

혼합도메인 오실로스코프 와 USB스펙트럼 분석기를 이용한 광대역 노이즈 최신 측정기술 소개

- RSA306 (USB Spectrum Analyzer), MDO Series (Mixed Domain Oscilloscope)-

텍트로닉스
차경목 대리

**WIDER
DEEPER**

2015 Tektronix Innovation Forum



AGENDA

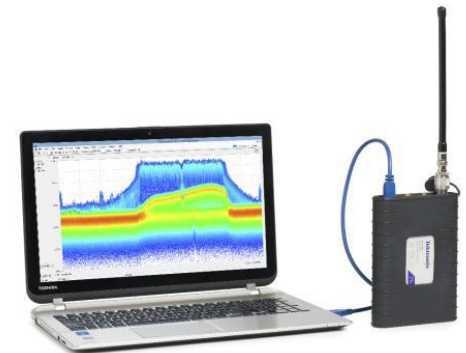
1. Full compliance test vs Pre compliance test.

2. EMI Debugging Using the RSA306.

- RSA306 Introduction.
- Near field solution with DPX and Spectrogram.
- Far field Test (Spurious Measurement).

3. EMI Debugging Using the MDO4000B Series.

- MDO(Mixed Domain Oscilloscope) Introduction.
- EMI Debugging with Mixed Domain.



1. Full compliance test vs Pre compliance test.

Is the Pre-compliance the Same As the Full Compliance?

Full compliance test.

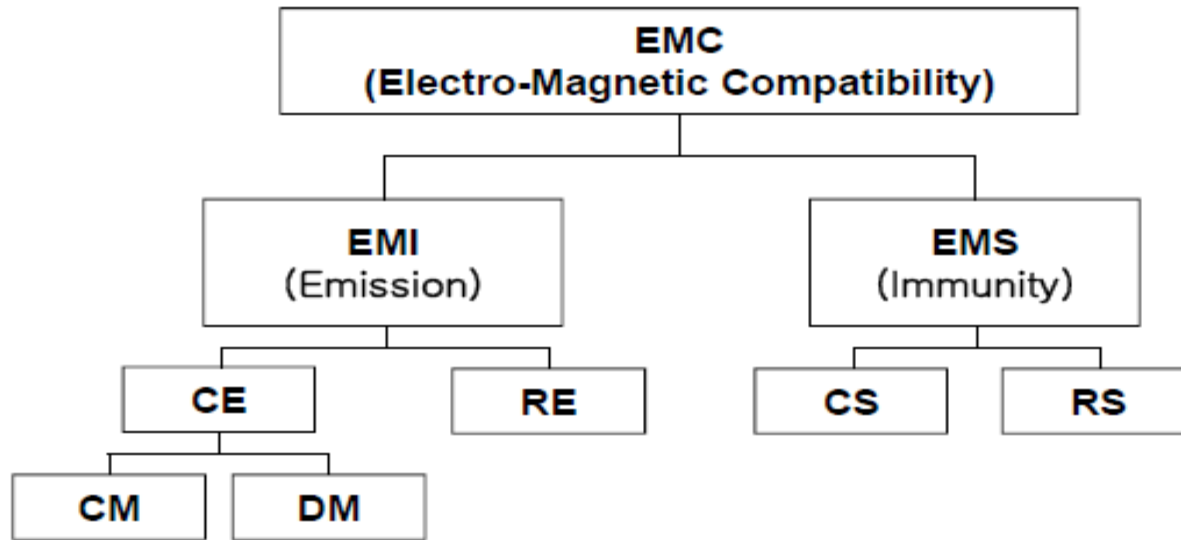
- Compliance testing **requires methods, equipment and measurements in compliance** with international standards.
- Compliance tests are commonly done as part of the design qualification prior to production of a device.
- Compliance testing is **exhaustive and time consuming**, and a failure in EMC at this stage of product development can cause **expensive re-design and product introduction delays**.

Is the Pre-compliance the Same As the Full Compliance?

Pre compliance test.

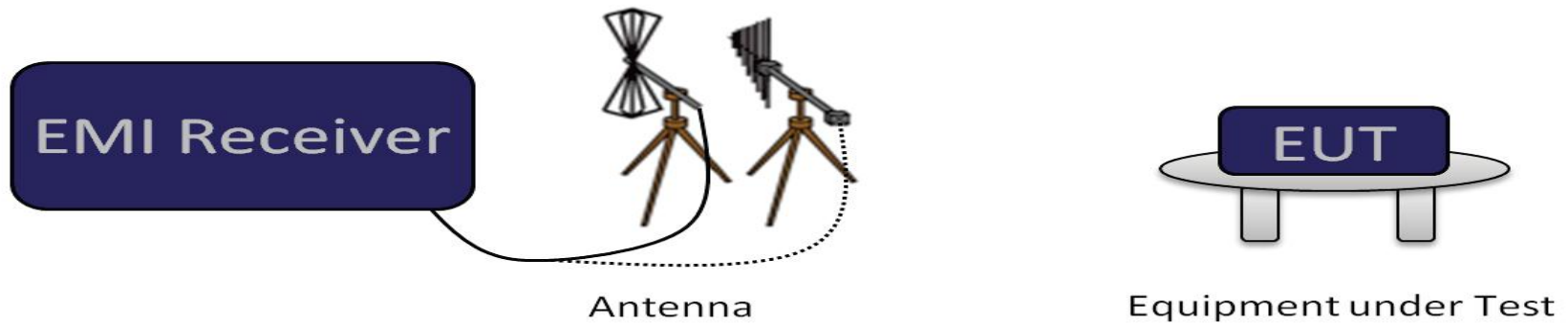
- Not required to conform to international standards
- The goal is to uncover potential problems and reduce risk of failure at the expensive compliance test stage.
- The equipment used does not have to include every feature and specification required by the standard, and can have lower accuracy and dynamic range than compliant receivers if sufficient margin is applied to the test results.
- May be done in a certified lab using fast measurement techniques intended to give a 'quick look' at problem areas, or done on the design bench by engineering personnel.

EMI Characterization

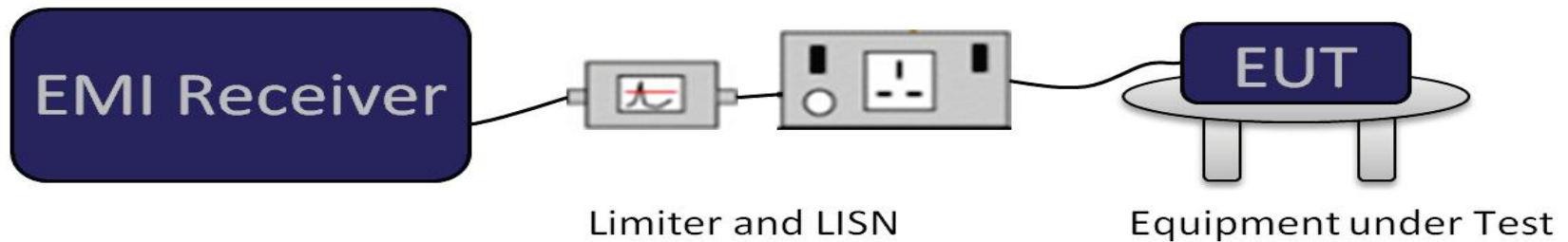


- **EMI** : Electromagnetic Interference
- **EMS** : Electromagnetic Susceptibility
- **CE(RE)** : Conducted(Radiated) Emission
- **CS(RS)** : Conducted(Radiated) Susceptibility
- **CM** : Common-Mode
- **DM** : Differential-Mode

What Is the Difference Between Radiated Emission and Conducted Emission?

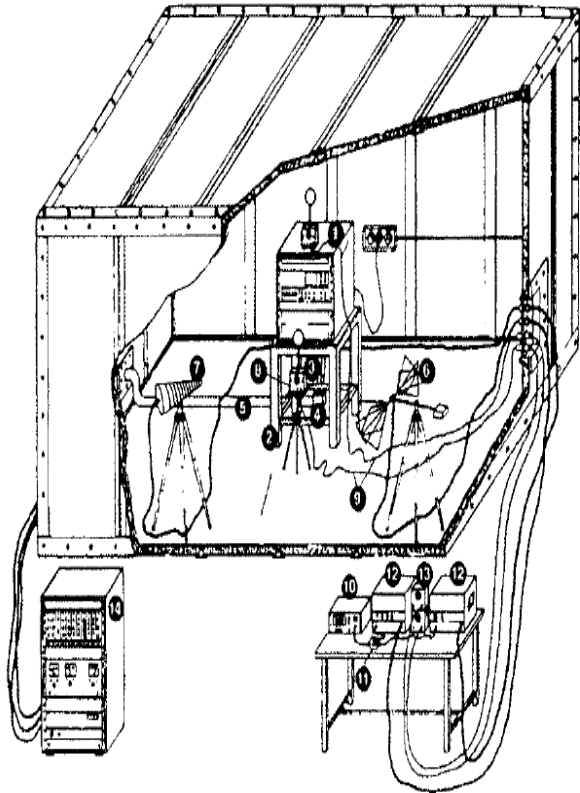


Radiated emission Test



Conducted emission Test

EMI Characterization



What Equipment Do You Need For a Full Compliance Test?

