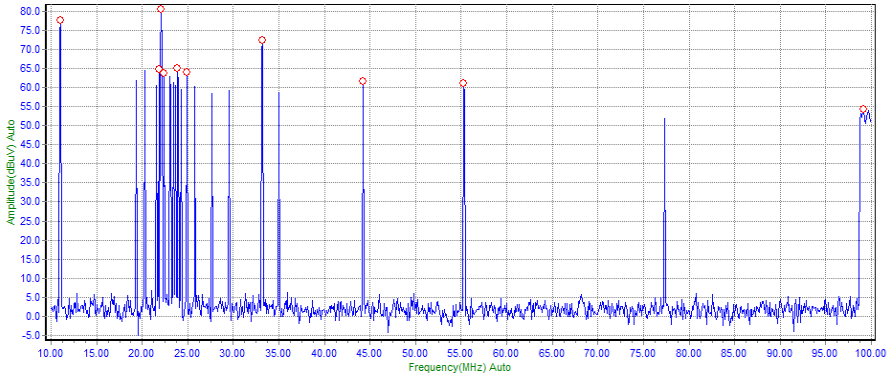
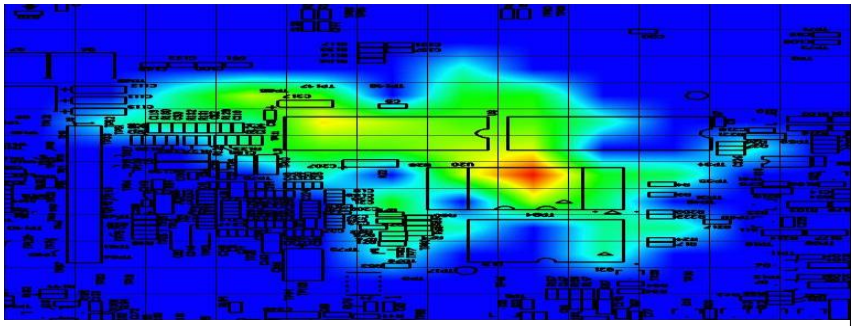
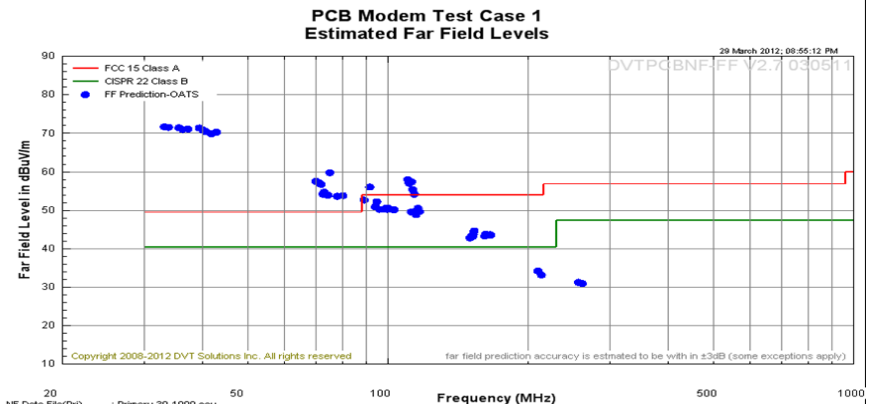
Functionality

- **Spectral scan**
  - Problem frequencies
  - Frequency: 150 kHz to 8 GHz
- **Very-near-field spatial scan**
  - Sources of radiated emissions
  - Hx and Hy
  - Resolution: 3.75 mm to 0.1 mm
- **Far-Field prediction for PCB**
  - Regulatory data
- **Compare and overlay functions**
- **Automated report generator**







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ERX+ Technical Specifications

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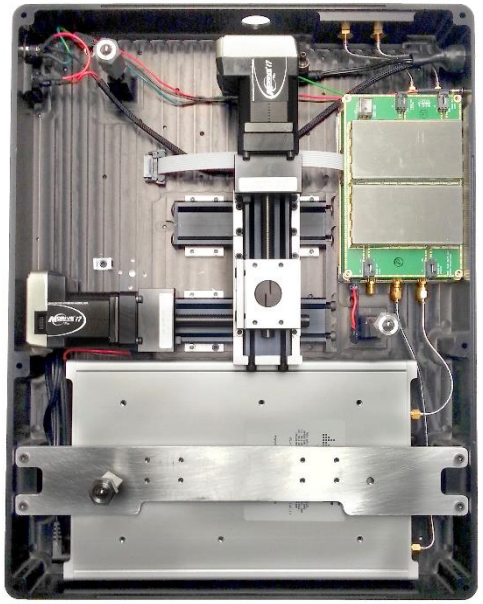
Hardware



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Concept

- **Scanner moves along X and Y axis**
  - Steps defined by required resolution
- **Multiple electronic scans per mechanical step**
  - Rich data acquisition
- **Maximum number of mechanical steps: 16384**
  - Regardless of DUT size
- **Maximum travelled distance: 7.5 mm**
  - Regardless of DUT size

