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Title of the presentation:

What does a Vector Network Analyzer tell us about our high-speed design?

Short CV:

Radu Voina holds a Master's Degree in Applied Electronics (2018) and a Bachelor's Degree in Telecommunications Technologies and Systems (2015) from the Technical University of Cluj-Napoca. He founded Keytek Innovation, a Value-Added Reseller (VAR) for Rhode & Schwarz in Romania, and has made a significant impact in mixed-signal board schematics, PCB design, and the analysis of signal and power integrity for high-speed interfaces, utilizing advanced PCB layout and simulation tools. He has also pursued further education in Electromagnetic Compatibility (EMC), Compliance Emissions, and PCB Manufacturing. From 2021 to 2023, Radu supported several preferred partners of Dassault Systèmes in PCB

design and simulation using CST Studio Suite. He later founded Optimal Designs Europe, a Value-Added Reseller (VAR) for Dassault Systèmes, providing CST Sales, Support, and Customer Enablement Services.

Mihai Dărăban received the Dipl.-Ing. degree in electronics engineering specialization telecommunication from the Technical University of Cluj-Napoca, and the Ph.D. degree in electronics and telecommunications from the Applied Electronics Department, Technical University of Cluj-Napoca (UTCN) in 2013. He is currently an Assistant Professor with the Applied Electronics Department, and member of Information Technology in Electronics Research and Development Centre (iTEC), UTCN. His current research interests include signal and power integrity analysis and simulation on high density printed circuit boards, and embedded systems and development of Internet of Things application.

Professional Development Courses Outline:

Nowadays, when using the term “network analyzer” the first thing that goes through our mind is Wi-Fi, LAN “networks”, mobile “network” (4G or 5G), or other technologies and devices through which we connect to the World Wide Web. Furthermore, many computers, servers, or even embedded devices are setup in “networks” that are all linked together to the cloud-fog-edge architecture. For each of these “networks” there exists a certain network analyzer tool used to verify performance, map coverage zones and identify problem areas.

This tutorial will present a different kind of network, which was defined long before any of the previous networks existed, and it even contributed to their development. The first Vector Network Analyzer (VNA) was invented around 1950 and was defined as an instrument that measures the frequency response of a component or a network composed of many components, which can be both passive and active. A VNA measures the power of a high-speed signal going into and coming back from a component or a network, because power, in contrast to voltage and current, can be measured accurately

at high frequencies. Both amplitude and phase of the high-frequency signal are captured at each frequency point. The built-in computer in the VNA calculates key parameters such as return loss and insertion loss of the network under test (scattering parameters or S-parameters). S-parameters are important parameters that characterize the electrical behavior of linear circuits, or more specifically, the input/output relationships of circuits between ports. Network analyzers can also measure Y-parameters, Z-parameters, and H-parameters. These parameters are used to characterize the electrical behavior of nonlinear circuits. By measuring these parameters, network analyzers can help engineers understand how their circuits will behave under different conditions. VNA measurements are key aspect in designing high speed channels and solving power integrity issues on printed circuit boards.

Course Outline:

- Scattering or S-parameters
- Introduction to Vector Network Analysis
- Time Domain and Frequency Domain Network Analysis compared
- Time Domain Reflectometer, Scope, Spectrum analyzer, VNA
- What a VNA can tell us
- Setup a VNA measurement
- When, Why, and how to calibrate a VNA
- What is De-embedding
- Tips and tricks that can improve your measurement and protect your equipment