- 1) large anechoic test chamber.
- 2) An EMI receiver with Quasi-peak detector and preamplifier.
- 3) Mast and Turn table.
- 4) Antenna - Radiated measurements.
- 5) EMI Software controlling the test equipment like masts, turntables, and EMI Receiver and generate reports.
- 6) Line impedance stabilization network (LISN) for Conducted measurements.
Transient Limiter for Conducted measurements.

TEST SETUP FOR RADIATED ELECTROMAGNETIC FIELD TESTS IN A SHIELDED ROOM WHERE THE ANTENNAE, FIELD STRENGTH MONITORS AND EUT ARE INSIDE AND THE MEASURING INSTRUMENTS AND ASSOCIATED EQUIPMENT ARE OUTSIDE THE SHIELDED ROOM

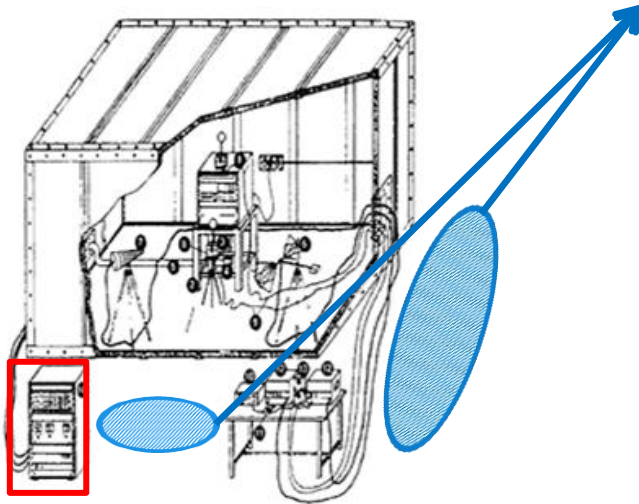
EMI Characterization

- Compliance Measurements → **Test House**
 - Often used to avoid expense of setting up in-house lab
 - Expensive
 - “one time” expense ?
 - Time consuming
 - How full is the schedule ?
 - Will report an EMI failure, but no what you can do about it
 - Pre-Compliance Measurement → **In House**
 - Test for EMI issues throughout the design process
 - Catch problems early
 - You still need to go to a EMI test house
- *EMI Troubleshooting will save time/money by identifying problem areas before they become expensive re-design issues*

2. EMI Debugging Using the RSA306

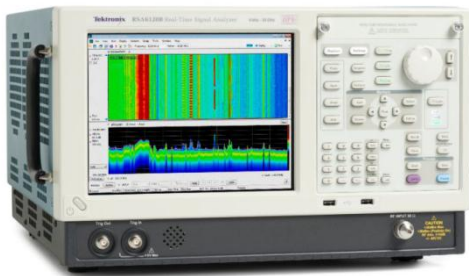
- RSA306 Introduction.
- Near field solution with DPX and Spectrogram.
- Far field Test (Spurious Measurement).
- Conduction Test.

Increasing needs the Portable High performance Spectrum Analyzer.



1. Outside Chamber.

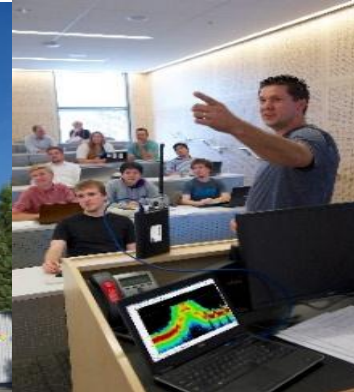
2. Factory Line.



High performance Spectrum Analyzer



3. In the field.



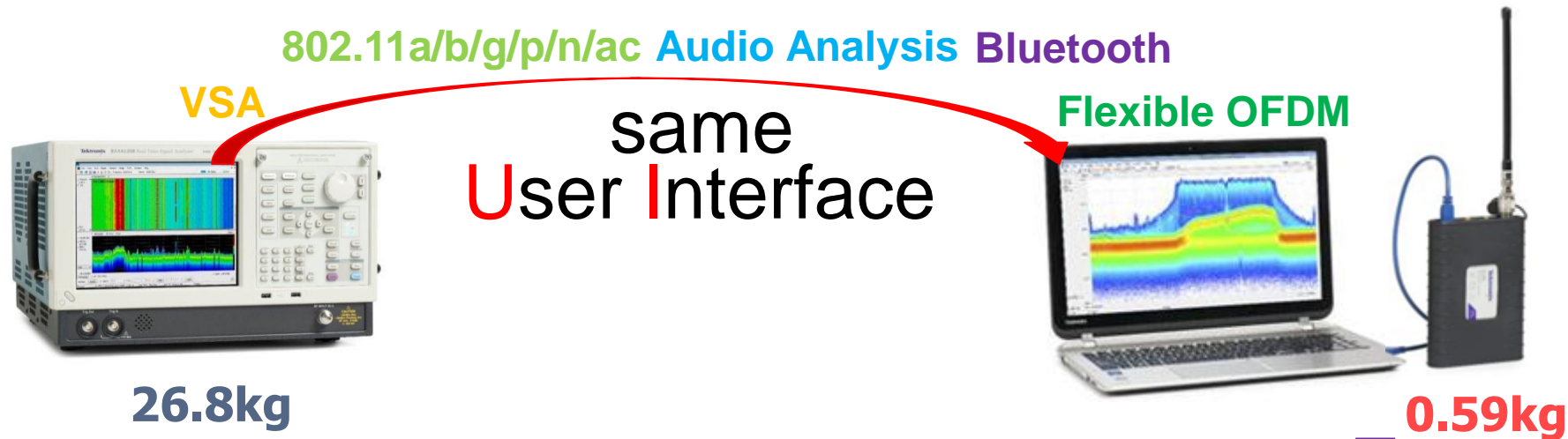
5. Business Trip

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4. Education.

New RSA306 USB Spectrum Analyzer

802.11a/b/g/p/n/ac Audio Analysis Bluetooth
VSA same User Interface Flexible OFDM



The image shows two pieces of equipment. On the left is the RSA5KB LAB, a rack-mountable spectrum analyzer with a large screen and many physical controls. On the right is the RSA306, a compact USB spectrum analyzer connected to a laptop. A red curved arrow connects the two, indicating they share the same user interface. A large purple arrow points from the RSA306 towards the bottom right, emphasizing its portability.

26.8kg

0.59kg

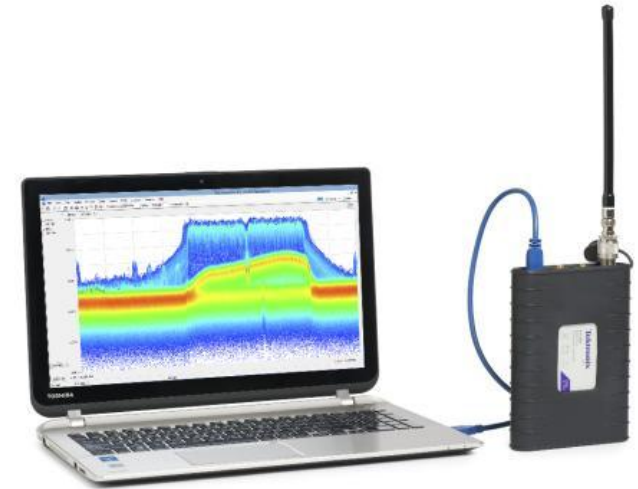
	RSA5KB LAB	RSA306
Frequency Range	1Hz – 3/6.2/15/26.5GHz	9kHz-6.2GHz
Max RF Input	+30dBm	+20dBm
SFDR (dBc)	-75 dBc	-50 dBc

RF signal analysis in your hands!