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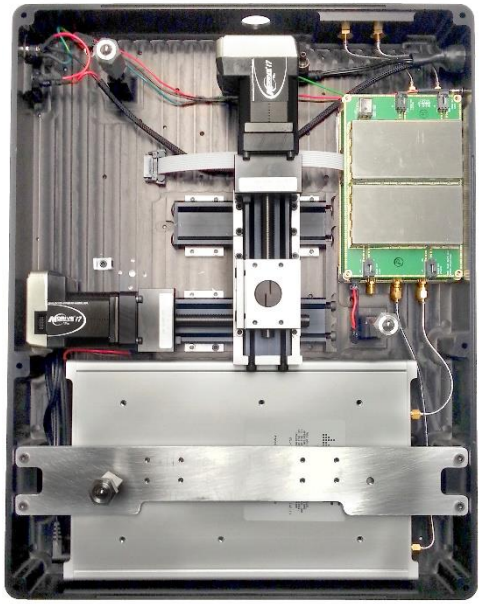
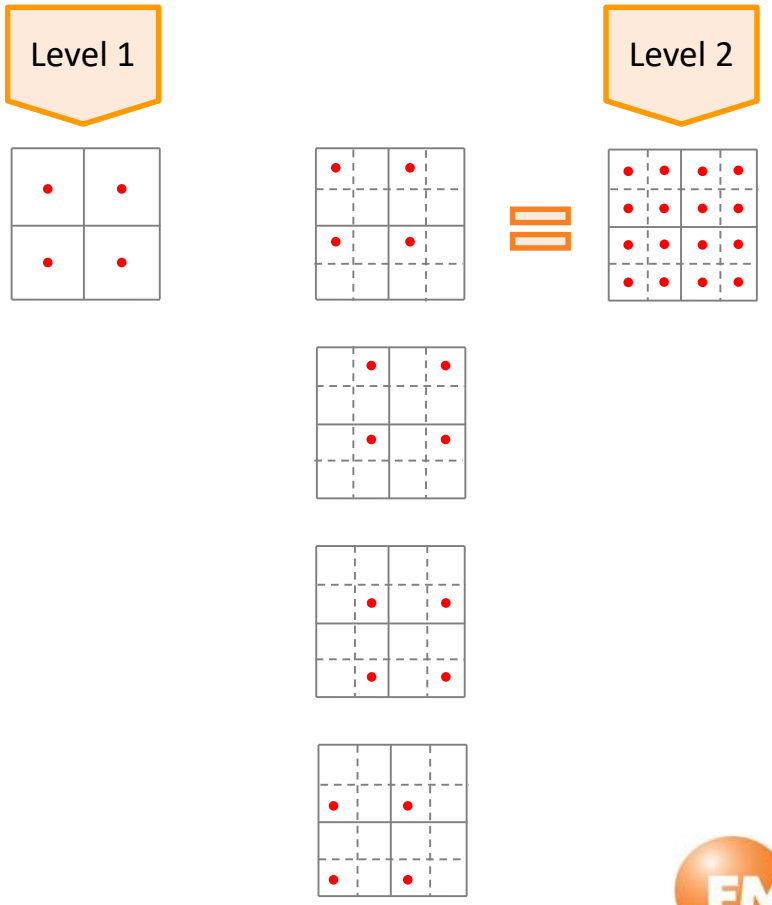
Higher Resolution Spatial Scan

- Move the entire probe array to synthesize small probe spacing





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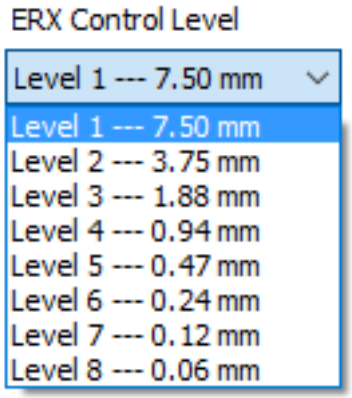
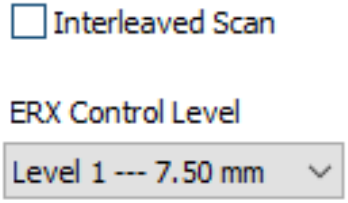
Specifications

- **8 measurement levels - 0**



- **Interleaved scan i.e. blind spot reduction**
  - 2 x duration



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Frequency Domain Data

Currently Available

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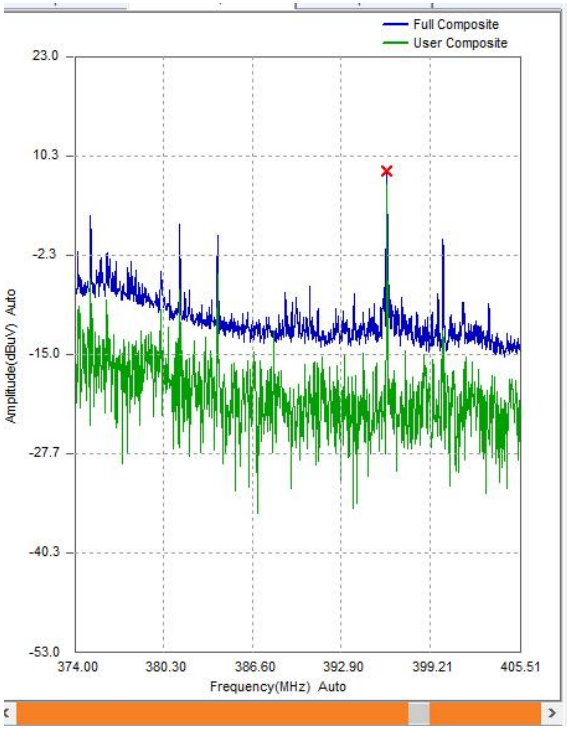
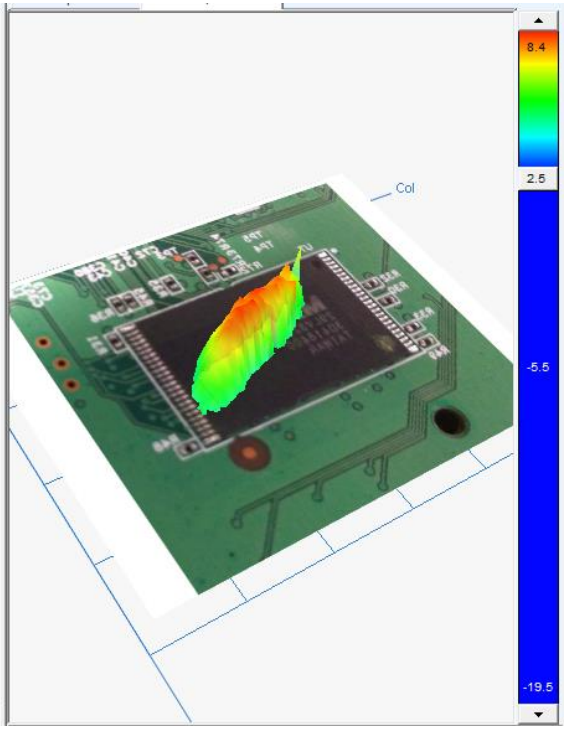
Current Spectral Domain Data

- Probes measured sequentially
- Spectral content at each probe is available
- Spatial distribution for every frequency is available





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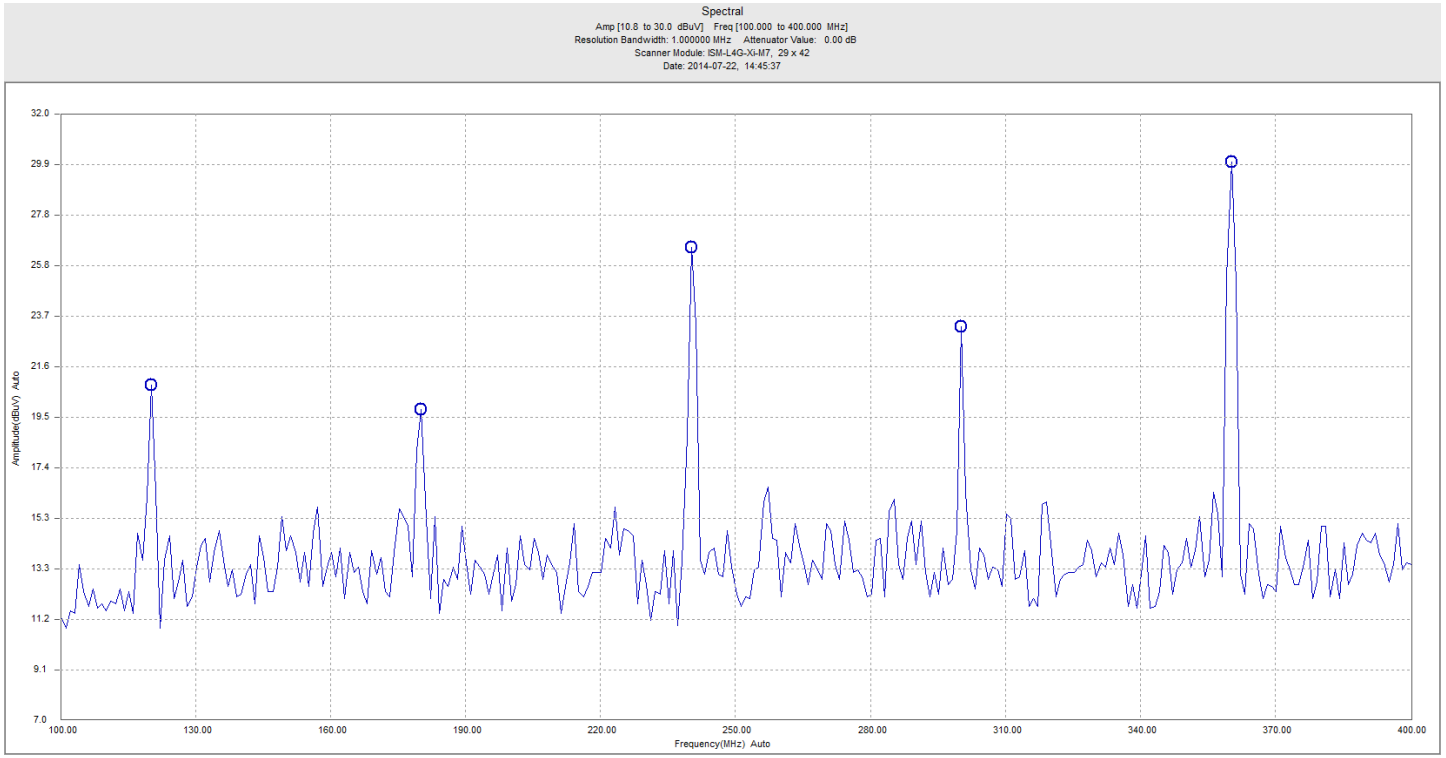
L1 Spectral Scan



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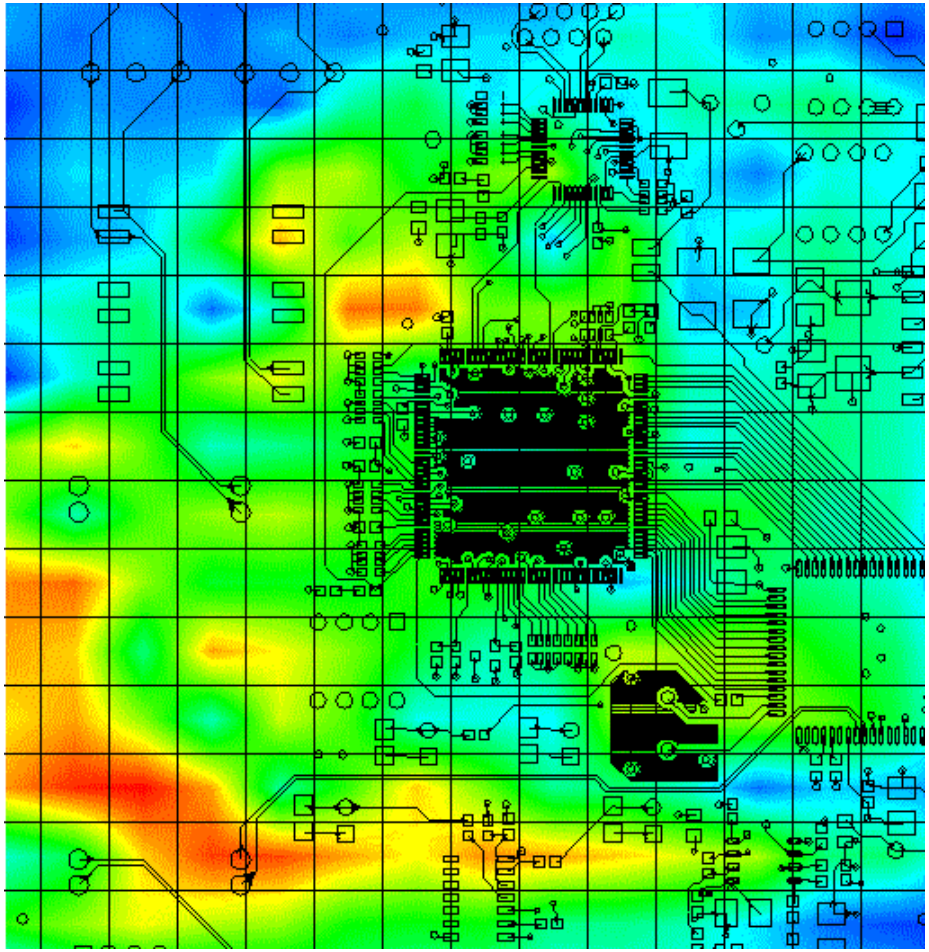
L1 Spatial Scan: “Real-Time” Scanning