New RSA306 USB Spectrum Analyzer

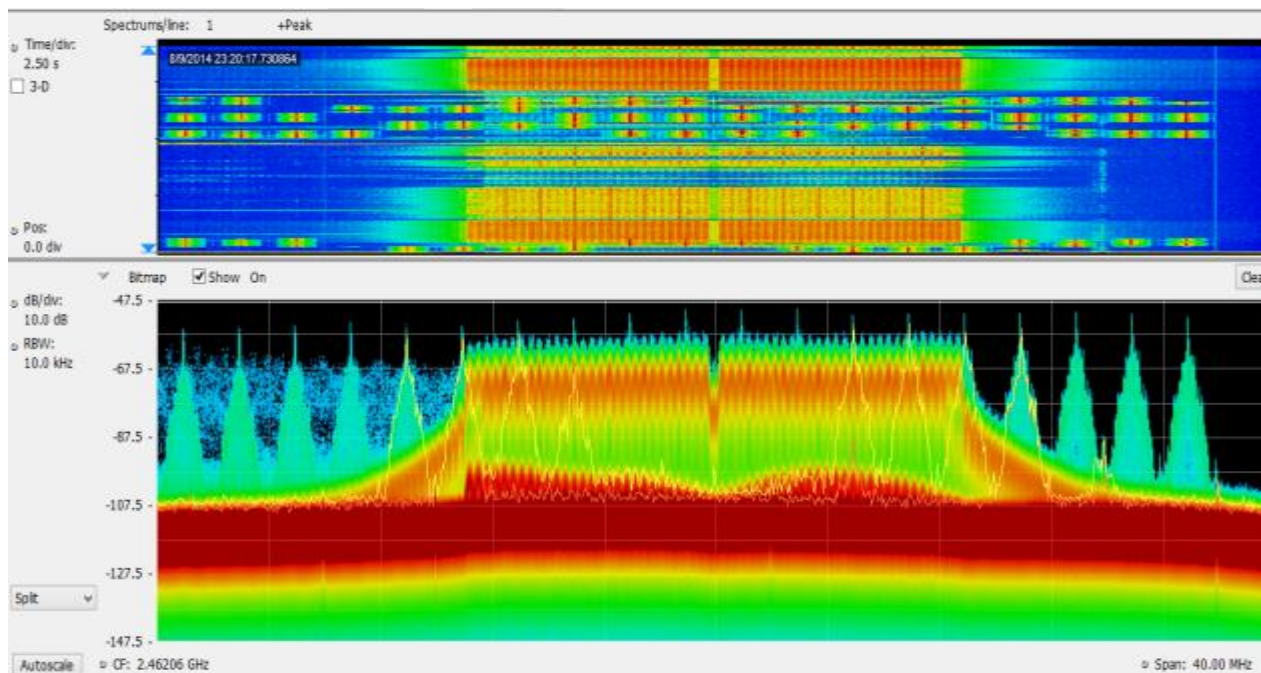
RF signal analysis in your hands!

- Unmatched Price/Performance
- Unmatched form factor: USB powered and controlled, highly portable
- Unmatched HW features in its class: 6.2 GHz Signal Analyzer with 40 MHz Real Time Bandwidth
- Measurement Range from -160 dBm to +20 dBm
- Unmatched SW features: Benchtop features with a low cost analyzer
 - Runs with SignalVu-PC software
 - Optional capabilities, such as Wi-Fi, P25, and Audio Analysis
 - Long duration signal recording
- Ruggedized and meets Mil-Std 28800 Class 2 specifications



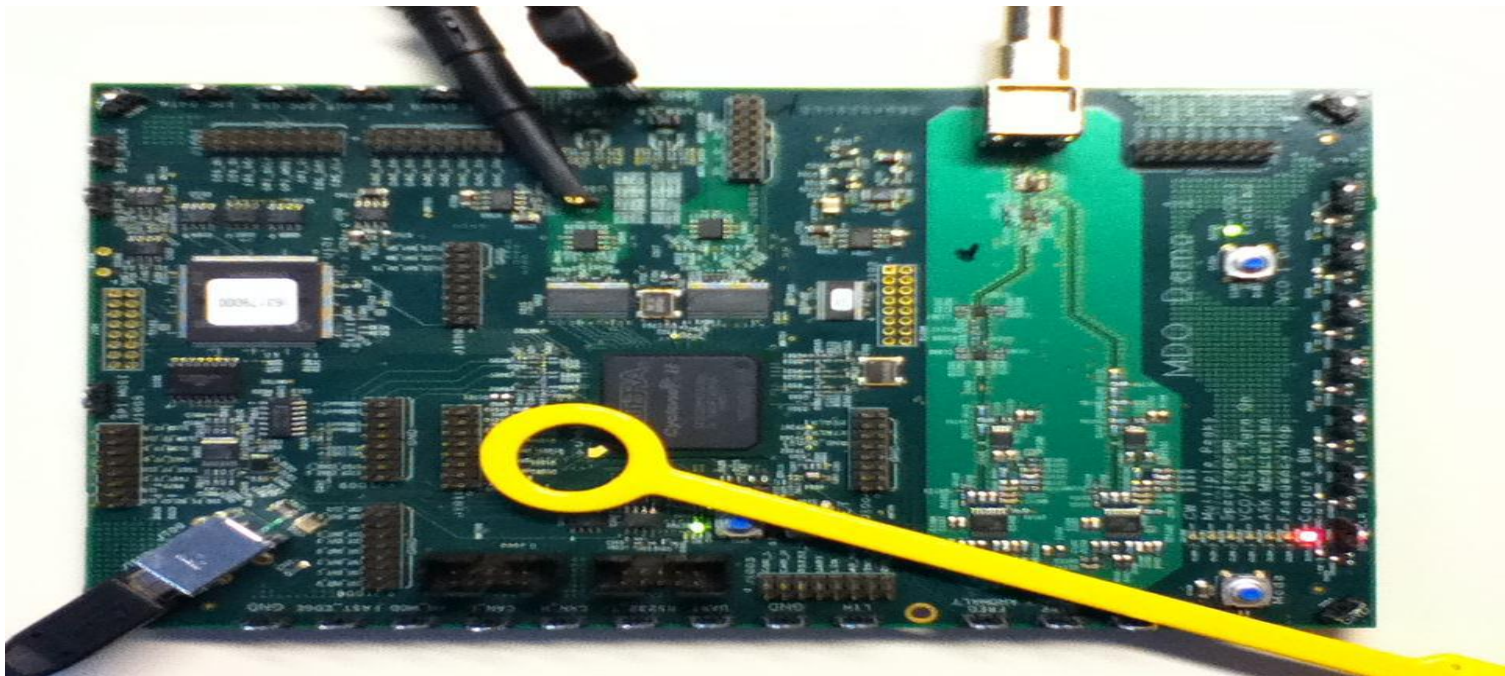
- Demonstration -

(RSA 306 DPX and Spectrogram.)