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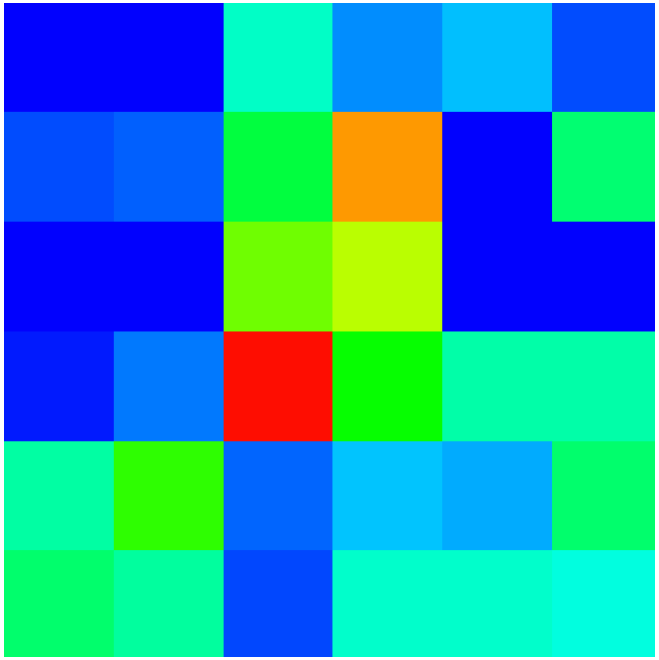
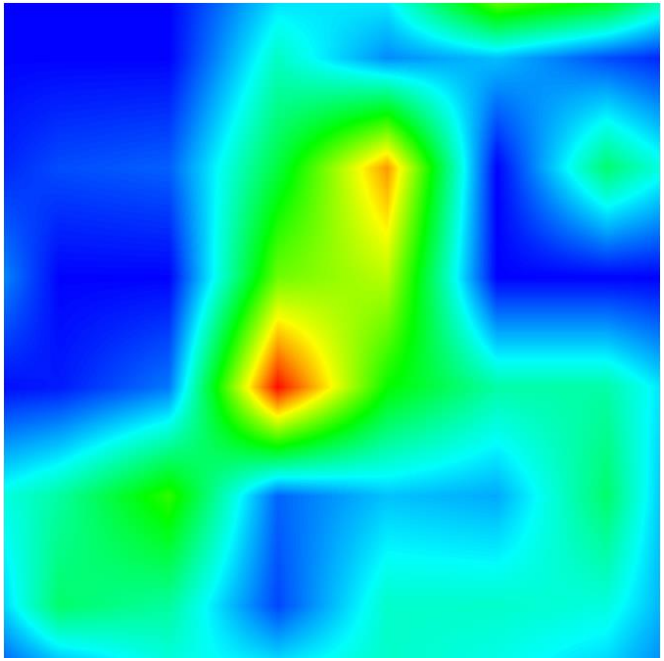
L1 Spatial Scan: Standard Resolution

Physical 7.5 mm No Interpolation



Effective 3.75 mm Interpolation



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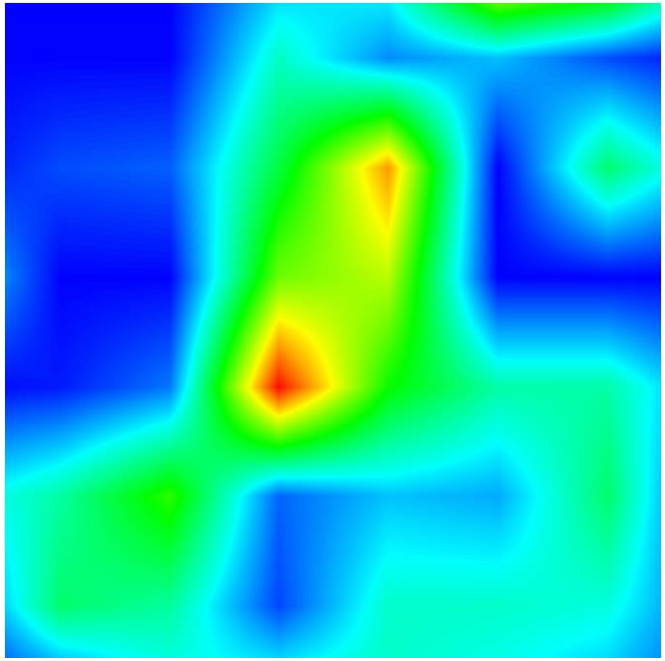
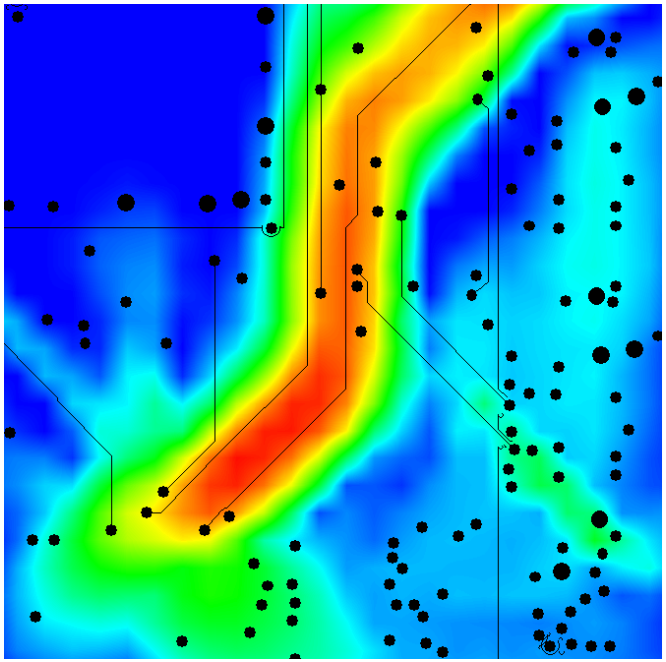
L2 – L8 High Resolution Spatial Scan