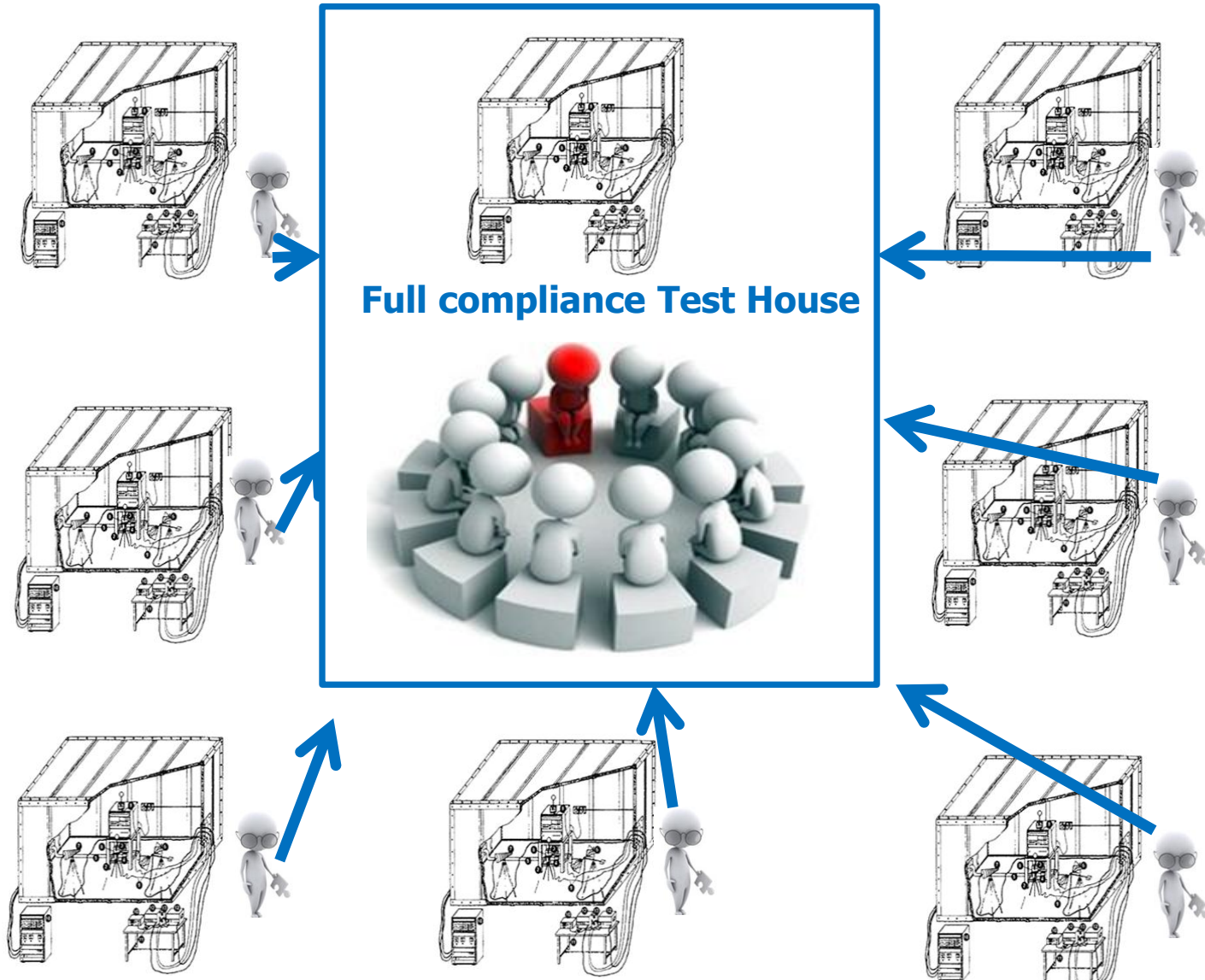


- Demonstration -

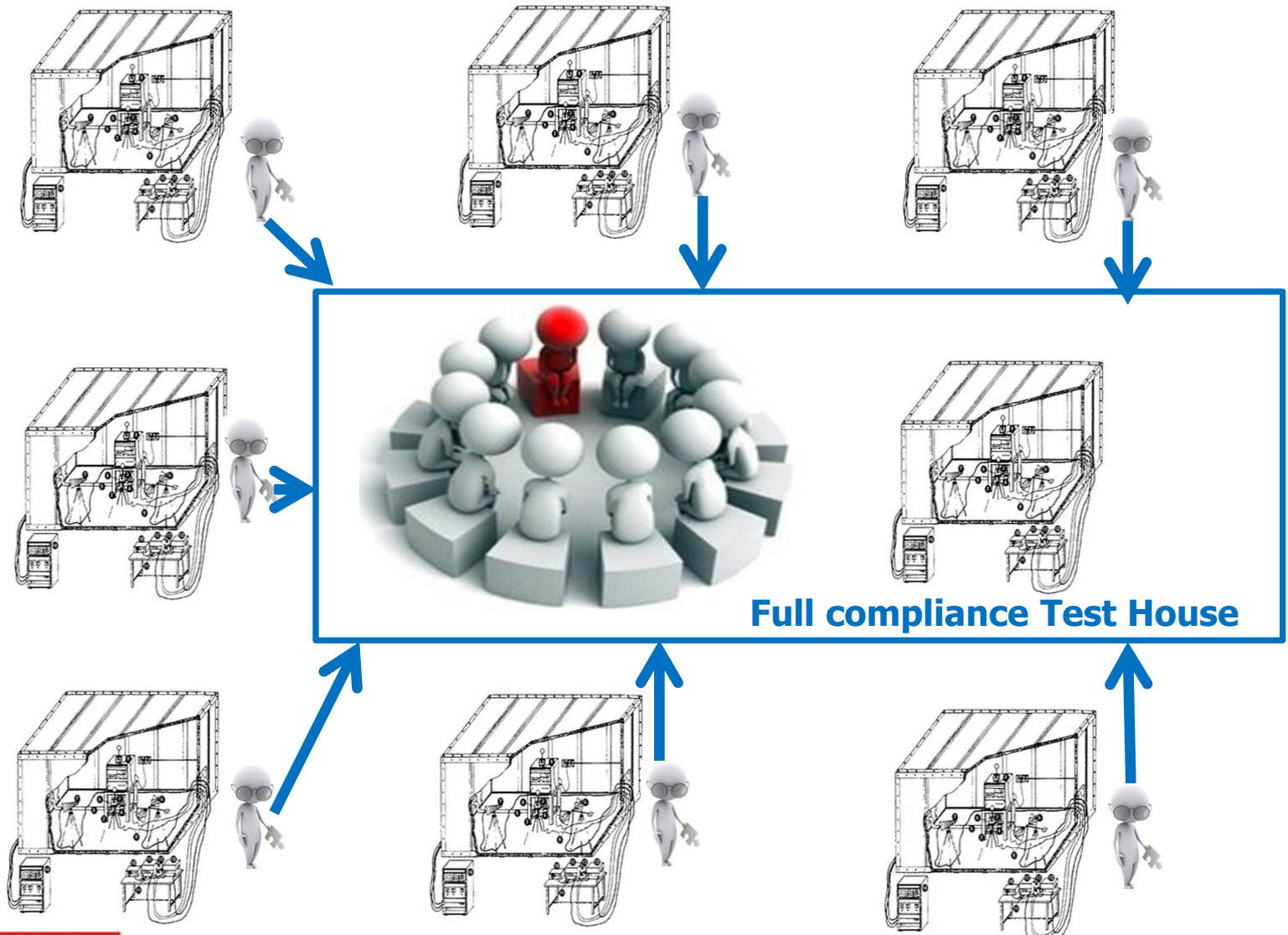
(Near field probe solution with DPX and Spectrogram.)



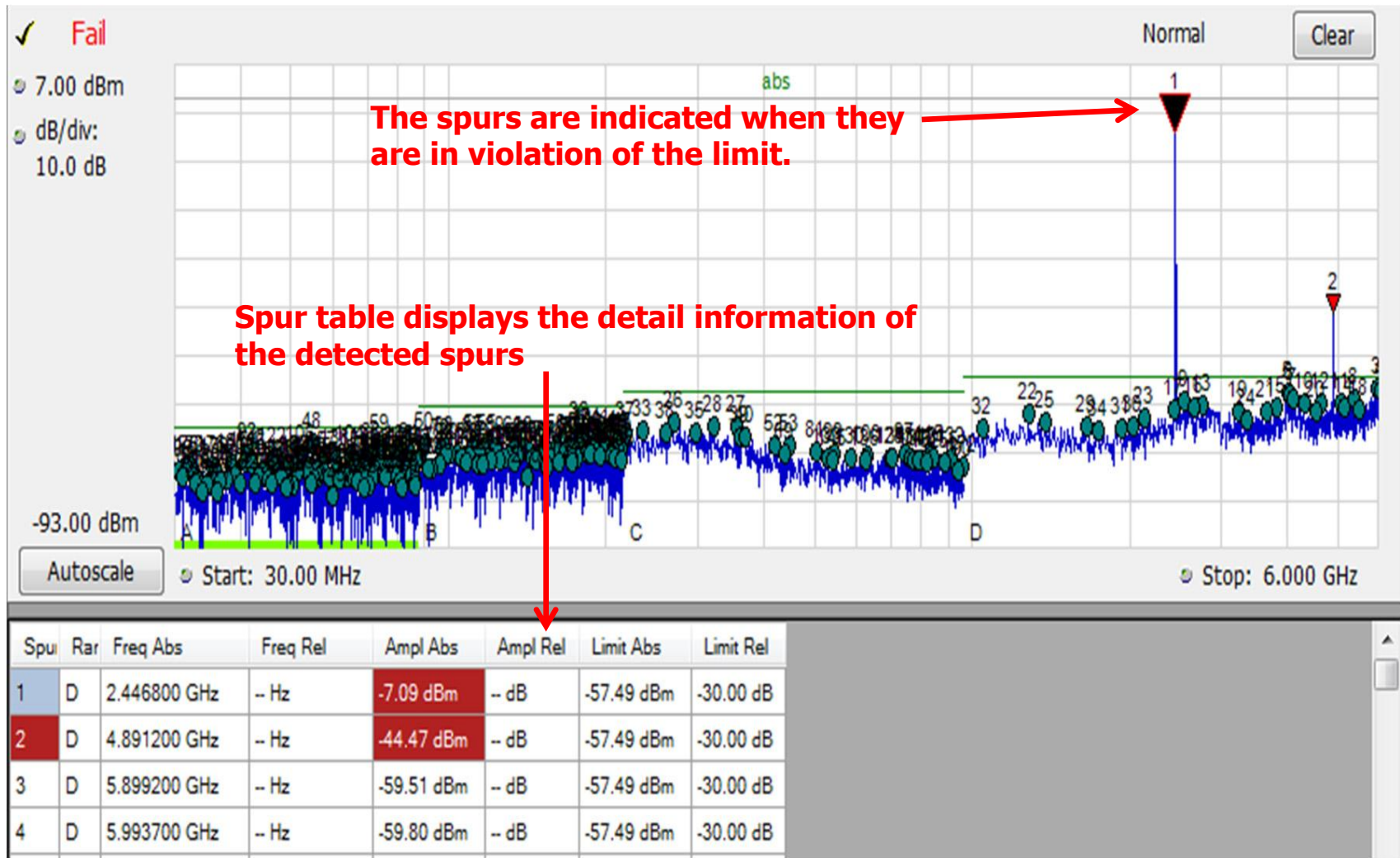
EMI full compliance test debugging work flow