Level 1



Level 3



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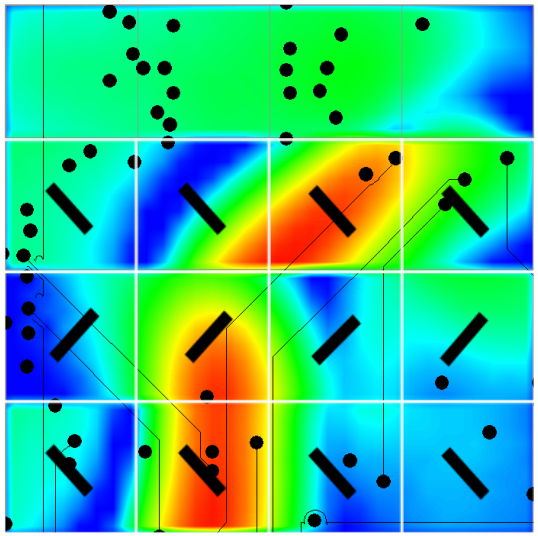
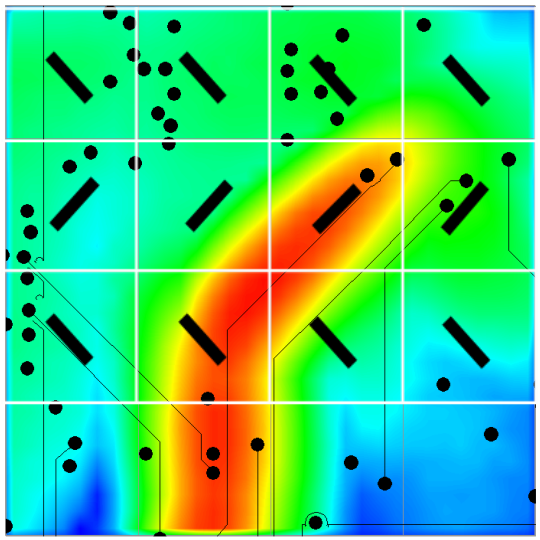
L1-L8 Spatial Scan: Interleaved

- **Powerful feature to remove blind spot**
  - First original scan
  - Second scan with probes shifted one row





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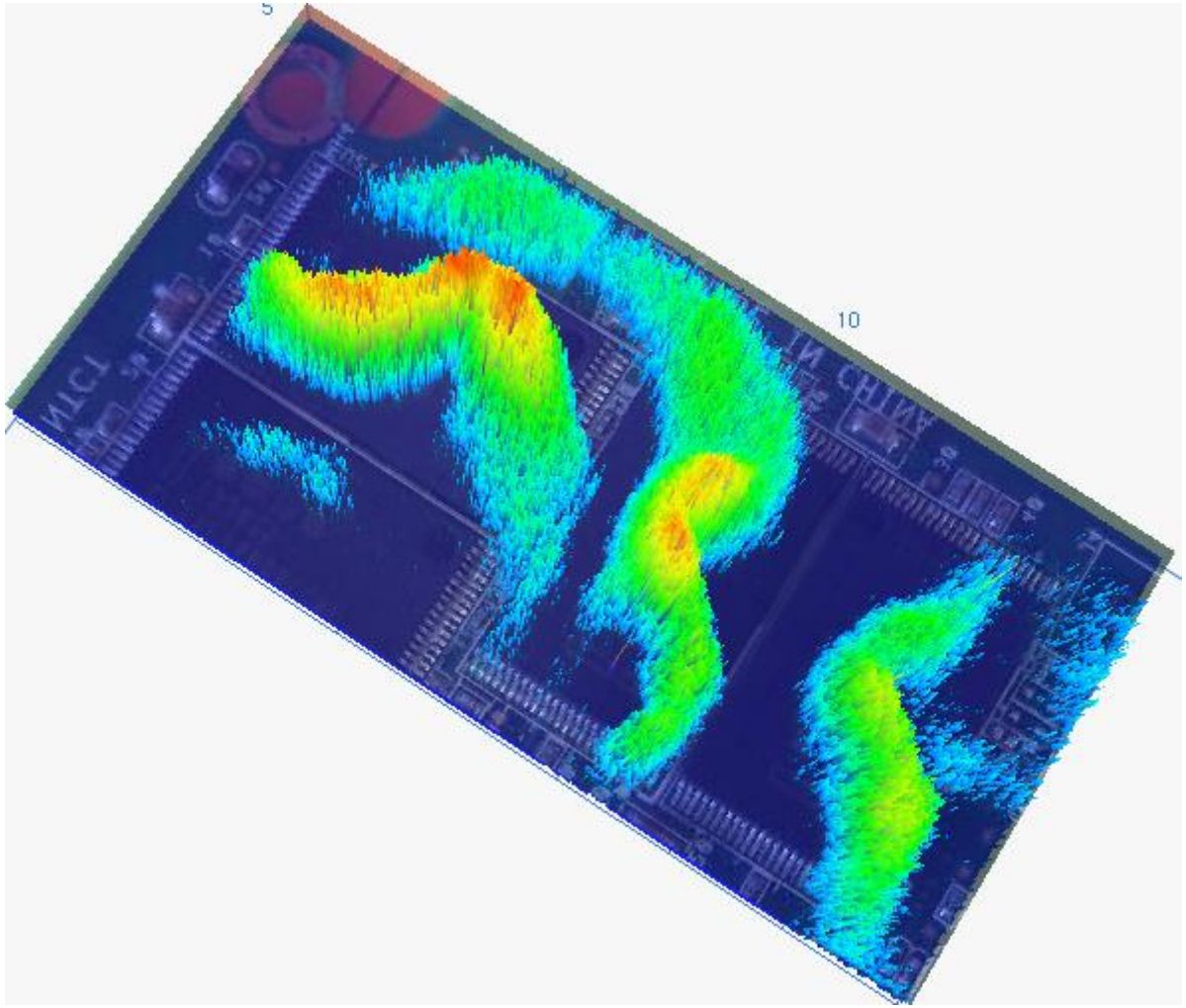
L8 Spatial Scan: 3D Interleaved