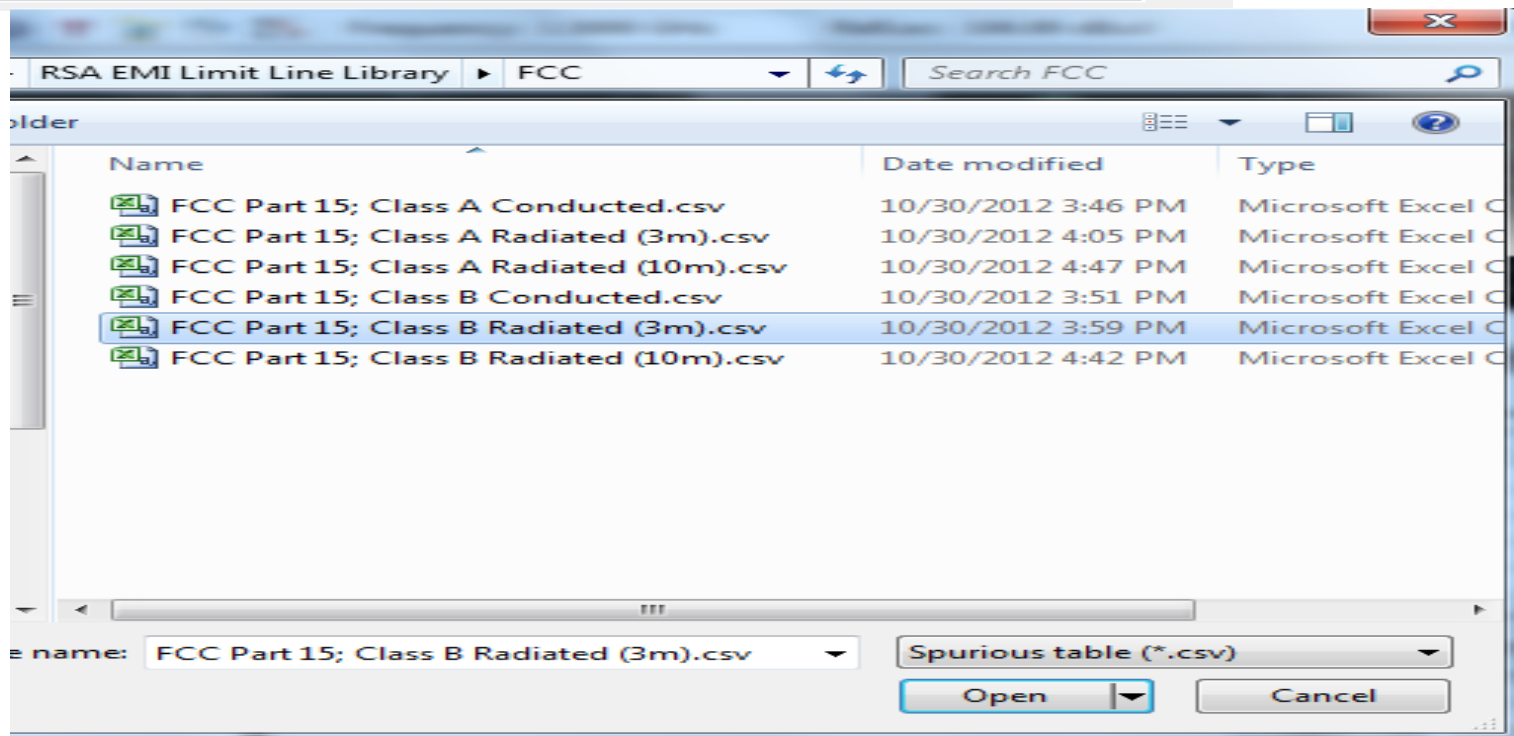
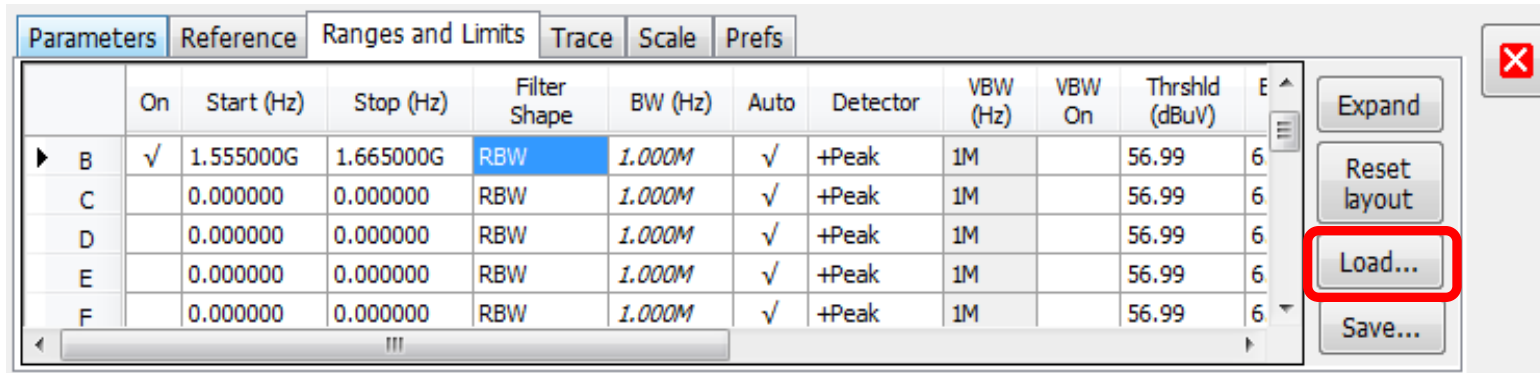
EMI full compliance test debugging work flow



Far field Test (Spurious Measurement)



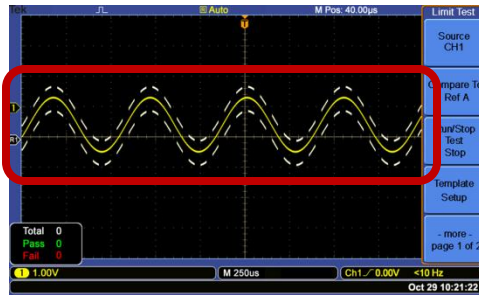
Far field Test (Spurious Measurement)



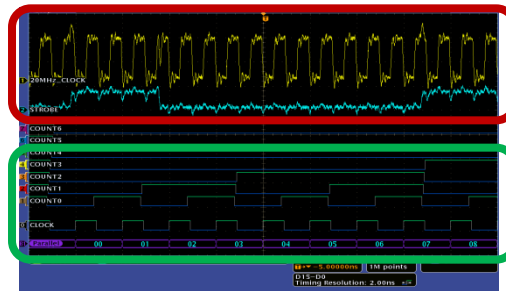
3. EMI Debugging Using the MDO4000B Series.

- MDO (Mixed Domain Oscilloscope) Introduction.
- EMI Debugging with Mixed Domain.

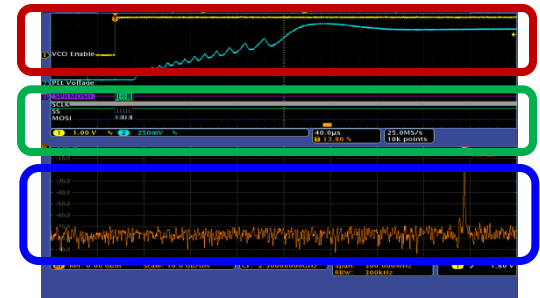
MDO(Mixed Domain Oscilloscope) Introduction.



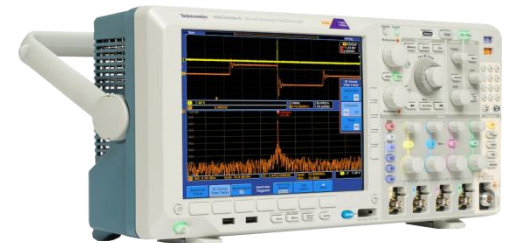
Analog Signal



Analog Signal
+
Digital & Bus Signal

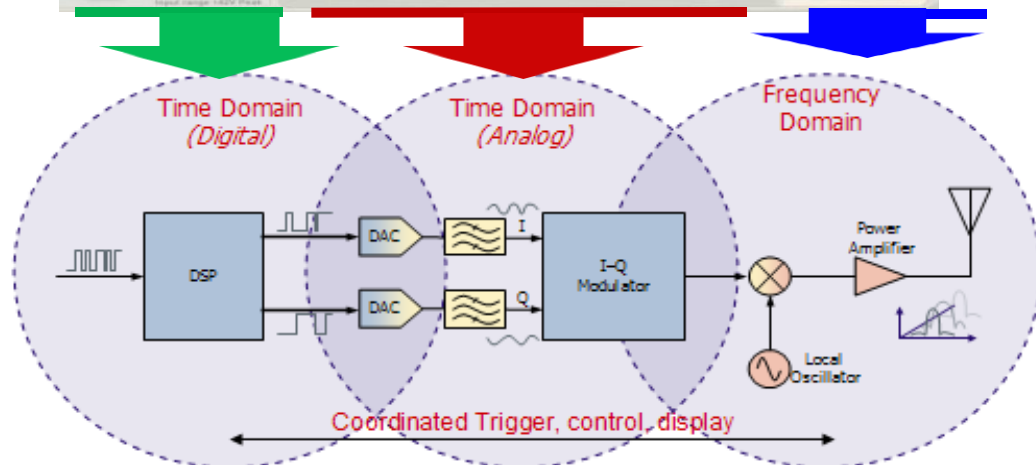


Analog Signal
+
Digital & Bus Signal
+
RF Signal



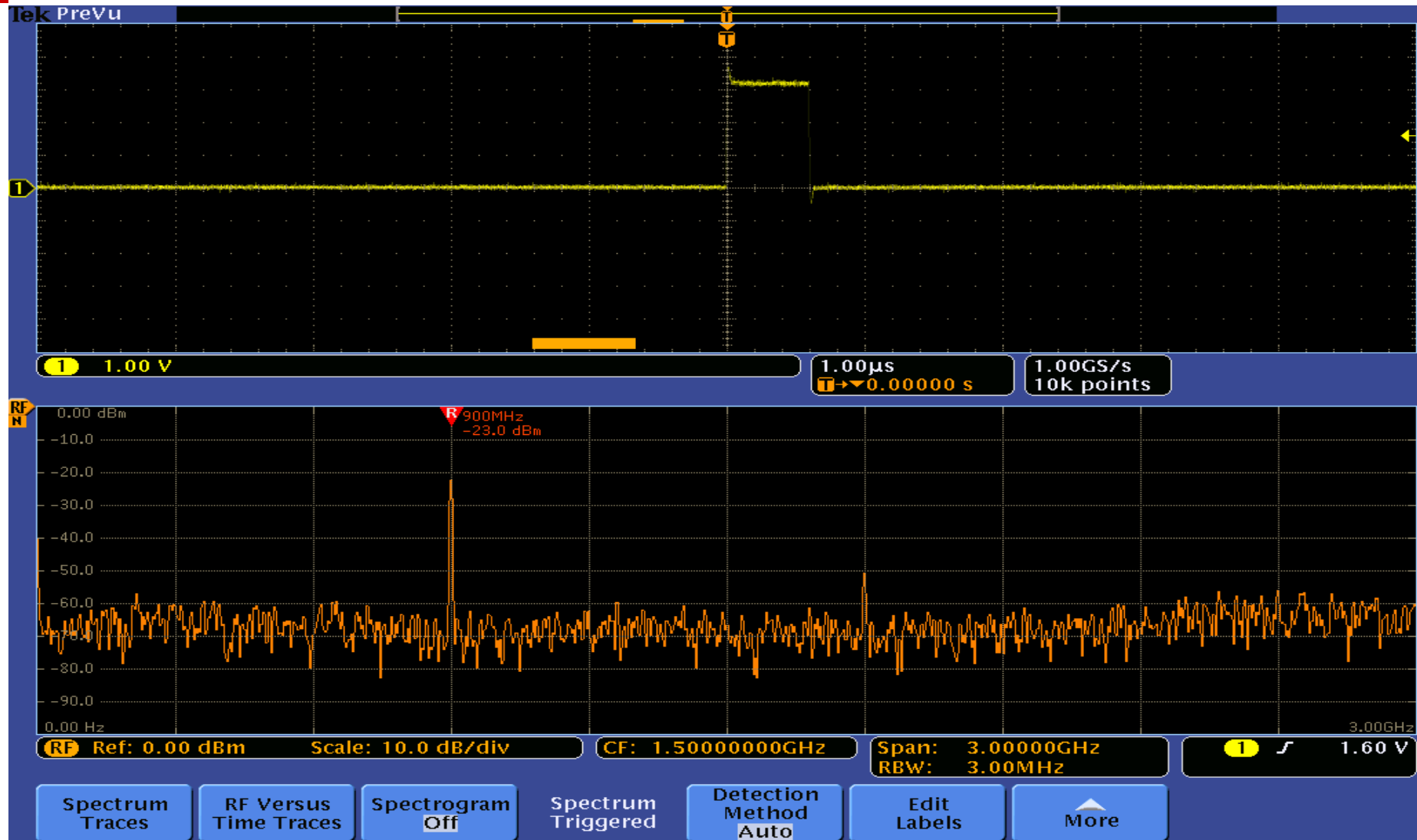
Time correlated acquisition system.

Time correlated acquisition.



- Mixed-domain analysis
 - Time-correlated analog, digital, and RF signal acquisitions in a single instrument.
 - Amplitude, frequency, and phase vs. time waveforms derived from spectrum analyzer input
 - Selectable spectrum time to discover and analyze how RF
 - spectrum changes over time - even on a stopped acquisition

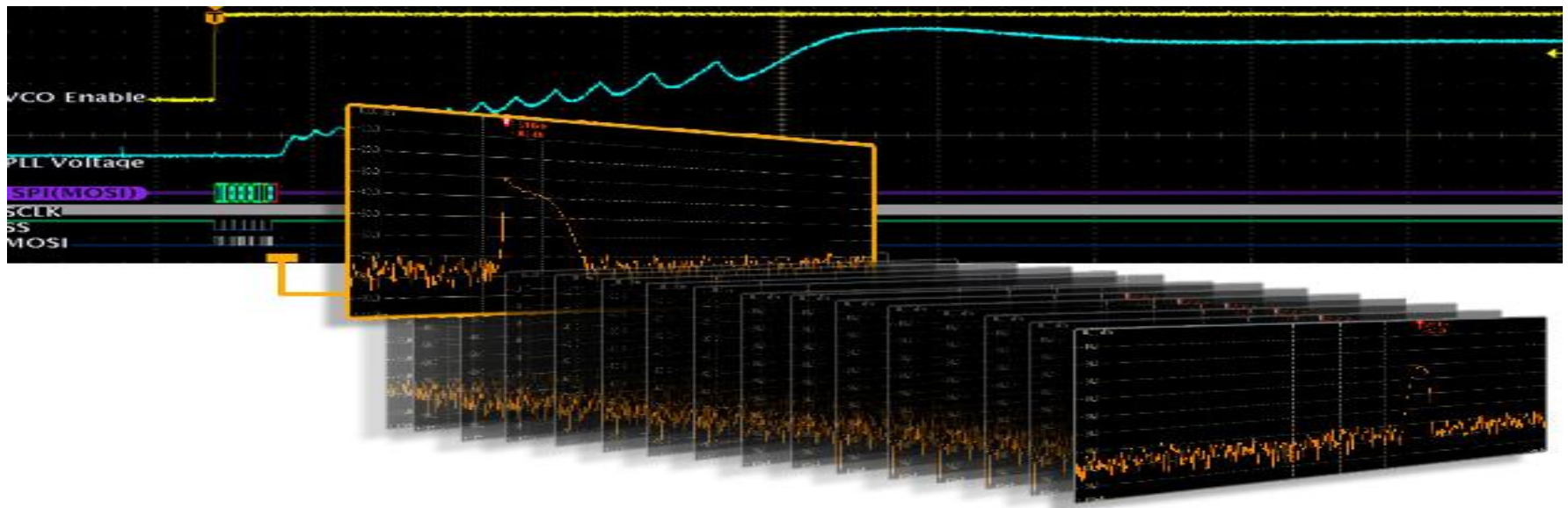
Time correlated acquisition system with wide capture bandwidth.



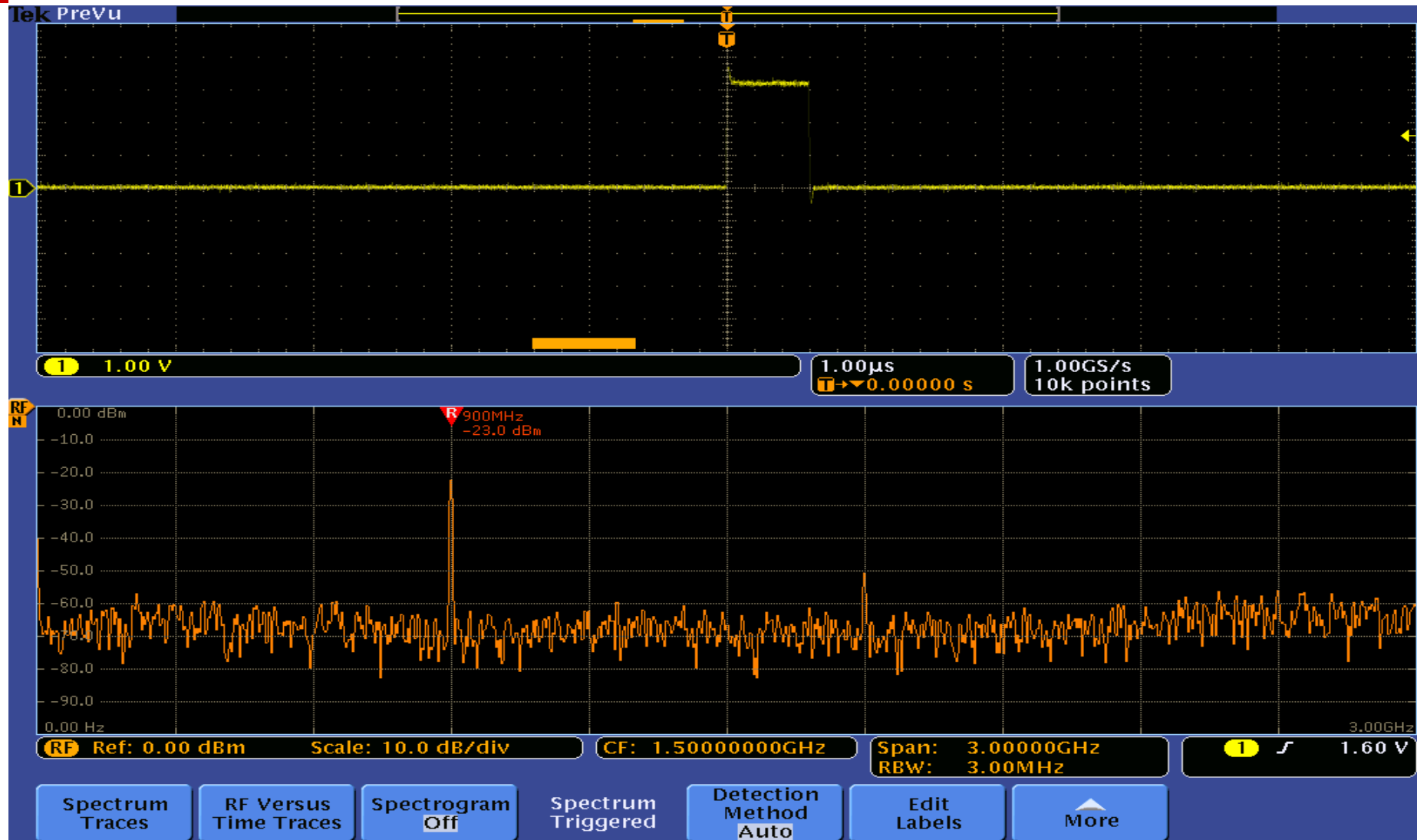
Time correlated acquisition system with wide capture bandwidth.