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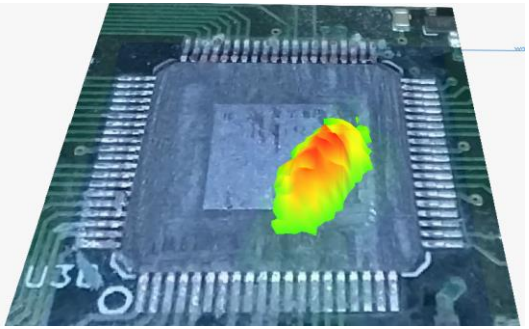
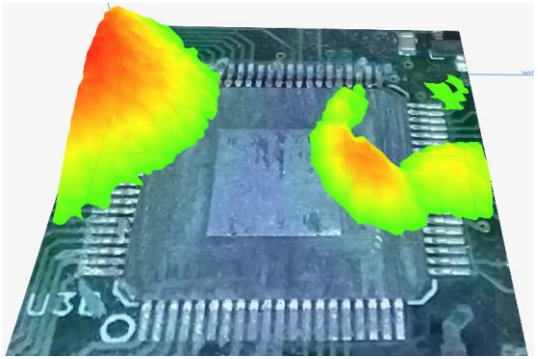
IC Analysis

- **About 2 minutes per scan**

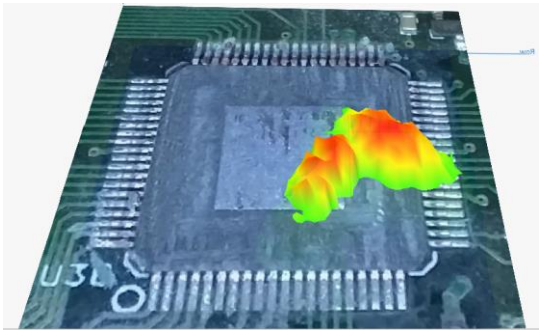
100 MHz



120MHz



130MHz



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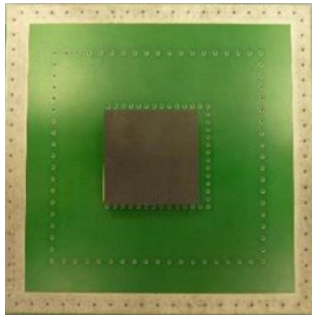
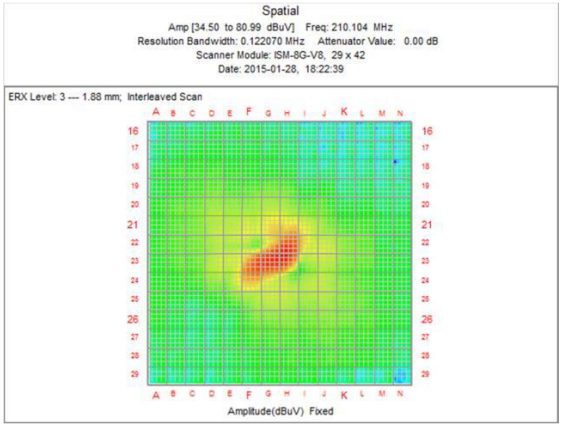
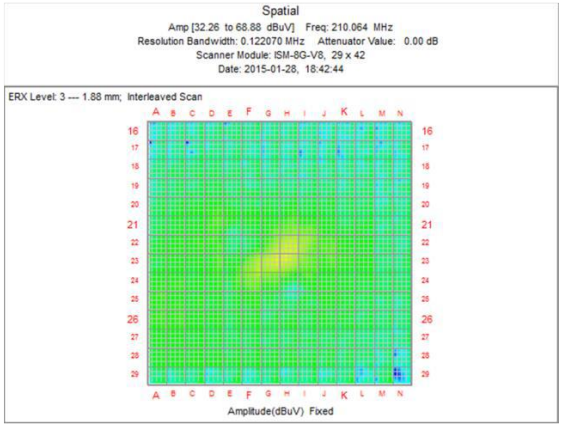
IC Analysis