Time and Frequency Domains

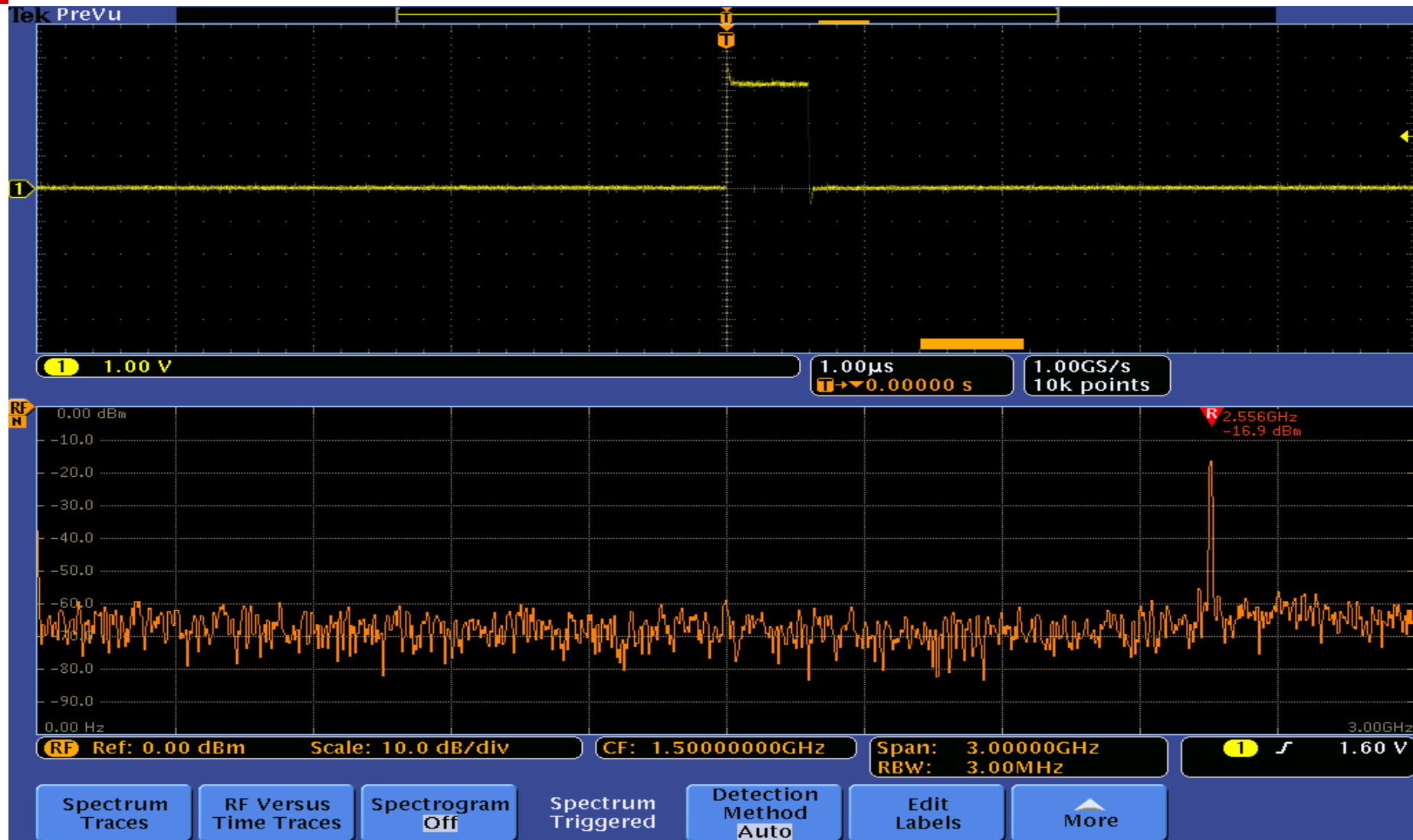
The real power of the MDO4000B comes from its universal trigger and acquisition system. All channels are fully integrated, so you can trigger on any of your signals and the oscilloscope will capture all channels simultaneously. As a result, all signals—analogue, digital and RF—are time-correlated for accurate analysis



Time correlated acquisition system with wide capture bandwidth.

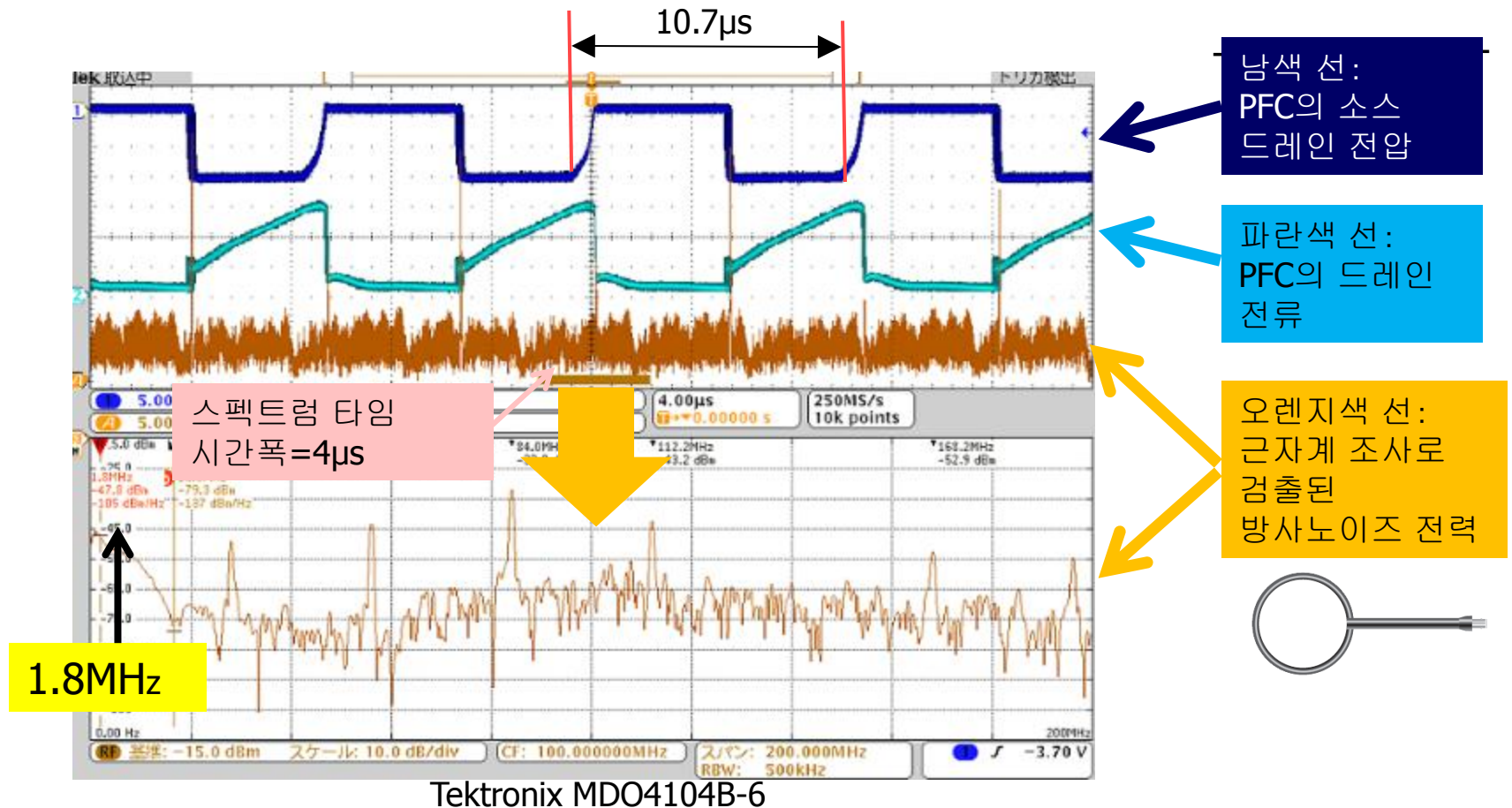


Time correlated acquisition system with wide capture bandwidth.



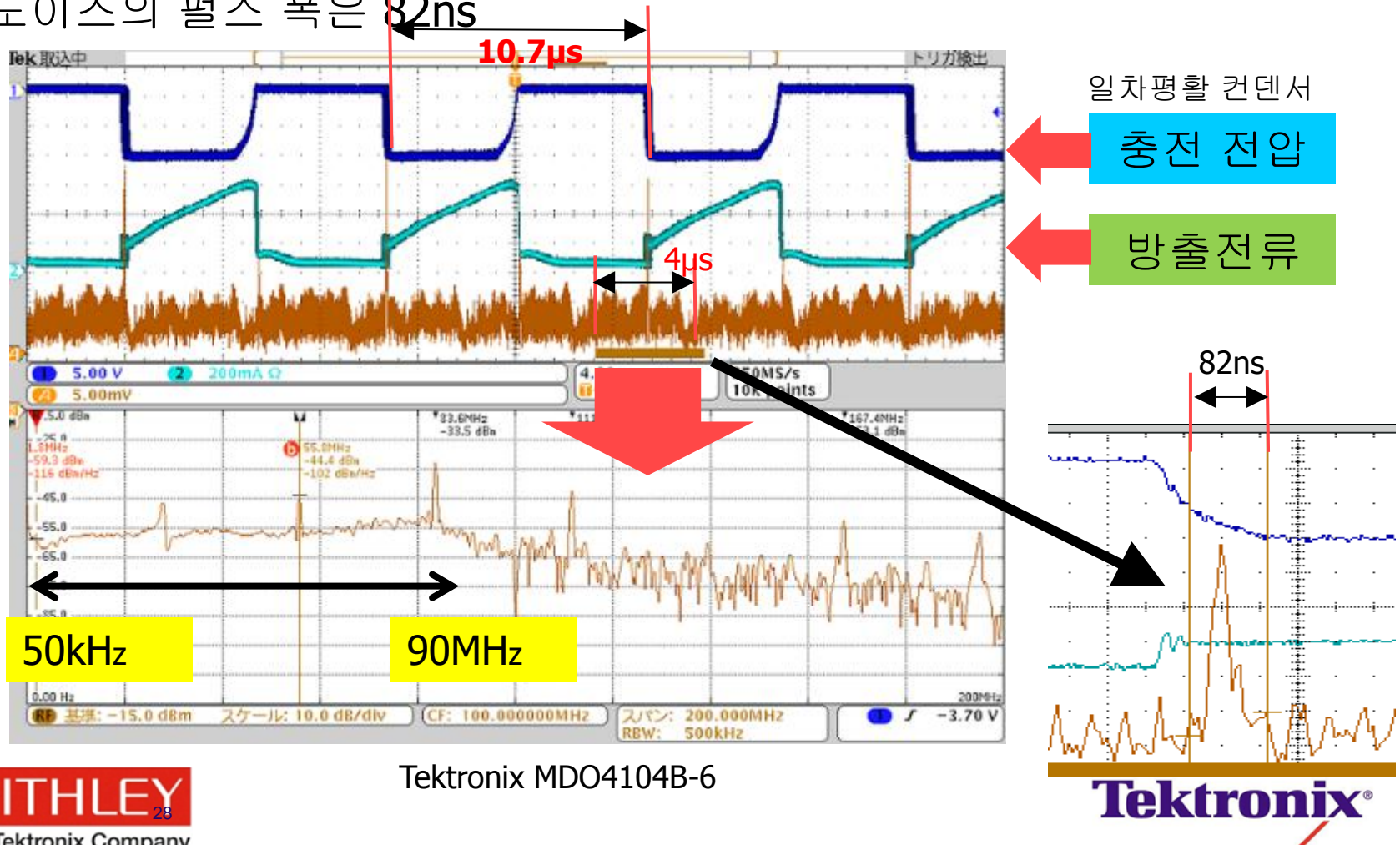
EMI Debugging with Mixed Domain.

- Pulse noise가 방출 되고 있는 time 혹은 Duration은?
- 방출전류가 높아지고 낮아지는 때에 1.8MHz의 **협대역 노이즈** 발생

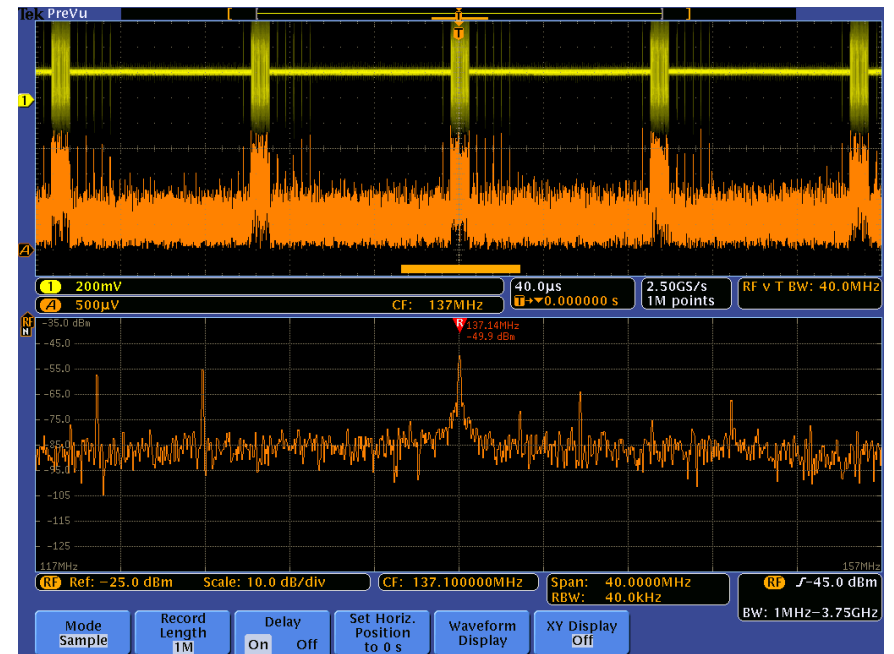
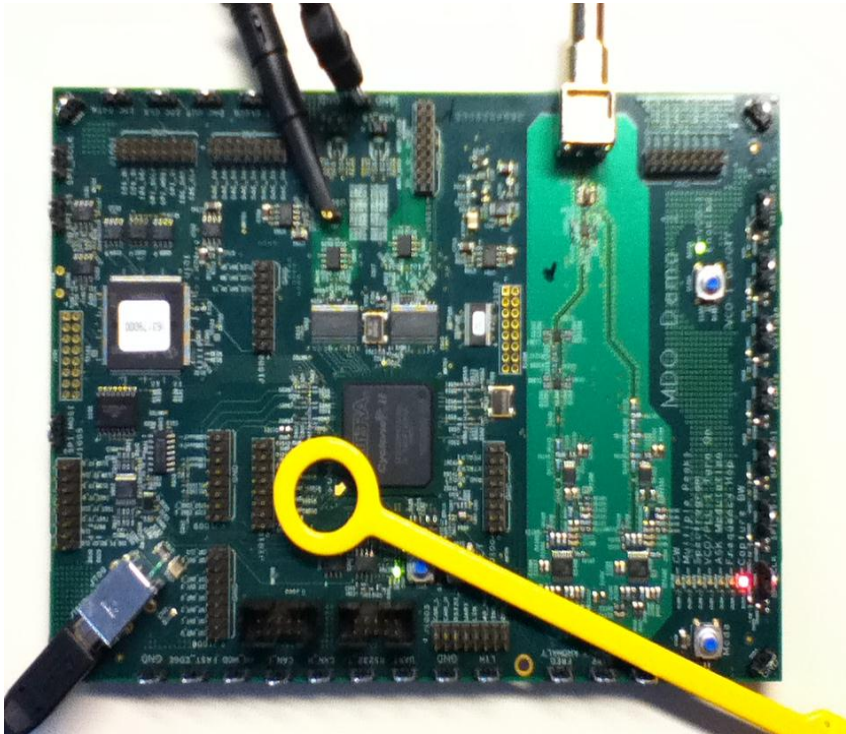


EMI Debugging with Mixed Domain.

- 충전 전압이 상승 또는 하강할 때에 50kHz ~ 90MHz의 광대역노이즈 발생
- 노이즈의 펄스 폭은 82ns



- Demonstration -





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