- **Effectiveness of Shielding**







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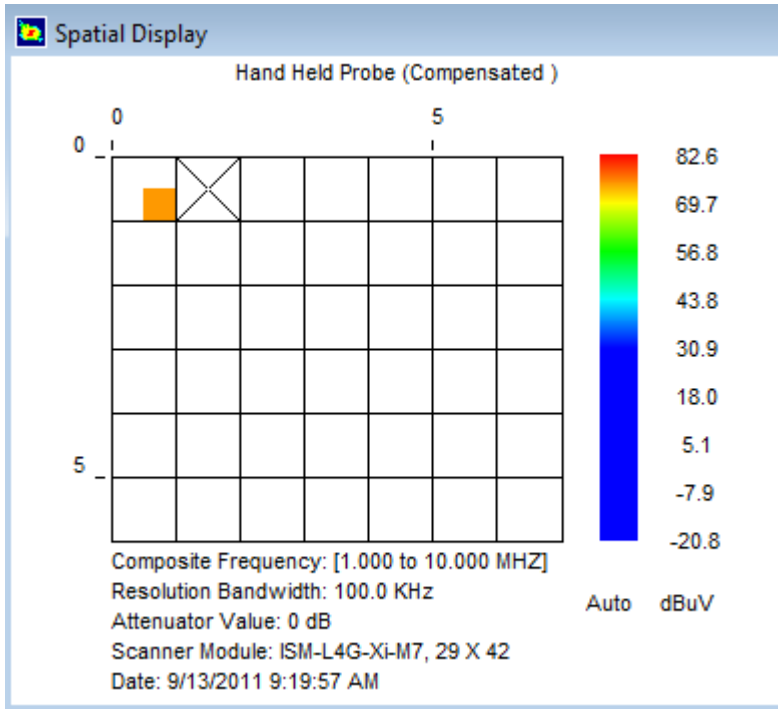
Spectral/Spatial Scan: Hand-Held Probe

- **External probe**
  - E-field probe
  - Hz probe
- **Programmed mode up to 19,955,712 measurements**



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By-Pass

- **Directly from scanner to analyzer externally**
  - Better amplifier at a specific frequency
  - Greater than 20 dB attenuator
  - Passband filter

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Synchronous Time Domain Data

New Technology in 2018

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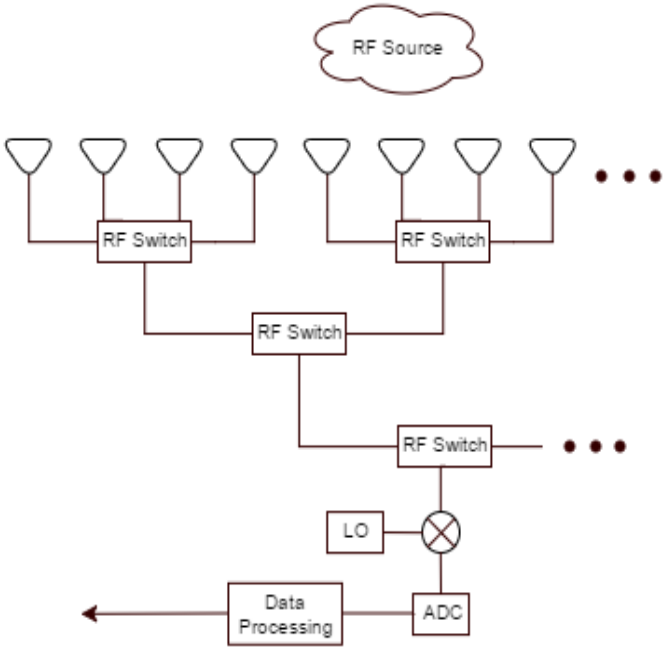
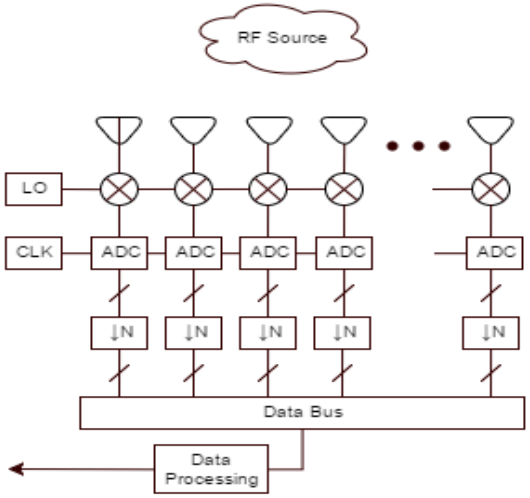
Existing Architecture



New Architecture

- **Under development for 2018 up to 20 GHz**



Synchronous data capture
Single event capture possible

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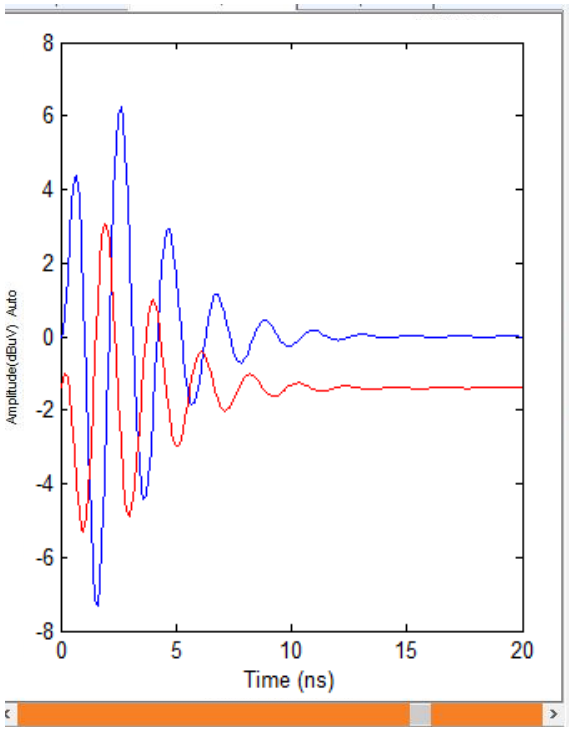
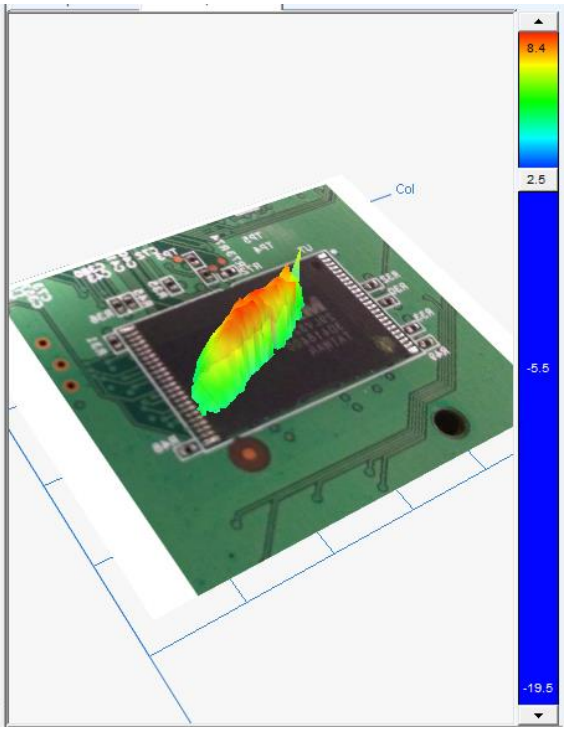
Time Domain Functionaity

- Many probes measured simultaneously
- Time domain content available at each probe
- Spatial distribution of energy available at every point in time





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Asynchronous Time Domain Data

On-Demand Development Feasible in 2017

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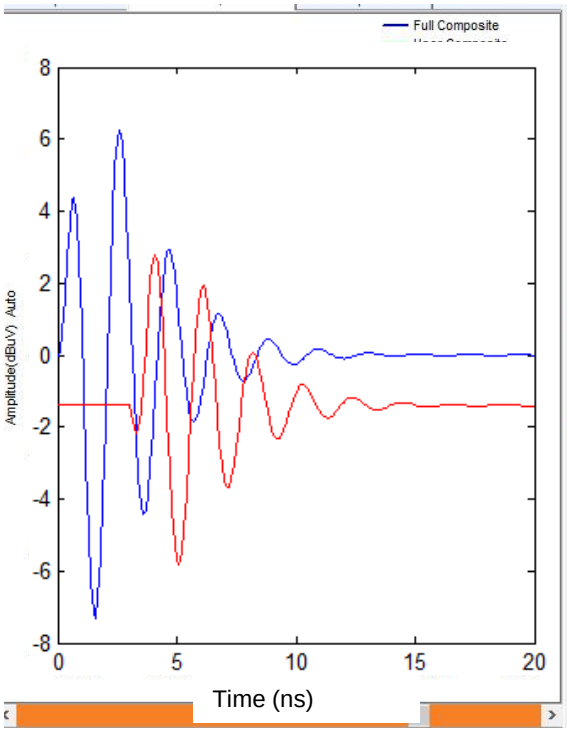
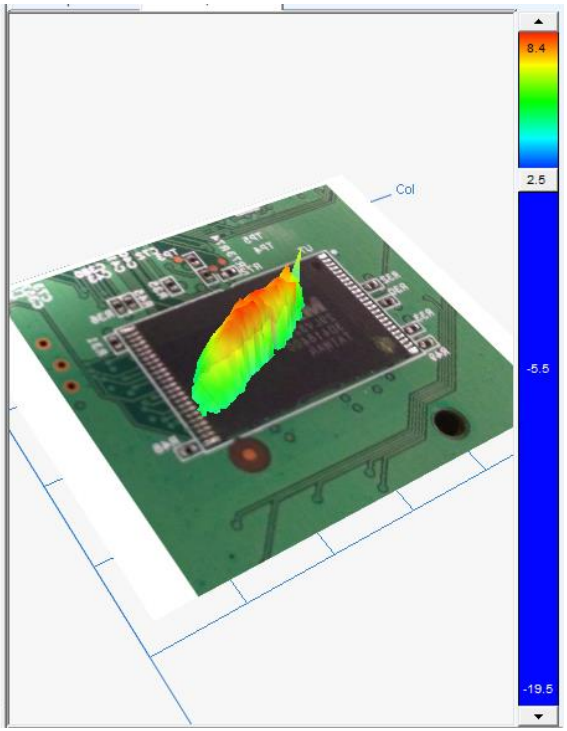
Easily Obtainable Time Domain Data

- Probes measured sequentially
- Time domain content at each probe is available
- Content from each probe is not synchronized





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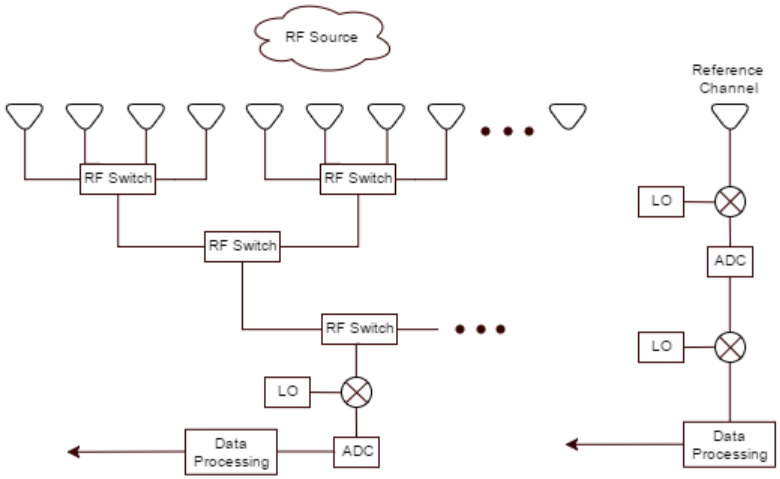
Architecture Changes

- **Similar to RFxpert implementation**



Asynchronous with external reference
May require cyclostationary process

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Business Case

- **Displacing existing plans and commitments**
  - Four ERX+ cover development and opportunity costs
  - Aggregated from multiple customers

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